B. Subbottom Profile Survey

A Report Prepared for:
Oceaneering Technologies, Inc.
2055 North Ventura Avenue
Ventura, California 93001

SUBBOTTOM PROFILE SURVEY
CAMBRIA DESALINATION PLANT INTAKE AND OUTFALL STRUCTURES
PROPOSED INSTALLATION SITE

Offshore Cambria, California
Fugro West, Inc., W.O. No. 94-83-9277

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(In Pockets)

1.0 INTRODUCTION

Oceaneering Technologies, Inc., is currently in the process of designing Intake and Outfall structures for the Cambria Desalination Plant in Cambria, California. In order to design the structures, information on the depth of sediments over the existing bedrock at the proposed installation site is required. The information is required to determine the sediment and rock characteristics for tunneling and burial of the proposed structures.

Fugro West, Inc., was contracted by Oceaneering Technologies to conduct bathymetric and high-resolution subbottom geophysical analysis at the site. The geophysical survey was conducted to provide information for defining the extent and depth of surficial sedimentation. Specifically, the intent was to: 1) obtain new bathymetry to compare to prior bathymetry collected in October 1994 and 2) obtain seismic reflection data using a system with greater energy than had been used during the prior October 1994 geophysical survey.

The survey vessel was mobilized in Morro Bay on January 28, 1995, and the survey conducted on January 29th, 1995, Daily Logs from the survey are included in Appendix A. The survey collected data in a grid pattern approximately 2,200 feet by 1,500 feet centered at the proposed installation site.

Additional data from previous surveys at the site were also included during the data interpretation phase of this survey. Those data were included to tie together all available information at the site.

This report describes the area surveyed, survey procedures, instrumentation, data processing, and interpretation of the survey data.

2.0 FIELD INVESTIGATION

Survey procedures and equipment systems are described in the following sections. Equipment specifications are included in the Appendices.

2.1 FIELD OPERATIONS

The vessel used for the subtotal survey was the R/V Shana Rae owned and operated by Monterey Canyon Research Vessels. Mobilization was conducted at Morro Bay Harbor prior to the survey on January 28th. The field operations commenced with system tests, calibrations, and preliminary test lines on January 29th, 1995. Upon arrival at the survey location, the equipment systems were deployed, tested, calibrated, and tuned to provide optimum performance.

The entire survey was conducted on January 29th utilizing the Sub-Bottom Profiler and Precision Echosounder. Weather conditions at the site were fair during the early morning hours and slowly deteriorated during the late morning and early afternoon.

2.2 FIELD PROCEDURES

The geophysical survey utilized a subbottom profiler and precision echosounder. Data were collected along eight lines oriented perpendicular to the shoreline at 150-foot intervals, along five lines oriented parallel to shore at 200-foot intervals, along four lines oriented parallel to the proposed microtunnel at 150-foot spacing, and along two diagonal lines crossing the survey area. The total survey grid was approximately 2,200 feet by 1,500 feet centered near the proposed structure installation site.

A Starfix II Wide Area Differential GPS positioning system was utilized for the surface navigation system. The system provided positioning accuracies of approximately ± 2 meters. The Starfix II DGPS system was interfaced to a Line Run integrated navigation computer system to control positioning operations and coordinate the event, speed, and output functions to the peripheral devices. The system provided a complete suite of data collection, and plotting functions while providing clear, concise, color-graphic displays, which allow the helmsman to visually monitor vessel and equipment functions.

During data acquisition, the vessel speed averaged between 3 and 4 knots. Navigation fix positions were recorded at 100-foot intervals along all survey lines. Navigation fix data and bathymetric soundings were logged to hard disk and printed out in real-time during data collection. Simultaneous event closures were sent at each fix point to the echosounder and subbottom recorders, placing an event mark on each analog record. All records were annotated with fix numbers, line numbers, time, and scale changes. Data were collected simultaneously on all the geophysical systems for all survey lines.

High-density, bathymetric soundings were recorded on paper utilizing a Raytheon precision echosounder and Odom digitrace and recorded to disk at approximately 1.0 second intervals along each survey line. This closely spaced bathymetric coverage between fix positions produced a very accurate profile of the sea floor bathymetry. Upon arrival at the survey area, the echosounder was "Bar-Check" calibrated before beginning data acquisition. The transducer draft correction was then dialed into the echosounder to correct for transducer depth.

The ORE Geopulse subbottom profiler was tuned to maximum energy in an attempt to provide maximum penetration into the sediments. The purpose was to obtain greater subbottom penetration than had been obtained in a previous October 1994 survey that used a smaller energy system and had provided subbottom definition to only a limited penetration. Data were recorded on an EPC dual trace thermal recorder at a scale of 125 ms. Subbottom data were also digitally recorded on DAT tape for computer enhancement and swell filtering during the subsequent data processing phase. The sub-bottom profiler boomer source and hydrophone were both towed 50 feet astern of the vessel directly behind the navigation antenna.

The survey was completed at 13:20 hours on January 29th at which time the geophysical systems were recovered. Following systems recovery the boat returned to Morro Bay for demobilization on January 30th, 1995.

3.0 DATA PROCESSING

Data processing of the positioning, bathymetric, and subbottom data was accomplished at the Fugro offices in Ventura and Petaluma, California. Additional subbottom data enhancement and swell filtering procedures were conducted at the ORE office in Houston, Texas. The following sections describe the data processing procedures utilized.

3.1 NAVIGATION PROCESSING

Navigation data recorded during the project were processed and plotted at a scale of 1 inch equals 200 feet (1" = 200') to produce a working post-plot navigation map. Processing of navigation data included fix editing, scaling, base map preparation, and plotting of information onto a stable mylar film. This map served as the basis for the subbottom data processing and is shown on the included *Navigation Post-Plot and Bathymetry Map.*

3.2 BATHYMETRIC PROCESSING

Raw digital bathymetric data were corrected for tidal variations and reduced to Mean Lower Low Water (MLLW) datum during post-processing. Tidal corrections were determined by using the predicted tides at San Simeon for the survey period. Tidal fluctuation curves used are included in Appendix F.

The raw echosounder records had some "peaks and troughs" as the transducer was lifted and dropped by the sea swells. In addition, a slight roll may extend some of the troughs slightly more than the actual vertical drop caused by the boats motion. To compensate for these variations in readings, a smoothing curve was drawn through the data approximately one-third the distance down from the peaks.

Edited and tide-corrected soundings were then input to a computer mapping program. Computer generated contours were then calculated at 2-foot contour intervals. These contours are plotted on the included *Navigation Post-Plot and Bathymetry Map.*

3.3 SUBBOTTOM PROCESSING

The original seismic reflection data were submitted to Ferranti O.R.E. in Houston, Texas, for further processing in hopes of enhancing the resolution of the seismic section. Processing efforts were aimed at: eliminating the jitter resulting from the poor sea conditions during data acquisition, removing the sea floor multiple, enhancing the deeper portions of the record, and reducing the acoustic ringing just below the sea bed. Survey lines 205 and 206 (which bound the proposed seawater intake and the brine outfall locations) are reproduced on Figure 1 and provide an illustration of the improved record quality with processing.

4.0 DATA INTERPRETATION

Data interpretation was performed at the Fugro offices in Ventura and Petaluma, California. The following sections describe the bathymetry and sub-bottom stratigraphy observed from the field data.

4.1 PHYSICAL SETTING

The survey area is located offshore from the mouth of the San Simeon Creek. Onshore to the east, the flood plain for the creek is about 800 to 1,200 feet wide and is incised into the Franciscan bedrock formation. Subsurface exploration and geophysical data at the Cambria Community Services District's (CCSD) well field, about 1 mile inland, suggest the Franciscan bedrock may be as deep as El. -75 feet, beneath the floodplain. The onshore San Simeon Creek floodplain probably was scoured to bedrock during prior sea level lowstands during the late Pleistocene. Therefore, it is logical to assume that an infilled submarine canyon may extend outward from the mouth of San Simeon Creek. Based on the onshore data, the base of the sediments in the axis of such a canyon should be below at least El. -75 feet.

The survey area, offshore from the mouth of San Simeon Creek, is located between two kelp beds. The area between the kelp beds is about 800 to 1,000 feet wide. Previous data have shown that those kelp beds are founded on rock outcrops. In addition, several sea mounts are present along the shoreline to the north of the survey area.

4.2 PREVIOUS SURVEY AND VIBRACORE SAMPLING

A previous geophysical survey was conducted, by Coastal Resources Management, in October 1994. Documentation for that survey indicates that the survey included collection of bathymetric data, side-scan sonar, and subbottom profiler data. The survey lines for the prior survey were oriented perpendicular to the adjacent shoreline and no survey lines were oriented parallel to the shoreline. That orientation of survey lines presumably was because of the thickness of the kelp bed, which prevented deployment of the survey systems in the kelp. A portion of the side-scan mosaic from that survey is reproduced herein on Figure 2. The specifications for the survey indicated that power availability on the survey vessel limited the energy output of the 3.5 kHZ subbottom profiler.

In addition, eight vibracores were collected, for Jones & Stokes Associates, Inc., in June 1994. Those vibracores were collected with a relatively small and light weight Rossfelder Model P-5 vibracorer, which was deployed with a 10-foot-long sample tube.

4.3 LATE JANUARY 1995 BATHYMETRY

Bathymetry contours for the late January 1995 survey are plotted on the included *Navigation Post-Plot and Bathymetry Map*. These contours are at 2-foot intervals and are referenced to MLLW.

Water depths recorded in the area vary from 44 feet located in the southwest corner of the survey area to 16 feet in the northeast corner. The terminus of the proposed microtunnel and saltwater intake lie in 27 feet of water and the terminus of the brine outfall lies in 31 feet of water.

The sea floor near the terminus of the microtunnel slopes to the southwest at about 1 foot per 50 feet, further offshore from the slope is flatter at about 1 foot per 70 feet. The quality and resolution of the echosounder data is very good with only slight degradation because of the sea conditions.

4.4 COMPARISON OF OCTOBER 1994 AND LATE JANUARY 1995 BATHYMETRY

The late January 1995 bathymetry is compared to the bathymetry interpreted from the Prior October 1994 bathymetry on the *Combined Bathymetry and Sea Floor Features Map*. The comparison of the bathymetry charts for those two dates indicates that sediment was deposited shoreward of the micro-tunnel alignment between the two survey dates. That seaward thinning wedge of new sediment probably is material that was deposited from San Simeon Creek during the early- and mid-January rainfalls. The two bathymetry charts suggests the new sediments are about 6 to 8 feet thick at the shoreward side of the survey area (approximately 1,000 feet from the beach), where, in late January 1995, the bathymetric contour was less than El. -24 feet. The new sediments thin to less than about 2 feet by the El. -30-foot contour and then thin farther to about a foot in thickness near to the El. -40 bathymetric contour. Seaward from the El. -40-foot-contour, the new bathymetry appears to be about 1 foot higher than the earlier October 1994 bathymetry.

4.5 SUBBOTTOM STRATIGRAPHY

GeoPulse data collected by Fugro in late January 1995 were reviewed together with subbottom profiler records collected during the prior October 1994 Coastal Resources Management survey. The original field records from both surveys were examined with the objective of determining the amount of unconsolidated sediment overlying bedrock within the survey area, offshore from the mouth of San Simeon Creek.

A map constructed from the Coastal Resources Management data identifies a subbottom reflector lying 2.5 to 5 feet beneath the seabed between the kelp beds. Although the unit was not always identified as continuous along any single survey line, it does persist throughout the surveyed corridor. Beneath the shallow seismic reflector, no evidence of any additional acoustic "events" was found. Flanking the survey corridor on either side, rock outcrops were mapped from subbottom and sea floor imaging data. However, because no survey lines were oriented across the interface between the kelp bed and the adjacent sediment area, the prior survey data do not provide evidence relative to the continuity or lack of continuity of the rock across and beneath the survey area. The identification of a dense kelp canopy to the north and south of the survey corridor further supports the interpretation that the sea bed flanking the corridor is comprised of rock. Our review of the prior subbottom profile data confirms the original interpretations.

The lack of additional information below the shallow (2.5- to 5-foot) reflector could indicate that: 1) the sea bed and the shallow unit are reflecting and/or absorbing all the systems energy, 2) additional subsurface reflectors are not present to a depth within the systems capabilities because the underlying sediment is homogeneous or that 3) any deeper reflecting units or bedrock lay buried deeper than the penetrating power of the system. That is the penetration of the subbottom profiler used for the Coastal Resources Management survey was restricted by either the systems output power limitations or the site-specific geological conditions. It was, therefore, reasoned that a system with more output power should help to resolve this and define the amount of sediment overlying bedrock, which was presumed to be at a greater depth.

The Fugro survey, therefore, used a more powerful GeoPulse system. Additionally, several survey tracklines were run perpendicular to the trend of the assumed offshore geologic structure to enhance the possibility of acquiring data deeper in the geologic section. The GeoPulse system was operated at 375 joules and should have had sufficient power to penetrate to a depth of more than 30 meters. The resultant field records, however, did not yield any better detail than did those from the prior survey. Again, a very shallow reflector is somewhat recognizable at 2.5 to 5 feet beneath the sea floor, but no reflectors are seen deeper in the seismic section. Even after processing, these new records provide little definition of the total thickness of unconsolidated sediment beneath the upper 5 feet of sea floor material.

Whilst neither survey data set confirms the extent of unconsolidated sediment in the proposed project area there is a consistency to what they do reveal. The few feet of material is an unconsolidated, possible mobile, unit of sand, or sometimes coarser material. The very shallow reflector seen in the two seismic reflection data sets defines the base of this unit

Unfortunately the exact nature of the material beneath the upper few feet of sediment is not known, nor can the depth to bedrock be confirmed from the data. Some inferences can, however, be made from the lack of reflectors. From both seismic reflection surveys, the data reveal no acoustic reflecting surfaces beneath the upper few feet and further the nature of the material responsible for the reflective event can not be confirmed as bedrock. If the material deeper in the geologic section is unconsolidated or even indurated sediment, it might be expected to be stratified especially in a fluvial depositional regime. Such a sediment should provide recognizable, deeper reflectors in the seismic data. If, on the other hand, the upper few feet of sea floor material is underlain by bedrock, much or all of the acoustic energy might be reflected back and no reflective horizons would be seen deeper in the seismic section. The acoustic signature of the shallow reflector is not, however, as distinct nor crisp as typically associated with bedrock.

In trying to understand the nature of the materials lying beneath the offshore survey area, it is tempting to project the onshore geologic conditions seaward. The onshore geology of the creek valley gives evidence of a deep channel incised into bedrock. Topographic relief surrounding the San Simeon Creek valley floor exceeds 150 feet. Approximately 1 mile inland from the coastline, the floor of the valley is approximately 600 to 800 feet wide. Westward toward the coast, the valley floor broadens to a width of approximately 1,500 feet at the coastline. Seismic refraction surveys conducted within the valley indicate bedrock to be below El. -75 beneath the valley floor. Well data further identify the soil types overlying the bedrock to be fine to coarse sands and gravels with some silt and clay.

The assumption that the project site, lying approximately 1,000 to 1,500 feet off the mouth of San Simeon Creek, should mirror the geologic conditions found within the streambed onshore, however, is not supported by the marine seismic data. Even if the seismic energy sources were insufficient to penetrate to bedrock depth near the axis of any offshore extension of the creek channel, transgressive overlap seismic sequences should be recognizable at the lateral limits of the channel. That is, the boundary where the channel sediments lap over onto underlying bedrock should be identifiable adjacent to the area where bedrock is exposed at or near the seafloor. This contact or boundary, however, is absent in the marine seismic data. The lack of that contact is consistent with the postulation that if the paleo-San Simeon streambed might have been diverted either, toward the south or north, near the present shoreline.

4.6 SUBBOTTOM MATERIALS

Eight vibracores were collected, for Jones & Stokes Associates, Inc., in June 1994. The eight vibracore locations were between about -20 feet and slightly offshore of the -45-

foot bathymetric contours. The Jones & Stokes report for the vibracoring effort indicates that 3 to 4 feet of sediment were recovered in six cores, a maximum of 6 feet of sediment was recovered in one core, and no sediment was recovered in the remaining core (which had been attempted in the kelp bed).

With the exception of a comment relative to pieces of rock observed in the core barrel for the coring attempt in the kelp bed area, the vibracoring report does not provide information relative to the potential question of "did the vibracores refuse on rock?". The core logs indicate that the sediment at the coring locations consisted of sand with variable quantities of shell and gravel. The grain size of the sand was reported to vary between silty fine sand and fine- to coarse-sand. The core logs appear to suggest that the grain size of the shallow sands is somewhat stratified.

4.7 CONCLUSIONS

The lack of other seismic event in either of the two geophysical surveys, as well as the result of the prior vibracore sampling program, are interpreted to be consistent with the presence of rock at shallow depths below the sediment to the offshore of the San Simeon Creek. What is seen in the seismic data is a thin layer of sediment overlying a shallow reflector of unknown origin. The failure of the vibratory corer to penetrate more than 6 feet anywhere within the survey area may indicate the presence of shallow bedrock or a partially indurated sediment. Finally the possibility that both marine seismic systems were simply unable, for some unknown reason, to penetrate the underlying sediment can not be ruled out.

The interpretation of a shallow bedrock surface in the survey area is recognized to be inconsistent with the expectation that an infilled submarine canyon should extend outward from the mouth of San Simeon Creek. Based on the onshore data, the base of the sediments in the axis of such a canyon should be below at least EL. -75 feet. The marine geophysical data, however, are inconsistent with the seismic section that should be observed if such a condition existed. To confirm the presence or absence of rock beneath a thin layer of sediment probably will require sampling using wet rotary or other similar types of sampling methods.

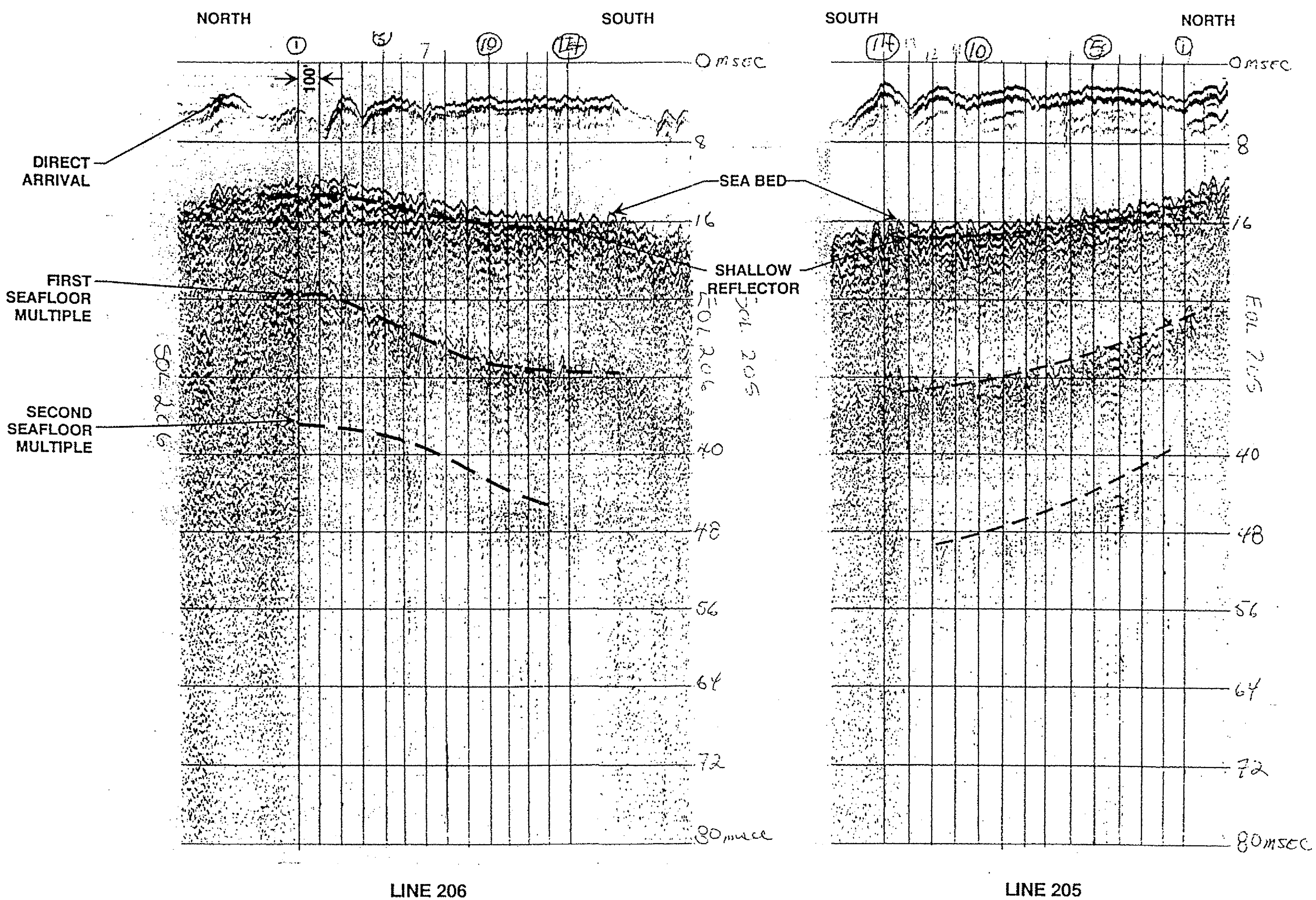
On the basis of the marine data collected to date, it is our opinion that the intake and effluent outfall line alignments are likely to be underlain by only a minimal thickness of sediment. In addition, the thickness of sediment may fluctuate seasonally and in response to storm events.

5.0 REFERENCES

Coastal Marine Resources (1994)

Jones & Stokes Associates, Inc. (1994), *Sea Floor Sediment Sampling near San Simeon Creek, San Luis Obispo County, California*, prepared for Cambria Community Services District, July.

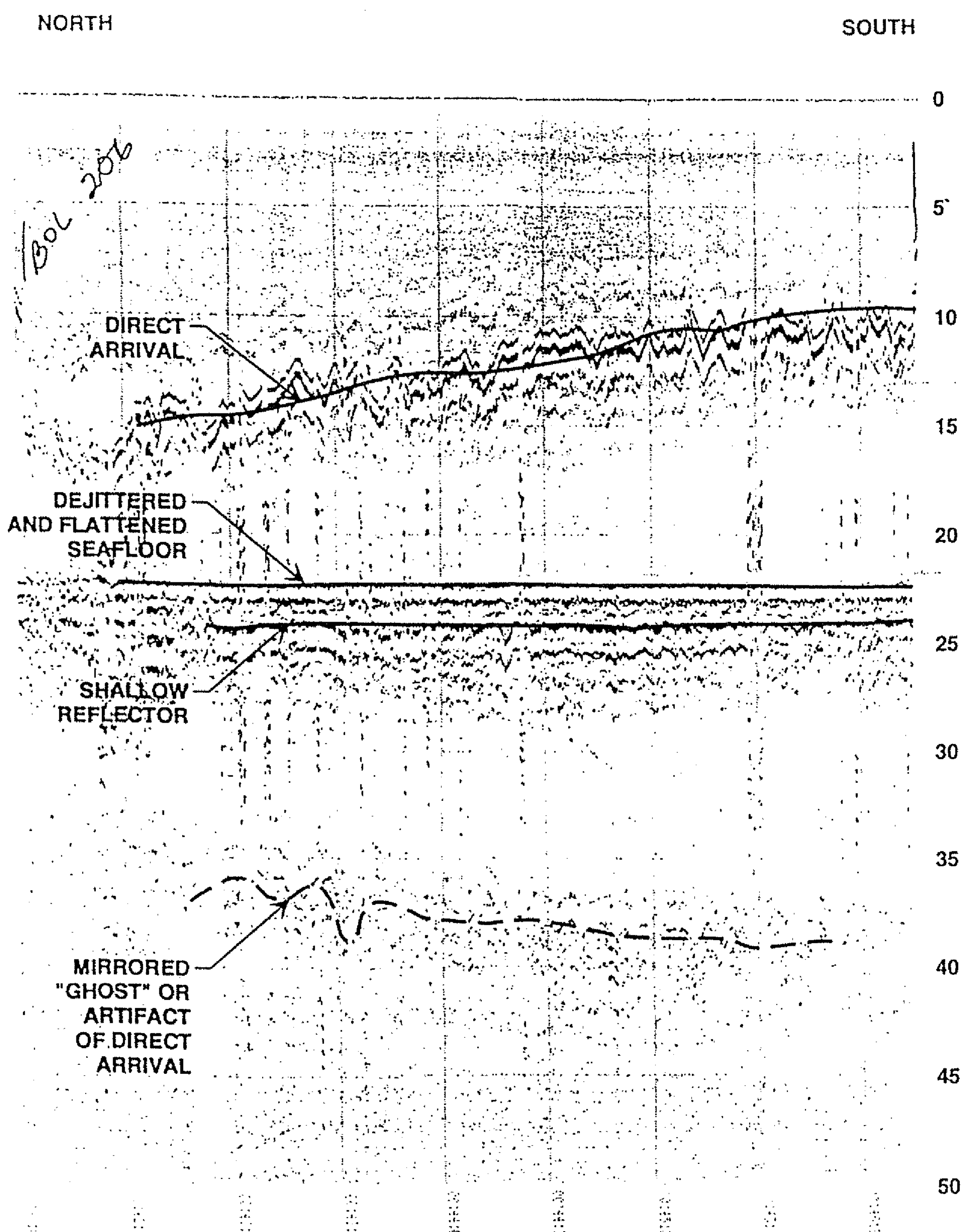
FUGRO



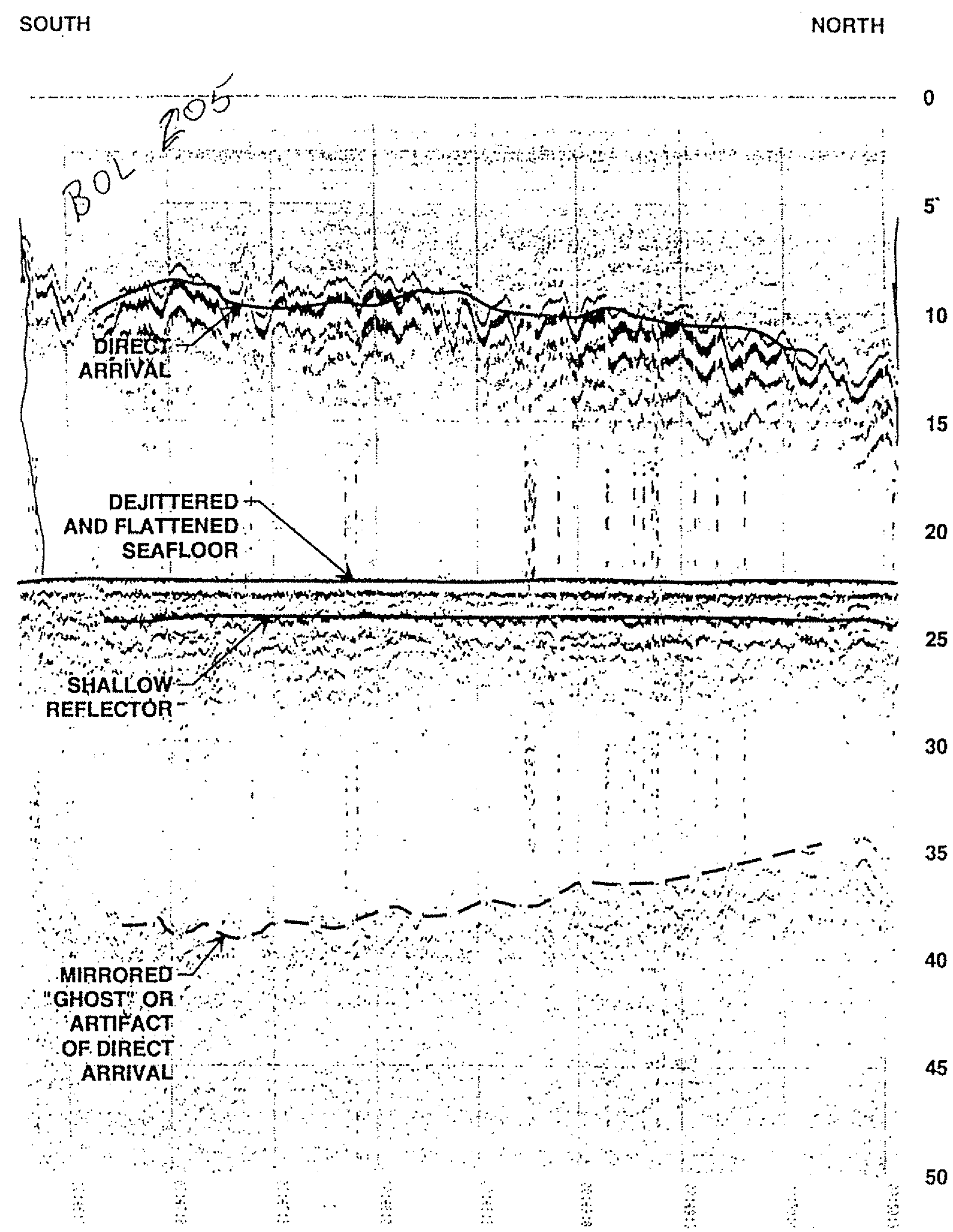
ANNOTATED SEISMIC RECORDS
Original Field Data
Proposed Cambria Desalination Plant
Intake and Outfall Structures

FIGURE 1a

FUGRO



PROCESSED SECTION
LINE 206



PROCESSED SECTION
LINE 205

ANNOTATED SEISMIC RECORDS
Processed Data
Proposed Cambria Desalination Plant
Intake and Outfall Structures

FIGURE 1b

APPENDIX A
DAILY PROJECT LOGS

DAILY PROJECT LOG

CLIENT : OCEANEERING TECHNOLOGIES

PROJECT: CAMBRIA SUBBOTTOM PROFILE SURVEY

DATE : 28th JANUARY 1995

VESSEL : R/V SHANA RAE

TIME	DESCRIPTION
0700	Depart Ventura for Morro Bay
1000	Arrive Morro Bay to mobilize vessel.
1730	Mobilization complete, systems testing.

DAILY PROJECT LOG

CLIENT : OCEANEERING TECHNOLOGIES

PROJECT: CAMBRIA SUBBOTTOM PROFILE SURVEY

DATE : 29th JANUARY 1995

VESSEL : R/V SHANA RAE

TIME	DESCRIPTION
0400	Depart Morro Bay for Worksite
0700	Echosounder deployed, conducting calibration
0710	Subbottom in water, tuning system.
0740	Running test lines and tuning systems.
0907	Systems tuned begin survey.
1159	Weather and swell increasing - Wind West @ 15 knots; Swell 5-7 feet.
1319	Complete Survey.
1325	Recover Gear.
1340	Underway for Morro Bay.
1700	Arrive Morro Bay

DAILY PROJECT LOG

CLIENT : OCEANEERING TECHNOLOGIES

PROJECT: CAMBRIA SUBBOTTOM PROFILE SURVEY

DATE : 30th JANUARY 1995

VESSEL : R/V SHANA RAE

TIME	DESCRIPTION
0700	Demobilize Vessel
1200	Arrive Ventura.

APPENDIX B
SURVEY INSTRUMENTATION

B1 NAVIGATION SYSTEM

B1.1 STARFIX II WIDE AREA DIFFERENTIAL GPS SYSTEM

Surface positioning of the vessel was accomplished through the utilization of a DGPS positioning system and integrated navigation software. The Fugro West software is operated on a 486 shipboard computer that serves as a controller for a variety of input/output devices. The differential method of using GPS is a viable way of enhancing the accuracy of the GPS over the survey area. Real-time corrections were transmitted via a dedicated satellite transponder to the vessel. The corrections themselves are pseudo-range corrections and range-rate corrections for every satellite in view. The GPS base stations that collectively comprise of the Wide Area Differential (WAD) network are located throughout North America. These base stations make real-time differential observations of the GPS satellite constellation in their view. The differential data is then modemed to the STARFIX control center located in Houston, Texas at the JECA STARFIX Division office. At the control center, the data is further enhanced by applying corrections for ionospheric and tropospheric corrections. The enhanced data is then uplinked to a dedicated communication satellite transponder and simultaneously transmitted to the vessel. On board the vessel a dedicated WAD computer compiles received time tagged data with the vessels GPS position and outputs the DGPS position to the navigation computer. This method of transmitting WAD requires no local base station, has no radio range or line-of-sight considerations and will produce a position in the order +-2 meter accuracy or better. Furthermore, the update rate of this method is in the order of 1.5 to 2 seconds and has a very high reliability rate. Additional input data, including vessels heading information from the gyrocompass will be logged at every fix mark. The computer logged position information was stored on disk and also backed up by hard copy print out. Position fix marks were generated from the computer system at the desired intervals along the pre-plotted track lines.

B1.2 INTEGRATED NAVIGATION COMPUTER SYSTEM

Line Run software developed by JECA is the result of Fugro West's need for a transportable, PC based navigation system. The system has the capability of interfacing DGPS positions of latitude and longitude and converting them to the appropriate State Plane coordinates if necessary. In addition to data acquisition of positioning data, the software can interface with external instruments such as fathometers, Ultra Short Base Line acoustic systems, side scan sonar and geophysical equipment for annotation of records. One of the systems strengths is its ability to import AutoCad generated maps and charts and have them depicted on several graphics display monitors that can be stationed throughout the vessel. If specified, detail of bathymetry, hazards, land masses or special details can be depicted in two dimensions (X&Y) in a north up orientation.

The graphic monitor displays a scaled depiction of a sonar towfish and vessel position relative to the pipelines, and range and bearing from an ROV to target locations. The surveyor can control the scaling of the graphics screen to assist the captain in fine tuning the vessel and sonar towfish position in relation to the pipelines.

B2 BATHYMETRY SYSTEM

A Raytheon precision echosounder was used to record water depths. The operating frequency of the fathometer system is 210 Khz. This instrument features complete calibration for speed of sound velocity, draft of transducer and tidal correction. Recording is accomplished high resolution printing techniques on paper with additional digital output to the navigation computer utilizing an Odom digitrace.

The recorder generates a keying pulse which is converted to a short burst of high frequency energy by internal transmitter electronics. This energy is routed to a transducer assembly affixed to the side of the vessel. Return signals from the transducer are amplified and filtered. This signal is digitally processed in order to apply speed of sound velocity and draft corrections. The output is then applied to the calibrated graphic display.

High density digital depth data from the fathometer is recorded by the navigation system at approximately 2 foot intervals for post processing. Fix marks from the navigation system are also recorded at the appropriate time on the fathometer recorder for later correlation to the post-plotted position on the track line base map.

Prior to the survey a bar-check calibration was performed. A metallic reflecting surface (an aluminum plate) is suspended in the water directly beneath the transducer at calibrated intervals of ten feet. The plate is lowered to an appropriate depth and this depth is compared to the reading of the reflected signal on the fathometer recording chart paper. The water velocity and draft measurements are entered into the recorder via front panel switches. Depths of the plate are compared with the chart readout and measurements or adjustments are made until the depths correlate to within 0.1 ft.

The transducer was mounted over-the-side on a pole. Transducer depth was physically measured at 4.0 feet. This draft was then corrected at the recorder. Tide corrections were determined using the predicted tides. These corrections were applied during data processing.

B3 SUBBOTTOM PROFILER SYSTEM

Fugro used an ORE GeoPulse subbottom profiler system to provide the shallow penetration sub-bottom profiler requirements of the project. The system consists of an ORE Model 5430A Transmitter, ORE Model 5210A Receiver, ORE Towed Boomer Plate Source, and ORE Hydrophone Array. This system can be operated at 1.0 or 7.0 Khz to power levels of 10 kilowatts. This system provides a means of differentiating sediments and producing a graph of the seafloor stratigraphy with high resolution in the upper sediments.

The GeoPulse boomer system consists of an electro-mechanical plate sound source. A short duration high energy pulse is discharged thorough the source plate mechanism causing motion of the plate. This motion generates a broad band acoustic pulse that is transferred to the water. This broad band acoustic pulse does no have the strong cavitation and ringing associated with a conventional sparker source.

Onboard the vessel the return signal is applied to a time-varied gain amplifier in the receiver. This unit allows the gain to increase linearly from the instant the source is fired to the end of the record length. Combined TVG and operator controllable gain provide up to 100 dB of active gain for low amplitude signal processing. This acoustic signal is then passed to the recorder for the analog data display.

The EPC graphic recorder provides a visual means of depicting geologic features in two axes. One axis is two-way travel time of the acoustic signal through the water column and the seafloor. The other is the track line of the vessel as measured in distance.

APPENDIX C
GEODETIC AND SURVEY PARAMETERS

C1 GEODETIC PARAMETERS

The following parameters were used during the survey. Units used throughout are U.S. Survey feet.

- Spheroid — Clarke 1866
  - Semi Major Axis — 20,925,874.00 ft.
  - Eccentricity Squared — 0.006,758,675,997
- Projection — Lambert California Zone 5

C2 SURVEY SYSTEM PARAMETERS

Horizontal control utilized during the project consisted of a Starfix II Wide Area Differential GPS (DGPS) Positioning System.

APPENDIX D
VESSEL SPECIFICATIONS

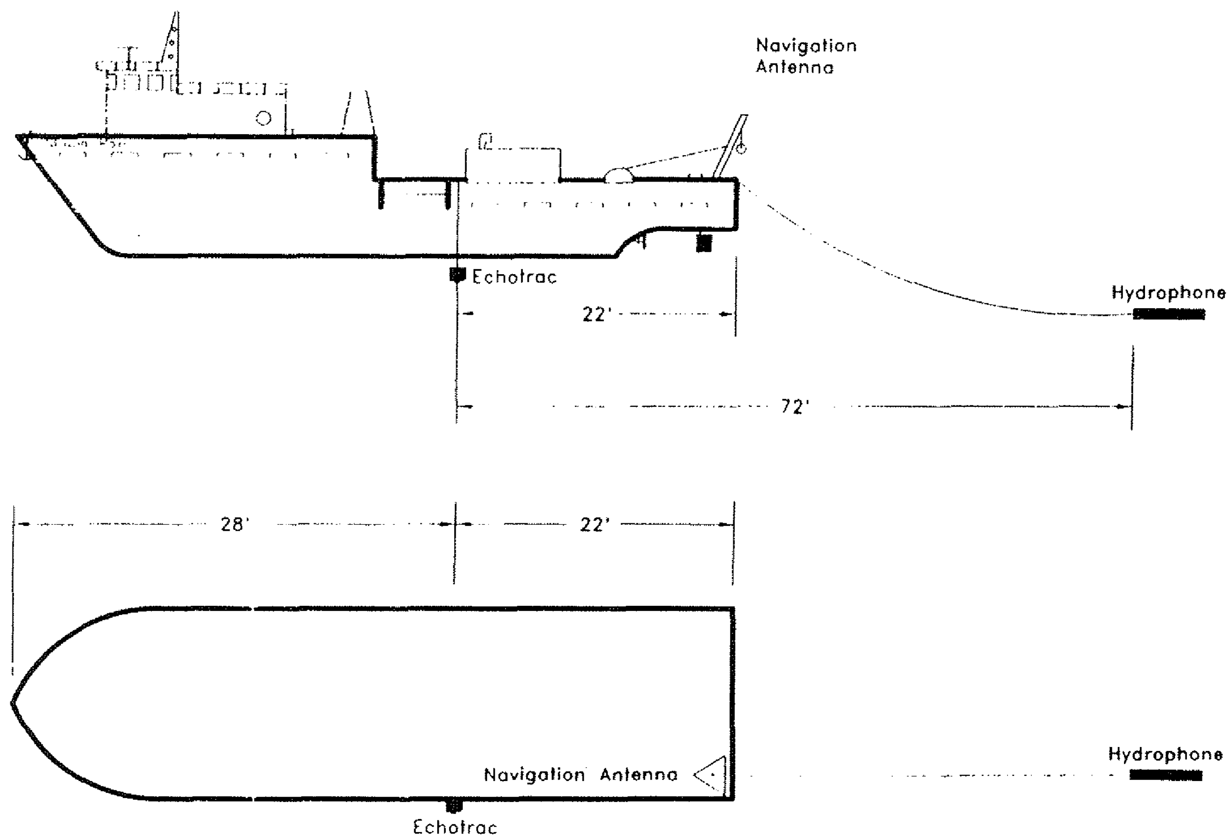
D1 GEOPHYSICAL SURVEY VESSEL DESCRIPTION

The geophysical survey utilized the R/V Shana Rae, owned and operated by Monterey Canyon Research Vessels.

D2 VESSEL SPECIFICATIONS

Length	50 feet
Beam	16 feet
Draft	4 feet

FIGURE 3



Vessel Tow Configuration Diagram

APPENDIX E
PERSONNEL

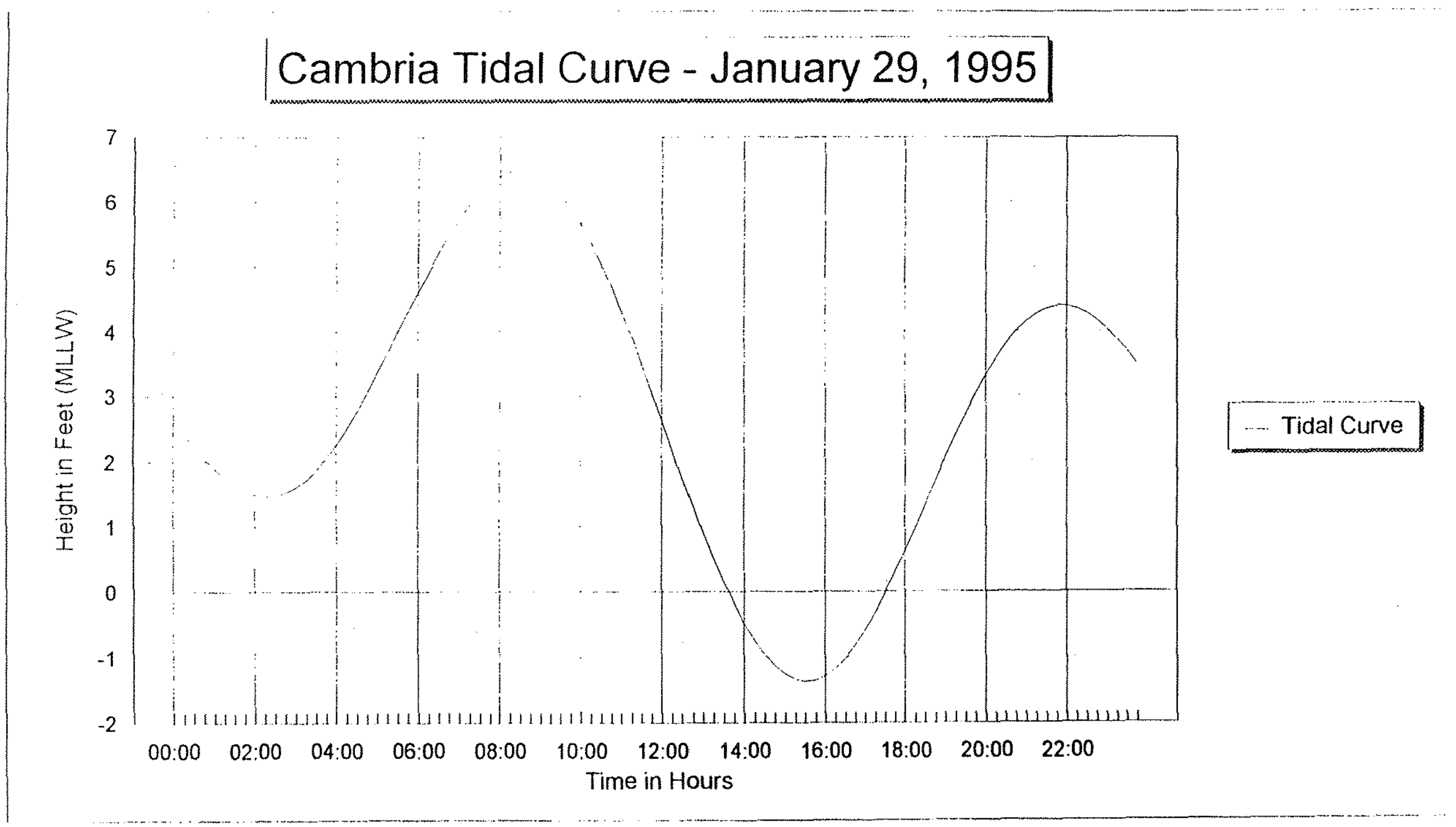
E1 FIELD INVESTIGATION PERSONNEL

Jeff Babbitt	Field Party Chief
Tim Seward	Data Acquisition Systems Operator

E2 REPORT PERSONNEL

Gilbert Suarez	Mapping
Jeff Carothers	Data Reduction and Review
Chuck Chamberlain	Geophysics
Tom McNeilan	Geophysics and Review

APPENDIX F
TIDAL DATA



Cambria Tidal Curve - January 29, 1995
7
6
5
4
3
2
1
0
-1
-2
Height in Feet (MLLW)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time in Hours
Tidal Curve

APPENDIX G
LINE SUMMARY LOGS

FUGRO WEST, INC. LINE SUMMARY LOG PAGE: 1 OF 2

CLIENT: OCEANEERING TECH. AREA: CAMBRIA, CA VESSEL: R/V SHANA RAE

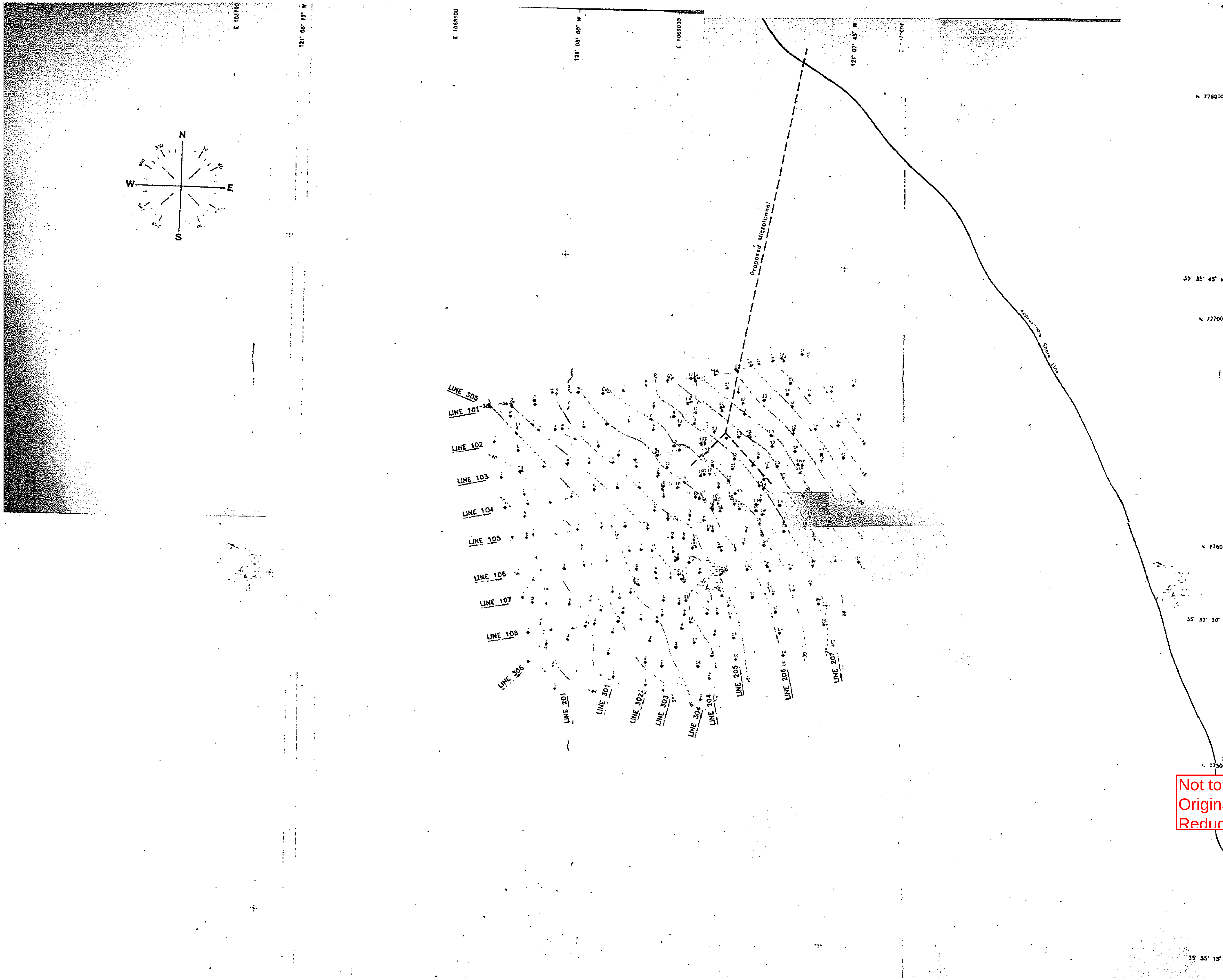
DATE	LINE NO.	HDG.	FIRST SHOTPOINT		LAST SHOTPOINT		STEPBACK FEET				REMARKS	ROLL NUMBER			
			NO.	TIME	NO.	TIME	E/S	MAG	S/S	S/B		E/S	S/S	S/B	MAG
1/29/95	103	East	1	0844	16	0849	0			72	No Events Abort Line	1		1	
	103	East	1	0907	17	0912									
	102	East	1	0936	17	0941					Change S/B Recorder			2	
	101	East	1	0954	15	0958									
	207	South	14	1007	27	1011									
	206	South	1	1022	14	1026									
	205	North	14	1029	1	1031									
	204	South	1	1041	14	1044									
	104	East	1	1053	16	1057									
	105	East	1	1105	13	1108									
	106	East	1	1114	15	1117									
	306	North	1	1125	17	1130									
	301	North	1	1144	15	1148									
	302	North	1	1155	15	1159					Weather & Swell Increasing				
	303	North	1	1206	13	1210					Wind 15 Knots, Swell 5 - 7 feet				
	304	North	1	1216	13	1220									
	107	East	1	1228	16	1232									
	108	East	1	1239	13	1242									
1/29/95	109	East	1				0			72	Nav Lock Abort Line	1		2	
	305	East	1	1304	15	1308									
	201	North	1	1315	14	1319									

APPENDIX H
SURVEY MAPS

H1 **Fugro Drawing No.: 94-83-9277A**

Navigation Post-Plot and Bathymetry Map

H2 **Fugro Drawing No.: 94-83-9277B __________ Map**



OCEANEERING TECHNOLOGIES, INC.

MAP SHOWING

Sub-bottom Profile Survey Navigation Post-Plot and Bathymetry

Cambria Desalination Plant Intake and Outfall Structures Proposed Installation Site

Plate 1 of

Fugro West, Inc.

MARINE AND LAND SURVEYING GROUP
4820 McGrath Street 140 Ventura, California 93003
Telephone (805) 658-0455 • fax (805) 658-6679

LEGEND

= California zone 5 coordinate graticule.
= Geographic coordinate graticule.
= Navigation position fix (Echosounder Transducer).
= Vessel trackline.
LINE # = Indicates vessel direction and line number.
= Bathymetry from January 29, 1995 survey.

NOTES

1. Sub-bottom data collected utilizing an EG&G Geopulse System.
2. Bathymetric contours are in feet, reduced to Mean Lower Low Water Datum (MLLW)
3. Coordinates shown on this sketch conform with the California Coordinate System (Lambert Projection) zone 5, in feet.

REVISIONS

NO.	DATE	DESCRIPTION	BY

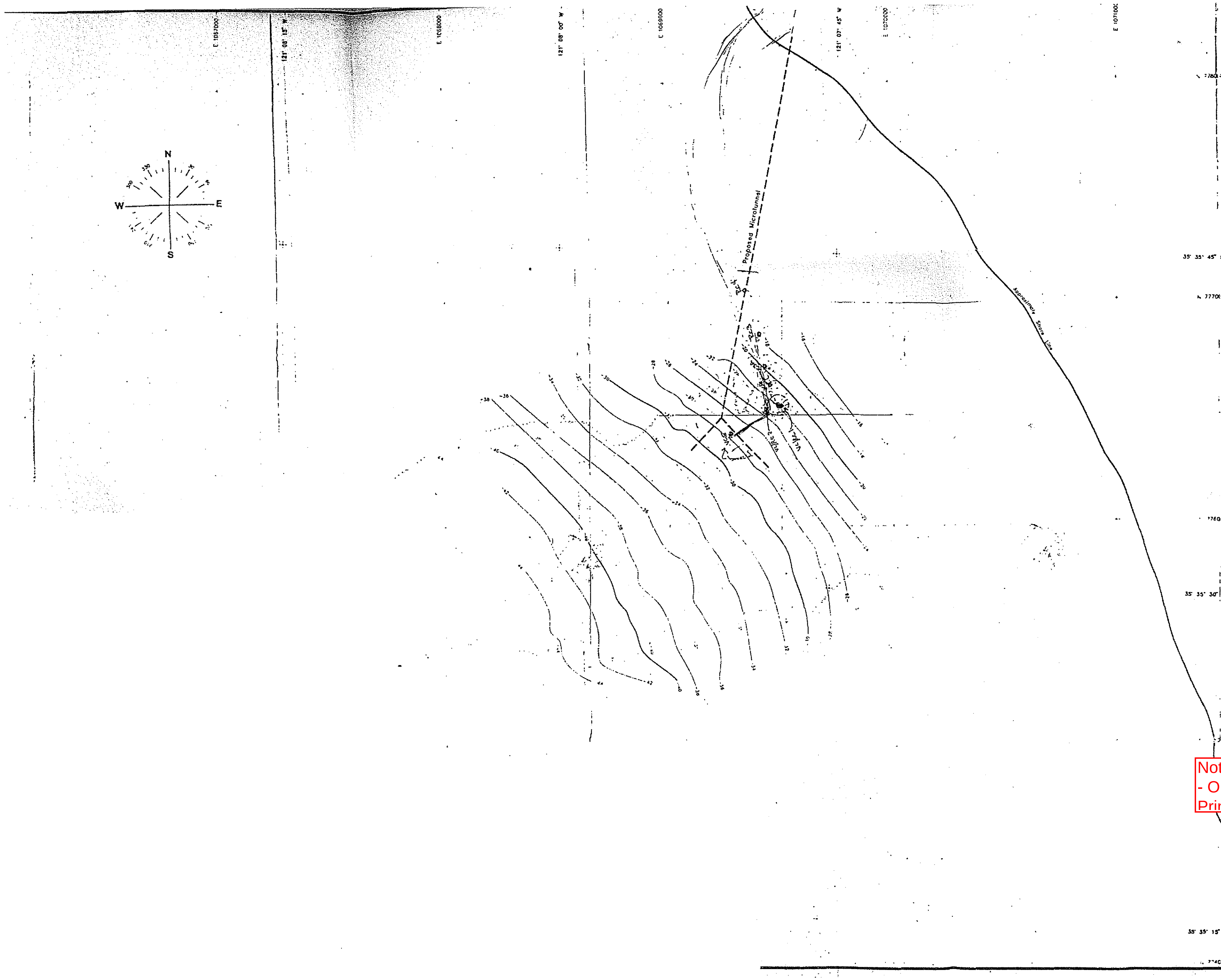
Not to Scale - Original Print Reduced

0 200 400 600

SCALE 1:2400

STARFIX II/DGPS	NAD 1927	CLARK 1866
CALIFORNIA COORDINATE SYSTEM	5	FEET
1-29-95	SHANA RAE	94-83-9277

PLATE I



OCEANEERING TECHNOLOGIES, INC.

MAP SHOWING

Sub-bottom Profile Survey
Combined Bathymetry and Seafloor Features

Cambria Desalination Plant Intake and Outfall Structures Proposed Installation Site

Plate 2 of 2

Fugro West, Inc.

MARINE AND LAND SURVEYING GROUP
4820 McGrath Street 140 Ventura, California 93003
Telephone (805) 658-0455 • Fax (805) 658-6679

LEGEND

= California zone 5 coordinate graticule.
= Geographic coordinate graticule.
= Bathymetry from January 29, 1995 survey.
= Interpreted bathymetry shown on Side Scan Mosaic from prior October 10, 1994 survey.
= Approximate edge of rock shown on Side Scan Mosaic from October 10, 1994 survey.
= Approximate edge of kelp shown on Side Scan Mosaic from October 10, 1994 survey.

NOTES

1. Sub-bottom data collected utilizing an ORE Geopulse system.
2. Bathymetric contours are in feet, reduced to Mean Lower Low Water Datum (MLLW).
3. Coordinates shown on this sketch conform with the California Coordinate System (Lambert Projection) zone 5, in feet.

REVISIONS

No	DATE	DESCRIPTION	BY

1" = 200'

0 200' 400' 600'

Not to Scale - Original Print

SCALE: 1:2400

STARFIX II/DGPS	NAD 1927	CLARK 1866
CALIFORNIA COORDINATE SYSTEM	5	FEET
1-29-95	SHANA RAE	94-83-9277
K.L.C.		94-83-9277B

PLATE