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NUMBER 8548

EPP 25

DUNTROON BASIN

BORDA AND BORDA EXTENSION SITE SURVEYS

REPORTS

Submitted by

**BHP Petroleum (Vic.) Pty Ltd
1993**

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MINES AND ENERGY
SOUTH AUSTRALIA



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ENVELOPE 8548

TENEMENT: EPP 25; Duntroon Basin

TENEMENT HOLDER: BHP Petroleum [Vic.] Pty Ltd (operator), INPEX South Lincoln Ltd and Deilmann Oil and Gas Pty Ltd

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Friday 20 March 1992

The Designated Authority,
c/o The Director,
Oil, Gas and Coal Division,
Department of Mines and Energy,
191 Greenhill Road,
PARKSIDE SA 5063.



Attention: Mr R Laws

Dear Sir

**APPLICATION TO CONDUCT A MARINE SITE SURVEY IN EXPLORATION
PERMIT EPP25 OF THE OFFSHORE DUNTROON BASIN**

BHP Engineering Pty Ltd., is assisting BHP Petroleum (Victoria) Pty Ltd., by acting as coordinator during the acquisition of a number of marine site surveys in conjunction with their 1992 drilling programme.

BHP Engineering Pty Ltd., acting on behalf of BHP Petroleum (Victoria) Pty Ltd., wishes to lodge an application for permission to conduct marine site survey in Exploration Permit EPP 25 of the offshore Duntroon Basin.

This survey will be part of the basinwide 1992 drilling programme and will be carried out in conjunction with site surveys in other permits in which BHP Petroleum (Victoria) Pty Ltd., has interests. BHP Petroleum Pty. Ltd., will be operator for the entire programme.

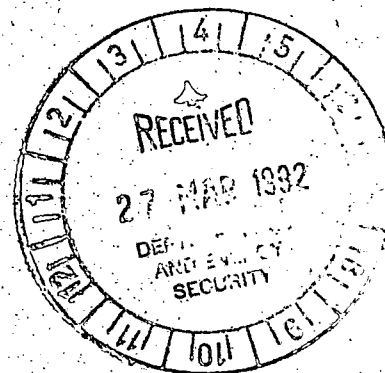
The site surveys will ascertain seabed and sub seabed conditions for anchoring of the drilling rig and additionally investigate near surface geological conditions for the occurrence of shallow gas pockets or other conditions that could complicate the early stages of the drilling programme.

Two copies of a 1:500,000 map are included with this application, detailing the location of the site survey in EPP25. In addition a location summary sheet is included. The survey will cover an area as detailed in the summary sheet, centred on the well location with the square orientated in the line direction shown.

Also included are the technical specifications of the "Tilbata Creek", the vessel sub-contracted by Racal Surveys, which is anticipated to commence the surveys in EPP 25 on or about April 20th 1992.

Yours faithfully

B. E. MILLIKEN
Senior Manager Land Technologies
on behalf of BHP Petroleum Pty Ltd



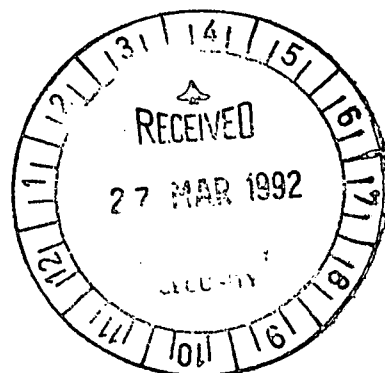
APPLICATION FOR PERMISSION TO CONDUCT MARINE SITE SURVEYS IN EPP25

BHP Petroleum (Victoria) of 120 Collins Street, Melbourne, Victoria 3000, hereby makes application for permission to conduct a marine site survey and submits the following information in support thereof:

- | | | |
|----|-------------------------------------|---|
| 1 | Name of Survey | ~~Bordat~~ Site Survey |
| 2 | Prime Survey | High Resolution Digital |
| 3 | Secondary Survey | Bathymetry and Side Scan Sonar |
| 4 | Area of Survey | EPP25 |
| 5 | Name & Address of Contractor | Racal Survey Australia Ltd
Unit 1, 20 Abrams Street
Balcatta, Perth, WA |
| 6 | Name of Survey Vessel | Tilbata Creek |
| 7 | Technical Details of Vessel | As attached |
| 8 | Port from which vessel will Operate | Port Lincoln |
| 9 | Technique | Marine seismic reflection |
| 10 | Energy Source | Airguns |
| 11 | Proposed Commencement Date | 20 April 1992 |
| 12 | Estimated Duration | 4 weeks (as part of larger survey) |
| 13 | Navigation System | Differential GPS |
| 14 | Survey Size | 3km x 3km |
| 15 | Estimated Cost | \$100,000 each site |
| 16 | Object of Survey | Check anchoring and drilling conditions. |

Petroleum (Submerged Lands) Act 1967 of the Commonwealth of Australia


B.E. MILLIKEN
 Senior Manager Land Technologies
 on behalf of BHP Petroleum Pty Ltd



SITE SURVEY LOCATION

BASIN:	Duntroon
PERMIT:	EPP 25
PROSPECT:	Borda Site Survey
LINE:	DH91-237
SP:	1100
LAT:	35° 49' 12.04"
LONG:	135° 42' 5.83"
Em:	563380
Nm:	6035774
LINE DIRECTION:	026 degrees

M/V TILBATA CREEK

Owner	; Guardian Marine Services Pty Ltd
Flag	; Australia
Official No	; 332241
Call Sign	; VJFP
Port of Registry	; Fremantle
Year of Construction	; 1982
Length	; 33.53 metres
Beam	; 8.87 metres
Draft	; 4.02 metres
Hull	; Steel
Tonnage	; 178.52 tons
Speed	; 11.5 knots
Engines	; 2 x General Motors 980 bhp total
Propulsion	; 2 x fixed blades in kort nozzles.
Generators	; 2 x 415/240v 80KVA, 50 Hz alternators driven by Detroit 4-71 diesels.
Radar	; Decca RM914C
Gyro Compass	; Furuno
Fuel	; 116.88 tonnes
Fresh water	; 143.62 tonnes
Communications	; Sailor 100 series HF & SSB radios.

SITE SURVEY EQUIPMENT SPECIFICATIONS**A. High Resolution Seismic Recording Equipment.**

Recording Unit	TTS 128.
Source Type	Single Texas Instrument sleeve gun x 4
Source Volume	4 x 40 cubic inches
Compressors	PB44 Detroit Diesels
Streamer type	Teledyne T1
Streamer length	1200 metres
Number of channels	96 channels
Number of hydrophones per group	8 phones/6.25m group

B. Sub Bottom Profiling System

Recorder	EPC 3200 and Elics Delph System
Source Type	EG&G UniBoom Electro-mechanical
Power Source	EG&G 234 Power Supply
Hydrophone	EG&G 265
Filters	TSS Swell Filter Krohn-hite Filter

C. Side Scan Sonar

Recorder	Klein 595 Side Scan Recorder
Towfish	Klein 100 kHz towfish c/w 1500 metres of cable

D. Echosounder

Recorder	Atlas Deso 20 Recorder
Transducer	33/210 khz Atlas Transducer

E. Navigation

GPS Receivers	Del Norte 1008 GPS Receivers
Differential Link	Racal SkyFix

F. Computer Equipment

Computers

Hewlett Packard 310

Printers

Hewlett Packard 2671G

Plotters

Hewlett Packard 9475

Disk Drives

Hewlett Packard 9122D

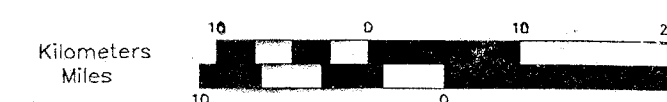
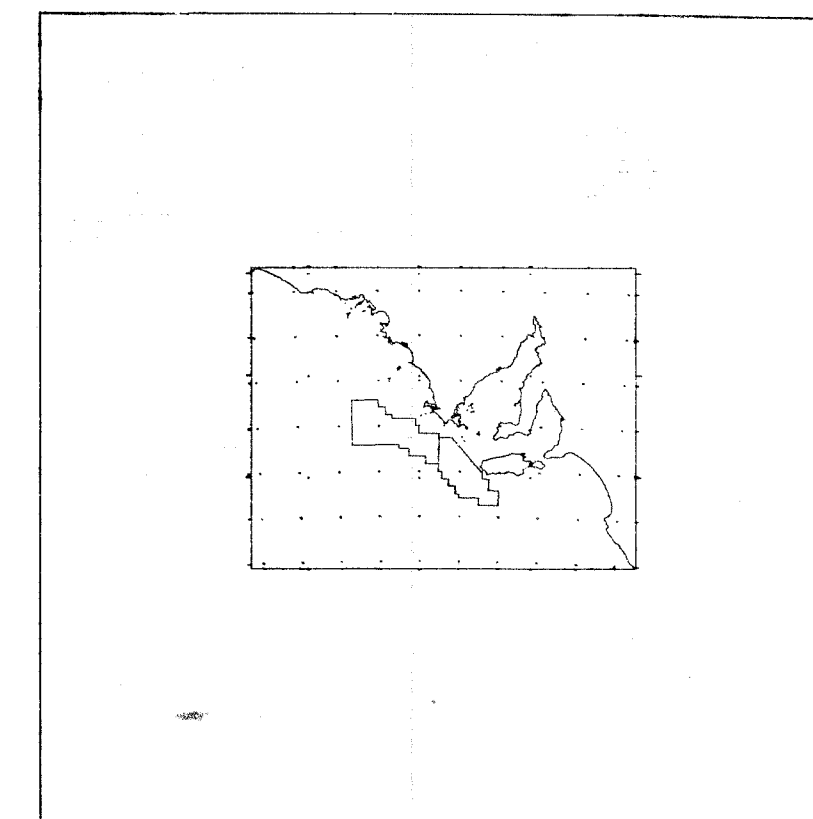
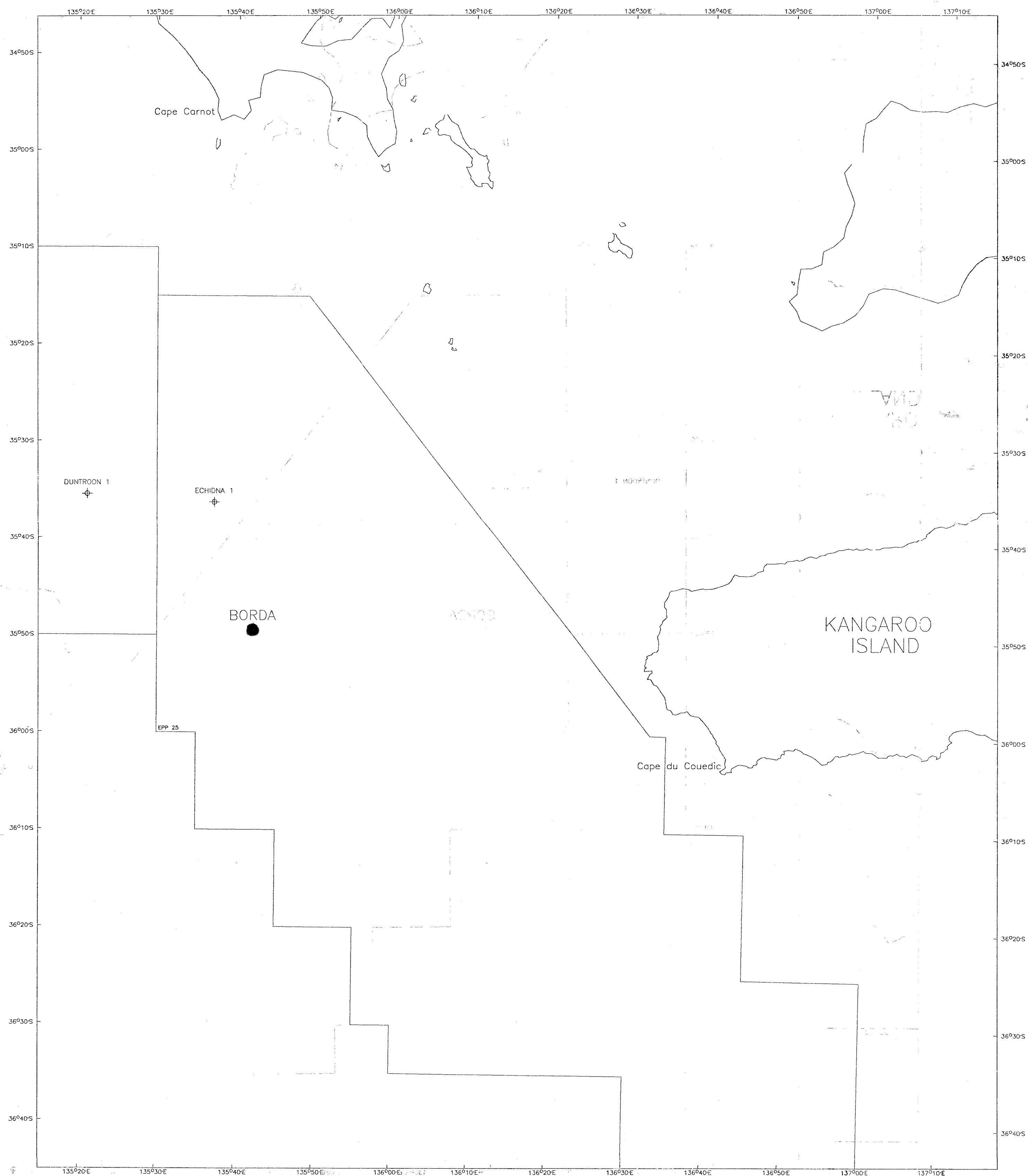
G. Ancillary Equipment.

Drop Corer

300kg Drop Corer with 2m barrel

Velocity Meter

Applied Microsystems STD-12



DUNTROON BASIN
EPP 25
SITE SURVEY LOCATION

8548-1

Project Name: DUNTROON	
Author: AAWILD	Date: 16/3/92
Map Name: SITE_SURVEY	
Scale: 500000.00 METERS/METERS	
Projection: UTM-53	Contour Int:

VOLUME 1

ANALOGUE SITE SURVEY REPORT

FOR

BHP PETROLEUM PTY LTD

LOCATION : BORDA
BLOCK : DUNTROON BASIN
DATE : 14th - 20th JUNE, 1992
REPORT REF : 1916e



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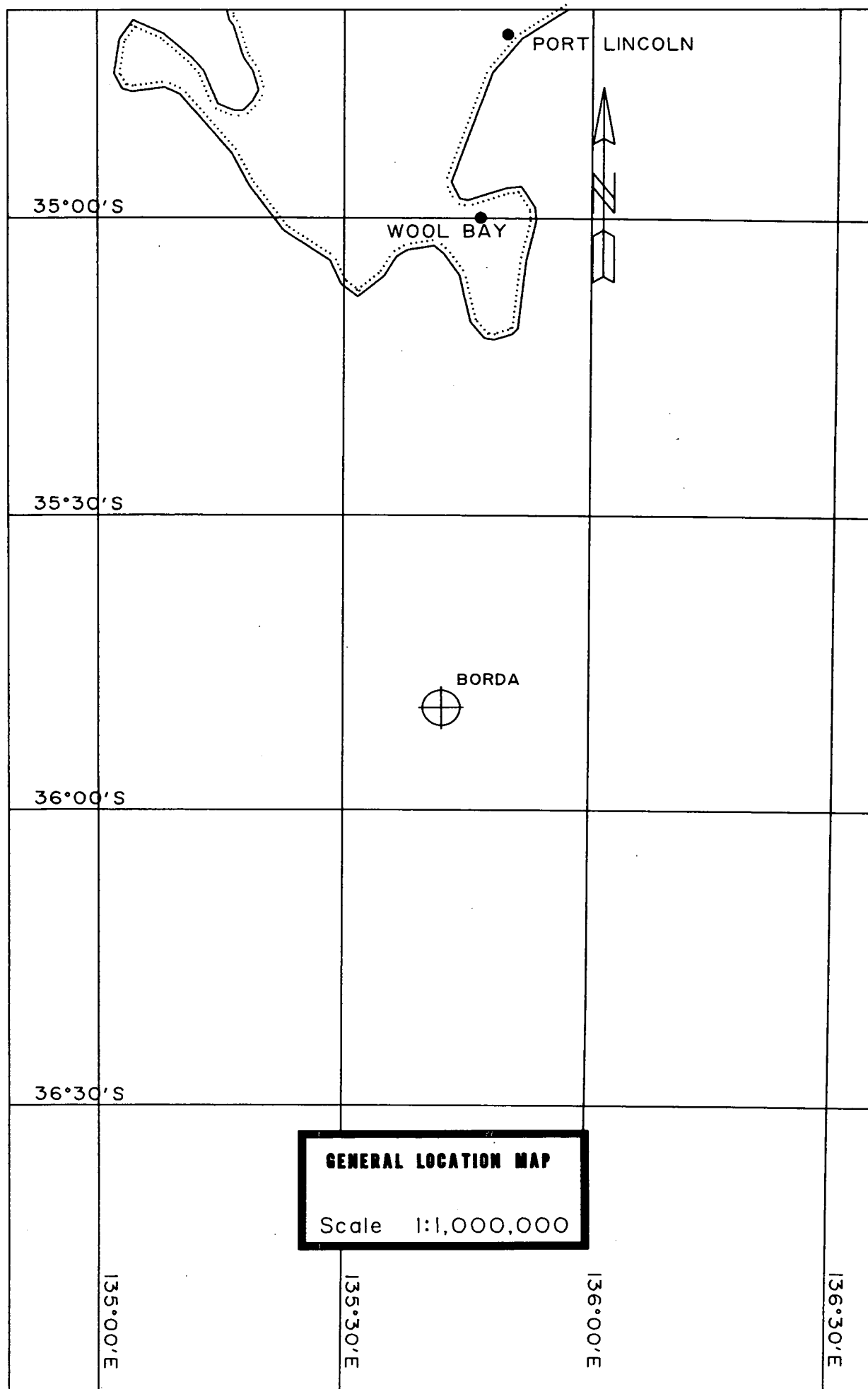
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Volume 2	DIGITAL SITE SURVEY REPORT	



1. INTRODUCTION

Positioning and geophysical services were provided by RACAL SURVEY AUSTRALIA LIMITED, (Racal) for a site survey of the proposed wellsite Borda for BROKEN HILL PROPRIETARY PETROLEUM PTY LTD (BHPP) in the Duntroon Basin. All survey requirements and operating procedures were undertaken in accordance with the contract between Racal and BHPP.

The survey vessel M.V. "Tilbata Creek" was mobilised with the necessary survey positioning and geophysical equipment. A Trimble 4000DL 8 channel Global Positioning System (GPS) receiver and Racals' "SkyFix" Differential GPS system was used in conjunction with Trimble DeltaNav - Navigator software to provide on-line positioning.

A 3km x 3.75km site was surveyed based around the proposed Borda location, the AGD 66 co-ordinates of which are given as:

Datum AGD 66

Borda

Latitude	:	35° 49' 12.04" South
Longitude	:	135° 42' 05.83" East

AMG Zone 53 C.M. 135° East

Easting	:	563 380m
Northing	:	6 035 774m

The survey was undertaken over a period from the 14th to the 20th of May, 1992. All times quoted are in Central Standard Time (GMT + 9.5 hours) unless otherwise specified.

2. REQUIREMENTS

Racal were to provide a navigation system, echosounder, sidescan sonar, boomer seismic profiler, and personnel for the project.

The survey procedure was to be as follows:

- (a) To carry out a bathymetric, sidescan sonar and seismic profile survey of the proposed Borda wellsite covering an area 3km x 3.75km based around the Borda location, but centred on the following co-ordinates which are 375 metres on a bearing of 25° 36' from the proposed location:

Datum AGD 66

Latitude : 35° 49' 01.056" South
Longitude : 135° 42' 12.293" East

AMG Zone 53 C.M. 135° East

Easting : 563 544m
Northing : 6 036 111m

- (b) The survey to comprise 31 primary lines orientated 026°, spaced at 100 metre intervals and 16 cross-tie lines orientated 116°, spaced at 250 metre intervals. The survey was to be conducted with the boomer, echosounder and sidescan equipment operating simultaneously on all lines.

3. SURVEY RESULTS

3.1 BATHYMETRY

Both analogue and digital soundings of the seafloor were recorded throughout the survey by an Atlas Deso 20 echosounder, mounted on the starboard side of the M.V. "Tilbata Creek". The echosounder was operated in conjunction with a Heco 10 Heave Compensator.

Unfortunately, the prevailing swell throughout the survey resulted in considerable degradation of the data. To compensate for both high frequency 2 metre swell and a secondary 4 metre low frequency swell, a mean seafloor was drawn through the analogue trace. The normalized depth was then read off the analogue trace and used to substitute the digital data. The soundings were reduced to L.A.T. using the predicted tidal curve for Wool Bay which is located at 35° 00' S, 135° 45' E.

The mean speed of sound was measured prior to the commencement of the survey and was set at 1513 metres per second for the duration of operations in the Borda area.

The water depth at the proposed Borda location, and within a radius of 40 metres, is 154 metres. The general nature of the seafloor is that of a gentle shallowing from a maximum depth of 158 metres in the extreme south of the survey area, to 141 metres in the northeast of the area. The maximum observed gradient is 1:350 located 1500 metres SSE of the proposed wellsite location.

The seafloor is dominated by a series of undulating elongate sand formed bodies which trend SW-NE. These bodies have average depths of 3 metres and have an average spacing of 600 metres. The proposed Borda wellsite lies in the base of one such depression, from which the seafloor rises to 151 metres, both 200 metres west and 400 metres north. East and south of Borda the seafloor is relatively flat.

The seafloor bathymetry is presented as a contour plot, in 1 metre intervals, on chart 1916e.2, herein.

3.2 SEABED FEATURES

The seafloor around the proposed Borda wellsite location and surrounding area was acoustically surveyed by a 100kHz Klein sidescan sonar with a Klein 595 digital graphic recorder. Analogue data were acquired at a 100 metre slant range scale, giving a coverage of 200% over the survey area.

The quality of the analogue traces were good. Unfortunately due to the deteriorating weather conditions, no seafloor samples were obtained. The textural types present on the seafloor were classified and identified therefore, by their intrinsic characteristics and physical configuration. A seabed feature chart has been compiled from the data, chart 1916e.3 herein.

The seafloor over the survey area is generally featureless and characterised by large areas of low reflectivity, separated by outcrops of highly reflective calcarenite. These areas of low reflectivity are interpreted as unconsolidated coarse-grained carbonate sands. In parts, the sands form sand waves, which have wavelengths of 100 to 80 metres and amplitudes of 1 to 1.50 metres. They have a 056°/236° orientation and show the direction net sediment transport to be northward.

The areas of exposed calcarenite occur in two main areas:

- i. 1300 metres due south of the proposed Borda location. These rocks show characteristic carbonate carious weathering, and are partially covered with coarse-grained transgressive carbonate sands and,
- ii. 400 metres northwest of the proposed Borda location. The calcarenites in this area are covered by a thin, 140 cm thick, deposit of coarse sands, from which they outcrop in patches.

At the proposed Borda location the nature of the seafloor is that of featureless low reflectivity carbonate sands. An example of the sidescan sonar record in this location is given in Appendix E.

With the exception of a small patch of highly reflective material (possibly debris) at 563 920m E 6 036 375m N, 300m NE of Borda. This patch has no height and a diameter of 15 metres.

3.3 SHALLOW GEOLOGY

The shallow geology of the Borda proposed well location and its surrounding area was detailed by the deployment of an EG & G 240 sub-tow boomer. The boomer firing rate was set at 500ms with a pulse of 300 Joules.

In the absence of any core material from the area, a velocity of 1650 metres per second has been assumed for the speed of sound through the substrate. This, and the sweep time of 250ms have been maintained throughout the survey; thereby giving a vertical scale of 1cm = approximately 4 metres on the analogue trace.

Data quality was good. Acoustic penetration of the seafloor is limited to a depth of 14 metres with a minimum resolution of 0.40 metre. Beneath 14 metres, or the top 1 metre of Unit B (see below) the data quality is considerably degraded and noisy.

Two units have been defined based on their intrinsic internal acoustic characteristics, and are termed Unit A (uppermost) and Unit B. The interpreted analogue data are presented as an isopach chart of Unit A, contoured at 1 metre intervals (Chart 1916e.4) and two profiles of the lines which cross the proposed Borda location (Chart 1916e.5). The characteristics of the data are briefly discussed below.

Unit A (0 - 12 metres thick)

Unit A has an average vertical thickness of 6 metres ranging between 0 and 12 metres. The term Unit A comes as a collective term for three sub-unit, which are termed Unit A (uppermost) Unit A2 and Unit A3 (lowermost).

- i) Unit A1 is generally 0 to 1 metres thick, it is acoustically transparent and present throughout the area. It is interpreted as a mobile transgressive carbon sand it overlies Unit A2.
- ii) Unit A2 is 1 to 4 metres in vertical thickness. It is characterised by a series of sub-parallel internal reflectors of low to medium acoustic strength. The reflectors describe asymmetric bedding which is associated with dune/sand wave development. This unit is ascribed to a unconsolidated coarse to medium carbonate sand, it overlies Unit A3.
- iii) Unit A3 is represented by highly reflective acoustic returns. This unit is typically located in filling channels and gullies on the unconformable surface of Unit B. It forms a discontinuous deposit and is between 0 and 8 metres in vertical thickness. It is interpreted as being a semi-consolidated carbonate sand.

Unit B

Unit B underlies Unit A from which it is separated by an unconformable erosive intact-Reflector R1. The unit shows neither internal stratification nor structure, it is highly reflective and impedes acoustic penetration. It is interpreted as a calcarenite.

At the proposed Borda location Unit A1 is present and is 1 metre thick, Unit A2 is also present and is 0.50 metres thick. Unit A3 is absent.

3.4 RECOMMENDATIONS

The nature of the seafloor of the survey area is essentially that of mobile transgressive sediments (Unit A1). These, in parts, form sand waves, and part of a collective unconsolidated sediment unit, Unit A. Unit A increases in vertical thickness to 12 metres in the western quadrant. Both northward and southward of the proposed location the underlying calcarenite is exposed at the surface.

3.5.1 Anchoring Conditions

The proposed Borda wellsite location lies surrounded by an area of unconsolidated sands. These sands have a vertical thickness of 1 to 2 metres minimum within a 300 metre diameter. 350 metres north of the proposed location the sands thin to less than 40cm overlying to calcarenite. In this area some anchor holding problems may occur.

3.5.2 Drilling Hazards

No problems are envisaged during drilling in this area.

4. GEODETIC PARAMETERS

All co-ordinates shown in this report refer to the following:

The location co-ordinates are defined on Australian Geodetic Datum 1966 (AGD 66).

The Global Positioning System (GPS) is referenced to the World Geodetic System 1984 (WGS 84).

4.1 DATUMS

Datum	:	Australian Geodetic Datum 1966
Spheroid	:	Australian National
Semi-major Axis (a)	:	6 378 160.000m
Semi-minor Axis (b)	:	6 356 774.719m
Eccentricity Squared (e^2)	:	0.006 694 542
Flattening (1/f)	:	298.25

Datum	:	World Geodetic System 1984
Spheroid	:	WGS 84
Semi-major Axis (a)	:	6 378 137.000m
Semi-minor Axis (b)	:	6 356 752.3142m
Eccentricity Squared (e^2)	:	0.006 694 380
Flattening (1/f)	:	298.257 223 563

4.2 PROJECTION

Projection	:	Universal Transverse Mercator
AMG Zone	:	53
Central Meridian (C.M.)	:	135° East
Scale factor on the C.M.	:	0.9996
False Easting	:	500 000m
False Northing	:	10 000 000m
Latitude of Origin	:	0° (Equator)
Unit of Measure	:	International Metre

4.3 DATUM TRANSFORMATION

The following 7-parameter datum transformation was used to convert WGS 84 co-ordinates to AGD 66 co-ordinates:

Dx =	+116.00m
Dy =	+50.47m
Dz =	-141.69m
Rx =	+0.230"
Ry =	+0.390"
Rz =	+0.344"
Scale (K) =	-0.0983

Note: The sign conventions used in Racal software in the datum transformations were derived as follows:

GNS Survey Software:

The convention used is that used by the US Department of Defence and by Higgins (Transformation from WGS 84 to AGD 84 - An Interim Solution), where a positive rotation about the Z axis is an anti-clockwise movement of the X and Y axes (when viewed from the North Pole looking towards the centre of the Earth).

The values used for the 7-parameter datum transformation were the AGD 84 values, as it was determined that the difference between the 1984 and 1966 Australian Geodetic Datums in the area of survey operations (Duntroon Basin) was negligible.

5. OPERATIONAL SUMMARY

5.1 ON-LINE PROCEDURES

The Racal Survey General Navigation System (GNS) was used to obtain and log the real-time position of the survey vessel. A Trimble 4000DL GPS receiver, in conjunction with Racal's "SkyFix" Differential GPS and other ancillary equipment (printer, 3.5" dual disc drive, gyrocompass), were interfaced to a HP330 series desk top computer operating the navigation software.

A fix closure was supplied to the sidescan sonar, echosounder and boomer profiler via a TSS Annotator every 50 metres. The annotator provided information including date, time, line name and heading which was output onto the hard copy analogue records. The vessel's position was also logged onto 3.5" diskettes with a paper printout of the navigational position and status obtained at the fix interval.

The echosounder was used as the 'Datum Point', with offsets applied from the datum. (Refer to Appendix A).

A total of 31 primary lines orientated 026°, with a line spacing interval of 100 metres and 16 cross-tie lines orientated 116°, with a line spacing interval of 250 metres were surveyed whilst simultaneously operating boomer, sidescan sonar and echosounder equipment.

5.2 SEA WATER VELOCITY PROBE

An Applied Microsystems Model STD-12 velocity probe was used to determine the ambient sea water velocity profile. The probe head, which was lowered into the water column using a winch located on the port quarter, contains sensors which measure and record conductivity, temperature and depth (CTD). The data is stored on a logging device which is also situated in the probe head. The memory algorithm ensures data are logged for every metre of depth or at an user selectable interval in metres or time.

Once returned to the surface, the data from the probe is downloaded, as a data file, to a Toshiba 1200 employing the 'Soft-12 STD' software package. The speed of sound in seawater was determined using Chen and Milleros calculation.

A CTD dip was carried out, on location, on the 15th of June, 1992, at 0020 hours. A velocity of 1513 (1513.24) metres per second was determined and maintained throughout the survey.

5.3 ECHOSOUNDER

Continuous bathymetric profiles throughout the survey were obtained using a dual-frequency Atlas Deso 20 echosounder. The transducer was attached to the starboard side of the hull (see Appendix A: Offset Diagram). The echosounder employed both the 33 and 210kHz transducers and was coupled to a Heco 10 Heave compensator, operational throughout the survey.

The stylus motor speed was set for a seawater velocity of sound of 1513 metres per second. The transmission line was set for a depth of 2.73 metres as the depth of the transducer below sea level (draft), measured during a bar check carried out on the 13th of June at 0955 hours.

5.4 SIDESCAN SONAR

The sidescan sonar data were acquired by the deployment of a 100kHz, 1.5° beam width Klein 422 tow fish in conjunction with a Klein 595 digital graph recorder.

The sidescan fish was towed from a winch located aft on the port quarter. The fish and cable were streamed to 200 metres via a block upon which a calibrated cable counter was fitted.

The recorder was set to operate on a 100 metre slant range with fiducial marks and annotations supplied by a closure every 50 metres.

5.5 SUB-BOTTOM PROFILER

Sub-bottom geology was identified by the deployment of a sub-bottom boomer sled. The boomer was towed 10 metres aft of the starboard quarter and the 8-element hydrophone array deployed from a point 9 metres away, on the opposite quarter.

The boomer was operated at a power of 300 Joules and fired every 500ms by an EG & G 231 Triggered Capacitor Bank coupled with an EG & G Model 232A Power Supply. The returning signals were initially filtered through a Krohn-Hite analogue filter with a band pass set between 700 and 1500 Hz. The processed signals were amplified by a TSS 307 TVG amplifier and then printed on an EPC 9701 graphic recorder. The record sweep was set at 250ms.

6. SUMMARY OF EVENTS

The survey vessel M.V. "Tilbata Creek" arrived at the Borda location at 2340 on the 14th of June, 1992 and deployed the echosounder transducer. With the completion of a sound velocity profile, the analogue equipment was deployed and tuned.

After overcoming some initial problems with the navigation system and equipment cable counter, sounding commenced at 0655 on June the 15th. No work could be undertaken between 2210 and 2316 due to poor satellite availability, however operations resumed at 2316 and continued uninterrupted until 0630 on the 16th of June when a problem with the sidescan sonar occurred.

At 0818 the recorder was repaired and work recommenced, only to be halted by rapidly deteriorating weather. At 1716, sounding stopped and by 1800, with all equipment recovered and secured, the M.V. "Tilbata Creek" made passage to Port Lincoln for shelter.

The vessel remained alongside Port Lincoln from 1315 on the 17th of June to 0823 on the 18th of June, during which time the opportunity was taken to replenish stores and water. The departure on the 18th of June saw the survey vessel make several attempts to reach the Borda location, only to be hampered by bad weather. A safe anchorage was found at Memory Cove during the period, with a successful attempt to get to location made at 1617 on the 19th of June, 1992.

By 2220, the M.V. "Tilbata Creek" had arrived at site and immediately deployed and tuned the analogue equipment. The sidescan sonar was not operated at the Client Representative's request, given the prevailing weather conditions.

At 2304 sounding operations commenced and continued without incident until 0445 on the 20th of June at which time the analogue survey was completed. Equipment was recovered and secured at 0515 with the M.V. "Tilbata Creek" proceeding to other work.

7. PERSONNEL AND EQUIPMENT

7.1 PERSONNEL

The following personnel were employed on this project:

For : BHP PETROLEUM PTY LTD

Mr. A. Sellers	- Client Representative
Mr. P. O'Donnell	- Client Representative

For : RACAL SURVEY AUSTRALIA LIMITED

Mr. S. Downs	- Party Chief
Mr. J. Austin	- Surveyor
Mr. R. Taylor	- Navigation Technician
Mr. R. Bryder	- Underwater Engineer
Mr. R. Bruinsma	- Geophysicist

7.2 EQUIPMENT

The following equipment was used on this project:

2 x Atlas Deso 20 Dual Frequency Over the side mounted Transducer

2 x Atlas Deso 20 Echosounder Recorders

1 x Arma Brown Mk 10 Gyro

1 x Gyro Invertor

1 x Applied Microsystems STD-12 Velocity Probe

1 x Krupp Atlas Heco 10 Heave Compensator

1 x Klein 595 Digital Graphic Recorder

2 x Klein 422 Towfish

1 x Delph 386 CPU, c/w Plotter, Monitor, Keyboard

1 x Huntec Sea Otter Catamaran

1 x Huntec Boomer Plate Seismic Source

1 x TSS TVG Filter

1 x Krohn Hite Analogue Filter

1 x EPC 9701 Graphic Recorder

1 x EG & G 231 Triggered Capacitor Bank

1 x EG & G 232 Power Supply

1 x EG & G 234 Combined Power and Capacitor

2 x EG & G 265 8 Element Hydrophone Arrays

1 x TSS 305 Swell Filter

1 x EG & G Sub-tow 240 Boomer Sled

2 x Trimble 4000DL GPS Receivers

2 x Skyfix Antenna Control Units

2 x Skyfix Demodulators

1 x Skyfix Dome

2 x Compaq 386 Computers

1 x Toshiba 1200 Laptop Computer

2 x HP 9000/330 Computers c/w Disc Drives, VDU, Keyboard

1 x HP7475 Plotter

2 x HP Quietjet Printer

2 x Barco Monitors

2 x Taxan Monitors

1 x Bar Check

plus all associated software, cables, manuals, etc.

8. DISTRIBUTION

Copies of this report have been distributed as follows:

BHP Petroleum - Melbourne
Attn: Mr. R. Marlow

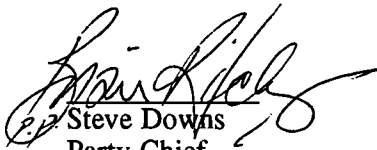
: 4 copy

BHP Engineering - Wollongong
Attn: Mr. S. Dykes

: 1 copy

Racal Survey Australia Limited

: 1 copy



Steve Downs
Party Chief

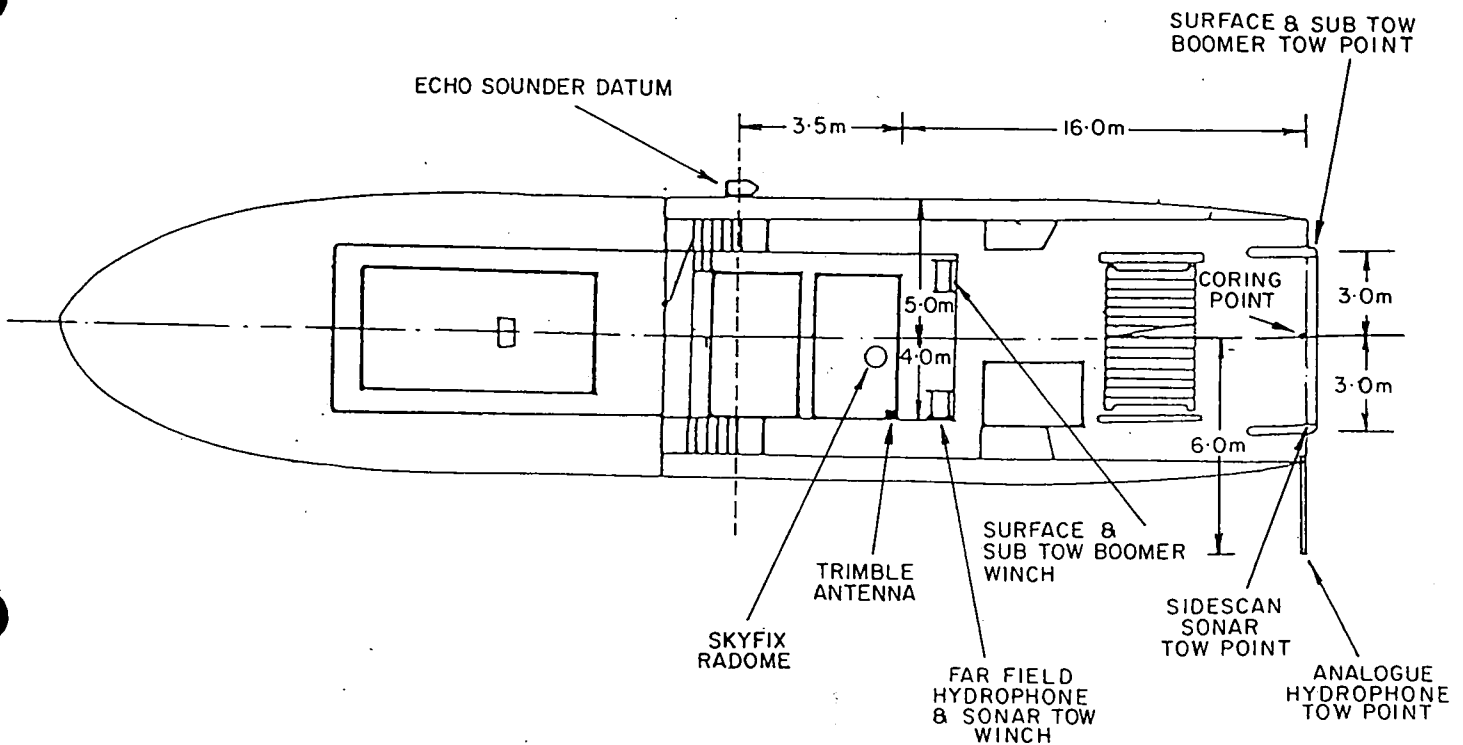
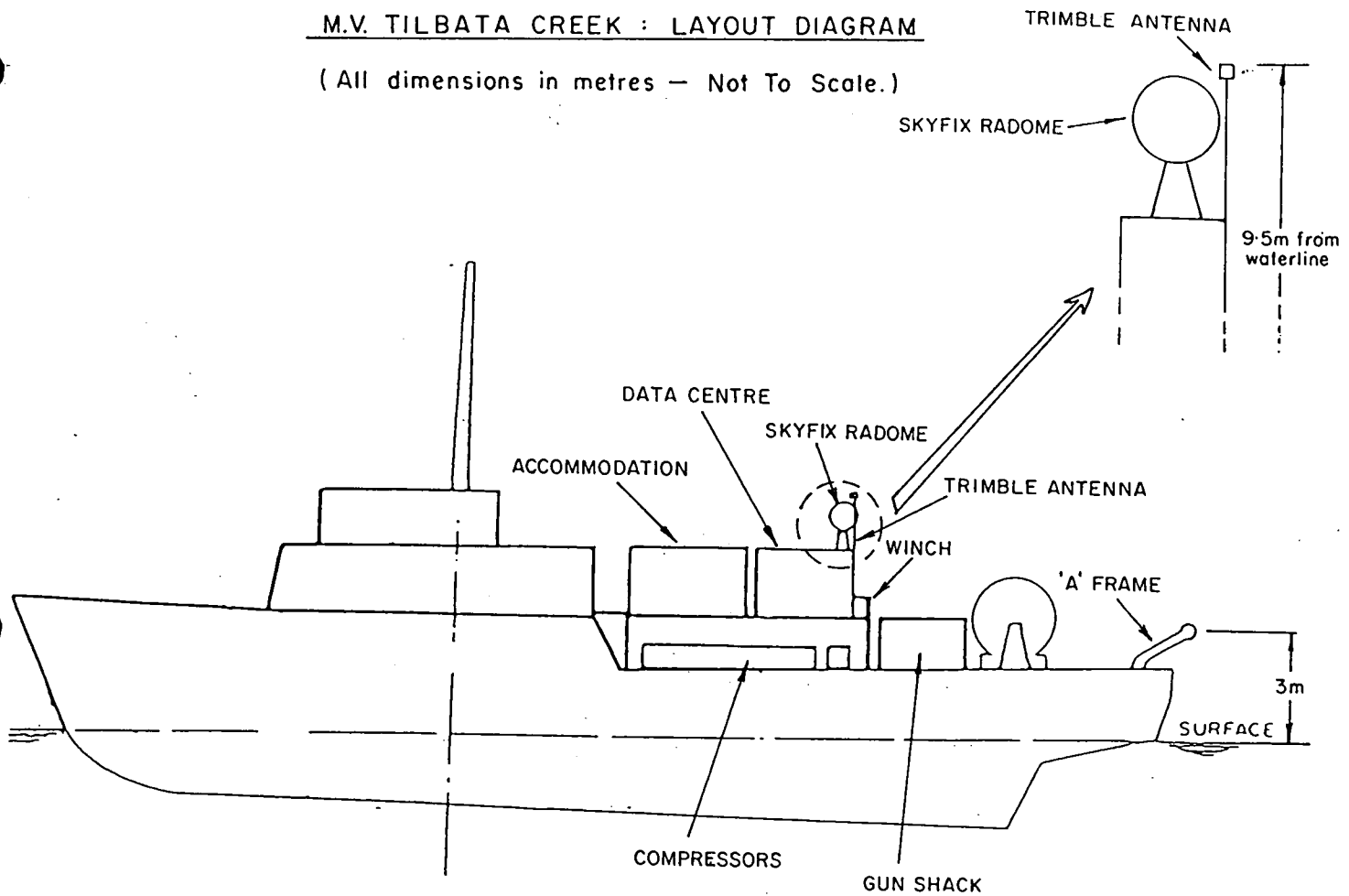


Gareth Jones
Area Surveyor

APPENDIX A
OFFSET DIAGRAM M.V. "Tilbata Creek"

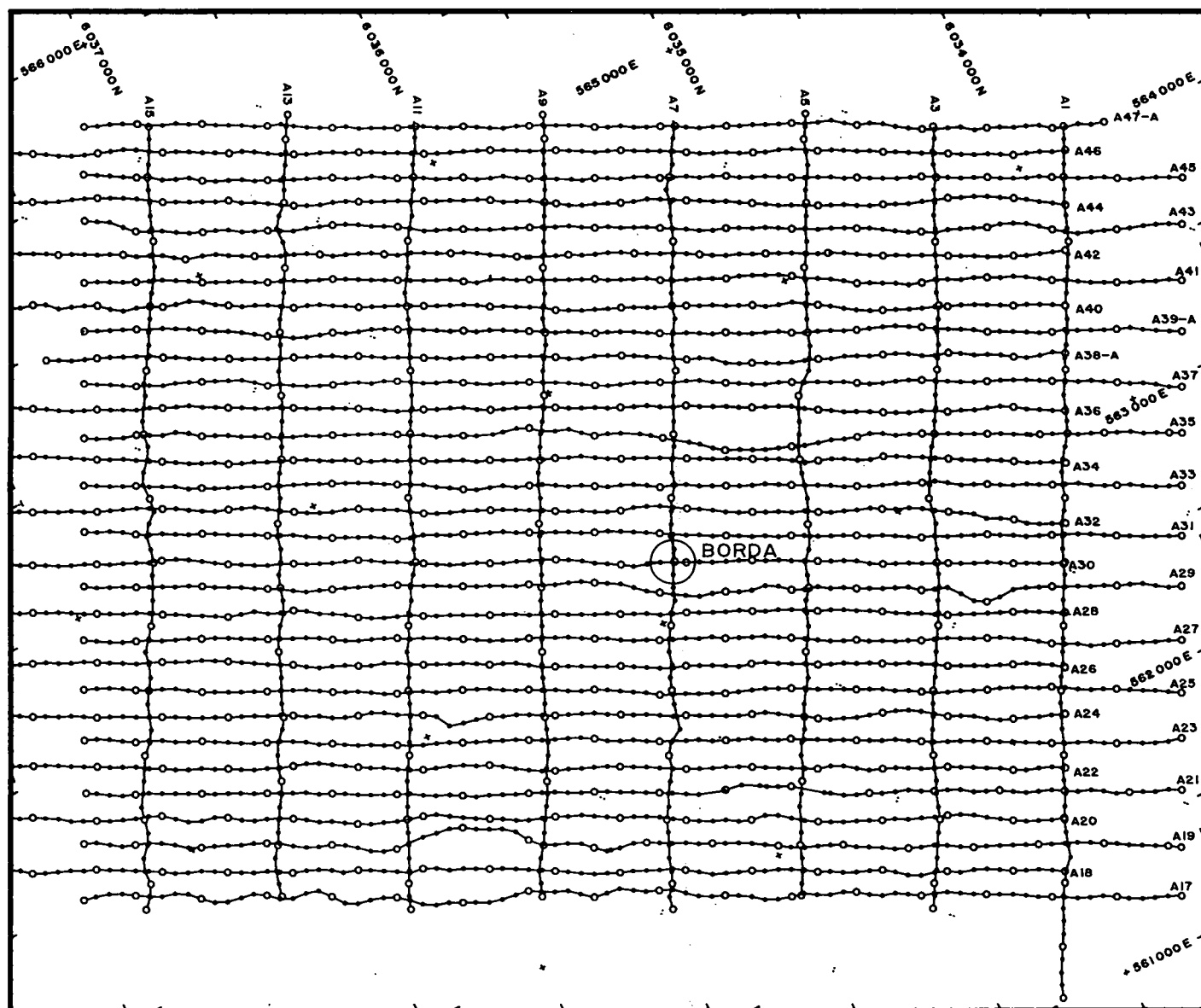
M.V. TILBATA CREEK : LAYOUT DIAGRAM

(All dimensions in metres — Not To Scale.)



APPENDIX B
SURVEY LINE DIAGRAMS

SURVEY LINE DIAGRAM



APPENDIX C
SURVEY LINE LOGS

CLIENT:	BHP	AREA:	SITE:	JOB NO.	1916
NAV. SYSTEM	DGPS	ECHO SOUNDER DRAFT: VELOCITY OF PROP.	2.73 M 1513 M/SEC	SURVEY DATUM	VESEL TILBATA CREEK
DATUM → STERN	M	DATUM → ECHO SOUNDER OFFSET:	MFWD AFT M PORT STED	DATUM → OFFSET:	MFWD AFT M PORT STED

[illegible]

ANALOGUE SURVEY LINE SUMMARY

CLIENT		LOCATION		JOB NO.		SHEET		1 OF 3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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ANALOGUE SURVEY LINE SUMMARY

CLIENT		BHP		LOCATION		BalDA		JOB NO.		1916		SHEET 2 OF 3					
LINE	FIX		DATE	C.S.T. TIME		LINE	DATA FILES		SYSTEMS				SIMRAD			NAV OK	REMARKS
	SOL	EOL		DIR	N		E	S	T	B	P	I	N	O	F		
A33	1	85	16/6/92	0251	0322	206	A3	21	✓	✓	✓	✓	✓	✓	✓	3D	
A36	1	85		0341	0413	026		22	✓	✓	✓	✓	✓	✓	✓	3D	
A41	1	85		0455	0524	206	A4	1	✓	✓	✓	✓	✓	✓	✓	3D	
A46	1	85		0543	0614	026		2	✓	✓	✓	✓	✓	✓	✓	3D/3D	
A39	1	6		0636	0637	206		3	✓	✓	✓	✓	✓	✓	✓	3D	3D. ATBL FOR SSS.
A39-A	1001	1085		0818	0847	206		4	✓	✓	✓	✓	✓	✓	✓	3D	
A44	1	85		0906	0942	026		5	✓	✓	✓	✓	✓	✓	✓	3D	3D. MISS 137450-200 SSS.
A34	1	85		1119	1149	026	A5	1	✓	✓	✓	✓	✓	✓	✓	3D	
A31	1	85		1208	1238	206		2	✓	✓	✓	✓	✓	✓	✓	3D	SSS 8 STB RECORDS.
A26	1	85		1300	1333	026		3	✓	✓	✓	✓	✓	✓	✓	3D	3D. HATCHED BY UNIT SSS 300/100
A21	1	84		1353	1422	206		4	✓	✓	✓	✓	✓	✓	✓	3D/2D	
A18	1	84		1445	1522	026		5	✓	✓	✓	✓	✓	✓	✓	3D/2P	
A29	1	85		1541	1610	206		6	✓	✓	✓	✓	✓	✓	✓	2D	SSS RETURNED AT FIX 72.
A1	1	65		1645	1716	206		7	✓	✓	✓	✓	✓	✓	✓	2D	2D. NAV CLICH - SSS - AT FIX 71.
A15	1	62	19/6/92	2304	2333	206		8	✓	✓	✓	✓	✓	✓	✓	2D	2D. SSS NOT USED.
A13	1	62		2345	0007	116		9	✓	✓	✓	✓	✓	✓	✓	3D	
A11	1	62	20/6	0021	0046	206		10	✓	✓	✓	✓	✓	✓	✓	2D	
A9	1	62		0059	0119	116	A6	11	✓	✓	✓	✓	✓	✓	✓	2D/3D	
A7	1	62		0136	0102	206		12	✓	✓	✓	✓	✓	✓	✓	2D	

[illegible]

APPENDIX D

EXAMPLE OF ECHOSOUNDER RECORDS OVER PROPOSED LOCATION

Appendix D1: Example of the echosounder trace over the proposed Borda location.

Depths in metres below datum (uncorrected)

E00039 T09 52

LINE A32
HDG: 026°

E00037 T09 52

E00035 T09 51

E00033 T09 50

E00031 T09 49

E00029 T09 48

E00027 T09 48

E00025 T09 47

E00023 T09 46

Fix No.

E00021 T09 46

E00019 T09 44

100 m

130m

135m

140m

145m

150m

155m

160m

165m

170m

175m

Proposed Borda location

Intersection with line A7

mean line

Seafloor trace

Scale of echosounder

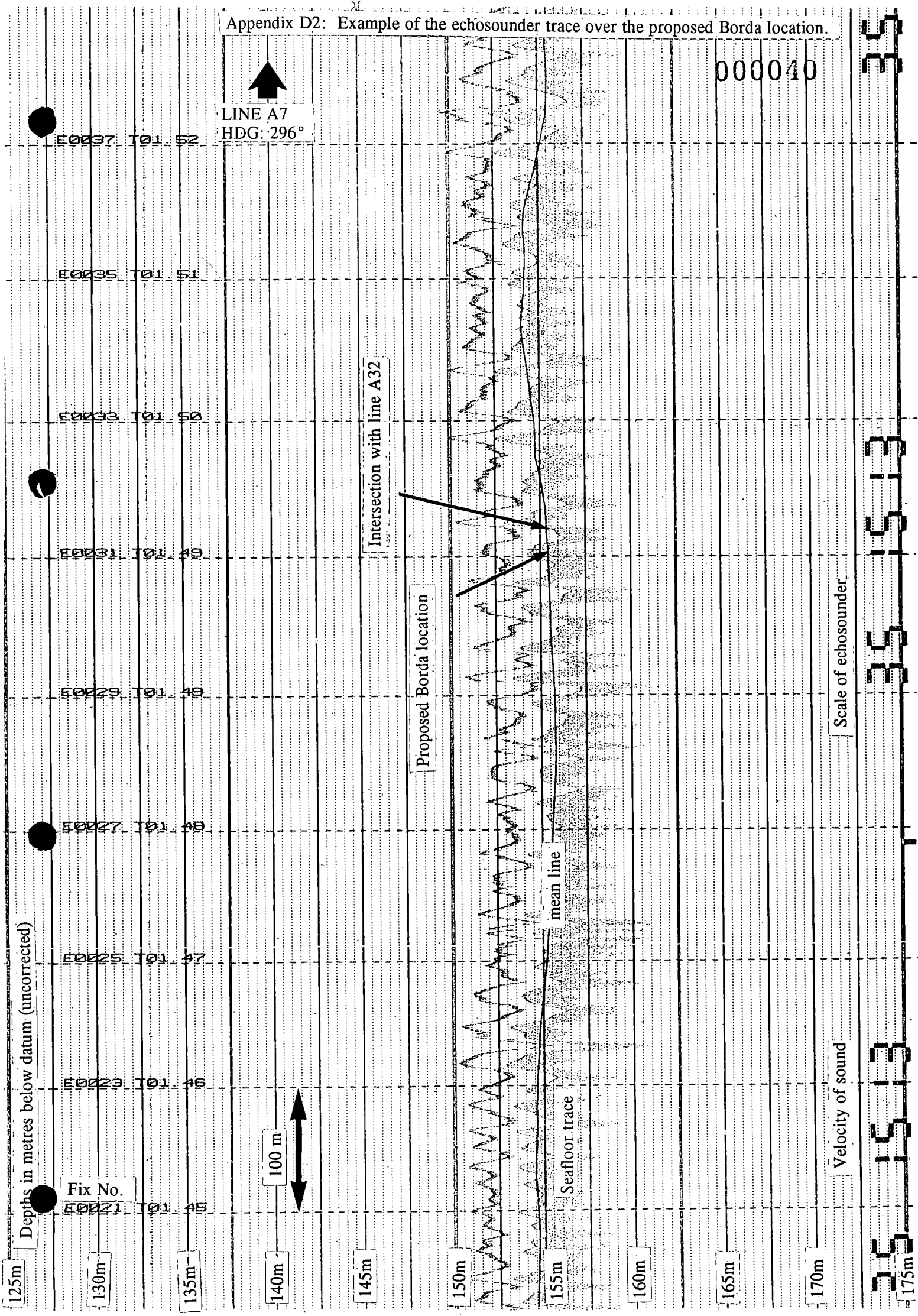
Velocity of sound

000039

35 15 13

35 15 13

Appendix D2: Example of the echosounder trace over the proposed Borda location.



APPENDIX E

EXAMPLE OF SIDESCAN SONAR RECORDS OVER PROPOSED LOCATION

000042

↑
LINE A32
HDG: 026°

Fix No. 40

Proposed Borda location
↓

Fix No. 39

First sea floor return

Sea surface return

Fix No. 38

Featureless coarse carbonate sands

Approx.
15m

Approx. 50m

Fix No. 37

APPENDIX F

EXAMPLE OF BOOMER RECORDS OVER PROPOSED LOCATION

Fix No.

Appendix F1: Example of the Boomer record over the proposed Borda location.

E0045 T09.55

000044

LINE A32
HDG: 026°

E0043 T09.54

E0041 T09.53

E0039 T09.52

E0037 T09.52

E0035 T09.51

E0033 T09.50

E0031 T09.49

E0029 T09.48

E0027 T09.48

E0025 T09.47

E0023 T09.46

E0021 T09.45

Proposed Borda location

Intersection with line A7

UNIT A1

UNIT B

UNIT A2

Approx 20.6m

UNIT A3

R1

100m

128m

152m

Depths in metres below datum

106m

Fix No.

Appendix F2: Example of the Boomer record over the proposed Borda location.

E0041 T01.54

000045

E0039 T01.53

LINE A7
HDG: 296°

E0037 T01.52

E0035 T01.51

E0033 T01.50

Proposed Borda location

E0031 T01.49

Intersection with line A32

E0029 T01.49

RI
UNIT B

E0027 T01.48

E0025 T01.47

UNIT A1

E0023 T01.46

100m

UNIT A2

E0021 T01.45

Approx 20.6m

152m

E0019 T01.45

Depths in metres below datum

106m

128m

APPENDIX G
SEA WATER VELOCITY OF SOUND READINGS

DATA OBTAINED FROM FILE BORDA.rel

AVERAGE VELOCITY DESCENDING	1513.296
NUMBER OF SAMPLES DESCENDING	26

AVERAGE VELOCITY ASCENDING	1513.188
NUMBER OF SAMPLES ASCENDING	26

AVERAGE VELOCITY	1513.242
NUMBER OF SAMPLES TOTAL	51

NUMBER OF INVALID SAMPLES NOT USED	0
MAXIMUM DEPTH LOGGED	137.19

STD-12 DATA PRINTOUT FACILITY

File name - borda.rel

Created - 06-15-1992

Time sec.	Temp x°C	Depth d.	Cond mS/cm	Salin ppt	Gamma Snd Vel m/s
263	16.822	5.53	45.63	35.80	26.195 1513.3
270	16.829	10.67	45.64	35.79	26.211 1513.4
277	16.827	15.92	45.63	35.79	26.232 1513.5
284	16.828	21.25	45.63	35.79	26.252 1513.6
291	16.828	26.40	45.64	35.79	26.275 1513.6
297	16.828	31.89	45.63	35.78	26.293 1513.7
304	16.827	37.14	45.63	35.77	26.313 1513.8
309	16.831	42.51	45.64	35.78	26.337 1513.9
315	16.829	47.61	45.63	35.77	26.357 1514.0
322	16.828	52.95	45.63	35.77	26.375 1514.0
327	16.828	58.27	45.63	35.77	26.397 1514.1
333	16.822	63.61	45.62	35.77	26.421 1514.2
338	16.821	68.88	45.62	35.76	26.439 1514.3
344	16.812	74.02	45.61	35.76	26.463 1514.3
350	16.816	79.42	45.62	35.76	26.485 1514.4
356	16.845	84.69	45.66	35.77	26.508 1514.6
362	16.819	89.97	45.62	35.76	26.530 1514.6
369	16.784	95.14	45.57	35.74	26.548 1514.6
374	16.289	100.50	44.89	35.58	26.564 1513.0
380	16.002	105.62	44.53	35.51	26.600 1512.1
384	15.876	111.01	44.44	35.54	26.676 1511.8
390	15.799	116.40	44.32	35.50	26.688 1511.6
395	15.691	121.82	44.22	35.50	26.736 1511.4
399	15.637	126.95	44.16	35.50	26.767 1511.3
403	15.615	132.05	44.14	35.50	26.791 1511.3
408	15.599	137.19	44.12	35.49	26.815 1511.3
417	15.607	131.87	44.13	35.50	26.795 1511.3
421	15.630	126.63	44.16	35.51	26.772 1511.3
427	15.665	121.10	44.20	35.51	26.745 1511.3
429	15.789	115.77	44.35	35.53	26.710 1511.6
432	15.839	110.56	44.39	35.53	26.676 1511.7
437	15.928	105.30	44.54	35.59	26.673 1512.0
442	16.104	100.10	44.73	35.60	26.624 1512.4
446	16.530	94.85	45.40	35.82	26.665 1513.9
450	16.829	89.55	45.63	35.75	26.521 1514.6
455	16.818	84.09	45.61	35.75	26.501 1514.5
460	16.825	78.71	45.62	35.75	26.475 1514.4
465	16.824	73.17	45.61	35.75	26.447 1514.3
472	16.830	67.88	45.62	35.75	26.429 1514.3
477	16.827	62.74	45.61	35.75	26.402 1514.2
483	16.829	57.13	45.61	35.75	26.380 1514.1
490	16.829	51.92	45.61	35.75	26.356 1514.0
498	16.828	46.71	45.60	35.75	26.332 1513.9
507	16.823	41.27	45.59	35.74	26.308 1513.8
511	16.818	35.93	45.58	35.74	26.287 1513.7
517	16.811	30.60	45.57	35.74	26.262 1513.6

STD-12 DATA PRINTOUT FACILITY

File name - borda.rel

Created - 06-15-1992

ime sec.	Temp xC	Depth d.	Cond mS/cm	Salin ppt	Gamma Snd	Vel m/s
522	16.814	25.29	45.57	35.74	26.235	1513.5
527	16.813	19.70	45.56	35.73	26.209	1513.4
532	16.815	14.58	45.56	35.74	26.189	1513.3
537	16.810	9.28	45.56	35.74	26.170	1513.3
542	16.806	4.06	45.55	35.74	26.146	1513.2

ge 2

APPENDIX H
TIDAL PREDICTIONS - WOOL BAY

TIDAL DATA

15/ 6/92	0 0 0	1.30
15/ 6/92	030 0	1.38
15/ 6/92	1 0 0	1.46
15/ 6/92	130 0	1.57
15/ 6/92	2 0 0	1.68
15/ 6/92	230 0	1.80
15/ 6/92	3 0 0	1.90
15/ 6/92	330 0	1.99
15/ 6/92	4 0 0	2.06
15/ 6/92	430 0	2.10
15/ 6/92	5 0 0	2.12
15/ 6/92	530 0	2.10
15/ 6/92	6 0 0	2.07
15/ 6/92	630 0	2.01
15/ 6/92	7 0 0	1.94
15/ 6/92	730 0	1.87
15/ 6/92	8 0 0	1.79
15/ 6/92	830 0	1.72
15/ 6/92	9 0 0	1.67
15/ 6/92	930 0	1.64
15/ 6/92	10 0 0	1.63
15/ 6/92	1030 0	1.66
15/ 6/92	11 0 0	1.71
15/ 6/92	1130 0	1.80
15/ 6/92	12 0 0	1.92
15/ 6/92	1230 0	2.06
15/ 6/92	13 0 0	2.21
15/ 6/92	1330 0	2.37
15/ 6/92	14 0 0	2.53
15/ 6/92	1430 0	2.67
15/ 6/92	15 0 0	2.80
15/ 6/92	1530 0	2.89
15/ 6/92	16 0 0	2.95
15/ 6/92	1630 0	2.97
15/ 6/92	17 0 0	2.95
15/ 6/92	1730 0	2.89
15/ 6/92	18 0 0	2.78
15/ 6/92	1830 0	2.65
15/ 6/92	19 0 0	2.48
15/ 6/92	1930 0	2.30
15/ 6/92	20 0 0	2.10
15/ 6/92	2030 0	1.91
15/ 6/92	21 0 0	1.71
15/ 6/92	2130 0	1.55
15/ 6/92	22 0 0	1.41
15/ 6/92	2230 0	1.30
15/ 6/92	23 0 0	1.23
15/ 6/92	2330 0	1.20

16/ 6/92	0 0 0	1.21
16/ 6/92	030 0	1.26
16/ 6/92	1 0 0	1.34
16/ 6/92	130 0	1.44
16/ 6/92	2 0 0	1.56
16/ 6/92	230 0	1.69
16/ 6/92	3 0 0	1.81
16/ 6/92	330 0	1.93
16/ 6/92	4 0 0	2.02
16/ 6/92	430 0	2.10
16/ 6/92	5 0 0	2.14
16/ 6/92	530 0	2.15
16/ 6/92	6 0 0	2.14
16/ 6/92	630 0	2.10
16/ 6/92	7 0 0	2.04
16/ 6/92	730 0	1.95
16/ 6/92	8 0 0	1.87
16/ 6/92	830 0	1.77
16/ 6/92	9 0 0	1.70
16/ 6/92	930 0	1.63
16/ 6/92	10 0 0	1.60
16/ 6/92	1030 0	1.58
16/ 6/92	11 0 0	1.61
16/ 6/92	1130 0	1.66
16/ 6/92	12 0 0	1.75
16/ 6/92	1230 0	1.88
16/ 6/92	13 0 0	2.03
16/ 6/92	1330 0	2.18
16/ 6/92	14 0 0	2.36
16/ 6/92	1430 0	2.52
16/ 6/92	15 0 0	2.68
16/ 6/92	1530 0	2.81
16/ 6/92	16 0 0	2.92
16/ 6/92	1630 0	2.98
16/ 6/92	17 0 0	3.01
16/ 6/92	1730 0	2.99
16/ 6/92	18 0 0	2.92
16/ 6/92	1830 0	2.82
16/ 6/92	19 0 0	2.68
16/ 6/92	1930 0	2.51
16/ 6/92	20 0 0	2.31
16/ 6/92	2030 0	2.11
16/ 6/92	21 0 0	1.90
16/ 6/92	2130 0	1.72
16/ 6/92	22 0 0	1.54
16/ 6/92	2230 0	1.40
16/ 6/92	23 0 0	1.28
16/ 6/92	2330 0	1.22

17/ 6/92	0 0 0	1.19
17/ 6/92	030 0	1.20
17/ 6/92	1 0 0	1.25
17/ 6/92	130 0	1.34
17/ 6/92	2 0 0	1.44
17/ 6/92	230 0	1.57
17/ 6/92	3 0 0	1.70
17/ 6/92	330 0	1.84
17/ 6/92	4 0 0	1.95
17/ 6/92	430 0	2.06
17/ 6/92	5 0 0	2.13
17/ 6/92	530 0	2.17
17/ 6/92	6 0 0	2.19
17/ 6/92	630 0	2.17
17/ 6/92	7 0 0	2.13
17/ 6/92	730 0	2.05
17/ 6/92	8 0 0	1.97
17/ 6/92	830 0	1.86
17/ 6/92	9 0 0	1.77
17/ 6/92	930 0	1.68
17/ 6/92	10 0 0	1.61
17/ 6/92	1030 0	1.57
17/ 6/92	11 0 0	1.55
17/ 6/92	1130 0	1.57
17/ 6/92	12 0 0	1.63
17/ 6/92	1230 0	1.72
17/ 6/92	13 0 0	1.84
17/ 6/92	1330 0	1.99
17/ 6/92	14 0 0	2.16
17/ 6/92	1430 0	2.32
17/ 6/92	15 0 0	2.50
17/ 6/92	1530 0	2.66
17/ 6/92	16 0 0	2.80
17/ 6/92	1630 0	2.90
17/ 6/92	17 0 0	2.97
17/ 6/92	1730 0	3.00
17/ 6/92	18 0 0	2.98
17/ 6/92	1830 0	2.92
17/ 6/92	19 0 0	2.81
17/ 6/92	1930 0	2.68
17/ 6/92	20 0 0	2.50
17/ 6/92	2030 0	2.31
17/ 6/92	21 0 0	2.10
17/ 6/92	2130 0	1.91
17/ 6/92	22 0 0	1.71
17/ 6/92	2230 0	1.54
17/ 6/92	23 0 0	1.40
17/ 6/92	2330 0	1.29

18/ 6/92	0 0 0	1.23
18/ 6/92	030 0	1.20
18/ 6/92	1 0 0	1.22
18/ 6/92	130 0	1.28
18/ 6/92	2 0 0	1.36
18/ 6/92	230 0	1.48
18/ 6/92	3 0 0	1.60
18/ 6/92	330 0	1.74
18/ 6/92	4 0 0	1.87
18/ 6/92	430 0	1.99
18/ 6/92	5 0 0	2.09
18/ 6/92	530 0	2.17
18/ 6/92	6 0 0	2.21
18/ 6/92	630 0	2.22
18/ 6/92	7 0 0	2.20
18/ 6/92	730 0	2.14
18/ 6/92	8 0 0	2.07
18/ 6/92	830 0	1.98
18/ 6/92	9 0 0	1.87
18/ 6/92	930 0	1.77
18/ 6/92	10 0 0	1.67
18/ 6/92	1030 0	1.60
18/ 6/92	11 0 0	1.55
18/ 6/92	1130 0	1.54
18/ 6/92	12 0 0	1.55
18/ 6/92	1230 0	1.61
18/ 6/92	13 0 0	1.69
18/ 6/92	1330 0	1.82
18/ 6/92	14 0 0	1.96
18/ 6/92	1430 0	2.12
18/ 6/92	15 0 0	2.29
18/ 6/92	1530 0	2.47
18/ 6/92	16 0 0	2.62
18/ 6/92	1630 0	2.76
18/ 6/92	17 0 0	2.87
18/ 6/92	1730 0	2.94
18/ 6/92	18 0 0	2.96
18/ 6/92	1830 0	2.94
18/ 6/92	19 0 0	2.88
18/ 6/92	1930 0	2.78
18/ 6/92	20 0 0	2.64
18/ 6/92	2030 0	2.47
18/ 6/92	21 0 0	2.28
18/ 6/92	2130 0	2.08
18/ 6/92	22 0 0	1.89
18/ 6/92	2230 0	1.71
18/ 6/92	23 0 0	1.54
18/ 6/92	2330 0	1.41

19/	6/92	0 0 0	1.31
19/	6/92	030 0	1.25
19/	6/92	1 0 0	1.24
19/	6/92	130 0	1.26
19/	6/92	2 0 0	1.32
19/	6/92	230 0	1.42
19/	6/92	3 0 0	1.53
19/	6/92	330 0	1.66
19/	6/92	4 0 0	1.79
19/	6/92	430 0	1.92
19/	6/92	5 0 0	2.04
19/	6/92	530 0	2.13
19/	6/92	6 0 0	2.20
19/	6/92	630 0	2.24
19/	6/92	7 0 0	2.24
19/	6/92	730 0	2.21
19/	6/92	8 0 0	2.15
19/	6/92	830 0	2.07
19/	6/92	9 0 0	1.98
19/	6/92	930 0	1.88
19/	6/92	10 0 0	1.77
19/	6/92	1030 0	1.68
19/	6/92	11 0 0	1.61
19/	6/92	1130 0	1.56
19/	6/92	12 0 0	1.54
19/	6/92	1230 0	1.55
19/	6/92	13 0 0	1.61
19/	6/92	1330 0	1.69
19/	6/92	14 0 0	1.81
19/	6/92	1430 0	1.95
19/	6/92	15 0 0	2.10
19/	6/92	1530 0	2.27
19/	6/92	16 0 0	2.43
19/	6/92	1630 0	2.58
19/	6/92	17 0 0	2.70
19/	6/92	1730 0	2.80
19/	6/92	18 0 0	2.86
19/	6/92	1830 0	2.89
19/	6/92	19 0 0	2.87
19/	6/92	1930 0	2.81
19/	6/92	20 0 0	2.71
19/	6/92	2030 0	2.58
19/	6/92	21 0 0	2.41
19/	6/92	2130 0	2.24
19/	6/92	22 0 0	2.05
19/	6/92	2230 0	1.87
19/	6/92	23 0 0	1.70
19/	6/92	2330 0	1.56

20/ 6/92	0 0 0	1.43
20/ 6/92	030 0	1.35
20/ 6/92	1 0 0	1.30
20/ 6/92	130 0	1.29
20/ 6/92	2 0 0	1.32
20/ 6/92	230 0	1.39
20/ 6/92	3 0 0	1.48
20/ 6/92	330 0	1.59
20/ 6/92	4 0 0	1.72
20/ 6/92	430 0	1.85
20/ 6/92	5 0 0	1.97
20/ 6/92	530 0	2.08
20/ 6/92	6 0 0	2.16
20/ 6/92	630 0	2.23
20/ 6/92	7 0 0	2.26
20/ 6/92	730 0	2.26
20/ 6/92	8 0 0	2.23
20/ 6/92	830 0	2.17
20/ 6/92	9 0 0	2.09
20/ 6/92	930 0	2.00
20/ 6/92	10 0 0	1.90
20/ 6/92	1030 0	1.80
20/ 6/92	11 0 0	1.71
20/ 6/92	1130 0	1.64
20/ 6/92	12 0 0	1.59
20/ 6/92	1230 0	1.57
20/ 6/92	13 0 0	1.58
20/ 6/92	1330 0	1.63
20/ 6/92	14 0 0	1.71
20/ 6/92	1430 0	1.81
20/ 6/92	15 0 0	1.94
20/ 6/92	1530 0	2.08
20/ 6/92	16 0 0	2.23
20/ 6/92	1630 0	2.38
20/ 6/92	17 0 0	2.51
20/ 6/92	1730 0	2.63
20/ 6/92	18 0 0	2.71
20/ 6/92	1830 0	2.77
20/ 6/92	19 0 0	2.79
20/ 6/92	1930 0	2.77
20/ 6/92	20 0 0	2.71
20/ 6/92	2030 0	2.62
20/ 6/92	21 0 0	2.49
20/ 6/92	2130 0	2.35
20/ 6/92	22 0 0	2.18
20/ 6/92	2230 0	2.02
20/ 6/92	23 0 0	1.85
20/ 6/92	2330 0	1.70

APPENDIX I
GPS CONSTELLATION EVENT SCHEDULE



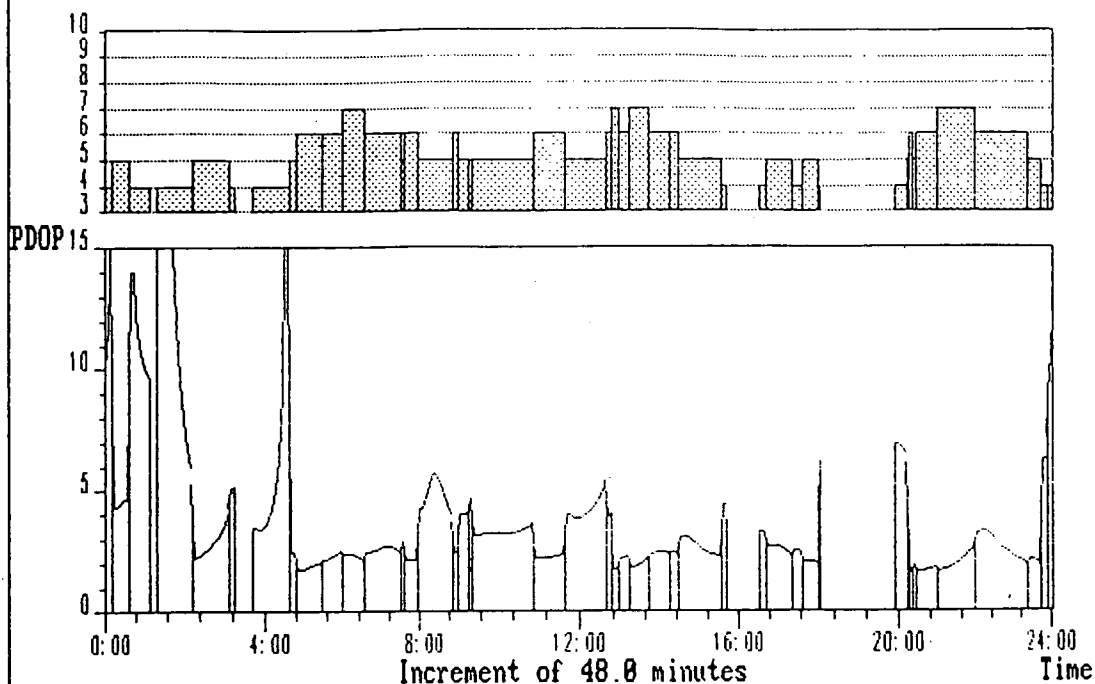
Station : otway Date : 20 May 1992

All-In-View PDOP vs Time Latitude : 38 00'00"S Longitude : 141 00'00"E Zone : 10:00 Cut-off Elevation : 10

000058

Number of Satellites

8 Channel Receiver



GPS event schedule indicative of
SV coverage throughout the survey.

All-In-View PDOP for otway					
Date : 20 May 1992			Latitude : 38° 00' 00" S		
Time : 0:00 -> 24:00			Longitude : 141° 00' 00" E		
Cut-off Elevation : 10°			Zone : 10:00		
Satellite Constellation	Time Rise	Time Set	dT	PDOP Rise	PDOP Set
2 6 13 19	0:00	0:12	0:12	10.5	19.1
2 6 13 15 19	0:12	0:37	0:25	4.3	4.7
2 6 13 15	0:37	1:10	0:33	14.0	9.6
2 6 12 13	1:20	2:12	0:52	99.9	5.3
2 6 12 13 24	2:12	3:07	0:55	2.2	4.3
6 12 13 24	3:07	3:15	0:08	5.2	5.2
12 13 20 24	3:40	4:37	0:57	3.4	21.3
3 12 13 20 24	4:37	4:47	0:10	2.4	2.4
3 12 13 16 20 24	4:47	5:27	0:40	1.7	2.1
3 12 16 20 24 25	5:27	5:57	0:30	2.2	2.5
3 12 16 17 20 24 25	5:57	6:32	0:35	2.4	2.1
3 16 17 20 24 25	6:32	7:32	1:00	2.5	2.3
3 16 17 20 25	7:32	7:37	0:05	3.0	3.0
3 16 17 20 23 25	7:37	7:57	0:20	2.1	2.2
3 16 17 20 23	7:57	8:52	0:55	4.3	3.7
3 16 17 20 21 23	8:52	9:02	0:10	2.5	2.4
3 17 20 21 23	9:02	9:17	0:15	4.0	4.0
3 17 21 23	9:17	9:22	0:05	4.6	4.6
3 17 21 23 28	9:22	10:52	1:30	3.2	3.7
3 11 17 21 23 28	10:52	11:37	0:45	2.2	2.4
11 17 21 23 28	11:37	12:37	1:00	4.0	5.5
11 12 17 21 23 28	12:37	12:47	0:10	4.0	4.1
11 12 15 17 21 23 28	12:47	12:57	0:10	1.8	1.8
11 12 15 21 23 28	12:57	13:12	0:15	2.3	2.3
11 12 15 21 23 25 28	13:12	13:42	0:30	1.8	2.2
11 12 15 21 25 28	13:42	14:12	0:30	2.4	2.4
11 14 15 21 25 28	14:12	14:27	0:15	2.5	2.4
11 14 15 21 25	14:27	15:32	1:05	3.1	2.3
14 15 21 25	15:32	15:40	0:08	4.4	3.8
13 14 15 25	16:30	16:42	0:12	3.3	3.1
13 14 15 18 25	16:42	17:22	0:40	2.7	2.3
14 15 18 25	17:22	17:37	0:15	2.5	2.4
14 15 18 19 25	17:37	18:02	0:25	2.1	2.0
14 15 18 19	18:02	18:05	0:03	6.2	6.2
14 18 19 28	19:55	20:12	0:17	6.9	6.2
6 14 18 19 28	20:12	20:17	0:05	2.5	2.5
6 14 16 18 19 28	20:17	20:22	0:05	1.6	1.6
6 16 18 19 28	20:22	20:27	0:05	1.9	1.9
2 6 16 18 19 28	20:27	20:57	0:30	1.7	1.9
2 6 11 16 18 19 28	20:57	21:57	1:00	1.7	2.7
2 6 11 16 18 19	21:57	23:22	1:25	3.3	1.9
2 6 11 16 19	23:22	23:42	0:20	2.1	2.0
2 6 16 19	23:42	23:52	0:10	6.3	7.2
2 6 13 19	23:52	24:00	0:08	10.1	12.9

APPENDIX J

DAILY LOGS

RACAL-SURVEY

VESSEL TILBATA CREEK

DAILY LOG 11288

PROJECT LEADER STEVE DOWNS

CLIENT BHPP

DATE 15th JUNE 1992

PROJECT 1916 OTWAY DUNTRON

TIMEZONE.....GMT + 9.5

SYSTEM DAG/SSS/STB/ES/GNS/SKYFIX

[illegible]

REMARKS

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

RACAL-SURVEY

DAILY LOG

11289

VESSEL TILBATA CREEK

PROJECT LEADER STEVE DOWNS

CLIENT BHPP

DATE 16th JUNE 1992

PROJECT 1916 OTWAY/DUNTROON...

TIMEZONE GMT+9.5

SYSTEM DAG/SSS/STB/ES/GNS/SKYFIX

[illegible]

REMARKS

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

RACAL-SURVEY

VESSEL TILBATA CREEK DAILY LOG 11290

PROJECT LEADER STEVE DOWNS CLIENT BHPP

DATE 17th JUNE 92 PROJECT 1916 OTWAY DUNTREON

TIMEZONE GMT+9.5 SYSTEM DAG|ESS|STB|ES|GNS|SICKFIX

[illegible]

REMARKS

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

RACAL-SURVEY

DAILY LOG

11291

VESSEL TILBATA CREEK

PROJECT LEADER STEVE DOWNS

CLIENT BHRP

DATE 18th June 92 PROJECT 1916 OTWAY/DUNTROON

TIMEZONE GMT+9.5 SYSTEM DAG|SSS|STB|ES|ENS|SKYFOX

[illegible]

REMARKS

SIGNED

8th Down

DIRECT READER

SIGNED

Wan Fellen

CLIENT REPRESENTATIVE

RACAL-SURVEY

DAILY LOG 11292

VESSEL TILBATA CREEK

PROJECT LEADER STEVE DOWNS

CLIENT BHPP

DATE 19th June 92

PROJECT 1916 OTWAY / OUNTRON

TIMEZONE GMT + 9.5

SYSTEM DAG / SSS / STB / ES / GNS / SKYFRX

[illegible]

REMARKS

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

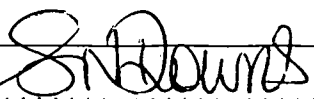
RACAL-SURVEY

VESSEL TILBATA CREEK DAILY LOG 11295PROJECT LEADER STEVE DOWNS CLIENT BHPPDATE 20th JUNE 92 PROJECT 1916 OTWAY/DUNTROONTIMEZONE GMT+9.5 SYSTEM DAG/SSS/STB/ES/GNS/SKYFIX

TIME	NARRATIVE	INITIAL
0000-0445	RUN LINES AM, A, 7, 5, 3, 38A, 47A STB/ES (OPS)	
0445-0512	RECOVER ANALOGUE GEAR - ANALOGUE SITE	
	COMPLETED (OPS)	
0512-0625	STREAMER DEPLOYED (OPS)	
0625-0720	SURVEY GENERATOR FAULT (V/L D/T)	
0720-0840	TRYING LINES DIRECTIONS (WX STBY)	
0840-0942	AGREE TO SHOOT LINES D4, D22 FIRST, HEAD FOR LINE (STBY)	
0942-0954	RUN LINE D4 - DAG/ES NTBP GUN FAILURE (D/T)	
0954-1028	RECOVER, REPAIR GUN-REDEPLOY (D/T)	
1028-1115	CONTINUE LONG LINE CHANGE TO LINE D22 (STBY)	
1115-1447	RUN LINES D22, D21, D27, 23 DAG/ES (OPS)	
1447-1556	GUN FAILURE, RECOVER REPLACE (D/T)	
1556-1735	RUN LINES D20, 4A, 17 DAG/ES (OPS)	
1735-1845	GUN CONTROLLER FAILURE - D5 RUN-IN ABORTED (D/T)	
1845-2132	RUN LINES D3, 6, 4A, 5A, 25 DAG/ES (OPS)	
2132-2245	STANDING BY FOR SATELLITES (STBY)	
2245-2400	RUN LINES D29, 19 DAG/ES (OPS)	
	ANALOGUE TIE LINE COVERAGE CONSIDERED SUFFICIENT BY CLIENT REP.	

REMARKS

SIGNED

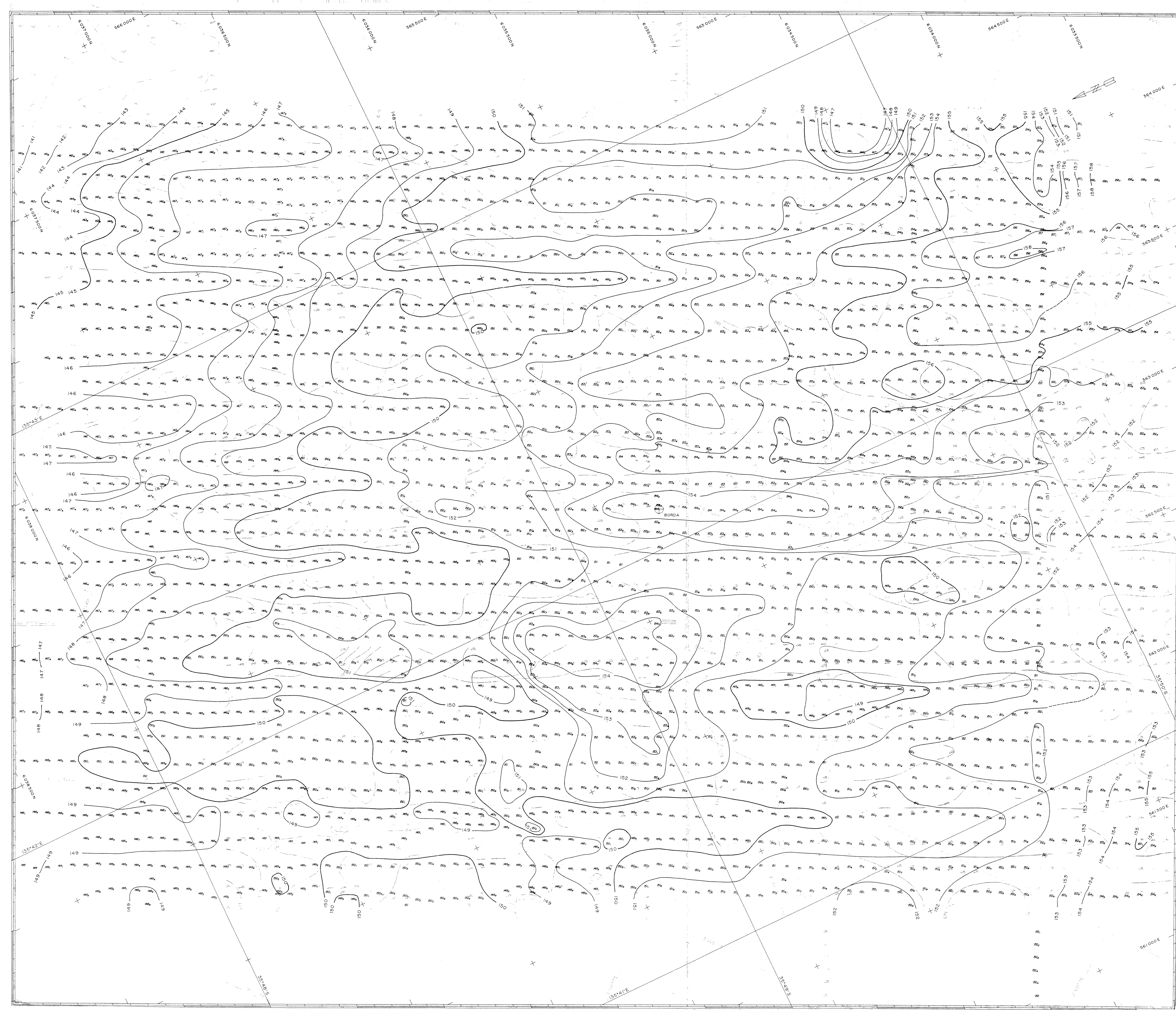


PROJECT LEADER

SIGNED



CLIENT REPRESENTATIVE



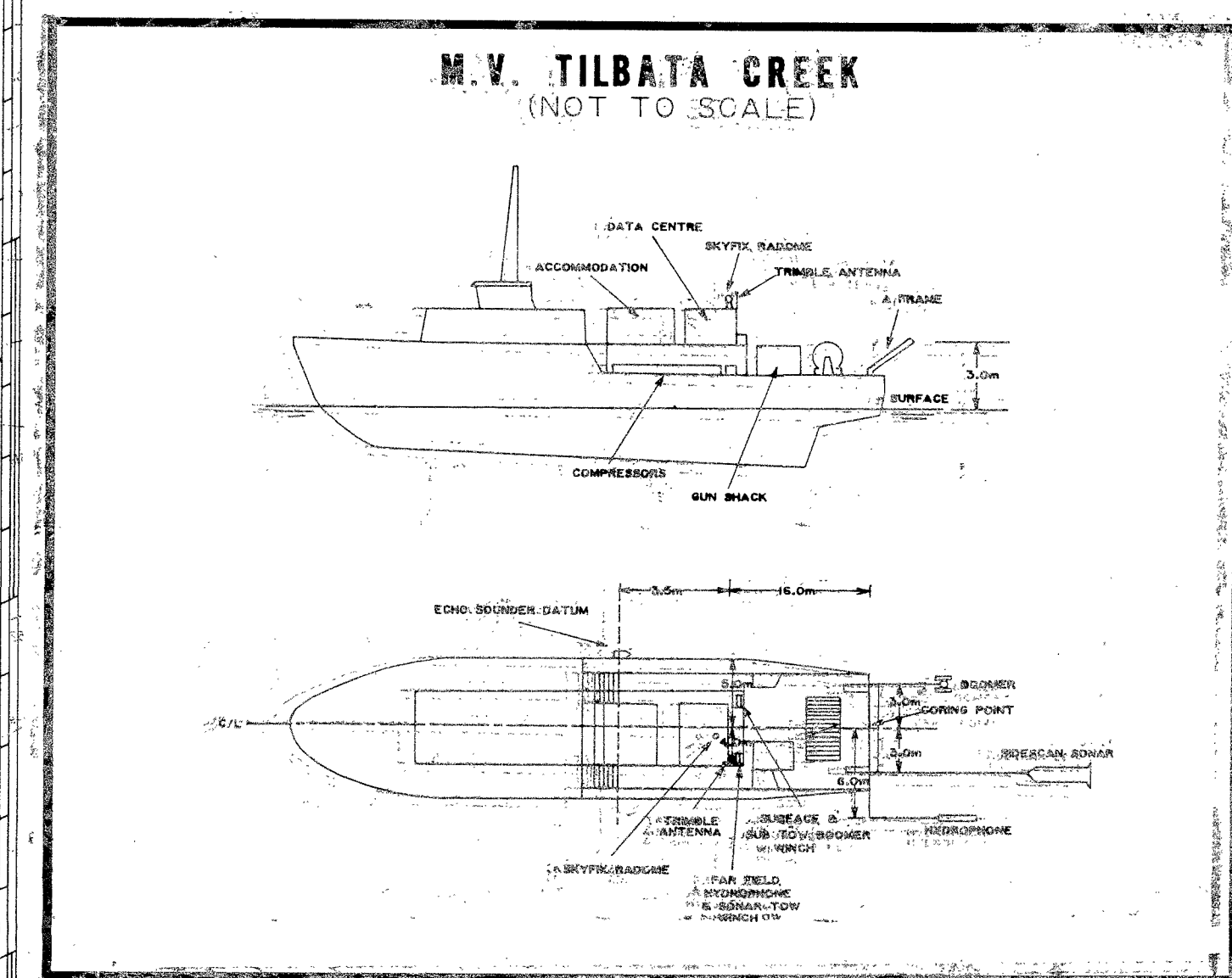
LEGEND

⊕ PROPOSED BORDA LOCATION 563 380 mE
6 035 774 mN

~ BATHYMETRY CONTOURS AT 1 METRE INTERVALS

149, BATHYMETRIC SOUNDINGS IN METRES AND DECIMETRES
REDUCED TO L.A.T. USING WOOL BAY

NOTE:
1. POSITIONING SYSTEM : DIFFERENTIAL GPS



BHP PETROLEUM PTY. LTD.

BORDA SITE SURVEY

BATHYMETRY

RACAL

RACAL SURVEY AUSTRALIA LTD.

8548-3

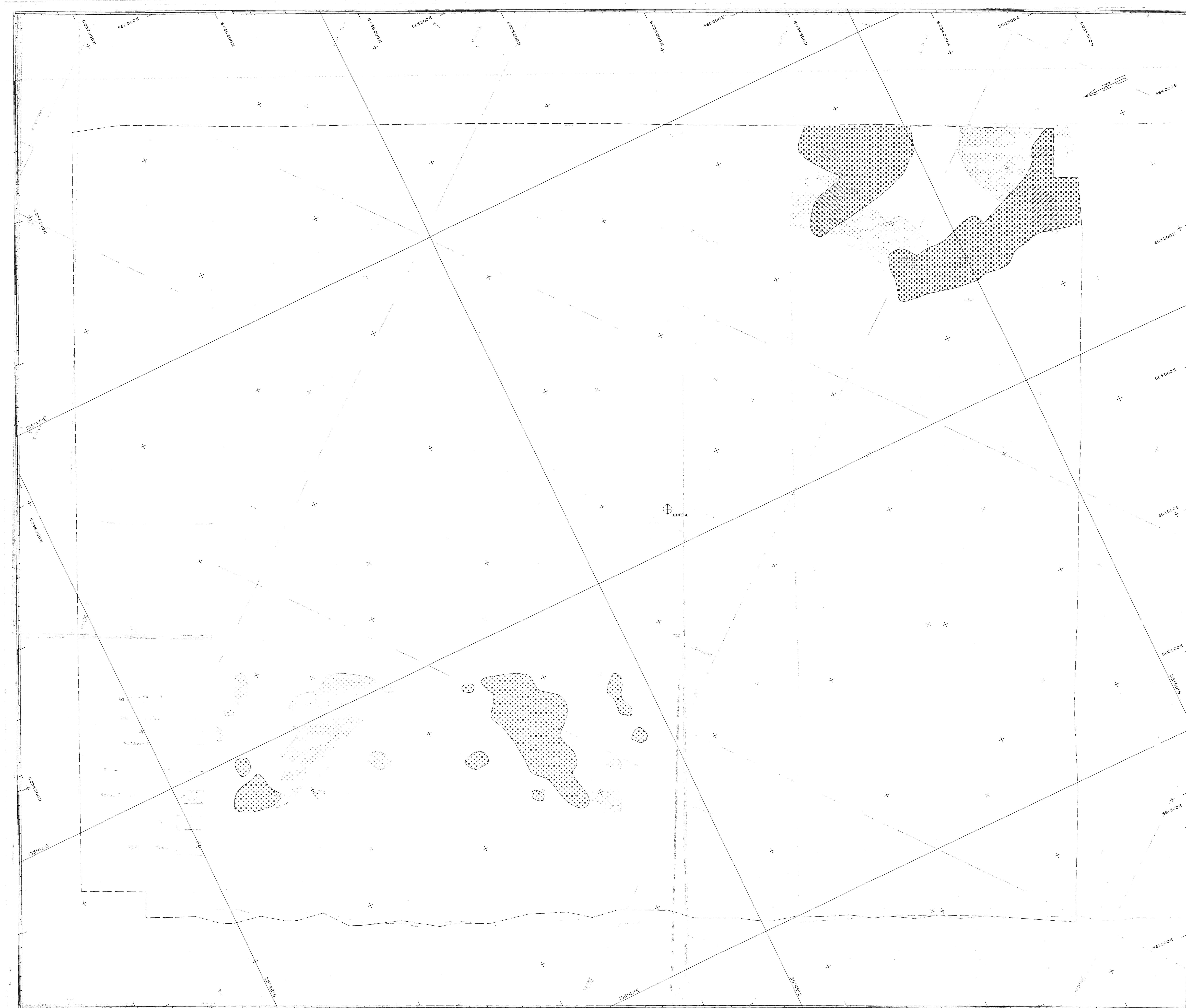
SCALE 1 : 5000

AUSTRALIAN GEODETIC DATUM 1966

False Easting 500000mE Latitude of Origin 0° 0' 0"N
False Northing 1000000mN Longitude of Origin 135° 0' 0"E

Party Chief : S. Downs	Project Date : May 92	Vessel : TILBATA CREEK
Drawn by : F. Fitzpatrick	Date : Jun 92	Sheet No. : 2 of 5
Checked by : G. Jones	Date : Aug 92	Chart No. : 1916EE2

RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Boleatta, W.A. 6021.
TEL : (08) 344 7166 FAX : (08) 344 8783 TELEX : RA94341 RACSUR



LEGEND



PROPOSED BORDA LOCATION 563 380 mE
6 035 774 mN

INDISTINCT BOUNDARY

- CLEARLY DEFINED BOUNDARY



EXPOSED CALCARENITE LAYER



COARSE CARBONATE SAND

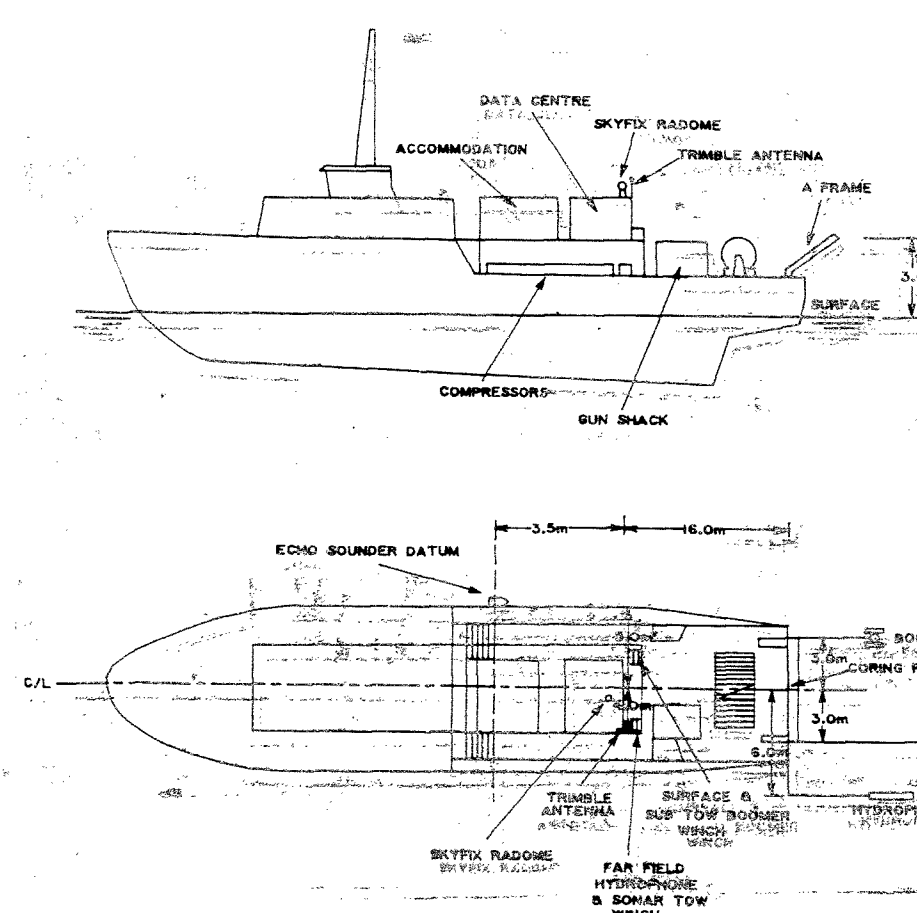


LIMIT OF SURVEY

NOTE

I. POSITIONING SYSTEM : DIFFERENTIAL GPS

M.V. TILBATA CREEK
(NOT TO SCALE)



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BORDA SITE SURVEY

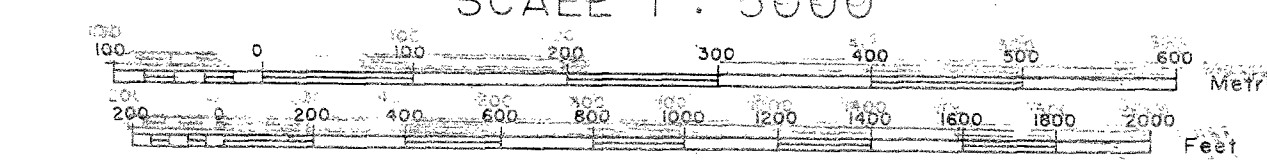
SEABED FEATURES CHART

RACAL

RACAL SURVEY AUSTRALIA LTD.

8548-4

SCALE 1 : 5000

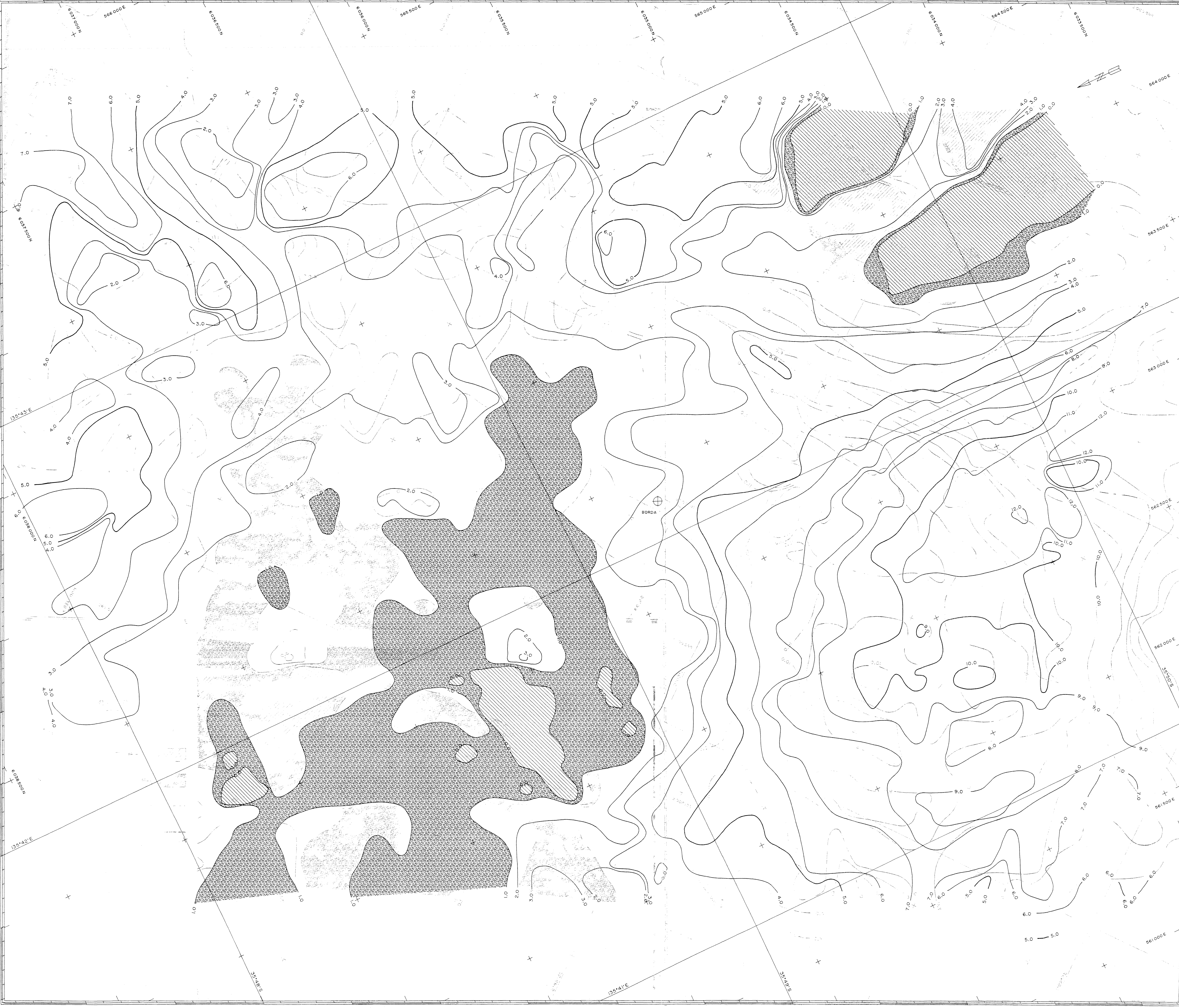


AUSTRALIAN GEODETIC DATUM 1966

False Easting 500000mE Latitude of Origin 0° 0' 0"

False Northing 1000000mN Longitude of Origin 135° 0' 0"

Project Name: <u>RECONSTRUCTION</u>		Longitude or Origin: <u>155° 0' 0" E</u>	
Party Chief: <u>B. Owens</u>	Project Date: <u>May 92</u>	Vessel: <u>TILBATA CREEK</u>	
Drawn by: <u>F. Filzsdorff</u>	Date: <u>Jun 92</u>	Sheet No.: <u>3 of 5</u>	
Rechecked by: <u>G. Jones</u>	Date: <u>Aug 92</u>	Chart No.: <u>1916-E-3</u>	
RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Belmont, W.A. 6001 TEL: (09) 344 7166 FAX: (09) 344 8783 TELEX: A493431 RACAL			



LEGEND

⊕ PROPOSED BORDA LOCATION 563 380 mE
6 035 774 mN

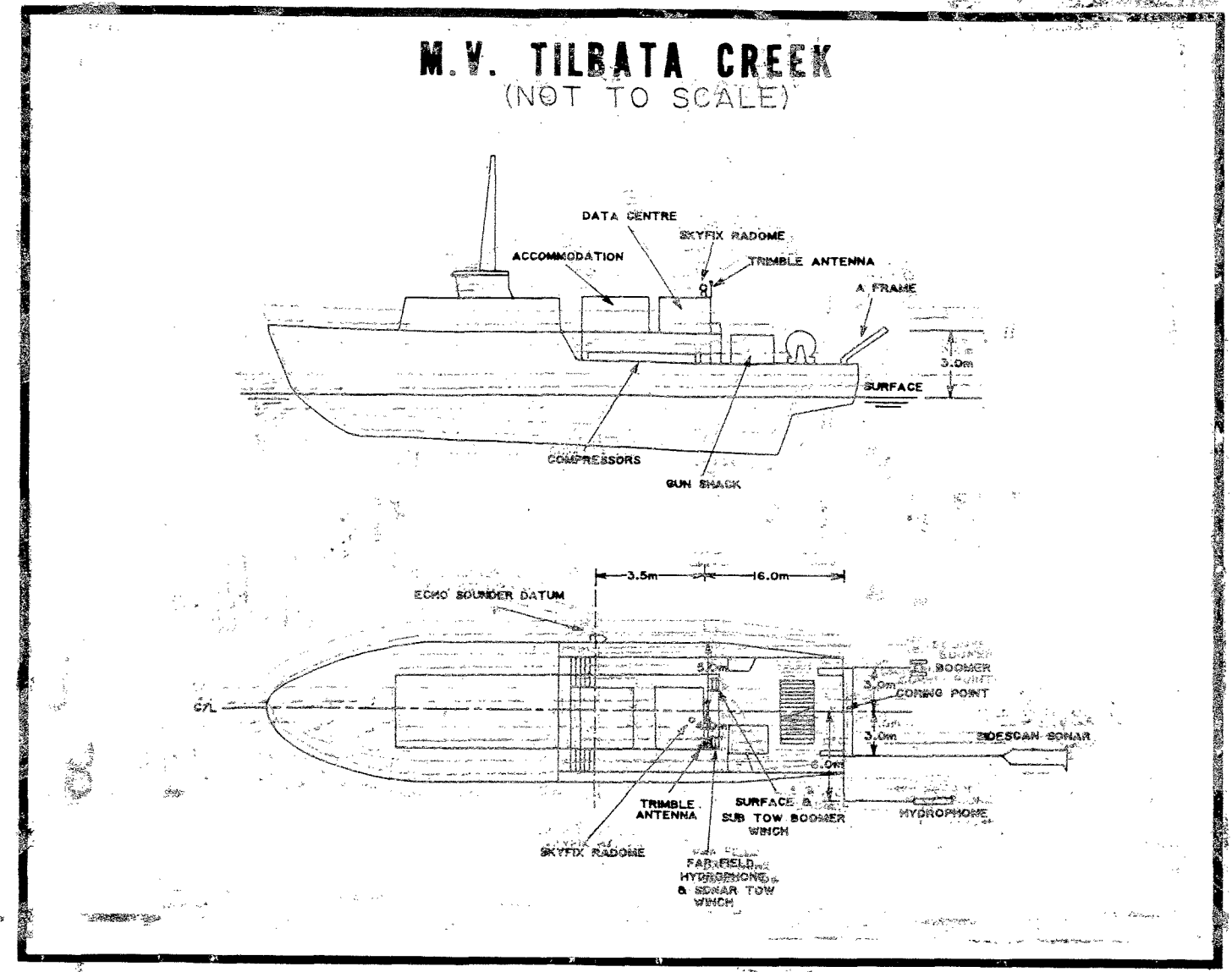
▨ UNIT A ABSENT

▤ LESS THAN 40 CENTIMETRES OF SURFICIAL SAND

— ISOPACH

- - - INFERRED ISOPACH

NOTE:
1. POSITIONING SYSTEM : DIFFERENTIAL GPS



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BORDA SITE SURVEY

ISOPACH OF UNIT A

RACAL

RACAL SURVEY AUSTRALIA LTD.

8548-S

SCALE 1 : 5000

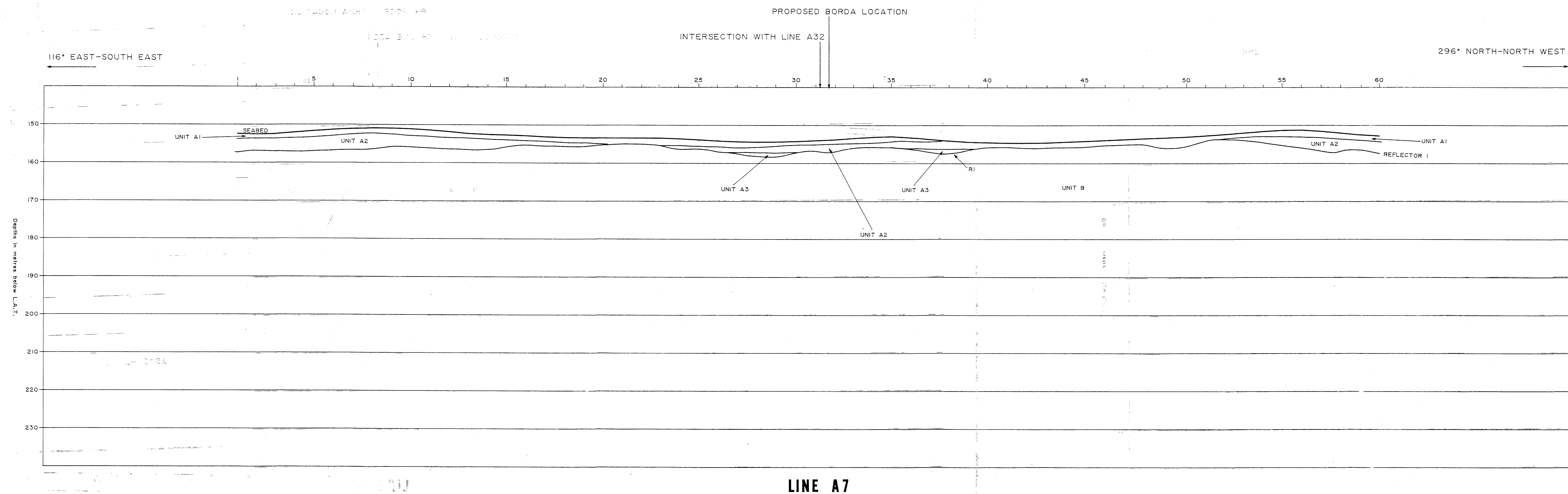
100 0 200 300 400 500 600 Metres
300 0 300 600 900 1200 1500 1800 2100 Feet

AUSTRALIAN GEODETIC DATUM 1966

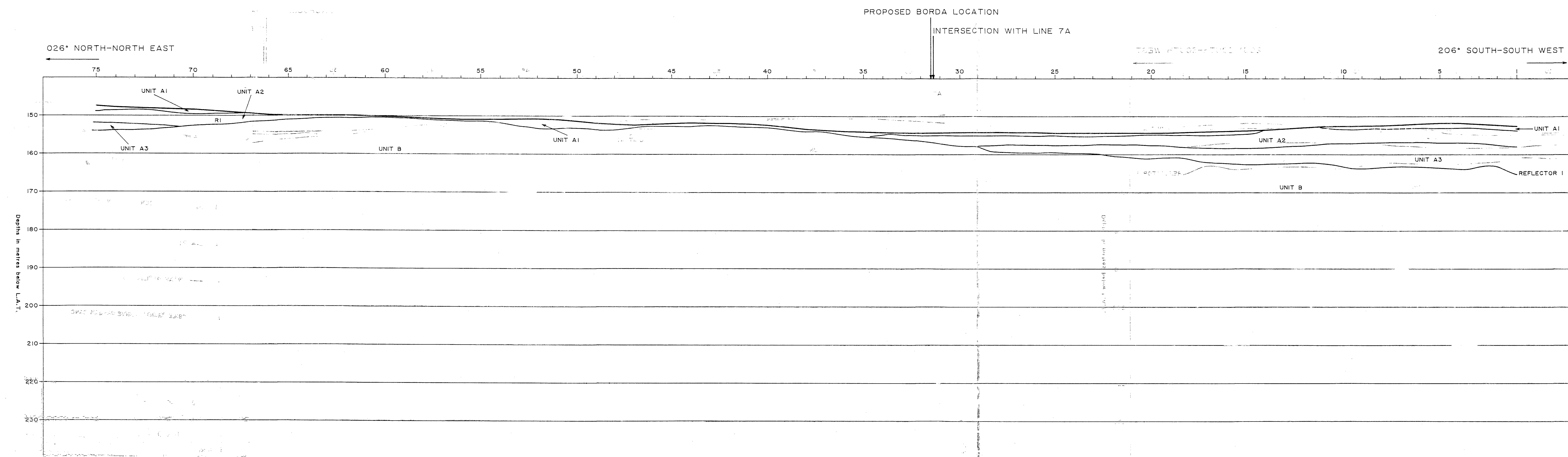
False Easting : 500000mE Latitude of Origin : 0° 0' 0"N
False Northing : 1000000mN Longitude of Origin : 135° 0' 0"E

Party Chief : S. Downs	Project Date : May 92	Vessel : TILBATA CREEK
Drawn by : R. Fitzpatrick	Date : Jun 92	Sheet No. : 4 of 5
Checked by : T.G. Jones	Date : Aug 92	Chart No. : 1916-E-4

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LINE A7



LINE A32

LEGEND

- 45 ECHOSOUNDER POSITION (SHIP'S DATUM)
- STRONG REFLECTOR
- WEAK REFLECTOR

UNIT A1 = MOBILE TRANSGRESSIVE CARBON SAND

UNIT A2 = UNCONSOLIDATED COARSE TO MEDIUM CARBONATE SAND

UNIT A3 = SEMI-CONSOLIDATED CARBONATE SAND

R1 = UNCONFORMABLE EROSION SURFACE

UNIT B = CALCARENITE

BHP PETROLEUM PTY. LTD.

BORDA SITE SURVEY

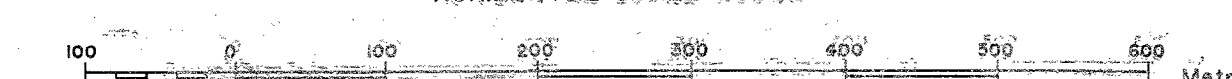
BOOMER PROFILES

RACAL

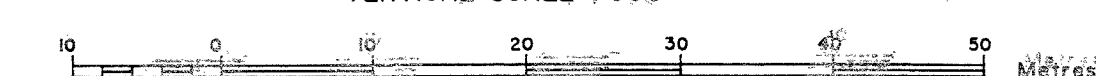
RACAL SURVEY AUSTRALIA LTD.

8548-6

HORIZONTAL SCALE 1:5000



VERTICAL SCALE 1:500



Party Chief : S. Downs	Project Date : May 92	Vessel : TILBATA CREEK
Drawn by : F. Fitzpatrick	Date : Jun 92	Sheet No. : 5 of 5
Checked by : G. Jones	Date : Aug 92	Chart No. : 1916-E-5

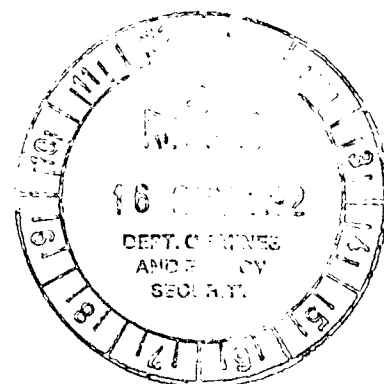
RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Bayswater, W.A. 6021
TEL : (09) 344 7166 FAX : (09) 344 8783 TELEX : AA94321 RACSUR

VOLUME 2
DIGITAL SITE SURVEY REPORT

FOR

BHP PETROLEUM PTY LTD

LOCATION : BORDA
BLOCK : OTWAY BASIN
DATE : 20TH - 21ST JUNE, 1992
REPORT REF : 1916e



CONTENTS**SURVEY RESULTS****INTERMEDIATE ZONE GEOLOGY****DRILLING HAZARDS WITHIN THE INTERMEDIATE ZONE GEOLOGY****APPENDICES**

Appendix A	Annotated Digital Section of Line D22
Appendix B	Scatter Plot of Stacking Velocities Vs Two Way Time
Appendix C	Time Depth Curve
Appendix D	Digital Observers Logs

CHARTS

Chart 1916e-A.7	Track Chart	Scale 1:5000
Chart 1916e-A.8	Isochrons to Blue Horizon and Anomalies	Scale 1:5000

INTERMEDIATE ZONE GEOLOGY

The Intermediate Zone Geology within the Borda survey area was identified from data obtained from the clustered airgun array acquisition. Digital observer's logs are included in Appendix D. The data was processed by Racal Survey Malaysia in Kuala Lumpur Data Centre.

All time-depth conversions have been based on the Time-Depth curve derived from the average of stacking velocities at 72 velocity locations of the survey area. The scatter-plot of stacking velocities versus two-way time and Time-Depth curve used are included in Appendices B and C. An annotated seismic profile through the Proposed Borda Location is included as Appendix A.

The multichannel digital data has been interpreted and is presented as one isochron map to a prominent horizon and locally enhanced high amplitude anomalies. The stratigraphy can be divided in 2 general units, arbitrary named Unit X and Y, based on the reflection characteristics and information obtained from the predicted lithological section and seismic data supplied by BHP Petroleum Australia on 14 and 25 of August 1992. These units are demarcated by a prominent horizon, arbitrarily named Blue Horizon lying at about 0.307 sec TWT (237 m bsl) beneath the Proposed Borda Location.

The geology within the survey area in general corresponds to Nullarbor Formation of Miocene to Oligocene age.

The characteristics of each of the name units are discussed below and reference should be made to the accompanying annotated profile and chart 1916f.2.

Unit X (Seabed to Blue Horizon : 0.207 sec TWT to 0.307 sec TWT)

Unit X is generally characterized by low acoustic reflectivity and extends from the seabed to the top of the regionally dipping, moderate strength Blue Horizon lying between 0.280 sec TWT (215 m bsl) in the northeast and 0.315 sec TWT (243 m bsl) in the southwest of the survey area. The extent of this moderately strong event is charted on Chart 1916f.2 of this report.

From the processed seismic data, locally enhanced higher amplitudes and reflections within the uppermost part of Unit X is believed to represent a bioclastic calcarenite layer, where as a whole, Unit X corresponds to a unit of the Nullarbor Limestone Formation (Miocene to Oligocene).

The base of Unit X, demarcated by a well defined horizon, is believed to comprise a thin layer of marl. Locally enhanced high amplitude anomalies and reflections lying immediately below the Blue Horizon are believed to be associated with locally deposited coarser sediments and/or sediments which are differentially compacted.

At the Proposed Borda Location, the Blue Horizon lies 0.307 sec TWT (237 m bsl).

Unit Y (Blue Horizon and below : 0.307 sec TWT and below)

The top of Unit Y is delineated by the moderate strength Blue Horizon. As a whole, based on the information from the predicted lithological section, Unit Y also represents the limestone of the Nullarbor Formation (Miocene to Oligocene).

The upper interval of Unit Y is characterized by an overall low to moderate impedance appearance. A few locally enhanced amplitude anomalies noted are likely to be lithological, closely spaced thin beds or lateral variations in sediment compaction or grain size. Even if the presence of gas is not clearly evident on the processed data, the possibility of a gas bearing horizon within these anomaly zones cannot be ruled out.

The lower interval of Unit Y (below 1 sec TWT), coherency of signal quality is poor and this is believed to be attributed to signal loss through the Nullarbor Limestone Formation.

Ref : i) BHP Petroleum Predicted Lithological Section, Borda Site, Otway Basin.
 ii) BHP Seismic Data, Borda - 1 site, Otway Basin.

Structural Components and Anomalies

As discussed above, geology within the survey area in general corresponds to the Nullarbor Limestone Formation.

A major amplitude reflector (Blue Horizon) is noted in the upper interval of the intermediate zone, lying between 0.280 sec TWT (215 m bsl) and 0.315 sec TWT (243 m bsl). It is believed to be associated with the top of a marl layer.

Scattered patches of localized high amplitude anomalies noted within the intermediate zone interval are believed to be associated with differential compaction of sediments and/or deposits of coarser sediments. Though no major anomalies indicative of gas accumulation are noted, the possibility of a gas bearing horizon within these anomaly zones cannot be ruled out.

Below is a summary of the horizons and events expected to be encountered when drilling at the Proposed Borda Location.

Two Way Time (seconds)	Depth (metres bsl)	Events	Comments
0.207	155	Seabed	
0.307	237	Blue Horizon	Regional moderately strong reflector. Top of Marl layer.
0.615	193	Anomaly	Localised high amplitude anomaly associated with coarser sediments.
0.973	1034	Anomaly	Localised high amplitude anomaly associated with coarser sediments.

DRILLING HAZARDS WITHIN THE INTERMEDIATE ZONE GEOLOGY

At the Proposed Borda Location, no significant drilling constraint is noted.

Drilling is expected to encounter a high amplitude anomalies and horizon lying at 0.615 sec TWT (577 m bsl) and 0.973 sec TWT (1034 m bsl) respectively. Although no acoustic masking, indicative of gas is noted, caution is advised when drilling approaches these levels. The anomalies are believed to be associated with coarser sediments and/or differential compaction.

DISTRIBUTION

Copies of this report have been distributed as follows:

BHP Petroleum - Melbourne
Attn: Mr. R. Marlow

: 4 copies

BHP Engineering - Wollongong
Attn: Mr. S. Dykes

: 1 copy

Racal Survey Australia Limited

: 1 copy

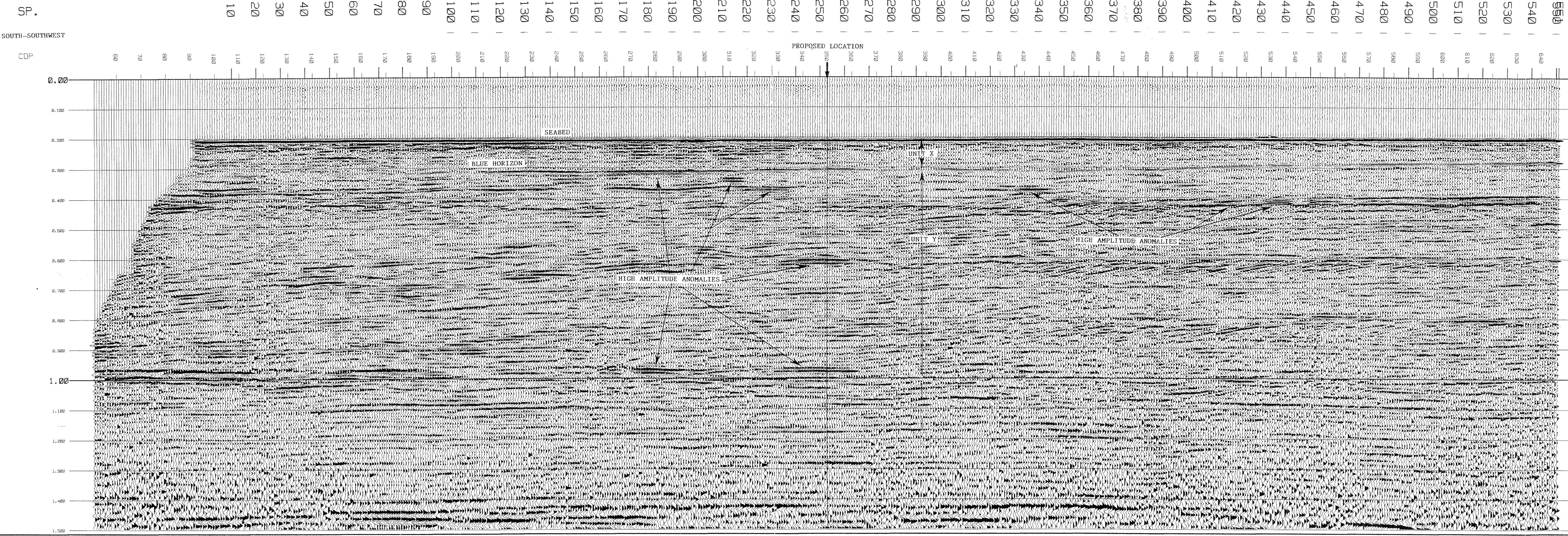

Steve Downs
Party Chief


Gareth Jones
Area Surveyor

APPENDIX A

**ANNOTATED DIGITAL SECTION OF
LINE D22**

8548-7



PROCESS: DAS
TYPE: EQUALIZED PLOT
PROVISIONAL COPY

CLIENT: BHP
AREA: OTWAY BASIN
SITE: BORDA
LINE: D22
SP RANGE: 0001 - 0551
DIRECTION: 26 DEGREE (L-R)

PROCESSING SEQUENCE:

[01] TRANSCRIPTION: SEG-D
- NO. OF CHANNEL: 48
- RECORD LENGTH: 1.5 SEC
- SAMPLE RATE: 0.5 MSEC

[02] GUN DELAY CORRECTION: NIL

[03] SPHERICAL DIVERGENCE: TIME VEL TIME VEL TIME VEL
0 1500 110 1500 400 1800
1000 2025 1500 2225

[04] EXPONENTIAL ABSORPTION: 16 DB/SEC FROM 110 TO 1200 MSEC
AND THEN TAPER OFF

[05] COMMON DEPTH POINT GATHER: MAX. 48 FOLD

[06] PREDICTIVE DBS: 8 MSEC
- PREDICTION LAG: 210 MSEC
- NO. OF WINDOW: 1
- WHITE NOISE: 1.0 %

[07] NMO AND MUTING: NMO USING VELOCITY FROM AVERAGE
OF 0.5 KM INTERVAL
MUTE TIME (MSEC) OFFSET (M)
0000 95
0250 119
0400 319
0800 620

[08] CDP STACKING

[09] GUN AND CABLE CORRECTIONS: 4 MSEC

[10] PREDICTIVE DBS: 10 MSEC
- PREDICTION LAG: 210 MSEC
- NO. OF WINDOW: 1
- WHITE NOISE: 1.0 %

[11] TIME VARIANT FILTER: TIME (MSEC) LC (HZ) HC (HZ)
0000 40 230
0500 30 180
1000 20 120
1500 15 60

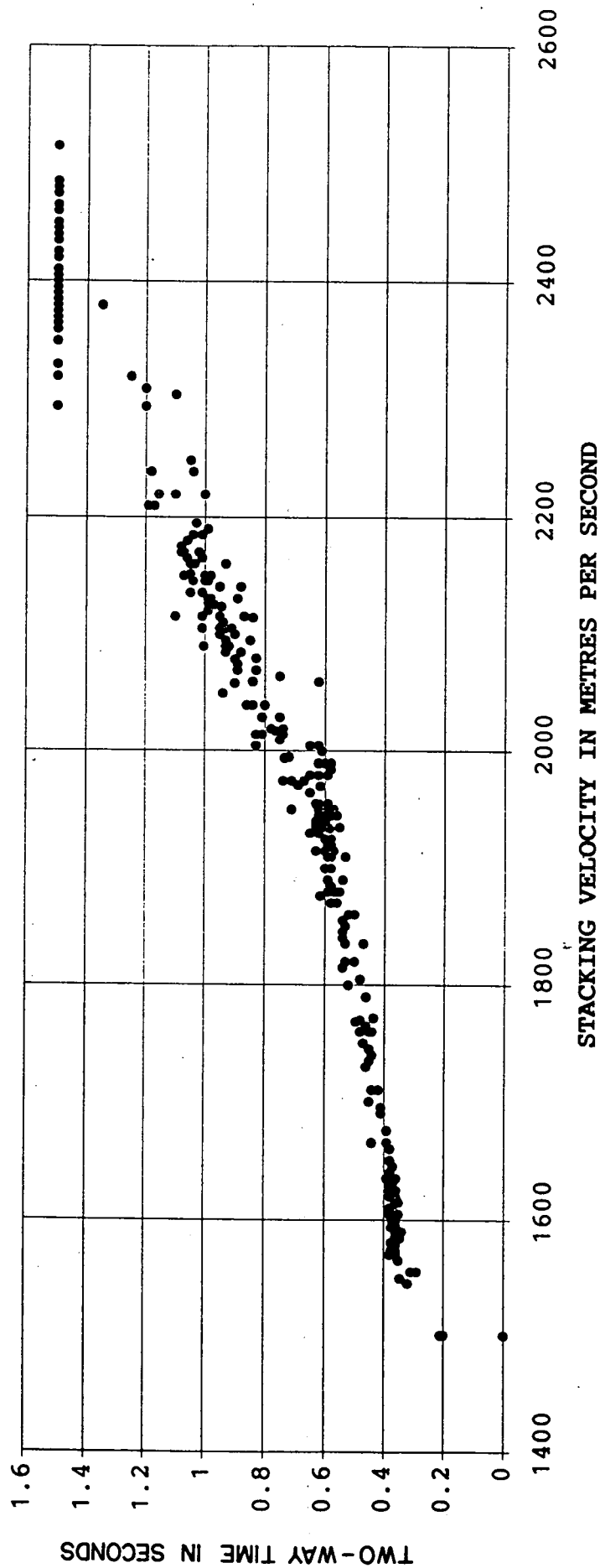
[12] SCALING: TRACE EQUALIZATION
5 DISCRETE GATE

[13] DISPLAY SCALE: 1:5000
- HORIZONTAL: 20.320 TRS/IN
- VERTICAL: 7.874 IN/SEC
- DATUM: MEAN SEA LEVEL
- ANNOTATION: CDP POSITION

APPENDIX B

**SCATTER PLOT OF STACKING VELOCITIES
VERSUS TWO WAY TIME**

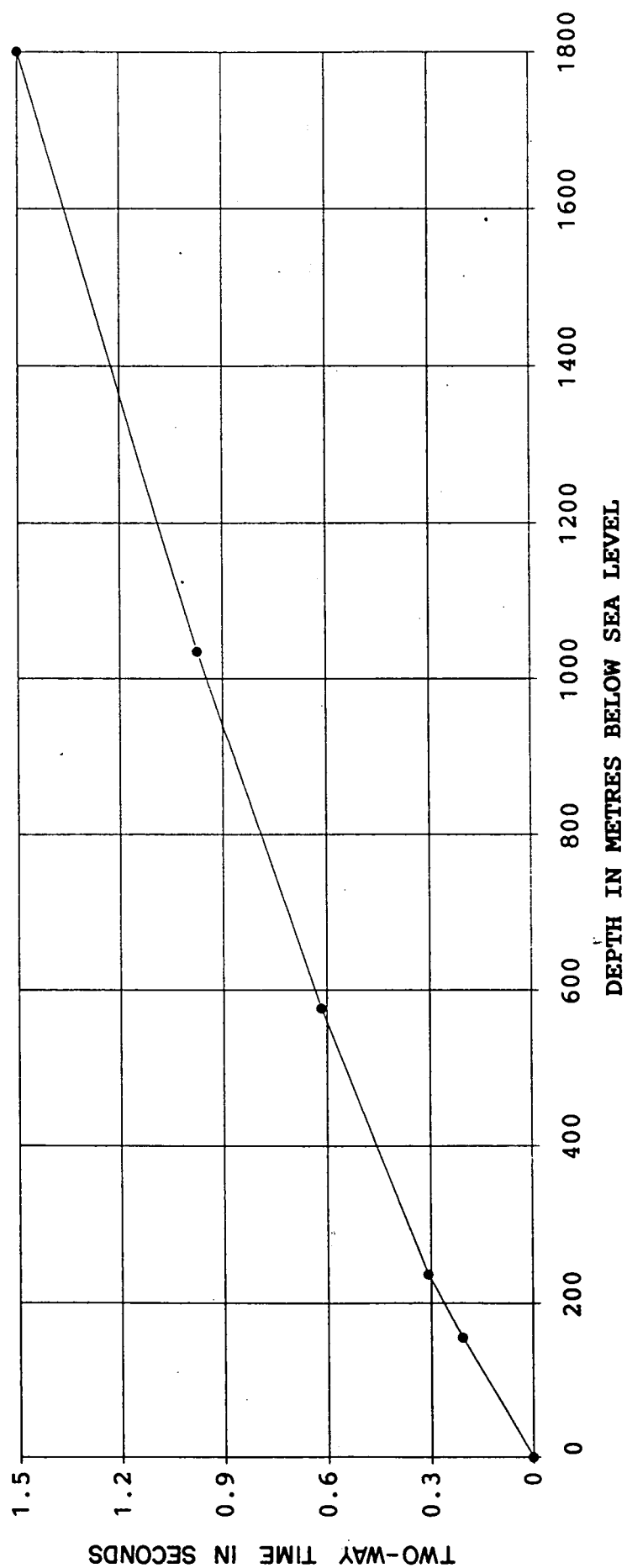
SCATTER PLOT OF STACKING VELOCITIES VERSUS TWO WAY TIME - BHP PETROLEUM
AUSTRALIA - BORDA SITE



APPENDIX C

TIME DEPTH CURVE

TIME DEPTH CONVERSION CURVE - BHP PETROLEUM AUSTRALIA - BORDA SITE



APPENDIX D

DIGITAL OBSERVERS LOGS

[illegible]

RACAL

BRACAL SURVEY (UK) LTD.
Gt. Yarmouth, Norfolk
Tel: (0493) 857011
Telex: 97407

[illegible]

[illegible]

LINE	06		OBSERVER		SHOT POINT INT. 6 25 M.		e / of		RACAL					
AREA	BORDA		VESSEL TIGATA		SYSTEM TTS 125		SAMPLE RATE 1/2 ms.		RACAL SURVEY (UK) LTD. Gt. Yarmouth, Norfolk Tel: (0493) 857011 Telex: 97407					
JOB NUMBER	1416		DATE 20 / 6 / 92		HEADING 210		CHANNELS		SEIS 4f AUX 2					
File	S.P.	Reel No.	STREAMER DEPTH (FEET)								Time	Feathering Angle	Water Depth	Remarks
			1	2	3	4	5	6	7	8				
1	1	4443	7	8	7	9					19.20	1°S		Normal 246 256 266 276 286 296 306 316 326 336 346 356 366 376 386 396 406 416 426 436 446 456 466 476 486 496 506 516 526 536 546 556 566 576 586 596 606 616 626 636 646 656 666 676 686 696 706 716 726 736 746 756 766 776 786 796 806 816 826 836 846 856 866 876 886 896 906 916 926 936 946 956 966 976 986 996 1006 1016 1026 1036 1046 1056 1066 1076 1086 1096 1106 1116 1126 1136 1146 1156 1166 1176 1186 1196 1206 1216 1226 1236 1246 1256 1266 1276 1286 1296 1306 1316 1326 1336 1346 1356 1366 1376 1386 1396 1406 1416 1426 1436 1446 1456 1466 1476 1486 1496 1506 1516 1526 1536 1546 1556 1566 1576 1586 1596 1606 1616 1626 1636 1646 1656 1666 1676 1686 1696 1706 1716 1726 1736 1746 1756 1766 1776 1786 1796 1806 1816 1826 1836 1846 1856 1866 1876 1886 1896 1906 1916 1926 1936 1946 1956 1966 1976 1986 1996 2006 2016 2026 2036 2046 2056 2066 2076 2086 2096 2106 2116 2126 2136 2146 2156 2166 2176 2186 2196 2206 2216 2226 2236 2246 2256 2266 2276 2286 2296 2306 2316 2326 2336 2346 2356 2366 2376 2386 2396 2406 2416 2426 2436 2446 2456 2466 2476 2486 2496 2506 2516 2526 2536 2546 2556 2566 2576 2586 2596 2606 2616 2626 2636 2646 2656 2666 2676 2686 2696 2706 2716 2726 2736 2746 2756 2766 2776 2786 2796 2806 2816 2826 2836 2846 2856 2866 2876 2886 2896 2906 2916 2926 2936 2946 2956 2966 2976 2986 2996 3006 3016 3026 3036 3046 3056 3066 3076 3086 3096 3106 3116 3126 3136 3146 3156 3166 3176 3186 3196 3206 3216 3226 3236 3246 3256 3266 3276 3286 3296 3306 3316 3326 3336 3346 3356 3366 3376 3386 3396 3406 3416 3426 3436 3446 3456 3466 3476 3486 3496 3506 3516 3526 3536 3546 3556 3566 3576 3586 3596 3606 3616 3626 3636 3646 3656 3666 3676 3686 3696 3706 3716 3726 3736 3746 3756 3766 3776 3786 3796 3806 3816 3826 3836 3846 3856 3866 3876 3886 3896 3906 3916 3926 3936 3946 3956 3966 3976 3986 3996 4006 4016 4026 4036 4046 4056 4066 4076 4086 4096 4106 4116 4126 4136 4146 4156 4166 4176 4186 4196 4206 4216 4226 4236 4246 4256 4266 4276 4286 4296 4306 4316 4326 4336 4346 4356 4366 4376 4386 4396 4406 4416 4426 4436 4446 4456 4466 4476 4486 4496 4506 4516 4526 4536 4546 4556 4566 4576 4586 4596 4606 4616 4626 4636 4646 4656 4666 4676 4686 4696 4706 4716 4726 4736 4746 4756 4766 4776 4786 4796 4806 4816 4826 4836 4846 4856 4866 4876 4886 4896 4906 4916 4926 4936 4946 4956 4966 4976 4986 4996 5006 5016 5026 5036 5046 5056 5066 5076 5086 5096 5106 5116 5126 5136 5146 5156 5166 5176 5186 5196 5206 5216 5226 5236 5246 5256 5266 5276 5286 5296 5306 5316 5326 5336 5346 5356 5366 5376 5386 5396 5406 5416 5426 5436 5446 5456 5466 5476 5486 5496 5506 5516 5526 5536 5546 5556 5566 5576 5586 5596 5606 5616 5626 5636 5646 5656 5666 5676 5686 5696 5706 5716 5726 5736 5746 5756 5766 5776 5786 5796 5806 5816 5826 5836 5846 5856 5866 5876 5886 5896 5906 5916 5926 5936 5946 5956 5966 5976 5986 5996 6006 6016 6026 6036 6046 6056 6066 6076 6086 6096 6106 6116 6126 6136 6146 6156 6166 6176 6186 6196 6206 6216 6226 6236 6246 6256 6266 6276 6286 6296 6306 6316 6326 6336 6346 6356 6366 6376 6386 6396 6406 6416 6426 6436 6446 6456 6466 6476 6486 6496 6506 6516 6526 6536 6546 6556 6566 6576 6586 6596 6606 6616 6626 6636 6646 6656 6666 6676 6686 6696 6706 6716 6726 6736 6746 6756 6766 6776 6786 6796 6806 6816 6826 6836 6846 6856 6866 6876 6886 6896 6906 6916 6926 6936 6946 6956 6966 6976 6986 6996 7006 7016 7026 7036 7046 7056 7066 7076 7086 7096 7106 7116 7126 7136 7146 7156 7166 7176 7186 7196 7206 7216 7226 7236 7246 7256 7266 7276 7286 7296 7306 7316 7326 7336 7346 7356 7366 7376 7386 7396 7406 7416 7426 7436 7446 7456 7466 7476 7486 7496 7506 7516 7526 7536 7546 7556 7566 7576 7586 7596 7606 7616 7626 7636 7646 7656 7666 7676 7686 7696 7706 7716 7726 7736 7746 7756 7766 7776 7786 7796 7806 7816 7826 7836 7846 7856 7866 7876 7886 7896 7906 7916 7926 7936 7946 7956 7966 7976 7986 7996 8006 8016 8026 8036 8046 8056 8066 8076 8086 8096 8106 8116 8126 8136 8146 8156 8166 8176 8186 8196 8206 8216 8226 8236 8246 8256 8266 8276 8286 8296 8306 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LINE	D-15	OBSERVER	SHOT POINT INT. 6' 2.5" M.	of									
AREA	B040A	VESEL TILBATA CAGUIC	SYSTEM TTS 128	SAMPLE RATE 1/2 ms.									
JOB NUMBER	141C	DATE 16 / 92	HEADING	CHANNELS SEIS 45 AUX 2									
File	S.P.	Reel No.	STREAMER DEPTH (FEET)							Time	Feathering Angle	Water Depth	Remarks
			1	2	3	4	5	6	7	8			
000		4500											U 49 Cape Fear
													Nine Fl Ref U 240 25 Gull 7 3 min
													RMS Nine 5-7 PD
													Barostat 10-15 MB
0001	001		5	10	12	12					0051	5°P	151.9 SOL
030	030		5	8	7	11	10						
060	060		9	7	7	7	8						150.4
090	090		5	7	7	7	7						
120	120		9	6	6	6	6						
150	150		5	6	6	8	8						
180	180		8	7	7	7	7						
210	210		8	7	7	7	8					154	
250	250		10	11	11	11	11						
280	280		9	8	11	11	11						
310	310		9	8	11	11	11				0101	5°P	153 EOL
351	351		10	8	9	9	9						

~~000087~~

[illegible]

000088

[illegible]

[illegible]

[illegible]

[illegible]

LINE	0-20	OBSERVER	SHOT POINT INT. 6-25 M	ge	'	of								
AREA	BORDA	VESSEL TILBATA (CRS)	SYSTEM 775128	SAMPLE RATE	1/2	ms.								
JOB NUMBER	1916	DATE	20 / 6 / 92	HEADING	206°	CHANNELS								
File	S.P.	Reel No.	STREAMER DEPTH (FEET)				Time	Feathering Angle	Water Depth	Remarks				
			1	2	3	4	5	6	7	8				
D		4453												
1	1		11	9	9	9					15:50	30°		SOIL
40	40		10	10	9	9								
80	80		9	10	10	10								
120	120		8	7	7	8								
160	160		8	8	9	10								10 SI mixed Between 94-100
200	190		9	7	8	8								
240	230		10	10	10	10								
280	270		9	8	11	12					16:14	20°		SOIL
309	294		9	8	10	10								NOISE FILE Ref Ch 24 (2) 205 gals. 7 sub RMS Noise 10db Burst

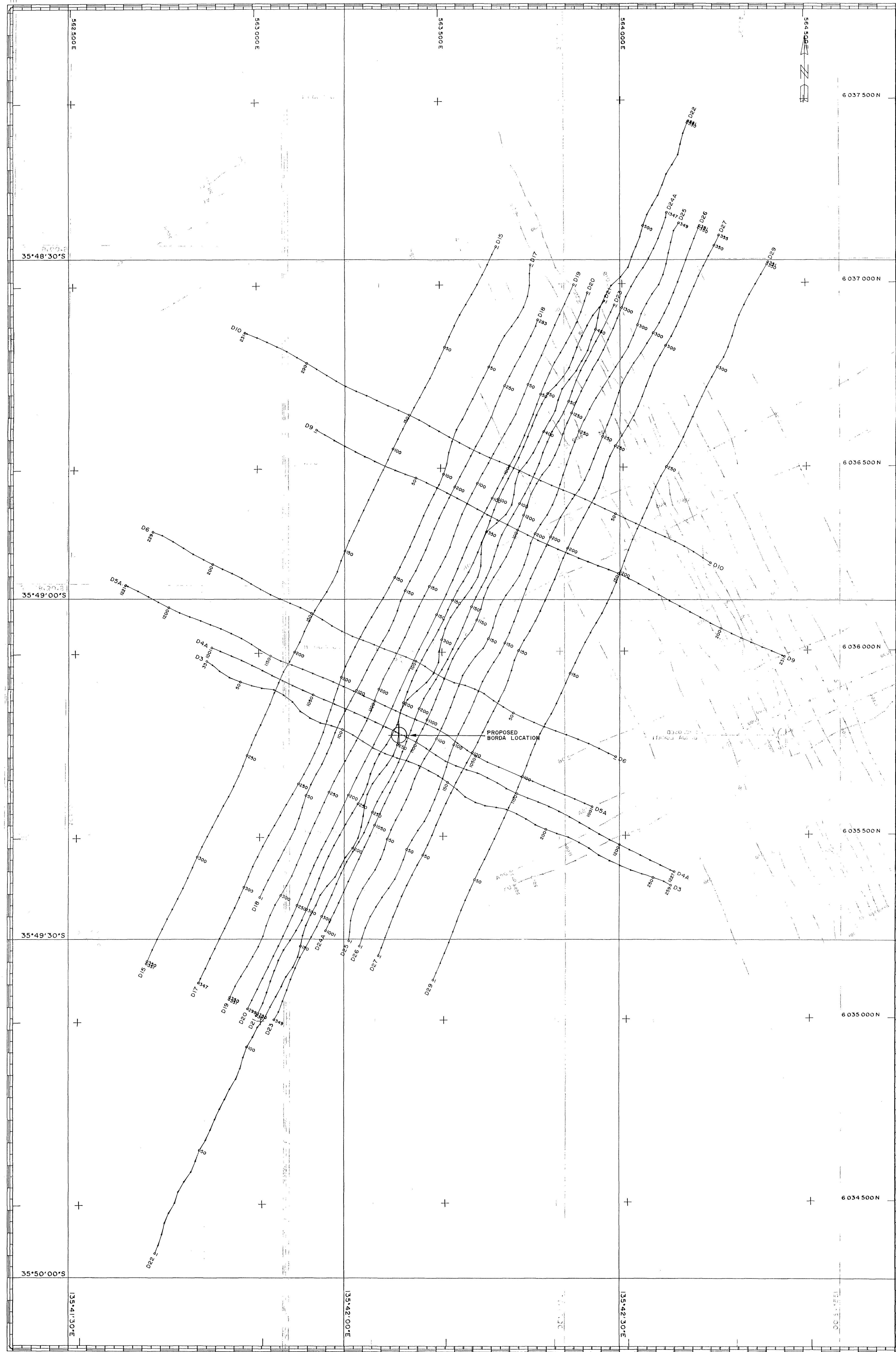
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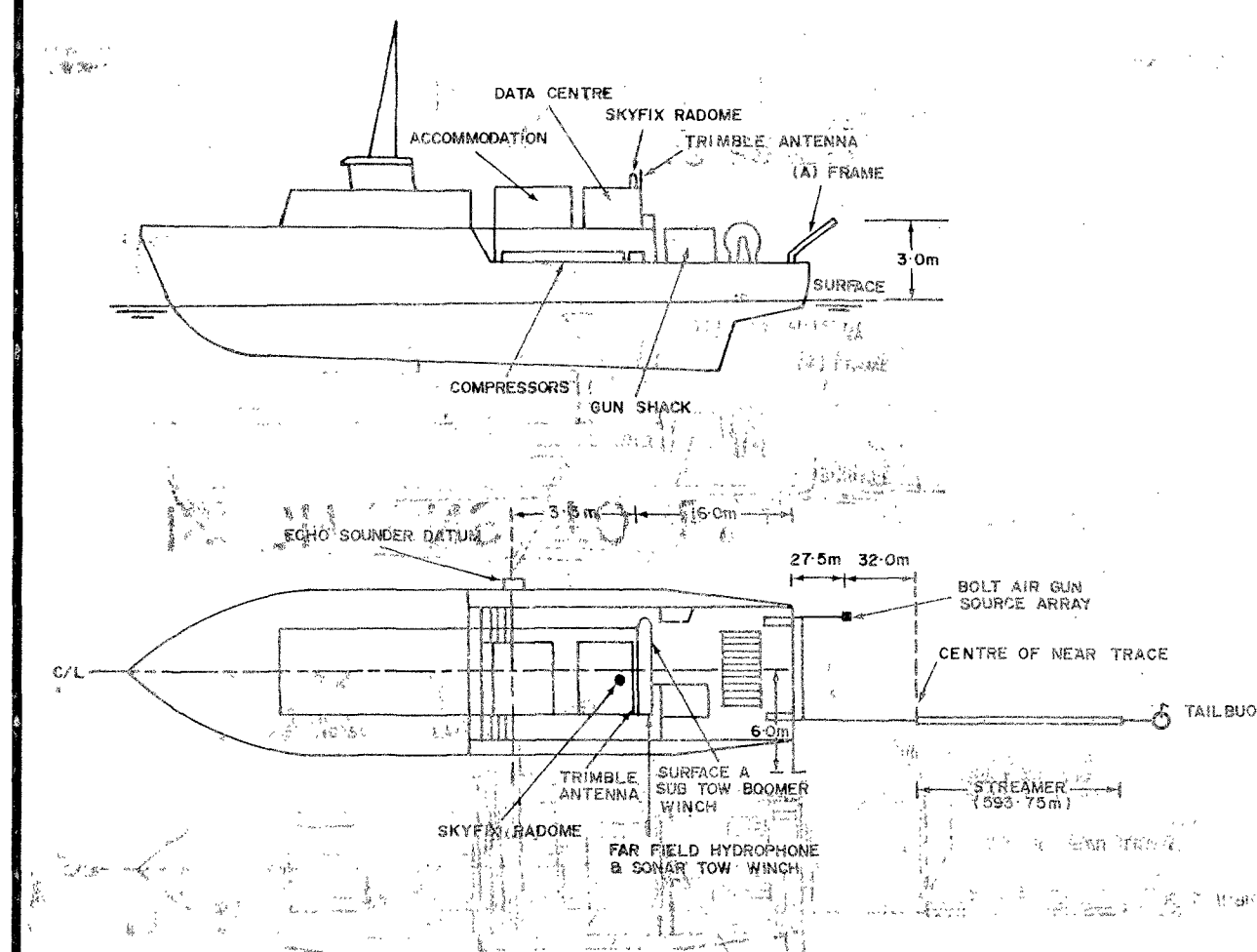
[illegible]



LEGEND

NOTE: POSITIONING SYSTEM DIFFERENTIAL GPS

M.V. TILBATA CREEK (NOT TO SCALE)



B.H.P. PETROLEUM PTY. LTD.

BORDA SITE SURVEY

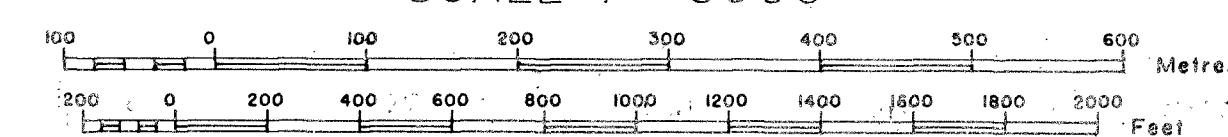
TRACK CHART

RACAL

RACAL SURVEY AUSTRALIA LTD.

8548-8

SCALE 1 : 5000



AUSTRALIAN GEODETIC DATUM 1966

False Easting 500000mE Latitude of Origin 0° 0' 0"N

False Northing 10000000mN Longitude of Origin 141° 0' 0"E

Party Chief : S. Downs Project Date : May 92 Vessel : TILBATA CREEK

Drawn by : F. Fitzpatrick Date : June 92 Sheet No. : 1 of 2

Checked by : G. Jones Date : Aug 92 Chart No. : 18166-7

RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Balcatla, W.A. 6021

TEL : (09) 344 7166 FAX : (09) 344 8783 TELEX : AA94341 RACSUR

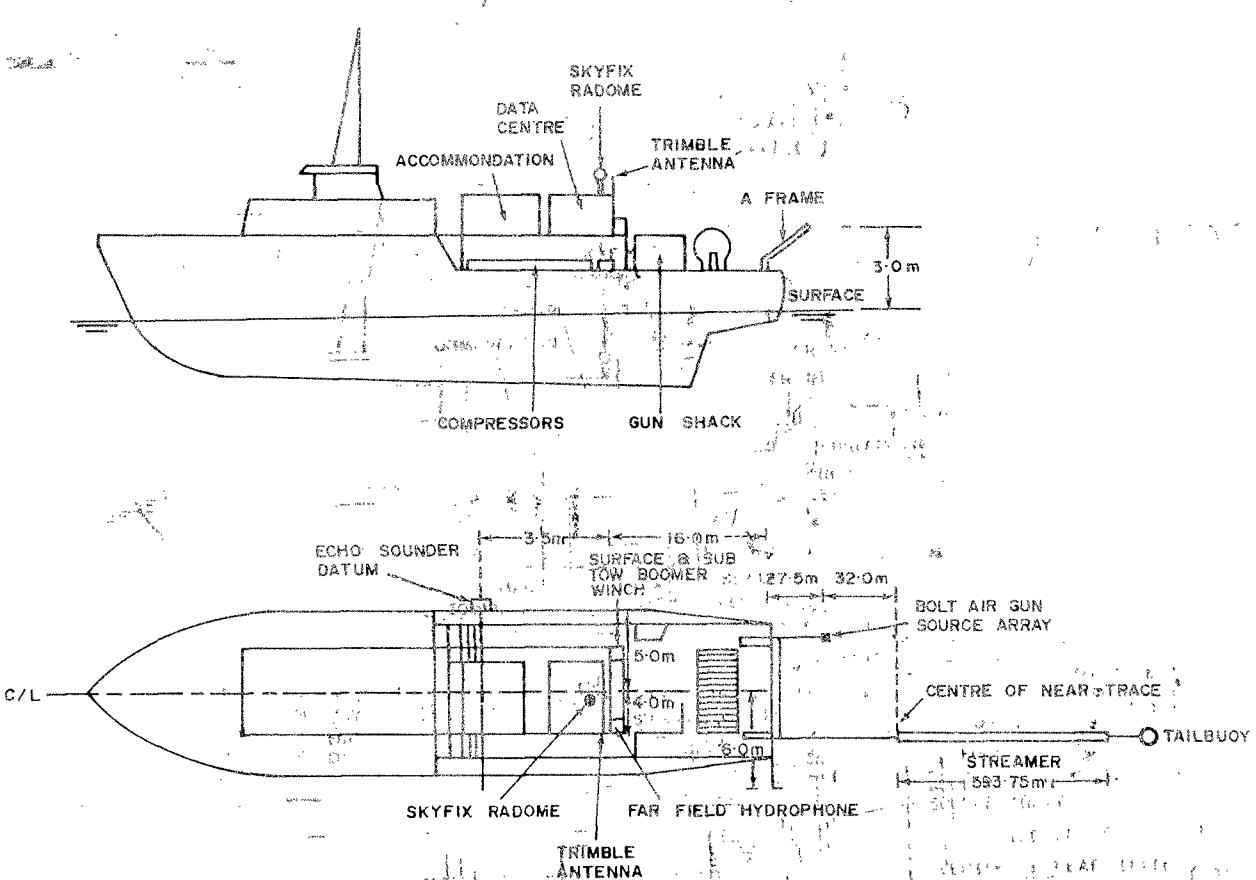
LEGEND

- 0.280 (215m)
Isochrons to Blue Horizon, a regional strong amplitude horizon. Figures denote TWT in seconds and depths in metres.
- Locally enhanced amplitude reflections at Blue Horizon.
 - Locally enhanced amplitude anomalies lying at 0.345 sec. TWT (275 mbsl).
 - Locally enhanced amplitude anomalies lying between 0.372 sec. TWT (310 mbsl) and 0.375 sec. TWT (313 mbsl).
 - Locally enhanced amplitude anomalies lying between 0.416 sec. TWT (356 mbsl) and 0.418 sec. TWT (358 mbsl).
 - Locally enhanced amplitude anomalies lying between 0.532 sec. TWT (485 mbsl) and 0.550 sec. TWT (504 mbsl).
 - Locally enhanced amplitude anomalies lying between 0.615 sec. TWT (537 mbsl) and 0.631 sec. TWT (596 mbsl).
 - Locally enhanced amplitude anomalies lying between 0.976 sec. TWT (1032 mbsl) and 0.979 sec. TWT (1042 mbsl).

NOTES

Time - Depth Conversions based on Time - Depth Curve derived from stacking velocities.

M.V. TILBATA CREEK (NOT TO SCALE)



B.H.P. PETROLEUM PTY. LTD.

BORDA SITE SURVEY

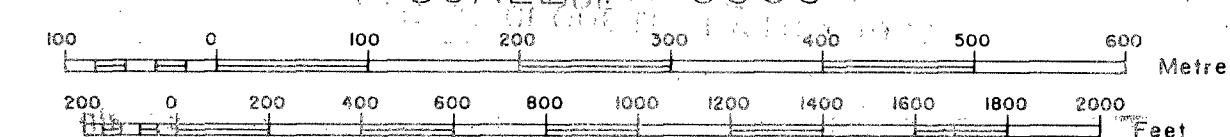
ISOCHRONS TO BLUE HORIZON AND ANOMALIES

RACAL

RACAL SURVEY AUSTRALIA LTD.

8548-9

SCALE: 1:5000



AUSTRALIAN GEODETIC DATUM 1966

False Easting 500000mE Latitude of Origin 0° 0' 0"N
False Northing 1000000mN Longitude of Origin 141° 0' 0"E

Party Chief : S. Downs	Project Date : May 92	Vessel : TILBATA CREEK
Drawn by : F. Fitzpatrick	Date : June 92	Sheet No. : 2 of 2
Checked by : G. Jones	Date : Aug 92	Chart No. : 13168-B
RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Balclutha, W.A. 6021. TEL : (09) 344 7166 FAX : (09) 344 8783 TELEX : AA94341 RACSUR		

SR. 27/3/84

SD:MB:L703/2
C12/10/2/3

30 October 1992

The Director
Oil Gas & Coal
Department of Mines & Energy
191 Greenhill Road
PARKSIDE SA 5063

Attention: Mr R Laws

Dear Sir

**APPLICATION TO CONDUCT AN EXTENSION TO
THE BORDA LOCATION MARINE SITE SURVEY IN EXPLORATION
PERMIT EPP25 OF THE OFFSHORE DUNTROON BASIN**

BHP Engineering Pty Ltd is assisting BHP Petroleum (Victoria) Pty Ltd by acting as coordinator during the acquisition of a number of marine site surveys in conjunction with their 1992 drilling program.

BHP Engineering Pty Ltd acting on behalf of BHP Petroleum (Victoria) Pty Ltd, wishes to lodge an application for permission to conduct an extension to the Borda location marine site survey in Exploration Permit EPP25 of the offshore Otway Basin.

The original survey was carried out in June 1992, however due to detailed prospect evaluation, the surface location of Borda has been revised requiring an extension to the existing survey.

These surveys will be part of the basinwide 1992/1993 drilling program and will be carried out in conjunction with site surveys in other permits in which BHP Petroleum (Victoria) Pty Ltd, has interests. BHP Petroleum Pty Ltd will be operator for the entire program.

The site surveys will ascertain seabed and sub seabed conditions for anchoring of the drilling rig and additionally investigate near surface geological conditions for the occurrence of shallow gas pockets or other conditions that could complicate the early stages of the drilling program.

One (1) copy of a 1:250 000 map is included with this application, detailing the location of the site survey in EPP25. In addition a location summary sheet is included.

During the surveys we will be adhering to our adopted code of Environmental Practice, the Maritime Rescue Coordination Centre will be kept informed of the vessel's movements, the S.A. Fishing Industry Council will be informed and weekly progress reports will be submitted to the Department of Minerals and Energy as per your correspondence of 21st April 1992, Reference 27/3/83 and 84KRL:ms.

Also included are the technical specifications of the "Pacific Oak", the vessel sub-contracted by Racal Surveys which is anticipated to commence the surveys in EPP25 on or about November 10th 1992.

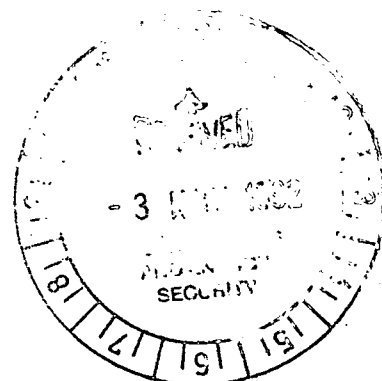
Yours faithfully



B E MILLIKEN
Senior Manager Land Technologies

Land Technologies Division 000100

Wollongong
Barclay Centre, 26 Atchison Street
Wollongong, NSW 2500
PO box 1794 Wollongong
NSW, Australia 2500
Telephone 042 28 0411
International Telephone 6142 28 0411
Telex 29176
Facsimile No 042 280893

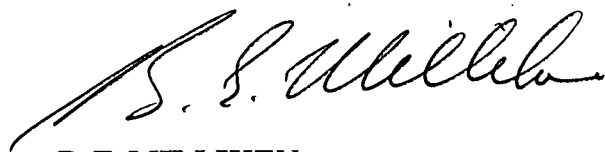


**APPLICATION FOR PERMISSION TO CONDUCT
MARINE SITE SURVEYS IN EPP25**

BHP Petroleum (Victoria) of 120 Collins Street, Melbourne, Victoria 3000, hereby makes application for permission to conduct a marine site survey and submits the following information in support thereof:

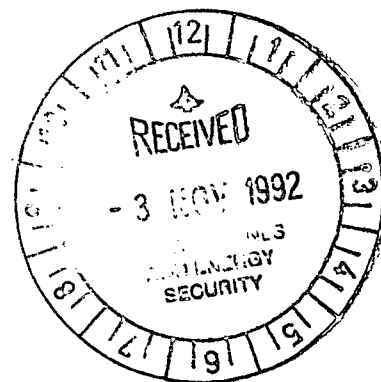
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|-----|-------------------------------------|---|
| 1. | Name of Survey | Borda Site Survey |
| 2. | Prime Survey | High Resolution Digital |
| 3. | Secondary Survey | Bathymetry and Site Scan Sonar |
| 4. | Area of Survey | EPP25 |
| 5. | Name and Address of Contractor | Racal Survey Australia Ltd
Unit 1, 20 Abrams Street
BALCATTA PERTH WA |
| 6. | Name of Vessel | Pacific Oak |
| 7. | Technical Details of Vessel | As attached |
| 8. | Port from which vessel will operate | Port Lincoln |
| 9. | Technique | Marine seismic reflection |
| 10. | Energy Source | Airguns |
| 11. | Proposed Commencement Date | 10th November 1992 |
| 12. | Estimated Duration | 4 weeks (as part of larger survey) |
| 13. | Navigation System | Differential GPS |
| 14. | Survey Size | 2.5km x 2.5km |
| 15. | Estimated Cost | \$100,000 each site |
| 16. | Object of Survey | Check anchoring and drilling conditions |

Petroleum (Submerged Lands) Act 1967 of the Commonwealth of Australia.



B E MILLIKEN
Senior Manager Land Technologies

on behalf of BHP Petroleum Pty Ltd



SITE SURVEY LOCATION

BASIN:	DUNTROON
PERMIT:	EPP25
PROSPECT:	BORDA
LINE:	DH92-169
SP:	1223
LAT:	35° 50' 40.70" S
LONG:	135° 41' 15" E
Em:	562 084.7
Nm:	6 033 051.2
LINE DIRECTION:	64/116 Degrees

MV PACIFIC OAK

Owner	: Guardian Marine Services Pty Ltd
Flag	: Panama
Call Sign	: HQ5579
Year of Construction	: 1982
Length	: 49 metres
Beam	: 12.2 metres
Draft	: 3.65 metres
Hull	: Steel
Tonnage	: 471.39 tons
Speed	: 13 knots
Engines	: 2 x Yanmar 3000 bhp total
Propulsion	: 2 x fixed blades in kort nozzles
Generators	: 3 x 440V 160kw, 50 Hz alternators driven by Yanmar 6MAI
Radar	: Furuno FR1011
Gyro Compass	: SPERRY FS11
Fuel	: 130 m ³
Fresh Water	: 141 m ³
Communications	: Sailor 100 series HF & SSB radios

SITE SURVEY EQUIPMENT SPECIFICATIONS**A. High Resolution Recording Equipment**

Recording Unit	TTS 128
Source Type	Single Texas Instrument sleeve gun x 4
Source Volume	4 x 40 cubic inches
Compressors	PB44 Detroit Diesels
Streamer Type	Teledyne T1
Streamer Length	600 metres
Number of channels	48 channels
Number of hydrophones per group	8 phones/6.25m group

B. Sub Bottom Profiling System

Recorder	EPC 3200 and Elics Delph System
Source Type	EG & G UniBoom Electro-mechanical
Power Source	EG & G 234 Power Supply
Hydrophone	EG & G 265
Filters	TSS Swell Filter Krohn-hite Filter

C. Side Scan Sonar

Recorder	Klein 595 Side Scan Recorder
Towfish	Klein 100 kHz towfish c/w 1500 metres of cable

D. Echosounder

Recorder	Atlas Deso 20 Recorder
Transducer	33/210 khz Atlas Transducer

E. Navigation

GPS Receivers	Trimble DL
Differential Link	Racal SkyFix

F. Computer Equipment

Computers	Hewlett Packard 310
Printers	Hewlett Packard 2671G
Plotters	Hewlett Packard 9475
disk Drives	Hewlett Packard 9122D

G. Ancillary Equipment

Drop Corer	300kg Drop Corer with 2m barrel
Velocity Meter	Applied Microsystems STD-12

ANALOGUE SITE SURVEY REPORT

FOR

BHP PETROLEUM PTY LTD

LOCATION : BORDA
BLOCK : DUNTROON BASIN
DATE : 3rd - 10th DECEMBER, 1992
REPORT REF : 2015b

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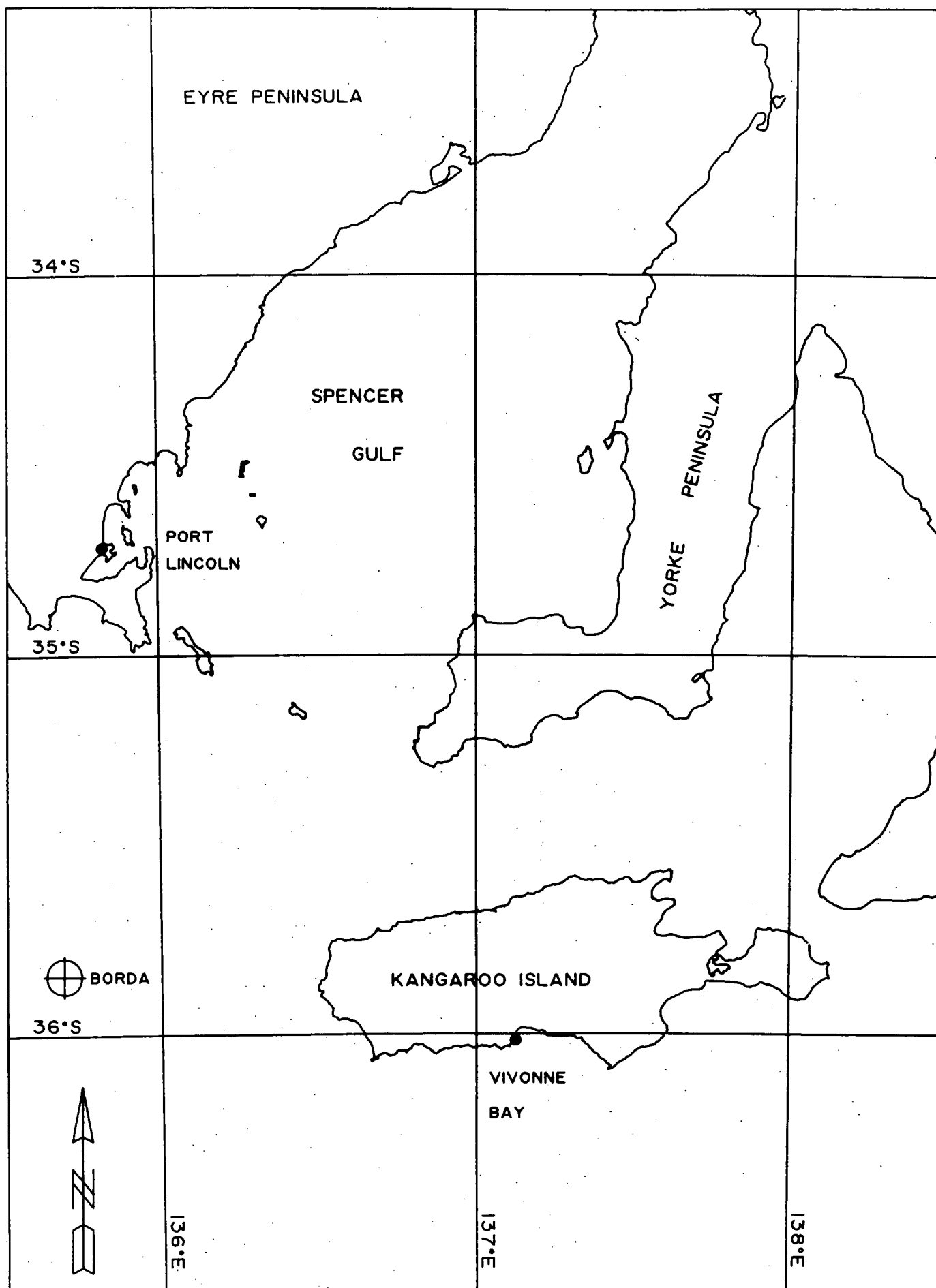
APPENDICES

- A - OFFSET DIAGRAM M.V. "Pacific Oak"
- B - SURVEY LINE DIAGRAM
- C - SURVEY LINE LOGS
- D - EXAMPLE OF ECHOSOUNDER RECORDS
- E - EXAMPLE OF SIDESCAN SONAR RECORDS OVER PROPOSED LOCATION
- F - EXAMPLE OF BOOMER RECORDS
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- I - DAILY LOGS

CHARTS

Chart 2015b.1	TRACK CHART	Scale 1:5000
Chart 2015b.2	BATHYMETRY	Scale 1:5000
Chart 2015b.3	SEABED FEATURES	Scale 1:5000
Chart 2015b.4	ISOPACH OF UNIT A	Scale 1:5000
Chart 2015b.5	BOOMER PROFILES	Scale 1:5000

LOCATION DIAGRAM



SCALE 1:1500000

1. INTRODUCTION

Positioning and geophysical services were provided by RACAL SURVEY AUSTRALIA LIMITED, (Racal) for a site survey of the proposed wellsite Borda for BROKEN HILL PROPRIETARY PETROLEUM PTY LTD (BHPP) in the Duntroon Basin. All survey requirements and operating procedures were undertaken in accordance with the contract between Racal and BHPP.

The survey vessel M.V. "Pacific Oak" was mobilised with the necessary survey positioning and geophysical equipment. A Trimble 4000DL 8 channel Global Positioning System (GPS) receiver and Racals' "SkyFix" Differential GPS system was used in conjunction with Trimble DeltaNav - Navigator software to provide on-line positioning.

A 2.5km x 2.5km site was surveyed based around the proposed Borda location, the AGD 84 co-ordinates of which are given as:

Borda

Datum AGD 84

Latitude : 35° 50' 40.701" South
Longitude : 135° 41' 14.998" East

AMG Zone 53 C.M. 135° East

Easting : 562 084.7m
Northing : 6 033 051.2m

The survey was undertaken over a period from the 3rd to the 10th of December, 1992. All times quoted are in Eastern Summer Time (GMT + 11 hours) unless otherwise specified.

2. REQUIREMENTS

Racal were to provide a navigation system, echosounder, sidescan sonar, boomer seismic profiler, and personnel for the project.

The survey procedure was to be as follows:

- (a) To carry out a bathymetric, sidescan sonar and seismic profile survey of the proposed Borda wellsite covering an area 2.5km x 2.5km based around the Borda location as below:

Datum AGD 84

Latitude : 35° 50' 40.701" South
Longitude : 135° 41' 14.998" East

AMG Zone 53 C.M. 135° East

Easting : 562 084.7m
Northing : 6 033 051.2m

- (b) The survey to comprise 26 primary lines orientated 116°, spaced at 100 metre intervals and 6 cross-tie lines orientated 026°, spaced at 500 metre intervals. The survey was to be conducted with the boomer, echosounder and sidescan equipment operating simultaneously on all lines.

3. SURVEY RESULTS

3.1 BATHYMETRY

Both analogue and digital soundings of the seafloor were recorded throughout the survey by an Atlas Deso 20 echosounder, mounted on the port side of the M.V. "Pacific Oak". The echosounder was operated in conjunction with a Heco 10 Heave Compensator.

The mean speed of sound was measured prior to the commencement of the survey and was set at 1509 metres per second for the duration of operations in the Borda area.

Soundings were reduced to L.A.T. using the predicted tidal curve for Vivonne Bay located at 36°00'S, 137°11'E. The distance of Vivonne Bay (some 60 miles) from proposed location and the lack of a comprehensive tidal database for the area inevitably results in mis-ties in the bathymetric data. Over the majority of the site these were 0.5 metres or less, considered acceptable with the constraints noted above. It is recommended that a tide gauge is deployed during future surveys in this area.

The water depth at the proposed Borda location is 159.1 metres. The general nature of the seafloor is that of a gentle shallowing to a minimum depth of 153.8m in the extreme north of the area. Gradient at location is 1:400 down to the south. In the extreme south and southwest the seabed deepens significantly reaching a maximum depth of 180.8m some 1450m south of the Borda location, with a slope of 1:10 down to the south. The seafloor bathymetry is presented as a contour plot, in one metre intervals, on chart 2015b.2, herein.

3.2 SEABED FEATURES

The seafloor around the proposed Borda location and the surrounding area was acoustically surveyed using a 100KHz Klein sidescan sonar with a Klein 595 digital graphic recorder. Analogue data were acquired at a 100m slant range scale, giving a coverage of 200% over the survey area. The quality of the data was moderate. Four dropcores were attempted, results of which are detailed below. A seabed feature chart has been compiled, chart 2015b.3 herein.

The seabed comprises low reflectivity featureless sediments over the majority of the site; with outcrops of higher reflectivity calcarenite and other small areas of moderately higher reflectivity, possibly due to presence of coarser material such as shell accumulations. The areas of low reflectivity are interpreted as unconsolidated medium to coarse grained carbonate sand. To the west of the survey area the sands form low amplitude (less than one metre) sand waves with wavelengths typically of 25 metres. These have an orientation of northeast - southwest.

Three areas of exposed calcarenite occur:-

- i) To the south of the site, some 600m from the proposed location. These rocks are partially covered with coarse grained transgressive sands.
- ii) To the extreme west of the survey area.
- iii) To the extreme northeast of the survey coverage.

At the proposed Borda location the nature of the seabed is that of featureless low reflectivity sands. An example of the sidescan sonar record in this area is given in appendix E.

Four cores were attempted, yielding the following results:-

- core 1 - at location. Here, 31cm of medium to coarse grained sand was recovered. The sand becomes less coarse with depth.
- core 2 - at the extreme south of the site, in the area of exposed calcarenite. This sample yielding only fragments of calcarenite with shells, both broken and intact and some grains of coarse sand.
- core 3 - 800m north of location. Yielding only small amounts of broken shells, gravel and coarse grained sand. It is thought the sand amounts would be much greater than obtained but were washed from the core cutter on recovery.
- core 4 - 600m south-east of location. No sample was recovered in two attempts, again, probably sands being washed out on recovery.

Isolated small sonar contacts were noted. Generally they have no height except for those listed below:-

Easting(m)	Northing(m)	Dimensions(m)	Apparent Heights(m)
562 423	6 032 108	4 x 2	0.5
561 811	6 032 587	3 x 1	0.4
561 718	6 033 998	3 x 2	0.5

These may represent minor debris items or accumulations of shelly, coarser material. The character of the contacts suggests a natural origin.

3.3 SHALLOW GEOLOGY

The shallow geology of the Borda proposed well location and its surrounding area was detailed by the deployment of a Hunttec surface tow boomer. The boomer firing rate was set at 500ms with an energy of 300 Joules.

A velocity of 1650m per second has been assumed for the speed of sound through the surficial sediments. With a sweep time of 120ms being maintained throughout the survey this gives a vertical scale of 1cm = approximately 4m on the analogue trace.

Data quality was good with acoustic penetration to the limits of unit A (see below), being at least 22m to the extreme south of the survey area. A minimum resolution of 0.5m was obtained.

Two units are defined, based on the internal acoustic characteristics. The terminology used in a previous report for BHPP for the Borda area (Report reference 1916e, 14th - 20th June, 1992) has been maintained. The interpreted shallow geology is presented as an isopach chart of unit A (the uppermost) contoured at 1m intervals (chart 2015b.4) and two profiles of lines close to the Borda location (chart 2015b.5). The shallow geology is briefly described below:

Unit A (6-22m thick)

Unit A is typically 6 to 12m thick (10m at location). This unit comprises three sub-units detailed below.

- i) Unit A1, generally 0 to 1m thick, is acoustically transparent and present throughout the majority of the area. It is thought to comprise a mobile carbon sand veneer verifying Unit A2.
- ii) Unit A2 is from 0 to 5m in thickness reaching a maximum about 900 metres to the northwest of location. The seismic character displays internal reflectors of moderate strength, with asymmetric bedding, typical of dune/sand wave origin. The unit probably consists of unconsolidated medium to coarse carbon sand and overlies unit A3.
- iii) Unit A3 is characterised by highly reflective acoustic reflectors. The unit is typically 5-10m in thickness where present but thickens considerably to 22m plus on the downslope to the south side of the site.

Unit B

Unit B underlies Unit A from which it is divided by a non-conformable erosion surface denoted R1. The unit shows no internal structure and is not penetrated by the boomer. It is interpreted as calcarenite.

At the proposed Borda location Unit A1 is less than 0.5m thick and Unit A2 is approximately 3.0m thick. Unit A3 is present and has a thickness of 6.5m giving a total thickness of Unit A sands of approximately 10m.

3.4 RECOMMENDATIONS

The nature of the seafloor of the survey area is essentially that of mobile transgressive sediments (Unit A1). These, in parts, form sand waves, and part of a collective unconsolidated sediment unit, Unit A. Unit A increases in vertical thickness to 13 metres in the north central area of the site. Both westward and southward of the proposed location the underlying calcarenite is exposed at the surface.

3.5.1 Anchoring Conditions

The proposed Borda wellsite location lies surrounded by an area of unconsolidated sands. These sands have a vertical thickness of 8 to 9 metres minimum within a 500 metre diameter. 650 metres south-southwest of the proposed location the sands thin to less than 1m overlying calcarenite. In this area some anchor holding problems may occur.

3.5.2 Drilling Hazards

No problems are envisaged during drilling in this area.

4. GEODETIC PARAMETERS

All co-ordinates shown in this report refer to the following:

The location co-ordinates are defined on Australian Geodetic Datum 1984 (AGD 84).

The Global Positioning System (GPS) is referenced to the World Geodetic System 1984 (WGS 84).

4.1 DATUMS

Datum	:	Australian Geodetic Datum 1984
Spheroid	:	Australian National
Semi-major Axis (a)	:	6 378 160.000m
Semi-minor Axis (b)	:	6 356 774.719m
Eccentricity Squared (e^2)	:	0.006 694 542
Flattening (1/f)	:	298.25

Datum	:	World Geodetic System 1984
Spheroid	:	WGS 84
Semi-major Axis (a)	:	6 378 137.000m
Semi-minor Axis (b)	:	6 356 752.3142m
Eccentricity Squared (e^2)	:	0.006 694 380
Flattening (1/f)	:	298.257 223 563

4.2 PROJECTION

Projection	:	Universal Transverse Mercator
AMG Zone	:	53
Central Meridian (C.M.)	:	135° East
Scale factor on the C.M.	:	0.9996
False Easting	:	500 000m
False Northing	:	10 000 000m
Latitude of Origin	:	0° (Equator)
Unit of Measure	:	International Metre

4.3 DATUM TRANSFORMATION

The following 7-parameter datum transformation was used to convert WGS 84 co-ordinates to AGD 84 co-ordinates:

Dx =	+116.00m
Dy =	+50.47m
Dz =	-141.69m
Rx =	+0.230"
Ry =	+0.390"
Rz =	+0.344"
Scale (K) =	-0.0983

Note: The sign conventions used in Racal software in the datum transformations were derived as follows:

GNS Survey Software:

The convention used is that used by the US Department of Defence and by Higgins (Transformation from WGS 84 to AGD 84 - An Interim Solution), where a positive rotation about the Z axis is an anti-clockwise movement of the X and Y axes (when viewed from the North Pole looking towards the centre of the Earth).

5. OPERATIONAL SUMMARY

5.1 ON-LINE PROCEDURES

The Racal Survey General Navigation System (GNS) was used to obtain and log the real-time position of the survey vessel. A Trimble 4000DL GPS receiver, in conjunction with Racal's "SkyFix" Differential GPS and other ancillary equipment (printer, 3.5" dual disc drive, gyrocompass), were interfaced to a HP330 series desk top computer operating the navigation software.

A fix closure was supplied to the echosounder via a TSS Annotator every 50 metres and to the sidescan sonar and boomer every 100 metres. The annotator provided information including date, time, line name and heading which was output onto the hard copy analogue records. The vessel's position was also logged onto 3.5" diskettes with a paper printout of the navigational position and status obtained at the fix interval of 50 metres.

The echosounder was used as the 'Datum Point', with offsets applied from the datum. (Refer to Appendix A).

A total of 26 primary lines orientated 116°, with a line spacing interval of 100 metres and 6 cross-tie lines orientated 026°, with a line spacing interval of 500 metres were surveyed whilst simultaneously operating boomer, sidescan sonar and echosounder equipment.

5.2 SEA WATER VELOCITY PROBE

An Applied Microsystems Model STD-12 velocity probe was used to determine the ambient sea water velocity profile. The probe head, which was lowered into the water column using a winch located on the port quarter, contains sensors which measure and record conductivity, temperature and depth (CTD). The data is stored on a logging device which is also situated in the probe head. The memory algorithm ensures data are logged for every metre of depth or at an user selectable interval in metres or time.

Once returned to the surface, the data from the probe is downloaded, as a data file, to a Toshiba 1200 employing the 'Soft-12 STD' software package. The speed of sound in seawater was determined using Chen and Milleros calculation.

A CTD dip was carried out, on location, on the 3rd of December, 1992, at 0900 hours. A velocity of 1509 metres per second was determined and maintained throughout the survey.

5.3 ECHOSOUNDER

Continuous bathymetric profiles throughout the survey were obtained using a dual-frequency Atlas Deso 20 echosounder. The transducer was attached to the port side of the hull (see Appendix A: Offset Diagram). The echosounder employed both the 33 and 210kHz transducers and was coupled to a Heco 10 Heave compensator, operational throughout the survey.

The stylus motor speed was set for a seawater velocity of sound of 1509 metres per second. The transmission line was set for a depth of 2.00 metres as the depth of the transducer below sea level (draft), measured in Port Lincoln on the 2nd of December.

5.4 SIDESCAN SONAR

The sidescan sonar data were acquired by the deployment of a 100kHz, 1.5° beam width Klein 422 tow fish in conjunction with a Klein 595 digital graph recorder.

The sidescan fish was towed from a winch located aft on the port quarter. The fish and cable were streamed to 200 metres via a block upon which a calibrated cable counter was fitted.

The recorder was set to operate on a 100 metre slant range with fiducial marks and annotations supplied by a closure every 100 metres.

5.5 SUB-BOTTOM PROFILER

Sub-bottom geology was identified by the deployment of a surface tow boomer sled. The boomer was towed 16 metres aft of the starboard quarter and the 8-element hydrophone array deployed from a point 10.6 metres away, on the opposite quarter.

The boomer was operated at a power of 300 Joules and fired every 500ms by an EG & G 231 Triggered Capacitor Bank coupled with an EG & G Model 232A Power Supply. The returning signals were passed to an ELICS DELPH 1 processor for filtering at 480-1800Hz, TVG amplification and swell filtering, before being displayed on a Gultan Datalogger thermal printer. Display length was set at 120ms.

6. SUMMARY OF EVENTS

The survey vessel M.V. "Pacific Oak" departed Port Lincoln for the Borda site at 0030 on the 3rd of December, 1992 and on arriving at location at 1120 a temperature/salinity measurement was taken. Digital equipment deployment commenced but was abandoned due to adverse weather conditions. The vessel proceeded to shelter near Kangaroo Island. The streamer was deployed, to prove its tailbuoy tracking radar, before moving to shelter at Taylor Island arriving at 0215 on the 4th of December.

Weather conditions moderated sufficiently to sail for location at 0715 on the 8th of December, arriving on site and deploying the digital spread. Digital acquisition commenced at 1557 being completed at 0807 on the 9th of December. Analogue acquisition commenced at 1255 and was completed at 1900 on the 10th of December.

Four drop cores were then undertaken and on completion of these at 2114 a temperature/salinity measurement was made. The vessel departed the Borda site, on route to the semi-submersive drilling rig "Byford Dolphin", at 2145.

7. PERSONNEL AND EQUIPMENT

7.1 PERSONNEL

The following personnel were employed on this project:

For : BHP PETROLEUM PTY LTD

Mr. A. Sellers	- Client Representative
Mr. R. Blizzard	- Client Representative

For : RACAL SURVEY AUSTRALIA LIMITED

Mr. C. Shuttleworth	- Party Chief
Mr. D. Westall	- Surveyor
Mr. A. Webster	- Surveyor
Mr. M. Bamford	- Navigation Technician
Mr. M. Spooner	- Underwater Engineer
Mr. S. Kattat	- Underwater Engineer
Mr. R. Dixon	- Systems Engineer
Mr. A. Ferguson	- Systems Engineer
Mr. R. Turpin	- Gun Mechanic
Mr. P. Flatman	- Geophysicist

7.2 EQUIPMENT

The following equipment was used on this project:

- 1 x Krupp Atlas Deso 20 Dual Frequency Over the side mounted Transducer
- 2 x Krupp Atlas Deso 20 Echosounder Recorders
- 1 x TSS Annotator
- 1 x SG 1000 Gyro
- 1 x Applied Microsystems STD-12 Velocity Probe
- 1 x Toshiba 1200 Laptop Computer
- 1 x Krupp Atlas Heco 10 Heave Compensator
- 1 x Klein 595 Digital Graphic Recorder c/w spares
- 2 x Klein 422 Towfish
- 1 x Electric sidescan winch c/w cable counter and tow block
- 1 x Delph 386 CPU, c/w Plotter, Monitor, Keyboard
- 1 x TSS 305 Swell Filter
- 1 x TSS TVG Filter
- 1 x Krohn Hite Analogue Filter
- 1 x EPC 4600 Graphic Recorder
- 1 x EG & G 230 Uniboom Catamaran
- 2 x EG & G 231 Triggered Capacitor Banks
- 2 x EG & G 232 Power Supplies
- 2 x EG & G 265 8 Element Hydrophone Arrays
- 2 x Trimble 4000DL GPS Receivers
- 2 x Skyfix Antenna Control Units
- 2 x Skyfix Demodulators DDM 2400
- 2 x Skyfix Domes
- 2 x Compaq 386 Computers

2 x HP 9000/330 Computers c/w Disc Drives, VDU's, Keyboards

2 x HP 9133 Hard Disk Drives

2 x HP Quietjet Printers

2 x Interface 80's

2 x Barco Monitors

2 x Cub Monitors

1 x Bar Check

1 x Gravity Drop Corer c/w Barrels and Core Consummables

plus all associated software, cables, manuals, etc.

8. DISTRIBUTION

Copies of this report have been distributed as follows:

BHP Petroleum - Melbourne
Attn: Mr. R. Marlow

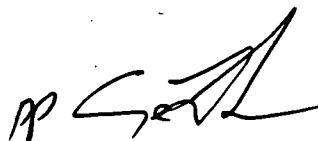
: 4 copy

BHP Engineering - Wollongong
Attn: Mr. S. Dykes

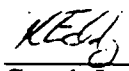
: 1 copy

Racal Survey Australia Limited

: 1 copy



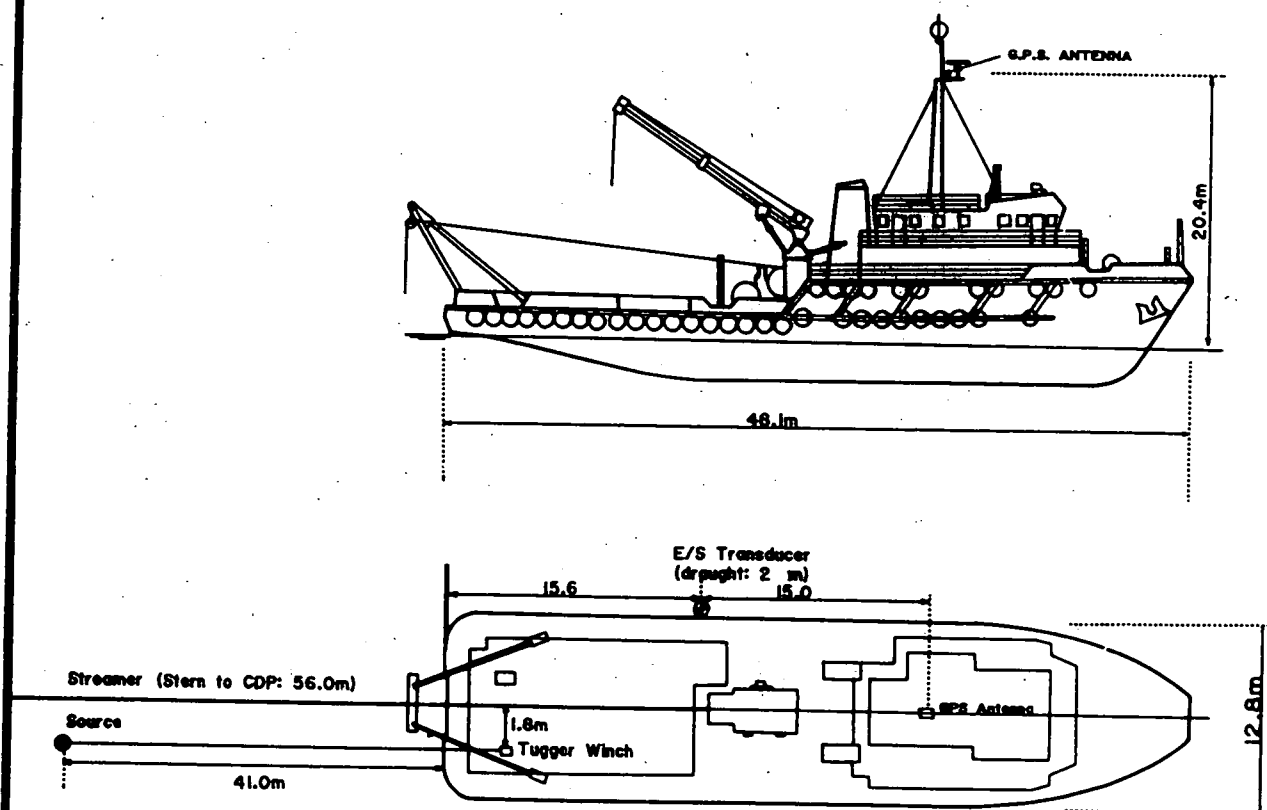
P. Flatman
Interpretation Geophysicist

P.P. 
Gareth Jones
Area Surveyor

APPENDIX A

OFFSET DIAGRAM M.V. "Pacific Oak"

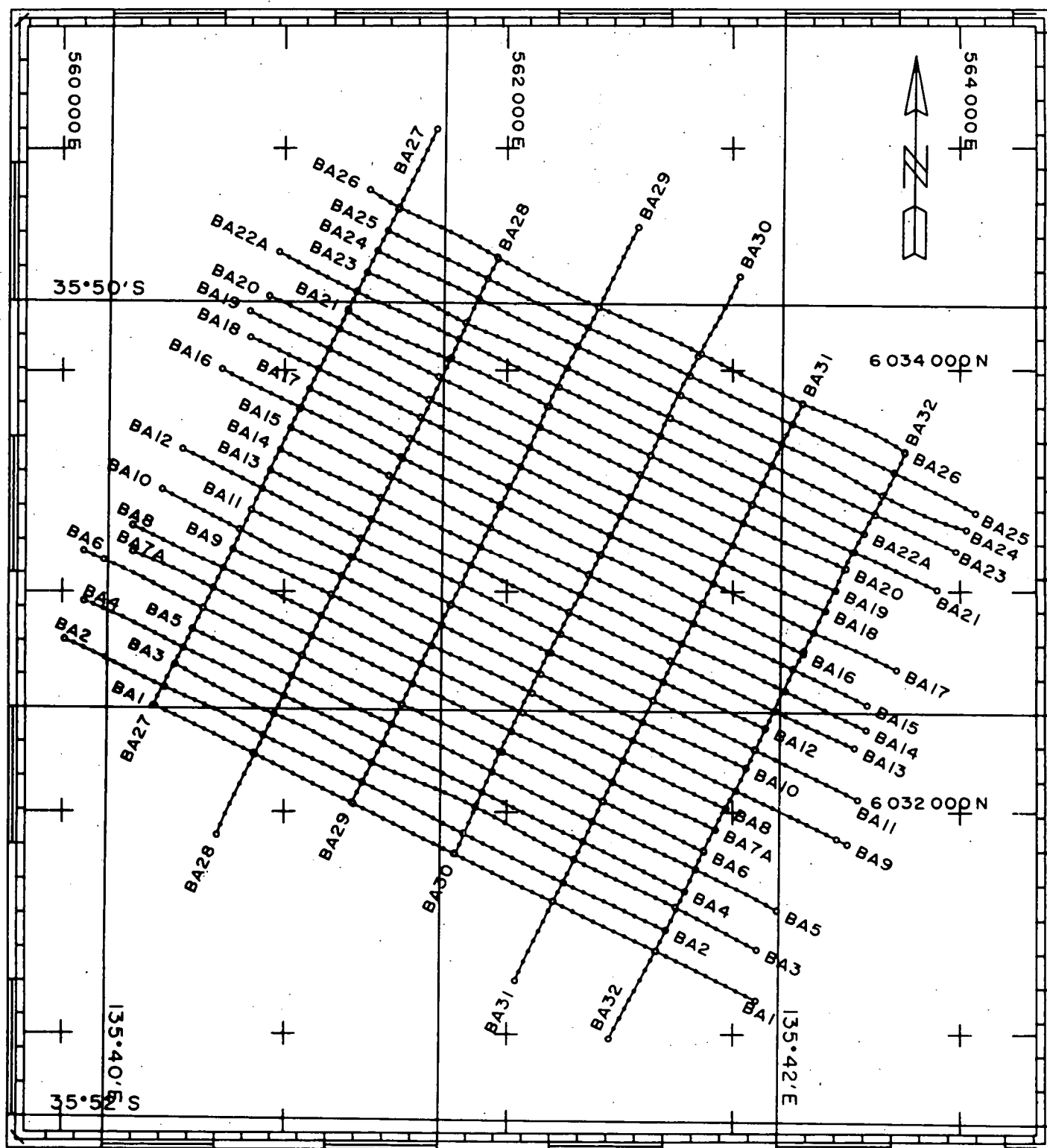
VESSEL OFFSET DIAGRAM



M.V. PACIFIC OAK

(NOT TO SCALE)

APPENDIX B
SURVEY LINE DIAGRAMS



SCALE 1:25000

APPENDIX C
SURVEY LINE LOGS

of 2

of

CLIENT:	BHP	AREA:	DUNTERMAN BASIN		SITE:	BORDA		JOB NO.	2015	
NAV. SYSTEM	SKYFIX	ECHO SOUNDER DRAFT:	1507.00		SURVEY DATUM	E/S		VESSEL	PACIFIC OAK	
DATUM → STERN	M	DATUM → ECHO SOUNDER OFFSET:	M FWD AFT M PORT STED	M FWD AFT M PORT STED	DATUM OFFSET:	M FWD AFT M PORT STED		DATUM OFFSET:	M FWD AFT M PORT STED	
			15-6							

DATE	LINE	FIXES		TIMES		DISC	FILE	ES ROLL	EQUIPMENT RANGES			C/O	CABLE OUT FROM STERN		COMMENTS
		SOL	EOL	SOL	EOL				E/S	SSS	Boomer Sup		SSS	Boomer	
9/12/80	BA														SS CABLE
"	7	100	160	1130	1158				125-175	100	1205	406	35		406m L.B.
"	2	100	160	1255	1324				"	"		406	"		
"	9	100	160	1337	1424				"	"		406	"		BAD SHIP SPEED AT START
"	4	100	160	1501	1526				"	"		406	"		WX - light winds in sea
"	11	100	160	1555	1622				"	"		406	"		
"	6	100	162	1731	1802				"	"		406/356	"		C/O ADJUSTED 3 TIMES
"	1	100	160	1834	1909				"	"		356/375	"		
"	8	100	160	1931	2000				"	"		356	"		
"	13	100	160	2025	2055				"	"		356/356	"		FISH BOTTOMED / SPEED CONTROL
"	18	100	158	2112	2141				"	"		356/344	"		DE-PTH CRASHED FX 108-114 MISSED
"	15	100	158	2204	2232				"	"		340	"		FISH BOTTOMED / BOAT VESSEL CONTROL
"	20	100	158	2249	2316				"	"		380	"		- ON LWEZO MISSED FX 128
"	17	100	158	2339	0007				"	"		406	"		
10/12/80	22	100	/	0028	/				"	"		.	"		ABORTED
"	22A	100	158	0113	0140				"	"		361	"		361/351 FX 118
"	14	100	158	0223	0250				"	"		406	"		
"	19	100	158	0312	0340				"	"		356	"		339/F119, 330-F132
"	25	100	158	0402	0429				"	"		406	"		
"	16	100	158	0457	0519				"	"		355	"		345/F108, 326/F114
"	23	100	158	0550	0620				"	"		406	"		396/F108, 406/F118, 396/F130
"	26	100	152	0645	0711				"	"		355	"		286/F115, 336/F124, 361/F128, 271/F131
"	21	100	158	0734	0802				"	"		396	"		406/F112
"	12	100	158	0830	0856				"	"		305	"		345/F108, 355/F122, 365/F130, 381
"	5	100	158	0920	0948				"	"		366	"		406/F152
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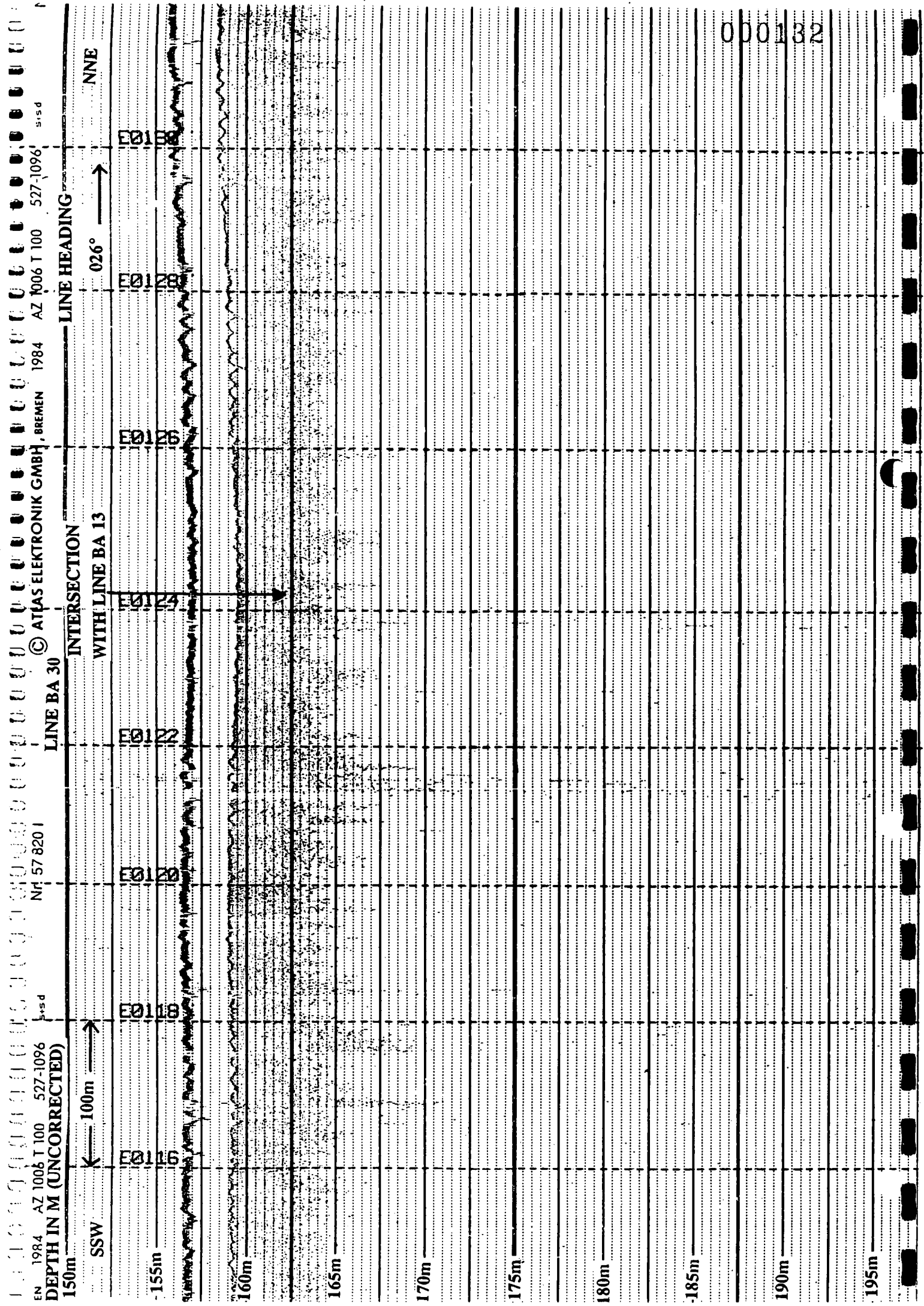
WHITE - OFFICE.

WHITE - OFFICE.

WHITE - OFFICE.

000129

APPENDIX D
EXAMPLE OF ECHOSOUNDER RECORDS



EN 1984 AZ 1006 T 100 527-1096
DEPTH IN M (UNCORRECTED)

Nr 57 820 I

LINE BA 30

© ATLAS ELEKTRONIK GMBH, BREMEN 1984 AZ 1006 T 100 527-1096

LINE HEADING

SSW

NNE

100m

INTERSECTION
WITH LINE BA 13

026°

E0116

E0118

E0120

E0122

E0124

E0126

E0128

E0130

155m

160m

165m

170m

175m

180m

185m

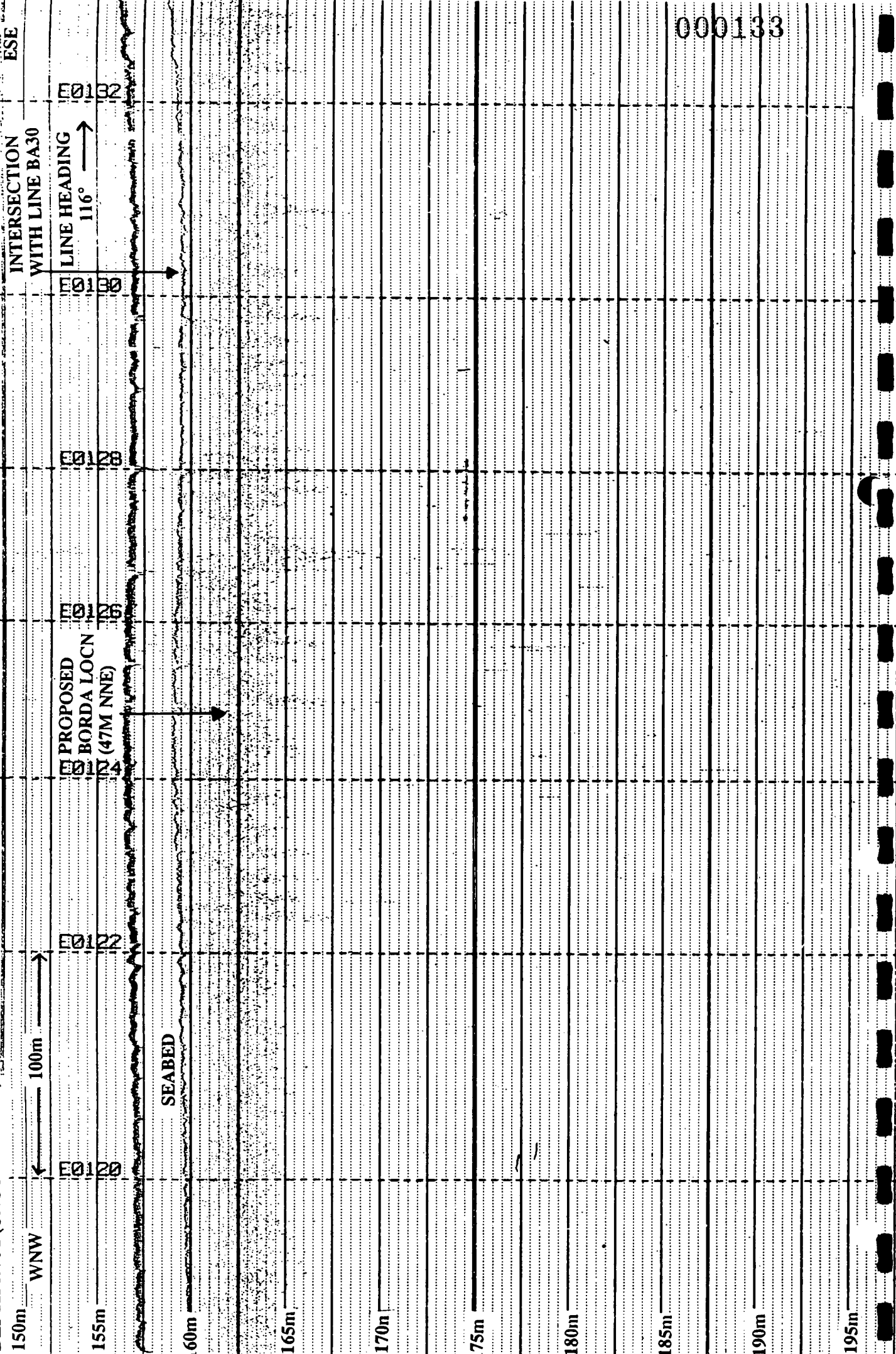
190m

195m

000132

LINE BA 13

DEPTH IN M (UNCORRECTED)

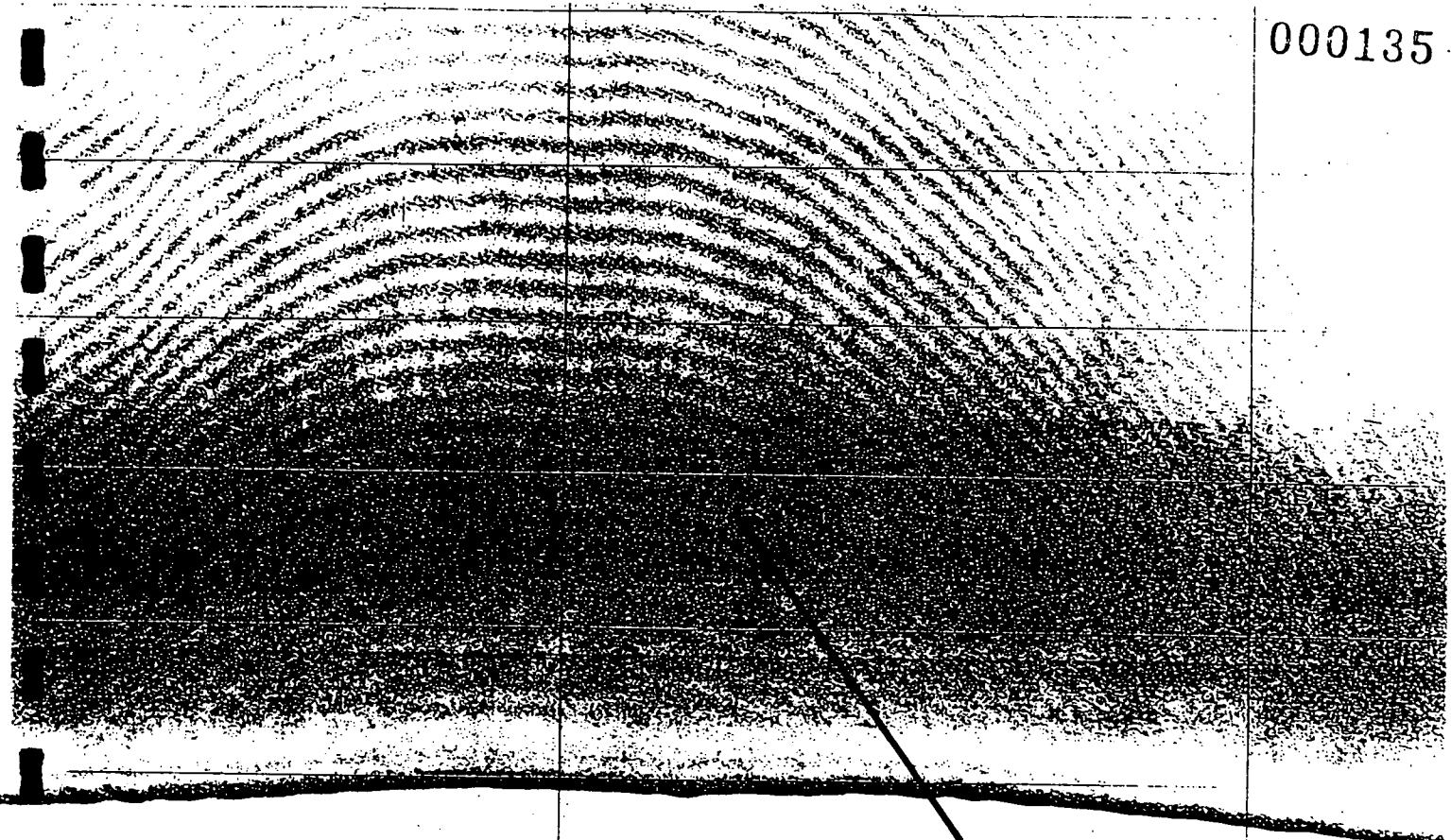


000133

APPENDIX E

EXAMPLE OF SIDESCAN SONAR RECORDS OVER PROPOSED LOCATION

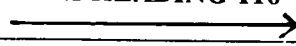
000135



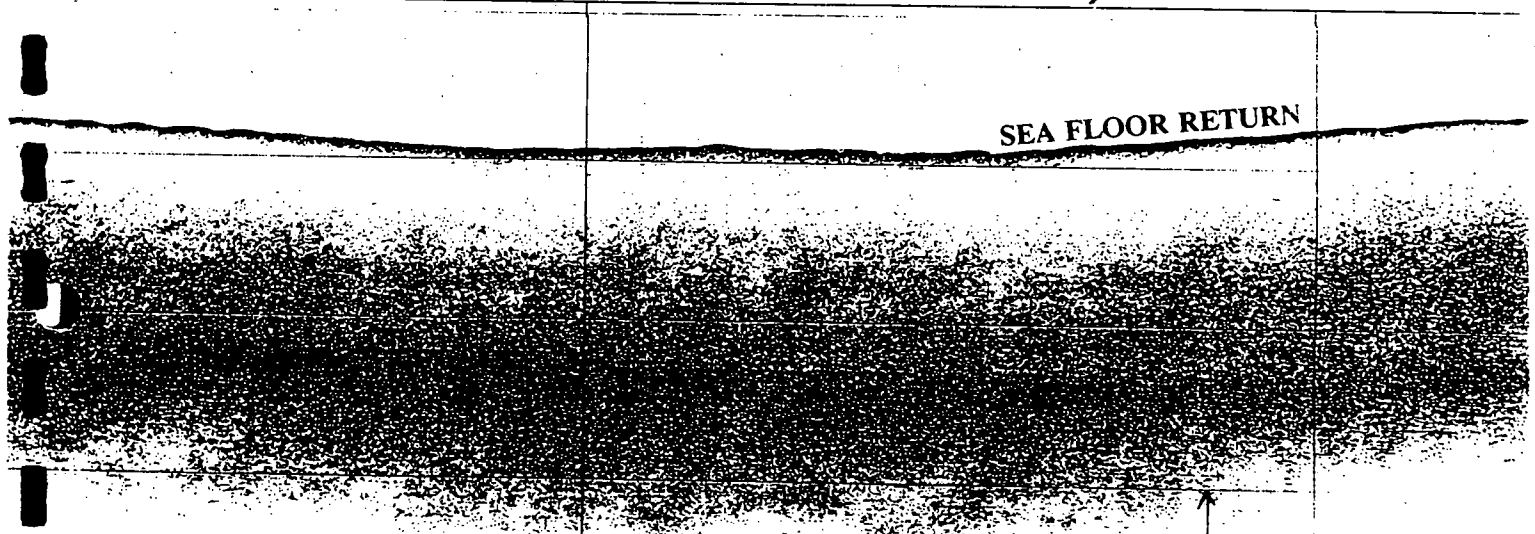
PROPOSED BORDA LOCATION

LINE A13

LINE HEADING 116°



SEA FLOOR RETURN

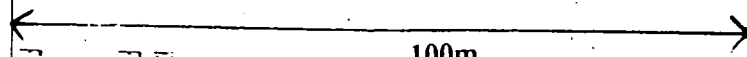


APPROX 15m



FEATURELESS MEDIUM COARSE
CARBONATE SANDS

100m



000132 2014212

NP: 1.60
FSH NP: 0.00

000132 2014212

NP: 1.60
FSH NP: 0.00

APPENDIX F
EXAMPLE OF BOOMER RECORDS

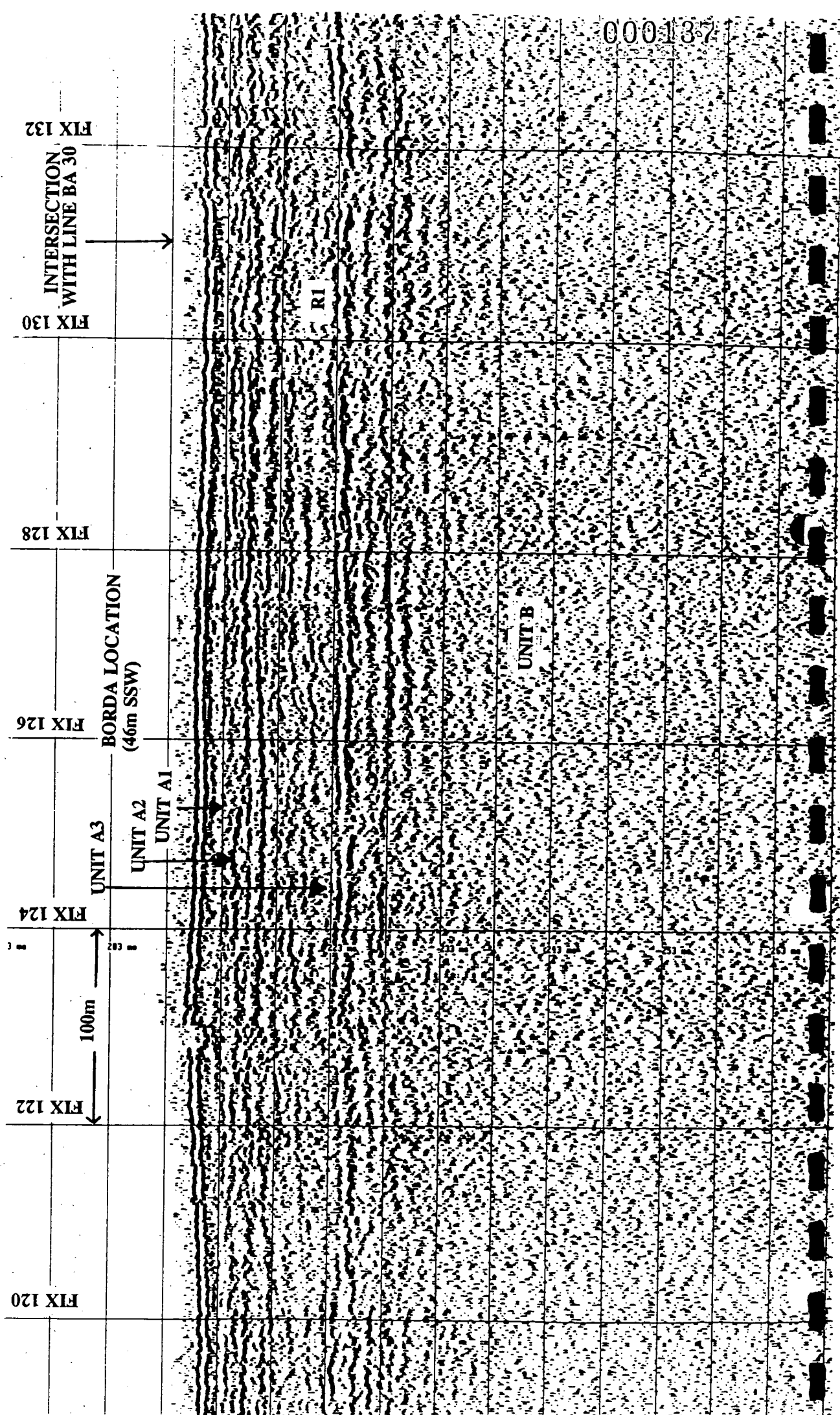
WNW

LINE BA 14

LINE HEADING

116° →

ESE



NNE

100m

UNIT A3

UNIT A2

UNIT A1

FIX 134

FIX 132

FIX 130

APPROX 8m

LINE BA 30

FIX 128

INTERSECTION
WITH LINE BA 14

FIX 126

BORDA LOCATION
(246m WNW)

FIX 124

LINE HEADING
026°

FIX 122

R1

UNIT B

000138

SSW

APPENDIX G
TIDAL PREDICTIONS - VIVONNE BAY

Level : .60
 Seasonal correction : .00
 Value : .60

	M2	S2	K1	O1
Angles used for required day are	307.00	355.00	1.00	308.00
Angles used for next day are	331.00	356.00	1.00	333.00
Factors used for required day are	.96	.79	1.31	1.00
Factors used for next day are	1.00	.79	1.33	1.04
Harmonic constant angles used are	337.40	30.60	18.10	354.70
Harmonic constant heights used are	.14	.15	.17	.12
	F4	F4	F6	F6

1/4 and 1/6 diurnal corrections used : .00 .00 .00 .00

Tidal Predictions

Time : .00	Height : 1.01
Time : .30	Height : .98
Time : 1.00	Height : .94
Time : 1.30	Height : .89
Time : 2.00	Height : .83
Time : 2.30	Height : .77
Time : 3.00	Height : .70
Time : 3.30	Height : .64
Time : 4.00	Height : .58
Time : 4.30	Height : .52
Time : 5.00	Height : .48
Time : 5.30	Height : .45
Time : 6.00	Height : .42
Time : 6.30	Height : .41
Time : 7.00	Height : .41
Time : 7.30	Height : .41
Time : 8.00	Height : .42
Time : 8.30	Height : .44
Time : 9.00	Height : .46
Time : 9.30	Height : .48
Time : 10.00	Height : .49
Time : 10.30	Height : .50
Time : 11.00	Height : .50
Time : 11.30	Height : .49
Time : 12.00	Height : .48
Time : 12.30	Height : .46
Time : 13.00	Height : .43
Time : 13.30	Height : .41
Time : 14.00	Height : .38
Time : 14.30	Height : .35
Time : 15.00	Height : .33
Time : 15.30	Height : .31
Time : 16.00	Height : .31
Time : 16.30	Height : .32
Time : 17.00	Height : .34
Time : 17.30	Height : .37
Time : 18.00	Height : .42
Time : 18.30	Height : .48
Time : 19.00	Height : .55
Time : 19.30	Height : .63
Time : 20.00	Height : .71
Time : 20.30	Height : .79
Time : 21.00	Height : .88
Time : 21.30	Height : .95
Time : 22.00	Height : 1.01
Time : 22.30	Height : 1.06
Time : 23.00	Height : 1.09
Time : 23.30	Height : 1.11

9 Dec 1992

Level : .60
 Local correction : .00
 Value : .60

	M2	S2	K1	O1
Angles used for required day are	331.00	356.00	1.00	333.00
Angles used for next day are	356.00	357.00	.00	.00
Factors used for required day are	1.00	.79	1.33	1.04
Factors used for next day are	1.04	.79	1.34	1.08
Trigonometric constant angles used are	337.40	30.60	18.10	354.70
Trigonometric constant heights used are	.14	.15	.17	.12
	f4	F4	f6	F6
4 and 1/6 diurnal corrections used	.00	.00	.00	.00

Tidal Predictions

Time : 1.00	Height : 1.11
Time : 1.30	Height : 1.08
Time : 1.00	Height : 1.02
Time : 1.30	Height : .95
Time : 2.00	Height : .87
Time : 2.30	Height : .78
Time : 3.00	Height : .69
Time : 3.30	Height : .60
Time : 4.00	Height : .52
Time : 4.30	Height : .45
Time : 5.00	Height : .40
Time : 5.30	Height : .36
Time : 6.00	Height : .35
Time : 6.30	Height : .36
Time : 7.00	Height : .38
Time : 7.30	Height : .42
Time : 8.00	Height : .47
Time : 8.30	Height : .53
Time : 9.00	Height : .59
Time : 9.30	Height : .65
Time : 10.00	Height : .69
Time : 10.30	Height : .73
Time : 11.00	Height : .75
Time : 11.30	Height : .75
Time : 12.00	Height : .73
Time : 12.30	Height : .69
Time : 13.00	Height : .64
Time : 13.30	Height : .57
Time : 14.00	Height : .50
Time : 14.30	Height : .42
Time : 15.00	Height : .34
Time : 15.30	Height : .27
Time : 16.00	Height : .21
Time : 16.30	Height : .17
Time : 17.00	Height : .15
Time : 17.30	Height : .15
Time : 18.00	Height : .18
Time : 18.30	Height : .23
Time : 19.00	Height : .30
Time : 19.30	Height : .39
Time : 20.00	Height : .50
Time : 20.30	Height : .62
Time : 21.00	Height : .74
Time : 21.30	Height : .85
Time : 22.00	Height : .96
Time : 22.30	Height : 1.04
Time : 23.00	Height : 1.11
Time : 23.30	Height : 1.16

level : .60
Paternal correction : .00
value : .60

	M2	S2	K1	O1
Angles used for required day are :	356.00	357.00	.00	.00
Angles used for next day are :	21.00	358.00	.00	26.00
Factors used for required day are :	1.04	.79	1.34	1.08
Factors used for next day are :	1.08	.79	1.36	1.11
Harmonic constant angles used are :	337.40	30.60	18.10	354.70
Harmonic constant heights used are :	.14	.15	.17	.12
	f4	F4	f6	F6

1/4 and 1/6 diurnal corrections used : .00 .00 .00 .00

Tidal Predictions.

Time : .00	Height : 1.18
Time : .30	Height : 1.17
Time : 1.00	Height : 1.15
Time : 1.30	Height : 1.10
Time : 2.00	Height : 1.04
Time : 2.30	Height : .97
Time : 3.00	Height : .88
Time : 3.30	Height : .80
Time : 4.00	Height : .71
Time : 4.30	Height : .62
Time : 5.00	Height : .54
Time : 5.30	Height : .48
Time : 6.00	Height : .42
Time : 6.30	Height : .39
Time : 7.00	Height : .36
Time : 7.30	Height : .36
Time : 8.00	Height : .36
Time : 8.30	Height : .38
Time : 9.00	Height : .40
Time : 9.30	Height : .43
Time : 10.00	Height : .46
Time : 10.30	Height : .49
Time : 11.00	Height : .50
Time : 11.30	Height : .51
Time : 12.00	Height : .51
Time : 12.30	Height : .50
Time : 13.00	Height : .48
Time : 13.30	Height : .45
Time : 14.00	Height : .41
Time : 14.30	Height : .37
Time : 15.00	Height : .32
Time : 15.30	Height : .28
Time : 16.00	Height : .25
Time : 16.30	Height : .22
Time : 17.00	Height : .21
Time : 17.30	Height : .22
Time : 18.00	Height : .24
Time : 18.30	Height : .28
Time : 19.00	Height : .35
Time : 19.30	Height : .42
Time : 20.00	Height : .51
Time : 20.30	Height : .61
Time : 21.00	Height : .72
Time : 21.30	Height : .82
Time : 22.00	Height : .92
Time : 22.30	Height : 1.01
Time : 23.00	Height : 1.09
Time : 23.30	Height : 1.15

APPENDIX H
GPS CONSTELLATION EVENT SCHEDULE

All-In-View PDOP for duntroon

Date : 3 Dec 1992
 ime : 0:01 -> 12:01
 Cut-off Elevation : 10°

Latitude : 35° 51' 00" S
 Longitude : 135° 41' 00" E
 Zone : 0:00

Satellite Constellation	Time Rise	Time Set	dT	PDOP Rise	PDOP Set
2 11 16 19 26 27	0:01	0:13	0:12	2.1	1.9
2 16 19 26 27	0:13	0:23	0:10	3.5	3.8
2 13 16 19 26 27	0:23	0:48	0:25	3.6	3.2
2 13 19 26 27	0:48	0:53	0:05	3.8	3.8
2 13 26 27	0:53	1:53	1:00	99.9	5.1
2 12 13 26 27	1:53	2:28	0:35	2.6	2.1
2 12 13 24 26	2:28	3:28	1:00	2.1	2.5
12 13 24 26	3:28	3:41	0:13	48.8	12.7
12 13 20 24	4:01	4:58	0:57	4.0	18.9
3 12 13 20 24	4:58	5:28	0:30	2.3	2.3
3 12 13 16 20 24	5:28	5:38	0:10	1.8	1.8
3 12 16 20 24	5:38	5:53	0:15	2.6	3.0
3 12 16 20 24 25	5:53	6:13	0:20	2.1	2.3
3 12 16 17 20 24 25	6:13	7:13	1:00	2.1	1.9
3 16 17 20 24 25	7:13	7:33	0:20	2.5	2.6
3 16 17 20 25	7:33	7:58	0:25	3.3	3.2
3 16 17 20 23 25	7:58	8:43	0:45	2.2	2.2
3 16 17 20 23 25 26	8:43	8:48	0:05	1.8	1.8
3 16 17 20 23 26	8:48	9:08	0:20	8.3	5.2
3 16 17 20 21 23 26	9:08	9:33	0:25	2.3	2.2
3 17 20 21 23 26	9:33	9:38	0:05	3.5	3.5
3 17 20 21 23 26 28	9:38	9:53	0:15	1.7	1.7
3 17 21 23 26 28	9:53	11:03	1:10	2.1	2.9
3 17 21 23 26 28 32	11:03	11:28	0:25	1.9	2.1
3 11 17 21 23 28 32	11:28	12:01	0:33	1.8	2.1

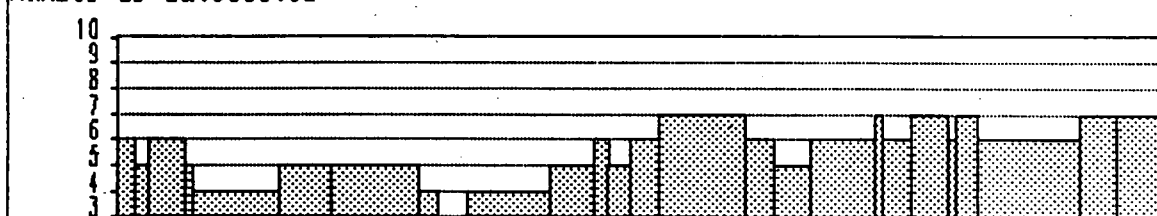


All-In-View PDOP vs Time

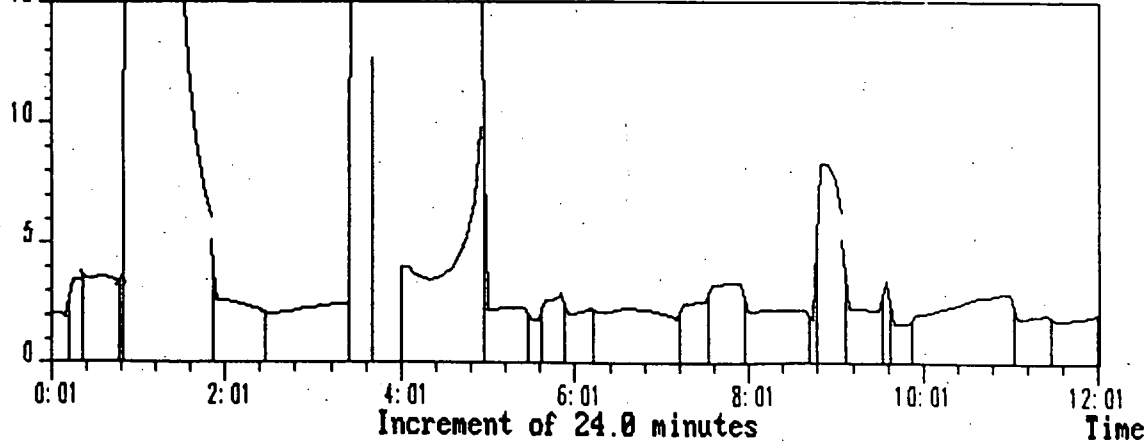
Station : duntroon Latitude : 35 51'00"S Longitude : 135 41'00"E
 Date : 3 Dec 1992 Zone : 0:00 Cut-off Elevation : 10

Number of Satellites

8 Channel Receiver



PDOP 15



Increment of 24.0 minutes

Time

APPENDIX I
DAILY LOGS

RACAL-SURVEY

VESSEL . . . Pacific Oak

PROJECT LEADER KE SHUTTEWORTH CLIENT BHF

DATE 3rd Dec 92 PROJECT WAY 2015

TIMEZONE GMT + 11 SYSTEM as per

REMARKS BHP -

Tailboy Truck operational at 1730 hr.

Summary of

1730 - 1735 down time 17.5 Hr.
1735 - 2400 on standby 6.5 Hr.

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

RACAL-SURVEY

VESSEL Pacific GAK

CLIENT BH

PROJECT AWAY 2015

SYSTEM as per

REMARKS

PROJECT LEADER

CLIENT REPRESENTATIVE

RACAL-SURVEY

DAILY LOG

11844

VESSEL

Pacific. 0 112

PROJECT LEADER

FR. S. J. LEWORTH

CLIENT

B HF

DATE _____

5th Dec 92

PROJECT

May 2015

TIMEZONE

$$G_{MT} + i\epsilon$$

SYSTEM

as over

[illegible]

REMARKS

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

RACAL-SURVEY

DAILY LOG

11845

VESSEL

Pacific EMC

PROJECT LEADER

IZ. Shtutnawortn

CLIENT

B.H.

DATE _____

6th Dec 92.

PROJECT

July 2015

TIMEZONE

9.5711

SYSTEM

as prev

[illegible]

REMARKS

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

RACAL-SURVEY

VESSEL

PROJECT LEADER

CLIENT

DATE _____

PROJECT

TIMEZONE

SYSTEM

REMARKS

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

RACAL-SURVEY

VESSEL Pacific One

PROJECT LEADER EC. Shuttleworth

CLIENT BHF

DATE 8th Dec 92

PROJECT OTWAY 2015

TIMEZONE . . . GMT + 11

SYSTEM *as per*

REMARKS

[Handwritten signature]

PROJECT LEADER

SIGNED

Alfred P. Sloan

CLIENT REPRESENTATIVE

RACAL-SURVEY

DAILY LOG 11848

VESSEL Pacific Oak

PROJECT LEADER E.C. Shuttleworth

CLIENT BHP

DATE 9th Dec 92

PROJECT ORWAY 2015

TIMEZONE GMT +11

SYSTEM as prev.

TIME	NARRATIVE	INITIAL
0-0110	Unable to control strainer	Wx
-0155	Shooting digital	sp
-0240	Heading to shoot one direction only	Wx
-0321	Shooting digital	sp
-0519	Differential lost for 1 hr from Adelaide	Wx
-0807	Shooting digital	sp
-0846	Revised digital	sp
-1100	Deploying analogue	sp
-1255	Attempting to compensate for short S88 cable	Wx
-1640	Shooting analogue	sp
-1731	Adelaide differential lost.	Wx
-2400	Shooting analogue	sp
	Timings	
	Operational 17.5 hr	
	Wx Standby 1.9	
	Downtime 4.6	
	Total 24 -	

REMARKS

SIGNED

PROJECT LEADER

SIGNED

CLIENT REPRESENTATIVE

000153

RACAL-SURVEY

DAILY LOG 11849

VESSEL Pacific Oak

PROJECT LEADER

Ed Shuttleworth

CLIENT

BHP

DATE

10th Dec 92

PROJECT

away 20.5

TIMEZONE

GMT + 11

SYSTEM

as pred.

TIME	NARRATIVE	INITIAL
0-0028	Shooting analogue	ap
-0113	Nav computer hang up	ap
-0645	Shooting analogue	ap
-0734	Unable to control vessels speed	ap
-1847	Shooting analogue	ap
-1933	Recovering analogue, preparing cover	ap
-2145	Coring SVP check	ap
-2400	Heading Byford Dolphin	soy
	Timings	
	Operational 20.3	
	other Standby 2.2	
	Downtime 1.5	
	Totals 24 -	

REMARKS BHP Timings

Operational 14.8
Downtime 7.0
Transit 2.2

SIGNED

PROJECT LEADER

SIGNED

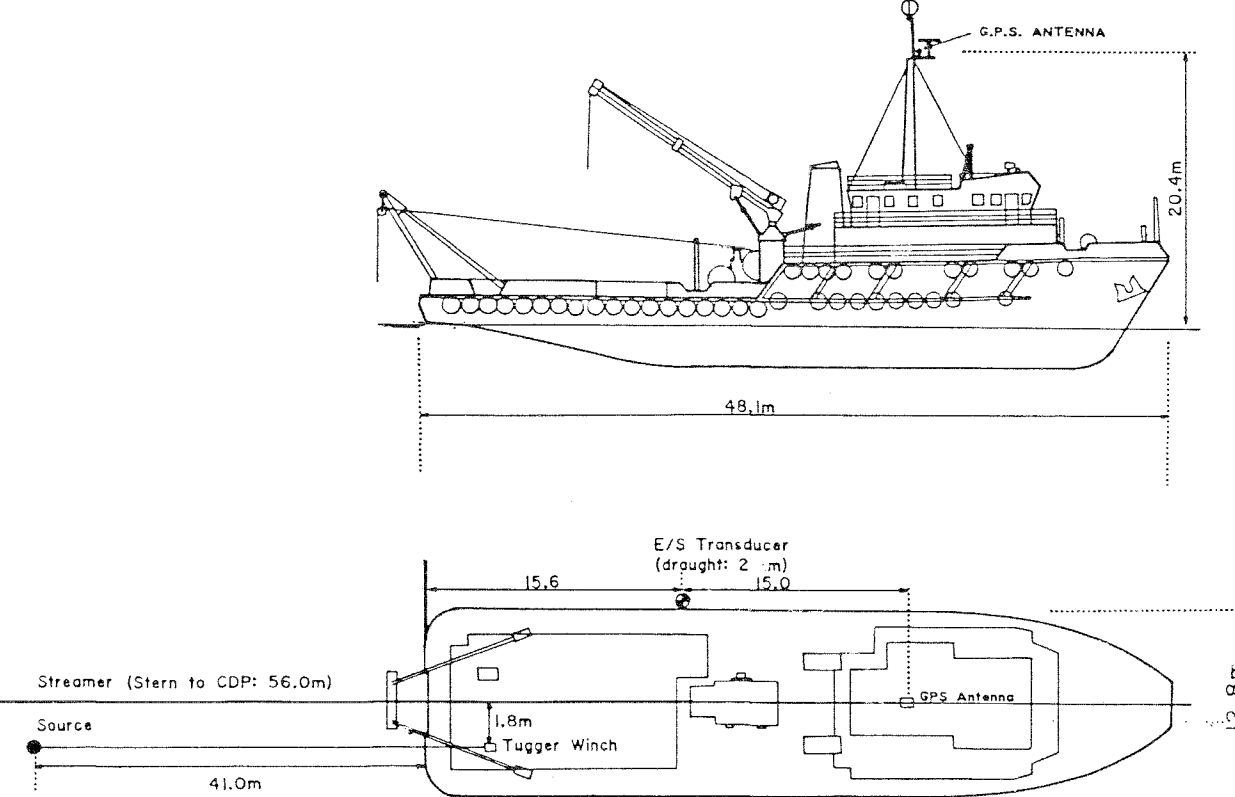
CLIENT REPRESENTATIVE

LEGEND

- +— VESSEL TRACK (ECHOSOUNDER TRANSDUCER AS DATUM)
- ⊕ PROPOSED BORDA LOCATION 562 085 mE
6 033 051 mN
- CORE POSITIONS

NOTES : POSITIONING SYSTEM : DIFFERENTIAL GPS (SKYFIX)

VESSEL DIAGRAM



M.V. PACIFIC OAK
(NOT TO SCALE)

BHP PETROLEUM PTY. LTD.

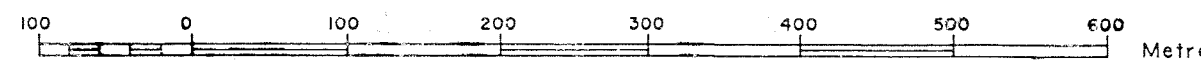
BORDA SITE SURVEY
TRACK CHART

RACAL

RACAL SURVEY AUSTRALIA LTD.

8548-10

SCALE 1 : 5000

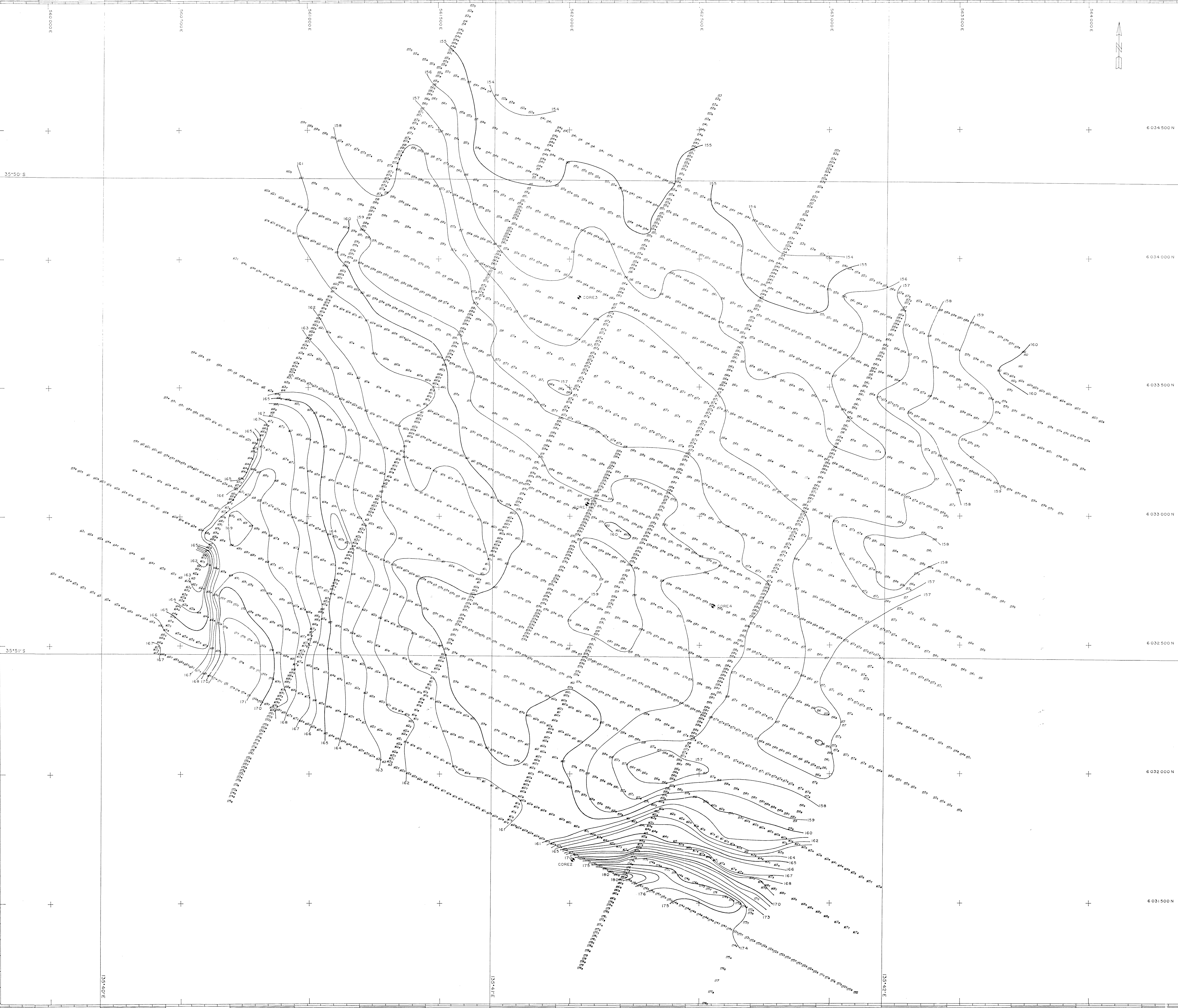


AUSTRALIAN GEODETIC DATUM 1984

False Easting 500000mE Latitude of Origin 0° 0' 0"N
False Northing 1000000mN Longitude of Origin 135° 0' 0"E

Party Chief : C. Shuttleworth	Project Date : NOV. 92	Vessel : PACIFIC OAK
Drawn by : A. Webster	Date : DEC. 92	Sheet No. : 1 of 5
Checked by : G. Jones	Date : DEC. 92	Chart No. : 2015b.1

RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Balclutha, W.A. 6021
TEL : (08) 344 7166 FAX : (08) 344 8783 TELEX : AA94341 RACSUR

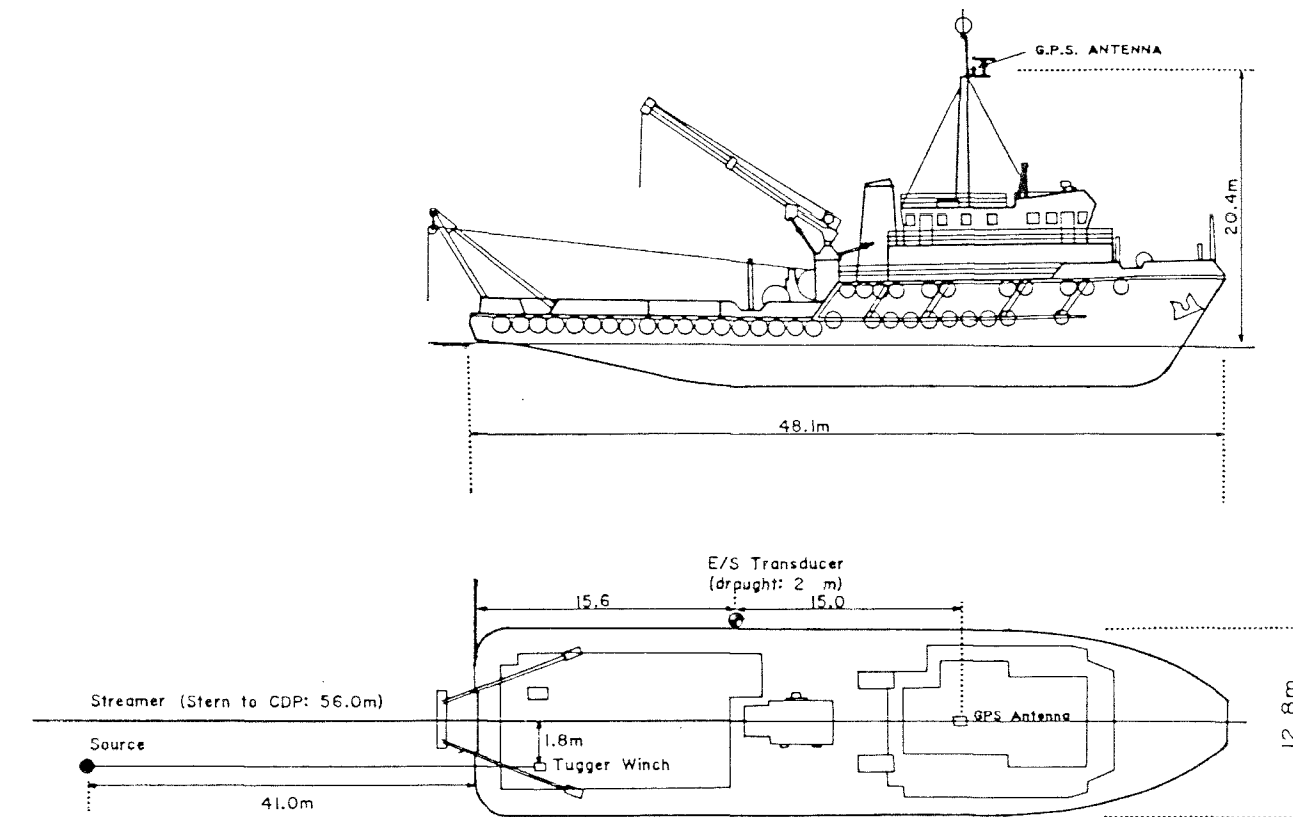


LEGEND

- PROPOSED BORDA LOCATION 562 085 mE 6 033 051 mN
- BATHYMETRY CONTOURS AT 1 METRE INTERVALS
- BATHYMETRY SOUNDINGS IN METRES AND DECIMETRES REDUCED TO LAT
- CORE LOCATION

NOTES: 1. POSITIONING SYSTEM : DIFFERENTIAL GPS (SKYFIX)
2. ALL SOUNDINGS REDUCED TO LAT USING CONSTITUENT DATA FOR VIVONNE BAY OBTAINED FROM AUSTRALIAN NATIONAL TIDE TABLES

VESSEL DIAGRAM



M.V. PACIFIC OAK
(NOT TO SCALE)

BHP PETROLEUM PTY. LTD.

BORDA SITE SURVEY

BATHYMETRY

RACAL

RACAL SURVEY AUSTRALIA LTD.

8548-11

SCALE 1 : 5000

100 0 100 200 300 400 500 600 Metres

AUSTRALIAN GEODETIC DATUM 1984

False Easting 500000mE Latitude of Origin 0° 0' 0"N

False Northing 10000000mN Longitude of Origin 135° 0' 0"E

Party Chief : C. Shuttleworth Project Date : NOV. 92 Vessel : PACIFIC OAK

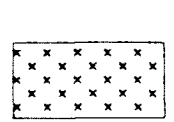
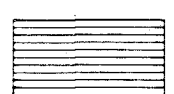
Interpreted by : P. Flatman Date : DEC. 92 Sheet No. : 2 of 5

Checked by : G. Jones Date : DEC. 92 Chart No. : 2015b.2

RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Balclutha, W.A. 8021

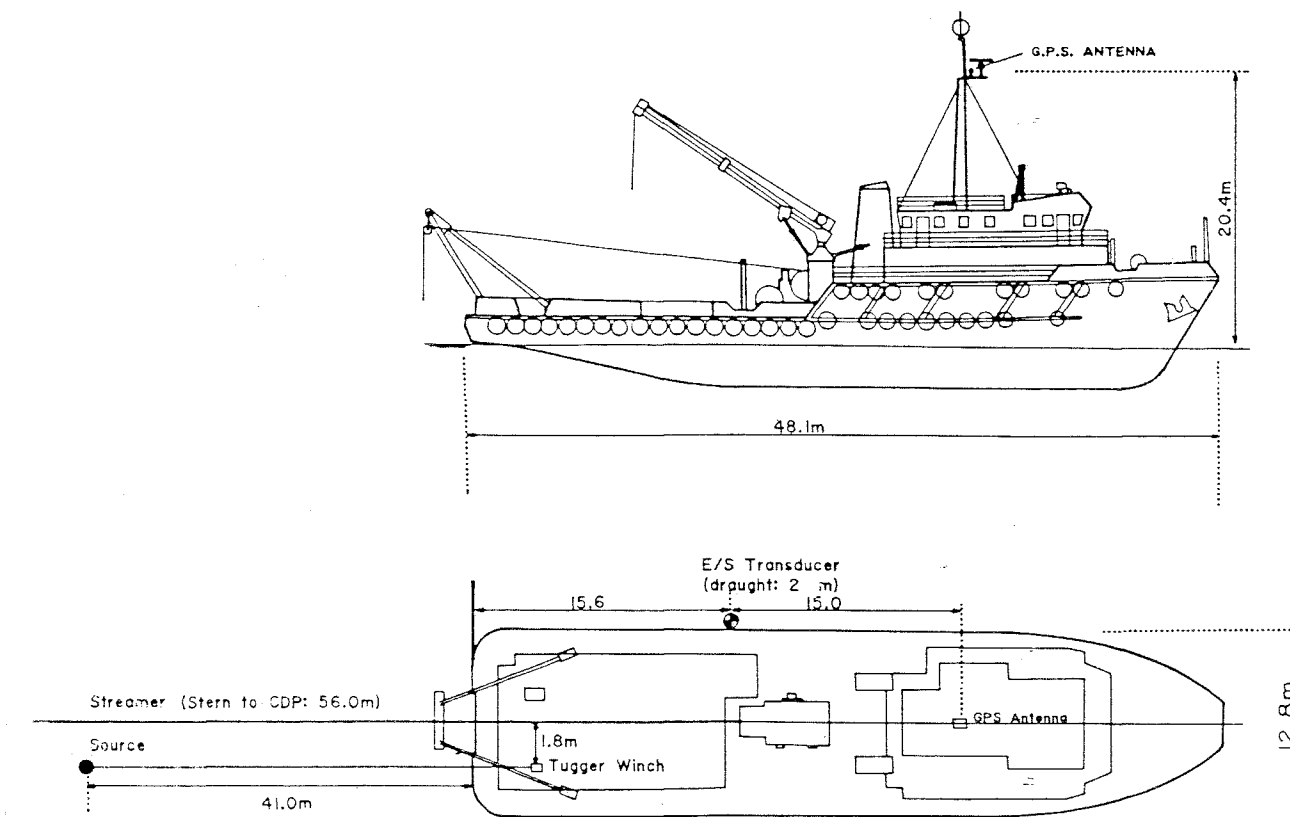
TEL : (09) 344 7166 FAX : (09) 344 8783 TELEX : AA94341 RACSUR

LEGEND

-  PROPOSED BORDA LOCATION 562 095 mE
6 033 051 mN
-  CORE POSITIONS
-  1 METRE OR LESS OF UNIT A SANDS
-  REFLECTOR OBSCURE UNIT A PROBABLY ABSENT AT LESS THAN 1 METRE

NOTES: POSITIONING SYSTEM : DIFFERENTIAL GPS (SKYFIX)

VESSEL DIAGRAM



M.V. PACIFIC OAK
(NOT TO SCALE)

BHP PETROLEUM PTY. LTD.

BORDA SITE SURVEY

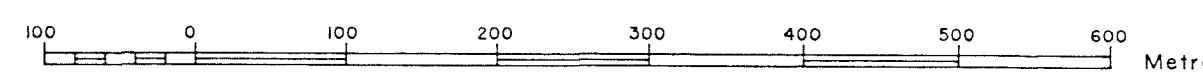
ISOPACH OF UNIT A

RACAL

RACAL SURVEY AUSTRALIA LTD.

8548-13

SCALE 1 : 5000



AUSTRALIAN GEODETIC DATUM 1984

False Easting 500000mE Latitude of Origin 0° 0' 0"N
False Northing 10000000mN Longitude of Origin 135° 0' 0"E

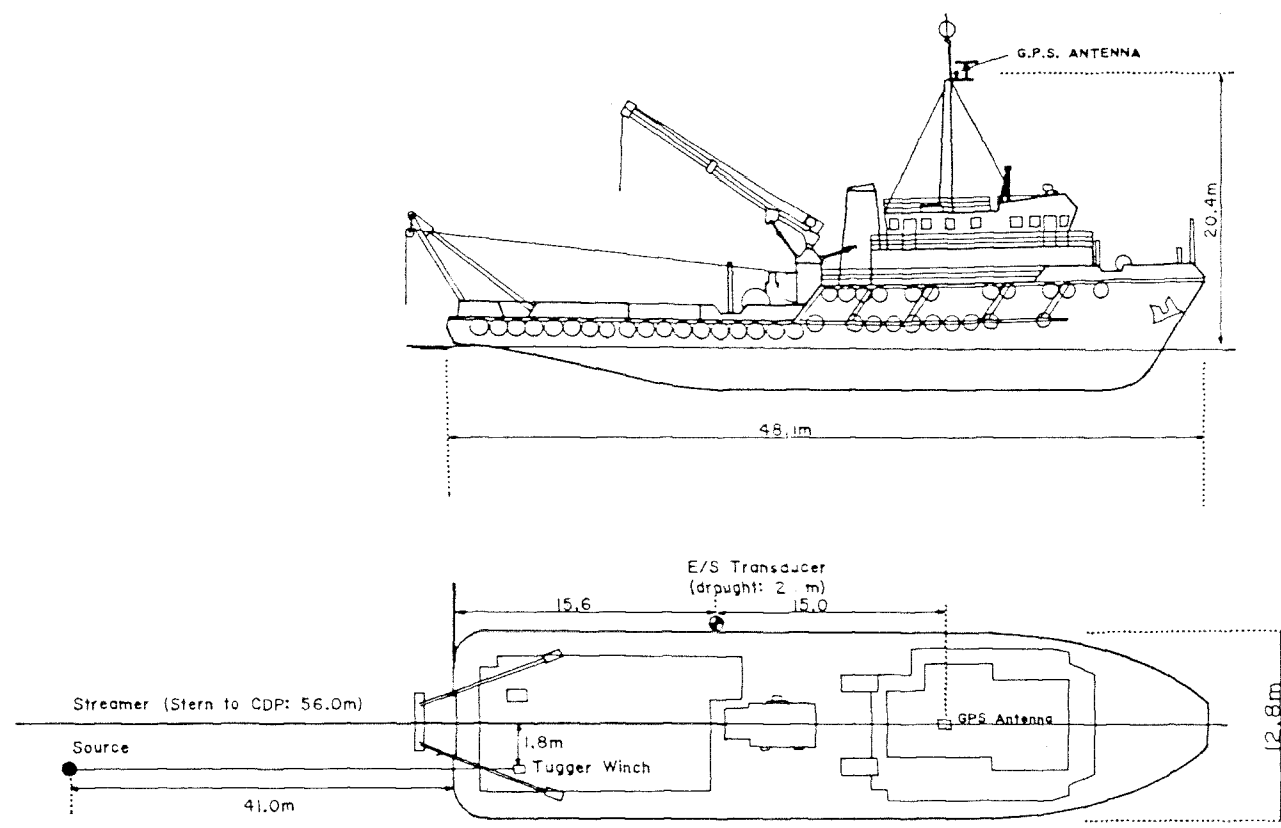
Party Chief : C. Shuttleworth	Project Date : NOV. 92	Vessel : PACIFIC OAK
Interpreted by : P. Flatman	Date : DEC. 92	Sheet No. : 4 OF 5
Checked by : G. Jones	Date : DEC. 92	Chart No. : 2015t.4
RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Balclutha, W.A. 6021		
TEL : (09) 344 7166 FAX : (09) 344 8783 TELEX : AA94341 RACSUR		

LEGEND

UNIT A1 • MOBILE CARBONATE SAND
UNIT A2 • UNCONSOLIDATED MEDIUM TO COARSE CARBONATE SAND
UNIT A3 • SEM-CONSOLIDATED CARBONATE SAND
R1 • EROSION SURFACE
UNIT B • CALCARENITE

NOTES: POSITIONING SYSTEM : DIFFERENTIAL GPS (SKYFIX)

VESSEL DIAGRAM



M.V. PACIFIC OAK

(NOT TO SCALE)

BHP PETROLEUM PTY. LTD.

BORDA SITE SURVEY

BOOMER PROFILES

RACAL

RACAL SURVEY AUSTRALIA LTD.

3548-K

HORIZONTAL SCALE 1:5000

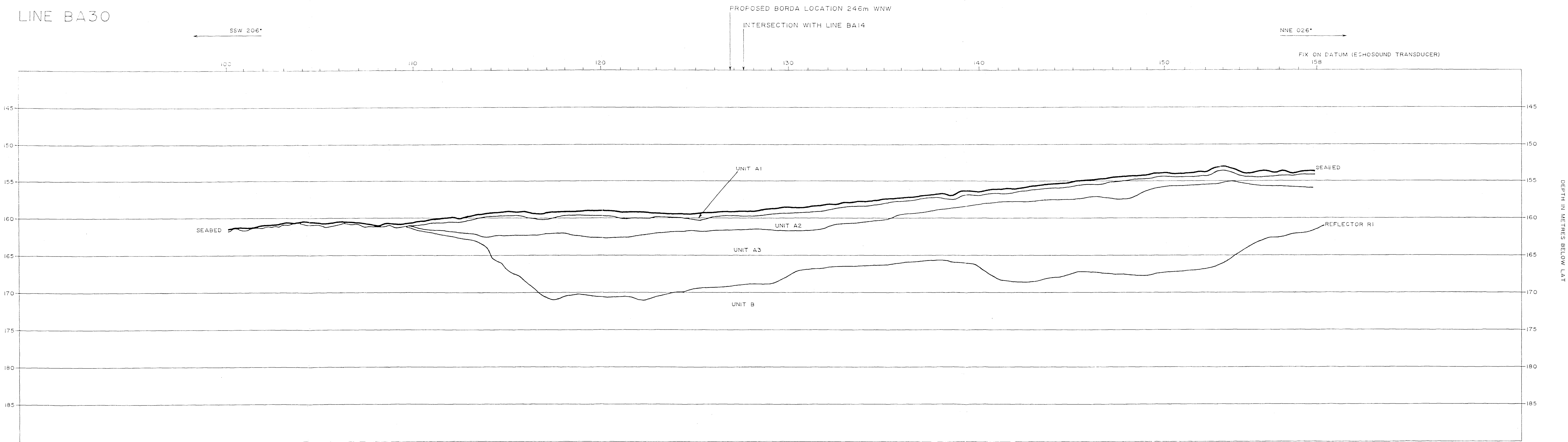
0 100 200 300 400 500 600 Metres

VERTICAL SCALE 1:250

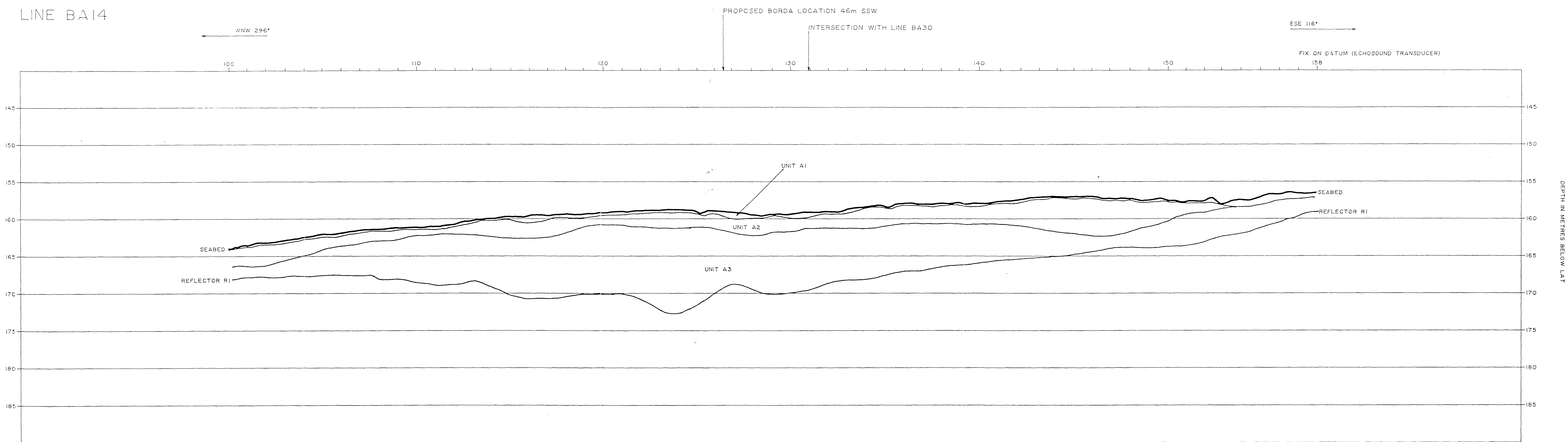
0 5 10 15 20 25 Metres

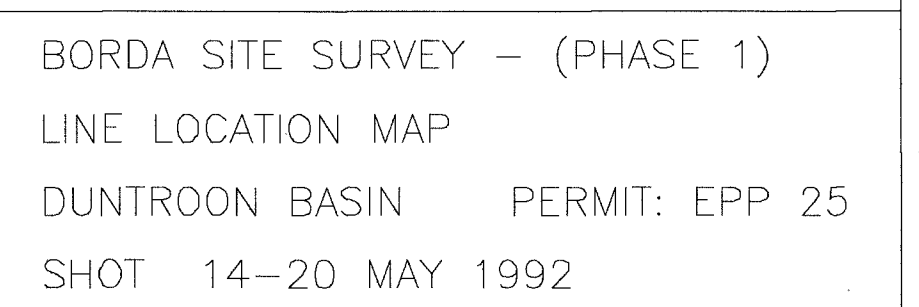
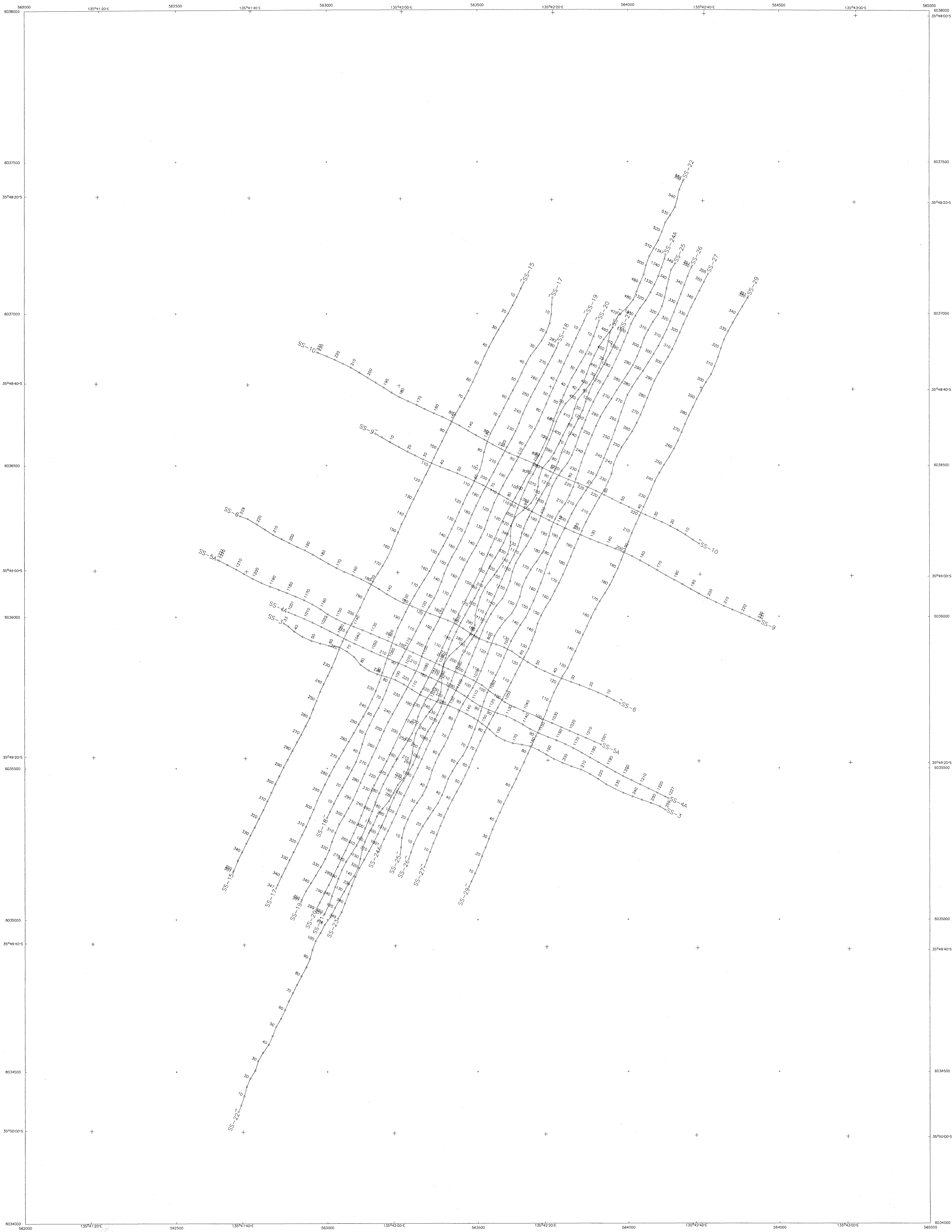
Party Chief : C. Shuttleworth	Project Date : NOV. 92	Vessel : PACIFIC OAK
Interpreted by : P. Flatman	Date : DEC. 92	Sheet No. : 5 of 5
Checked by : G. Jones	Date : DEC. 92	Chart No. : 20158.5
RACAL SURVEY AUSTRALIA LIMITED, 4 Ledger Rd, Balcatla, W.A. 6021		
TEL : (09) 344 7166 FAX : (09) 344 8783 TELEX : AA94341 RACSUR		

LINE BA30



LINE BA14





Project Name: DUNTROON	
Author: AAALLM	Date: 4/5/93
Map Name: SITE_SURVEY_BORDA_(SS_PHASE1)	
Scale: 5000.00 METERS/METERS	
Projection: UTM-53	Contour Int:



BHP PETROLEUM PTY. LTD.
A.C.N. 006 918 832

BORDA PROSPECT, EPP 25, DUNTROON BASIN

DIGITAL SITE SURVEY INTERPRETATION REPORT

PREPARED BY: G. Collins

gic0933

DATE: April, 1993

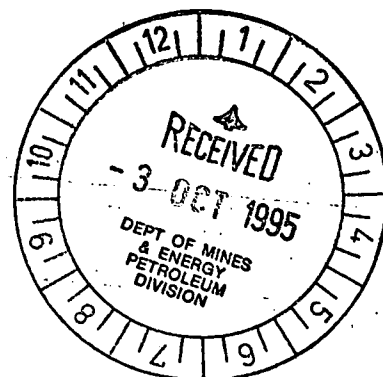


TABLE OF CONTENTS

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1	EXECUTIVE SUMMARY	1
2	INTRODUCTION	2
3	SEISMIC ACQUISITION AND PROCESSING	2
4	SEISMIC INTERPRETATION AND ANOMALY MAPPING	3
5	CONCLUSIONS AND RECOMMENDATIONS	4

LIST OF FIGURES

1. Borda Site Survey Location Map
2. Velocities used for Depth Conversion
3. Seismic line CL2
4. Seismic line D8
5. Seismic line CL2 Reflection Strength Display

APPENDIX

1. Seismic Acquisition Parameters
2. Seismic Processing Sequence

ENCLOSURES

1. Borda Site Survey Line Location Map
2. Borda Site Survey Seismic Anomaly Map — ? never prepared (missing from both BHP & MESA versions of this report).

1 EXECUTIVE SUMMARY

A total of 9 line kilometres of digital high resolution seismic data was acquired as part of a site survey over the Borda prospect in EPP25, Duntroon Basin (figure 1). The operation was conducted by Racal Survey Australia Ltd and completed on 10th December 1992. The data was processed by Simon Petroleum Technology (SPT), Perth with final tapes received from SPT on 1st March 1993.

The co-ordinates of the central point of the survey are:

Latitude: 35° 50' 40.701"S
Longitude: 135° 41' 14.998"E

Easting: 562,084.7mE
Northing: 6,033,051.2mN
UTM Zone: 53

Note that this is the report of the second site survey in the Borda area. An earlier survey was undertaken in June 1992 to the north of this area and interpreted by Racal.

Geophysical examination of seismic sections and consultation with area geologists was undertaken with the aim of identifying potential drilling hazards associated with the presence of shallow gas accumulations. Attention was particularly paid to the section to 560mSS (580ms) where 20inch casing is to be set.

At the proposed Borda-1 location no significant drilling constraint is noted.

Drilling is expected to encounter high amplitude anomalies within minor closure at 240mSS (310ms) and at 340mSS (405ms). Although evidence points to these being facies related, caution is advised when approaching these levels. Additionally it should be noted that there is minor closure from near sea floor to 360mSS (420ms).



DUNTROON BASIN BORDA-1 LOCATION

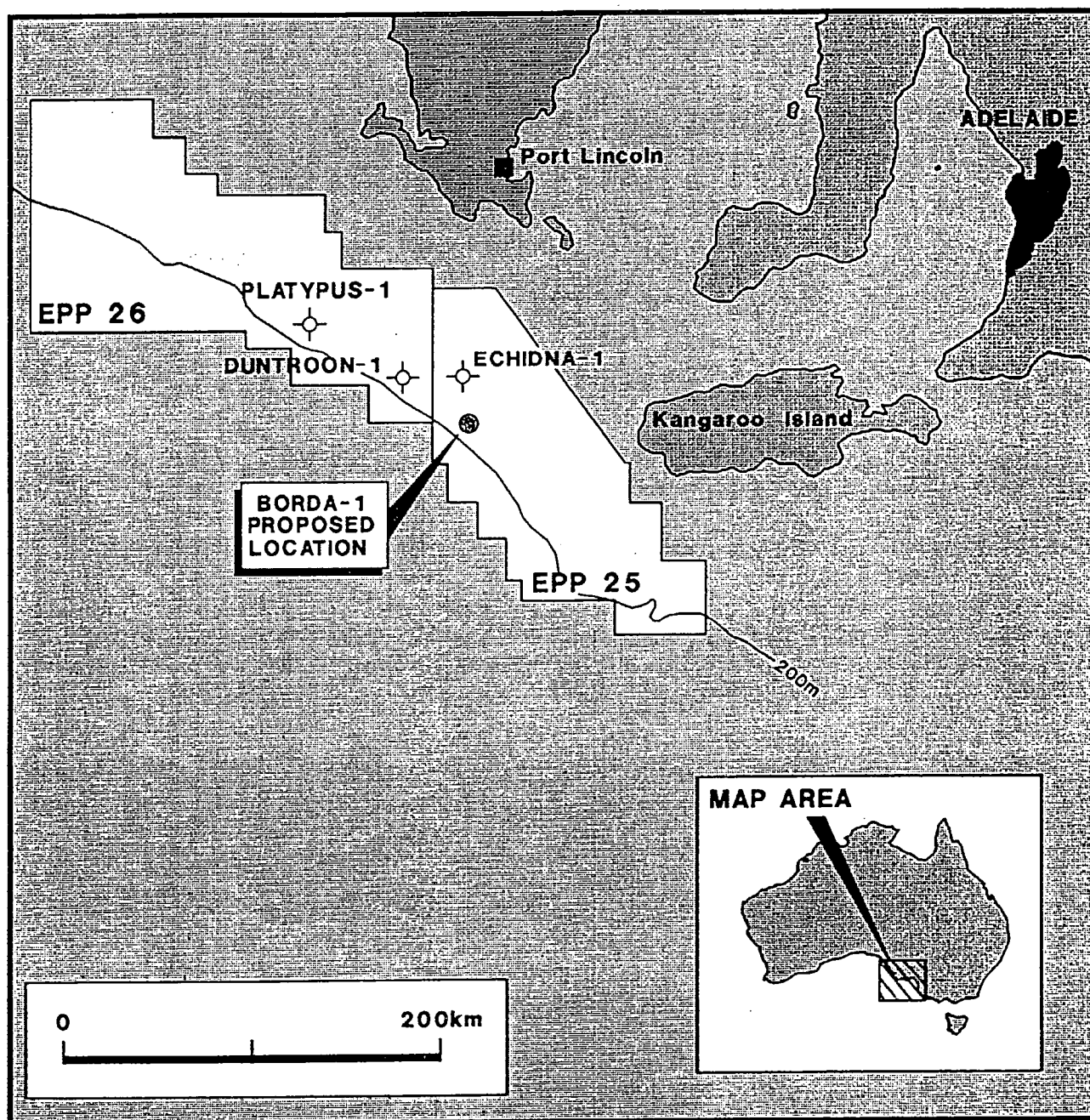


Figure 1

2 INTRODUCTION

The aim of conducting a digital site survey over a potential drilling location is to identify drilling hazards in the shallow section particularly down to the first casing point.

This report comprises a brief summary of the acquisition and processing parameters together with a more detailed description of the geophysical interpretation of the processed data in regard to identifying any potential drilling hazards. A separate report by Racal covers the analogue survey and coring operations aimed at identifying sea floor hazards for rig anchoring.

3 SEISMIC ACQUISITION AND PROCESSING

RACAL SURVEY AUSTRALIA LIMITED were contracted by BHP PETROLEUM PTY LTD to carry out an analogue and digital site survey at the proposed wellsite Borda-1 in EPP25, Duntroon Basin, South Australia (figure 1).

The survey vessel M.V. "Pacific Oak" was mobilised for the operation. A Trimble 4000DL 8 channel GPS receiver and Racal's "Skyfix" Differential GPS was used in conjunction with Trimble DeltaNav - Navigator software to provide positioning.

Austral Geophysical Consultants Pty Ltd were contracted by BHPP to provide onboard quality control.

The survey was undertaken over a period from 3rd December to 10th December which included five and a half days of weather standby.

A 1km x 1km grid was surveyed comprising 9 line kilometres in 7 lines spaced at 100m in the NW SE direction and 3 lines spaced at 250m in the NE SW direction.

The co-ordinates of the central point of the survey are:

Latitude:	35° 50' 40.701"S
Longitude:	135° 41' 14.998"E
Easting:	562,084.7mE
Northing:	6,033,051.2mN
UTM Zone:	53

Acquisition parameters are listed in Appendix 1.

Upon completion of the survey, the field tapes were sent to Tensor Pacific, Melbourne, Victoria for processing. Tensor Pacific were unable to complete the processing and the data was then forwarded to Simon Petroleum Technology in Perth, Western Australia.

Data was recorded and processed to 1.5 seconds with a 1ms sample interval. It was processed to retain true amplitudes in order to avoid masking of anomalies. Wavelets in the section to 600ms were 13m (1675m/s, 125Hz) or shorter leading to resolution of better than 10m. Data was supplied to BHPP on magnetic tape in migrated, unscaled format and then loaded to a Landmark workstation.

The processing stream is listed in Appendix 2.

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SEISMIC INTERPRETATION AND ANOMALY MAPPING

Expected lithology down to the 20 inch casing point at 560mSS (580ms) at the well location is limestone and calcarenite of the Nullarbor Formation. Minor sand may be present at channelling events. This will be similar to Duntroon-1 offset well 43km NW which has a similar character on seismic. Prospect scale seismic shows units that generally prograde to the SW with occasional channelling cutting back up the depositional slope.

Depth conversion is based on stacking velocities from the first site survey centred 3km north at sp1100 DH91-237 (figure 2).

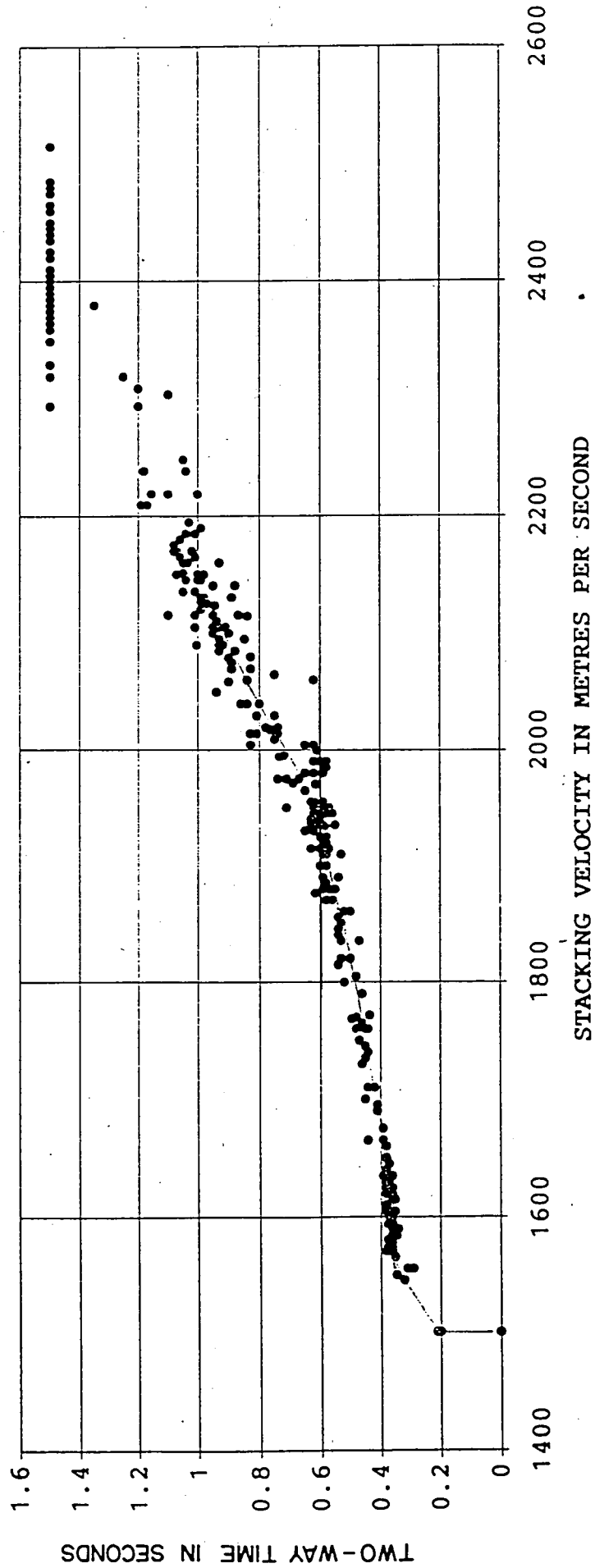
Interpretation involved looking for indicators of shallow gas in the shallow section of the data particularly in the section to 560mSS (580ms) where 20inch casing is planned to be set.

Indicators of shallow gas are:

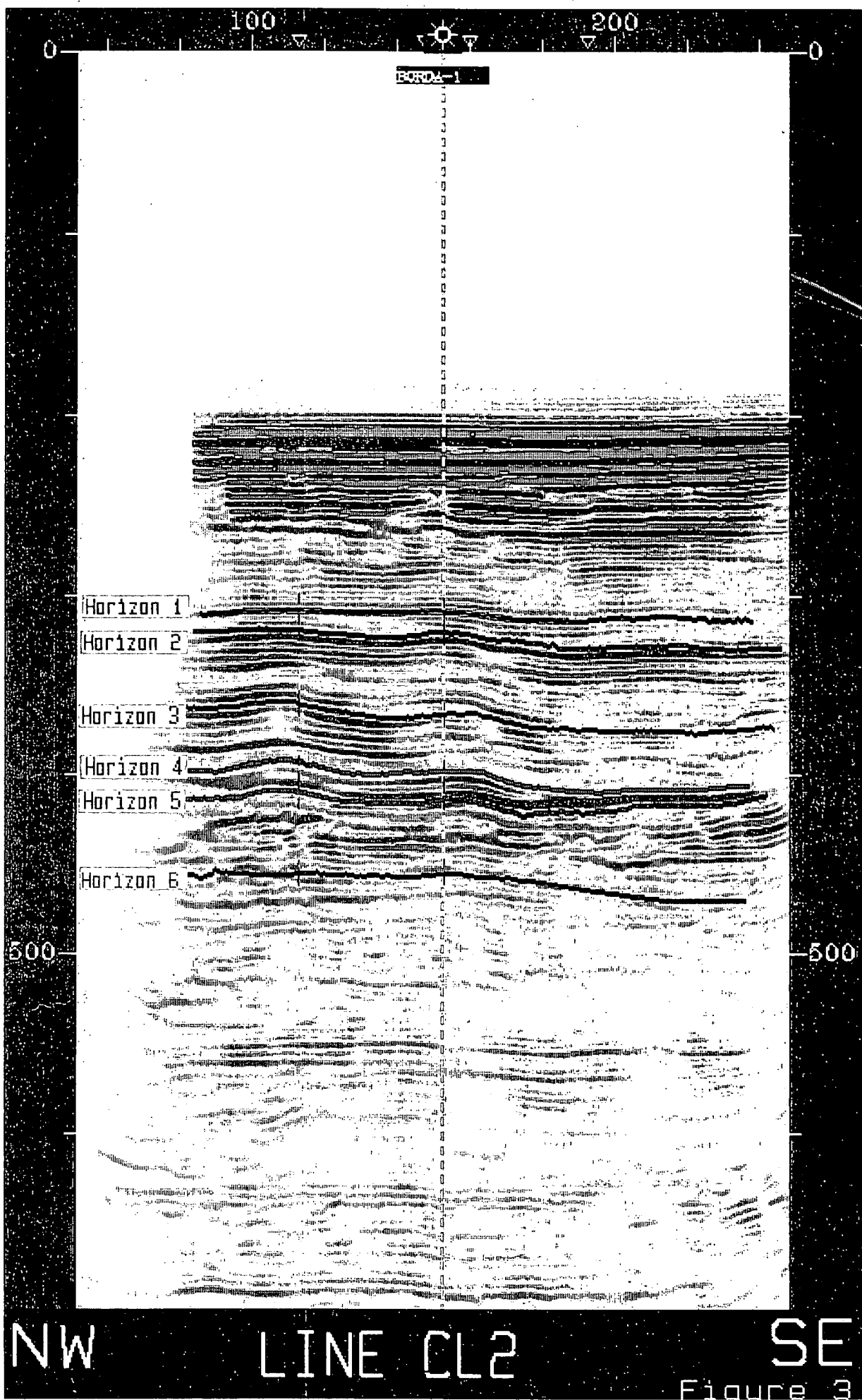
- : localised high amplitude anomalies.
- : impedance masking beneath anomalies.
- : velocity push-down beneath anomalies.
- : trapping geometries.
- : flat spots.
- : shallow gas at offset wells.

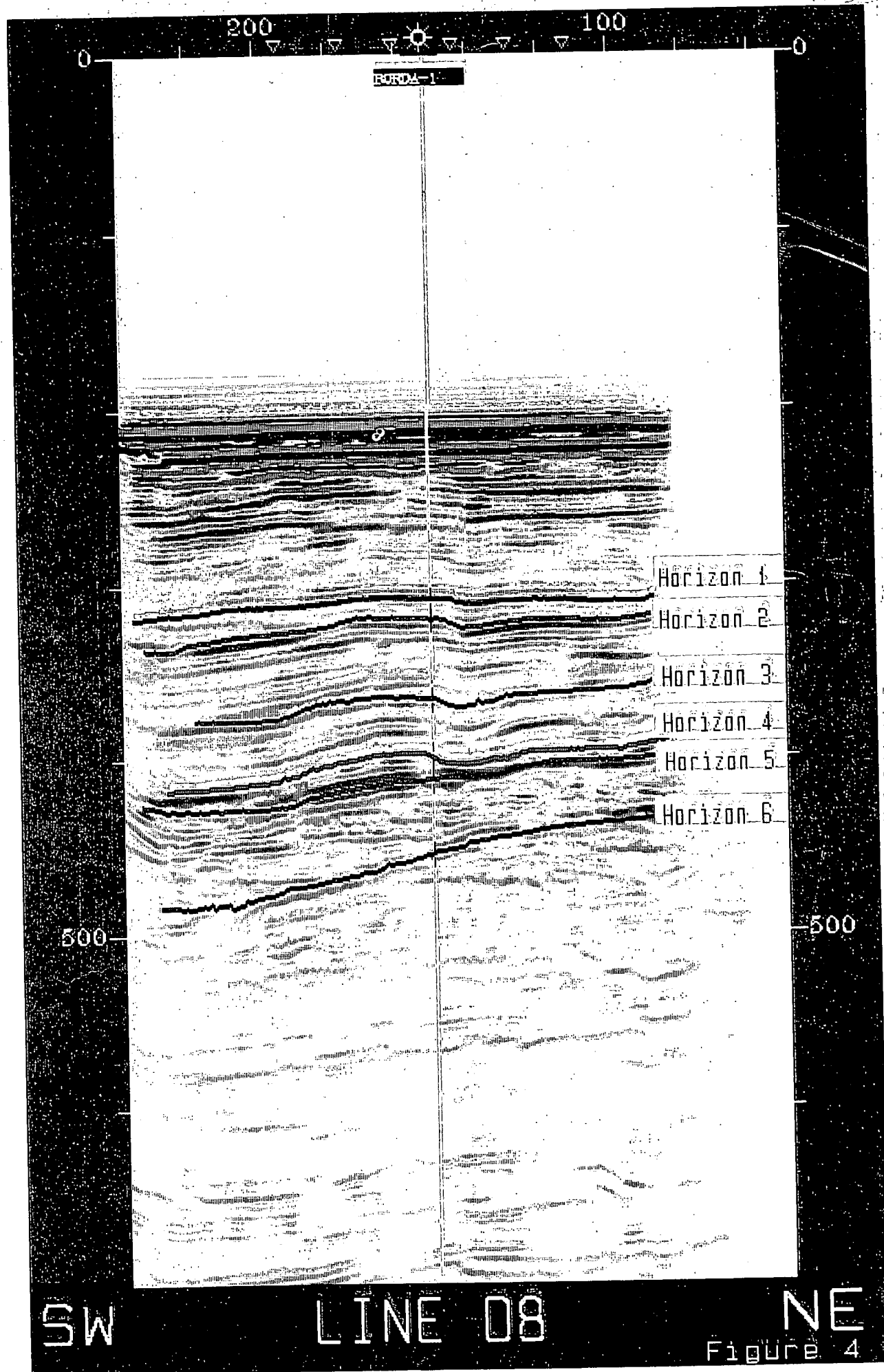
Two of the above indicators were observed on the data. They were high amplitude anomalies and trapping geometries. These are indicated on the anomalies map (enclosure 2) and on seismic line CL-2 (figures 3 and 5). In addition seismic line D8 (figure 4) shows channelling at 455ms at the well location.

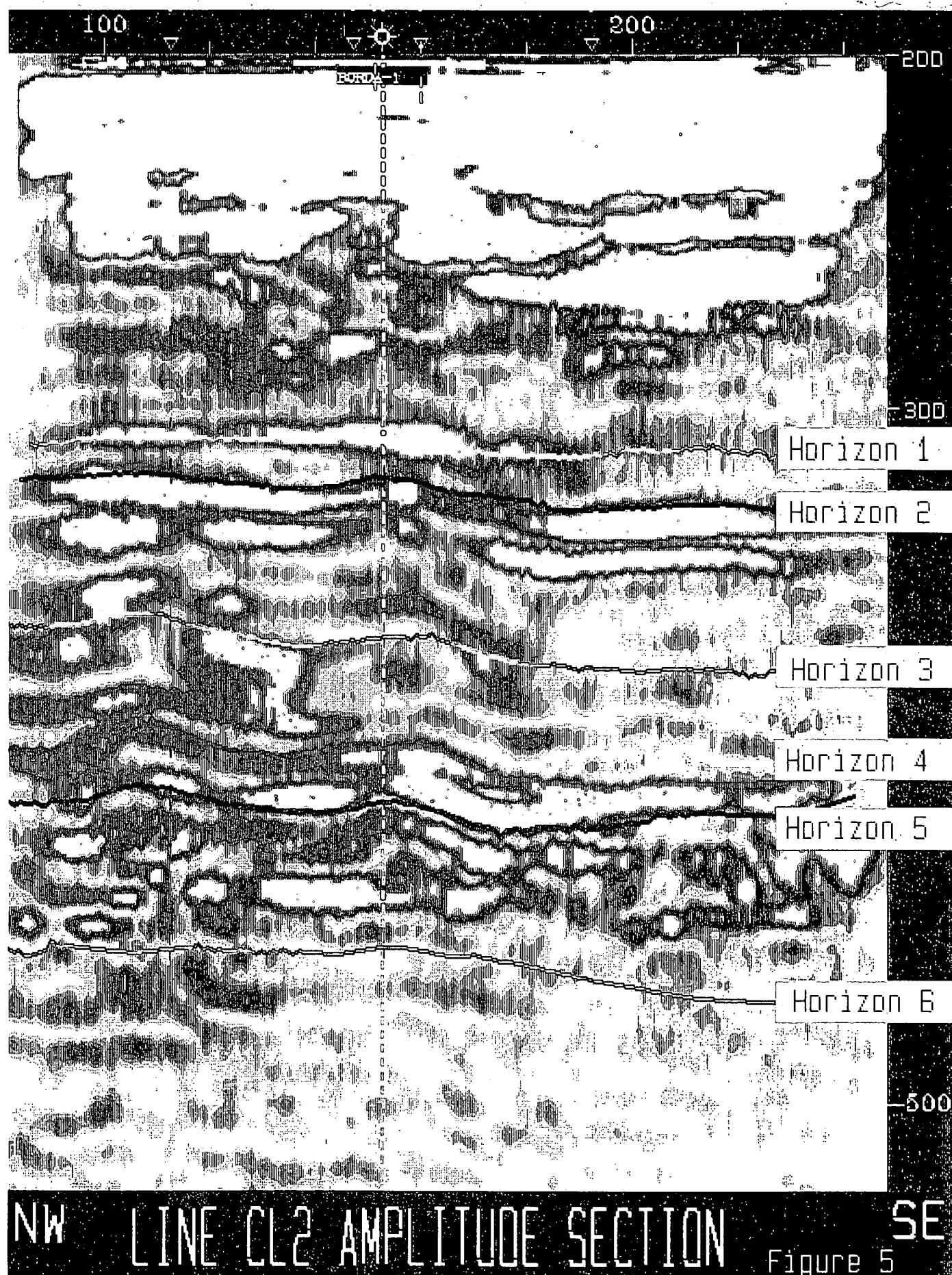
SCATTER PLOT OF STACKING VELOCITIES VERSUS TWO WAY TIME - BHP PETROLEUM
 AUSTRALIA - BORDA SITE (first site survey - 6/92)



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The amplitude anomalies are distributed across the section and are not necessarily linked to the trapping geometries. By comparison with current seabed conditions (refer to analogue site survey report) it is interpreted that these amplitude anomalies are associated with facies changes. High reflectivity units at the seafloor are associated with coarse grained material, possibly shell fragments. Lower reflectivity units are associated with fine to coarse grained, unconsolidated, carbonate sand. The trapping geometries are low relief anticlines decreasing in relief upwards. This indicates a deposit of less compactable material which is overlapped and draped by later sediment to create a compactional high. Further reason for discounting shallow gas is that none of the other indicators is present.

There are two high amplitude events which coincide with minor closure at the well location. These are at 240mSS (310ms horizon 1) and at 340mSS (405ms horizon 4). For the reasons given above these are not expected to be gas sands however caution is advised when approaching them.

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CONCLUSIONS AND RECOMMENDATIONS

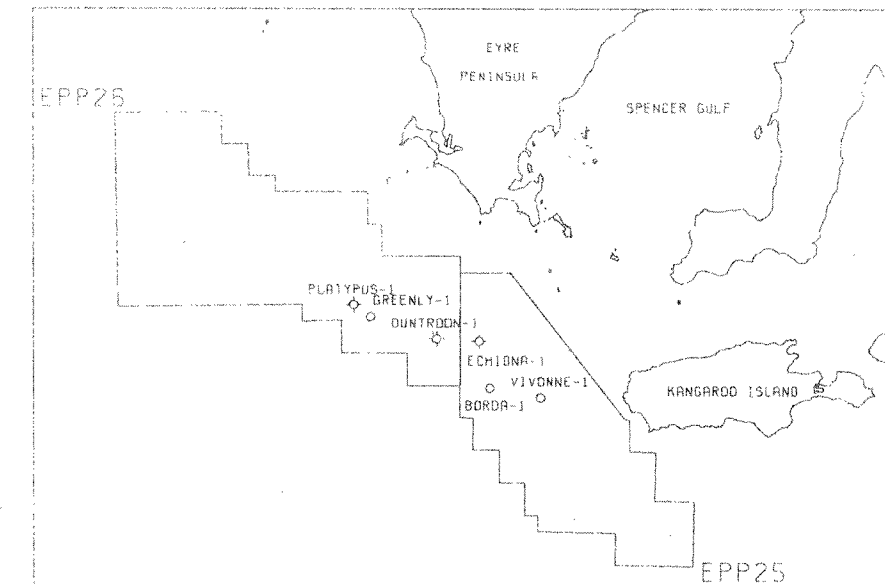
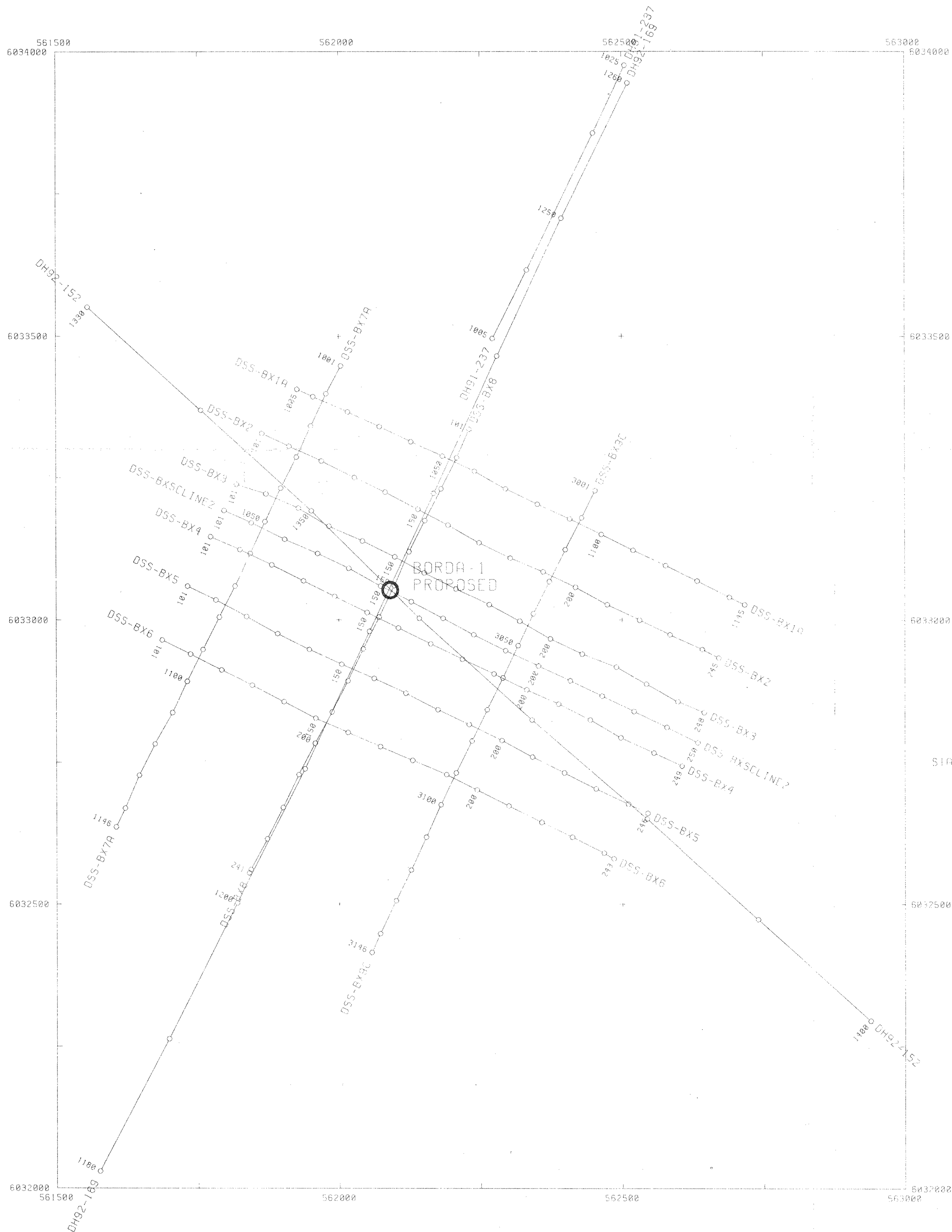
Two high amplitude events which coincide with minor closure are present at the well location shallower than the proposed 20 inch casing point. Seismic evidence and lack of shallow gas at offset wells indicates that these are not shallow gas. However caution is advised when approaching the 240mSS (310ms) and 340mSS (405ms) levels.

APPENDIX 1 - SEISMIC ACQUISITION PARAMETERS

Vessel	M.V. Pacific Oak
Streamer	high resolution digital
Traces	48 groups
Group interval	12.5 metres
Group length	12.5m
Streamer length	700m
Shotpoint interval	6.5m
Fold	48
Sample rate	1ms
Record length	1500ms
High cut filter	256Hz/72dB per octave
Low cut filter	8Hz/18dB per octave
Cable depth	1.5 to 2.5m
Cable offset	30m (max)
Airgun array volume	160cu in
Airgun array pressure	2000psi
Airgun array	single chassis, 4 airguns
Airgun array depth	1.5 to 2.5m
Water velocity	1509m/s

APPENDIX 2 - SEISMIC PROCESSING SEQUENCE

Transcription	SEG B to SEG Y
Wavelet Processing	minimum phase output, 8-256 Hz, 18-70 dB/oct
Gain Recovery	20t+71 dB/s
FK Multiple Attenuation pass	+ve 32-32 cycles/m -ve 1-32 cycles/m
DMO	dip moveout
NMO/Mute/Stack	inner and outer mute 48 fold
Statics	gun and geophone correction of -7ms
Phase Conversion	convert to zero phase
Filter	noise reduction by F-X prediction
Migration	wave equation migration by finite difference method
Filter	time variant bandpass filter
Scaling	500ms window agc applied to test displays



DUNTROON BASIN - EPP25 BORDA PROSPECT SITE SURVEY LINE LOCATION MAP ENCLOSURE 1		
SCALE 1:5000	DATE 9 APR 93	
DRAWN BY: COLLINS CHECKED BY:		

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