FIELD AREA REPORT

ON

A VIBROSEIS* REFLECTION SURVEY

FOR

MAGELLAN PETROLEUM CORPORATION

BY

SEISMOGRAPH SERVICE LIMITED

PARTY 179

CONDUCTED IN CAMEL FLATS AREA

OF OP189

NORTHERN TERRITORY AUSTRALIA

BETWEEN

23RD AUGUST AND 19TH OCTOBER 1981

*Trademark of Continental Oil Company

CONTENTS

SYNOPSIS

Magellan Petroleum Corporation contracted Seismograph Service Limited to carry out a Vibroseis seismic reflection survey in licence block OP189 of Northern Territory, Australia. The survey was over the Camel Flats Syncline.

Geological reports on the large outcrops to the north and south of the prospect gave hopes that there might be an anticlinal ridge within the syncline. No modern seismic survey had been conducted in the area and there was little evidence as to the expected data quality, depth of interest, or other structures that might be found.

The recording started on 24th August and finished on 19th October and the correlated field monitor data quality was generally good.

INTRODUCTION

The main party arrived in Alice Springs from Western Australia on 22nd August, 1981, the equipment travelling by train. The survey party arrived in July from Queensland.

The seismic lines were programmed according to topographic features and were all across leased cattle station property. No lines could be started, nor camp sites established until the Central Lands Council had approved the routes.

Similar outcropping rock formations had been found in the Amadeus Basin west of Alice Springs and it was hoped that the basin between the outcrops at Camel Flats would be as fruitful as the Amadeus.

TERRAIN AND LOGISTICS

OP189 is situated on the northern edge of the Simpson Desert south east of Alice Springs and is accessible via the rough but firm gravel road to Santa Teresa and by the smoother but softer track down the old South Road and Deep Well Station. Both routes lead to Allambi Station in the north west corner of the permit and took about 2 hours from Alice Springs. Tracks lead from Allambi south eastwards through the Train Hills to the Rodinga Range and also eastwards north of the Train Hills and then south to the Rodinga Range. There was thus a good track system to serve the bulk of the prospect.

Between the Train Hills and the Rodinga Range the Camel Flats area was of sand dunes orientated north north west, south south east. The orientation dictated the bearings of the seismic lines which were positioned between the dunes whenever possible.

The exceptions were Lines MCF81-11 and MCF81-1 which crossed the sand dunes at right angles. The dunes were very large in the west, and much smaller in the east. More large dunes were encountered in the smaller grid of lines between the Rodinga Range and the Pillar Range. Vegetation on the dunes was usually spinifex grass, with desert oaks and occassional gums in the interdunal corridors.

Both the survey and main camps were $1\frac{1}{2}$ kilometres west of Desert Bore, on the north side of the middle of the Rodinga Range. This was central to all the programme that was recorded, although the survey camp did move to Butterfly Gap (8 kilometres north of Athenita Bore) before the most easterly lines were cancelled.

Good water was available from Desert Bore and Athenita Bore and was transported to the camps in 1000 gallon tanks. Total consumption was about 1250 gallons per day.

Food was brought in from Alice Springs in S.S.L. Bedford 4 x 4 transport.

Fuel was delivered by Northern Fuels. It was often necessary to supply a vibrator and winch to pull the fuel trucks through soft patches of sand between the dunes.

Most spares and supplies were obtained from suppliers in Alice Springs. The Client provided an office for the administrator. A warehouse was rented for storage of infrequently used spares and equipment and for bulky supplies.

Labour were recruited in Alice Springs, although a few travelled from the party's previous contract near Perth. They had a week's break after three week's work or two week's break after six week's work. Transport was by station wagon Toyota Landcruiser 4 x 4 to Alice Springs, about 3 hour's drive from camp.

Staff worked approximately 3 weeks before taking a week off. They also travelled to Alice Springs and usually flew on to Adelaide by scheduled flights.

Accommodation in Alice Springs was always very difficult to find and often limited the required movements of staff.

PERMITTING AND DAMAGES

The permitting for the survey was all undertaken by the Client. This involved obtaining approval for the survey from the seven stations in the area.

The Central Land Council was approached by the Client with a view to establishing that the aboriginal community had no objection to the planned positions of the lines. An anthropologist and four aboriginal traditional owners were guided by one of S.S.L.'s Surveyors along the planned routes of the lines. Then they departed for a week to consult with other traditional owners who were no longer in the area. Finally, approval was given for all lines, with but one moved slightly to miss a sacred site.

During the survey, a number of fences were dropped to allow vehicles to pass. The Client was making arrangements for repairs to be made by personnel from Santa Teresa Mission.

Most of the work was on Alambi Station. Although Mr. Andrew Smith was remarkably understanding about the extra traffic on his property, he did expect some road improvements to be made at the end of the survey - the Client was arranging for these.

A number of gates were damaged when transporters took the bulldozers into the area. The Client was seeking redress from the transport company.

Camp sites were left clean but not flattend. Rubbish and fuel pits and generator and explosives mounds were to be filled and levelled later with a small bulldozer from Santa Teresa Mission.

EARTHMOVING

A reconnaissance of the area in June by the Client and the Party Chief led them to think a Caterpillar D8 bulldozer and a Caterpillar 14 grader would be ideal.

The Client was keen to employ a local contractor and engaged Dussin Contructions to supply what was described as a Caterpillar D7 and a grader. A transport strike delayed the arrival of the bulldozer for ten days until August 2nd, when an International TD20 arrived.

Meanwhile, a Cat 12 grader had been trying to clear the flatter portions of Line 9 since July 28th, omitting the dunes when necessary.

The TD20 was very unreliable and had only just been purchased by its owners for this contract. It only worked for 6 days from 2nd to 20th August, when it was taken off the contract.

As a temporary replacement, Dussin supplied a Cat 824 between 10th and 13th August. This was described as a 'rubber tyred D9 bulldozer' but turned out to be little more than a front end loader which could not even cross the dunes let alone cut them.

The Dussin Constructions Cat 12 grader was fairly reliable and did a good job throughout the contract in grading access tracks and lines.

Mr. Douglas Parks of Alice Springs was contracted to supply a Caterpillar D9H and a D9G to speed the cutting. They started on 14th and 18th respectively and were reliable. Their operators were helpful even if one was a little inexperienced.

The bulldozers were usually cutting the lines by following the flags left by the Surveyors when they were showing the CLC group the proposed lines. In other places the lines were set out with ranging rods for the bulldozers to start cutting and thereafter a straight line was maintained by the operators sighting backwards periodically. The lines were chained and pegged after bulldozing.

The bulldozing was completed on 19th September. The grader finished on 22nd September.

The line cutting was stopped very suddenly on the Client's instuctions, and some lines in the east were never cut.

After the bulldozers left, it was found that Line MCF81-5 was 3 kilometres short at the southern end. It was extended by a D4 bulldozer hired from Santa Teresa Mission. A grader from the mission was to have been used instead, but it broke down after only 100 metres.

SURVEY

The national transport strike delayed the start of the surveying, in that the camp equipment could not leave the storage yard in Alice Springs. The camp was set up on 21st July, 1981.

The Surveyors then worked with the Central Lands Council group, obtaining approval for the line positions. This was from 22nd July to 27th August.

Despite the grader cutting sections of Line MCF81-9, chaining and survey could not be started until there was a reasonable length of line available. Only 7 kilometres had been chained by 8th August.

White topped 0.6 metre wooden pegs were chained into position every 50 metres alongside the bulldozed track and marked with the line number and station number in felt tipped pen.

Permanent markers were set at line intersections and ends of lines. They consisted of steel star picket fencing posts driven into the ground. They were marked with aluminium tags bolted to the tops of the markers. The tags were die stamped with the line station numbers. A list of the permanent markers with their elevations and co-ordinates is given in Appendix A.

The lines were set out to fit the topographic and geological features of the area, especially in the ranges to the north and south. The bearing of a line was then established by observation of the sun azimuth at each end of the line and by measurement of the included angles along its length, using a Wild T1-A theodolite.

The theodolite and metric levelling staff were used for levelling the lines by tacheometry. Top of staff readings were also taken as a check on the chaining distances.

Priority was requested for lines in the west of the programme. In this area there was good horizontal control available from trig points at the south of Line NCF81-15 and south of Line MCF81-7 ext. Initially, elevations were also quoted with reference to the unreliable elevations given for these trig points. There was a leval traverse along the track beside Line MCF81-4 and when the survey progressed that far east the elevations were adjusted to the three reliable bench mark values.

There were trig points at the north and south of Line MCF81-5. These were used for further horizontal control and their levels tied to the nearby bench marks near Line MCF81-4 to establish that there was indeed an error in the quoted elevations for the trig stations in this area and so justify the elevation adjustment mentioned above.

The survey control used is listed in Appendix B.

The four trig points gave a reasonable check on positional errors and the elevation differences between them were a check on the field elevations. As there were no closed loops in the programme of lines, normal loop adjustment methods could not be used without introducing many extra tie lines.

All survey data was despatched to the Client, who was making his own VP Location Map, and does not form part of this report.

90 kilometres of line at the eastern end were cancelled at short notice and so terminated the survey prematurely. Of this, some 40 kilometres had already been surveyed.

RECORDING

The main camp moved from Alice Springs to Camel Flats on 23rd August 1981. Experiments were conducted on 24th and 25th August to determine the recording parameters and production started on 26th August and finished on 19th October.

The experiments were undertaken on Line MCF81-7, chosen for its relatively level profile. A noise spread was laid between the production Pegs 1164 and 1164. 24 stations of 12 bunched geophones were laid every 4.16 metres between these pegs. A single vibrator vibrated 16s sweeps of 80 to 10Hz at every other production peg from 1164 to 1142.

The correlated monitor records were glued together to give a conventional noise spread display. As a result of the noise spread, the Client requested four different geophone patterns to be laid alongside each other from Station 1168 to 1188. Source comparisons were to be made from records of the four different geophone arrays and so determine the best source and detector array combination. The four patterns were each of 24 geophones:

(a) a weighted array 112233 332211 with 7 metres between points. 77 metres overall.

(b) similarly weighted but with 5 metres spacing, 55 metres overall.

(c) a linear array with 2.6 metres spacing between geophones, 59.8 metres overall.

and

(d) a linear array with 5 metres spacing, 115 metres overall.

VP 1193 was repeated for each experiment. Three vibrators were used to determine the sweep frequencies, number of sweeps per VP, source pattern length and vibrator spacing.

Firstly using a 120 metre pattern length, 10 metres spacing and 16 sweeps per VP, sweep frequencies of 80-10Hz, 60-10Hz, 50-10Hz and 50-16Hz were compared. There seemed to be no advantage in using frequencies above 50Hz or below 16Hz. The number of sweeps was reduced to 8 per VP for subsequent tests and for production.

Pattern lengths of 120 metres, 80 metres and 62 metres were compared and the longest pattern gave sharper reflections. It was not thought wise to increase it any more, bearing in mind the 50 metres station interval.

Vibrator spacings of 10 metres, 14 metres and 20 metres were compared. 14 metres gave the best results.

The final production parameters were chosen after VP 2117 had been vibrated to check the results of using a much longer offset and after slight adjustments to make the total moveup distance fit the 100 metres between VP centres and so speed production.

The parameters are listed in Appendix C.

The first production Line was MCF81-10. At the first sign of record quality deterioration, the number of sweeps per VP was doubled to 16; this made no improvement. As the programme continued, changes in record quality were found to be frequent and were at least partly caused by the geology.

On the experimental Line MCF81-7, the first breaks were very sharp and it was decided to try and enhance these for weathering control purpose by additionally vibrating every 20th VP without moving vibrators between sweeps. While this worked on the first few kilometres of Line MCF81-10 and later on parts of Line MCF81-10 and later on parts of Line MCF81-7, the first breaks were generally very weak and no special effort was made to record them. It is possible they might be enhanced in the processing.

Once production had started, a steady rate of production was soon achieved. Geophones were moved by three Toyota pickups, manned by a total of 9 workers and a further 3 men were engaged to move cables with a Bedford truck. Only on rare occasions such as leave change days, were there serious delays awaiting geophones ahead of the vibrators.

For all production lines, the data from the geophones was amplified and digitised by the Sercel 338HR, summed in the Addit III and the sum dumped at the end of each VP back into the Sercel for formatting and recording onto ½" tape in SEG B phase encoded mode.

Equipment performance was checked by recording a set of instrument tests and checking the phase relationship between the vibrator base plate displacements and the recording truck reference sweep before production each day. The summing and noise reject functions were continuously monitored on a trace sequential oscilloscope display and correlated monitor records were produced for 24 traces of every VP recorded.

WEATHERING CONTROL

Weathering control was achieved by shallow refraction spreads at a one kilometre interval along the lines. The shots were recorded by an RS4 recording oscillograph through a 12 takeout cable with a single SM4 geophone at each takeout. Two different cables were used during the survey. The first was 135 metres long and had the following station spacings; 5 metres, 5 metres, 10 metres, 10 metres, 25 metres, 25 metres, 25 metres, 10 metres, 10 metres, 5 metres, 5 metres. Two shots were detonated from each end, one with no offset using a 2 kilogramme charge, the second shot being offset 182.5 metres from the first geophone using a 5 kilogramme charge. The second cable, which was used on

Lines, 1, 4, 5, 7, 7 ext and 19 was 277 metres long with a station spacing of 27 metres except for the first and last intervals which 17 metres. With the extra length of this cable it was often possible to define both the weathering velocity and the elevation velocity with a single 2 kilogramme shot at each end of the spread. However, time distance graphs were plotted in the field to ensure that this had occurred. If the elevation velocity was not adequatley represented, a supplementary shot, with an appropriate offset varying from 100-200 metres was recorded from each end of the spread.

At the start of the survey, it was intended to make use of some of the old mineral bores in the area by lowering a hydrophone and detonating a charge on the surface. Only one bore hole proved to be deep enough and the results agreed well with those from a nearby refraction spread.

It was also hoped that a standing VP (i.e. without the vibrators advancing between sweeps) at every 10th peg could yield valuable data to reliably fill in the gaps between the L.V.L. spreads. The L.V.L.'s would then have been used mainly to obtain information about the first weathered layer. The lack of good first breaks on the vibroseis records anywhere but close to the hills or on the gypsum of Line MCF81-7 led to this scheme being abandoned. The L.V.L.'s were still spaced every 20th peg in the hope that good breaks might be obtainable from even the summed VP's at the processing stage and therefore yield additional weathering control data.

COMPUTING

Graphs were plotted of the first arrival times at each geophone against the distance of the respective geophone from the source. The velocities could be measured from the slopes of the graphs. There was usually an intermediate weathered layer.

Typical velocities were: first weathering layer velocity V0 = 600 metres per second; second weathering layer velocity V1 = 2000 metres per second and the elevation velocity V2 = 3400 metres per second.

The thickness of the first layer, d0 was derived from:

$$d0 = \frac{Xc}{2}\sqrt{\frac{V1 - V0}{V0 + V1}}$$

Where Xc was the critical distance from the source where the direct and refracted arrival times were the same, i.e. where the slope of the graph changed from V0 to V1. The thickness of the first weathering layer was typically 10 metres throughout the prospect.

The thickness of the second weathered layer, d1, was given by:

$$d1 = \frac{1}{2}\left\{T_1 - \frac{2d0\sqrt{V2^2 - V0^2}}{V2\ V0}\right\}\frac{V2.V1}{\sqrt{V2^2 - V1^2}}$$

Where T_1 was the intercept of the velocity V2 on the time axis of the graph. The second weathered layer was typically 40 metres thick, although it was absent in some places.

The elevation profile was reduced to a flat surface and the discrete values plotted for the apparent weathering and elevation velocities and weathering layer depths against the station numbers for each line.

This allowed any spurious results to be exposed and the trends of velocities and depths to be indicated. The static correction for each station was then calculated from the linearly extrapolated values for velocities and weathering depths.

The total static correction, ts, was given by:

$$ts = \frac{d0}{V0} + \frac{d1}{V1} + \frac{e - d0 + d1}{V2}$$

Where e = elevation of the station above datum. The datum was 250 metres above sea level.

The static correction was usually between -20 milliseconds and -80 milliseconds with -40 milliseconds being typical.

CONCLUSIONS AND RECOMMENDATIONS

The record quality judged from the field correlated monitors varied from good to poor, although there were reflections present on most of the records. It is expected that good sections should be possible from the data. Until a well is drilled in the area there will always be uncertainty as to the geological assignment of the horizons.

The equipment performed reliably and was well suited to the terrain and the climate.

There was a high turn over of labour, due in part to the large transient population of Alice Springs who only expect to work for a week before moving on. Some were moving on to seasonal coastal jobs such as cray fishing and harvesting while the temperature of the interior became uncomfortably warm. If transport could be provided back to Adelaide for leaves, a more permanent work force might be engaged from there. However, even with a high turn over, thery generally worked well.

The survey section, despite being in the area about seven weeks before the recording section, were delayed by the lack of bulldozers and by the CLC scouting party. The method of on site inspection required by the the CLC meant driving in straight lines over uncleared terrain. A very time consuming exercise. It is suggested that earlier approaches to the CLC might clear programmed lines before the Seismic Party arrive. However, the personnel of the scouting party were most co-operative and amenable; a good relationship was established between them and the S.S.L. surveyors.

There were bulldozing contractors in other parts of Australia who were willing to undertake the earthmoving, although their mobilisation fee would have been high. while a local contractor should have the better backup facilities, for any future bulldozing the machinery should be closely inspected or a contract drawn up to provide for suitable replacement machinery in the event of mechanical failure.

Computing was a long and tedious business, as it was requested that account was taken of all velocity changes (however small) in order to generate corrections for each station with the minimum of extrapolation. The computing was finished some two weeks after the recording.

No doubt any future lines would be in a conventional grid formation. This would certainly make for better checks on survey positions and elevations. It would be helpful if elevation and positional control could be extended into the area of the lines before the start of the survey. This would be best done by a survey contractor equipped for such work, as the trig points are usually on the peaks of the ranges.

R.K. Abbot
Party Chief

K.A. Potts
Area Supervisor

M.5187
23rd March, 1982
Holwood, Keston, Kent

DISTRIBUTION

Magellan Petroleum Corporation	10 Copies
Seismograph Service Limited, Holwood	1 Copy
Seismograph Service Limited, Adelaide	1 Copy

LIST OF APPENDICES AND ENCLOSURES

PERMANENT MARKER LISTING

Line	No.	Elevation	Eastings	Northings
MCF 81-01				
S.O.L.	1000	400.52	454 501	7 283 131
Int 1 & 10	1100	354.70	458 501	7 285 835
	1200	331.43	462 907	7 288 538
Int 1, 9 & 15	1225 + 13	333.87	463 969	7 289 221
	1300	323.34	467 115	7 291 237
	1400	315.51	471 317	7 293 941
Int 1 & 8	1424	303.25	472 323	7 294 593
	1500	298.67	475 507	7 296 666
Int 1 & 7	1580	299.74	478 858	7 298 854
	1600	296.25	479 696	7 299 402
	1700	295.55	483 890	7 302 129
Int 1 & Road	1729	296.28	485 106	7 302 947
Int 1 & 6	1768 + 45	297.01	486 778	7 304 011
	1800	294.96	488 081	7 304 860
	1900	292.60	492 259	7 307 608
Int 1 & 5	1973 + 24	292.63	495 313	7 309 654
	2000	291.85	496 414	7 310 393
	2100	292.69	500 572	7 313 169
Int 1 & 4	2109 + 24	292.59	500 970	7 313 427
E.o.L.	2135	291.55	502 042	7 314 120
MCF81-04				
S.O.L.	1000	278.69	506 890	7 303 112
Int 4 & 16	1009 + 9	277.84	506 661	7 303 510
Int 4 & Road	1094 + 36	283.35	504 533	7 307 220
	1100	284.03	504 402	7 307 449
Int 4 & Track	1159	288.83	502 934	7 310 008
	1200	290.49	501 913	7 311 785
Int 4 & 1	1237 + 43	292.59	500 970	7 313 427
	1300	292.80	499 423	7 316 121
	1400	302.78	496 930	7 320 456
E.o.L.	1440	306.35	495 936	7 322 191
MCF81-05				
S.O.L.	939 + 20	284.71	499 408	7 299 919
	1000	288.34	498 049	7 302 627
Int 5 & Track	1047	281.52	497 022	7 304 742
	1100	287.73	495 958	7 307 231
Int 5 & 1	1151	292.63	495 313	7 309 654
	1200	294.46	494 543	7 311 983
	1300	304.10	492 971	7 316 735
	1400	308.22	491 393	7 321 484
E.o.L.	1429	310.93	490 934	7 322 861

PERMANENT MARKER LISTING (Contd.)

Line	No.	Elevation	Eastings	Northings
MCF81-07				
S.O.L.	1000	292.04	482 175	7 288 216
	1100	299.89	480 789	7 292 994
Bore	1180	294.99	479 514	7 296 811
	1200	297.18	479 215	7 297 765
Int 7 & 1	1222 + 46	299.74	478 858	7 298 854
	1300	301.81	477 678	7 302 522
	1400	311.49	476 275	7 307 321
	1500	313.18	474 749	7 312 605
	1600	318.94	473 537	7 315 939
	1700	324.27	471 723	7 321 590
	1716 + 13	324.46	471 414	7 322 342
	1800	330.25	469 826	7 326 217
Int 7 & 7 Extn	1802	330.37	469 789	7 326 309
E.o.L.	1818	330.70	469 486	7 327 050
MCF81-07 Extn	1002	329.45	470 419	7 326 003
Int 7 Extn & 7	1016	330.37	469 789	7 326 309
	1100	341.58	466 010	7 328 143
E.o.L.	1195 + 19	377.39	461 725	7 330 232
MCF81-08				
S.O.L.	1000	309.98	474 030	7 288 516
Bore	1011 + 17	307.83	473 873	7 289 061
	1100	307.14	472 693	7 293 333
	1200	301.73	471 138	7 298 609
Int 8 & 1	1126 + 13	303.25	472 323	7 294 593
	1300	306.19	496 894	7 302 933
	1400	330.16	468 885	7 307 820
Cliff	1458 + 19	349.45	468 409	7 310 681
E.o.L.	1494 + 36	348.69	468 139	7 312 496
MCF81-09				
S.O.L.	1000	326.20	464 292	7 288 474
Int 9, 1 & 15	1016 + 14	333.87	463 969	7 289 221
Bore	1037	329.72	463 555	7 290 171
	1100	334.41	462 284	7 293 052
Int 9 & Track	1164	333.91	460 985	7 295 976
	1200	338.50	460 256	7 297 620
Int 9 & Track	1254	338.55	459 167	7 300 090
Int 9 & Track	1297	350.33	458 300	7 302 057
	1300	354.18	458 239	7 302 652
E.o.L.	1388 + 34	371.25	456 448	7 306 249

PERMANENT MARKER LISTING (Contd.)

Line	No.	Elevation	Eastings	Northings
MCF81-10				
S.O.L.	958 + 14	371.25	460 900	7 282 098
	1000	353.24	459 844	7 283 896
Int 10 & 1	1045	354.70	458 704	7 285 835
	1100	357.60	457 269	7 288 181
	1200	359.77	454 706	7 292 473
Int 10 & 11	1216	359.52	454 297	7 293 160
	1300	381.91	452 147	7 296 765
	1400	383.44	449 586	7 301 058
E.o.L.	1440 + 49	371.30	448 542	7 302 821
MCF81-11				
S.O.L.	1000	403.15	439 506	7 284 396
	1100	387.67	443 807	7 286 945
	1200	374.03	448 106	7 289 492
	1300	351.76	452 405	7 292 039
Int 11 & 10	1344	359.52	454 297	7 293 160
E.o.L.	1360	345.64	454 942	7 293 542
MCF81-13				
S.O.L.	984	327.95	450 146	7 267 920
Int 13 & 14	1000	335.46	450 913	7 268 278
	1100	324.78	455 717	7 269 518
	1177 + 17	324.03	459 432	7 270 586
	1200	321.88	460 520	7 270 900
Int 13 & 15	1290	331.08	464 837	7 272 167
	1300	327.32	465 316	7 272 309
	1400	317.81	470 110	7 273 730
Int 13 & 18	1444 + 38	304.82	472 255	7 274 364
E.o.L.	1462	304.06	473 081	7 274 608
MCF81-14				
S.O.L.	1036	322.46	452 922	7 264 453
	1100	345.42	451 392	7 267 262
Int 13 & 14	1120	336.25	450 913	7 268 140
E.o.L.	1140	325.39	450 424	7 269 012
MCF81-15				
S.O.L.	1000	307.44	464 925	7 265 651
	1100	333.99	464 850	7 270 649
Int 13 & 15	1130 + 18	331.08	464 837	7 272 167
	1200	329.90	464 805	7 275 649
	1300	347.68	464 560	7 281 141
	1400	329.88	464 218	7 285 630
Int 1, 9 & 15	1472	333.87	463 969	7 289 221
E.o.L.	1488	329.13	463 911	7 290 019

PERMANENT MARKER LISTING (Contd.)

Line	No.	Elevation	Eastings	Northings
MCF81-18				
S.O.L.	1000	304.36	473 648	7 269 563
Int 13 & 18	1100	304.82	472 255	7 274 364
	1200	313.46	470 841	7 279 159
E.o.L.	1259 + 16	352.42	470 004	7 282 003
MCF81-19				
S.O.L.	1000	320.59	459 611	7 265 594
Int 13 & 19	1100	324.03	459 432	7 270 586
	1200	355.71	459 253	7 275 581
E.o.L.	1286 + 45	403.43	459 089	7 279 921

CONTROL POINTS USED

Horizontal

NMG 242	2nd order	Near Line 15
NMG 253	2nd order	Bottom Line 5
NTS 333	2nd order	Top Line 5
NTS 339	2nd order	Top Line 7 extension

Vertical

NTL 384	Near 1440 on Line 4
NTL 386	Near 1159 on Line 4

Appendix C

OP 189 CAMEL FLATS RECORDING PARAMETERS

Line	VP's	Spread (m)	Fold	Vibrator Pattern	Sweeps	Sweeps Hz	Filters Lo	Filters Hi
MCF81-10	960-978	1400-250-0-250-1400	12	3 x 13m over 124m	8	50-16Hz, 16s	12.5	62.5
MCF81-10	980-998	" " " " "	"	" " " " 236m	16	" " "	"	"
MCF81-10	1000-1440	" " " " "	"	" " " " 124m	8	" " "	"	"
MCF81-09	1388-1000	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-15	1488-1000	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-18	1258-1000	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-13	1462-1000	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-14	1140-1036	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-19	1000-1288	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-11	1000-1360	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-08	1000-1492	" " " " "	"	" " " " "	"	" " "	"	"
MCF81 Extension	1100-1000	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-07	1100-1000	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-01	1000-2134	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-04	1440-1000	" " " " "	"	" " " " "	"	" " "	"	"
MCF81-05	940-1428	" " " " "	"	" " " " "	"	" " "	"	"

Notes

1. Geophone pattern: 24 geophones per station, no weighting, 5 metres between geophones. Total 115 metres.

2. All lines recorded with 50Hz notch filter out.

Appendix D

STATISTICS

Survey Dates	21st July - 12th October
CLC Dates	22nd July - 27th August
Recording Dates	23rd August - 19th October
Days Production Recording	52½
Days Experimental Recording	2
Days Maintenance	2
Days Instrument Tests	½
Kilometres Vibrated	320.00
VP's Vibrated	3215
Sweeps Vibrated	26,044
VP's/Production Day	61.24
Weathering Control Positions	343

Appendix E

EQUIPMENT

4	Failing Y900 Vibrators on International 6 x 6 Paystar 5000's
1	Bedford 4 x 4 Recording Truck
2	Bedford 4 x 4 Workshop Truck
2	Bedford 4 x 4 Water Trucks
3	Bedford 4 x 4 Load Carriers
2	Toyota 4 x 4 Hardtop Vehicles
7	Toyota 4 x 4 Pickups
1	Toyota 4 x 4 L.V.L. Recording Truck
1	Car (for Administrator)
1	Stores Trailer
1	Mess Trailer
1	Kitchen Trailer
2	Shower Trailers
2	Office Trailers
2	Toilet Trailers
2	Static Water Tank Trailers
1	Observer's Workshop Trailer
1	Mess/Kitchen Trailer
1	Sercel 338HR Digital Recording System, 48 Trace
1	Input/Output Rotalong Switch
1	SDW400 Electrostatic Oscillograph, 48 Trace
1	Addit III Digital Compositor
1	Quantum Correlator, 24 Trace
1	Pelton Sweep Encoder
5	Pelton Advance 1 Mk. IV Vibrator Electronics (1 additional)
14	VHF Radios (2 additional)
25	1100 Conductor CDP Cables, 48 Trace, 100 metre Intervals
2304	Geophones in strings of 12, SM4, 10Hz
1	RS4 Recording Oscillograph, 12 Trace
2	L.V.L. Cables, 12 Trace (see text for intervals) (one additional)
2	Wild T1-A Theodolites
6	SSB Radios (2 additional)

Appendix F

LIST OF PERSONNEL

Technical Staff (includes leave reliefs)

Party Chief	R.K. Abbot
Deputy Party Chief/Computer	S. Wright
Assistant Computer	I. Donnelly
Observers	K.C. Filer M.T. Jenkins
Assistant Observers	P. Spragg I. Heathfield (promoted to Observer 1.10.81)
Technical Assistants	P.C. Harris M. Small
Mechanics	R. Provis J.C. Timbrell F.B. Vitnell
Surveyors	P.D. Skelton H. Beattie G.D. Leith T. Cunnington
Administrator	A. Bauer

Auxiliary Staff 34

Cooks	2
Cook's Assistants	2
Vibrator Operators	5
Drivers	6
Utility Workers	12
Survey Labour	4
Refraction Crew	2
Mechanic's Assistant	1

Additional to Contract and not paid for by Client:

Administrative Assistant	R. Lenehan