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LOGISTICS REPORT

FOR THE

GRAVITY AND GROUND MAGNETICS SURVEY

FOR

BROADMERE, MANTUNGULA AND ST. VIDGEON PROSPECTS

MACARTHUR RIVER BASIN

NORTHERN TERRITORY

OP 191, OP 198

ON BEHALF OF

AMOCO PRODUCTION COMPANY (INTERNATIONAL)

SURVEYED BY

GEOTERREX PTY. LIMITED

JOB NO. 85-1478

JULY-OCTOBER, 1983

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I. INTRODUCTION

Geoterrex Pty. Limited, of 13 Whiting Street, Artarmon, N.S.W., Australia, conducted a gravity and magnetics survey on behalf of Amoco Production Company (International), of 16825 Northchase Drive, Houston, Texas, USA., on three prospects covering leases OP 191 and OP 198 in the MacArthur River Basin, Northern Territory, Australia. The survey was completed in two periods:

1) 20 July to 27 August, 1983, during which time the Broadmere and Mantungula prospects on OP 191 were covered.

2) 21 September to 26 October, 1983, for the St. Vidgeon prospect on OP 198.

Geoterrex crew comprised one senior geophysicist only: Tony Lynch for the first period, George Nader for the second period. Geoterrex also supplied the following equipment:

- La Coste and Romberg (model G 473 for period 1, model G 586 for period 2)

- one Geometrics G 816 field (proton precession) magnetometer, one Geometrics G 816 modified base magnetometer with chart recorder and one Geometrics G 856 back-up magnetometer

- programmable calculator.

Geosystems Pty. Limited seismic company provided Geoterrex with an assistant, vehicle and all logistical support.

II. SURVEY SPECIFICATIONS

All gravity and magnetics data were acquired along bulldozed seismic lines set out on a rectangular N-S/E-W grid. Station interval was a nominal 504 metres i.e. at every 14th peg (each 28 metres apart). This interval was largely adhered to except in circumstances where the required peg could not be located or, where it was located in a deep creek bed or on top of a local ridge.

All elevation data were supplied by Geosystems. On the Broadmere and Mantungula prospects approximately 50% of the required station elevations had to be interpolated between given peg elevations, while on the St. Vidgeon prospects gravity stations were chosen where elevations had been surveyed.

The survey coverage comprised:

Prospect	Lines	Approx. Length (kms)
BROADMERE	83-110	8.5
	83-112	16.5
	83-114	20.1
	83-116	23.0
	83-118	26.2
	83-120	28.2
	83-122	28.4
	83-124	22.0
	83-126A	18.0
	83-111	24.9
	83-113	50.6
	83-115	35.0
	83-117	18.5
		319.9 kms Total Stations = 651
MANTUNGULA	83-140	13.2
	83-142	14.4
	83-144	16.1
	83-146	18.1
	83-148	9.7
	83-141	22.7
	83-143	28.9
		123.1 kms Total Stations = 240

ST. VIDGEON	83-160	11.5
	83-162	22.4
	83-164	22.7
	83-166	21.7
	83-168	22.3
	83-170	20.0
	83-172	15.0
	83-174	12.8
	83-161	12.2
	83-163	16.2
	83-165	14.9
	83-167	15.5
	83-169	21.4
	83-171	19.7
	83-173	17.9
	83-175	17.7
	83-177	8.2
		292.1 kms Total Stations = 608

Total survey length = 735.1 kms
Total survey stations = 1499
Total production days = 64.25
Average number of stations (including field data reduction)
per production day over entire survey period = 23.3 stations per day.

III. SURVEY PROCEDURE

Access around the survey areas for the two-man crew was by means of a 4WD Toyota Landcruiser trayback. Base station readings were taken at the start and end of each loop, with loop duration being about 3 to 4 hours. Usually both the gravity and magnetics readings were recorded simultaneously, except where the magnetics or gravity had to be repeated.

1. Magnetics

To remove the effect of diurnal variation from the total magnetic field measurements, a base station magnetometer was established at the operating base. Readings were recorded every 20 seconds for the Broadmere and Mantungula surveys using the modified Geometrics G 816 magnetometer with chart recorder, while the sample interval for St. Vidgeon prospect was one minute, using the Geometrics G 856 unit with data printout facility.

Because of the larger area involved, a series of base stations was established on the Broadmere and Mantungula prospects, while only one central base was used for the St. Vidgeon area. The locations of the bases are listed in Appendix B.

In general, magnetics bases were set up about 50 to 75 metres away from track intersections, usually in a NE direction, to avoid the interference from passing vehicles. The magnetic sensor was mounted on a verticle pole 2 metres off the ground for Broadmere and Mantungula areas, and was orientated at 45° from vertical for St. Vidgeon.

Before the magnetometer was read at each station, the vehicle was driven down the line about 50 metres. The magnetic sensor was mounted on the end of a 2 metre aluminium pole. Usually 3 or 4 readings were taken at each station, within a 10-30 metre radius of the station peg.

In areas of surficial or shallow laterite cover it was necessary to take up to 10 or 20 readings before a meaningful averaged value was obtained. This laterite effect was particularly noticeable over most of the St. Vidgeon area and also to a significant extent on the eastern section of the Broadmere prospect. In these regions readings may vary hundreds or even thousands of nanoteslas over just a few metres.

Where readings were taken at line intersections or permanent steel picket markers, care was taken to record data at least 20 metres away from the metal pegs, usually to the north of the intersection.

2. Gravity

The first day was spent tying in government gravity bench-marks to the southern end of the Broadmere grid. Bench-marks 5907. 3092, 5907. 3094 and 5907. 3097 were sought but could not be recovered. The latter benchmark occurred at or near the abandoned homestead of O.T. Downs (latitude 16° 37.3'S, longitude 135° 2.8'E). The gravity value was recorded here on a concrete verandah (description of location in Appendix F), and also a reading was taken at the assumed location of BM 5907.3094 (latitude 16° 35.9'S, 135° 12.2'E), near the intersection of a track and creek (see Appendix F). As the recorded difference between the corrected observed gravity readings (corrected for instrument factor, tidal effect and meter drift), 4.69 mgals, compared favourably with the given government computed difference of 4.50 mgals, it was assumed that the O.T. Downs reading was sufficiently accurate for the purpose of tying in the Broadmere grid. A gravity loop tying in station VP 109 on line 83-113 with O.T. Downs BM was then completed. The difference in corrected observed readings between L83-113VP109 and O.T. Downs BM was 11.71 mgals.

L83-113 VP 109 was the first of 17 base stations established on Broadmere at the survey line intersections next to the cement steel picket. Only Base 2 was located at a wooden peg on L83-113 VP 445.

The Mantungula grid was later tied to Base 16 (intersection L83-113/83-126A) to establish Base 18 at intersection L83-142/83-143. The difference in the corrected observed reading between Base 18 and Base 16 is 6.65 mgals. Bases 18 to 23 were established at line intersections on the Mantungula grid (See Appendix B).

Two government benchmarks, numbers 6708.407 (latitude 15^{o} 2.8'S, longitude 134^{o} 41.5'E) and 6708.408 (latitude 15^{o} 3.7'S, longitude 134^{o} 42.9'E) were tied in to the St. Vidgeon grid at the intersection of lines 83-166 and 83-169. This intersection constituted the only base (number 24) for the St. Vidgeon area. The difference in corrected observed reading between base 24 and BM 6708.407 is 0.88 mgals. The satellite navigation station SV1 was also tied to base 24: the difference between base 24 and the satellite navigation station is 5.44 mgals.

All line intersections were repeated at least once so that they could be used as a suitable base station at a later stage in the survey, or should survey lines be extended in the near future. A summary of the corrected observed reading, Bouguer values, elevation and corrected magnetic value for each base station is given in Appendix B.

All gravity readings were taken adjacent to the survey peg except where the track had been regraded along soft sandy stretches, thus significantly lowering the original surveyed level. In these few instances readings were taken off on the side of the track.

With loop periods of around 3 to 4 hours, operating in temperatures usually $25^{o}C$ to $35^{o}C$, and sometimes driving over rugged tracks where survey lines pass near ridges, the rate of drift on the gravity meters was found to be in the order of 10^{-3} mgals per hour (see Appendix D).

Only on two occasions were gravity loops repeated because of a tare in the meter.

There were two instances where seismic activity was observed to affect the gravity meter; on 25 August ½ hour was lost, and on 22 October 3 hours were lost. No discernable influence of the vibrator trucks was seen to affect the gravity meter, although readings were never taken closer than about 1 km to the trucks.

Apart from repeated readings at intersections other stations were also repeated to monitor the accuracy of the gravity and magnetics data. Altogether 1499 new stations were occuped over the 3 prospects, and a total of 175 stations (11.6%) were repeated (excluding base readings). A listing of the repeated stations is given in Appendix C.

IV. DATA REDUCTION AND PRESENTATION

All gravity data were reduced in the field to Bouguer gravity values and plotted as profiles and contours of one Bouguer density (2.2 gm/cc). The gravity data were recomputed in the office before storing on 9-track tape for presentation. The magnetics data were also corrected in the field for diurnal drift. Two tapes were produced, the first containing all the raw gravity data, the second with all the reduced gravity data, using 6 Bouguer densities of 2.1, 2.2, 2.3, 2.4, 2.5 and 2.67 gm/cc. Both tapes stored the raw and corrected magnetic reading. Tape formats are listed in Appendix G.

1. Gravity Reduction

The following corrections were applied to the gravity meter readings to obtain Bouguer gravity values:

Bouguer gravity = corrected observed gravity + free-air correction - Bouguer correction + latitude correction + standard correction,

where the

Corrected observed gravity is the gravity meter reading multiplied by the appropriate instrument conversion factor, corrected for meter drift over the period of the loop, and corrected for tidal effects. Hourly tidal correction tables were supplied by the Bureau of Mineral Resources, Canberra. The appropriate conversion factors for gravity meters G 473 and G 586 were 1.00922 and 1.02708 respectively.

Free-air correction in effect relocates the station, at elevation h above the datum plane, back to the datum plane, which in this case was sea-level. The correction factor is 0.3086 h mgal/metre.

Bouguer correction compensates for the effect of the attraction of the rock material between sea-level and the station at elevation h. The Bouguer correction factor is 0.04185 p h, where six Bouguer densities (p) were used: 2.1, 2.2, 2.3, 2.4, 2.5, 2.67 gm/cc.

Latitude correction accounts for the decrease in the gravitational force that a body experiences nearer the equator than the poles. Such a decrease is due to the centrifugal force of the earth's rotation plus the effect of the increased distance from the centre of the earth's mass as the equator is approached. The latitude correction was applied in the form of a latitude gradient, which was 0.43908, 0.42736 and 0.41150 mgals/km true north for Broadmere, Mantungula and St. Vidgeon areas respectively. These gradient factors were calculated using the 1930 International Gravity Formula, where the gravitational attraction at a given latitude $\emptyset$ is given by:

$$g_{\emptyset} = 978.049\ (1 + 0.0052884 \sin^2 \emptyset - 0.0000059 \sin^2 2\emptyset)\ \text{gals}$$

The latitude pairs used to calculate the gradient for each prospect are:

Broadmere:	$16^{\circ}5'S/16^{\circ}40'S$
Mantungula:	$15^{\circ}40'S/16^{\circ}00'S$
St. Vidgeon:	$15^{\circ}07'19"S/15^{\circ}16'17"S$

The Geoterrex field geophysicist was supplied with Australian Map Grid (A.M.G.) co-ordinates for all stations by Geosystems. Since the divergence between true north and AMG north is 0.1° for all prospects, the AMG north was used to calculate distances due north of a given reference line for each area. The error in this assumption is discussed in the next section. For Broadmere, Mantungula and St. Vidgeon the E-W reference lines (from which northing distances were measured) were 8160000 mN, 8230000 mN and 8328172.41 mN (satellite station SV1 near airstrip) for Broadmere, Mantungula and St. Vidgeon respectively.

Standard Correction is a constant adjustment applied to all the data in each area to bring the data into agreement with the government gravity network. For Broadmere, Mantungula and St. Vidgeon these values are -455.66, -425.18 and -43.42 mgals respectively. (The gross difference between values for St. Vidgeon and the other two areas is correct, and is simply due to an arbitrary choice by the operator of the initial assumed corrected base reading.)

Note that no terrain corrections were applied as it was deemed by the operators that even in the few locations where the ground was not relatively flat the effect would be less than the reading accuracy of the gravity meter, i.e. less than $\pm$ 0.01 mgal. In the few instances where a proposed gravity station may have been situated on a sharp topographic feature an alternative station was chosen nearby to ensure there was no contribution of terrain effect on the gravity reading.

2. Magnetics reduction

The magnetics data were all corrected relative to a particular base station value on each prospect:

Prospect	Base Station	Assumed Magnetic Value
Broadmere	L83-113, VP 445	49000 nT
Mantungula	L83-142/L83-143	48550 nT
St. Vidgeon	L83-166/L83-169	48250 nT

Field magnetometer and base station magnetometer readings were recorded at the start and end of each loop to calibrate the two instruments, and an offset difference was corrected for, as well as the diurnal change.

V. DATA ACCURACY

Over the three prospects a total 1499 stations were read, and a total of 175 stations were repeated (excluding base loop readings) to monitor the data accuracy. An analysis of the repeat differences is given below:

	Range	Mean Difference	Stand. Dev. of Differences
Gravity	-0.06 to 0.06	0.005	0.021 mgal
Magnetics	-18 to 36	0.5	6.4 nT

Source of Errors

1) Gravity

In the corrected observed reading the errors, as is manifest in the above analysis of the repeated data, may be due to a combination of low frequency seismic activity causing very slow drift of the gravity meter needle; instrument reading accuracy of $\pm$ 0.01 mgal; instrument drift, as influenced by external vibration, generally around 1×10^{-3} mgal/hour; interpolation of hourly tidal corrections, introducing possible errors of no more than $\pm$ 0.01 mgals; and operator error.

Errors in elevation and latitude correction factors are not evident in the repeated data. Errors in the Bouguer gravity value due to elevation errors amount to approximately 0.2 mgal/metre. Most elevations supplied were rounded to the nearest centimetre, and many station elevations on the Broadmere and Mantungula prospects were values interpolated between given surveyed stations with height differences mostly less than one metre, though in some instances exceeding five metres. There must also be some contribution to the final elevation error due to the uncertainty in the location of the gravity instrument with respect to where the original elevation reading was recorded. This was only a problem in areas of soft sand, where the ground elevation adjacent to a peg may have been lowered by up to 10 or even 20 cm by regrading the tracks.

The overall elevation accuracy for most of the stations is considered to be better than ± 2 cm, while the assumed elevations for a small percentage may be in error by about ± 5-10 cm, the latter giving an error of ± 0.01 - 0.02 mgals in the final Bouguer value.

Finally, the error in the latitude correction factor due to the assumption that the AMG north equalled true north is negligable, amounting to a small gradient of about 0.001 mgals per 20 km along an E-W profile.

2) Magnetics

The reading accuracy of the Geometrics G 816 magnetometer is ± 1 nT; for model G 856 the accuracy is ± 0.1 nT, although the values were rounded to the nearest integer. At the commencement of the survey the three magnetometers were set up at the same location and were found to give similar read-outs to within ± 2 nT. As all readings were taken away from the influence of vehicle and metal stakes it is reasonable to assume that where repeated readings differed from the original readings by more than ± 2 nT this was probably due to the local high magnetic gradient. In areas of surficial and shallow-buried laterite magnetic readings varied by up to hundreds or even thousands of nanoteslas over a few metres, and so required a large number of readings in a radius of about 20 metres of the peg before a reliable averaged value was obtained. The quality of the ground magnetics data is especially impaired on the St. Vidgeon prospect where laterite was extensive, while the data on the eastern section of Broadmere was to a lesser degree also affected by laterite. Mantungula magnetics, on the other hand, was relatively free of geological noise.

Magnetic storm activity during the survey periods was minimal, the most notable occurrences being observed on July 24, August 8 and October 4. However, after considerations of wide field sample interval, close monitoring of magnetic field by the base station and the inherent variability in the field data due to geological noise, it was felt the significant additional time required to return to repeat the few stations recorded during a storm phase could not be justified. The only magnetics data that was repeated was when the base station malfunctioned, i.e. on 24, 28, 29 July; 29 September; 5, 6 October.

Occasionally the G816 base station magnetometer trace showed significant fluctuations at irregular sample intervals around an otherwise quiet diurnal background. On one of these occasions all three magnetometers were monitored closely and a similar pattern was observed on all three instruments. It was thought that this was due to loss of lock on the magnetic signal and so the sensor was then orientated at about 45^{o} to the vertical.

VI. CONCLUSIONS AND RECOMMENDATIONS

From a consideration of the 11.6% repeats over 1499 stations, the accuracy (one standard deviation of the repeat differences) of the gravity and magnetics data is ± 0.021mgals and ± 6.4 nanoteslas respectively.

To improve the efficiency and accuracy of the gravity survey it is recommended that stations where readings are required could be marked with flagging tape and their elevations surveyed. This would not only ensure there would be no elevation errors due to interpolation between adjacent known stations, but should save time in not having to look around for fallen pegs or missing pegs that were collected after the seismic traverse is completed.

Geoterrex Pty. Limited flew two aeromagnetic lines at its own expense on the Broadmere prospect : lines 83-116 and 83-122. Copies of these traces are in Appendix H. The comparison between the ground magnetics and the aeromangetics profile shows the superiority of the low-noise aeromagnetics data. The magnetometer system used was a high-sensitivity Cesium-vapour type, with 0.04 nanotesla sensitivity, noise envelope ± 0.1 nT and sample interval 200 m. sec (approx. 15 metres). Aeromagnetic data over the St. Vidgeon prospect would have given significantly more information on the geological structure than was possible with the ground magnetics due to masking by the near-surface laterite.

If further work is to be considered for the MacArthur Basin project it is highly recommended that preliminary aeromagnetic data be collected as a cost-effective approach to planning seismic line locations.

Respectfully submitted,
GEOTERREX PTY. LIMITED

A.M. LYNCH
MANAGER
GROUND SURVEYS

A P P E N D I X B

BASE STATION DATA

A) BROADMERE

BASE NO.	LOCATION	C.O.R.	BOUGUER (2.2)	MAG
1	L83-113, VP 109	417.49	5.32	49041
2	L83-113, VP 445	416.49	6.94	49000
3	Inter 83-112/83-111	410.49	0.32	48944
4	L83-113, VP 917	406.97	2.03	48922
5	Inter 83-112/83-115	410.72	6.67	48944
6	Inter 83-111/83-114	407.12	0.50	48898
7	Inter 83-113/83-116	408.95	1.30	48890
8	Inter 83-111/83-118	411.74	3.03	48861
9	Inter 83-120/83-111	409.81	5.16	48832
10	Inter 83-118/83-113	409.54	6.87	48853
11	Inter 83-115/83-118	409.51	7.60	48839
12	Inter 83-120/83-115	410.10	8.85	48833
13	Inter 83-111/83-122	410.53	6.80	48812
14	Inter 83-122/83-113	414.93	9.85	48836
15	Inter 83-122/83-115	412.93	9.53	48829
16	Inter 83-113/83-126A	412.87	7.59	48804
17	Inter 83-115/83-126A	409.90	8.08	48804

B) MANTUNGULA

18	Inter 83-142/83-143	419.52	23.34	48550
19	Inter 83-143/83-144	418.04	23.52	48546
20	Inter 83-143/83-148	414.12	22.63	48474
21	Inter 83-142/83-141	427.49	27.35	48555
22	Inter 83-141/83-144	425.95	26.42	48543
23	Inter 83-143/83-146	415.73	23.52	48528

C) ST. VIDGEON

24	Inter 83-166/83-169	46.06	12.90	48250

C.O.R. = Corrected observed gravity reading.

BOUGUER (2.2) = Bouguer gravity value for density 2.2 gm/cc

MAG = Total field magnetic value corrected for diurnal drift.

APPENDIX C

REPEATED STATION DATA

		LOOP NUMBER		ORIG - RPT	
LINE	STATION	ORIG	RPT	GRAVITY	MAGNETICS
83-113	445	1	1	0.02	0
83-113	305	1	1	0.01	0
83-110	353	2	2	0.00	-
83-113	917	3	3	0.04	- 6
83-112	248	3	3	-0.01	-
83-111	1697	5	5	0.01	- 2
83-113	1356	6	6	-0.01	-
83-113	1134	6	6	0.01	-
83-112	855	7	7	0.00	-11
83-115	1546	8	8	0.02	- 1
83-115	1546	8	8	0.00	- 3
83-115	1921	9	9	0.00	-10
83-111	1497	10	10	0.01	- 3
83-114	577	8	10	0.06	-
83-114	764	10	10	0.02	-
83-111	1497	10	10	0.02	-
83-111	1274	12	12	0.01	2
83-116	610	6	13	-0.04	-12
83-116	942	13	13	0.03	-
83-116	942	14	14	-0.01	- 2
83-116	1165	14	14	0.02	-
83-116	942	13	14	0.00	-
83-113	1441	6	15	-0.02	-10
83-118	729	15	15	0.01	1
83-111	1051	15	15	0.02	- 4
83-111	828	16	16	0.02	0
83-111	828	16	17	0.04	0
83-111	828	17	17	0.06	- 1
83-118	1062	20	20	0.01	- 3
83-115	1546	8	21	0.03	-18
83-115	1324	13	21	0.03	4
83-115	659	22	22	0.01	-
83-115	880	22	22	-0.01	0
83-120	493	23	23	0.01	1
83-120	1007	19	24	0.06	4
83-113	1579	15	24	-0.01	7

83-120	952	24	24	0.02	4
83-111	606	25	25	0.00	0
83-122	972	26	26	-0.01	-
83-113	1802	24	27	0.05	- 1
83-120	979	24	27	0.01	- 2
83-120	923	24	27	-0.02	- 3
83-122	636	28	28	0.01	-
83-113	2219	29	29	0.00	- 2
83-113	2137	29	29	-0.03	3
83-113	2413	29	29	-0.01	-
83-122	353	30	30	-0.03	- 4
83-155	489	29	31	0.02	3
83-124	1055	31	31	0.01	0
83-113	2669	32	32	0.01	- 3
83-126A	1471	33	33	0.00	-
83-126A	2050	34	34	0.01	0
83-126A	1879	34	34	0.00	0
83-111	385	34	34	0.00	-
83-126A	1253	35	35	-0.02	- 6
83-115	185	36	36	-0.01	0
83-115	48	31	37	0.01	9
83-115	381	37	37	0.00	- 1
83-113	2389	29	38	0.01	-
83-111	395	34	39	0.01	- 4
83-124	431	29	39	0.00	- 8
83-111	465	39	39	-0.01	0
83-122	972	26	54	0.01	- 4
83-117	427	54	54	-0.02	- 3
83-117	661	54	54	0.04	- 3
83-117	1130	55	55	0.03	0
83-117	896	55	55	0.00	1

83-143	1593	40	40	0.02	0
83-142	784	41	41	0.01	4
83-140	726	43	43	0.01	- 2
83-143	1593	40	43	0.01	0
83-143	903	44	44	-0.01	- 1

83-143	237	45	45	0.01	1
83-143	570	45	45	0.01	- 2
83-141	913	47	47	0.02	- 1
83-141	833	47	47	0.01	0
83-141	221	43	48	-0.01	- 6
83-141	389	48	48	0.00	- 1
83-141	1245	49	49	-0.01	- 2
83-144	669	44	50	0.02	0
83-144	437	50	50	-0.02	- 1
83-146	211	49	51	-0.02	- 6
83-146	449	51	51	0.03	- 2
83-146	871	52	52	-0.02	0
83-148	365	53	53	-0.01	1
83-143	181	46	53	0.00	- 7
83-143	209	45	53	0.03	- 7
83-169	577	56	57	-0.01	7
83-169	715	57	57	0.04	0
83-171	773	58	58	0.03	- 1
83-171	543	58	58	-0.02	- 3
83-169	1021	59	59	0.01	- 2
83-173	971	60	60	0.02	1
83-173	833	60	60	-0.04	3
83-171	543	58	61	-0.02	7
83-171	241	61	61	-0.02	0
83-175	330	62	62	0.02	-
83-175	447	62	63	-0.01	- 1
83-175	829	63	63	0.02	0
83-175	663	63	63	-0.03	1
83-175	447	62	63	0.01	- 5
83-163	179	64	64	-0.01	1
83-163	521	64	64	-0.03	- 1
83-166	521	58	65	0.01	- 4
83-166	382	60	65	-0.04	- 2
83-166	216	62	65	-0.02	6
83-163	540	64	66	-0.02	2
83-163	803	66	66	0.02	3
83-163	659	66	66	0.02	3

83-169	688	57	81	-0.01	- 4
83-164	616	68	81	-0.01	- 3
83-164	478	70	81	-0.03	- 7
83-164	340	66	81	0.04	18
83-164	226	78	81	0.01	9
83-164	785	57	82	-0.01	2
83-164	924	58	82	-0.03	13
83-164	1063	71	83	-0.02	11
83-164	1229	63	83	0.01	8
83-160	667	56	83	0.04	5
83-160	528	58	83	0.01	3
83-160	389	71	84	0.00	10
83-160	223	63	84	0.02	11
83-172	857	85	85	0.01	2
83-172	773	85	85	-0.01	- 2
83-174	241	86	86	0.00	0
83-172	698	85	86	0.01	0
83-172	577	86	87	0.02	- 2
83-177	410	86	88	0.02	0
83-169	1161	59	88	0.01	-
83-172	521	87	89	0.00	1
83-172	437	89	90	0.03	-
83-174	409	86	90	0.00	35
83-169	1051	91	91	0.01	-
83-172	201	90	92	0.01	- 5
83-172	139	92	92	0.00	-

	Gravity	Magnetics
Total no. repeats	175	143
Range of differences	-0.06 to 0.06 mgal	-18 to 36 nT
Mean difference	0.005 mgal	0.5 nT
Standard deviation	0.021 mgal	6.4 nT

APPENDIX D

GRAVITY METER DRIFT

LOOP NO.	DRIFT RATE x 10^{-3} mgal/hr	LOOP PERIOD (hrs)
1	3.09	3.92
2	0.36	3.55
3	-2.04	4.78
4	-1.11	1.20
5	3.97	1.53
6	4.76	3.82
7	1.06	2.90
8	1.49	4.83
9	-1.37	2.00
10	0.82	5.47
11	4.76	1.55
12	3.39	3.00
13	2.43	3.75
14	2.69	4.20
15	-0.74	5.16
16	-10.00	1.88
17	0.67	3.22
18	-0.77	2.00
19	2.61	1.18
20	2.61	4.18
21	0.00	2.23
22	-1.79	2.48
23	2.28	2.43
24	-0.53	2.90
25	-3.79	3.65
26	-1.65	1.75
27	6.18	1.38
28	5.94	1.88
29	0.44	3.88
30	4.48	2.87
31	-0.41	3.83
32	2.18	2.38
33	-0.56	1.45
34	-0.49	2.62
35	-1.70	2.42
36	0.50	0.95
37	5.40	1.38
38	10.90	0.18
39	1.03	3.20
40	5.56	4.28

41	-1.81	3.40
42	-1.47	0.62
43	7.67	5.28
44	-1.52	4.67
45	1.86	4.10
46	7.95	1.32
47	5.38	5.10
48	1.22	3.93
49	3.35	3.02
50	0.38	3.32
51	-0.36	3.03
52	4.47	3.32
53	1.96	4.08
54	-1.00	4.42
55	1.93	4.97
56	5.88	5.05
57	8.40	2.35
58	2.40	5.72
59	-2.52	3.20
60	0.29	4.25
61	1.86	3.92
62	14.40	2.92
63	2.88	5.25
64	0.78	4.05
65	8.40	3.67
66	7.80	3.80
67	0.52	4.17
68	0.35	3.27
69	8.64	3.98
70	-12.61	4.18
71	4.8	4.45
72	3.96	4.53
73	1.80	4.00
74	1.14	5.67
75	4.98	3.48
76	0.96	5.93
77	6.00	3.75
78	4.32	4.07
79	7.02	4.83
80	-2.40	3.33
81	2.16	6.02
82	5.52	4.28

83	4.74	4.85
84	2.10	3.35
85	1.50	2.07
86	1.19	4.13
87	3.72	1.25
88	1.86	3.62
89	3.54	4.03
90	3.96	5.55
91	7.80	3.53
92	4.56	3.20

Drift Rate Range	=	-12.60 to 14.40 x 10^{-3} mgal/hour
Mean Drift Rate	=	2.19 x 10^{-3} mgal/hour
Standard Deviation	=	3.87 x 10^{-3} mgal/hour
Loop Period Range	=	0.18 to 6.02 hours
Mean Loop Period	=	3.44 hours
Standard	=	1.31 hours

A P P E N D I X E

PRODUCTION LOG

GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1678 TYPE OF SURVEY GRAVITY/MAGNETICS.

	DATE	PRODUCTION	LOOP No(S)	Daily Total	Cum. Total
SUNDAY					
MONDAY					
TUESDAY					
WEDNESDAY	20 July 1983	T. Lynch flew Sydney - Mt Isa - Broadmere camp. Arrived camp about 5-30 pm			
THURSDAY	21	BROADMERE : Familiarisation with survey area. Tied in govt benchmarks H3094, H3097 (O.T. "DOWNS") to L83-113 BP 109. 5.30 pm return			
FRIDAY	22	BROADMERE : L83-113 L83-110 Field 7.15am - 6pm Office 1hr	1, 2	37 (3 pts)	37 3 pts.
SATURDAY	23	BROADMERE : L83-113 , L83-112 , L83-111 Field 7am - 6.30pm Office 1½ hrs	3, 4, 5	31 (3 pts)	

ACCOMMODATION: Hotel Name — ..... Period — ..... Bill paid by Client or Geoterrex?

VEHICLE HIRE: Company Hired From — ..... Period — .....

PURCHASE ORDERS: Attach Pink Copy of Order to this report.

NOTES:

PARTY CHIEF : T. LYNCH

Form 102 – N.P.

GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1478 TYPE OF SURVEY GRAVITY / MAG.

	DATE	PRODUCTION	Loop Nos	Daily Total	Cum. Total
SUNDAY	24 July	BROADMERE: L 83-113, L 83-112 field 7am - 6.30pm office 1½ hrs	6, 7	36 (3 rpts)	
MONDAY	25	BROADMERE: L 83-115, L 83-114 field 7.45am - 5.15pm office 4 hours	8, 9	35 (3 rpts)	
TUESDAY	26	BROADMERE: L 83-111, L 83-114 Field 7am - 6pm office 5 hours	10, 11	35 (4 rpts)	
WEDNESDAY	27	BROADMERE: L 83-111, L 83-116 Field 9am - 1pm office 6½ hrs Reparation for camp move	12	16 (1 rpt)	
THURSDAY	28	BROADMERE: Moved camp to Broadmere homestead. L 83-116 Field 11.30 am - 4.45 pm office 1½ hrs	13	21 (2 rpts)	
FRIDAY	29	BROADMERE: L 83-116 Field 8.30 am - 2.30 pm + 2½ hrs repeat mag (base stn malfunction) office 2½ hrs	14	16 (3 rpts)	
SATURDAY	30	BROADMERE: L 83-111, L 83-118, L 83-113 Field 8.30 - 5.15 pm office 2 hrs	15, 16	31 (4 rpts)	

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Form 102 – N.P.

GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1478 TYPE OF SURVEY GRAVITY / MAGNETICS.

	DATE	PRODUCTION	LOOP Nos.	Daily Total	Cum. Total
SUNDAY	31 July	BROADMERE · office 8 am - 9-30 pm data reductions.			
MONDAY	1 August	BROADMERE: L 83-120, L 83-118 Field 8.30 - 6.30 pm.	17, 18, 19	36 (2 pts)	294 (28 pts)
TUESDAY	2	BROADMERE: L 83-118 Field 8 00 - 2.30 pm office 3.30 - 9.30 pm	20	31 (1 pt)	325 (29 pts)
WEDNESDAY	3	BROADMERE: L 83-115 Field 10.30 - 5-30 pm office. 7-00 am - 10.30 pm	21, 22	31 (4 pts)	356 (33 pts)
THURSDAY	4	BROADMERE. L 83-120, L 83-113 Field 9-6 pm. office 8-9 am, 7.30 pm - 8.30 pm. ONE HOUR TRAVEL EACH WAY TO SITE	23, 24	38 (4 pts)	394 (37 pts)
FRIDAY	5	BROADMERE · L 83-111 L 83-122 Field 9.30 - 6 pm. office 7.30 - 9 am, 7.30 - 8.30 pm. ONE HOUR TRAVEL ETCH WAY.	25, 26	31 (2 pts)	425 (39 pts)
SATURDAY	6	BROADMERE: office: 12 hrs calculations / plotting		0	425 (39 pts)

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Form 102 – N.P.

GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1478 TYPE OF SURVEY GRAVITY/MAG.

	DATE	PRODUCTION	Loop Nos.	Daily Total	Cum. Total.
SUNDAY	7 August 1983	BROADMERE : L83-113, L83-122, L83-124. Field 7.15 - 6pm. Calcs 7-30 - 8-30 pm.	27, 28, 29	44 (7 pts)	469 (46 pts)
MONDAY	8	BROADMERE : L83-122, L83-115, L83-124 Field 8 am - 6.30 pm Calcs 8-9 pm. STILL ONE HOUR EACH WAY TO SITE.	30, 31	44 (3 pts)	513 (49 pts)
TUESDAY	9	BROADMERE : L83-113, L83-126, L83-111 Field 7.45 am - 6 pm.	32, 33, 34	48 (5 pts)	561 (54 pts)
WEDNESDAY	10	BROADMERE Calculation / plotting 9 am - 10 pm		0	561 (54 pts)
THURSDAY	11	BROADMERE L83-126, L83-115 Field 7.45 am - 3 pm Calcs 4 - 7 pm.	35, 36, 37, 38	31 (5 pts)	592 (59 pts)
FRIDAY	12	BROADMERE : L83-111, L83-124 ONE HOUR DRIVE EACH WAY TO SITE. PM: PACKED CAMP AND MOVED TO MANTUNGULA CAMP. ARRIVD 6:30pm	39	18 (3 pts)	610 (62 pts)
SATURDAY	13	AM: MANTUNGULA : Tied in Base #18 on Mantungula to B#16 on Broadmere. PM: BROADMERE : Calculations (7 hrs)		0	

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GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1478 TYPE OF SURVEY GRAVITY / MAG.

	DATE	PRODUCTION	Loop Nos	Daily Total	Cum. Total
SUNDAY	14 August 1983	BROADMERE. Calculations / plotting 7.30 am - 10.15 pm			
MONDAY	15	MANTUNGULA. L 83 - 143, L83 - 140, L83 - 142 Field 7.30 - 5.30 pm.	40, 41, 42	45 (2 mpts)	45 (2 mpts)
TUESDAY	16	MANTUNGULA. L 83 - 140, L83 - 143, L83 - 144, L83 - 142 Field 7.30 - 6.30 pm	43, 44	51 (3 mpts)	96 (5 mpts)
WEDNESDAY	17	MANTUNGULA. L 83 - 143, L83 - 148 Field 7.45 - 6.30 pm. 2 HRS LOST DUE TO GRAVITY METER OVERHEATING.	45, 46	34 (2 mpts)	130 (7 mpts)
THURSDAY	18	BROADMERE. Calcs + plotting 12 hrs. Received elevations 83-113 previous evening.		0	130 (7 mpts)
FRIDAY	19	BROADMERE. Calcs / plotting 12 hrs.		0	130 (7 mpts)
SATURDAY	20	MANTUNGULA: Calcs / plotting 12 hrs.		0	130 (7 mpts)

ACCOMMODATION: Hotel Name – ..... Period – ..... Bill paid by Client or Geoterrex?

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GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 83-1478 TYPE OF SURVEY GRAVITY / MAG.

	DATE	PRODUCTION	Loop Nos.	Daily Total	Cum Total.
SUNDAY	21 Aug 1983	MANTUNGULA : L 83-141 L 83-144 Field 8 am - 7 pm + 1 hrs calcs. No assistant today.	47, 48	40 (4 xpts)	170 (11 xpts)
MONDAY	22	MANTUNGULA: L 83-141, 83-146, 83-144 Field 7-30 am - 6-30 pm No assistant available 2 HRS LOST DUE TO BASE STN MALFUNCTION - TIME RECOVERED NEXT DAY.	49, 50	27 (3 xpts).	197 (14 xpts)
TUESDAY	23	MANTUNGULA : L 83-146, 83-148, 83-143 Field 5-30 am - 7.15 pm . No assistant	51, 52, 53	43 (6 xpts)	MANTUNGULA 240 (20 xpts)
WEDNESDAY	24	BROADMERE . L 83-117 Very long day 4-30 am ex - Mantungula - 6 30 pm. No assistant 11 hours gravity, 3 hrs travel.	54, 55	41 (5 xpts)	BROADMERE 651 (67 xpts)
THURSDAY	25	MANTUNGULA. Returned to Mantungula camp from surveyors camp at Broadmere. Cleaned vehicle, packed eqpt. 7 hrs calcs / plotting of Mantungula data.			
FRIDAY	26	BROADMERE : 3 hrs calcs MANTUNGULA : 8 hrs calcs.			
SATURDAY	27	Demobilise Mantungula camp - Mt Isa - Sydney.			

ACCOMMODATION: Hotel Name – ..... Period – ..... Bill paid by Client or Geoterrex?

VEHICLE HIRE: Company Hired From – ..... Period – .....

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GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1478 TYPE OF SURVEY GRAVITY / MAG.

	DATE	PRODUCTION	Loop No.	Daily Total	Cum. Total
SUNDAY					
MONDAY					
TUESDAY	20 September 1983	G. Nader arrives Mt Isa.			
WEDNESDAY	21	Mobilise to St Vidgeon camp 4 pm - 7 pm			
THURSDAY	22	Acquaintance with survey area. Tie in BMR stations 41 & 47 to grid.			
FRIDAY	23	ST. VIDGEON : L83-169	56, 57	29 (3 rpt)	29 (3 rpt).
SATURDAY	24	ST. VID. : L 83-171 L 83-169 Stns to be read only at pegs with known elevations	58, 59	43 3 rpts.	72 (6 rpt)

ACCOMMODATION: Hotel Name – ..... Period – ..... Bill paid by Client or Geoterrex?

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NOTES:

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GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION. PROJECT No. 85-1478 TYPE OF SURVEY GRAVITY / MAG.

	DATE	PRODUCTION	Loop No.	Daily Total	Cum Total
SUNDAY	25 Sept.	ST VID. L 83-173 L 83-171	60, 61	32 (4 mpb)	104 (10 sta.)
MONDAY	26	ST. VID. L 83-173 : L 83-175	62	41 (4 mpb)	145 (14 mpb)
TUESDAY	27	ST. VID. Reduction of data. 12 hours.		0.	145 (14 mpb)
WEDNESDAY	28	ST VID. L 83-175 L 83-163	63, 64	44 (6 mpb)	189 (20 sta.).
THURSDAY	29	ST. VID. L. 83-166 L. 83-163 Repeated mag data on L 83-166	65, 66	37 (6 mpb)	226 (26 mpb)
FRIDAY	30	ST VID. L. 83-166 L 83-167	67, 68	40 (4 mpb)	266 (30 mpb).
SATURDAY	1 October	ST VID. L 83-167 L 83-165	69, 70	35 (4 mpb)	301 (34 mpb)

ACCOMMODATION: Hotel Name – ..... Period – ..... Bill paid by Client or Geoterrex?

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GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1478. TYPE OF SURVEY GRAVITY / MAG.

	DATE	PRODUCTION	Loop No.	Daily Total	Cum total.
SUNDAY	2 October 1983	ST VID. Data reduction : 12 hrs.		0	301 (36 mpts)
MONDAY	3	ST VID. Data plotting 8 hrs L 83-173 repeated from VP 101 – 72 + 12m.	71	0	301 (36 mpts)
TUESDAY	4	ST VID L 83-162 L 83-165	72, 73	37 (6 mpts)	338 (140 mpts)
WEDNESDAY	5	ST VID. L. 83-162 L 83-168 (Mag base stn inoperable in pm)	74, 75	40 (8 mpts)	378 (48 mpts)
THURSDAY	6	ST VID. L 83-168 L 83-170. (Mag base stn problem in pm)	76, 77	42 (7 mpts).	420 (55 mpts)
FRIDAY	7	ST VID. Repeat mag on loops 76, 77 in am. L 83-161	78	16 (2 mpts)	436 (57 mpts)
SATURDAY	8	ST. VID L. 83-170 L 83-161 Very difficult terrain, slow going.	79, 80	25 (5 mpts)	461 (62 mpts)

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GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1478 TYPE OF SURVEY GRAVITY/MAG.

	DATE	PRODUCTION	Loop No's.	Daily Total	Cum. Total.
SUNDAY	9 October 1983.	ST V.D. 12 hrs data reduction / plotting.		0.	461 (62 rpts).
MONDAY	10	ST V.D: 12 hrs data reduction / plotting.		0	461 (62 rpts)
TUESDAY	11	ST V.D. L 83-164 ~~L 83~~ Magnetics very 'unstable' over lateritic area.	81, 82	39 (9 rpts).	500 (71 rpts)
WEDNESDAY	12	ST V.D: L 83-160 This line contained few pegs - difficult to locate position	83, 84	21 (4 rpts)	521 (75 rpts)
THURSDAY	13	ST V.D: Data reduction : 10 hrs. Notified of extension.		0	
FRIDAY	14	ST V.D: Half day data reduction Awaiting for extension.		0	
SATURDAY	15	ST V.D: No work program - extension lines being cleared & surveyed.		0	

ACCOMMODATION: Hotel Name – ..... Period – ..... Bill paid by Client or Geoterrex?

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GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION. PROJECT No. 85-1478. TYPE OF SURVEY GRAVITY/MAG.

	DATE	PRODUCTION	Loc° Nos.	Daily Total	Cum. Total.
SUNDAY	16 October 1983.	ST. VID. No work program – extension lines being surveyed.		0.	
MONDAY	17	ST VID: No work program Rain ½ day		0	
TUESDAY	18	ST VID: Road/seismic lines too wet to travel on in morning. Rain in pm.		0	
WEDNESDAY	19	ST. VID. Too wet in am to survey. pm: L82-172, L83-174 Rain, vehicle bogged	85	20 (2 mpts)	541 (77 mpts)
THURSDAY	20	ST VID. : L83-174, L83-172	86, 87	12 (3 mpts)	553 (80 mpts)
FRIDAY	21	ST VID L 83-177 in pm [No work program in am]	88	18 (2 mpts)	571 (82 mpts)
SATURDAY	22	ST VID: AM: Data reduction. No field work program in am. L83-172 Seismic activity in pm – 3 hrs lost. No elevations for gravity reduction available as yet.	89	3 (1 mpt)	574 (83 mpts)

ACCOMMODATION: Hotel Name – ..... Period – ..... Bill paid by Client or Geoterrex?

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GEOTERREX WEEKLY PRODUCTION REPORT

CLIENT AMOCO PRODUCTION PROJECT No. 85-1478 TYPE OF SURVEY Gravity/Mag.

	DATE	PRODUCTION	Loop No's	Daily Total	Cum Total.
SUNDAY	23 October 1983	ST VID. L 83-172 L 83-174 L 83-169	90, 91	27 (2 mpts)	601 (85 stns)
MONDAY	24	ST VID. Data reductions. Notified of 2nd extension 2½ km west of 83-172 extn. Bulldozed, pegged + surveyed in pm by survey team.		0	
TUESDAY	25	ST VID. L 83-172 in am plus data reduction GRAVITY / MAGNETICS SURVEY FINISHED.	92	7 (2 mpts)	ST VIDGEON 608 87 (mpts)
WEDNESDAY	26.	Demobilise St Vidgeon – Mt Isa – Sydney.			
THURSDAY					
FRIDAY					
SATURDAY					

ACCOMMODATION: Hotel Name – ..... Period – ..... Bill paid by Client or Geoterrex?

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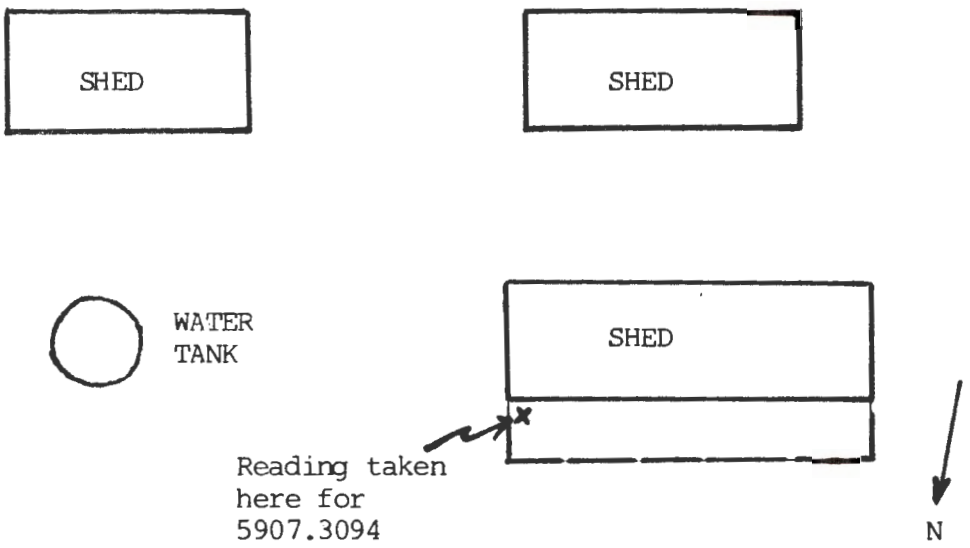
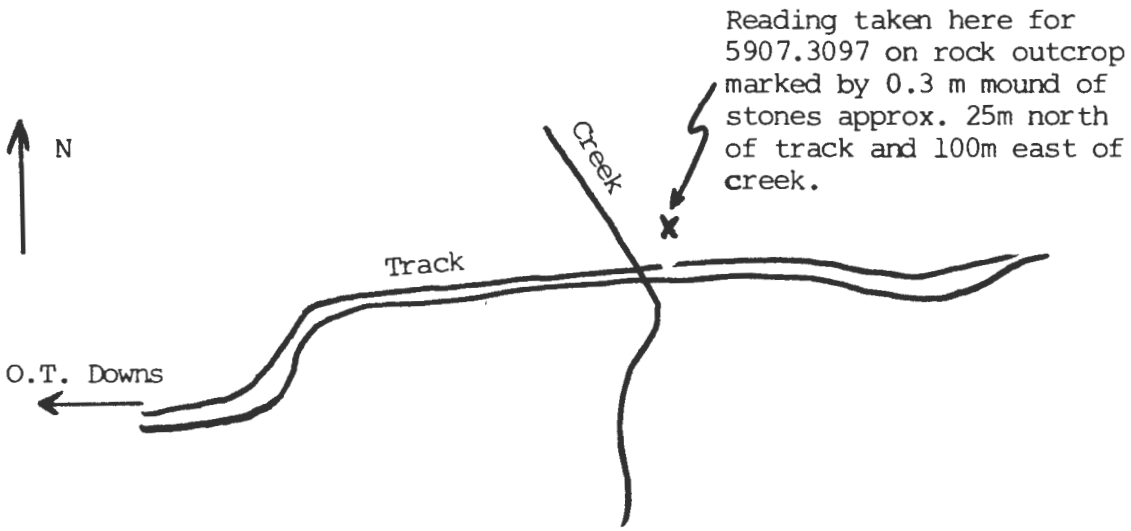
A P P E N D I X F

LOCATION BENCHMARKS 5907.3094, 5907.3097

O.T. Downs


SHED
SHED
WATER
TANK
SHED
Reading taken
here for
5907.3094
N


Reading taken here for
5907.3097 on rock outcrop
marked by 0.3 m mound of
stones approx. 25m north
of track and 100m east of
creek.
N
Creek
Track
O.T. Downs

A P P E N D I X G

DATA TAPE FORMAT

84-1478

RAW DATA TAPE FORMAT

Column	Description	Format
1 - 8	Line Number	2A4
9	Blank	
10 - 17	Station Number	2A4
18	Blank	
19 - 20	Loop Number	A2
21	Blank	
22 - 26	Raw Gravity Meter Reading	F5.2
27	Blank	
28 - 32	Time of Gravity Reading (HH.MM)	F5.2
33	Blank	
34 - 39	Tidal Correction	F6.4
40	Blank	
41 - 46	Elevation (metres)	F6.2
47	Blank	
48 - 53	Latitude	F6.2
54	Blank	
55 - 59	Time of Start Base Reading (HH.MM)	F5.2
60	Blank	
61 - 65	Raw Start Base Reading	F5.2
66	Blank	
67 - 72	Tidal Correction for Start Base	F6.4
73	Blank	
74 - 78	Time of End Base Reading (HH.MM)	F5.2
79	Blank	
80 - 84	Raw End Base Reading	F5.2
85	Blank	
86 - 91	Tidal Correction for End Base	F6.4
92 - 100	Blank	

Record length = 100 bytes
Block size = 5000 bytes
9 Track ASCII 1600 bpi

3 Files on Tape

85-1478 BROADMERE PROSPECT

GRAVITY DATA TAPE FORMAT

Field	Description	Remarks
1 - 8	Line number	2A4
9	Blank	
10 - 17	Station number	2A4
18	Blank	
19 - 24	Elevation	F6.2
25	Blank	
26 - 30	Reduced Gravity reading- 2.1 g/cc	F5.2
31	Blank	
32 - 36	Reduced Gravity reading - 2.2g/cc	F5.2
37	Blank	
38 - 42	Reduced Gravity reading - 2.3g/cc	F5.2
43	Blank	
44 - 48	Reduced Gravity reading - 2.4 g/cc	F5.2
49	Blank	
50 - 54	Reduced Gravity reading - 2.5 g/cc	F5.2
55	Blank	
56 - 60	Reduced Gravity reading - 2.67 g/cc	F5.2
61	Blank	
62 - 66	Raw Magnetic reading	I5
67	Blank	
68 - 72	Corrected Magnetic reading	I5
73 - 80	Blank	

9 TRACK ASCII Code

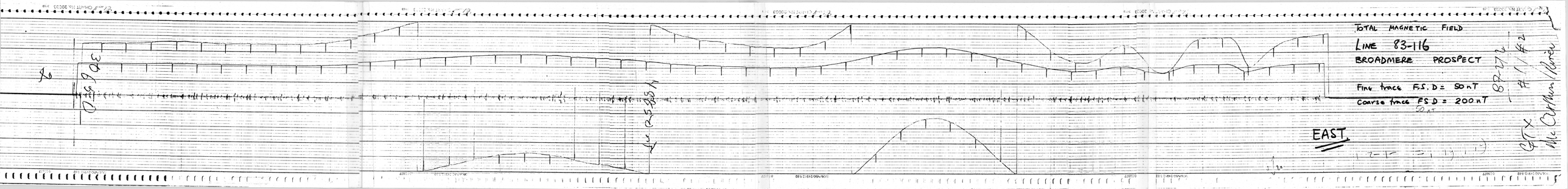
1600 bpi

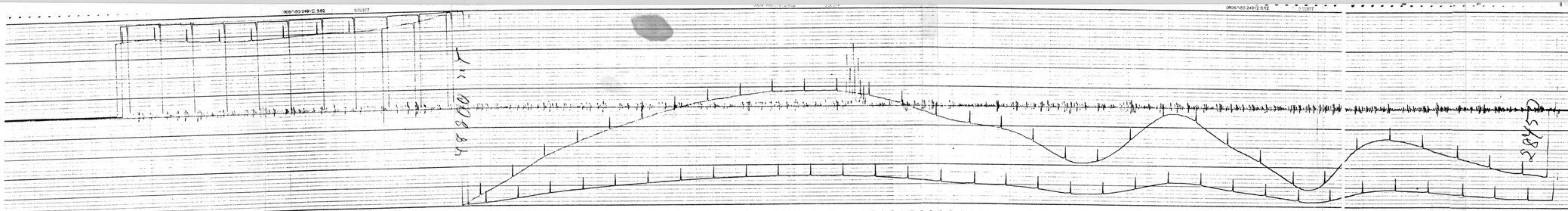
Record Length = 80 bytes

Block Size = 4000 bytes

APPENDIX H

AEROMAGNETIC PROFILES


TOTAL MAGNETIC FIELD
LINE 83-116
BROADMERE PROSPECT
Fine trace F.S.D = 50nT
Coarse trace F.S.D = 200nT
EAST
Mc Cuaig Holdings


TOTAL MAGNETIC FIELD
LINE 83-122
BROADMERE PROSPECT
Fine trace F.S.D. = 50 nT
Coarse trace F.S.D. = 200 nT
EAST