

Pacific Oil & Gas Pty. Limited

WELL PROPOSAL

MAGEE 1 EP38 AMADEUS BASIN

**OPEN FILE**

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**ONSHORE**

CRAE Report No. 304654

DEPT. OF MINES & ENERGY  
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### LIST OF PLANS

| <u>Plan Number</u> | <u>Title</u>  | <u>Scale</u>                  |
|--------------------|---|-------------------------------|
| PetNTcw5147        | Magee 1 Proposed Location<br>and access map             | 1: 1000 000                   |
| PetNTcw5150        | Magee 1 Well Schematic                                  | 1:10 000 Vert                 |
| PetNTcw5149        | Mt Charlotte Structure and<br>Magee 1 proposed location | 1:25,000 Hor<br>1:10,000 Vert |

### LIST OF APPENDICES

|            |                           |
|------------|---------------------------|
| Appendix 1 | OIME Rig 1 specifications |
|------------|---------------------------|

## 1 GENERAL INFORMATION

### 1.1 Introduction and Objectives

Pacific Oil & Gas Pty. Limited, a subsidiary of CRA Exploration Pty. Limited, intends to drill a deep exploration borehole as part of the work programme for EP38.

Magee No. 1 is to be drilled to test the Heavitree Quartzite and the lower part of the Bitter Springs Formation for hydrocarbons and/or other indicators of prospectivity. The location for the well is on a structural high at top Heavitree Quartzite level located by the 1991 Depot Hill Seismic Survey.

The uppermost Upper Proterozoic section below the Chandler Formation is a secondary objective of the well.

### 1.2 Well Data

|               |                          |
|---------------|--------------------------|
| Well Name:    | MAGEE No 1               |
| Location:     | RODINGA 1:250 000 Sheet  |
| (Preliminary) | Latitude: 24° 53' 60"    |
|               | Longitude: 133° 59' 23"  |
|               | AMG Zone 53              |
|               | Easting 397 958          |
|               | Northing 7 245 738       |
| Seismic Line: | DH91-2N, shot point 2152 |
| Elevation:    | Ground Level 371.1 AMSL  |
|               | Rotary Table 377.0 AMSL  |

The final location will be surveyed on completion of the programme.

Total Depth: 2600m KB or on instruction from Pacific Oil & Gas Pty. Limited

Spud Date: 18 September 1992 or most practicable date thereafter.

Drilling Time: 30-40 days

*Objectives :*

*Estimate Well Cost :*

**Contractors:**

|                  |                                  |
|------------------|----------------------------------|
| Drilling         | OD&E Pty. Limited, OIME Rig 1    |
| Mud              | Milpark Drilling Fluids          |
| Mud Logging      | Colin Higgins & Associates       |
| Wireline Logging | Schlumberger Seaco Inc.          |
| DST & Coring     | Australian DST Company Pty. Ltd. |
| Cementing        | Halliburton Australia Pty. Ltd.  |
| Earthworks       | R.E. & M.L. Dehne                |
| Air Services     | Oiltools International Pty. Ltd. |

**1.3 Communications and Reporting**

A daily drilling and geological report will be faxed to Pacific Oil & Gas Pty. Limited and to the Northern Territory Department of Mines and Energy, Darwin office. Notice will also be sent of all departures from the Well Proposal, any drill stem tests and prior to the abandonment of the well.

Wireline logs, drill stem test results and other critical data will be forwarded to the above parties either by fax or overnight courier. Tour sheets, cuttings and core descriptions, mudlog data and cost reports will be forwarded to Pacific's Box Hill office on a weekly basis.

A Well Completion Report, including all data derived from the well, will be prepared and forwarded to the above parties following the completion of field operations.

**1.4 Persons Responsible**

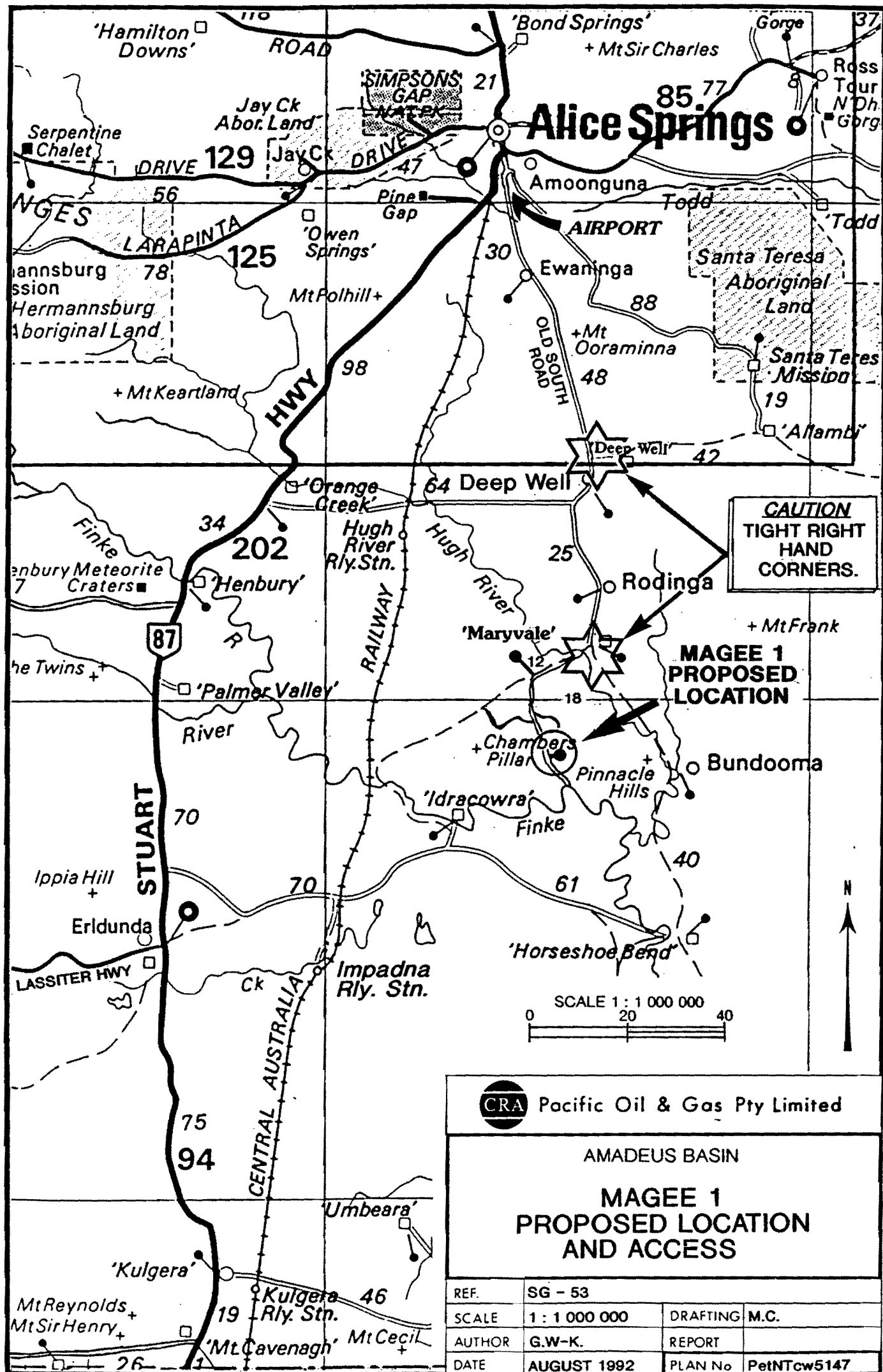
Final and Statutory authority for the Company's exploration programme in the Northern Territory lies with Dr Kevin D Tuckwell, Chief Geologist - Petroleum.

Responsibility for Amadeus Basin operations and operations related communication rests with Iain M Clementson, Principal Geologist and Gordon J Wakelin-King, Project Geologist.

## 1.5 Contact Phone Numbers

Persons and organisations involved in Magee 1 can be contacted at the following locations:

|                                     |                       |
|-------------------------------------|-----------------------|
| PACIFIC OIL & GAS PTY. LIMITED      | Ph: (03) 895 3000     |
| Box Hill Office                     | Fx: (03) 890 0029     |
| Att: Iain Clementson                |                       |
| Att: Kevin Tuckwell                 |                       |
| PACIFIC OIL & GAS PTY. LIMITED      | Ph: (089) 53 0229     |
| Alice Springs Office                | Fx: (089) 53 0224 324 |
| Att: Tony Kress                     | Ah: (089) 52 4440     |
| N.T. DEPT. MINES & ENERGY           | Ph: (089) 89 5511     |
| Att: W.L. Tinapple (Bill)           | Fx: (089) 89 5530     |
| Dusan Sadjak - Engineer             | Ah: (089) 27 0425     |
| PACIFIC OIL & GAS PTY. LIMITED      | Ph: 0071 14121        |
| Magee 1 Well Site                   | Fx: 007 114122        |
| OD&E PTY. LIMITED                   | Ph: (08) 255 3011     |
| Att: Neil Dean                      | Fx: (08) 252 0272     |
| Drilling Manager                    | Ah: (08) 333 2607     |
| MILPARK DRILLING FLUID              | Ph: (09) 382 1766     |
| Att: Lewis Arndt                    | Fx: (09) 381 4907     |
| Sales Engineer                      | Ah: (09) 447 7073     |
| COLIN HIGGINS & ASSOCIATES          | Ph: (09) 364 6165     |
| Att: Colin Higgins                  | Fx: (09) 364 6165     |
|                                     | Ah: (09) A/A          |
| SCHLUMBERGER SEACO INC              | Ph: (076) 22 2394     |
| Att: Steve Kapell                   | Fx: (076) 22 2033     |
|                                     | Ah: (076) 22 2987     |
| AUSTRALIAN DST COMPANY PTY. LIMITED | Ph: (076) 22 2655     |
| Att: Vern Sale                      | Fx: (076) 22 1150     |
|                                     | Ah: (076) 22 4433     |
| R.E. & M.L. DEHNE                   | Ph: (089) 52 8891     |
| Att: Ron or Marilyn Dehne           | Fx: (089) 53 2372     |
| OILTOOLS INTERNATIONAL PTY. LIMITED | Ph: (09) 356 1277     |
| Att: Ken Carlsson                   | Fx: (09) 356 1003     |
|                                     | Ah: (09) 310 7787     |
|                                     | Mobile: 018 917 700   |
| DEHNE TRANSPORT                     | Ph: (089) 52 4463     |
| Att: Les Dehne                      | Fx: (089) 52 8755     |
|                                     | Mobile: 018 897 055   |
| HALLIBURTON AUST PTY. LIMITED       | Ph: (076) 22 2318     |
|                                     | Fx: (076) 22 3674     |



## 2 DRILLING

### 2.1 Drilling Programme Summary

- 1 Move in rig and rig up on location. Be absolutely certain the sub is level before assembly proceeds. Use a theodolite or a clear hose with water to check as half a day at this stage will save a lot of problems later.
- 2 Spud in w/ 17.5" bit on 9" Mission 380 hammer. Pick up a 12" square drill collar for weight and stability. Use four compressors. Hang tarpaulins to keep as much dust as possible from the engines. Drill to 24m.KB.
3. Run 13 3/8" conductor. Put a cement plug in the bottom 2ft and allow to set. Run conductor using slings and pad eyes. Tack weld a 1" grout pipe to the conductor as it is run.
4. Cement conductor to surface with class A cement via grout pipe.
5. Nipple up rotating head and blooey line.
6. Run in hole with a 12 1/4" Hammerbit on T1120 hammer with a 12" square drill collar followed by 2 x 8" drill collars. Use four compressors, 2000-6000 lbs WOB, 10/30 rpm. Ensure supply of hammer lubricant, 4 litres/hour, Shell Torcula or equivalent to standpipe.
7. If severe water influx occurs then drill sufficient hole to bury BHA plus one joint of drill pipe i.e. 100m. POOH and lay out hammer. RIH w/ 4-3-7 rotary bit, square drill collar, 8 x 8" drill collars. Run a float in the bit sub.
8. Drill 12 1/4" hole to approximately 200m. Survey at 100m intervals using the slickline. Measure casing and float equipment and drill to depth to minimize rathole, a screw-on bowl will be used. Excess hole is undesirable. Steel line measure tubulars on POOH. Lay out BHA before running casing. Remove conductor barrel and rotating head before running casing.
9. Run 9 5/8", 36 ppf, K55 csg to 200m. Centralize Jts #1, #2, #3 and at 50m. Cement class A as per cementing programme and displace with water. Use a top plug only. Bump with 500 psi over circulating pressure. Land casing and chain down before cementing. Wait on cement 6 hours.



- NB: Steps 8 and 9 assume no water influx has occurred. If water is encountered foam will be needed while drilling. 5 bbls/hour of 1% geofoam solution should suffice. The booster may also be required but this is unlikely. A good cellar jet or pump will also be needed to dispose of returns while cementing.
10. Remove landing joint. Install bradenhead, nipple up BOP and function test. Pressure test blind rams against casing 500 psi for 10 mins followed by 1500 psi for 10 mins. Test all valves in choke manifold and choke and kill lines 500/1500 psi. Test flare line 1500 psi. NB: No wear bushing will be run. Incorporate sufficient spacer spools into space-out to minimize realignment problems with blooey line as successive casing strings are run.
  11. Pick up an 8.5" 4-3-7. rotary bit, 18 x 6.25" DC, 3 x HWDP. Run drilling float.
  12. Drill out cement with water.
  13. POOH, make up I-R 380 hammer and 8½" bit, 18 x 6¼" DC, 3 x HWDP and RIH.
  14. Blow hole completely dry.
  15. Hammer drill 8½" hole. Survey at 150m intervals. Stabilize BHA as required for deviation control. If water is encountered foam should be injected immediately. Keep a flame burning at all times at the blooey line. Sharpen and/or re-choke hammer as required.
  16. Impact hammer drilling may prove ineffective in the Chandler Salt in which case POOH and lay out I-R 350 hammer, pick up 6 3/4" Hammerdrill with 8½" rotary bit and RIH. Hammer or air rotary drill with brine foam injection as required, 3 bpm brine with 1% geofoam @ 1800 SCFM is recommended.
  17. At casing point = 1000m or 50m beneath the top of the Winnall Beds, whichever is the least, hole should be blown or circulated clean. Pull out of hole, wiper trip, S.L.M. pipe. Blow clean, pull out of hole laying down all tubulars.
  18. Run 7" casing. Casing should be set as close to bottom as possible.
  19. Cement casing as per programme. Cement programme will be an extended lead slurry with a salt based tail slurry, volumes and additives will be advised. Displace with water and bump plug 500 psi over final circulating pressure.

20. Drop slips and nipple down BOP. Cut casing and dress stump. Remove spacer spool, and install 'B' section. Test seal assy 3000 psi/10mins. Nipple up BOP. Test blind. Rams/casing and choke manifold 500/1500 psi 10 mins. Change pipe rams to 3½".
21. Pick up 6 1/8" rotary bit, 4 3/4" drill collars, 3½" drill pipe. Run in hole and tag plug.
22. Test pipe rams and annular 500/1500 psi, 10 mins.
23. Drill out cement and 1m of formation with water. Perform leak-off test to 16 ppg M.W.E. POOH, make up T36 Hammer with 6 1/8" bit; RIH
24. Blow hole completely dry.
25. Hammer drill ahead 6 1/8" hole. Keep a fire burning at all times at end of blooey line. Any decrease in dust signifies either water or wet gas. Both require immediate use of foam at approx 20 bbl/hr. Air requirement for this hole section is 1500scfm. A booster may be needed if mist is used. Deviation surveys should be taken at 150m intervals. Any sudden increase in deviation should be corrected as quickly as possible. Hammer choke size, mist/foam injection, and air flow should be re-assessed if any change in formation water influx occurs.
26. POOH to replace hammer bit when any decrease in ROP not attributable to formation change occurs. Sharpen and gage bit, always run larger gage bit available. If gage loss reduces hole size to less than 5 7/8", make up and run T50 hammer and 5 3/4" bits.
27. Total depth will be called by site geologist, who will also oversee the electric logging programme.
28. Well suspension or abandonment plug programme will be based on well results and decided at total depth.

## 2.2 Safety Precautions when Air Drilling

1. Keep Flare Bucket burning at Blooey Line at all times.
2. Aim bug blower at rotating head and keep it running.
3. Aim mud gun at rotating head ready for use.
4. Keep pits full of water.
5. Wear ear protection near compressors and eye protection on rig floor.
6. Blow hole before connections and do not start drilling again until dust is visible.
7. Remove rotating head drive bushing from Kelly when starting trip.
8. Ensure primary jet is functional at all times.
9. Monitor dust returns carefully and treat any reduction in dust returns as indicator of possible problems downhole.

## 2.3 Procedure for safe handling of high rate gas influx.

The general principal of gas control in air drilled wells is to allow gas to flow with minimum restriction from the rotary BOP to the flare pit where it is burned. Whilst drilling with gas influx, water injection is used to prevent down-hole fires. When drilling is stopped for a connection, trip etc. a venturi system (primary jet) is used to draw gas from the wellhead down the flare line. This system is capable of handling gas flow rates of up to 3 MMCFD.

If gas flow rates greater than 3 MMCFD but less than 8 MMCFD are encountered, drilling proceeds with the gas diverted from the rotary BOP to the flare pit as above. Connections, tubing etc. are made by stripping through the rotary BOP.

Flow rates in excess of 8 MMCFD must be killed by pumping heavy mud to the hole. The small annular volumes of a slim conventional hole assists the rapid and efficient displacement to the mud. Mud stocks on location are maintained at sufficient levels to allow this procedure to be carried out at any time. Drilling can then continue using mud techniques, or a decision made to case and suspend the hole as a producer.

This general programme is carried out safely in both Mereenie and Palm Valley where gas flows of up to 137 MMCFD have occurred. It is unlikely that this flow rate could be approached in Magee 1 due to the smaller annular cross-sectional area and greater depth.

In the specific instance of a gas flow from a zone immediately below the Chandler Formation, unless the option to suspend as a producer is accepted, the gas zone will be killed with mud and cased as per the programme. The casing depth and grades in the current proposal are adequate for this task.

#### 2.4 Bit Programme

Surface - 20m KB:

17½" STC DSJ on 9" Hammerdrill 350.

20m - 200m KB:

12½" Drillquip hammerbit on T1120 hammer.

200m - 1000m KB:

8½" Drillquip hammerbit on I-R 380 hammer.

or if water influx prevents use of hammer,

8½" 5-1-7 rotary bits on 6 ¾" Mission hammerdrill.

1000m - 2600m KB:

6 1/8" - 6" Drillquip hammer bits on T36 hammer.

or if water influx prevents use of hammer,

6" 5-1-7 to 6-2-7 rotary bits using air rotary or mud rotary techniques.

Hammerbits should be replaced and resharpend when ROP decreases for no reason attributable to the formation. Use the largest gauge bit available and check gauge on pulled bits. RIH into "new" hole with extreme care. Ream undergauge hole with rotary bit if required.

It is anticipated that gauge loss from 6 1/8" to approximately 5 7/8" will occur in the nominal 6" section of hole. This trend will be combatted by frequent bit replacement however in the event of severe gauge loss a 5 3/4" hammer drilling assembly will be available on location.

Viability of continued hammer drilling will be reviewed throughout the hole. If water influx becomes too great for water to be successfully unloaded by adjusting hammer choke sizes then rotary air or rotary mud techniques may be engaged.

## 2.5 Deviation Requirement

Deviation control is not critical to the objectives of the well however BHA selection should be made to minimise the risk of hazardous dog-legs in the hole. Deviation control will be selected and applied before the security of the hole is risked.

Maximum allowable rate of deviation change  
 $\frac{1}{2}^{\circ}$  per 50m. Maximum allowable deviation  
 6°.

## 2.6 Drilling Fluids Programme

The majority of the hole will be air hammer drilled with direct water or foam injection to the standpipe as required. A reserve of basic Rapidgel-Polymer mud will be maintained in the tanks for the 8 1/2" and the nominal 6" sections of the hole to act as a base for stiff foam, and to act as a base in the event of a kill mud being required. The base mud will be used to stabilise the hole for logging at TD.

In the event that salt sections have to be mud-drilled, a salt based mud will be used.

Mud make-up formulas are as follows:-

Foam Injection

|              |            |
|--------------|------------|
| Caustic Soda | 0.2 lb/bbl |
| Geofoam      | 1/4 to 1%  |

Polymer Base Mud

|             |             |
|-------------|-------------|
| Rapidgel    | 1.1 lb/bbl  |
| Milpac      | 1.5 lb/bbl  |
| XCD Polymer | 0.75 lb/bbl |
| Caustic     | 0.5 lb/bbl  |

NaCl Polymer Mud

|             |             |
|-------------|-------------|
| Milpac      | 1.5 lb/bbl  |
| XCD Polymer | 0.75 lb/bbl |
| Permalose   | 6 lb/bbl    |
| NaCl        | 42 lb/bbl   |
| W.O.30      | 3 lb/bbl    |

Either of the base muds may be injected with geofoam into the air stream to produce stiff foam if required.

Only in the event of serious water influx and/or hole instability, will rotary mud techniques be engaged.

## 2.7 Casing & Cement Programme

| Casing Specifications |           |         |          |       |     |         |
|-----------------------|-----------|---------|----------|-------|-----|---------|
| Depth                 | Bit       | Casing  | Thread   | Wt    | Grd | Cement  |
| ±20m                  | 17 1/2"   | 13 3/8" | 8RND STC | 47ppf | H40 | Class A |
| ±200m                 | 12 1/4"   | 9 5/8"  | 8RND LTC | 36ppf | K55 | Class A |
| ±1000m                | 8 1/2"    | 7"      | BTC      | 26ppf | K55 | Class A |
| ±2600m                | 6 1/8"-6" | -       | -        | -     | -   | -       |

NB:

1. Zones of water influx will be cemented off as required.
2. Final cementing programmes including volumes, additives etc will be advised.

## SURFACE CASING, SURFACE - 200m

Data

9 5/8" K-55 36 lb/ft 8rnd LTC

Drift diameter 8.765" I.D. 8.921"

Collapse resistance 2020 psi

Internal yield 3520 psi

|                |     |      |        |
|----------------|-----|------|--------|
| Make-up torque | Min | 3170 | ft/lbs |
|                | Opt | 4230 | ft/lbs |
|                | Max | 5920 | ft/lbs |

Collapse

Maximum anticipated overburden pressure gradient  
1.0 psi/ft. Safety margin with hole evacuated  
1364 psi. Safety factor = 3.08

Burst

Maximum anticipated formation pressure in next  
hole section 1450 psi. Safety margin 2070 psi.  
Safety factor = 1.42

Joint strength

|                                  |   |         |     |
|----------------------------------|---|---------|-----|
| Casing weight in air (17 joints) | = | 24 100  | lbs |
| Joint strength                   | = | 489 000 | lbs |
| Safety factor                    | = | 20.3    |     |

Programme

One joint of casing will be run between float and shoe.

A centralizer will be run 3m above shoe, and on the next two collars above the float.

A centralizer and a cement basket will be run at 60m.

Casing will be cemented to surface and a top-up performed if required.

Cement will be a neat 15.6 ppg class A tail slurry. Volumes will be advised. A 10% excess will be used.

## INTERMEDIATE CASING - SURFACE - 1000m

Data

7" K-55 26 lb/ft Buttress joint.

Drift diameter 6.151" I.D. 6.276"

Collapse resistance 4320 psi

Internal yield 4980 psi

Make-up torque    Min 3010 ft/lbs  
                          Opt 4010 ft/lbs  
                          Max 5010 ft/lbs

Collapse

Maximum anticipated overburden pressure gradient  
 1.0 psi/ft Safety margin with hole evacuated  
 1040 psi. Safety factor = 1.32

Burst

Maximum anticipated pressure in the target horizon  
 is derived from the pressure gradient, and the  
 expected gas column height from the seismic data.

(Depth + column height) x gradient = anticipated pressure

depth = 2290 ± 50m => 2340m = 7677 feet  
 column = 125m ± 25m => 150m = 492 feet

anticipated gradient = 0.5 psi/ft (salt water gradient)

(7677 + 492) 0.5 = 4085 psi

Safety factor =  $\frac{4890}{4085} = 1.20$

NB. the pressure gradient used here exceeds that in all  
 Amadeus Basin gas fields.

If a gas influx occurs during this section it will not be  
 shut in. If the BOP must be closed the flow will be  
 diverted to the flare pit and burnt. A flow test will  
 indicate whether drilling can safely continue with air. If  
 not the well must be flooded with a suitable mud, and  
 drilling continued conventionally.

Joint strength

Casing weight in air (84 joints) = 86 000 lbs  
 Joint strength = 592 000 lbs  
 Safety factor = 6.88



### Programme

One joint of casing will be run between float and shoe.

A centralizer will be run 3m above shoe, and on the next two collars above the float.

Casing will be cemented to surface.

Cement programme will be an extended lead slurry followed by a full weight class A tail slurry formulated to bond effectively with salt. Volumes and additives will be advised. Excess cement used will be determined on hole conditions but will be at least 10%.

High rate water zones may require cement and/or sodium silicate squeezes to block water influx. This may prove necessary in the Stairway Sandstone or the Loves Creek Member. Material and equipment will be available on location for this purpose.

A leak-off test will be performed after drilling out shoe to a maximum equivalent mud weight of 16.0 ppg.

## 2.8 Pressure Control Procedures and Equipment

The rotary BOP will be installed on the 13 3/8" conductor casing set at 24m and will remain functional throughout any air drilled sections of hole.

The main BOP stack will be installed on the 9 5/8" casing set at 200m. The BOP will be tested according to the programme. The casing shoe will not be drilled out until a satisfactory test has been achieved. Valves and lines through to the flare line will also be tested at this time.

The rig crew will perform a BOP drill once per week per crew and performance noted in the tour sheet.

BOPs and primary jet will be function tested while pipe is out of the hole during bit trips. Results will be noted in tour sheets.

The BOP will be reinstalled on the 7" casing and tested as per the programme. The casing shoe will not be drilled out until a satisfactory test has been achieved. A formation integrity test to a mud weight equivalent of 16 ppg will be performed.

Kill sheets and mud stock requirements will be updated regularly.

Pressure control equipment in use is detailed in Appendix 1 OIME RIG INVENTORY.

## 2.9 Formation Testing

Testing (where warranted) will be carried out to evaluate significant hydrocarbon indications. Hydrocarbon zones encountered while air drilling will be flow tested at surface. Otherwise conventional closed chamber bottom-hole or straddle drill stem testing techniques will be used. Any significant hydrocarbon indication within the primary objective will be tested by a DST.

Drill Stem Testing equipment available at the well site will be:-

- 1 Set Sterling compression-set dual packer DST tools for bottom hole or straddle testing.
- 2 x Kuster AK1 chart pressure recorders
- 3 x MacAllister EMP pressure recorders
- 1 x 2" flow prover.

Inside, outside and fluid recovery gauges will be run in the string, and one EMP gauge used as a surface read-out gauge for closed chamber testing.

Times and durations of any DST will be reported in advance to the NTDME. In general terms preflow will be kept short, and flowing periods will be determined by monitoring of influx using the closed chamber equipment. Final shut in periods will be at least twice the duration of final flow periods.

### Flow Testing Procedures when Air Drilling:-

1. When gas is encountered pull off bottom and stop compressors.
2. Open HCR valve and close pipe rams direct gas to flare line.
3. Flow gas through flow prover until a stable rate is obtained. Use an orifice plate which is large enough to keep pressures low. This eliminates the need to compress a large volume of wellbore storage.
4. When test is complete open flare line and flow well to dissipate pressure.
5. Open pipe rams and start compressors.
6. Watch dust and start mist at any sign of moisture. i.e. decrease in dust.
7. Drill ahead and repeat procedure for any increase in size of flare.

Low rate (RTSTM) gas influx may be quantified by utilising the wellbore storage and closed chamber calculation techniques. Close in well at choke manifold and record casing pressure every minute until pressure approaches 500 psi or 50% of MACP. Open HCR and flare off gas.

### 2.10 Abandonment

In the event of no commercial hydrocarbons being discovered, the well will be abandoned according to the following principles:-

- Zones with significant hydrocarbon indications will be plugged.
- Water zones will be isolated from each other and from the surface.
- The 7" casing will be plugged at the shoe and the plug weight tested.
- The well will be plugged at surface.
- Plug sizes and procedures will be in accordance with regulations and reported to NTDME in advance of abandonment.

### 3 FORMATION EVALUATION

#### 3.1 Mud Logging

Mud logging services will be provided by Colin Higgins & Associates. The mud logging personnel will be responsible for the following:

- To monitor ROP, gas, pit level and drilling parameters and to catch, wash, describe and bag cuttings samples from the 9 5/8" casing shoe to total depth.
- To record the above parameters along with bit data, mud data, DST data, etc., on a Mudlog at a scale to be advised by the geologist. The lithology record will be based on cuttings or core descriptions in consultation with the well site geologist. The Mudlog shall be kept up to date on a daily basis.
- To assist the well site geologist during well testing by taking appropriate samples when instructed and marking them appropriately.

##### 3.1.1 Cuttings Sampling

From surface to 7" casing depth, samples taken at 10m intervals,

1 x Samplex tray  
3 x Washed and dried envelopes  
2 x Bagged unwashed

From base of 7" casing to T.D., samples taken at a 3m intervals,

1 x Samplex tray  
2 x Washed and dried envelopes  
2 x Bagged unwashed  
1 x Washed and dried 9m composite

Geochem tins and spot samples will be taken as directed. In general, samples with significant content of carbonaceous rock will be preserved in geochem tins.

##### 3.1.2 Core Handling

Any cores cut will be lightly washed, oriented and depth marked. A core description will be made before core is boxed.

### 3.2 Wireline Logging

A Schlumberger Seaco unit will be used to log the well.

The following logs will be run at T.D.

|                      |            |
|----------------------|------------|
| GR-CAL               | TD-Surface |
| DUAL LATEROLOG       | TD-1000m   |
| MICRO NORMAL/INVERSE | TD-1000m   |
| FORMATION DENSITY    | TD-1000m   |
| NEUTRON POROSITY     | TD-1000m   |
| COMPENSATED SONIC    | TD-1000m   |

Additional logs may be run in the event of significant hydrocarbon shows, this programme will be advised.

### 3.3 Coring

No cores are pre-programmed for Magee 1. A 20m core barrel and bits for the 6" hole section will be available on location. In the event that hydrocarbon zones requiring further evaluation are intersected, cores will be cut as necessary. A decision to core will be made by Pacific's Melbourne office in consultation with the wellsite geologist.

## 4 GEOLOGICAL PROGNOSIS

## 4.1 Stratigraphic Prognosis

| <u>Formation Name</u>         | <u>Approximate Depth(m)</u> |           | <u>Thickness<br/>(m)</u> |
|-------------------------------|-----------------------------|-----------|--------------------------|
|                               | <u>GL</u>                   | <u>KB</u> |                          |
| Pertnjara Formation           | Surface                     | 5.9       | 380                      |
| Stairway Sandstone            | 380                         | 385.9     | 100                      |
| Jay Creek Limestone           | 480                         | 485.9     | 240                      |
| Chandler Formation            | 720                         | 725.9     | 220                      |
| Winnall Beds (Pertatataka Fm) | 940                         | 945.9     | 450                      |
| Bitter Springs Formation      |                             |           |                          |
| Loves Creek Member            | 1390                        | 1395.9    | 180                      |
| upper Gillen Member           | 1570                        | 1575.9    | 260                      |
| Gillen Member salt            | 1830                        | 1835.9    | 260                      |
| basal Gillen Member           | 2090                        | 2095.9    | 200                      |
| Heavitree Quartzite           | 2290                        | 2295.9    | 230                      |
| Basement                      | 2520                        | 2525.9    | 80                       |
| TD                            | 2600                        | 2605.9    |                          |

Seismic Depths are based on preliminary depth conversion and are accurate to  $\pm 50\text{m}$ .

## 4.2 Formation Descriptions

The following is a brief description of the lithologies expected to be present in each of the formations prognosed.

## 4.2.1 Pertnjara Formation

| Age      | Range  | (thickness) |
|----------|--------|-------------|
| Devonian | 0-380m | (380m)      |

This formation consists of red-brown, silty, slightly micaceous shale, and brown, grey and tan, fine to medium grained, friable sandstone. The sandstone has poorly sorted, well rounded, frosted grains, and good porosity. The sandstone can be a water aquifer. The lower 15m of the unit comprises red, green and purple fine textured shales.

## 4.2.2 Stairway Sandstone

| Age        | Range    | (thickness) |
|------------|----------|-------------|
| Ordovician | 380-480m | (100m)      |

Sandstone, tan, slightly calcareous is thinly interbedded with pale grey-green, grey-purple silty micaceous shale. Occasional thick beds (up to 3m) of sandstone occur in this unit.

The sandstone coarsens downwards, from very fine grained at the top, to a poorly sorted conglomerate over the basal 12m. Grains are well rounded, frosted, and poorly cemented giving good porosity. The unit is very phosphatic, and shows worm tube impressions in outcrop. This unit is expected to be an aquifer however water flow rates from this unit in Mt Charlotte 1 were low.

## 4.2.3 Jay Creek Limestone

| Age      | Range    | (thickness) |
|----------|----------|-------------|
| Cambrian | 480-720m | (240m)      |

The Jay Creek Limestone is predominately silty with rare sandstone layers and interbedded sandy and anhydritic dolomite. Dolomite represents only 20% of the total formation thickness.

Dolomite, which occurs in thin bands, is compact to microlaminated, cryptocrystalline to microcrystalline, slightly calcareous (between 10 and 20%), and locally recrystallised into dolomite rhombs. The non carbonate content of the dolomite includes angular silt sized quartz grains; potassium feldspar, muscovite and green biotite grains; fine concretions and minute intergranular crystals of haematite. Recrystallised algal structures; carbonate lumps and concretions; small grains of glauconite; and rare chalcedonic quartz nodules also occur.

The majority of the formation consists of slightly calcareous, haematitic and micaceous clayey shale and chloritic siltstone, grading to thin very fine, angular sericitic, chloritic and dolomitic sandstone.

Anhydrite and a small amount of "chicken wire" gypsum occur in lenses or patches, parallel to bedding within greyish cryptocrystalline dolomite. The anhydrite may also occur as intergranular crystals, or as micro-granular crystals filling fractures, fissures and voids.

#### 4.2.4 Chandler Formation

| Age      | Range    | (thickness) |
|----------|----------|-------------|
| Cambrian | 720-940m | (220m)      |

The Chandler Formation is an evaporitic sequence with thin siltstone and dolomite units. Salt is estimated to occur between 720-853m and 883-940m.

The halite is light pink, coarsely crystalline with interbedded reddish, clayey siltstone and scattered quartz, potassium feldspar and some green biotite grains. Some of the quartz grains have reddish iron coatings. Very fine anhydrite and carbonate crystals occur throughout the salt.

Mudstone, siltstone and dolomite are interbedded with the salt units. The mudstone is haematitic. The siltstone is halitic and anhydritic with angular to rounded coarse grained ferruginous clastics. The dolomite is ferruginous, cryptocrystalline and slightly calcareous

#### 4.2.5 Winnall Beds (Pertatataka Formation)

| Age         | Range     | (thickness) |
|-------------|-----------|-------------|
| Proterozoic | 940-1390m | (450m)      |

The Winnall Beds are a monotonous sequence of greenish-grey to reddish brown shale and siltstone interlaminated with very thin sandstone streaks. Rare dolomite bands occur near the contact with the Bitter Springs Formation.



Green biotite and muscovite are aligned parallel to bedding planes. Grains are cemented by chlorite, limonite, haematite, and pyrite. Very fine dolomite crystals occur throughout the Formation.

Sandstone is present in fine laminations grading to shale and siltstone. The sandstone is composed of fine to very fine grained, angular, well sorted quartz, some potassium feldspar, very rare albite, igneous and sericitised rock grains and muscovite. Authigenic glauconite occurs in grains, pellets, in irregular aggregates moulded around quartz particles and as staining in the matrix. The glauconite is associated with phosphatic grains. Heavy minerals form the accessories. The cement is chlorite, as well as some kaolinite, sericite, intergranular quartz and a very small amount of dolomite.

#### 4.2.6 Bitter Springs Formation

The Bitter Springs Formation is formally divided into two Members, the Loves Creek Member and the Gillen Member. On the basis of seismic character and lithology the Gillen Member has been informally divided into three sub-units.

#### 4.2.7 Loves Creek Member

| Age         | Range      | (thickness) |
|-------------|------------|-------------|
| Proterozoic | 1390-1570m | (180m)      |

This sequence is essentially a dolomite with some interlaminated shale, siltstone and sandstone streaks. Salt does not occur in this member. The carbonate content of this member is higher than in the Gillen Member.

The dolomites of the Loves Creek Member are predominantly white and pink, finely laminated cryptocrystalline to microcrystalline rocks. Haematite occurs in fine clusters or intergranular spots. Coarse grained dolomite rhombs occur in grey to pink quartz chalcedonic nodules.

In general the dolomite contains detrital material composed of angular to rounded, fine to very coarse grains of quartz with scattered pebbles, some orthoclase and microcline, igneous and sericitised rock fragments, fine grained sandstone and carbonate lithics. Some of the detrital grains are coated with haematite.

Anhydrite and gypsum are present as intrusive layers, as spots in dolomite, siltstone and sandstone, or as intragranular crystals. Sulphates present are of secondary origin.

#### 4.2.8 upper Gillen Member (informal unit name)

|             |            |             |
|-------------|------------|-------------|
| Age         | Range      | (thickness) |
| Proterozoic | 1570-1830m | (260m)      |

This unit is represented by fine laminated dolomite and anhydrite bands interfingered with halite, black shale, siltstone and very thin streaks of sandstone.

Dolomite occurs as thick compact bands of haematitic cryptocrystalline to microcrystalline dolomite, characterised by a detrital content (10-40%) of angular to rounded, fine to very coarse grains of quartz with scattered pebbles, some orthoclase and microcline, igneous and sericitised rock fragments. Fine grained sandstone and carbonate lithics also occur, some of which have haematite coatings.

Siltstone and shale are present in thin layers grading to very fine sandstone. The siltstone is very haematitic, chloritic and locally micaceous grading to illitic shale, with scattered rounded conglomeratic quartz, feldspar, igneous and sandstone rock fragments. Dolomite content is very low (5%), recrystallised anhydrite occurs in patches and fine fissures.

Sandstone is interbedded in the siltstone in very thin layers. The sand is coarse grained, angular, well sorted quartz sandstone, with rare potassium feldspar, igneous and sericitised rock fragments.

Microquartzite and muscovite are also present in small amounts. Glauconite occurs as green to light brown grains, pellets or elongated crystals. Phosphate grains are present in all sandstone units as light pink to amber brown rounded grains. Phosphate is also present in fine interstitial granules. The cement is composed of quartz overgrowths, chlorite in flakes, fine coatings or pigments, some sericite, pyrite, limonite, carbonate minerals, anhydrite, and rare gypsum.

#### 4.2.9 Gillen Salt (informal unit name)

|             |            |             |
|-------------|------------|-------------|
| Age         | Range      | (thickness) |
| Proterozoic | 1830-2090m | (260m)      |

Grey, beige and pink, very coarse crystalline halite occurs between 1830-2090m, in a thick sequence including suspended broken pieces of grey and blackish laminated anhydrite with very fine grained dolomite, rich in black matter. Halite is also present in fine layers and streaks throughout the section.

Primary anhydrite and dolomite are the main components of this sequence, both occurring in fine rhythmically interlaminated layers with some syn-sedimentary structures. The anhydrite is greyish-white dense microcrystalline, in some places divided into laminae 2-3mm thick. The laminated texture is caused by thin, marly intercalations and inverted grading of the anhydrite grains. The marly layers are composed of very fine carbonate granules, mainly dolomite, argillaceous matter and in places haematite.

Crystalline anhydrite also occurs as isolated patches and lenses in a fine grained anhydritic-dolomitic ground mass. This rock grades to massive anhydritic dolomitic rocks in which the anhydrite consists of a fine grained interlocking mass and dolomite as small rounded crystals disseminated throughout.

Interlaminated within this rhythmic primary anhydrite there are laminae of brownish to blackish-grey, cryptocrystalline dolomite, very rich in carbonaceous matter and some clay. These layers have intraformational, synsedimentary contortions, microslumping and some breccias.

#### 4.2.10 basal Gillen Member (informal unit name)

| Age         | Range      | (thickness) |
|-------------|------------|-------------|
| Proterozoic | 2090-2290m | (200m)      |

This unit has not been intersected in the subsurface. Based on surface mapping it is similar in aspect to the upper Gillen Member. The unit is predicted to consist of dolomite with high content of detritals, and primary and secondary anhydrite. Halite is expected to be absent. Carbonaceous shale and/or carbonate is predicted to occur in this unit, most likely in numerous thin horizons.

#### 4.2.11 Heavitree Quartzite

| Age         | Range      | (thickness) |
|-------------|------------|-------------|
| Proterozoic | 2290-2520m | (230m)      |

The Heavitree Quartzite ranges in colour from pale pinkish-cream to red-brown. The formation consists almost entirely of clean, silicified quartz sandstone. It is possible that up to 10m of shale and siltstone will be present at the base of the formation. The following description is based on outcrop samples and thus may not be representative of the Formation at depth.

The rock is composed of approximately 85% quartz, 10% clay, 3% goethite and traces of heavy minerals. The clay tends to occur as a thin film rimming the quartz grains or forming a network between the quartz grains and quartz grain overgrowths. The rock has been compacted and this has resulted in pressure solution effects.

Lithic material is represented by small aggregates of fine grained silica which are thought to have originated from chert fragments. Porosity is expected to be low, and highly variable, with a component of fracture porosity. Drilling breaks should be circulated for evaluation.

## 5 POLICY GUIDELINES

### 5.1 Environment

Pacific Oil & Gas recognises the value in minimising the environmental impact from its field operations and plans its exploration programme accordingly. Throughout its operations Pacific will follow the APEA Code of Environmental Practice and as in the past will liaise closely with staff from the various Northern Territory Authorities to ensure the minimum environmental impact. All exploration sites will be fully rehabilitated at the conclusion of the programme. In addition to the foregoing, specific actions programmed for Magee 1 are as follows:-

- (a) Final site selection has been made with a view to causing minimum disturbance of the ground surface and vegetation.
- (b) Topsoil has been preserved to enable the re-establishment of the soil profile.
- (c) All pits will be back-filled, and levelled.
- (d) All contractors have been advised of their role with regard to environmental considerations.
- (e) Sufficient waste water storage volume has been prepared to contain expected volumes of produced water.
- (f) Rubbish will be burned on site and/or removed. Littering will not be tolerated.

### 5.2 Occupational Health and Safety

Pacific Oil & Gas is committed to the protection of the health and safety of its employees and to achieve a safe work environment. The health and safety of employees is integral to, and inseparable from good management practice. All employees are personally accountable for working in a manner that ensures their own safety and that of their colleagues and for suggesting ways of improving health and safety in the work place

Pacific Oil & Gas will comply with all applicable laws in Australia, and where appropriate, seek to do better. The health and safety management and planning will be of a consistently high standard, and take into account the best contemporary international practice. It is required that all employees comply with all applicable legal and regulatory governmental requirements and consistent consent arrangements relating to health and safety.

The Department of Mines and Energy require all injuries and diseases to be reported to them, along with the number of hours worked. This requirement only applies when working on site and reporting is to cover company employees as well as contract and other third party employees. This will necessitate reporting accidents and diseases as they occur or keeping a record. A monthly report is to be provided to the Department of Mines and Energy, Northern Territory.

In addition to the foregoing, specific actions required for Magee 1 are as follows:-

- (a) Rig personnel will be instructed in the noise, dust, and pressure-related dangers of compressed air operations.
- (b) Trained personnel only will maintain and operate air supply equipment.
- (c) The rig and camp are alcohol free at all times.
- (d) Vehicle movement will be controlled.

**KEYWORDS, LOCATION & DESCRIPTOR**

Petroleum, Oil, Gas, Proterozoic, Structural Trap, Stratigraphy, Geophysical Interpretation, Geophysical Logs, Seismic Survey, Hydrocarbons, Drilling, Percussion Drilling, Conservation, Well logs .

EP38 (Pinnacle Hills), Northern Territory, Finke SG53-6, RODINGA 1:250 000.

This report details the drilling programme and anticipated stratigraphy for Pacific Oil & Gas Pty. Limited Magee 1, EP38 Amadeus Basin NT.