SECTION 1 - ENGINEERING DATA

1.1 Engineering Summary

McManus-1 is located in Northern Territory Exploration Permit 24 (EP24) approximately 50km to the north east of Daly Waters (Figure 1). The hole was drilled as an exploration well to test fracture porosity in the updip flank of a large syncline, immediately south of a large thrust anticlinal structure identified from the 1989 Nutwood Downs seismic survey. The well was drilled by Pacific Oil & Gas Pty. Ltd., as sole permit holder and operator using Rockdrill Contractors Pty. Ltd.'s Rig 20, a Longyear 600.

Access to the location was via the boundary fenceline between Maryfield and Kalala stations and a one kilometre access along seismic line 109. Drill site preparation involved clearing a drilling pad over an area of approximately 150m x 150m. Drilling and potable water was pumped from a bore drilled on the site.

Well site supervision was provided by Ian Leddie and Griff Weste.

Drilling operations commenced at McManus-1 at 1600 hrs on September 28th, 1989 with Rockdrill Rig 20 reaming an 8 1/2 inch hole to 86 metres. The well had previously been precollared by Gorey and Cole as a 12 1/4 inch hole to 84 metres, which was then cased with ten inch PVC conductor to 64.5 metres. Then the hole was drilled to 131 metres using an 8 1/2 inch hammer and seven inch casing was set at 128.4 metres. Drilling continued past the seven inch casing shoe with a six inch hammer to 272m, at which depth it was decided to run five inch casing. (A strong water flow was reported at 227 metres). The five inch casing was set at 270.8m at 0900hrs on October 1. The BOP stack was nippled up and tested to 1000 psi prior to cement being drilled out with a 4 1/2 inch rotary bit.

The CHD 101 core assembly was made up and the hole drilled to 275.0 metres. A Formation Integrity Test was conducted and the formation found to leak off at 410 psi (equivalent mud weight 17.1ppg). The hole was then fully cored to a depth of 1319.95m where a DST was run. The formation did not flow and was presumed to be tight. The well was then fully cored to a total depth of 1617.25m. The hole was circulated and wireline logs, including a velocity survey, were run.

Following evaluation of wireline logs and other drilling data it was decided to abandon the hole with the setting of cement plugs over the following intervals: 1136-1370 metres, 302 - 242 metres and from 45 metres to surface. The abandonment was completed and the rig released at 1900 hrs on November 18, 1989. A chronological log of drilling activities is included as Appendix 1.
Figure 1. Location map for Walton-1 & 2 and McManus-1
1.2 General Data

Well Name: McManus-1
Well Type: Exploration Well
Operator: Pacific Oil & Gas Pty Limited
Licence Holders: Pacific Oil & Gas Pty Limited 100%
Petroleum Title: EP 24, Northern Territory

Location:
- Latitude: 15.55' 14.44" South
- Longitude: 133 37' 46.53" East
- Map: 1:100,000 sheet
- AMG: 353306.9E, 8239350.9N
- Zone 53

Elevation:
- Ground Level: 189.53m
- Drilling Floor: 192.03m

Total Depth:
- 1617.25 m (Driller)
- 1617.40m (Logger)

Commencement Date: 28th September 1989

Total Depth Reached: 0815hrs, 13th November, 1989

Rig Released: 1900 hours, 18th November, 1989

Drilled by: Rockdril Contractors Pty. Ltd.

Drilling Rig: Rig 20, Longyear 600

Hole Size:
- 12¼ inch to 84.0m
- 8¾ inch to 131.0m
- 6 inch to 272.0m
- 4½/3 inch to 1617.25m

Wireline Logs:
- Spontaneous Potential
- Dual Focussed Resistivity
- Gamma Ray, Caliper
- Density
- Dipmeter (tool failed)
- Multichannel Sonic
- Run from 1617m to 220m

Velocity Survey: A 23 level velocity survey was conducted by
Velocity Data.
1.3 Drilling Rig

ROCKDRIL RIG 20 - RIG AND EQUIPMENT DESCRIPTION

DRILLING RIG: Longyear 600

Depth Capacity: CHD 134 1,747 m (Rod Rating 1956m)
CHD 101 2,180 m (Rod Rating 3050m)
CHD 76 3,428 m (Rod Rating 2750m)

Power Unit: Caterpillar 3306-T 210 Hp @ 2,000 RPM
620 lb. Ft. @ 1,400 RPM

Transmission: To Powerhead and Hoist Hydr/Mech (Funk) 4 speed
Ratios: 6.27-1 (Blocked out on hoist)
3.12-1
1.75-1
1.00-1

Bit Speeds: Based on 2000 Engine RPM @ 3,000 psi Pump
Pressure: 1st - 130 RPM
2nd - 260 RPM
3rd - 466 RPM
4th - 822 RPM

Powerhead: Pump & Drive Motor - Sunstrand 23 lb.
Powerhead Ratio - 2.081:1
Overall Ratio - 1st 13.09:1
2nd 6.51:1
3rd 3.65:1
4th 2.087:1

Lubrication: Positive Lube Pump

Torque @ 4,500 psi - 1st 4,219 ft. lb
2nd 2,099 Ft. lb
3rd 1,179 Ft. lb
4th 673 Ft. lb

Spindle I.D. 4-3/16" (106mm)
Retraction 14" (355.6mm)

Max. casing size with head retracted - 12 "
(304.8mm).

Feed System: Feed Length - 11 ft (3.35m)
Cylinder Size - 5" Bore x 2-1/2" Piston Rod
Lift Capacity - 73,625 lbs (33,396 kgs) @ 2500 PSI
Thrust - 7,856 lbs (3,422 kgs) @ 200 PSI
Hydraulic Pump - 2 stage Compensator 2500 PSI
and 200 PSI (Delavan)
5.

Chuck: Hydraulic 3 - Jaw tungsten Inserts, Subs required to convert to top drive of Kelly from approximately 1200m 101 size hole.

Main Hoist: Type: Hydr/Gear
Drum Diam: 9-1/2" (241.3mm) - Grooved
Drum Length: 20-5/8" (523.87mm)
Flange Diam: 18-1/4" (463.55mm)
Drum Capacity: 730' x 5/8" Cable (223m x 16mm)
Hydr. Pump: Sunstrand f23
Hydr. Motor: Sunstrand f23 2-speed

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2nd 0-118ft/m (136m/m)</td>
<td>0-177ft/m (54m/m)</td>
</tr>
<tr>
<td>3rd 0-211ft/m (64.3m/m)</td>
<td>0-316ft/m (96m/m)</td>
</tr>
<tr>
<td>4th 0-370ft/m (113m/m)</td>
<td>0-555ft/m (169m/m)</td>
</tr>
</tbody>
</table>

Hoisting Capacity:

<table>
<thead>
<tr>
<th>Single</th>
<th>4 Pt. Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2nd 5,000 lbs (6804 kgs)</td>
<td>60,000 lbs (27,216 kgs)</td>
</tr>
<tr>
<td>3rd 9,750 lbs (4422 kgs)</td>
<td>39,000 lbs (17,690 kgs)</td>
</tr>
<tr>
<td>4th 5,500 lbs (2495 kgs)</td>
<td>22,000 lbs (9,979 kgs)</td>
</tr>
</tbody>
</table>

Brake:
Size - 18" x 14" (457 mm x 101 mm)
Area - 226 sq. ins. (1458 cm2)
Brakes used for holding loads only
Power up and down through hydraulics

Wireline Hoist: Type: Hydraulic-Chain drive from Main Hoist Motor
Drum Diam: 5-1/2" (140mm)
Drum Length: 17-1/8" (435mm)
Flange Diam: 30" (726mm)
Drum Capacity: 6486 ft. x 5/16" Cable (1996 m x 8 mm) at 75% of Spool Level Wind
Bare Drum Speed: 0-1000 F.P.M. (305 m/m)
Control: Power up and down through hydraulics with free wheel.
Mast:
- Crown Block Rating: 121000 lbs. (54866 kgs) inc. 1.64 Factor of safety
- Hook Load Rating: 60000 lbs (27216 kgs) with 4 part line
- Method of Raising: Hyd. Cyl. (2)
- Rod Stacking Cap: 30 & 40 ft. stands
- Guy Lines Required: 4
- Mast Length: 58.4" (17.78 m)
- Weight Indicator: Indicator gauge to 60000 lbs with 4 part line.

Mounting:
- Trailer mounted with four levelling jacks

Mud Pump:
- 5 x 6 G.D. Pump rated 150 G.P.M. @ 310 PSI
- Powered by Sunstrand f21 Pump & Motor with Gear Reducer
- 7-1/2 x 10 G.D. Pump Rated 487 G.P.M. @ 255 PSI (211 G.P.M. @ 574 PSI - Powered by 4-71 G.M. Diesel.

Fluid Pumps:
- 2 x 535 Bean Pumps Powered by Sunstrand
- f21 Pump Driving 2 sunstrand f20 in series with bypass
- Max. Flow - 1 pump 35 G.P.M.
- Max. Flow - 2 pumps 70 G.P.M.

Specifications of Associated Equipment

Substructure: Rig raising sub-base - 7m long 2.5m width x 2.0m high

Derrick Floor: 3.5 m long width x 2.0 m high
- Longyear Type LD max. safe static working load 28 tons. Max safe working load when rotating 15 tons at 200/300 RPM.

Weight Indicator: Martin-Decker Model WS8-11

Mud System:

a. Mud system consisting of the following items:

Settling Tank
- Overall dimensions 4.8m long 2.00m wide 0.90m high
- Mounted on oilfield type skid 6m long
- Capacity 8,600 litres (2,275 gals-54 BBLS)
Equipped with:

Geosource shale shaker capacity 300/500 GPM size 4' x 5' dual screen driven by an hydraulic motor 10HP

Pickup pump fe centrifugal 500 GPM hydraulic motor

Desilter 200 GPM model Economaster S2-E4

Mud agitator type axial flow impell 45 degree flat blade turbine, driven by a hydraulic low speed 60 RPM high torque motor.

Pump type Mission 3 x 4 x 13 centrifugal belt driven from engine.

Prime mover W/Power takeoff type Lister HR4 52 HP 1800 RPM

Hydraulic System: Gear pump tandem type suitable to operate pick-up, shale shaker, 2 mud agitators, centrifugal pump 2 x 2-1/2 x 12 (No. 1 Agitator and 2 Centrifugal pumps are fitted on the other tank)

Mud gun

Degasser

b. Mixing/storage tank-two compartments

Overall Dimensions 4.8m long 2.00 wide 1.20 high mounted on oilfield type skid 6m long capacity 11,500 litres (3,042 gals - 72.4 BBLs)

Equipped with:

Centrifugal pump-Kelly-Lewis 2 x 2-1/2 x 13 driven by a hydraulic motor 18 HP

2 mud agitator W/impeller 26" hydraulic driven

2 mud gun

c. Cementing/Killing unit mounted skid 6m long 22m wide w/two tanks around 1,000 gals. capacity each

Prime mover Lister diesel engine mel H46 103 Hp

Power take-off twin disc dry type

Gear box flexible coupling

Oilwell pump model D-323 type Triplex max. bore x stroke 2-1/2" x 3" rated HP 60 rated press. 4,000 PSI rated RPM 500
Agitators 6 HP capacity 60 RPM hydraulic driven one on each tank

Centrifugal pump type Kelly-Lewis K-70 2" x 2-1/2 x 9"
Hydraulic driven

Hydraulic system including tandem gear pump driven from front of engine.

Cameron gate valve 2" 3,000 PSI
Cameron pressure gauge 3,000 PSI
Shear relief valve 3,000 PSI

Wellhead Equipment:

No. 1 BOP Hydril 6"-3000 PSI W.P. Type GK bottom flanged
6"-3000 PSI bore size 7-1/6"

No. 1 BOP Shaffer 6" x 3,000 PSI W.P. Type B double unit top and bottom studded bore size 7-1/16"

No. 1 Breda National Wellhead 5000 PSI to suit 7", 5", 4" casing plus all accessories

No. 1 Drilling spacer spool 3000 PSI W.P. bottom and top flanged 6"-3000 PSI two outlets-1st flanged 2"-3000 PSI, 2nd 3"-3000 PSI bore size 7-1/6"

No. 2 National valve 2"-3000 PSI W.P. flanged for kill line
No. 1 National valve 3"-3000 PSI W.P. flanged for choke line
No. 1 National valve flo-tork model 3"-3000 PSI W.P. W./Hydraulic actuator
No. 1 Cameron check valve type R2"-3000 PSI W.P.
No. 1 National choke manifold assy. 3"x2-1/2" 3000 PSI W.P.
No. 1 Kill line 2"-3000 PSI W.P.
No. 1 Choke line 3"-3000 PSI W.P.
No. 1 Hydril automatic pump accumulator unit type HP-17-K80
No. 1 Shaffer hydraulic control panel pedestal type for BOP remote control
No. 1 Shaffer auxiliary control panel
No. 1 Bourne upper kelly cock 3000 PSI W.P.
No. 1 TIW Lower Kelly cock 3000 PSI W.P.
No. 2 Gray Inside BOP (float valve) 3000 PSI W.P.
No. 1 Guiberson type G tubing preventor 1,500 PSI W.P.
No. 1 Guiberson Wireline oil savers type H W/hydraulic pump 3000 PSI W.P.
No. 1 Guiberson Type C releasing attachment
Set stabbing valves for different thread connections-flare line

Tubular Equipment and Fishing Tools:

CHD 101 Longyear rods O.D. 3.701" I.D. 3.268 (Midbody) I.D. 3.091 joint depth rating 10,000 ft. (3,050m)
Set of cross-over subs
Core barrels for CHD 101mm
Gotco overshot O.D. 5-7/8" w/spiral to catch from 2-3/8" to 4-7/8
Taper and bell taps for all tubing sizes

Surface and Casing Equipment:

Longyear automatic pre-torque and break-out tool rod size CHD 76 through CHD 101
Casing size E through N
Max. torque (breakout) 2,8000 lb/ft
Max. torque (make-up) 2,4000 lb/ft
Rod clamp weight capacity 4,000 lb
Baash-Ross hinged casing spider w/different bushing
Baash-Ross casing slips 6-5/8"
Handling tools for 4", 5" and 7" casing
Set of circulating head for different sizes of casing
Set of lifting plugs for all tubing

Auxiliary Equipment:

Explosion proof lighting system
A.C. electric generator KVA60
A.C. electric generator KVA35
Water storage tank 2,000 gallons
Fuel storage tank 500 gallons
Workshop barrack
Motorpump type mono
Centrifugal pumps (2") - Petrol driven
Transportation and Lifting Means:
1 6 x 6 Mack truck fitted with hydraulic crane
2 Toyota Land-cruiser pick-up 4WD
Miscellaneous:
Radio-wireless set SSB radio fitted with appropriate flying doctor frequency
Set of mats for setting rig
Set of extinguishers
Drill collars and stabilizers to suit hole specifications.
1.4 Hole Sizes and Depths

McManus-1: Drilling commenced with the air drilling of a 12 1/4" precollar hole to 86.0m by Gorey and Cole. Rockdrill Rig 20 set over the precollar and air drilled with an 8¼" hammer to 131.0m. Hammer drilling of 6" hole continued to 272.0m. The remainder of the hole was fully cored with CHD 101 with a 110.5mm near-bit reamer shell.

1.5 Casing and Cementing

McManus-1: 10" PVC conductor set at 64.5m.
Make:
No of Joints: 9
Cement Used: 6 sacks class A cement
Accessories: Nil
Remarks: Cemented to surface

7" surface casing set at 128.4m
Make: Kawasaki
Weight: 26 lb/ft
Grade: N80
No of Joints: 12
Cement Used: 47 sacks class A cement
1 sack CFR2
Accessories: Cement shoe
Remarks: Cemented to surface

5" intermediate casing set at 270.8m
Make: Kawasaki
Weight: 13 lb/ft
Grade: K55
No of Joints: 28
Cement Used: 36 sacks class A cement
1 sack CFR2
Accessories: Cement shoe
Remarks: No returns were observed at the surface.

1.6 Drilling Mud

McManus-1 was spudded using an air drilling system, with stiff foam where lost circulation was encountered. Air drilling continued to 272 metres using water lifted from the hole, and where necessary water and gel misted with air. The remainder of the hole was drilled with a Drill Floc system (a polyacrilamide mud), with up to 3% KCl added towards the lower part of the hole.

Details of the drilling fluid properties and mud consumed for the hole are given in Appendix 2.
# TABLE 1

BIT SUMMARY

McManus-1

<table>
<thead>
<tr>
<th>Bit No</th>
<th>Make/Type</th>
<th>Serial No</th>
<th>Depth in (m)</th>
<th>Depth out (m)</th>
<th>W.O.B. (kg)</th>
<th>R.P.M.</th>
<th>Pump Pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Walker McDonald, 4½&quot;</td>
<td>L31345</td>
<td>272.25</td>
<td>274.85</td>
<td>6000</td>
<td>40</td>
<td>150-200</td>
</tr>
<tr>
<td>2</td>
<td>Longyear S6, 3.976&quot;</td>
<td>L31705</td>
<td>274.85</td>
<td>422.95</td>
<td>4-8000</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>3</td>
<td>Longyear, 4 step, 3.976&quot;</td>
<td>L3738</td>
<td>422.95</td>
<td>470.05</td>
<td>4-9000</td>
<td>30</td>
<td>200</td>
</tr>
<tr>
<td>4</td>
<td>Longyear, 4, step, 3.976&quot;</td>
<td>L31345</td>
<td>470.05</td>
<td>505.25</td>
<td>5-8000</td>
<td>250</td>
<td>500</td>
</tr>
<tr>
<td>5</td>
<td>Longyear, S6, 3.976&quot;</td>
<td>L69348</td>
<td>505.25</td>
<td>557.05</td>
<td>3000</td>
<td>30</td>
<td>800-1000</td>
</tr>
<tr>
<td>6</td>
<td>Longyear, S2, 3.976&quot;</td>
<td>L31705</td>
<td>557.05</td>
<td>846.75</td>
<td>3-6000</td>
<td>250</td>
<td>700-1200</td>
</tr>
<tr>
<td>7</td>
<td>Longyear, 4 step, 3.976&quot;</td>
<td>L28148</td>
<td>846.75</td>
<td>906.65</td>
<td>5-6000</td>
<td>250</td>
<td>500-1200</td>
</tr>
<tr>
<td>8</td>
<td>Longyear, 8 step, 3.976&quot;</td>
<td>L30956</td>
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<td>3-6000</td>
<td>250</td>
<td>700-1000</td>
</tr>
<tr>
<td>9</td>
<td>Longyear, S6, 3.976&quot;</td>
<td>L31346</td>
<td>1071.35</td>
<td>1319.95</td>
<td>3-8000</td>
<td>250</td>
<td>700-1200</td>
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<td>10</td>
<td>Longyear, S6, 3.976&quot;</td>
<td>L178401</td>
<td>1319.95</td>
<td>1612.0</td>
<td>4-8000</td>
<td>250</td>
<td>1000-1200-1500</td>
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<td>11</td>
<td>Longyear, S6, 3.976&quot;</td>
<td>L2902</td>
<td>1612.0</td>
<td>1617.25</td>
<td>4-6000</td>
<td>250</td>
<td>900-1200</td>
</tr>
</tbody>
</table>
1.7 Water Supply

Both drill and potable water were pumped from a water bore which was drilled at the wellsite by Gorey and Cole.

1.8 Bit & Deviation Record

1.8.1 Drilling Bits

Twelve bits were used in the drilling of McManus-1. Details of bit usage are given in Table 1.

1.8.2 Deviation

Deviation Survey details are given in Table 2.

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Deviation (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>164.0</td>
<td>0 3/4</td>
</tr>
<tr>
<td>266.0</td>
<td>0 1/4</td>
</tr>
<tr>
<td>345.0</td>
<td>1</td>
</tr>
<tr>
<td>412.95</td>
<td>2 3/4</td>
</tr>
<tr>
<td>430.0</td>
<td>3 1/4</td>
</tr>
<tr>
<td>452.0</td>
<td>3 1/4</td>
</tr>
<tr>
<td>470.0</td>
<td>3</td>
</tr>
<tr>
<td>525.0</td>
<td>3 1/2</td>
</tr>
<tr>
<td>575.0</td>
<td>3 1/2</td>
</tr>
<tr>
<td>630.0</td>
<td>3 1/2</td>
</tr>
<tr>
<td>693.25</td>
<td>3 1/2</td>
</tr>
<tr>
<td>789.0</td>
<td>4</td>
</tr>
<tr>
<td>945.0</td>
<td>4 1/2</td>
</tr>
<tr>
<td>1062.0</td>
<td>4</td>
</tr>
<tr>
<td>1178.0</td>
<td>4</td>
</tr>
<tr>
<td>1370.0</td>
<td>8</td>
</tr>
<tr>
<td>1500.0</td>
<td>4</td>
</tr>
</tbody>
</table>

1.9 Fishing and Related Operations

No fishing operations were conducted in McManus-1.
1.10 **Formation Testing**

A drill stem test was conducted in McManus-1 over the interval 1071.45 to 1319.95m. The conventional bottom-hole test commenced at 2015hrs on November 2 and was pulled at 0515hrs on the November 3. Approximately 652 metres of drilling mud was recovered from the drillstring above the tool. The tool itself also contained mud without any oil cut. Analysis of the pressure charts indicates a possible leak in the drill string enabling mud to flow from the annulus into the drill string. Full details of the test can be found in Appendix 3.

1.11 **Time Distribution**

Time spent on the various phases of the drilling operation are given in Appendix 4, and a time-depth curve for McManus-1 is included as Figure 2.

1.12 **Well Costs**

A detailed cost-break down for McManus-1 is given in Table 3.

**TABLE 3**

**WELL COSTS**

McManus-1

as at 30/06/90

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling</td>
<td>363,074</td>
</tr>
<tr>
<td>Supplies &amp; Communications</td>
<td>16,311</td>
</tr>
<tr>
<td>Vehicle Operation</td>
<td>2,523</td>
</tr>
<tr>
<td>Travel &amp; Accommodation</td>
<td>31,132</td>
</tr>
<tr>
<td>Contractors &amp; Professionals</td>
<td>22,660</td>
</tr>
<tr>
<td>Laboratory Analysis</td>
<td>7,322</td>
</tr>
<tr>
<td>Salaries, Office Costs &amp;</td>
<td>37,137</td>
</tr>
<tr>
<td>Other Costs</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>480,159</td>
</tr>
</tbody>
</table>