

**SANTOS – AWE – MITSUI**

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**SANTOS LIMITED**

*(A.B.N. 80 007 550 923)*

**CASINO-4DW1 and CASINO-4DW2**

**INTERPRETED DATA REPORT**

**(Combined)**

**PREPARED BY:  
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(Consultant)  
November 2005**

# CASINO-4DW1 and CASINO-4DW2

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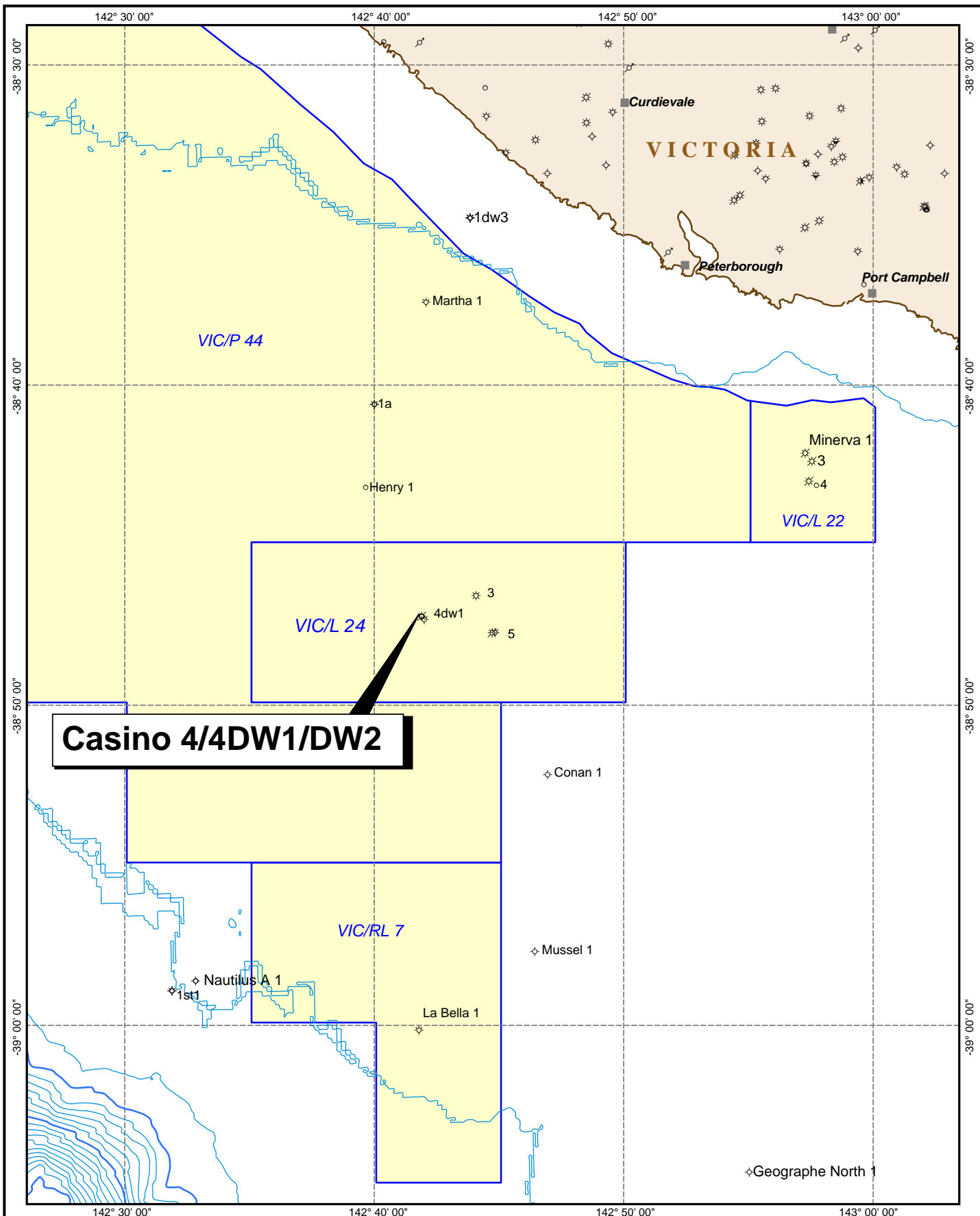
WELL PATH SCHEMATIC

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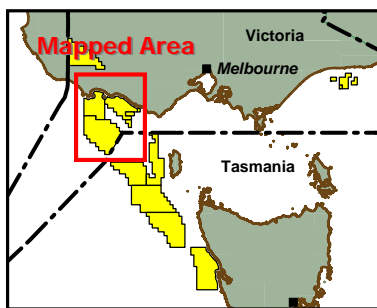
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## **LOCATION MAP**



**Casino 4/4DW1/DW2**



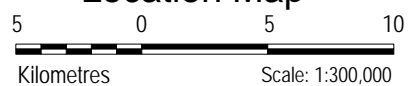
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Santos Permit

**Santos**

VIC/L24 - Victoria  
Otway Basin

**Casino 4/4DW1/DW2  
Location Map**



Date: Sept 2005, File No. OTWAY 658

**WELL CARD**  
**CASINO-4DW1**

|  |   |  |                    |                             |                  |
|--|---|--|--------------------|-----------------------------|------------------|
| <b>WELL:</b> CASINO-4DW1   | <b>WELL CATEGORY:</b><br>Offshore Gas Development Well<br><b>WELL INTENT:</b> Gas | <b>SPUD:</b> 21-05-05  |                    | <b>TD REACHED:</b> 22-05-05 |                  |
|  |   | <b>RIG RELEASED:</b> 26-05-05  |                    | <b>CMPLT:</b> -             |                  |
|  |   | <b>RIG:</b> OCEAN PATRIOT  |                    |                             |                  |
| <b>SURFACE LOCATION:</b> (GDA94)<br><b>LAT:</b> 38° 47' 13.03" S <b>LONG:</b> 142° 41' 54.49" E<br><b>NORTHING:</b> 5705495.28m <b>EASTING:</b> 647518.19m |   | <b>STATUS:</b><br>Plugged back & Sidetracked to Casino-4DW2 from 1146m |                    |                             |                  |
| <b>SEISMIC SURVEY:</b> Casino 3D Inline 6074 Xline 2742  |   | <b>REMARKS:</b>  |                    |                             |                  |
| <b>ELEVATION SEA FLOOR:</b> -70.8m LAT <b>RT</b> +22.0m LAT  |   |  |                    |                             |                  |
| <b>BLOCK/LICENCE:</b> Victoria – Otway Basin VIC/P44   |   |  |                    |                             |                  |
| <b>TD</b> - m (Logr Extrap) 1662 m (Drlr)  |   |  |                    |                             |                  |
| <b>PBTD</b> m (Logr) 1146 m (Drlr)   |   |  |                    |                             |                  |
| <b>TYPE STRUCTURE:</b> TILTED FAULT BLOCK  |   | <b>HOLE SIZE</b>   | <b>CASING SIZE</b> | <b>SHOE DEPTH</b>           | <b>TYPE</b>      |
| <b>TYPE COMPLETION:</b> NIL  |   | 914mm (Casino-4)   | 762mm              | 137.4m                      | 460 kg/m X56     |
| <b>ZONE(S):</b> -  |   | 445mm (Casino-4)   | 340mm              | 727.8m                      | 107 kg/m L80 BTC |

| AGE             | FORMATION OR ZONE TOPS | DEPTH (M)      |            | THICK-NESS (m) | HIGH (H) LOW (L) |
|-----------------|------------------------|----------------|------------|----------------|------------------|
|                 |                        | Loggers RT (m) | Subsea (m) |                |                  |
| Late Cretaceous | Paarate Formation      | 1304           | 1280       | 260.7          | 5m Low           |
| Late Cretaceous | Skull Creek Mudstone   | 1578           | 1540.7     | 86.5           | 0.3m High        |
|                 | Total Depth            | 1662           | 1627.2     |                |                  |

| TYPE OF LOG  | FROM (m) | TO (m) | REPEAT SECTION | TIME SINCE LAST CIRC | BHT |
|--|----------|--------|----------------|----------------------|-----|
| <b>MWD 311mm (12.25")</b><br>Gamma Ray, Resistivity, Vibration, Surveys (2 runs) | 1308     | 1662   |                |                      |     |

| LOG INTERPRETATION   |     |      |             |     |      | PERFORATIONS |          |          |     |
|----------------------|-----|------|-------------|-----|------|--------------|----------|----------|-----|
| INTERVAL(m)          | Ø % | SW % | INTERVAL(m) | Ø % | SW % | FORMATION    |          | INTERVAL |     |
|                      |     |      |             |     |      |              |          |          |     |
| No Log Analysis Done |     |      |             |     |      |              |          |          |     |
|                      |     |      |             |     |      | CORES        |          |          |     |
|                      |     |      |             |     |      | NO.          | INTERVAL | CUT      | REC |
|                      |     |      |             |     |      |              |          |          |     |

### PRODUCTION TEST RESULTS

No production tests were conducted at Casino-4DW1

**SUMMARY:**

Casino-4 (the parent hole for the sidetracked Casino-4DW1) was drilled as an Otway Basin gas exploration well in the Victoria Offshore VIC/P44 licence. The Surface Location is Latitude: 38° 47' 13.03" S Longitude: 142° 41' 54.49" E (GDA94), Northing: 5705495.28m, Easting: 647518.19m (MGA-94), with a seismic reference of Inline 6074, Xline 2742, Casino-3D Survey 2001. The location lies 220 m northwest of Casino-1. The water depth at the well location was 70.8m LAT.

Casino-4DW1 was kicked off from 1308m from a cement plug in Casino-4 at 09:30 hrs on 21-05-05. Bit 6, a 311mm (12.25") Security-DBS FS2663 was run in hole along with MWD tools and the Sperry Sun GEOPLOT steerable unit. Cement was tagged at 1273m and the kick-off was initiated from 1308m. Directional hole was drilled from 1308m to 1599m where the bit was pulled up into the casing shoe to undertake repairs to the Top Drive System. After the repairs the bit was run to bottom and drilling continued from 1599m to 1662m. However, the required build rate was not being achieved. The drill string was pulled to surface and a motor assembly with a 1.5° bend was made and run in hole. However this assembly was not able to pass below the wellhead. Instructions were received to plug back to about 1200m and re-attempt the sidetrack. Total depth of Casino-4DW1 was reached at 17:30 hours on 22-05-05. The 311mm (12 ¼") section was logged while drilling with Sperry Sun MWD tools to record Gamma Ray, Resistivity, Vibration/Shock, Annular Pressure and Deviation Survey data.

Thereafter a kick-off plug was set in the interval 1200m-1350m. While waiting on cement, the Blowout Preventers were tested. From 1200m to 1265m attempts to kick-off from this plug failed and plug #3 was then set from 1100m to 1265m. A PDC was run in hole and used to initiate the sidetrack to Casino-4DW2 from 1146m. All activities on Casino-4DW1 ceased at 24:00 hrs on 26-05-05.

**AUTHOR:** R. SUBRAMANIAN**DATE:** November 2005

**WELL CARD**  
**CASINO-4DW2**



|   |   |  |                |               |                     |
|---|---|--|----------------|---------------|---------------------|
| WELL: CASINO-4DW2   | WELL CATEGORY:<br>Offshore Gas Development Well<br>WELL INTENT: Gas | SPUD: 27-05-05                      TD REACHED: 04-06-05 |                |               |                     |
|   |   | RIG RELEASED: 14-06-05    CMPLT: 14-06-05                |                |               |                     |
|   |   | RIG: OCEAN PATRIOT                                       |                |               |                     |
| SURFACE LOCATION: (GDA94)<br>LAT: 38° 47' 13.03" S    LONG: 142° 41' 54.49" E<br>NORTHING: 5705495.28m    EASTING: 647518.19m |   | STATUS: SUSPENDED GAS WELL (SUG)                         |                |               |                     |
| SEISMIC SURVEY: Casino 3D Inline 6074 Xline 2742  |   | REMARKS:   |                |               |                     |
| ELEVATION SEA FLOOR: -70.8m LAT    RT    +22.0m LAT   |   |  |                |               |                     |
| BLOCK/LICENCE: Victoria – Otway Basin VIC/P44   |   |  |                |               |                     |
| KICK-OFF POINT: 1146m   |   |  |                |               |                     |
| TD                      - m (Logr Extrap)    2404 m (Drlr)  |   |  |                |               |                     |
| PBTD                      - m (Logr)                      1308 m (Drlr)   |   | HOLE<br>SIZE   | CASING<br>SIZE | SHOE<br>DEPTH | TYPE                |
| TYPE STRUCTURE: TILTED FAULT BLOCK  |   | 914mm<br>(Casino-4)                                      | 762mm          | 137.4m        | 460 kg/m<br>X56     |
| TYPE COMPLETION: Sub Horizontal Open Hole Sand<br>Screened Completion   |   | 445mm<br>(Casino-4)                                      | 340mm          | 727.8m        | 107 kg/m<br>L80 BTC |
| ZONE(S): WAARRE “A” FORMATION   |   | 311mm  | 244mm          | 1989.85m      | 70 kg/m<br>L80 VAM  |

| AGE                     | FORMATION OR ZONE TOPS   | DEPTH (M)      |            | THICK-NESS (m) | HIGH (H) LOW (L) |
|-------------------------|--------------------------|----------------|------------|----------------|------------------|
|                         |                          | Loggers RT (m) | Subsea (m) |                |                  |
| Late Cretaceous         | Paarate Formation        | 1304           | 1280       | 260.7          | 5m Low           |
| Late Cretaceous         | Skull Creek              | 1592           | 1540.7     | 178.6          | 0.3m High        |
| Early - Late Cretaceous | Upper Waarre A Formation | 1988           | 1718.6     | 18.4           | 4.6m Low         |
|                         | Lower Waarre A Formation | 2082           | 1737       | 20             | 0.6m Low         |
|                         | Base Waarre A            | 2362           | 1757       |                | 15m High         |
|                         | Total Depth              | 2404           | 1764.6     |                |                  |

| TYPE OF LOG   | FROM (m) | TO (m) | REPEAT SECTION | TIME SINCE LAST CIRC | BHT |
|---|----------|--------|----------------|----------------------|-----|
| <b>MWD 311mm (12.25")</b><br>Mud Motor, Gamma Ray, Resistivity, Vibration, Surveys (2 runs)           | 1146     | 1274   |                |                      |     |
| <b>MWD 311mm (12.25")</b><br>GEOPILLOT, Gamma Ray, Resistivity, Vibration, Surveys (1 run)            | 1274     | 1998   |                |                      |     |
| <b>MWD 216mm (8.5")</b><br>Motor, Gamma Ray, Neutron-Density, Resistivity, Vibration, Surveys (1 run) | 1998     | 2404   |                |                      |     |

| LOG INTERPRETATION                |      |      |                              |      |      | PERFORATIONS             |                 |            |            |
|-----------------------------------|------|------|------------------------------|------|------|--------------------------|-----------------|------------|------------|
| INTERVAL(m)                       | Ø %  | SW % | INTERVAL(m)                  | Ø %  | SW % | FORMATION                |                 | INTERVAL   |            |
|                                   |      |      |                              |      |      | Sand screened open hole. |                 |            |            |
| <b>Upper Waarre A Formation :</b> |      |      | <b>Waarre A Formation:</b>   |      |      |                          |                 |            |            |
| <b>1444.2-1458.4m: (TVD)</b>      |      |      | <b>1458.4-1478.5m: (TVD)</b> |      |      | <b>CORES</b>             |                 |            |            |
| Net Pay: 8.7m                     | 17.4 | 54.4 | Net Pay: 19.4m               | 20.4 | 46.2 | <b>NO.</b>               | <b>INTERVAL</b> | <b>CUT</b> | <b>REC</b> |
|                                   |      |      |                              |      |      |                          |                 |            |            |

**PRODUCTION TEST RESULTS**

The well was completed and flowed back to the Ocean Patriot to 'clean-up' the wellbore of unwanted solids and completion fluids and to confirm well deliverability. As part of this program a multi-rate test was conducted. A diesel underbalance was displaced to the completion string before setting the packer. The well was cleaned up and a well test performed with an Expro surface well test package. The clean up and well test duration was 48.25 hrs. The total duration for the completion including the well test was 7 days. A maximum rate of approximately 47 MMscf/d was achieved during the final flow period of the multi-rate test. This rate was constrained by the production facilities and achieved with a 1" choke with a flowing upstream choke pressure of approximately 2100 psi. Shut-in wellhead pressure was 2340 psi.

**SUMMARY:**

Casino-4 (the parent hole for Casino-DW1 and DW2) was drilled as an Otway Basin gas exploration well in the Victoria Offshore VIC/P44 licence. The Surface Location is Latitude: 38° 47' 13.03" S Longitude: 142° 41' 54.49" E (GDA94), Northing: 5705495.28m, Easting: 647518.19m (MGA-94), with a seismic reference of Inline 6074, Xline 2742, Casino-3D Survey 2001. The location lies 220 m northwest of Casino-1. The water depth at the well location was 70.8m LAT.

The primary purpose of the Casino development drilling campaign was to drill and complete a production well in each of the Casino reservoirs thus developing the reserves of the Casino gas field. Casino-4 was a vertical pilot hole in the Waarre A reservoir while Casino-4DW1 was the Waarre A production well. The reservoir modelling work carried out as part of development planning studies highlighted the uncertainty concerning the Waarre A reservoir properties, especially the intrinsic formation permeability. To address this uncertainty it was decided to drill, core and evaluate a vertical pilot hole (designated as Casino-4) in the Waarre A reservoir. A key objective of this well was to recover a full core which would be immediately subjected to routine core analysis for porosity and permeability and selected plugs would also be subjected to special core analysis for relative permeability and petrophysical properties. The data obtained from this well would be used to understand the subsequent production performance of the Waarre A reservoir at Casino and would also be important to justify future exploration surrounding Casino targeting potential Waarre A gas accumulations.

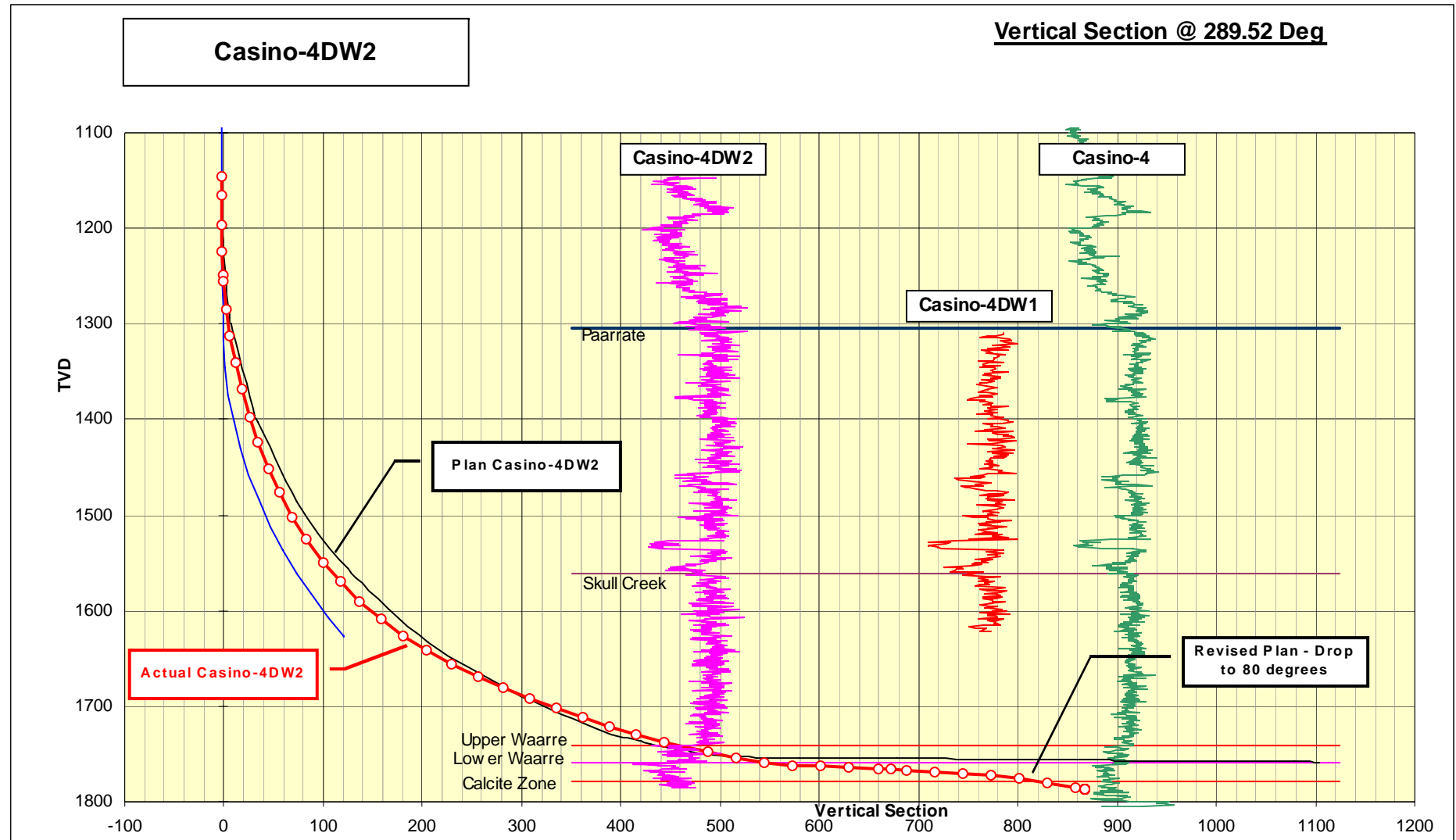
Casino-4DW2 was kicked off from a cement plug from 1146m. Activities on the well commenced at 00:00 hrs on 27-05-05 after 90% formation was seen in the cuttings. A 311mm (12.25") PDC sidetrack bit along with MWD tools and mud-motor (1.15° bend) was used to kick-off and initiate the sidetrack from 1146m to 1157m where it was pulled out of hole due to slow penetration rates. A TCI bit was then run in hole along with the mud-motor and MWD tools and drilled directional hole from 1157m to 1274m. A PDC bit was then run in hole along with the GEOPILLOT steering assembly and drilled directional hole from 1274m to the casing point of 1998m which was reached at 15:00 hours on 30-05-05. A wiper trip was performed to clean out tight hole and condition mud. A string of 244mm (9.625") casing was run and cemented with the shoe at 1989.85mMD (1740.8mTVD). The cementing assembly and the landing string were laid and the 216mm (8.5") directional assembly was run in hole with a Security FMF3553 PDC bit, GEOPILLOT and LWD tools consisting of a Gamma Ray, Resistivity, Vibration, Pressure, Density-Neutron Porosity and Surveys were run in hole to drill out the shoe track. The 216mm (8.5") section was drilled from 1998m to 2404m where drilling was terminated at 03:30 hours on 04-06-05. A completions string was run and the well tested. The rig was released at 20:00 hours on 14-06-05.

While drilling Casino-4DW2, the penetrated depths of most formations were within 7m of their respective prognosed depths as can be seen in the table in the Well Card. Casino-4DW2 encountered the top of the Waarre Formation at 1988m RT (-1718.6m SS) which was 4.6m low to prognosis. The well penetrated some 374m of Waarre A Formation in the 216mm (8.5") section.

The wellpath of Casino-4DW2 penetrated the Upper and Lower units of the Waarre A Formation which was the primary target for the Casino-4DW2 production well. Gas levels rose significantly in the Upper Waarre A Formation (1988m-2082m MDRT) to range between 50 and 450 units with a typical ratio of 97/2/1/trace/trace %. In the Lower Waarre A Formation (2082m-2362m MDRT) total gas ranged between 300 and 960 units. The general composition of the gas was 97/2/1/trace/trace %. Log analysis of the Waarre "A" Formation indicates a total of 28.1m(TVD) of net pay of average  $\phi_i$  19.5% and average  $S_{wt}$  48.5% was identified in the Waarre A sands.

**AUTHOR:** R. SUBRAMANIAN**DATE:** November 2005

## **WELL PATH SCHEMATIC**



## **1. GEOLOGY**

### **1.1 INTRODUCTION**

The Casino gas field is located in the southeast corner of the offshore Otway Basin. The field lies in about 70m of water and is 29km southwest of Port Campbell and 250km southwest of Melbourne. The permit holders are: Santos Limited (50%) Operator, Peedamullah Petroleum Pty Ltd (AWE) (25%), Mittwell Energy Resources Pty Limited (Mitsui) (25%)

Casino-4DW1 / Casino-4DW2 were drilled in the Otway Basin in the Victoria Offshore VIC/P44 licence as sidetracks to the Casino-4 parent well. The Surface Location (Casino-4) is Latitude: 38° 47' 13.03" South, Longitude: 142° 41' 54.49" East (GDA94), Northing: 570549.5m, Easting: 647518.19m (MGA-94). The Seismic Reference is the Casino 3D Survey Inline 6074 Xline 2742. The surface location lies 220 m northwest of Casino-1. Casino-4DW1 / Casino-4DW2 are located in 70.8m of water and was drilled by the semi-submersible drilling rig "Ocean Patriot".

The primary purpose of the Casino development drilling campaign was to drill and complete a production well in each of the Casino reservoirs thus developing the reserves of the Casino gas field. Casino-4 was a vertical pilot hole in the Waarre A reservoir well while Casino-4DW1 was the Waarre A production well.

Following conclusion of evaluation operations on Casino-4 the well was to be plugged back and sidetracked to drill and complete a Waarre A development well, Casino-4DW1. The key objective of the directional well would be to develop the Waarre A gas reserves via a sub-horizontal completion in the Waarre A reservoir. The well path would be located so as to contact the full stratigraphic succession apart from the lowermost zone known as the calcite cemented zone.

### **1.2 FIELD DESCRIPTION**

While detailed discussions on the petroleum geology of the Casino field are available elsewhere, the field can be generally summarised as follows. The structure is a tilted fault block with dip closure to the west, north and east. Prior to drilling Casino-4, the Casino field has been penetrated by three wells namely Casino-1, Casino-2 and Casino-3. The reservoir comprises Turonian aged sandstones from the Waarre Sandstone unit, part of the Shipwreck Sub Group, Sherbrook Group. Two reservoir intervals are present; the older Waarre A and the overlying Waarre C. The sandstones were deposited in fluvial to shallow marine environments. The two reservoir intervals are in separate pressure regimes. The deeper Waarre A is almost 200 psi over-pressured compared the regional aquifer gradient. The Waarre C is only slightly over-pressured at 14 psi above the regional gradient.

In the Casino area, the Waarre A gas bearing interval is approximately 50m thick and is subdivided into upper and lower units, ~20m and ~30m thick respectively. The Waarre A sands have fair reservoir properties with an average log porosity of 20%. Due to the absence of definitive core data significant uncertainty remains in the permeability of the Waarre A reservoir with average permeabilities expected to be in the range 5 – 100 mD.

The Waarre C is not present at Casino-1 having been eroded by a later erosive event. This truncation of the reservoir makes the Waarre C accumulation a combination structural/stratigraphic trap. The gross, gas bearing intervals in Casino-2 and Casino-3 have a similar thickness; 38.6m and 43.8m respectively. The Waarre C reservoir has excellent reservoir qualities, with an average porosity of 22% and permeability ranging from 100s mD to greater than 10,000mD.

The gross Waarre A gas column is 206 m, with the GWC at -1839mSS. The Waarre C gas column is 304m with the GWC at -1999mSS.

Casino-4 was the vertical pilot hole in the Waarre A reservoir whose main objective was to acquire a core of the reservoir. Following conclusion of core evaluation operations on Casino-4 the well would be plugged back and sidetracked to drill and complete Waarre A development well, Casino-4DW1, the key objective which was to develop the Waarre A gas reserves via a sub-horizontal completion in the Waarre A reservoir. The well path would be located so as to contact the full stratigraphic succession apart from the lowermost zone known as the calcite cemented zone.

Working back from the heel of the sub horizontal section, the vertical pilot hole is located some 220m northwest of Casino-1. The location of the pilot hole was optimised in order to penetrate a Lower Waarre A interval predicted to be of good quality.

The only circumstances in which the Casino-4DW1 well would not be drilled were if the results of the pilot hole indicated that drilling, completion and connection of Casino-4DW1 is not economically viable.

### 1.3 WELL LOCATION

The Casino gas field is located in the southeast corner of the offshore Otway Basin. The field lies in 70m of water and is 29km southwest of Port Campbell and 250km southwest of Melbourne. The water depth at the well location was 70.8m LAT.

#### **The Surface Surveyed Location for Casino-4DW1 / Casino-4DW2 is :**

|            |                                  |
|------------|----------------------------------|
| Latitude:  | 38° 47' 13.03" South             |
| Longitude: | 142° 41' 54.49" East (GDA-94).   |
| Easting:   | 647 518.19 m                     |
| Northing:  | 5705 495.28 m (MGA-94)           |
| Rig        | Diamond Offshore - Ocean Patriot |

#### **The Seismic Location for Casino-4DW1 / Casino-4DW2 is:**

Inline 6074, Xline 2742.  
2001 Casino-3D seismic dataset.

## 2. RESULTS OF DRILLING

### 2.1 STRATIGRAPHY & GEOPHYSICAL PROGNOSIS

While drilling Casino-4DW1/DW2, the penetrated depths of most formations were within 7m of their respective prognosed depths as can be seen in the table in the Well Card.

The Waarre Formation, which constitutes the main reservoir, is a prominent and generally reliable seismic reflector. However due to the extremely complex post-depositional faulting in the area, the reflector is very broken-up in a regional sense. During the drilling of Casino-4DW2 the primary objective Waarre Formation was penetrated 5.5m low to the prognosed depth. The depth prognosis was reasonably accurate. Depth conversion was not considered an issue. The gas sand has a strong amplitude anomaly confirming the effectiveness of the prognosis.

The well penetrated some 370mMD (along the hole) of the Waarre Formation.

### 2.2 STRATIGRAPHY & DEPOSITIONAL ENVIRONMENT (Drillers MDRT Depths)

The well cards at the front of this report tables the subsea elevations and thickness of formations penetrated in Casino-4DW1 and Casino-4DW2. A brief description of lithology and interpreted environments of deposition follows. More detailed descriptions can be found in Section 2.1 of the Basic Data Report.

#### Casino-4DW1:

Total depth for Casino-4DW1 was reached at 1662m (D) when desired build rates were not being achieved by the existing directional assembly. The drilling was terminated in the **Skull Creek Mudstone** which unconformably overlies the Waarre Formation in the Casino field. The Skull Creek Mudstone consists of a thick siltstone which affords an excellent seal for hydrocarbons. The Belfast Mudstone and Nullawarre Greensand were not evidenced at Casino-4. The top of the Skull Creek Mudstone was encountered at 1578m and is 87.2m (TVD) was penetrated. The formation was penetrated 1m high to prognosis which is reasonably close to where it was expected. It comprises a medium to dark brown to brownish-grey siltstone which is argillaceous and grades to a silty claystone. The Skull Creek Mudstone commonly has dispersed fine to medium quartz grains, trace glauconite, trace carbonaceous specks and trace disseminated pyrite. It is soft to firm and occasional moderately hard and generally subblocky. A pro-delta environment of deposition and an age of Santonian has been attributed to the Skull Creek Mudstone.

The Skull Creek Mudstone is overlain by the late Cretaceous **Paaratte Formation**, the youngest formation of the Sherbrook Group. The top was intercepted at 1304m, 5m low to prognosis. The 260.7m thick formation is made up of thin to fairly thick, sandstone packages, interbedded with claystone and minor siltstone. The sandstone is very light brownish-grey to very light grey, and towards the base becomes off-white to light brown. Grain size is predominantly coarse to very coarse, though ranges from very fine to pebbly, and decreases in grain size to fine to very fine towards the base. The grains are angular to subrounded, are very poorly sorted, though improve to moderate at the base. There is weak pyrite, silica and calcareous cement throughout the section. A trace of argillaceous and silty matrix occurs at the top, and again at the base where it

is common to abundant. Common, decreasing to trace, grey, green and red volcanogenic lithics are found and abundant altered feldspar grains were noted. Trace to common very fine carbonaceous material occurs throughout, in part associated with pyrite. The sandstone is dominantly friable and occasionally moderately hard in part. It has fair to occasionally good porosity, decreasing to very poor, visible porosity at the base. No fluorescence was noted.

The minor thinly interbedded claystone is medium to dark grey to medium brownish-grey, moderately to very silty, in part finely arenaceous, trace to common pyrite, trace to common black carbonaceous flecks and detritus, in part associated with pyrite, trace micromica, soft, in part very dispersive and slightly subfissile.

The Paaratte Formation was deposited in a deltaic environment, in this case, presumably delta plain, and has been dated to be Santonian to Maastrichtian in age in the Otway Basin.

### **Casino-4DW2:**

Total depth for Casino-4DW2 was reached at 2404m (D) when some 374m of directional hole was drilled in the target reservoir sands in the Waarre A Formation. The Upper Waarre A Formation was penetrated at 1988m (D) with the base of the Waarre A Formation being encountered at 2362m.

The Waarre Formation makes up the oldest formation of the Sherbrook Group and is dated to be Turonian in age (Partridge, 1997). The Waarre Formation was deposited as the initial post-rift sequence at the commencement of Turonian time. Microplankton at the base of the Waarre formation record the first evidence of wholesale marine incursion into the Otway Basin. The section is sub-divided into three sub-units – Waarre “A”, “B” & “C”.

Casino-4DW2 penetrated the Waarre “A” unit which represents a basal transgressive systems tract (TST) characterised by flooding of an incised valley with sediments deposited under marginal marine/estuarine conditions. Lithologically, the unit is similar to the underlying Eumeralla Formation from which it is sourced. The unit is comprised of fine to coarse grained lithic sandstone, interbedded with thin beds of silty carbonaceous mudstone. Onshore the sandstones are dominantly fluvial, but offshore marine conditions are indicated by coarsening upward beds.

In the cuttings samples, the sandstone is translucent, off-white to light brownish-grey to light grey, very fine to medium in size, though becoming fine to coarse grained with depth. The grains are subangular to subrounded, poorly to moderately sorted, generally contain a weak to moderate silica cement and locally abundant calcareous cement. There is trace to common light grey argillaceous matrix throughout, clear to opaque quartz grains, and minor black carbonaceous detritus. The sandstone is moderately hard, has poor visible porosity without any hydrocarbon fluorescence. The sandstone packages are generally blocky in shape. The basal Waarre is interpreted to be shallow marine to marginal marine. After the transgression in the lower part of the Waarre, the formation became more regressive, depositing the best reservoir sands in the lower coastal and delta areas.

In the Otway Basin, the Waarre Formation was transgressed by another flooding event (conformably overlain) by the **Flaxmans Formation** which is commonly the seal for the Waarre reservoir. In the Casino-4DW2 well the Flaxmans Formation was not present.



The **Skull Creek Mudstone**, (sometimes considered part of the Paaratte Formation), unconformably overlies the Waarre Formation in Casino-4DW2. The Skull Creek Mudstone consists of a thick siltstone which affords an excellent seal for hydrocarbons. The Belfast Mudstone and Nullawarre Greensand were not evidenced at Casino-4DW2. The formation was penetrated close to where it was expected. It comprises a medium to dark brown to brownish-grey siltstone which is argillaceous and grades to a silty claystone. The Skull Creek Mudstone commonly has dispersed fine to medium quartz grains, trace glauconite, trace carbonaceous specks and trace disseminated pyrite. It is soft to firm and occasional moderately hard and generally subblocky. A pro-delta environment of deposition and an age of Santonian has been attributed to the Skull Creek Mudstone.

The Skull Creek Mudstone is overlain by the late Cretaceous **Paaratte Formation**, the youngest formation of the Sherbrook Group. The top was intercepted at 1304m, 5m low to prognosis. The 260.7m thick formation is made up of thin to fairly thick, sandstone packages, interbedded with claystone and minor siltstone. The sandstone is very light brownish-grey to very light grey, and towards the base becomes off-white to light brown. Grain size is predominantly coarse to very coarse, though ranges from very fine to pebbly, and decreases in grain size to fine to very fine towards the base. The grains are angular to subrounded, are very poorly sorted, though improve to moderate at the base. There is weak pyrite, silica and calcareous cement throughout the section. A trace of argillaceous and silty matrix occurs at the top, and again at the base where it is common to abundant. Common, decreasing to trace, grey, green and red volcanogenic lithics are found and abundant altered feldspar grains were noted. Trace to common very fine carbonaceous material occurs throughout, in part associated with pyrite. The sandstone is dominantly friable and occasionally moderately hard in part. It has fair to occasionally good porosity, decreasing to very poor, visible porosity at the base. No fluorescence was noted.

The minor thinly interbedded claystone is medium to dark grey to medium brownish-grey, moderately to very silty, in part finely arenaceous, trace to common pyrite, trace to common black carbonaceous flecks and detritus, in part associated with pyrite, trace micromica, soft, in part very dispersive and slightly subfissile.

The Paaratte Formation was deposited in a deltaic environment, in this case, presumably delta plain, and has been dated to be Santonian to Maastrichtian in age in the Otway Basin.

The kick-off to Casino-4DW2 was initiated in the **Timboon Formation** from 1146m. The top of the youngest formation of the Sherbrook Group, the Timboon Sandstone was intersected at 1111.5m in the parent hole Casino-4. The formation is made up of thin to fairly thick sandstone packages, interbedded with siltstone. The sandstone is pale grey to grey, clear to translucent, predominantly medium grained to minor coarse grained. The sandstone is moderately well sorted and the grains are subrounded to subangular in part. The sandstone has a weak siliceous cement, has trace lithic fragments and traces of disseminated pyrite. The sandstone is friable to loose, and occasionally in moderately hard aggregates. No hydrocarbon fluorescence was observed. The interbedded siltstone is light to medium brown to brown grey, arenaceous, slightly calcareous with minor disseminated pyrite. The siltstone is firm to moderately hard and subblocky. The Timboon Sandstone was deposited in a deltaic environment, in this case, presumably delta plain, and has been dated to be Campanian to Maastrichtian in age in the Otway Basin.

## 2.3 HYDROCARBON SUMMARY

Ditch gas values were monitored and recorded in units (U) by RESERVAL Total Gas detector, where one unit is equivalent to 200 ppm (parts per million) of methane gas in air. The ditch gas was also monitored for hydrocarbon gas composition by the RESERVAL chromatograph. Gas composition refers to percent components of the hydrocarbon alkane series: (methane, ethane, propane, butane and pentane). Gas compositions are quoted as the percentage ratios of these five gases (i.e. 94/2/1/1/1 denotes 94% C1, 2% C2, 1% C3, 1% C4 and 1% C5). Ditch cuttings were tested for hydrocarbon fluorescence by using an ultra-violet fluoroscope.

Gas was monitored realtime from the kick-off point of 1146m in the Timboon Sandstone. Total Gas in the Timboon Sandstone ranged between 2 and 8 units and consisted of 99/1/trace %. In the Paarate Formation total gas varied between 5 and 55 units and consisted of 98/1/1/trace %. Total gas in the Skull Creek Formation varied between 30 and 45 units with a composition of 96/3/1/trace/trace %.

The wellpath of Casino-4DW2 penetrated the Upper and Lower units of the Waarre A Formation which was the primary target for the Casino-4DW2 production well. Gas levels rose significantly in the Upper Waarre A Formation (1988m-2082m MDRT) to range between 50 and 450 units with a typical ratio of 97/2/1/trace/trace %. In the Lower Waarre A Formation (2082m-2362m MDRT) total gas ranged between 300 and 960 units. The general composition of the gas was 97/2/1/trace/trace %. Log analysis of the Waarre A Formation indicates a total of 28.1m (TVD) of Net Pay of average  $\phi_t$  19.5% and average  $S_{wt}$  48.5%.

## 2.4 SUMMARY

Casino-4 (the parent hole for Casino-DW1 and DW2) was drilled as an Otway Basin gas exploration well in the Victoria Offshore VIC/P44 licence. The Surface Location is Latitude: 38° 47' 13.03" S Longitude: 142° 41' 54.49" E (GDA94), Northing: 5705495.28m, Easting: 647518.19m (MGA-94), with a seismic reference of Inline 6074, Xline 2742, Casino-3D Survey 2001. The location lies 220 m northwest of Casino-1. The water depth at the well location was 70.8m LAT.

The primary purpose of the Casino development drilling campaign was to drill and complete a production well in each of the Casino reservoirs thus developing the reserves of the Casino gas field. Casino-4 was a vertical pilot hole in the Waarre A reservoir while Casino-4DW1 was the Waarre A production well. The reservoir modelling work carried out as part of development planning studies highlighted the uncertainty concerning the Waarre A reservoir properties, especially the intrinsic formation permeability. To address this uncertainty it was decided to drill, core and evaluate a vertical pilot hole (designated as Casino-4) in the Waarre A reservoir. A key objective of this well was to recover a full core which would be immediately subjected to routine core analysis for porosity and permeability and selected plugs would also be subjected to special core analysis for relative permeability and petrophysical properties. The data obtained from this well would be used to understand the subsequent production performance of the Waarre A reservoir at Casino and would also be important to justify future exploration surrounding Casino targeting potential Waarre A gas accumulations.

Casino-4DW1 was kicked off from 1308m from a cement plug in Casino-4 at 09:30 hrs on 21-05-05. Bit 6, a 311mm (12.25") Security-DBS FS2663 was run in hole along with MWD tools and the Sperry Sun GEOPILLOT steerable unit. Cement was tagged at 1273m and the kick-off was initiated from 1308m. Directional hole was drilled from 1308m to 1599m where the bit was pulled up into the casing shoe to undertake repairs to the Top Drive System. After the repairs the bit was run to bottom and drilling continued from 1599m to 1662m. However, the required build rate was not being achieved. The drill string was pulled to surface and a motor assembly with a 1.5° bend was made and run in hole. However this assembly was not able to pass below the wellhead. Instructions were received to plug back to about 1200m and re-attempt the sidetrack. Total depth of Casino-4DW1 was reached at 17:30 hours on 22-05-05. The 311mm (12 ¼") section was logged while drilling with Sperry Sun MWD tools to record Gamma Ray, Resistivity, Vibration/Shock, Annular Pressure and Deviation Survey data.

Thereafter a kick-off plug was set in the interval 1200m-1350m. While waiting on cement, the Blowout Preventers were tested. From 1200m to 1265m attempts to kick-off from this plug failed and plug #3 was then set from 1100m to 1265m. A PDC was run in hole and used to initiate the sidetrack to Casino-4DW2 from 1146m. All activities on Casino-4DW1 ceased at 24:00 hrs on 26-05-05.

Casino-4DW2 was kicked off from a cement plug from 1146m. Activities on the well commenced at 00:00 hrs on 27-05-05 after 90% formation was seen in the cuttings. A 311mm (12.25") PDC sidetrack bit along with MWD tools and mud-motor (1.15° bend) was used to kick-off and initiate the sidetrack from 1146m to 1157m where it was pulled out of hole due to

slow penetration rates. A TCI bit was then run in hole along with the mud-motor and MWD tools and drilled directional hole from 1157m to 1274m. A PDC bit was then run in hole along with the GEOPILLOT steering assembly and drilled directional hole from 1274m to the casing point of 1998m which was reached at 15:00 hours on 30-05-05. A wiper trip was performed to clean out tight hole and condition mud. A string of 244mm (9.625") casing was run and cemented with the shoe at 1989.85mMD (1740.8mTVD). The cementing assembly and the landing string were laid and the 216mm (8.5") directional assembly was run in hole with a Security FMF3553 PDC bit, GEOPILLOT and LWD tools consisting of a Gamma Ray, Resistivity, Vibration, Pressure, Density-Neutron Porosity and Surveys were run in hole to drill out the shoe track. The 216mm (8.5") section was drilled from 1998m to 2404m where drilling was terminated at 03:30 hours on 04-06-05. A completions string was run and the well tested. The rig was released at 20:00 hours on 14-06-05.

While drilling Casino-4DW2, the penetrated depths of most formations were within 7m of their respective prognosed depths as can be seen in the table in the Well Card. Casino-4DW2 encountered the top of the Waarre Formation at 1988m RT (-1718.6m SS) which was 4.6m low to prognosis. The well penetrated some 374m of Waarre A Formation in the 216mm (8.5") section.

The wellpath of Casino-4DW2 penetrated the Upper and Lower units of the Waarre A Formation which was the primary target for the Casino-4DW2 production well. Gas levels rose significantly in the Upper Waarre A Formation (1988m-2082m MDRT) to range between 50 and 450 units with a typical ratio of 97/2/1/trace/trace %. In the Lower Waarre A Formation (2082m-2362m MDRT) total gas ranged between 300 and 960 units. The general composition of the gas was 97/2/1/trace/trace %. Log analysis of the Waarre "A" Formation indicates a total of 28.1m (TVD) of net pay of average  $\phi_t$  19.5% and average  $S_{wt}$  48.5% was identified in the Waarre A sands.

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## **APPENDIX I : LOG ANALYSIS**

A total of 28.1m (TVD) of net pay of average  $\phi_t$  19.5% and average  $S_{wt}$  48.5% was identified in the Waarre A sands.

The Log analysis report is presented overleaf.

# **CASINO 4DW2**

## **PETROPHYSICAL ANALYSIS**

**By**

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**Santos**

**November 2005**

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No convention core.

### 3.4. Well Production Test

No DST.

## 4. Interpretation

### 4.1. Log Processing and Remarks

- The bottom hole temperature used in the log analysis was 172.4°F.
- Over all the data was of good quality.
- Formation water resistivity was taken from Casino field, which is 0.4 ohmm at 75°F.
- All logs are depth shifted and sonic edited for cycle skipping prior to evaluation.
- All logs were borehole environmentally corrected.
- The water saturation (Sw) was calculated using Dual Water Saturation Equation.
- Permeability was calculated using Coates' Free Water Method

### 4.2. Interpretation Procedures and Parameters

The GEOLOG Multimin Probabilistic method was used. This method focuses wireline logging tools response to the environment being logged. Response equations for predicting each measurement in the logging suite are posed in terms of summing all the volumes of minerals and fluids that influenced each sensor. These volumes were adjusted to give the optimum or most probable match of the measured and predicted readings across the suite of measurements being modelled. From this most likely solution, the volumes of minerals were derived, as were the fluid volumes and hence, porosity and fluid saturations of the modelled formation.

In general, the tool response equation can be defined as:

$$tool = (toola.xwa)(vxwa) + (toola.xga)(vxga) + (toola.xoi)(vxoi) + \sum_{i=1}^{nm} (toola.i)(v.i) + \sum_{i=1}^{nclays} ((toola_{cl}.i)(1 - \phi_{cl}.i) + (toola.xbw)(\phi_{cl}.i)(v_{cl}.i))$$

Where

|                  |   |  |
|------------------|---|--|
| <i>tool</i>      | = | Input log such as $\rho_b$ , $\phi_N$ , <i>DT</i> and etc. |
| <i>toola.xwa</i> | = | The response parameter for flushed fluid                   |
| <i>vxwa</i>      | = | Volume of flushed fluid                                    |
| <i>toola.xga</i> | = | The response parameter for gas                             |
| <i>vxga</i>      | = | Volume of gas  |
| <i>toola.xoi</i> | = | The response parameter for oil                             |
| <i>vxoi</i>      | = | Volume of oil  |
| <i>nm</i>        | = | Number of formation minerals, excluding clay               |
| <i>toola.i</i>   | = | The response parameter for mineral <i>i</i>                |
| <i>v.i</i>       | = | The volume of mineral <i>i</i>                             |
| <i>nclays</i>    | = | The number of clays in the formation                       |

- $toola_{cl.i}$  = The dry clay response parameter for clay  $i$   
 $\phi_{cl.i}$  = Clay  $i$  porosity  
 $tools.xbw$  = The response parameter for bound water  
 $v_{cl.i}$  = The volume of clay  $i$

#### 4.2.1. Water Saturation

The water saturation was derived using the Dual Water Saturation Equation as defined below:

$$C_t = \frac{1}{a} \phi_t^m S_{wt}^n \left[ \left( \frac{S_{wt} - S_{wb}}{S_{wt}} \right) C_w + C_{bw} \frac{S_{wb}}{S_{wt}} \right]$$

Therefore, the effective porosity  $\phi_e$  is

$$\phi_e = \phi_t (1 - S_{wb})$$

And effective water saturation  $S_{we}$  is

$$S_{we} = \frac{S_{wt} - S_{wb}}{1 - S_{wb}}$$

Where

- $S_{wb}$  = Clay bound water saturation  
 $C_w$  = Formation water conductivity  
 $C_{bw}$  = Clay bound water conductivity

#### 4.2.2. Coates Free Fluid Index Permeability

The permeability ( $k$ ) equation is defined as:-

$$k = \left[ c \phi_e^2 \left( \frac{\phi_t - bfv}{bfv} \right) \right]^x$$

Where

- $\phi_e$  = Effective porosity  
 $\phi_t$  = Total porosity  
 $c$  = Coates constant  
 $x$  = Power coefficient  
 $bfv$  = Bound fluid volume

And  $bfv$  is defined as,

$$bfv = \max(\text{volume\_of\_boundwater}, 0.06)$$

Relative permeability is derived using the relationships proposed by Park Jones (and other). The equations are:

$$k_{rw} = \left( \frac{S_{wt} - bfv}{1 - bfv} \right)^3$$

And

$$k_{ro} = \frac{(1 - S_{wt})^{2.1}}{(1 - bfv)^2}$$

Where  $k_{rw}$  and  $k_{ro}$  are the relative permeability to water and oil, and  $bfv$  in this case is equal to  $S_{wi}$ , the irreducible water saturation.

#### 4.2.3. Multimin Model

The parameters used in the model for Casino 4DW2 are summarised in Table 2 below:-

Table 2 - Input parameters used to model the Casino 4DW2 well

| Mineral   | $\rho_b$ (g/cc) | $\phi_N$ (v/v) | GR (Gapi) | U (B/cc) | CEC(m/g) |
|---|-----------------|----------------|-----------|----------|----------|
| Quartz  | 2.645           | -0.05          | 40        | 4.78     | -        |
| Orthoclase  | 2.57            | -0.05          | 0         | 8.71     | -        |
| Illite  | 2.78            | 0.3            | 265       | 11.73    | 0.25     |
| <b>Rw = 0.4 ohmm @75°F, a = 1.0, m = 2.0, n = 2.0</b> |                 |                |           |          |          |

#### 4.2.4. Net Pay determination

A net pay cut-off of  $Vcl < 45\%$ ,  $\phi_i > 10\%$  and  $Swt < 70\%$  and  $Vcl < 45\%$ ,  $\phi_i > 4\%$  and  $Swt < 70\%$  were used. The results in TVD and MD are summarised in Table 3 and 4 below:-

Table 3 - Net pay cut-off (TVD): -  $Vcl < 45\%$ ,  $\phi_i > 10\%$  &  $Swt < 60\%$  and  $Vcl < 45\%$ ,  $\phi_i > 4\%$  &  $Swt < 60\%$

| FORMATION      |                   | CAT1 : $\phi_e > 4\%$ , $Swe < 70\%$ , $Vcl < 45\%$ |          |           |          |           |           |          | CAT2 : $\phi_e > 10\%$ , $Swe < 70\%$ , $Vcl < 45\%$ |          |           |          |           |           |          |
|----------------|-------------------|---|----------|-----------|----------|-----------|-----------|----------|--|----------|-----------|----------|-----------|-----------|----------|
| SAND NAME      | Sand Interval TVD | Net Pay m   | Avg Øt % | Avg Swt % | Avg Øe % | Avg Swe % | Avg Vcl % | Avg k mD | Net Pay m  | Avg Øt % | Avg Swt % | Avg Øe % | Avg Swe % | Avg Vcl % | Avg k mD |
| WAARRE         |                   |   |          |           |          |           |           |          |  |          |           |          |           |           |          |
| Upper Waarre A | 1444.2 - 1458.4   | 8.7   | 17.4     | 54.4      | 9.1      | 7.4       | 34.5      | 83.0     | 2.0  | 20.1     | 45.9      | 14.6     | 23.7      | 22.7      | 348.0    |
| Waarre A       | 1458.4 - 1478.5   | 19.4  | 20.4     | 46.2      | 17.2     | 32.7      | 13.2      | 1029.0   | 16.4   | 21.5     | 43.0      | 19.2     | 35.2      | 9.4       | 1210.0   |
| Total/Average  |                   | 28.1  | 19.5     | 48.5      | 14.7     | 27.8      | 19.8      | 736.1    | 18.4   | 21.3     | 43.3      | 18.7     | 34.2      | 10.8      | 1116.3   |

Table 4 - Net pay cut-off (MD): -  $Vcl < 45\%$ ,  $\phi_i > 10\%$  &  $Swt < 60\%$  and  $Vcl < 45\%$ ,  $\phi_i > 4\%$  &  $Swt < 60\%$

| FORMATION      |                  | CAT1 : $\phi_e > 4\%$ , $Swe < 70\%$ , $Vcl < 45\%$ |          |           |          |           |           |          | CAT2 : $\phi_e > 10\%$ , $Swe < 70\%$ , $Vcl < 45\%$ |          |           |          |           |           |          |
|----------------|------------------|---|----------|-----------|----------|-----------|-----------|----------|--|----------|-----------|----------|-----------|-----------|----------|
| SAND NAME      | Sand Interval MD | Net Pay m   | Avg Øt % | Avg Swt % | Avg Øe % | Avg Swe % | Avg Vcl % | Avg k mD | Net Pay m  | Avg Øt % | Avg Swt % | Avg Øe % | Avg Swe % | Avg Vcl % | Avg k mD |
| WAARRE         |                  |   |          |           |          |           |           |          |  |          |           |          |           |           |          |
| Upper Waarre A | 2006.0 - 2078.5  | 44.1  | 17.4     | 54.0      | 9.2      | 7.4       | 34.5      | 85.0     | 12.2   | 19.8     | 46.2      | 14.0     | 20.9      | 24.4      | 301.0    |
| Waarre A       | 2078.5 - 2361.0  | 272.2   | 21.0     | 44.5      | 18.4     | 34.1      | 11.1      | 1104.0   | 258.0  | 21.3     | 43.9      | 19.0     | 35.8      | 9.8       | 1166.0   |
| Total/Average  |                  | 316.3   | 20.5     | 45.6      | 17.1     | 32.1      | 14.4      | 961.9    | 270.2  | 21.2     | 44.0      | 18.8     | 35.3      | 10.5      | 1126.9   |

The composite logs in TVD subsea over the reservoir are shown in figure 2 below.

**Pay Summary**

| Unit           | Net Sand   | CAT1 Pay | CAT2 Pay |
|----------------|------------|----------|----------|
| UPPER WARREA A | 8.7m       | 5.7m     | 2.0m     |
|                | N/G 0.61   | 0.61     | 0.14     |
|                | Swt 17.4%  | 17.4%    | 20.1%    |
|                | Phie 54.4% | 54.4%    | 45.9%    |
|                | Phie 9.1%  | 9.1%     | 14.6%    |
|                | Swe 7.4%   | 7.4%     | 23.7%    |
|                | K 83.mD    | 83.mD    | 348.mD   |
|                | Vcl 34.6%  | 34.6%    | 22.7%    |
| WARREA A       |            |          |          |
|                | Net 19.4m  | 19.4m    | 18.4m    |
|                | N/G 0.96   | 0.96     | 0.82     |
|                | Swt 20.4%  | 20.4%    | 21.5%    |
|                | Phie 46.2% | 46.2%    | 43.0%    |
|                | Phie 17.2% | 17.2%    | 19.2%    |
|                | Swe 32.7%  | 32.7%    | 35.2%    |
|                | K 1029.mD  | 1029.mD  | 1210.mD  |
|                | Vcl 13.2%  | 13.2%    | 9.4%     |

Total of 28.1m(TVD) of net pay of average  $\phi_t$  19.5% and average  $S_{wt}$  48.5% was identified in the Waarre A sands

\\ADEF01\Tech\_Servs\GEOLOGY\WCR\VIC\Casino4DW1\_DW2\Casino4DW2\_loganalysis.doc

Bit Size: 8.5 in.  
Mud Type: KCL POLYMER  
Mud weight: 10.6 lb/gal  
Rm: 0.06 @ 73.94F  
Rmf: 0.04 @ 75.02F  
Rmc: 0.09 @ 68F  
Bottom hole temperature: 172.4F

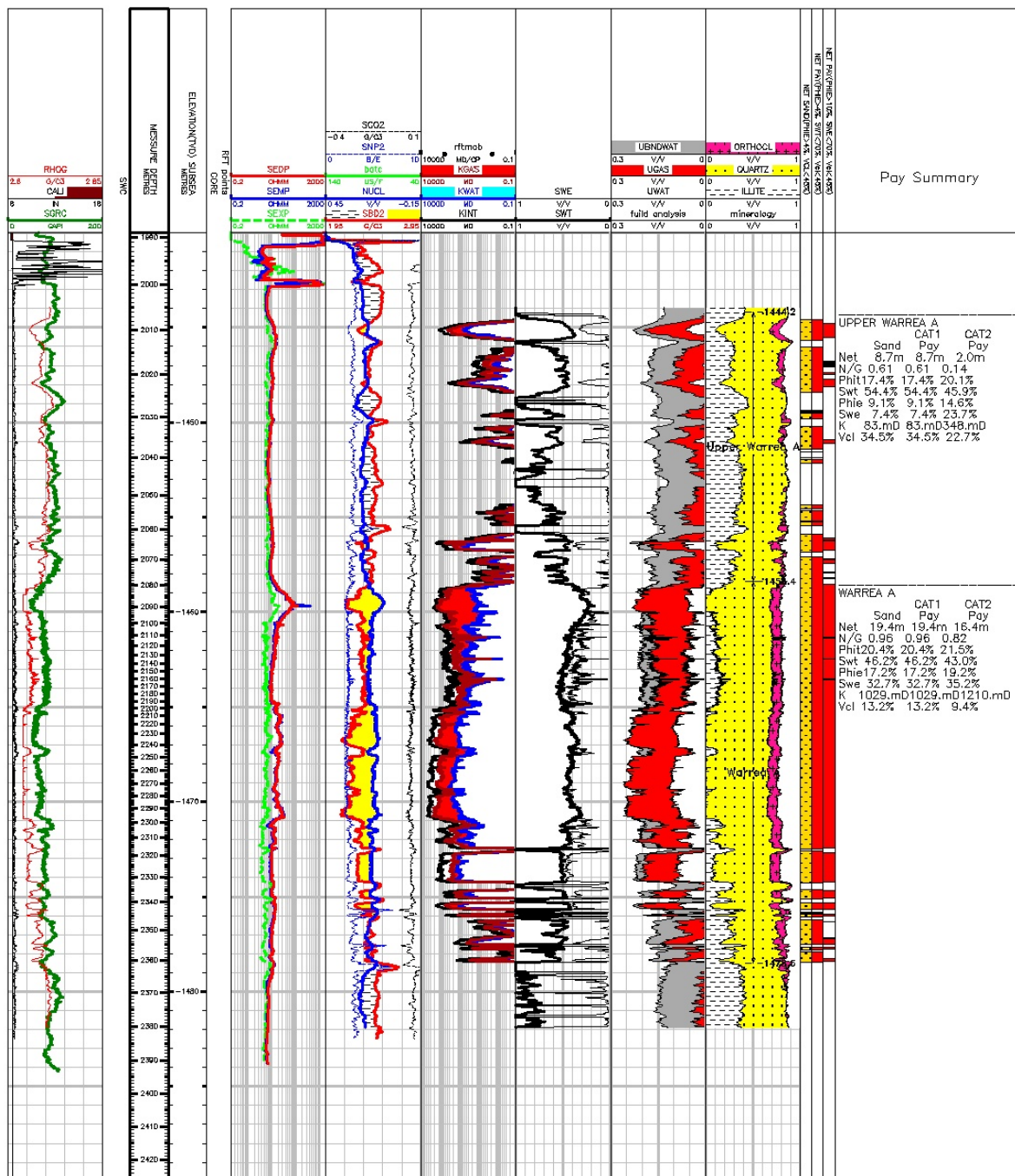
## CASINO\_4DW2 LOG ANALYSIS

Rw=0.4 ohmm @ 75DegF.(14478ppm) calculated using Pickett Plot.  
a=1, m=2.0, n=2.0, using Dual Water Saturation Equation.  
Permeability Calculated using Coates Free Fluid Mehtod.

KB/RT :22 METRES

NET PAY CUTOFF  
CAT1 CAT2

PHIE>4% PHIE>10%  
SWE<70% SWE<70%  
VCL<45% VCL<45%



## 6. Appendix

### 6.1 Multimin Report

```
*****
*
*          MULTIMIN REPORT          *
*
*   Project : TRY2                  *
*   User id  : loosi                *
*   Date     : 04-Nov-2005 10:37:14 *
*
*****
```

1

MULTIMIN REPORT for well CASINO\_4DW2 (1988.00 - 2404.00 metres)  
Reported by loosi on 04-Nov-2005 at 10:37  
Analysed by loosi on 29-Jun-2005 at 14:55

Project TRY2

## MODELS:

| Type    | Name       | Cond# | Cutoff | Expression |
|---------|------------|-------|--------|------------|
| Primary | CASINO4DW2 | 2.983 | 10.0   |            |

## FORMATION FLUID PARAMETERS:

Fluid properties option = MODEL

Oil Gravity Degrees API = 30.00 dapi

Rws = 0.4000 @ 75.00 degF

Gas specific gravity = 0.650

Cwbs = - @ - degF

Rmfs = 0.0400 @ 75.02 degF

## BOREHOLE PARAMETERS:

Mud base = WATER

SHT = -

Rms = 0.0600 @ 73.94 degF

Mud density = 10.600 lb/g

BHT = 78.00 degF

Rmcs = 0.090 @ 68.00 degF

KCl concentration of mud = 7.50 %

Total depth = - metres

Average temperature of 164.32 degF by TLI/BLI method.

Average pressure of 3982.81 psi by MUD\_DENS method.



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MULTIMIN REPORT for well CASINO\_4DW2 (1988.00 - 2404.00 metres)

Project TRY2

## PRIMARY MODEL CASINO4DW2:

Cementation factor m = 2.000

Saturation exponent n = 2.000

Linear dual-water w = 2.00

Expansion of clay bound water is enabled.

| Component           | QUARTZ | ORTHOCL | ILLITE | XBNDWAT | XFREWAT | UGAS   | UBNDWAT | UFREWAT |
|---------------------|--------|---------|--------|---------|---------|--------|---------|---------|
| Error of prediction | 0.0424 | 0.0707  | 0.0566 | 0.0157  | 0.0325  | 0.0337 | 0.0206  | 0.0455  |

## EQUATION RESPONSES:

| Log                             | Method               | Uncertainty |        |        |       |       |       |       |       |       |
|---------------------------------|----------------------|-------------|--------|--------|-------|-------|-------|-------|-------|-------|
| Formation density [G/C3]        |                      | 0.0264      | 2.650  | 2.570  | 2.780 | 1.149 | 1.149 | 0.000 | 0.000 | 0.000 |
| RHO_COR                         | Linear               |             | -----  | -----  | ----- | ----- | ----- | ----- | ----- | ----- |
| Neutron [V/V]                   |                      | 0.0140      | -0.050 | -0.050 | 0.300 | 0.867 | 0.867 | 0.000 | 0.000 | 0.000 |
| TNPH_COR                        | Linear               |             | -----  | -----  | ----- | ----- | ----- | ----- | ----- | ----- |
| Photoelectric absorption [B/C3] |                      | 0.3200      | 5.04   | 8.71   | 11.12 | 1.54  | 1.54  | 0.00  | 0.00  | 0.00  |
| U                               | Linear               |             | -----  | -----  | ----- | ----- | ----- | ----- | ----- | ----- |
| Total gamma [GAPI]              |                      | 12.0000     | 20.0   | 280.0  | 265.0 | 0.0   | 36.0  | 0.0   | 0.0   | 0.0   |
| GR                              | Linear               |             | -----  | -----  | ----- | ----- | ----- | ----- | ----- | ----- |
| Unflushed conductivity [MH/M]   |                      | 0.06861     | 0.00   | 0.00   | 0.00  | 0.00  | 0.00  | 0.00  | 14.42 | 5.22  |
| CT                              | Dual-water nonlinear |             | -----  | -----  | ----- | ----- | ----- | ----- | ----- | ----- |

## CONSTRAINTS: Value Type Uncertainty

|                  |       |      |        |       |       |       |        |       |        |        |        |
|------------------|-------|------|--------|-------|-------|-------|--------|-------|--------|--------|--------|
| <PROG UNITY>     | 1.000 | Tool | 0.0100 | 1.000 | 1.000 | 1.000 | 0.000  | 0.000 | 1.000  | 1.000  | 1.000  |
| <PROG POROSITY>  | 0.000 | Tool | 0.0100 | 0.000 | 0.000 | 0.000 | 1.000  | 1.000 | -1.000 | -1.000 | -1.000 |
| <PROG X BNDWAT>  | 0.000 | Tool | 0.0100 | 0.000 | 0.000 | 0.213 | -1.000 | 0.000 | 0.000  | 0.000  | 0.000  |
| <PROG U BNDWAT>  | 0.000 | Tool | 0.0100 | 0.000 | 0.000 | 0.325 | 0.000  | 0.000 | 0.000  | -1.000 | 0.000  |
| <PROG WATER MUD> | 0.000 | <=   | -      | 0.000 | 0.000 | 0.000 | 1.000  | 1.000 | 0.000  | -1.000 | -1.000 |

## PROPERTIES AND BOUNDS:

|                                  |       |       |       |       |       |       |       |       |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Mineral grain density            | 2.650 | 2.570 | 2.780 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Mineral cation exchange capacity | 0.000 | 0.000 | 0.300 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Lower Bound

Upper Bound

|       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| 1.000 | 0.100 | 1.000 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 |

```
*****
*
*          MULTIMIN REPORT          *
*
*          *** End of Report ***    *
*
*   Project : TRY2                  *
*   User id  : loosi                *
*   Date    : 04-Nov-2005 10:37:15 *
*   Pages   : 2                    *
*
*****
```

## **APPENDIX II: HYDROCARBON SHOW REPORT**

**No Hydrocarbon Fluorescence was observed in Casino-4DW1 / DW2**

### **APPENDIX III : GEOTHERMAL GRADIENT**

Wireline Logs were not run in Casino-4DW2 and temperature data was not available. However, data obtained in the parent well Casino-4 estimated a Geothermal Gradient of 2.2°F/100m which should be valid for Casino-4DW2.

## **APPENDIX IV : PRODUCTION TEST REPORT**

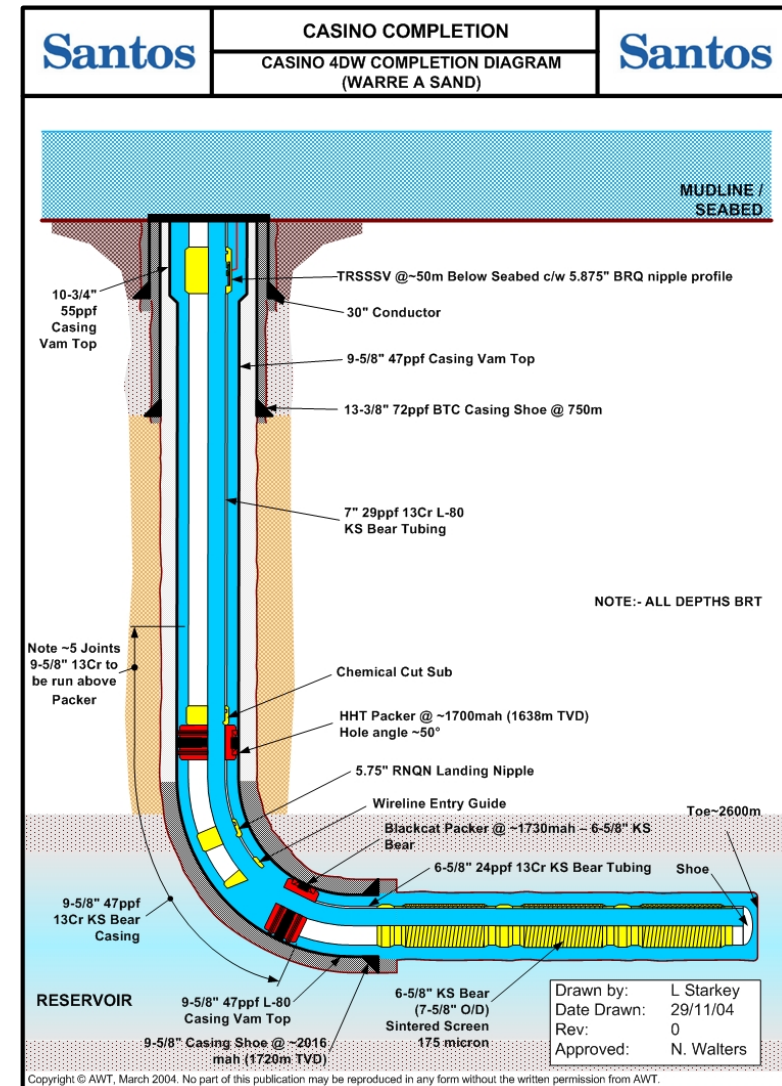
# Casino 4DW2 Flow-Back

Initial Review of Clean-Up and Well Test



# Casino 4DW2 – Completion

- 370 mMD of openhole reservoir section from 1992 to 2362 mMDRT
- 90mMD of Upper Waarre A sandstones from 76 to 88deg of deviation
- 280mMD of Lower Waarre A sandstones from 88 to 80deg of deviation
- 9 5/8" casing shoe set at 1990 mMDRT (1718.8 mTVDSS)
- 256 m of 6 5/8" sintered sand screens (31 joints)
- Lower Completion Packer set at approx 1690 mMDRT
- 7" 13Cr L-80 tubing
- Upper Completion Packer set at 1633.95 mMDRT
- Bottom hole gauges deployed on slickline. Gauge carrier landed in tailpipe of upper completion packer (~1657mMDRT).
- Carrier comprises CQG gauges. 2 gauges programmed for 1 sec and 1 gauge at 2 sec sampling frequency.



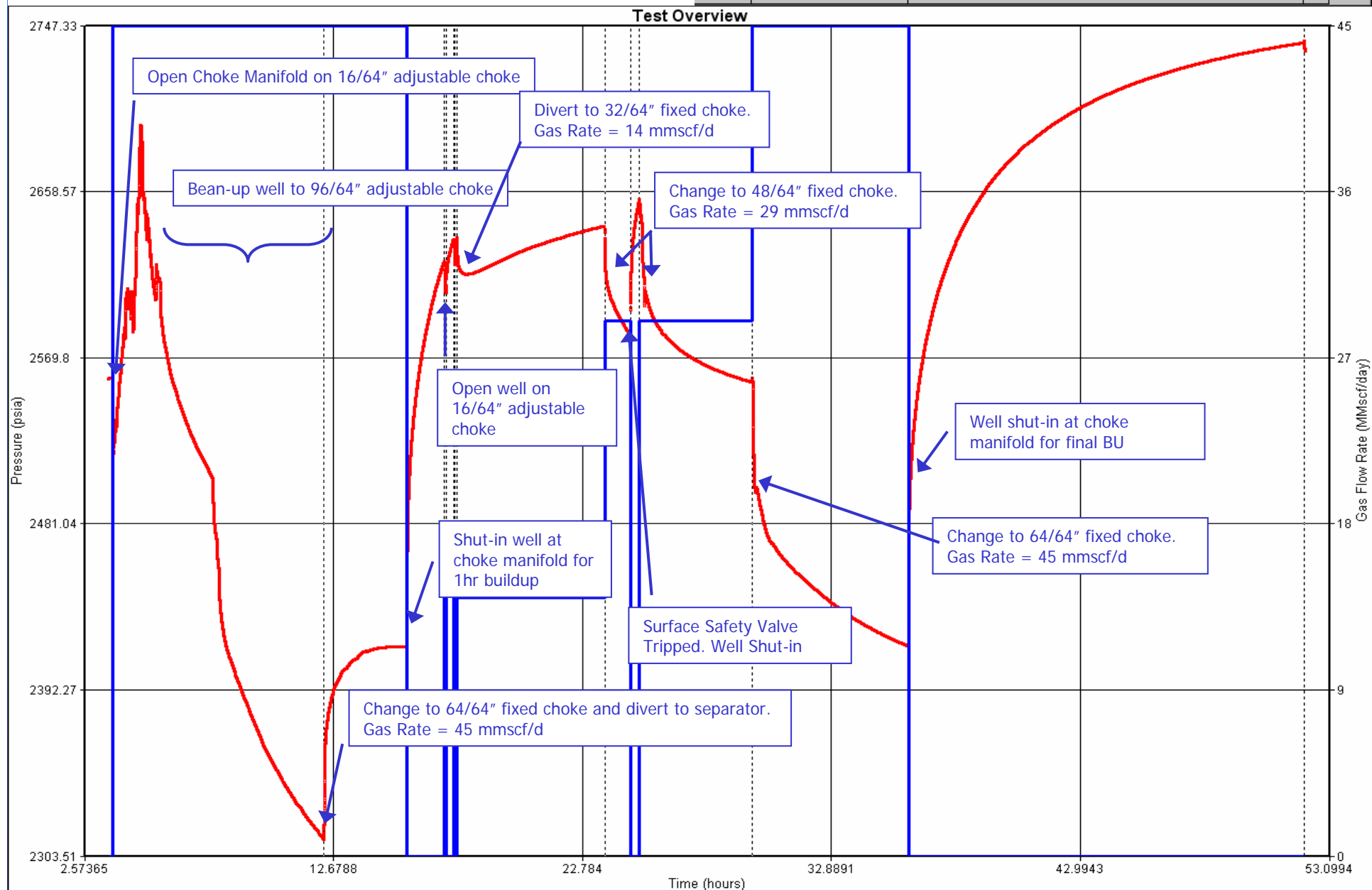
**Santos**



# Casino 4DW2 Flow Back - Summary

| Operation                 | Approx Duration (hrs) | Choke Size (/64 <sup>th</sup> ) | UcP (psig) | UcT (degC) | Gas Rate (mmscf/d) |
|---------------------------|-----------------------|---------------------------------|------------|------------|--------------------|
| Clean-Up                  | 12                    | 64                              | 2050       | 121        | 45                 |
| Initial BU                | 1                     | -                               |            |            |                    |
| 1 <sup>st</sup> Step Rate | 6                     | 32                              | 2336       | 97         | 14                 |
| 2 <sup>nd</sup> Step Rate | 6                     | 48                              | 2252       | 112        | 29                 |
| 3 <sup>rd</sup> Step Rate | 6                     | 64                              | 2050       | 121        | 45                 |
| Final BU                  | 15                    | -                               |            |            |                    |

# Bottom hole gauge data



## **APPENDIX V : PALYNOLOGY REPORT**

**No palynology work was done on this well.**

## **APPENDIX VI : WATER ANALYSIS REPORTS**

No water analysis was carried out in Casino-4DW2

**ENCLOSURE I : COMPOSITE LOG**

**ENCLOSURE II : STRUCTURE MAP**

**ENCLOSURE III : STRATIGRAPHIC CROSS SECTION**

**ENCLOSURE IV : LOG INTERPRETATION PLOT**