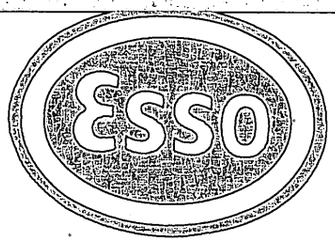

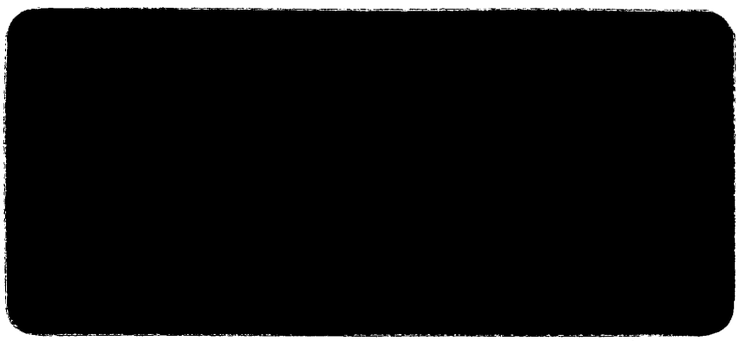

Well Completion Rpt.
Vol. 2, part 1 of 2

Turrum-7
(W1300)

Esso Australia Ltd.

TURRUM 7

WELL COMPLETION REPORT

VOLUME 2
INTERPRETIVE DATA
Part 1 of 2

GIPPSLAND BASIN
VICTORIA

ESSO AUSTRALIA LIMITED

Petroleum Development

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March, 2000

TURRUM 7
VOLUME 2: INTERPRETIVE DATA

Part 1 of 2

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TURRUM 7
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INTRODUCTION

The Turrum-7 location is 5.2 km south-east of the Marlin-A platform and 1.3 km east-southeast of the Turrum-3 well (Figure 1). The location lies in 62 metres of water within the VIC/L4 licence area in the Gippsland Basin.

The primary objective of the Turrum-7 well was to explore for oil in the Lower *L.balmei* aged lower coastal plain to marginal marine L360 reservoir sediments.

Turrum-5 identified oil in the L360 and L400 reservoirs on the west flank of the field. Turrum-7 was designed to explore for this oil leg on the east flank of the field.

Turrum-7 was also expected to provide additional control on the extent and reservoir quality of other reservoirs within the 'L.balmei' interval. In particular the L100, L500 and possibly the L310 were expected to be intersected outside of structural closure and consequently water wet. The L200/L220 and L260/L270 were identified as having oil potential but unlikely to contain gas unless isolated from the main gas reservoirs encountered at Turrum-2 and Turrum-3. The L360 and L400 were considered likely to contain oil at the Turrum-7 location.

It should be noted that all depths cited in this report refer to logger's depth (mMDRT or mTVDSS) with the exception of the section titled, Geological Discussion, L360 Reservoir, Core Analysis which cites core depths (driller's depth mMDRT).

SUMMARY OF WELL RESULTS

Turrum-7, an appraisal (outpost/extension) well within VIC/L4 of the Gippsland Basin, spudded 24 August 1999. Total depth of 2830 mMDRT was reached on 13 September, 1999. The well was plugged and abandoned and the rig released from location on 20 September 1999.

Objectives

Turrum-7 was drilled in order to determine if the oil penetrated by Turrum-5 on the western flank in the L-360 and L-400 reservoirs extended to the eastern flank of the Turrum structure. In addition the well was to provide control on the other Turrum field reservoirs.

Uncertainties

The key uncertainties associated with this location were variability in oil column height, reservoir quality and structure.

Results

The L360 reservoir at Turrum-7 was very poorly developed and no net reservoir was encountered. It consisted of interbedded shales, silts, coals and clay rich, silty sands. Pressure and sample data were unable to be taken in this low permeability rock. A 27 metre core was taken in the L360 section. Good hydrocarbon shows (either live oil or residual oil in water) were present over a distance of 1 metre in the upper section of the core. An L-360 gas / free water level of -2591 metres subsea has been established using pressure and sample data that has been taken in previous Turrum wells. The hydrocarbon shows occur approximately 3 metres above this depth. The poor rock quality makes determination of the fluid type difficult. Detailed core analysis and geochemistry has determined that these shows are not likely to be due to the presence of residual oil in gas, however, it has not been possible to differentiate between live oil and residual oil in water. If the shows could be demonstrated to have resulted from residual oil in water, a gas / water contact could be inferred near to the top of the show at –2587 mTVDSS within the Turrum-7 fault block (this is within the range of uncertainty for the gas/free water level constrained by Turrum-5 gas & Turrum-4 water pressure data to –2591 mTVDSS +/-5m). Conversely, if oil is present, the Turrum-7 fault block oil column height cannot be deduced due to the lack of pressure data in this zone. Only water bearing samples were observed below this interval, however, geochemical and MICP analyses suggest that the permeabilities of this rock are too low to allow hydrocarbon entry and that significant downdip oil potential is possible. **The possibility that an oil column with a height up to 157m is present on the east flank of the L360 reservoir has not been excluded by drilling Turrum-7.**

Hydrocarbon was found in 5 sands that occur above the L-360. The L-110 and L-132 sands contain gas which appear to be in pressure communication (refer Appendix 1). The L-170 and L-180 sands also contain gas and appear to occur as separate individual pressure systems. Log analysis indicates that there is a total of 11.9 metres

of net gas sand (refer Appendix 2). The L-200 section contains 4.9 metres of net rock. An oil/water transition zone is interpreted to have been intersected by Turrum-7 in the L200 reservoir. Interpretation of MDT pressure data obtained in Turrum-7 in conjunction with data from previous Turrum wells support the presence of approximately 31m of updip oil.

The L-100 was present and wet as prognosed. The L260/L270 & L-400 sands were not present at the Turrum-7 location. The L-500 reservoir was wet as prognosed and did not contain the section of dolomitic cement that was observed in Turrum-3.

OVERVIEW

Turrum is currently the largest undeveloped hydrocarbon resource in the Gippsland Basin. It is an intra-Latrobe Group south-west plunging, anticlinal trap, intersected by a set of west-north-west striking normal faults. The field contains a number of vertically stacked reservoirs, which consist of fluvial stacked channels, point bar and estuarine/tidal bar sands (refer Enclosures 1 & 2). They are top sealed by floodplain mudstones, coals, bay head delta & lagoonal deposits.

REGIONAL SETTING

The initial formation of the Gippsland Basin was associated with rifting and subsidence that extended along the southern and eastern margins of Australia during the Jurassic to Early Cretaceous. During this period, deposition of the predominantly volcanoclastic Strzelecki Group occurred in an alluvial environment.

Continued Late Cretaceous (approximately 95 MY) rifting diverged along the west coast of Tasmania resulting in the Gippsland Basin becoming a triple junction arm of the north-south Tasman rift along the eastern Australian margin with resultant deposition of the Golden Beach Group. Initial deposition of deep rift lacustrine shales and alluvial fans along basin margins gradually evolved into a fluvial-dominated system. Marine transgressions are recorded in the upper Golden Beach Group in the South-east of the basin.

The active rift phase in the Gippsland Basin ceased at approximately 80 MY and marked cessation of the Golden Beach Group deposition. At this point, the Gippsland Basin became a failed rift.

The Latrobe Group was deposited in a post rift setting with fault controlled subsidence continuing until the Late Palaeocene. Most of the Latrobe Group was deposited in a non-marine setting behind a NE-SW tending beach-barrier complex. As sedimentation rates declined, the strandline moved to the north-west, depositing thin Eocene-aged glauconitic green sands over a wide area (Gurnard Formation).

Two major phases of canyon cutting occurred during the Tertiary. The Early Eocene Tuna/Flounder Channel was cut and then filled with predominantly marine sediments of the Flounder Formation. The Marlin Channel was cut during the Middle Eocene and partially filled with distal marine sediment of the Turrum Formation. Erosion associated with the top of Latrobe Group unconformity resulted in the formation of many of the hydrocarbon traps in the basin.

The end of the Latrobe Group is marked by deposition of marl and calcareous siltstone of the Lakes Entrance Formation in response to continued marine transgression in the Oligocene. Prograding limestone and calcareous siltstone wedges of the Gippsland Limestone result in the formation of the present day shelf.

A compressional event in the late Eocene to mid Miocene caused selective inversion of faults around the basin and the establishment of the major ENE-WSW anticlinal trends in the basin.

STRATIGRAPHY

The stratigraphy of the Turrum-7 well is based on correlation to adjacent wells and the regional stratigraphic framework established for the basin during the Collaborative Research Project (1993-1994). An extensive study of Turrum cores, detailed facies analysis, detailed biostratigraphic correlation (refer Appendix 3) and correlation to seismic geometries observed from 3D seismic data provide detailed stratigraphic control in the Turrum region.

The well penetrated a thick sequence of limestones and marls of the Gippsland Limestone and the Lakes Entrance Formation (refer Table 1, Figure 2 & Enclosure 1). Top of Latrobe was intersected 6m high to prognosed at 1765 mMDRT (-1738 mTVDSS). A thin section of Eocene Turrum Formation prognosed to possibly underlie the top of Latrobe Group was not present. The thick section of *N. asperus* to *M. diversus* aged marginal marine to lower coastal plain sands, shales and coals which form the Marlin Field reservoir sequence, encountered in other Turrum wells, has been removed from the east Turrum region by Eocene to Miocene channelling events and was not penetrated by Turrum-7.

The Top Latrobe to Top L100 section (lower *M. diversus* to the basal upper *L. balmei* age) is dominated by shales and thin sheet sands deposited in a lower delta plain environment. Some thin coals, single channel sands generally less than 5m thick, minor point bars and some crevasse splay deposits occur within this section.

The objective reservoir interval of the well lies within the 500m thick lower *L. balmei* section (which contain the Turrum reservoirs). Parts of this section are shale prone; however, sand packages are thicker than the overlying section, consisting of braided and meandering fluvial non-marine deposits and marginal marine estuarine and bayhead delta deposits up to 25m thick. Coals are more common, thicker and can be correlated over large distances within the Turrum discovery. These sand packages are designated L100 to L500 (Table 1, Enclosures 1 & 2). The major reservoirs can generally be correlated across the main Turrum fault block. A comprehensive summary of the full range of facies (and their depositional environments) encountered within the Turrum section can be found in the Turrum-5 Well Completion Report and therefore will not be discussed further in this report.

The primary objective of the Turrum-7 well was to test the east flank oil potential of the L360 reservoir. The L360 reservoir consists of two stratigraphic units (L360 Upper & Lower), which share common hydrocarbon contacts. The L360 Upper is a good quality, laterally extensive sand package which has been deposited in a braided fluvial environment. The L360 Lower consists of variable quality sands deposited within a fluvial-dominated shoreline deltaic environment, consisting of poor quality meandering and braided fluvial facies in the west, grading to good quality stream mouth bar facies in the Marlin-4 region and good quality delta front interbedded sands at Turrum-3 grading to poorer quality prodelta sands and shales at Turrum-4. Unfortunately, dolomitic cementation at Turrum-3 & 4 has degraded (in part) the good quality L360 Lower sands.

The braided fluvial L360 Upper sands encountered in 7 of the 8 wells drilled into the main Turrum fault block were not present at the Turrum-7 location. The gross thickness of the L360 section has been maintained as the absence of L360 Upper sands has resulted in a thin veneer of interfluve shales and crevasse splay sands overlying a relatively thick, uneroded section of L360 Lower tidal facies. The L360 Lower appears to be predominantly marginal marine (tidal) with minor non-marine regressions (swamp). Whilst this is consistent with the pre-drill prognosed facies association (bayhead delta – lagoonal), reservoir quality is much poorer than expected, consisting of predominantly very fine to fine grained sands, silts and mudstones. Good quality bayhead delta sands present at both Turrum-3 (proximal) and Turrum-4 (distal) were not encountered at Turrum-7.

STRUCTURE

The intra-Latrobe Group Turrum discovery is contained within a fault dependent anticlinal trap. Total predicted hydrocarbon column height in the largest reservoir system, the L360, exceeds 300m. The structure maps (Enclosure 3) display a major north-east trending anticlinal axis consistent with north-west/south-east directed compression commencing in the late Eocene.

The anticline, which plunges to the south-west, is intersected by a set of north-west oriented normal faults, which predominantly step down to the south-west. There are some normal faults however that throw down to the north-east. There are also a few faults with reverse throw that occur to the north of the main field fault block. These have fault strikes oriented to the north-east and fault planes that dip to the south-east.

Turrum-7 tested the east flank of the main Turrum fault block. Turrum-7 penetrated the Turrum L360 22m low to prognoses at 2614 mMDRT (-2587 mTVDSS) in the south-east Turrum-3 fault block.

GEOLOGICAL DISCUSSION

L110/L132 RESERVOIR (2265.9 - 2274.1 mMDRT)

Significant mud gas of approximately 30% (above a background of approx. 0.7-2%) was encountered whilst drilling through the L110/L132 reservoirs at Turrum-7. MDT pressures confirm the presence of gas with points from both reservoirs lying on a single gas gradient of 0.32psi/m (refer Appendix 1). Although these sands are separated by shale within Turrum-7, the consistent gas pressure gradient suggests that they may represent one hydrocarbon system (ie. gas directly communicates away from the well bore). Hydrocarbon saturations (Sg) between 40-50% have been calculated in these good quality reservoir sands (Avg = 20-22% using 12% porosity cutoff) (refer Appendix 2). No cut or fluorescence was seen in this zone. A possible GWC was placed in this zone at 2272.8 mMDRT due to reduction in total gas saturation and gas NPHI/RHOB cross-over at this depth, however, it should be noted that these effects could be a result of decreased grain size at the base of the L132.

L133/L137 RESERVOIR (2280.6 - 2293.1 mMDRT)

The L133/L137 sands have previously been seen as independent sands separated by shale in other Turrum wells. These sands directly overly at Turrum-7 and represent a common reservoir system at this location. The L133/L137 reservoir produced high mud gas readings (30%), poor cut and fair fluorescence, however MDT pressures indicate that this zone is water wet. Petrophysical analyses confirms this conclusion calculating Sw=95-99% in good quality sands (Avg = 17-24% using 12% porosity cutoff).

L170 RESERVOIR (2347.2 - 2350.8 mMDRT)

8% mud gas was encountered whilst drilling through the L170 reservoir. The presence of gas has been confirmed by MDT & Petrophysical Analyses. A gas gradient of 0.33psi/m has been established from MDT pressures. This unit has a hydrocarbon saturation (Sg) of 70% calculated in good quality reservoir sands with average porosity of 21% (using 12% porosity cutoff).

L180 RESERVOIR (2353.6 - 2358.8 mMDRT)

The L180 reservoir exhibits similar reservoir characteristics to the L170, however a gas gradient of 0.37psi/m has been established which is at elevated pressure and therefore represents a separate hydrocarbon system from the L170. This unit has a hydrocarbon saturation (Sg) of 61% calculated in good quality reservoir sands with average porosity of 21% (using 12% porosity cutoff). 4% mud gas was encountered in this reservoir whilst drilling.

L190 & L193 RESERVOIRS (2383.8 - 2394.5 & 2408.6 - 2420.8 mMDRT)

Similar to the L133/L137, the L190 & L193 reservoirs produced elevated mud gas readings (10%), poor cut and poor fluorescence, however MDT pressures indicate that these zones are water wet.

Petrophysical evaluation suggests that 35% hydrocarbon saturation is present in the L190, however this unit consists of poorer quality sand (Avg porosity = 13% using 12% porosity cutoff) and therefore the interpreted high hydrocarbon saturation may be incorrect. Gas wetness ratios derived from the mud log (refer Appendix 2 - Attachment 2) suggest that gas is more likely to be present than oil in the L190, therefore it can be concluded that residual gas is responsible for elevated hydrocarbon saturations in this water wet reservoir.

Hydrocarbon saturation of 14% has been calculated for the L193 in similar quality rock (Avg porosity = 14%). This slight elevation in saturation has been attributed to residual hydrocarbon, however differentiation between oil and gas has been inconclusive.

L200 RESERVOIR (2440.0 - 2450.0 mMDRT)

Assessment of the L200 reservoir has proved to be complicated in Turrum-7. Elevated mud gas (>10%) with no cut or fluorescence were recorded for this reservoir. MDT pressures form a gradient of approx. 1.18 psi/m which lies between that of oil (approx. 0.92 psi/m) and water (1.42 psi/m). This is not interpreted to be the result of residual hydrocarbon in a water leg because in all cases when water is the dominant/communicating fluid a gradient of 1.42 psi/m will be seen. It is therefore reasonable to conclude that a hydrocarbon/fluid transition zone has been intersected. This interpretation is supported by the Petrophysical analysis which shows a downward decrease in hydrocarbon saturation despite a downward increase in reservoir quality in the lower 4m of the L200 reservoir (refer Appendix 2 - Attachment 1). Pressure data from L200 gas in the updip Turrum-3 well, when combined with data from L200 water in the downdip Turrum-4 suggest that the L200 *gas/free water level* lies many meters above the Turrum-7 L200 reservoir. Therefore, gas could not be present at the Turrum-7 location, unless isolated from the main gas reservoirs encountered at Turrum-2 and Turrum-3. Correlation of facies between Turrum-3 and Turrum-7 suggests that these sands represent a common system and it is therefore reasonable to conclude that an oil/water transition zone has been intersected in Turrum-7. If this conclusion is correct, approximately 31m of L200 oil column lies updip of Turrum-7 (refer Appendix 1).

Acquisition of 2 fluid samples were attempted from the L200 to confirm the presence of oil, however tight formation and concerns over differentially sticking the tool prevented these samples from being recovered.

L360 RESERVOIR (2613.7 - 2632.2 mMDRT)

MDT data

Turrum-7 failed to intersect any net reservoir rock at the L360 level. Hydrocarbon type and column height could not be assessed as sample and pressure data could not be acquired over this interval. Acquisition of 16 pretests were attempted from this zone without success. All pretests were tight or seats failed and therefore no samples were attempted.

Core Analysis

Core was cut over the majority of this interval and analyses have been performed on the core to assess the hydrocarbon potential of the surrounding reservoir. All depths cited in this section refer to core depths (driller's depth mMDRT). The result of these analyses are as follows:

- Core description

  The L360 Upper braided fluvial sands are absent at the Turrum-7 location, there being no obvious erosion of the L360 Lower.
  The L360 Lower appears to be predominantly marginal marine (tidal/lagoonal) with minor non-marine regressions (swamp). Whilst this is consistent with the pre-drill prognosed facies association (bayhead delta – lagoonal), reservoir quality is much poorer than expected, consisting of predominantly very fine to fine grained sands, silts, and flazer to lenticular bedded mudstone with abundant carbonaceous partings. Bayhead delta sands have not developed at this location despite being present at both Turrum-3 (proximal) and Turrum-4 (distal). The core is extensively bioturbated in many sections.

- Biostratigraphy (Report EMEC.32.BIO.99)

  The Turrum-7 L360 interval contains rare poorly preserved, restricted marine dinocysts consistent with a tidal/lagoonal setting (refer Appendix 3).

- Geochemistry (Report EPR.96ES.99)

  Comparison of geochemical data from Turrum-7 core was made with reservoir samples from known gas, oil & water zones from core, cuttings and samples from Turrum-3 to 7 & Marlin A6 & A24. Comparative geochemical data include *Iatroscan* (bulk composition), *Whole-extract gas chromatography* (GC) & *Thermal extract/gas chromatography* (TE/GC) (refer Appendix 4).
  The geochemical data suggests that the Turrum-7 well penetrated a "live" oil leg in the L360 down to 2610.62 mMDRT. TE/GC data from this interval are very similar to that from the Turrum-5 oil leg, suggesting they originate from the same hydrocarbon system. These extracted hydrocarbons from the L360 Turrum 7 (down to 2610.62 mMDRT) are substantially different to the calibration GCs

for gas/condensates suggesting they do not represent residual oil within a gas column. However the possibility that the Turrum-7 extracts may be residual oil within a water or gas leg cannot be dismissed.

Only water-wet sands are present below 2610.62 mMDRT. There is no geochemical evidence to suggest that hydrocarbons (oil or gas) have ever entered this lower interval (2618.4-2629.4 mMDRT). This suggests that a) hydrocarbons have not filled the L360 down to this level, b) this lower stratigraphic unit is isolated from hydrocarbon migration pathways or c) the reservoir quality is too poor to allow entry of hydrocarbons. Pore entry capillary pressure data has been acquired to test this latter possibility and is discussed in detail below.

- Mercury injection (pore entry) capillary pressure

Mercury Injection Capillary Pressure (MICP) analysis has been performed on 12 core plug offcuts from the Turrum-7 L360 section. The results of this analysis are presented in Appendix 5. Calculation of the maximum hydrocarbon column these samples could support has been undertaken using the methods documented by:

Vavra, C.L., Kaldi, J.G. and Sneider, R.M., 1992, *Geological Applications of Capillary Pressure: A Review,* The American Association of Petroleum Geologists Bulletin, Volume 76 no. 6.

In summary, air is displaced by 'pumping' mercury into the core plug offcut and the resultant mercury saturation is measured as a function of the pressure applied to do so. The initial displacement pressure (Pd) for the sample is determined by back extrapolating the resultant Capillary Pressure vs Mercury Saturation curve to S_{Hg}=0%. Initial displacement pressure measured in an air/mercury system ($Pd_{(air/Hg)}$) is then converted to an initial displacement pressure representative of the Turrum L360 water/oil system ($Pd_{(brine/hydrocarbon)}$) using generic values for brine & crude (>40 API) interfacial tension & contact angle. From this, the maximum down dip hydrocarbon column height this sample would support (as a sealing rock) can be calculated (refer Vavra, et al. 1992 for equations). This method is highly sensitive to the values assumed to represent the interfacial tension & contact angle of brine & hydrocarbon in the reservoir under scrutiny, and for this reason should be considered qualitative at best. A range of input parameters have been applied in order to investigate the full range of column heights these samples could support downdip before invasion would occur.

It can be demonstrated that sample 028c through to 244c (at 2610.3 – 2629.3 mMDRT) would support up to 30-60m of downdip oil potential before oil would exceed their capillary entry pressure and invade the rock. When considered in conjunction with the observation from Geochemical analysis that there is no evidence that hydrocarbon has ever migrated through these rocks, the possibility of L360 oil potential downdip of the Turrum-7 intersection cannot be excluded. Qualitative MICP analysis suggests that a large L360 oil column could be present (117m total; approx. 45m downdip of Turrum-7 location) and the rocks intersected at Turrum-7 would remain water wet as the oil capillary

entry pressure has not been exceeded. It should be noted that sample 016c (2610.3) which occurs in the 'live' oil zone would only support 2-6m downdip oil before invasion would occur.

L360 East Flank Oil Column Height

Pressure and sample data from Turrum-3, 4 & 5 demonstrate that the gas/free water level for the Turrum L360 reservoir (main fault block) is at –2591 mTVDSS (+/-5m)[1] therefore the minimum possible oil column height (0m) in the Turrum-7 fault block would be represented by a GWC at this depth (refer Figure 3). The maximum possible oil column height (157m) is defined by a GOC at Turrum-3 LKG (-2496 mTVDSS) and a corresponding OWC at Turrum-4 HKW (-2653 mTVDSS). Both the highside and lowside (oil column height) cases assume that an east flank oil column does not communicate directly with oil discovered on the west flank at Turrum-5. The pre-drill (Turrum-7) most likely prognosed oil column height is 117m which assumes direct communication of east flank L360 oil with west flank oil at Turrum-5. This is represented by a GOC at –2518 mTVDSS (Turrum-5) and a corresponding OWC defined by extrapolating the L360 oil gradient[2] from this GOC to intersect the Turrum-4 water gradient at –2635 mTVDSS.

The possibility that an oil column within the range of 0 to 157m high is present on the east flank of the L360 reservoir has not been excluded by drilling Turrum-7. Poor quality reservoir prevented evaluation of fluid type & column height by conventional means (sample and pressure acquisition). Geochemical evaluation does suggest the possibility of gas below the top of observed oil shows at –2587 mTVDSS[3] in the Turrum-7 core is highly unlikely. Whether these shows represent "live" oil or residual oil in water is not discernible. The presence of hydrocarbon down to –2587 mTVDSS can be established, however, as the residual oil scenario implies that a GWC is at or near to this depth.

The presence of hydrocarbon has therefore been represented by booking *static* gas down to –2587 mTVDSS on the east flank of the field (refer Figure 4). This volume revision has been categorised as *Static* due to the uncertainty associated with fluid type (ie. a portion may be oil).

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[1] 5m uncertainty accounts for error in gas gradient (Turrum-3 is very similar to Turrum-5 gas gradient), water gradient and pressure measurement uncertainty associated with the tools used to acquire the data.

[2] The Turrum-5 L360 oil sample is not deemed to be representative of the reservoir fluid. Therefore, the L360 oil gradient has been derived from chemical analysis of the Turrum-5 L400 oil sample.

[3] Core depths have been corrected (using Core Gamma log) to match log depths using the following:
logger's depth = driller's depth + 3.9m

GEOPHYSICAL DISCUSSION

GEOPHYSICAL DATA

The Turrum-7 well was located using seismic data from the G93 3D survey. The data was reprocessed in December 1998. Reprocessing improved the continuity of the data significantly down to the upper levels of the Turrum section. Unfortunately at the L360 reservoir level and below, which is the primary target interval for this well, the improvement in data quality was small. However the improvement in the shallower Turrum data allowed better fault and structural definition which translated to improved control at the deeper levels as well.

A Turrum-7 synthetic was created in SEISMOD using good quality sonic and VSP/checkshot data and is displayed as Enclosure 4. The frequency (25Hz) and lag (16msec) of this Turrum-7 synthetic gives the best tie to the Pink SM (seismic marker). The seismic that the synthetic is tied to in this display is 3D Inline I540. Twelve other wells in the survey area were tied to the seismic data using synthetic seismograms created in the IESX synthetics module. The data quality of the sonic logs and checkshot surveys that were used to create the other synthetics was generally good, however some of the older wells have few checkshots that are often of poorer quality. Significant lags need to be applied to the synthetics to produce character ties to the seismic data. The lags occur as the seismic is strongly affected by multiples that originate in the thick coals, which occur in the Latrobe Group. In the Turrum Formation the seismic response is dominated by reflections from the coals that occur throughout the interval. Coals with thicknesses of 10 metres or more are common.

TIME INTERPRETATION

Time interpretations were made on the base of two Miocene aged channels in the post-Latrobe Group section. Well data indicates that relatively fast velocity sediments in the base of the channel fill makes these horizons significant velocity interfaces. Interpretations were made for the top of the Latrobe Group (TOL), base of a coal prone interval in the upper Latrobe 'Marlin section' (BCOAL) and base of Eocene aged channelling (BEOC). An interpretation was made for the 'Blue-Grey' (BLGY) SM which was used to control the structure mapping for the L100 series reservoirs. The 'Upper Yellow Trough'(YTR1) SM controlled the L200 reservoir series, the 'Pink' SM the L300 series and the 'MFSA' SM controlled the L500 reservoir series. The 3D seismic inline I540 which intersects the Turrum-7 location is included as Enclosure 5.

The density of interpretation varied between horizons. The 'Pink' and 'MFSA' seismic markers were interpreted on a 100 metre inline (4 inlines) and 125 metre crossline (5 crosslines) spacing. Over much of the area the other main horizons were interpreted at half this density.

The seismic time data was grided in ZMAP using centre-line fault techniques to allow improved control in subsequent isopach mapping. Several other horizons were interpreted over limited areas or with lower density than these main horizons.

DEPTH CONVERSION

Actual well depths for Turrum-7 were all less than 1 percent different to those predicted prior to drilling (Table 1).

Well velocity, depth and location data were used in the Geodepth and ZMAP programs to depth convert the seismic time data. Depth conversion to the top of the Latrobe Group was accomplished by constructing 200 metre thick depth slices and populating them with well based interval velocities, which were constrained with the two interpreted Miocene channels. This provided a depth/velocity model, which allowed a linear depth conversion. Misties at the wells were grided and this correction grid was subsequently applied to produce ties at the well locations. The well based interval velocity depth conversion method was chosen as the base case because it allowed the well control to be projected into areas that have varying overburden geometries. The geometries of the major velocity interfaces (the two Miocene channels and the top of the Latrobe Group) and their effect on the average velocity to the top of the Latrobe Group, were incorporated into the velocity model by using this method. Turrum-7 intersected the top of the Latrobe Group 5 metres high to prediction, a 0.3% error.

Depth conversion of the Turrum Formation seismic markers used mid-point depth constructed interval velocities that were calculated using a function derived from well velocity data. One mid-point depth function was used to depth convert from Top Latrobe to a smoothed version of the 'Pink' SM time structure. Another was used to isopach from this smooth depth map to the other seismic markers in the Turrum Formation. This method was employed to minimise depth distortion near faults. Top of reservoir maps were constructed by isopaching from the nearest seismic marker depth map, with the isopach grids being controlled by well data.

The primary target for the Turrum-7 well was the L360 sands that were mapped by isopaching down from the Pink SM. Uncertainty in the depth conversion to the Pink SM was estimated to be +/- 25 metres at the well location. Turrum-7 intersected the Pink SM 20 metres low to prediction, a 0.8% error.

Tables

TABLES

TURRUM 7

FORMATION RESERVOIR TOPS

Formation/ Zone	mTVDSS			mMDRT	mTVT Net Hydrocarbon Sand	
	Predicted	Actual	Difference		Predicted	Actual
Base Upper Miocene Channel	-1493	-1494	1m low	1520		
Base Lower Miocene Channel	-1613	-1615	2m low	1641		
Top of Latrobe Group	-1744	-1739	5m high	1765		
Top of Coarse Clastics	-1758	-	-	-		
Top of L100 Reservoir	-2188	-2200	-	2226		
Blue-Grey Seismic Marker	-2198	-2209	11m low	2236		
Top of L110 Reservoir	-	-2238	-	2265	-	2.4m gas
Top of L132 Reservoir	-	-2245	-	2271	-	1.4m gas
Top of L170 Reservoir	-	-2321	-	2347	-	3.4m gas
Top of L180 Reservoir	-	-2327	-	2354	-	4.7m gas
YTR1 Seismic Marker	-2391	-2388	3m high	2415		
Top of L200 reservoir	-2405	-2413	-	2440	-	4.9m oil (transition zone)
Top of L310 Reservoir	-2483	-2522	-	2549		
Pink Seismic Marker	-2560	-2580	20m low	2607		
Top of L360 Reservoir	-2565	-2587	-	2614	13m oil	<1m oil
Top of L400 Reservoir	-2610	-	-	-		
Top of L500 Reservoir	-2656	-2647	-	2674		
MFSA Seismic Marker	-2664	-2669	5m low	2696		
Base L550	-2772	-2760	-	2787		
TOTAL DEPTH	**-2803**	**-2803**		**2830**		

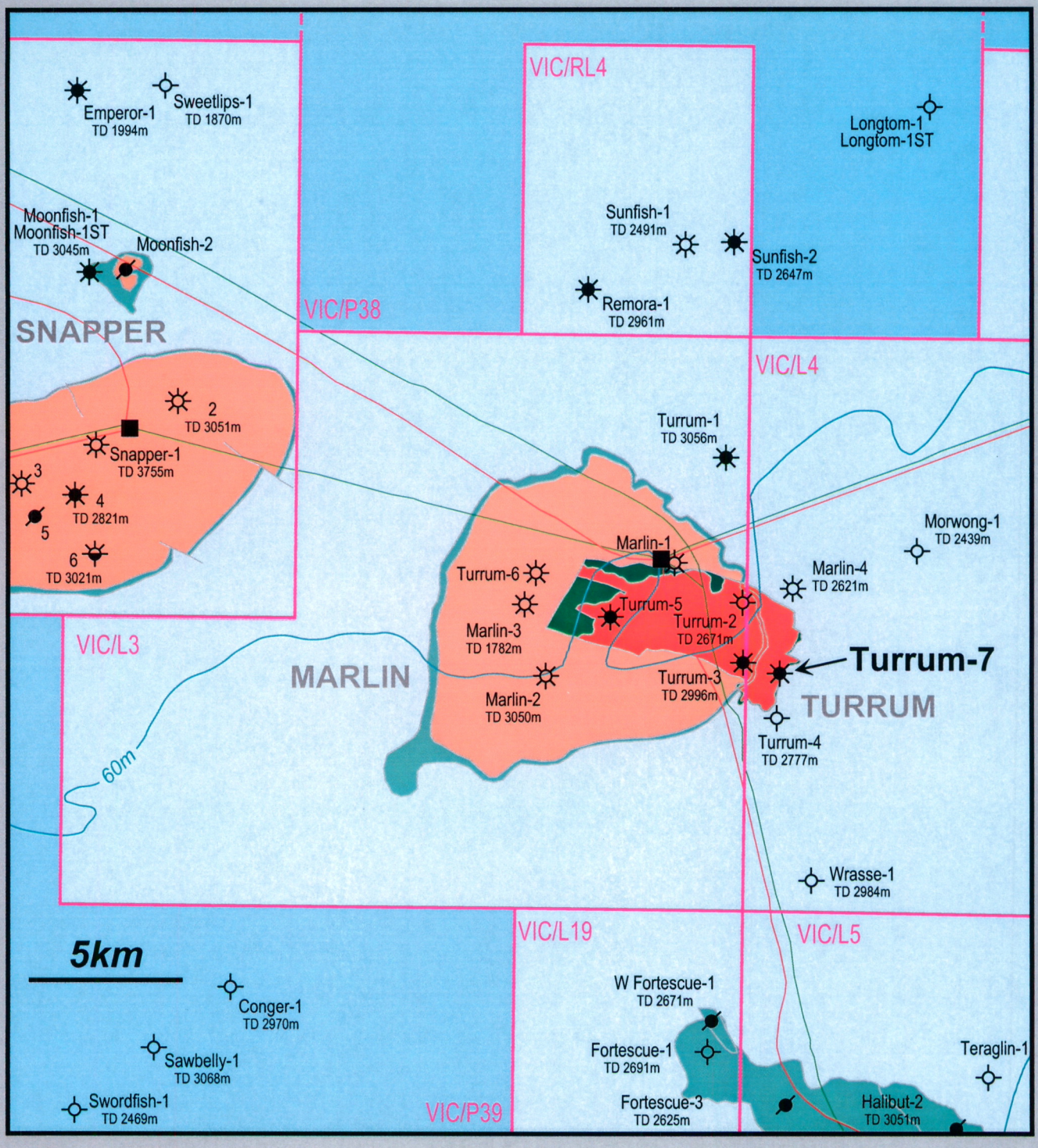
Figures

FIGURES

TURRUM 7

Turrum-7
LOCATION MAP

907506 023



2000 012

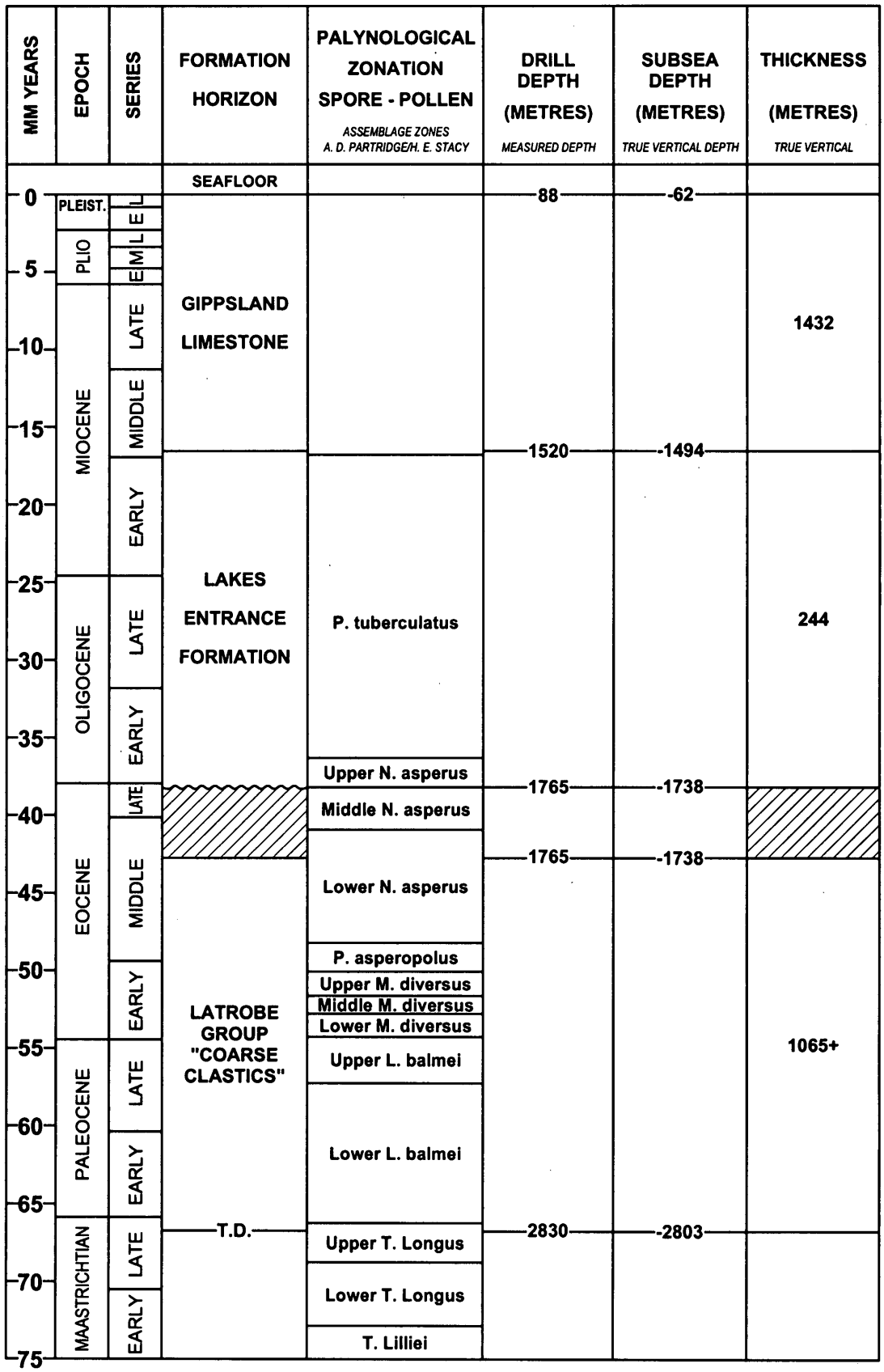
PE907506_01

FIGURE 1

GIPPSLAND BASIN

TURRUM-7 STRATIGRAPHIC SECTION

FIGURE 2

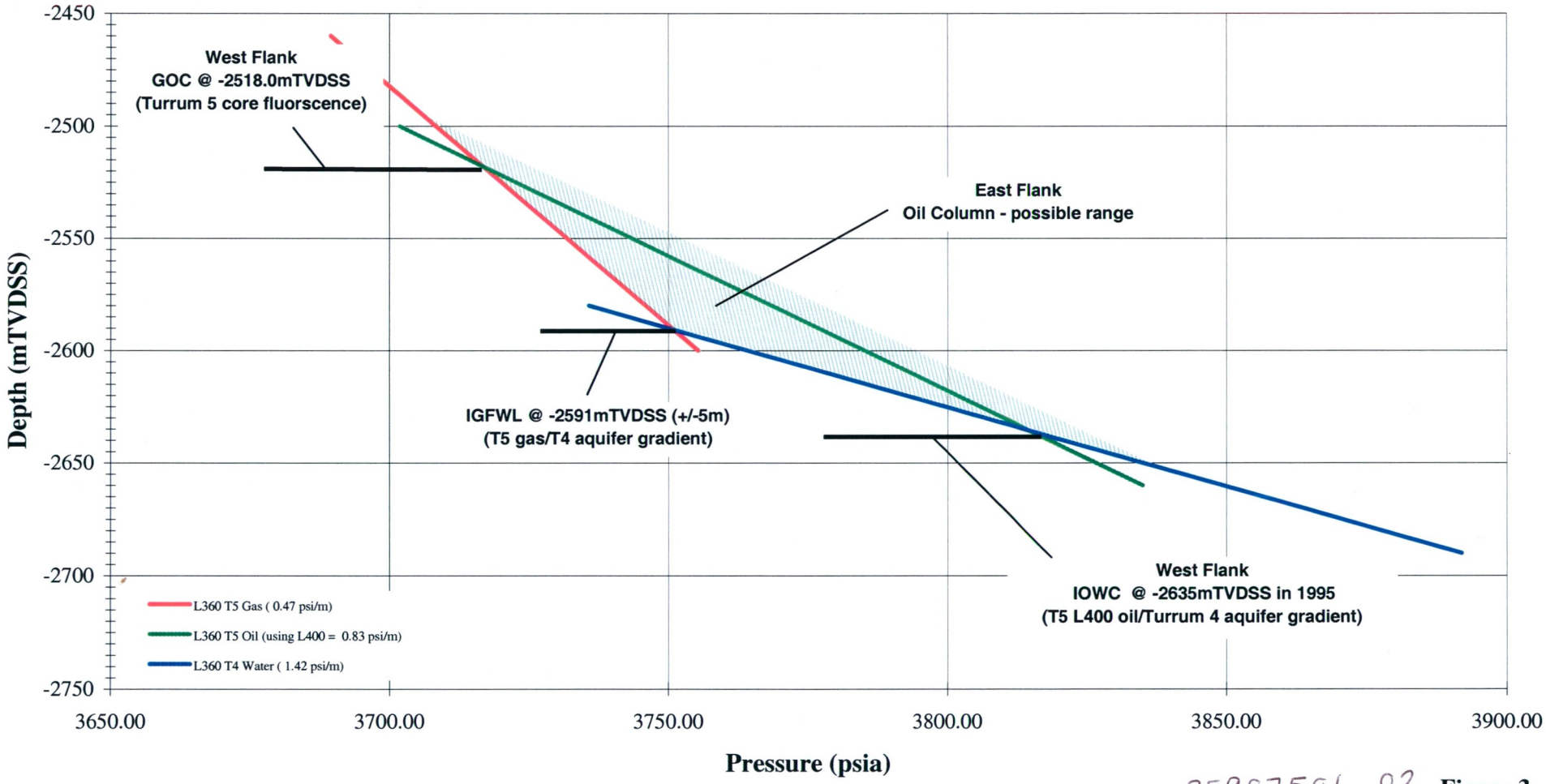


K.B. = 26.0m

NB: Ages are based on correlation to other Marlin/Turrum wells

99099

Turrum L360
Depth vs Pressure Plot

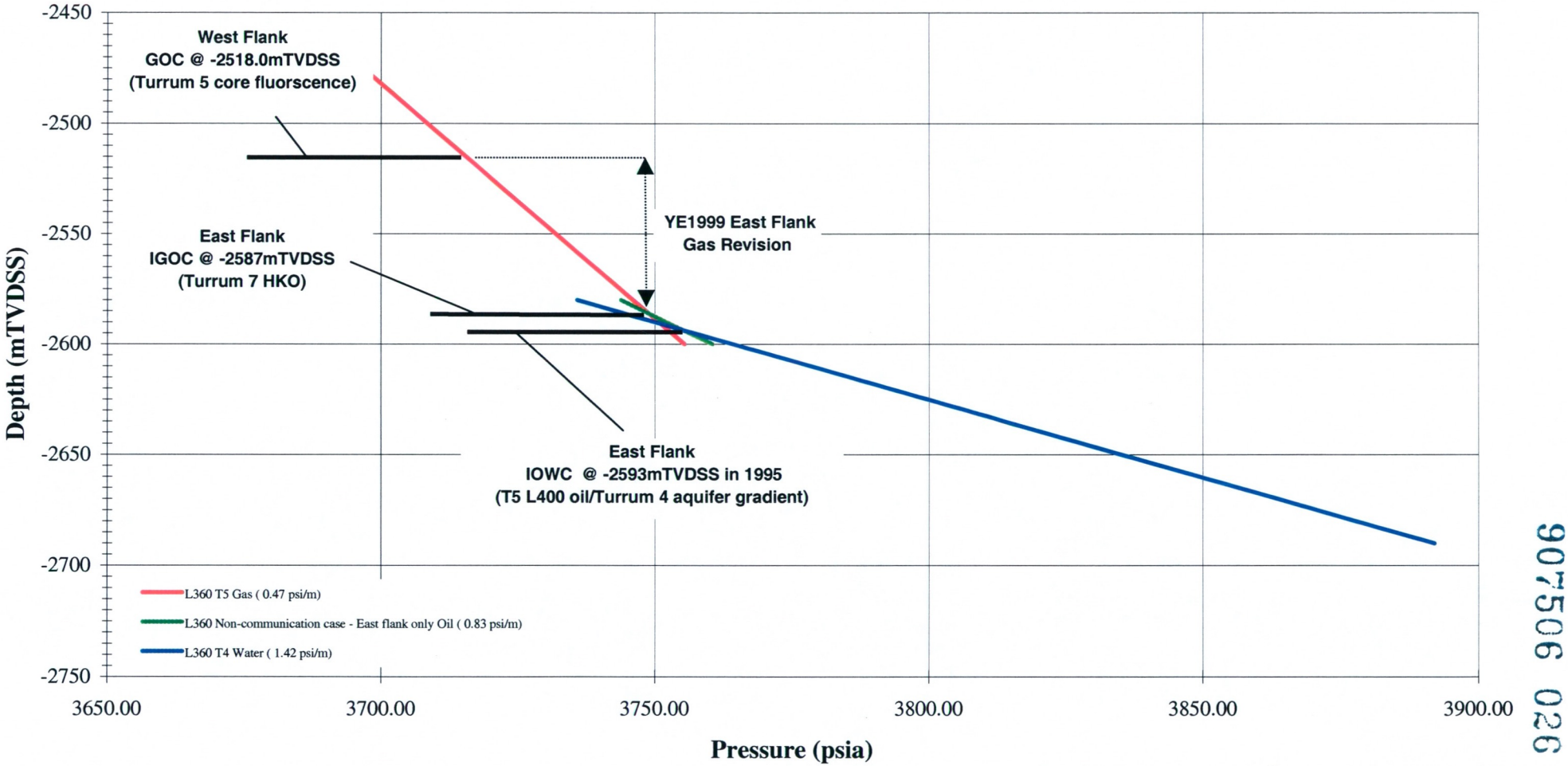


PE907506_02 **Figure 3**

907506 025

Prepared by Michael B Gilbert 3/4/2000
H:\ex\gipps\gpn\gpngg\Turrum\YE1999C T7 Post Drill_Documentation\Turrum L360 Pressure Plot.xls:L360 Most Likely (3)

Turrum L360 - East Flank
Depth vs Pressure Plot



907506 026

PE907506_03

Figure 4

Prepared by Michael B Gilbert 3/4/2000
H:\ex\gipps\gpn\gpngg\Turrum\YE1999C T7 Post Drill_Documentation\Turrum L360 Pressure Plot.xls:L360 Most Likely (4)

Enclosures

ENCLOSURES

TURRUM 7

PE907507

This is an enclosure indicator page.
The enclosure PE907507 is enclosed within the container PE907506 at this location in this document.

The enclosure PE907507 has the following characteristics:

ITEM_BARCODE	PE907507
CONTAINER_BARCODE	PE907506
NAME	Encl.1 Turrum Wells Cross Section
BASIN	GIPPSLAND
ONSHORE?	N
DATA_TYPE	WELL
DATA_SUB_TYPE	CROSS_SECTION
DESCRIPTION	Encl.1 Turrum-5 to Turrum-4 Diagrammatic Cross Section, Scale 1:1000, by Esso Australia Ltd, W1300, VIC/L4. Enclosure 1 contained in "Well Completion Report" [PE907506].
REMARKS	
DATE_WRITTEN	14-MAR-2000
DATE_PROCESSED	
DATE_RECEIVED	06-APR-2000
RECEIVED_FROM	Esso Australia Ltd
WELL_NAME	Turrum-7
CONTRACTOR	
AUTHOR	
ORIGINATOR	Esso Australia Ltd
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE907505

This is an enclosure indicator page.
The enclosure PE907505 is enclosed within the container PE907506 at this location in this document.

The enclosure PE907505 has the following characteristics:

ITEM_BARCODE	PE907505
CONTAINER_BARCODE	PE907506
NAME	Encl.2 Field Stratigraphic Correlation
BASIN	GIPPSLAND
ONSHORE?	N
DATA_TYPE	WELL
DATA_SUB_TYPE	WELL_CORRELATION
DESCRIPTION	Encl.2 Turrum Field Stratgraphic Correlation Main Fault Block & Turrum 4, by Esso Australia Ltd, W1300, VIC/L4. Enclosure 2 contained within "Well Completion Report" [PE907506].
REMARKS	
DATE_WRITTEN	31-MAR-2000
DATE_PROCESSED	
DATE_RECEIVED	06-APR-2000
RECEIVED_FROM	Esso Australia Ltd
WELL_NAME	Turrum-7
CONTRACTOR	
AUTHOR	
ORIGINATOR	Esso Australia Ltd
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE907508

This is an enclosure indicator page.
The enclosure PE907508 is enclosed within the container PE907506 at this location in this document.

The enclosure PE907508 has the following characteristics:

ITEM_BARCODE	PE907508
CONTAINER_BARCODE	PE907506
NAME	Encl.3 Turrum Field Depth Structure
BASIN	GIPPSLAND
ONSHORE?	N
DATA_TYPE	SEISMIC
DATA_SUB_TYPE	HRZN_CONTR_MAP
DESCRIPTION	Encl.3 Turrum Field Post Turrum-7 Top L360 Depth Structure Map, Scale 1:50000, C.I. 20m, by Esso Australia Ltd, W1300, VIC/L4. Enclosure 3 contained within "Well Completion Report" [PE907506].
REMARKS	
DATE_WRITTEN	31-MAR-2000
DATE_PROCESSED	
DATE_RECEIVED	06-APR-2000
RECEIVED_FROM	Esso Australia Ltd
WELL_NAME	Turrum-7
CONTRACTOR	Schlumberger
AUTHOR	
ORIGINATOR	Esso Australia Ltd
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE907509

This is an enclosure indicator page.
The enclosure PE907509 is enclosed within the container PE907506 at this location in this document.

The enclosure PE907509 has the following characteristics:

ITEM_BARCODE	= PE907509
CONTAINER_BARCODE	= PE907506
NAME	= Encl.4 Turrum-7 Synthetic Seismogram
BASIN	= GIPPSLAND
ONSHORE?	= N
DATA_TYPE	= WELL
DATA_SUB_TYPE	= SYNTH_SEISMOGRAM
DESCRIPTION	= Encl.4 Turrum-7 Synthetic Seismogram, by Esso Australia Ltd, W1300, VIC/L4. Enclosure 4 contained within "Well Completion Report" [PE907506].
REMARKS	=
DATE_WRITTEN	= 17-FEB-2000
DATE_PROCESSED	=
DATE_RECEIVED	= 06-APR-2000
RECEIVED_FROM	= Esso Australia Ltd
WELL_NAME	= Turrum-7
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	= Esso Australia Ltd
TOP_DEPTH	= 293
BOTTOM_DEPTH	= 2836
ROW_CREATED_BY	= DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE907510

This is an enclosure indicator page.
The enclosure PE907510 is enclosed within the container PE907506 at this location in this document.

The enclosure PE907510 has the following characteristics:

ITEM_BARCODE	PE907510
CONTAINER_BARCODE	PE907506
NAME	Encl.5 Turrum-7 Seismic Tie
BASIN	GIPPSLAND
ONSHORE?	N
DATA_TYPE	SEISMIC
DATA_SUB_TYPE	INTERP_SECTION
DESCRIPTION	Encl.5 Turrum-7 Seismic Tie 3D Inline I 540, by Esso Australia Ltd, W1300, VIC/L4. Enclosure 5 contained within "Well Completion Report" [PE907506].
REMARKS	
DATE_WRITTEN	17-FEB-2000
DATE_PROCESSED	
DATE_RECEIVED	06-APR-2000
RECEIVED_FROM	Esso Australia Ltd
WELL_NAME	Turrum-7
CONTRACTOR	
AUTHOR	
ORIGINATOR	Esso Australia Ltd
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

ATTACHMENTS

TURRUM 7

PE602968

This is an enclosure indicator page.
The enclosure PE602968 is enclosed within the container PE907506 at this location in this document.

The enclosure PE602968 has the following characteristics:

ITEM_BARCODE	= PE602968
CONTAINER_BARCODE	= PE907506
NAME	= Turrum-7 Well Completion Log Log
BASIN	= GIPPSLAND
ONSHORE?	= N
DATA_TYPE	= WELL
DATA_SUB_TYPE	= MONTAGE_LOG
DESCRIPTION	= Turrum-7 Well Completion Log Log, Scale 1 :500, by Esso Australia Ltd, W1300, VIC/L4. Attachment 1 contained within "Well Completion Report" [PE907506]
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	= 06-APR-2000
RECEIVED_FROM	= Esso Australia Ltd
WELL_NAME	= Turrum-7
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	= Esso Australia Ltd
TOP_DEPTH	=
BOTTOM_DEPTH	=
ROW_CREATED_BY	= DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)