CORE LABORATORIES
AUSTRALIA PTY LTD

# ROUTINE CORE ANALYSIS REPORT

# HARVEY-3

## WEST AUSTRALIA

Prepared for
**Department of Mines and Petroleum**

November 2015

Contract DMP 680714
Core Laboratories file: PRP-15 068

Rock Properties
Core Laboratories
Perth
Australia

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**CORE LABORATORIES**
**AUSTRALIA PTY LTD**

5th November 2015

**Department of Mines and Petroleum**
100 Plain Street
East Perth
WA 6004

**Attention : Louise Stelfox**

Subject : Routine Core Analysis
Well : Harvey-3
Contract : DMP 680714
File : PRP-15 068

Dear Louise,

Presented herein is the final report of a routine core analysis study conducted on cores from the above well that arrived at our laboratory in July 2015.

We appreciate the opportunity to present this service to Department of Mines and Petroleum. Please contact us should you require any further information or assistance.

Yours sincerely,
**Core Laboratories Australia Pty Ltd**

James Brown
Senior Core Analyst

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Planning document, Version 9

# INTRODUCTION

Harvey-3 was cored continuously from 584.0 to 1550.0m (966.0 metres). The core analysis work conducted on the cores was based on DMP Document "SWH Project, Harvey 2, 3, 4 Core Analysis Program, Routine Core Analysis, Special Core Analysis, Planning Document, Version 9" which is included as an Appendix in this report.

All core material from the Wonnerup Member and selected sections of core from the Yalgorup Member were delivered from the GSWA Core Library to Core Laboratories in July 2015. Sections of core preserved at the well-site had been previously delivered to Core Laboratories from March to May 2015 (during and shortly after the coring phase of the well programme).

Services performed on selected plug samples and presented in the report include:

- Porosity, permeability and grain density at NOBP ("reservoir" samples)
- Specific permeability to brine at NOBP ("reservoir" samples)
- Fresh state permeability to brine at NOBP ("seal/aquitard" samples)
- Threshold injection pressure to $CO_2$ at NOBP ("seal/aquitard samples")

The rationale for these tests and the samples selected was as follows:

(A) In the Wonnerup Member and the sandy sections of the Yalgorup Member ("reservoir" samples) to evaluate the storage capacity, injectivity and transmissitivity of these formations with respect to $CO_2$ injection. Two further points to note are:

   a. Porosity and permeability to air data were determined at net overburden pressure (NOBP) on all samples. These data were also generated at 800psi on approximately 20% of the samples so that (i) porosity/permeability data can be generated at any other selected overburden pressure using Stan Jones' 2-point fit equations* (ii) data can be correlated to porosity/permeability data derived from other wells (including Harvey#1, Harvey#2, Harvey#4).
   b. Specific permeabilities to brine were measured so that the more optimistic permeability to air data can be correlated to provide more realistic aquifer-related permeabilities.

(B) In the Eneabba Basal Shale and claystone rich facies of the Yalgorup Member ("seal/aquitard" samples) to evaluate the seal capacity of these formations (that is, their ability to retain $CO_2$ injected into the "reservoir" formations).

Please note this quote provided by the DMP:
*The GSWA is currently reviewing the stratigraphy of the southern Perth Basin, including the usage of units originally defined in the northern Perth Basin. The formation names and tops quoted in the DMP's Harvey studies are therefore preliminary and may be subject to change following this review.*

*SPE 15380, 1986.

## SUMMARY

Porosity and permeability measurements in the Yalgorup Member (sand-rich facies) were determined at 1250psi on 50 samples of which 13 were also measured at 800psi. Porosity and permeability measurements in the Wonnerup Member were determined at 1700psi on 133 samples of which 27 were also measured at 800psi. Grain Density was measured on all samples. 34 samples underwent permeability to brine and threshold pressure to CO2.

| | Minimum | Maximum | Average |
|---|---|---|---|
| **Yalgorup Member (sand-rich facies)** | | | |
| Net Confining Pressure of 800psi. | | | |
| Porosity (%) | 10.1 | 30.4 | 21.0 |
| Permeability, Horizontal, Kinf (md) | 0.004 | 6730 | 1246 |
| Grain Density (g/cc) | 2.592 | 2842 | 2.662 |
| Net Confining Pressure of 1250psi. | | | |
| Porosity (%) | 5.8 | 30.4 | 21.1 |
| Permeability, Horizontal, Kinf (md) | 0.002 | 26900 | 1272 |
| Permeability to brine (md) | 0.0001 | 4180 | 902 |
| **Basal Eneabba unit & Clay-rich Facies Yalgorup Member** | | | |
| Permeability to brine (md) | <0.00001 | 0.00003 | |
| Threshold Pressure to $CO_2$ (psi) | 850 | 4500 | |
| **Wonnerup Member (sand-rich facies)** | | | |
| Net Confining Pressure of 800psi. | | | |
| Porosity (%) | 17.1 | 24.1 | 20.5 |
| Permeability, Horizontal, Kinf (md) | 2.39 | 6810 | 1015 |
| Grain Density (g/cc) | 2.624 | 2.897 | 2.643 |
| Net Confining Pressure of 1750psi. | | | |
| Porosity (%) | 12.9 | 24.9 | 19.5 |
| Permeability, Horizontal, Kinf (md) | 0.003 | 10800 | 6345 |
| Permeability to brine (md) | 0.929 | 5247 | 629 |

# LABORATORY PROCEDURES

## Core Preparation:

The core material from the Harvey-3 well was laid out and sampling points were marked on the Wonnerup Member at a spacing of one sample per metre. Sampling points in the Yalgorup Member were selected in some of the sandy sections. A proposed listing of samples was forwarded to the Department of Mines and Petroleum on the 23rd July 2015. The final selection of sampling points was determined on the 30th July 2015 while viewing the core.

## Sample Preparation:

Horizontal routine core analysis plugs for porosity, permeability and grain density were cut and trimmed from the core to form 1.5" diameter cylinders (in SQ (120mm) core) and 1.0" diameter cylinders (in HQ 63.5mm) core) using 2% potassium chloride as the bit lubricant. Some samples, due to their friable nature, were mounted in Teflon, Nickel foil and screens to avoid grain loss. All samples were then cleaned of residual salts by warm methanol. Complete salt removal was indicated by the methanol, in which the samples were immersed, producing a negative reaction to silver nitrate. After cleaning, the samples were dried in a convection oven at 95°C. To ensure complete drying, each sample was weighed then put back into the oven for twenty-four hours, then reweighed. This process was repeated until consecutive weights were within +/- 0.01 g. After drying, the samples were cooled down in a desiccator to room temperature prior to analysis. The uncleaned, trimmed, plug off-cuts were placed into labelled snap-lock bags.

## Grain Volume and Grain Density:

The weight, diameter and length of all samples were measured before they were processed through the Ultrapore™ porosimeter to determine grain volume. As a standard quality control measure, a calibration check plug was run with every ten samples. Grain density data were calculated from grain volume and sample weight data. For mounted samples, corrections were made for Teflon, Nickel and screen weights and volumes.

## Porosity and Permeability:

The plug samples were run at the requested confining stresses while determining porosity and permeability. A standard check plug was run with every set of samples. Klinkenberg permeability ($K_{inf}$) values are obtained directly from the CMS$^{TM}$300, since it operates by unsteady-state principles. Porosity data was obtained by combining pore volumes from the CMS$^{TM}$300 data with grain volumes from the Ultrapore porosimeter-corrected for Teflon, Nickel and screen volumes for mounted samples. Permeability to brine was determined for every fifth sample for these "reservoir" samples.

## Preserved Sample Preparation:

Some sections of preserved clay-rich facies core ("seal/aquitard") were selected for permeability to brine and threshold pressure to $CO_2$. The end of the PVC tubing was removed and the mineral oil drained out. The core was gently slid out of the tube and inspected for obvious fractures, minor faulting, micro-fractures and other heterogeneity features like sand lenses. The plugs were drilled and trimmed with mineral oil, wrapped in Saran wrap and aluminium foil and placed into snap lock plastic bags and stored in a refrigerator until commencement of analysis.

### Permeability to Brine

- Selected "seal/aquitard" samples were unwrapped and loaded into individual core holders.
- The confining stress was gradually increased from ambient to the requisite net overburden pressure.
- The sample was initially flushed with the simulated formation brine (50,000 mg/L) under back-pressure to eliminate any trapped gas in the pore spaces.
- Brine flow (injection) rates were kept low to ensure laminar flow. For lower permeability samples, the net confining stress was adjusted to account for the increased upstream pressure.
- Brine injection was continued until stabilised flow pressure was attained.
- The effluent was inspected for production of fines. No fines were noticed in the effluent brine collected for any of the samples tested.
- Permeability to brine was calculated at the given injection rate using this equation :

$$Kw = (14700.Q.\mu.L) / \Delta P.A$$

*where :*

$Kw$ = *permeability to brine, md*
$Q$ = *rate,* $cm^3/sec$
$A$ = *cross sectional area,* $cm^2$
$L$ = *length, cm*
$\Delta P$ = *differential pressure (inlet-outlet), psi*
$\mu$ = *viscosity, cP*
*14700 = conversion factor from psi to atmospheres and Darcy to millidarcies*

- Since the "seal/aquitard" samples submitted for permeability to brine measurements were clay-rich facies, high flow pressures (>6,000 psi) were often utilised in an attempt to initiate flow. Where no flow was observed after a period of 24 hours, the tests were terminated and reported as "no flow". Wherever flow was possible, it took extended periods, between 2 to 10 days, to attain equilibrium for permeability measurements.

## Threshold Pressure to Carbon Dioxide ($CO_2$) Gas

- Upon completion of the permeability to brine measurement, the sample underwent threshold pressure to $CO_2$ measurement.
- With the sample still loaded in the core-holder at the applied net overburden pressure, the brine flow line at the upstream-end was removed and any excess brine from the end-stem was syringed out before attaching the $CO_2$ gas injection line. A graduated pipette was attached at the downstream effluent end.
- Gas injection (displacement) pressure was incrementally increased until effluent brine was first produced in the pipette. This pressure was recorded as the "threshold pressure", sometimes referred to as the "entry pressure", or "displacement pressure".
- The overburden pressure was continuously adjusted to compensate for the increasing $CO_2$ displacement pressures to maintain the **net** overburden pressure.
- Displacement/injection pressure was increased beyond 5,000 psi in most cases. Where no effluent brine was noted, testing was terminated and reported as "no injection".

**Company : Department of Mines and Petroleum**

**Well: Harvey-3**

## POROSITY, PERMEABILITY, and GRAIN DENSITY

| SAMPLE NUMBER | SAMPLE DEPTH (m) | CONFINING STRESS (800psi) CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | CONFINING STRESS (1250psi) CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | Permeability Kbrine (md) | GRAIN DENSITY (g/cc) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| **Yalgorup Member** | | | | | | | | | | |
| 142 | 760.15 | 4700 | 4750 | 30.4 | 4370 | 4420 | 29.7 | 2847 | 2.644 | Mounted in Ni sleeving |
| 143 | 769.30 | | | | 1380 | 1390 | 30.4 | | 2.638 | Mounted in Ni sleeving |
| 144 | 795.00 | | | | 2110 | 2140 | 29.3 | | 2.642 | Mounted in Ni sleeving |
| 145 | 808.50 | | | | 298 | 360 | 23.7 | | 2.638 | Mounted in Ni sleeving |
| 146 | 847.00 | | | | 546 | 605 | 26.3 | | 2.640 | Mounted in Ni sleeving |
| 147 | 863.00 | 17.3 | 19.9 | 23.7 | 16.2 | 18.9 | 23.4 | 2.38 | 2.637 | Mounted in Ni sleeving |
| 148 | 864.00 | | | | 6.04 | 7.50 | 22.6 | | 2.678 | Mounted in Ni sleeving |
| 149 | 874.00 | | | | 26900 | 27100 | 30.1 | | 2.637 | Mounted in Ni sleeving |
| 150 | 895.50 | | | | - | 3050 | 29.6 | | 2.630 | Poor sample |
| 151 | 904.00 | | | | 1680 | 1860 | 26.0 | | 2.632 | Mounted in Ni sleeving |
| 152 | 919.00 | 6730 | 6790 | 28.6 | 6550 | 6610 | 28.3 | 4180 | 2.631 | Mounted in Ni sleeving |
| 153 | 929.00 | | | | 3740 | 3950 | 28.2 | | 2.631 | Mounted in Ni sleeving |
| 154 | 938.00 | | | | 2420 | 2490 | 28.2 | | 2.639 | Mounted in Ni sleeving |
| 155 | 957.00 | | | | 850 | 806 | 24.7 | | 2.636 | Mounted in Ni sleeving |
| 156 | 990.50 | | | | - | 937 | 29.2 | | 2.656 | Poor sample |
| 157 | 991.00 | - | 1920 | 30.1 | - | 1890 | 29.3 | | 2.645 | Poor sample |
| 158 | 1004.30 | | | | 386 | 432 | 29.0 | | 2.675 | Mounted in Ni sleeving |
| 159 | 1036.00 | | | | 1.06 | 1.33 | 14.1 | | 2.680 | Mounted in Ni sleeving |
| 161 | 1055.50 | | | | 57.3 | 63.4 | 17.8 | | 2.632 | Mounted in Ni sleeving |
| 162 | 1066.60 | | | | - | 760 | 24.9 | | 2.592 | Poor sample |
| 163 | 1079.85 | 2.88 | 3.37 | 10.1 | 1.82 | 2.17 | 9.6 | 0.0001 | 2.657 | |
| 164 | 1087.00 | | | | 316 | 340 | 22.5 | | 2.623 | |
| 165 | 1090.00 | | | | 13.2 | 16.2 | 21.9 | | 2.634 | Mounted in Ni sleeving |
| 166 | 1106.00 | | | | 1080 | 1120 | 25.0 | | 2.615 | |
| 167 | 1145.20 | | | | - | - | - | | - | Failed |
| 168 | 1179.70 | 819 | 946 | 27.7 | 811 | 928 | 27.5 | 178 | 2.649 | |
| 169 | 1194.00 | | | | 1670 | 2240 | 27.2 | | 2.646 | |
| 170 | 1204.00 | | | | 4.67 | 5.76 | 17.0 | | 2.683 | |
| 171 | 1220.00 | | | | 2.09 | 2.68 | 21.2 | | 2.644 | |
| 172 | 1234.20 | | | | 0.844 | 1.15 | 16.5 | | 2.640 | |
| 173 | 1235.10 | - | 33.7 | 20.4 | - | 26.6 | 19.6 | | 2.713 | Poor sample |
| 174 | 1250.50 | | | | 169 | 183 | 21.6 | | 2.697 | Mounted in Ni sleeving |
| 175 | 1258.05 | | | | 0.014 | 0.024 | 5.8 | | 2.654 | |
| 176 | 1269.50 | | | | 389 | 415 | 24.1 | | 2.630 | Mounted in Ni sleeving |
| 177 | 1279.30 | | | | 18.8 | 25.5 | 24.0 | | 2.625 | |
| 178 | 1285.70 | 131 | 139 | 19.1 | 122 | 130 | 18.8 | 1.68 | 2.629 | |
| 179 | 1303.90 | | | | 10.2 | 13.6 | 22.1 | | 2.622 | |
| 180 | 1313.50 | | | | 131 | 143 | 18.9 | | 2.632 | |
| 181 | 1337.00 | | | | 8.45 | 10.7 | 22.9 | | 2.612 | |
| 182 | 1350.05 | | | | 244 | 280 | 23.4 | | 2.622 | |
| 183 | 1355.50 | 35.2 | 39.5 | 20.5 | 32.1 | 36.4 | 20.2 | 0.217 | 2.624 | |
| 184 | 1363.83 | | | | 204 | 215 | 20.3 | | 2.636 | |
| 185 | 1372.00 | | | | 384 | 399 | 21.3 | | 2.631 | |

**Company : Department of Mines and Petroleum**

**Well: Harvey-3**

## POROSITY, PERMEABILITY, and GRAIN DENSITY

| SAMPLE NUMBER | SAMPLE DEPTH (m) | CONFINING STRESS (800psi) | | | CONFINING STRESS (1250psi) | | | | GRAIN DENSITY (g/cc) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | Permeability Kbrine (md) | | |
| 187 | 1394.30 | | | | 16.2 | 17.8 | 18.1 | | 2.634 | |
| 186 | 1395.70 | | | | 321 | 333 | 20.5 | | 2.635 | |
| 1 | 1411.31 | | | | - | - | - | | 2.680 | Fractured rubble |
| V1 | 1411.34 | | | | 0.0002 | 0.0013 | 11.6 | | 2.737 | |
| 2 | 1412.11 | | | | 0.057 | 0.125 | 13.8 | | 2.812 | |
| 3 | 1413.00 | 0.206 | 0.358 | 16.6 | 0.185 | 0.317 | 16.5 | | 2.655 | |
| V2 | 1412.85 | | | | 0.091 | 0.181 | 15.0 | | 2.653 | |
| 4 | 1414.00 | 21.4 | 26.4 | 21.6 | 15.3 | 21.2 | 21.4 | 5.92 | 2.635 | |
| V3 | 1413.80 | | | | 8.23 | 9.64 | 14.3 | | 2.635 | |
| 5 | 1415.00 | | | | 0.014 | 0.041 | 12.8 | | 2.746 | |
| V4 | 1415.04 | | | | 0.0077 | 0.025 | 15.8 | | 2.795 | |
| V5 | 1416.06 | | | | 0.0002 | 0.0012 | 7.0 | | 2.728 | |
| 6 | 1415.81 | | | 12.0 | - | - | - | | 2.706 | Porosity by Hg. Bulk volume |
| V6 | 1416.88 | | | | 0.0002 | 0.0013 | 12.7 | | 2.842 | |
| 7 | 1417.06 | | | | 0.018 | 0.049 | 14.5 | | 2.809 | |
| 8 | 1417.50 | 0.004 | 0.014 | 11.7 | 0.002 | 0.008 | 11.5 | | 2.767 | |

**Company : Department of Mines and Petroleum**

**Well: Harvey-3**

## POROSITY, PERMEABILITY, and GRAIN DENSITY

| SAMPLE NUMBER | SAMPLE DEPTH (m) | CONFINING STRESS (800psi) CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | CONFINING STRESS (1700psi) CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | Permeability Kbrine (md) | GRAIN DENSITY (g/cc) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| **Wonnerup Member** | | | | | | | | | | |
| 9 | 1418.00 | | | | 13.4 | 16.1 | 14.0 | | 2.624 | |
| 10 | 1419.10 | 1.68 | 2.39 | 19.6 | 1.52 | 2.17 | 19.2 | 0.929 | 2.639 | |
| 11 | 1420.00 | | | | 29.7 | 35.1 | 23.2 | | 2.636 | |
| 12 | 1421.00 | | | | 15.5 | 17.8 | 19.1 | | 2.641 | |
| 13 | 1422.00 | | | | 7.35 | 9.05 | 19.2 | | 2.642 | |
| 14 | 1423.10 | | | | 48.6 | 58.1 | 23.4 | | 2.637 | |
| 15 | 1424.00 | 1070 | 1260 | 23.8 | 1040 | 1250 | 23.6 | 1017 | 2.630 | |
| 16 | 1425.05 | | | | 0.003 | 0.010 | 12.9 | | 2.819 | |
| 17 | 1426.00 | | | | 0.836 | 1.160 | 16.8 | | 2.639 | |
| 18 | 1427.00 | | | | 47.1 | 56.9 | 24.9 | | 2.640 | |
| 19 | 1428.00 | | | | 506 | 615 | 23.8 | | 2.639 | |
| 20 | 1429.00 | 20.5 | 24.9 | 22.4 | 17.6 | 22.0 | 22.0 | 5.82 | 2.643 | |
| 21 | 1430.00 | | | | 157 | 197 | 22.6 | | 2.654 | |
| 22 | 1431.00 | | | | 10200 | 10300 | 21.6 | | 2.636 | Mounted in Ni sleeving |
| 23 | 1432.00 | | | | 174 | 203 | 23.4 | | 2.647 | |
| 24 | 1432.93 | | | | 109 | 121 | 24.2 | | 2.654 | |
| 25 | 1434.00 | 1230 | 1490 | 19.5 | 1150 | 1400 | 19.0 | 1132 | 2.629 | |
| 26 | 1435.00 | | | | 536 | 582 | 24.4 | | 2.637 | |
| 27 | 1436.00 | | | | 1.98 | 2.75 | 21.4 | | 2.684 | |
| 28 | 1437.00 | | | | 376 | 448 | 22.2 | | 2.629 | |
| 29 | 1438.00 | | | | 1010 | 1250 | 20.3 | | 2.630 | |
| 30 | 1439.00 | 348 | 463 | 21.3 | 308 | 409 | 20.9 | 156 | 2.648 | |
| 31 | 1440.00 | | | | 290 | 337 | 19.7 | | 2.641 | |
| 32 | 1441.00 | | | | 1500 | 1600 | 16.5 | | 2.631 | |
| 33 | 1442.00 | | | | 1220 | 1570 | 17.1 | | 2.637 | |
| 34 | 1443.00 | | | | 241 | 368 | 17.0 | | 2.629 | |
| 35 | 1444.00 | 490 | 620 | 18.4 | 446 | 582 | 18.0 | 441 | 2.632 | |
| 36 | 1445.00 | | | | 271 | 330 | 15.9 | | 2.636 | |
| 37 | 1446.00 | | | | 535 | 678 | 17.0 | | 2.632 | |
| 38 | 1447.00 | | | | 142 | 178 | 20.0 | | 2.645 | |
| 39 | 1448.00 | | | | 133 | 167 | 19.9 | | 2.637 | |
| 40 | 1449.00 | 119 | 142 | 17.1 | 105 | 127 | 16.7 | 28.2 | 2.628 | |
| 41 | 1450.00 | | | | 207 | 277 | 16.6 | | 2.632 | |
| 42 | 1451.00 | | | | 394 | 518 | 17.0 | | 2.639 | |
| 43 | 1451.95 | | | | 780 | 1190 | 17.1 | | 2.630 | Mounted in Ni sleeving |
| 44 | 1453.00 | | | | 318 | 491 | 17.7 | | 2.631 | |
| 45 | 1454.00 | 327 | 405 | 19.8 | 299 | 371 | 19.4 | 130 | 2.634 | |
| 46 | 1455.00 | | | | 246 | 290 | 22.2 | | 2.638 | |
| 47 | 1456.00 | | | | 404 | 588 | 20.0 | | 2.633 | |
| 48 | 1457.00 | | | | 567 | 715 | 19.2 | | 2.633 | |
| 49 | 1458.00 | | | | 177 | 213 | 19.1 | | 2.641 | |
| 50 | 1459.00 | 151 | 185 | 22.6 | 139 | 171 | 22.3 | 37.3 | 2.631 | |
| 51 | 1460.00 | | | | 253 | 294 | 21.4 | | 2.640 | |

**Company : Department of Mines and Petroleum**

**Well: Harvey-3**

## POROSITY, PERMEABILITY, and GRAIN DENSITY

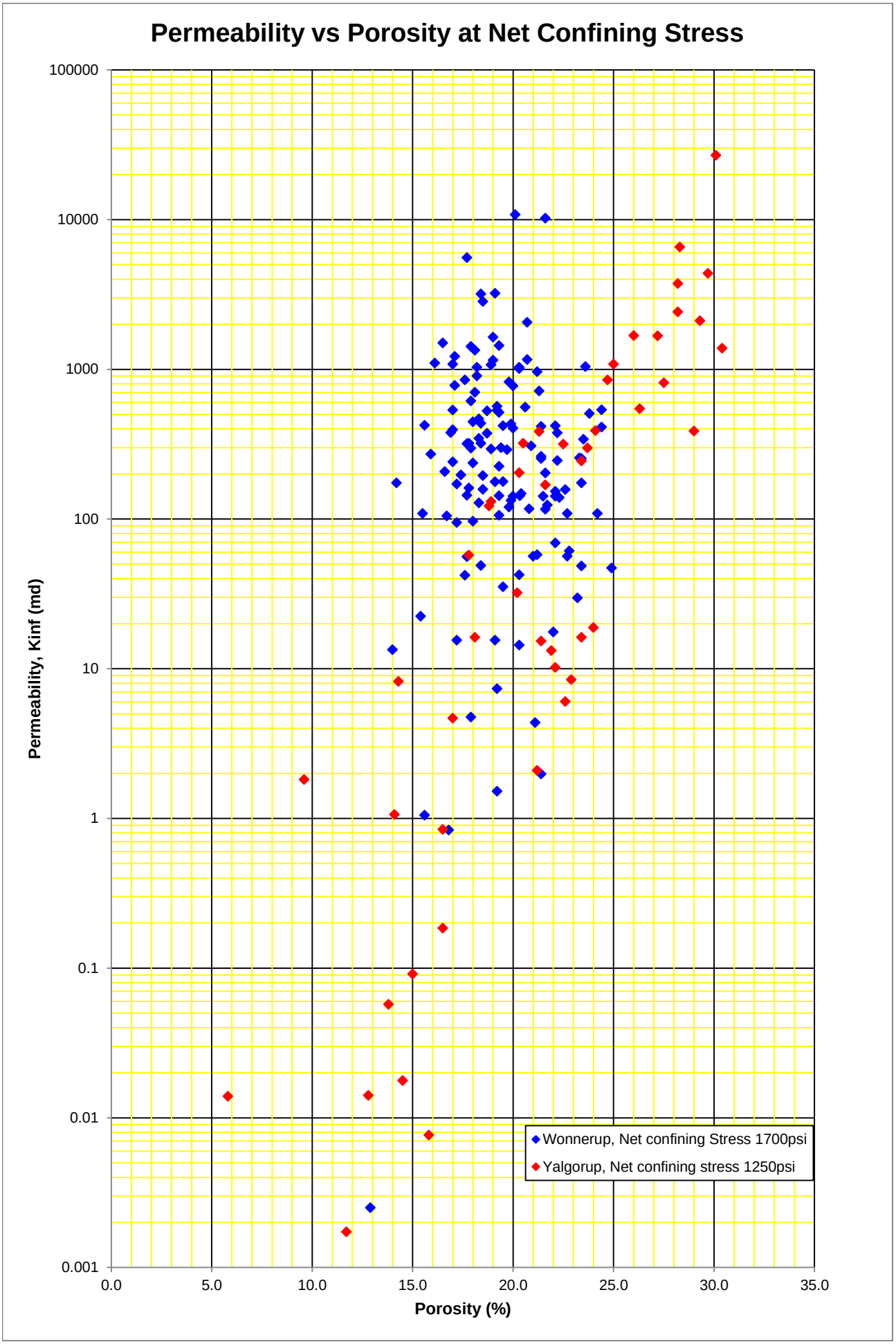
| SAMPLE NUMBER | SAMPLE DEPTH (m) | CONFINING STRESS (800psi) | | | CONFINING STRESS (1700psi) | | | | GRAIN DENSITY (g/cc) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | Permeability Kbrine (md) | | |
| 52 | 1460.95 | | | | 148 | 217 | 20.4 | | 2.633 | |
| 53 | 1462.00 | | | | 823 | 1030 | 19.8 | | 2.632 | Mounted in Ni sleeving |
| 54 | 1463.00 | | | | 161 | 244 | 17.8 | | 2.637 | |
| 55 | 1464.00 | 882 | 1190 | 22.2 | 716 | 1030 | 21.3 | 649 | 2.635 | Mounted in Ni sleeving |
| 56 | 1465.04 | | | | 775 | 1050 | 20.0 | | 2.639 | |
| 57 | 1466.00 | | | | 153 | 196 | 22.1 | | 2.635 | |
| 58 | 1467.00 | | | | 56 | 65 | 22.7 | | 2.641 | |
| 59 | 1468.00 | | | | 415 | 544 | 21.4 | | 2.637 | Mounted in Ni sleeving |
| 60 | 1469.00 | 280 | 371 | 24.1 | 253 | 335 | 23.4 | 212 | 2.649 | Mounted in Ni sleeving |
| 61 | 1470.00 | | | | 256 | 327 | 23.3 | | 2.640 | Mounted in Ni sleeving |
| 62 | 1471.00 | | | | 109 | 137 | 22.7 | | 2.644 | |
| 63 | 1472.00 | | | | 411 | 514 | 24.4 | | 2.649 | |
| 64 | 1473.00 | | | | 902 | 1120 | 18.2 | | 2.641 | Mounted in Ni sleeving |
| 65 | 1474.00 | 6510 | 6810 | 18.4 | 5560 | 6080 | 17.7 | 5247 | 2.629 | Mounted in Ni sleeving |
| 66 | 1475.00 | | | | 373 | 496 | 18.7 | | 2.637 | Mounted in Ni sleeving |
| 67 | 1476.00 | | | | 422 | 660 | 15.6 | | 2.631 | |
| 68 | 1477.00 | | | | 466 | 723 | 18.3 | | 2.631 | |
| 69 | 1478.00 | | | | 96.5 | 147 | 18.0 | | 2.641 | Mounted in Ni sleeving |
| 70 | 1479.00 | 213 | 329 | 18.9 | 195 | 309 | 18.5 | 190 | 2.641 | |
| 71 | 1480.00 | | | | 321 | 555 | 17.8 | | 2.632 | |
| 72 | 1481.00 | | | | 42.0 | 52.8 | 17.6 | | 2.648 | |
| 73 | 1482.00 | | | | 615 | 929 | 17.9 | | 2.636 | |
| 74 | 1483.00 | | | | 1340 | 1610 | 18.1 | | 2.634 | |
| 75 | 1484.00 | 550 | 854 | 19.2 | 527 | 815 | 18.7 | 462 | 2.632 | |
| 76 | 1485.00 | | | | 144 | 221 | 17.7 | | 2.635 | Mounted in Ni sleeving |
| 77 | 1486.00 | | | | 69 | 86 | 22.1 | | 2.651 | |
| 78 | 1487.00 | | | | 197 | 321 | 17.4 | | 2.635 | |
| 79 | 1488.00 | | | | 142 | 177 | 21.5 | | 2.646 | |
| 80 | 1489.00 | 170 | 215 | 22.8 | 142 | 180 | 22.1 | 96.0 | 2.641 | Mounted in Ni sleeving |
| 81 | 1490.00 | | | | 558 | 764 | 20.6 | | 2.634 | |
| 82 | 1491.00 | | | | 61.1 | 72.3 | 22.8 | | 2.638 | |
| 83 | 1492.00 | | | | 143 | 188 | 20.3 | | 2.638 | |
| 84 | 1493.00 | | | | 297 | 482 | 17.9 | | 2.634 | |
| 85 | 1494.00 | 135 | 164 | 22.2 | 124 | 152 | 21.7 | 62.2 | 2.636 | Mounted in Ni sleeving |
| 86 | 1495.00 | | | | 128 | 202 | 18.3 | | 2.640 | Mounted in Ni sleeving |
| 87 | 1496.00 | | | | 1640 | 2410 | 19.0 | | 2.657 | Mounted in Ni sleeving |
| 88 | 1497.00 | | | | 143 | 228 | 19.3 | | 2.631 | |
| 89 | 1498.00 | | | | 1.05 | 1.46 | 15.6 | | 2.671 | |
| 90 | 1499.00 | 5.04 | 6.40 | 21.6 | 4.36 | 5.79 | 21.1 | 2.98 | 2.662 | |
| 91 | 1500.00 | | | | 14.4 | 18.2 | 20.3 | | 2.652 | |
| 92 | 1501.00 | | | | 178 | 216 | 19.5 | | 2.648 | |
| 93 | 1502.00 | | | | 94.5 | 125 | 17.2 | | 2.637 | |
| 94 | 1503.00 | | | | 106 | 157 | 19.3 | | 2.897 | Mounted in Ni sleeving |
| 95 | 1504.00 | 62.4 | 71.6 | 21.6 | 57.7 | 65.7 | 21.2 | 13.3 | 2.641 | |
| 96 | 1505.00 | | | | 3220 | 3900 | 19.1 | | 2.638 | Mounted in Ni sleeving |

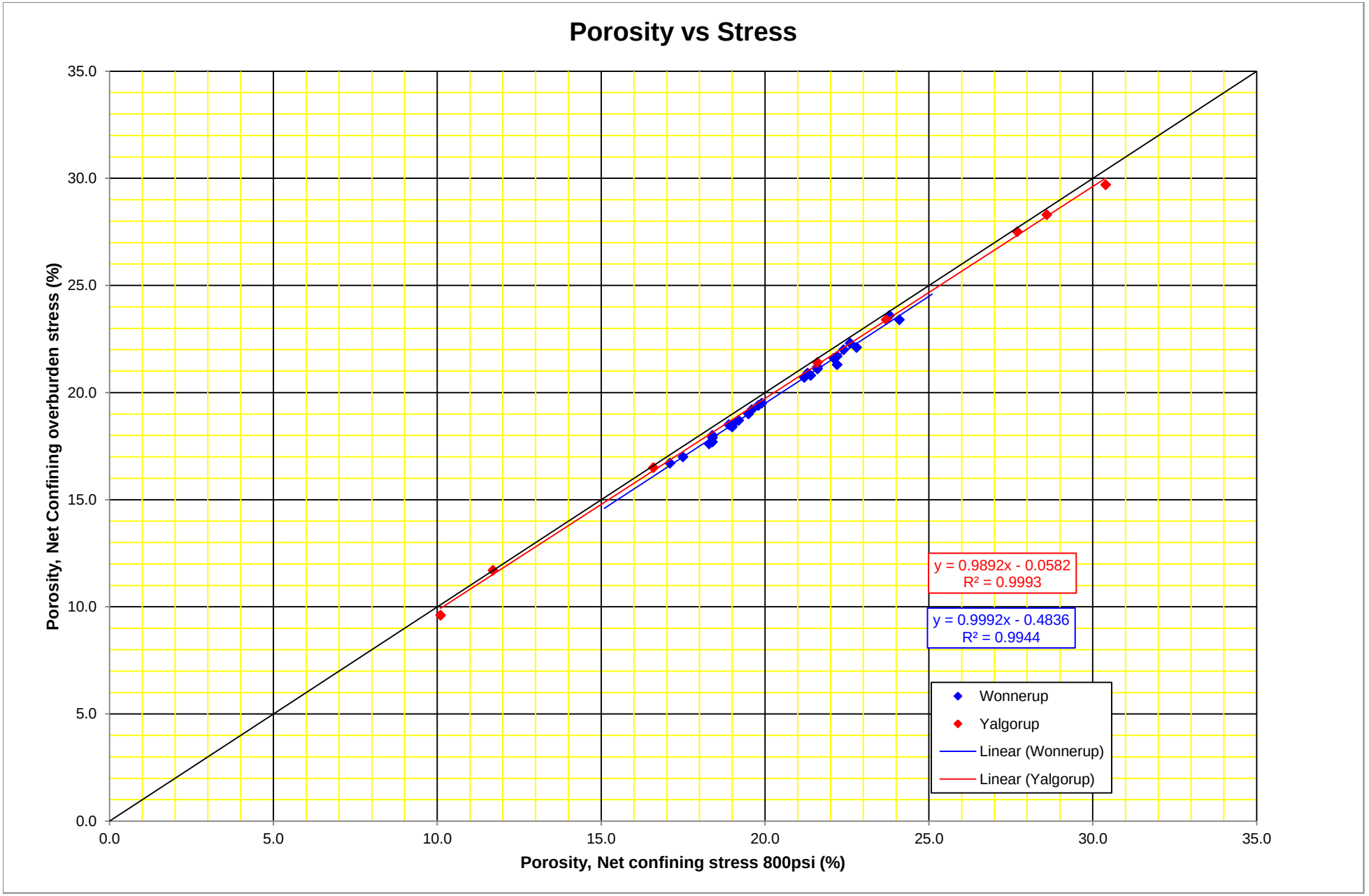
**Company : Department of Mines and Petroleum**

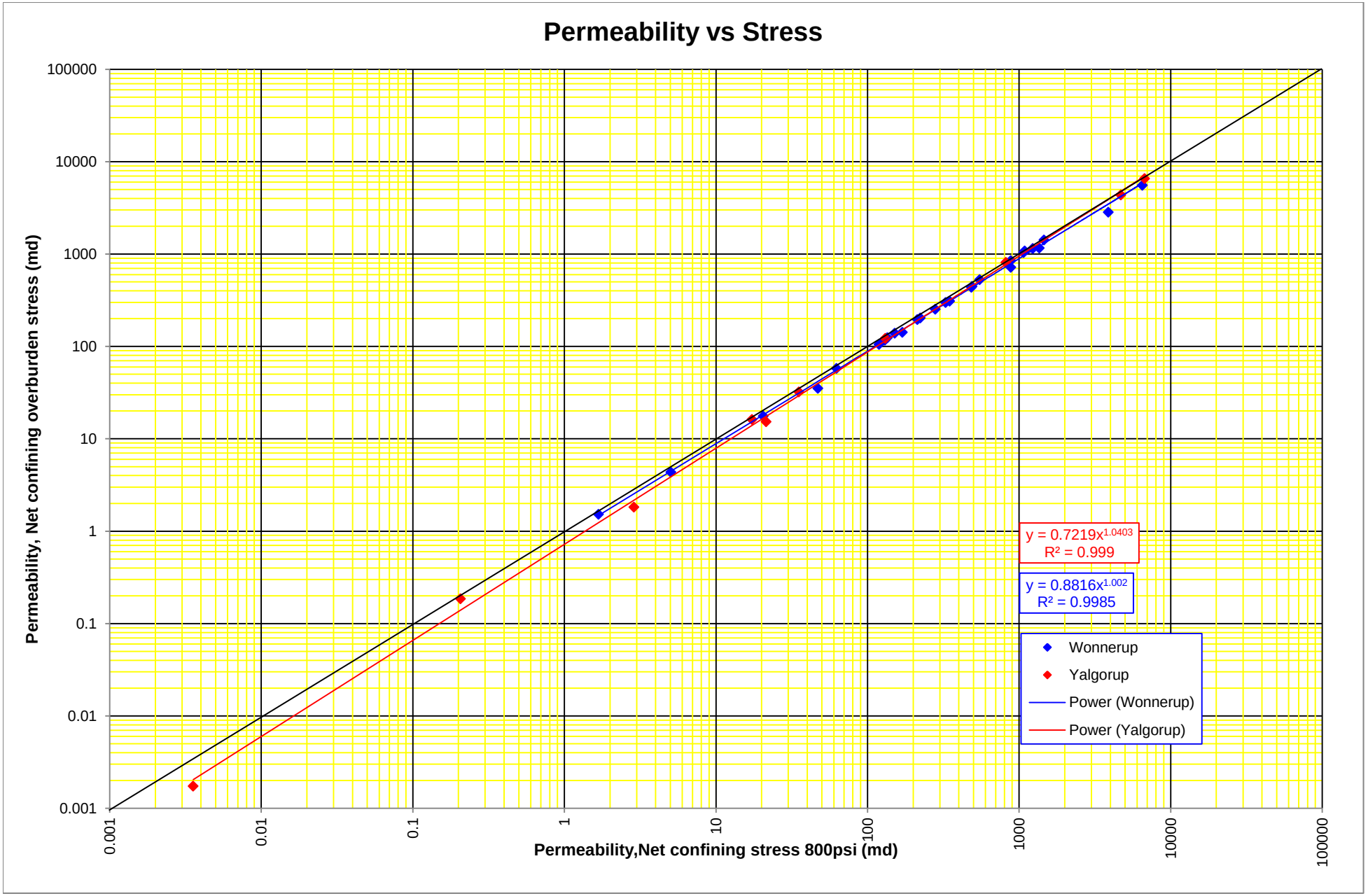
**Well: Harvey-3**

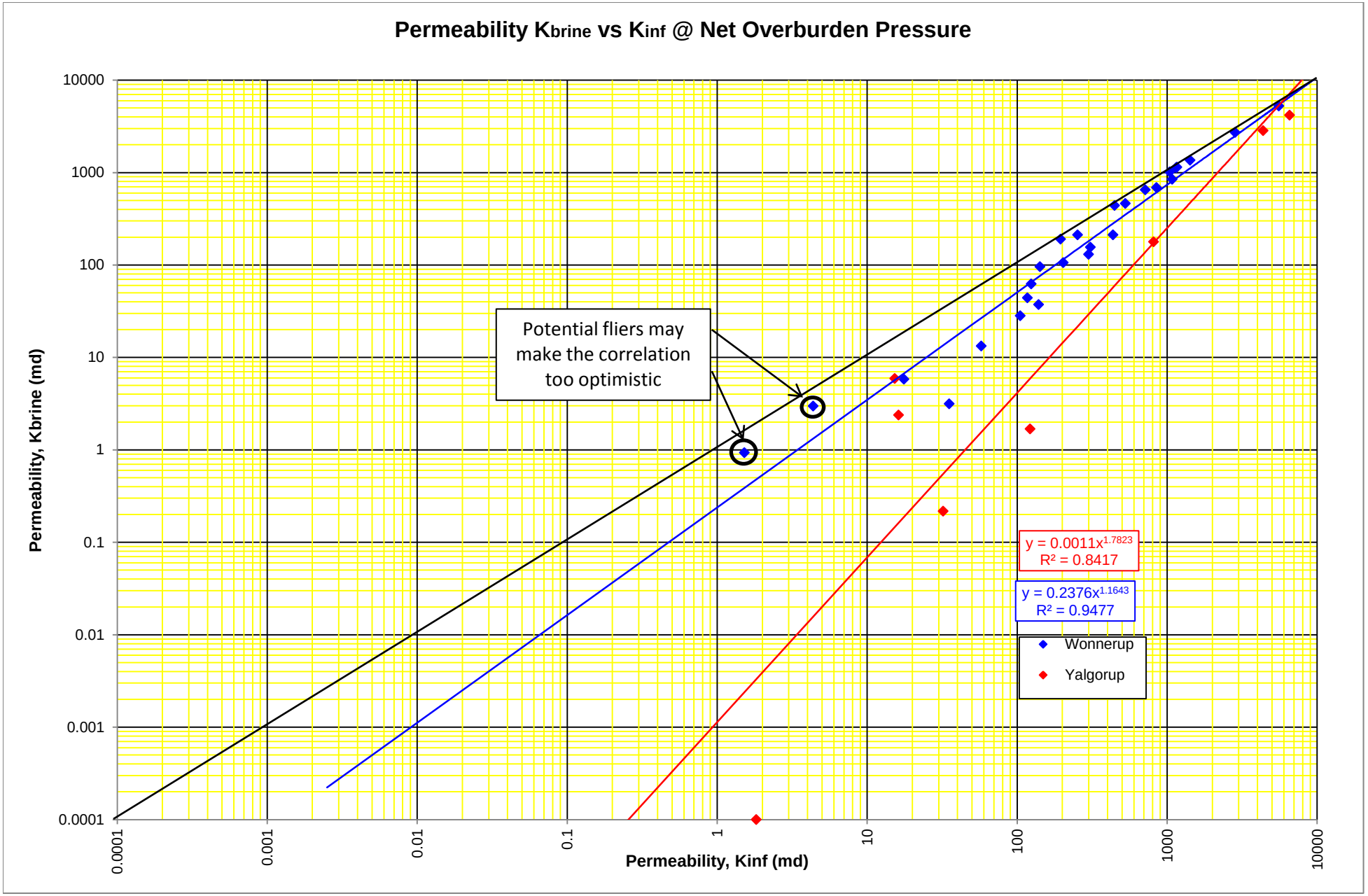
## POROSITY, PERMEABILITY, and GRAIN DENSITY

| SAMPLE NUMBER | SAMPLE DEPTH (m) | CONFINING STRESS (800psi) | | | CONFINING STRESS (1700psi) | | | | GRAIN DENSITY (g/cc) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | CMS Kinf (md) | CMS Kair (md) | POROSITY (%) | Permeability Kbrine (md) | | |
| 97 | 1506.00 | | | | 10800 | 10900 | 20.1 | | 2.633 | Mounted in Ni sleeving |
| 98 | 1507.00 | | | | 116 | 172 | 21.6 | | 2.652 | |
| 99 | 1508.00 | | | | 262 | 348 | 21.4 | | 2.639 | |
| 100 | 1509.00 | 223 | 277 | 22.1 | 203 | 252 | 21.6 | 106 | 2.640 | |
| 101 | 1510.00 | | | | 341 | 409 | 23.5 | | 2.639 | |
| 102 | 1511.00 | | | | 2060 | 3040 | 20.7 | | 2.635 | |
| 103 | 1512.00 | | | | 419 | 514 | 22.1 | | 2.645 | |
| 104 | 1513.00 | | | | 22.4 | 36.8 | 15.4 | | 2.648 | |
| 105 | 1514.00 | 130 | 160 | 21.4 | 117 | 145 | 20.8 | 44.1 | 2.644 | |
| 106 | 1515.00 | | | | 431 | 666 | 19.9 | | 2.631 | |
| 107 | 1516.00 | | | | 56.3 | 64.4 | 21.0 | | 2.641 | |
| 108 | 1517.00 | | | | 293 | 379 | 18.9 | | 2.636 | |
| 109 | 1518.00 | | | | 346 | 483 | 18.3 | | 2.633 | |
| 110 | 1519.00 | 1460 | 2140 | 18.4 | 1420 | 2070 | 17.9 | 1361 | 2.633 | |
| 111 | 1520.00 | | | | 1100 | 1620 | 16.1 | | 2.638 | |
| 112 | 1521.00 | | | | 378 | 599 | 16.9 | | 2.633 | |
| 113 | 1522.00 | | | | 320 | 490 | 18.4 | | 2.633 | |
| 114 | 1523.00 | | | | 237 | 331 | 18.0 | | 2.634 | |
| 115 | 1524.00 | 1090 | 1630 | 17.5 | 1080 | 1600 | 17.0 | 848 | 2.632 | |
| 116 | 1525.00 | | | | 174 | 225 | 14.2 | | 2.644 | |
| 117 | 1526.00 | | | | 171 | 258 | 17.2 | | 2.646 | |
| 118 | 1527.00 | | | | 1030 | 1560 | 18.2 | | 2.642 | |
| 119 | 1528.00 | | | | 514 | 714 | 19.3 | | 2.668 | |
| 120 | 1528.95 | 883 | 1330 | 18.3 | 849 | 1260 | 17.6 | 687 | 2.638 | |
| 121 | 1530.00 | | | | 42.3 | 50.4 | 20.3 | | 2.661 | |
| 122 | 1530.95 | | | | 15.5 | 18.2 | 17.2 | | 2.640 | |
| 123 | 1532.00 | | | | 48.8 | 59.5 | 18.4 | | 2.637 | |
| 124 | 1533.00 | | | | 1440 | 2120 | 19.3 | | 2.636 | |
| 125 | 1534.00 | 47.1 | 73.3 | 19.9 | 35.2 | 56.7 | 19.5 | 3.14 | 2.633 | |
| 126 | 1535.00 | | | | 532 | 827 | 19.2 | | 2.631 | |
| 127 | 1536.00 | | | | 962 | 1230 | 21.2 | | 2.667 | |
| 128 | 1537.00 | | | | 109 | 157 | 15.5 | | 2.630 | |
| 129 | 1538.00 | | | | 420 | 606 | 19.5 | | 2.632 | |
| 130 | 1539.00 | 1360 | 2050 | 21.2 | 1160 | 1860 | 20.7 | 1141 | 2.630 | |
| 131 | 1540.00 | | | | 56.0 | 69.3 | 17.7 | | 2.644 | |
| 132 | 1541.00 | | | | 4.75 | 5.93 | 17.9 | | 2.653 | |
| 133 | 1542.00 | | | | 120 | 150 | 19.8 | | 2.656 | |
| 134 | 1543.00 | | | | 225 | 339 | 19.3 | | 2.636 | |
| 135 | 1544.00 | 485 | 698 | 19.0 | 436 | 633 | 18.4 | 212 | 2.640 | |
| 136 | 1545.00 | | | | 1030 | 1410 | 20.3 | | 2.639 | |
| 137 | 1546.00 | | | | 158 | 244 | 18.5 | | 2.638 | |
| 138 | 1547.00 | | | | 3180 | 3240 | 18.4 | | 2.633 | Mounted in Ni sleeving |
| 139 | 1548.00 | | | | 702 | 1070 | 18.1 | | 2.645 | |
| 140 | 1549.00 | 3880 | 4450 | 19.0 | 2840 | 3700 | 18.5 | 2712 | 2.677 | |
| 141 | 1550.00 | | | | 1070 | 1580 | 18.9 | | 2.639 | Mounted in Ni sleeving |


Permeability vs Porosity at Net Confining Stress
Permeability, Kinf (md)
100000
10000
1000
100
10
1
0.1
0.01
0.001
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
Porosity (%)
Wonnerup, Net confining Stress 1700psi
Yalgorup, Net confining stress 1250psi


Porosity vs Stress
Porosity, Net Confining overburden stress (%)
Porosity, Net confining stress 800psi (%)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
y = 0.9892x - 0.0582
R² = 0.9993
y = 0.9992x - 0.4836
R² = 0.9944
Wonnerup
Yalgorup
Linear (Wonnerup)
Linear (Yalgorup)


Permeability vs Stress
Permeability, Net confining overburden stress (md)
100000
10000
1000
100
10
1
0.1
0.01
0.001
Permeability,Net confining stress 800psi (md)
0.001
0.01
0.1
1
10
100
1000
10000
100000
y = 0.7219x^1.0403
R² = 0.999
y = 0.8816x^1.002
R² = 0.9985
Wonnerup
Yalgorup
Power (Wonnerup)
Power (Yalgorup)


Permeability Kbrine vs Kinf @ Net Overburden Pressure
Permeability, Kbrine (md)
Permeability, Kinf (md)
10000
1000
100
10
1
0.1
0.01
0.001
0.0001
0.0001
0.001
0.01
0.1
1
10
100
1000
10000
Potential fliers may make the correlation too optimistic
y = 0.0011x^1.7823
R² = 0.8417
y = 0.2376x^1.1643
R² = 0.9477
Wonnerup
Yalgorup

# Permeability to Brine and threshold Pressure to CO2 at Net Confining Stress

Eneabba -800psi Net confining stress
Yalgorup Member -1250psi. Net confining stress

| Formation name | Sample no. | Depth (m) | Permeability To water (md) | CO2 threshold Pressure (psi) |
|---|---|---|---|---|
| Eneabba | PSH5 | 720.23 | No flow | no injection |
| Eneabba | PSH6 | 720.28 | No flow | no injection |
| Eneabba | PSV3 | 720.40 | No flow | no injection |
| Eneabba | PSH7 | 725.44 | No flow | no injection |
| Eneabba | PSH8 | 725.62 | 0.00002 | 2850 |
| Yalgorup | PSH9 | 740.70 | No flow | no injection |
| Yalgorup | PSH10 | 740.76 | No flow | no injection |
| Yalgorup | PSH13 | 914.78 | No flow | no injection |
| Yalgorup | PSH14 | 914.89 | No flow | no injection |
| Yalgorup | PSV5 | 915.00 | No flow | no injection |
| Yalgorup | PSH11 | 965.64 | No flow | no injection |
| Yalgorup | PSH12 | 965.70 | 0.00003 | 850 |
| Yalgorup | PSV4 | 965.78 | No flow | no injection |
| Yalgorup | PSH15 | 1226.38 | No flow | no injection |
| Yalgorup | PSH16 | 1226.42 | No flow | no injection |
| Yalgorup | PSV6 | 1226.55 | No flow | no injection |
| Yalgorup | PSH17 | 1291.53 | No flow | no injection |
| Yalgorup | PSH18 | 1291.61 | No flow | no injection |
| Yalgorup | PSV7 | 1291.83 | No flow | no injection |
| Yalgorup | PSH19 | 1324.43 | No flow | no injection |
| Yalgorup | PSH20 | 1324.48 | 0.00001 | 4500 |
| Yalgorup | PSV8 | 1324.70 | No flow | no injection |
| Yalgorup | PSH21 | 1326.88 | No flow | no injection |
| Yalgorup | PSH22 | 1326.94 | No flow | no injection |
| Yalgorup | PSH23 | 1353.68 | No flow | no injection |
| Yalgorup | PSV9 | 1353.71 | No flow | no injection |
| Yalgorup | PSH24 | 1353.81 | No flow | no injection |
| Yalgorup | PSH25 | 1388.04 | No flow | no injection |
| Yalgorup | PSH26 | 1388.10 | No flow | no injection |
| Yalgorup | PSH27 | 1406.28 | No flow | no injection |
| Yalgorup | PSH28 | 1406.33 | No flow | no injection |
| Yalgorup | PSV10 | 1406.48 | No flow | no injection |
| Yalgorup | PSH29 | 1416.60 | No flow | no injection |
| Yalgorup | PSH30 | 1416.65 | No flow | no injection |

# APPENDIX A

# PLUGGING LIST

Date: 15/10/2015

Client: Department of Mines and Petroleum

Well: Harvey-3

Job No: **PRP - 15068**

| Sample No. | PREPOSED Depth (m) | Depth Check | Revised Depth | Comments |
|---|---|---|---|---|
| | | | | |
| 142 | 760.15 | √ | | Top Yalgorup (741m) |
| 143 | 769.30 | √ | | |
| 144 | 795.00 | √ | | |
| 145 | 808.50 | √ | | |
| 146 | 847.00 | √ | | |
| 147 | 863.00 | √ | | |
| 148 | 864.00 | √ | | |
| 149 | 874.00 | √ | | |
| 150 | 895.50 | √ | | |
| 151 | 904.00 | √ | | |
| 152 | 919.00 | √ | | |
| 153 | 929.00 | √ | | |
| 154 | 938.00 | √ | | |
| 155 | 957.00 | √ | | |
| 156 | 990.50 | √ | | |
| 157 | 991.00 | √ | | |
| 158 | 1004.30 | √ | | |
| 159 | 1036.00 | √ | | |
| 160 | 1036.80 | | | Removed 30-7-15 as sample 159 is in same sand unit |
| 161 | 1055.50 | √ | | |
| 162 | 1066.60 | √ | | |
| 163 | 1079.85 | √ | | |
| 164 | 1087.00 | √ | | |
| 165 | 1090.00 | √ | | |
| 166 | 1106.00 | √ | | |
| 167 | 1145.20 | Failed | | |
| 168 | 1179.70 | √ | | |
| 169 | 1194.00 | √ | | |
| 170 | 1204.00 | √ | | |
| 171 | 1220.00 | √ | | |
| 172 | 1234.20 | √ | | |
| 173 | 1235.20 | √ | 1235.10 | |
| 174 | 1250.50 | √ | | |
| 175 | 1258.05 | √ | | |
| 176 | 1269.50 | √ | | |
| 177 | 1279.30 | √ | | |
| 178 | 1285.70 | √ | | |
| 179 | 1303.90 | √ | | |
| 180 | 1313.50 | √ | | |
| 181 | 1337.00 | √ | | |
| 182 | 1350.00 | √ | 1350.05 | |

# PLUGGING LIST

Date: 15/10/2015

Client: Department of Mines and Petroleum

Well: Harvey-3

Job No: **PRP - 15068**

| Sample No. | PREPOSED Depth (m) | Depth Check | Revised Depth | Comments |
|---|---|---|---|---|
| 183 | 1355.50 | √ | | |
| 184 | 1364.00 | √ | 1363.83 | |
| 185 | 1372.00 | √ | | |
| 187 | 1394.30 | √ | | Additional 30-7-15 |
| 186 | 1395.70 | √ | | |
| 1 | 1411.10 | √ | 1411.31 | |
| V1 | 1411.10 | √ | 1411.34 | |
| 2 | 1412.10 | √ | 1412.11 | |
| 3 | 1413.00 | √ | | |
| V2 | 1413.00 | √ | 1412.85 | |
| 4 | 1414.00 | √ | | |
| V3 | 1414.00 | √ | 1413.80 | |
| 5 | 1415.00 | √ | | |
| V4 | 1415.00 | √ | 1415.04 | |
| V5 | 1416.00 | √ | 1416.06 | |
| 6 | 1416.05 | √ | 1415.81 | |
| 7 | 1417.00 | √ | 1417.06 | |
| V6 | 1417.00 | √ | 1416.88 | |
| 8 | 1417.50 | √ | | |
| 9 | 1418.00 | √ | | Top Wonnerup (1418m) |
| V7 | 1418.00 | | | Postponed 30-7-15 |
| 10 | 1419.10 | √ | | |
| 11 | 1420.00 | √ | | |
| 12 | 1421.00 | √ | | |
| V8 | 1421.00 | | | Postponed 30-7-15 |
| 13 | 1422.00 | √ | | |
| 14 | 1423.10 | √ | | |
| 15 | 1424.00 | √ | | |
| V9 | 1424.00 | | | Postponed 30-7-15 |
| 16 | 1425.00 | √ | 1425.05 | |
| 17 | 1426.00 | √ | | |
| 18 | 1427.00 | √ | | |
| V10 | 1427.00 | | | Postponed 30-7-15 |
| 19 | 1428.00 | √ | | |
| 20 | 1429.00 | √ | | |
| 21 | 1430.00 | √ | | |
| V11 | 1430.00 | | | Postponed 30-7-15 |
| 22 | 1431.00 | √ | | |
| 23 | 1432.00 | √ | | |
| 24 | 1433.00 | | 1432.93 | |
| V12 | 1433.00 | | | Postponed 30-7-15 |
| 25 | 1434.00 | √ | | |

# PLUGGING LIST

Date: 15/10/2015

Client: Department of Mines and Petroleum

Well: Harvey-3

Job No: **PRP - 15068**

| Sample No. | PREPOSED Depth (m) | Depth Check | Revised Depth | Comments |
|---|---|---|---|---|
| 26 | 1435.00 | √ | | |
| 27 | 1436.00 | √ | | |
| V13 | 1436.00 | | | Postponed 30-7-15 |
| 28 | 1437.00 | √ | | |
| 29 | 1438.00 | √ | | |
| 30 | 1439.00 | √ | | |
| V14 | 1439.00 | | | Postponed 30-7-15 |
| 31 | 1440.00 | √ | | |
| 32 | 1441.00 | √ | | |
| 33 | 1442.00 | √ | | |
| V15 | 1442.00 | | | Postponed 30-7-15 |
| 34 | 1443.00 | √ | | |
| 35 | 1444.00 | √ | | |
| 36 | 1445.00 | √ | | |
| V16 | 1445.00 | | | Postponed 30-7-15 |
| 37 | 1446.00 | √ | | |
| 38 | 1447.00 | √ | | |
| 39 | 1448.00 | √ | | |
| V17 | 1448.00 | | | Postponed 30-7-15 |
| 40 | 1449.00 | √ | | |
| 41 | 1450.00 | √ | | |
| 42 | 1451.00 | √ | | |
| V18 | 1451.00 | | | Postponed 30-7-15 |
| 43 | 1452.00 | √ | 1451.95 | |
| 44 | 1453.00 | √ | | |
| 45 | 1454.00 | √ | | |
| V19 | 1454.00 | | | Postponed 30-7-15 |
| 46 | 1455.00 | √ | | |
| 47 | 1456.00 | √ | | |
| 48 | 1457.00 | √ | | |
| V20 | 1457.00 | | | Postponed 30-7-15 |
| 49 | 1458.00 | √ | | |
| 50 | 1459.00 | √ | | |
| 51 | 1460.00 | √ | | |
| V21 | 1460.00 | | | Postponed 30-7-15 |
| 52 | 1460.95 | √ | | |
| 53 | 1462.00 | √ | | |
| 54 | 1463.00 | √ | | |
| V22 | 1463.00 | | | Postponed 30-7-15 |
| 55 | 1464.00 | √ | | |
| 56 | 1465.00 | √ | 1465.04 | |
| 57 | 1466.00 | √ | | |

# PLUGGING LIST

Date: 15/10/2015

Client: Department of Mines and Petroleum

Well: Harvey-3

Job No: **PRP - 15068**

| Sample No. | PREPOSED Depth (m) | Depth Check | Revised Depth | Comments |
|---|---|---|---|---|
| V23 | 1466.00 | | | Postponed 30-7-15 |
| 58 | 1467.00 | √ | | |
| 59 | 1468.00 | √ | | |
| 60 | 1469.00 | √ | | |
| V24 | 1469.00 | | | Postponed 30-7-15 |
| 61 | 1470.00 | √ | | |
| 62 | 1471.00 | √ | | |
| 63 | 1472.00 | √ | | |
| V25 | 1472.00 | | | Postponed 30-7-15 |
| 64 | 1473.00 | √ | | |
| 65 | 1474.00 | √ | | |
| 66 | 1475.00 | √ | | |
| V26 | 1475.00 | | | Postponed 30-7-15 |
| 67 | 1476.00 | √ | | |
| 68 | 1477.00 | √ | | |
| 69 | 1478.00 | √ | | |
| V27 | 1478.00 | | | Postponed 30-7-15 |
| 70 | 1479.00 | √ | | |
| 71 | 1480.00 | √ | | |
| 72 | 1481.00 | √ | | |
| V28 | 1481.00 | | | Postponed 30-7-15 |
| 73 | 1482.00 | √ | | |
| 74 | 1483.00 | √ | | |
| 75 | 1484.00 | √ | | |
| V29 | 1484.00 | | | Postponed 30-7-15 |
| 76 | 1485.00 | √ | | |
| 77 | 1486.00 | √ | | |
| 78 | 1487.00 | √ | | |
| V30 | 1487.00 | | | Postponed 30-7-15 |
| 79 | 1488.00 | √ | | |
| 80 | 1489.00 | √ | | |
| 81 | 1490.00 | √ | | |
| V31 | 1490.00 | | | Postponed 30-7-15 |
| 82 | 1491.00 | √ | | |
| 83 | 1492.00 | √ | | |
| 84 | 1493.00 | √ | | |
| V32 | 1493.00 | | | Postponed 30-7-15 |
| 85 | 1494.00 | √ | | |
| 86 | 1495.00 | √ | | |
| 87 | 1496.00 | √ | | |
| V33 | 1496.00 | | | Postponed 30-7-15 |
| 88 | 1497.00 | √ | | |

# PLUGGING LIST

Date: 15/10/2015

Client: Department of Mines and Petroleum

Well: Harvey-3

Job No: **PRP - 15068**

| Sample No. | PREPOSED Depth (m) | Depth Check | Revised Depth | Comments |
|---|---|---|---|---|
| 89 | 1498.00 | √ | | |
| 90 | 1499.00 | √ | | |
| V34 | 1499.00 | | | Postponed 30-7-15 |
| 91 | 1500.00 | √ | | |
| 92 | 1501.00 | √ | | |
| 93 | 1502.00 | √ | | |
| V35 | 1502.00 | | | Postponed 30-7-15 |
| 94 | 1503.00 | √ | | |
| 95 | 1504.00 | √ | | |
| 96 | 1505.00 | √ | | |
| V36 | 1505.00 | | | Postponed 30-7-15 |
| 97 | 1506.00 | √ | | |
| 98 | 1507.00 | √ | | |
| 99 | 1508.00 | √ | | |
| V37 | 1508.00 | | | Postponed 30-7-15 |
| 100 | 1509.00 | √ | | |
| 101 | 1510.00 | √ | | |
| 102 | 1511.00 | √ | | |
| V38 | 1511.00 | | | Postponed 30-7-15 |
| 103 | 1512.00 | √ | | |
| 104 | 1513.00 | √ | | |
| 105 | 1514.00 | √ | | |
| V39 | 1514.00 | | | Postponed 30-7-15 |
| 106 | 1515.00 | √ | | |
| 107 | 1516.00 | √ | | |
| 108 | 1517.00 | √ | | |
| V40 | 1517.00 | | | Postponed 30-7-15 |
| 109 | 1518.00 | √ | | |
| 110 | 1519.00 | √ | | |
| 111 | 1520.00 | √ | | |
| V41 | 1520.00 | | | Postponed 30-7-15 |
| 112 | 1521.00 | √ | | |
| 113 | 1522.00 | √ | | |
| 114 | 1523.00 | √ | | |
| V42 | 1523.00 | | | Postponed 30-7-15 |
| 115 | 1524.00 | √ | | |
| 116 | 1525.00 | √ | | |
| 117 | 1526.00 | √ | | |
| V43 | 1526.00 | | | Postponed 30-7-15 |
| 118 | 1527.00 | √ | | |
| 119 | 1528.00 | √ | | |
| 120 | 1529.00 | √ | 1528.95 | |

# PLUGGING LIST

Date: 15/10/2015

Client: Department of Mines and Petroleum

Well: Harvey-3

Job No: **PRP - 15068**

| Sample No. | PREPOSED Depth (m) | Depth Check | Revised Depth | Comments |
|---|---|---|---|---|
| V44 | 1529.00 | | | Postponed 30-7-15 |
| 121 | 1530.00 | √ | | |
| 122 | 1531.00 | √ | 1530.95 | |
| 123 | 1532.00 | √ | | |
| V45 | 1532.00 | | | Postponed 30-7-15 |
| 124 | 1533.00 | √ | | |
| 125 | 1534.00 | √ | | |
| 126 | 1535.00 | √ | | |
| V46 | 1535.00 | | | Postponed 30-7-15 |
| 127 | 1536.00 | √ | | |
| 128 | 1537.00 | √ | | |
| 129 | 1538.00 | √ | | |
| V47 | 1538.00 | | | Postponed 30-7-15 |
| 130 | 1539.00 | √ | | |
| 131 | 1540.00 | √ | | |
| 132 | 1541.00 | √ | | |
| V48 | 1541.00 | | | Postponed 30-7-15 |
| 133 | 1542.00 | √ | | |
| 134 | 1543.00 | √ | | |
| 135 | 1544.00 | √ | | |
| V49 | 1544.00 | | | Postponed 30-7-15 |
| 136 | 1545.00 | √ | | |
| 137 | 1546.00 | √ | | |
| 138 | 1547.00 | √ | | |
| V50 | 1547.00 | | | Postponed 30-7-15 |
| 139 | 1548.00 | √ | | |
| 140 | 1549.00 | √ | | |
| 141 | 1550.00 | √ | | |
| | | | | |
| 5FS | 1459.40 | √ | 1459.40 | Additional 31-7-15 Ali Saeedi Sample (CSIRO) |
| 6FS | 1459.40 | √ | 1459.46 | Additional 31-7-15 Ali Saeedi Sample (CSIRO) |
| | | | | |
| CL-1 | 1411.46-.60 | √ | | WC and Plug |
| CL-2 | 1454.11-.25 | √ | | WC and Plug |
| | | | | |
| | | | | Preserved Samples |
| PSH1 | | Failed | | 664.55-664.90 |
| PSH2 | | Failed | | 664.55-664.90 |
| PSH3 | | Failed | | 696.70-697.00 |
| PSH4 | | Failed | | 696.70-697.00 |
| PSH5 | 720.23 | √ | | |
| PSH6 | 720.28 | √ | | |

# PLUGGING LIST

Date: 15/10/2015

Client: Department of Mines and Petroleum

Well: Harvey-3

Job No: **PRP - 15068**

| Sample No. | PREPOSED Depth (m) | Depth Check | Revised Depth | Comments |
|---|---|---|---|---|
| PSH7 | 725.44 | √ | | |
| PSH8 | 725.62 | √ | | |
| PSH9 | 740.70 | √ | | |
| PSH10 | 740.76 | √ | | |
| PSH11 | 965.64 | √ | | |
| PSH12 | 965.70 | √ | | |
| PSH13 | 914.78 | √ | | |
| PSH14 | 914.89 | √ | | |
| PSH15 | 1226.38 | √ | | |
| PSH16 | 1226.42 | √ | | |
| PSH17 | 1291.53 | √ | | |
| PSH18 | 1291.61 | √ | | |
| PSH19 | 1324.43 | √ | | |
| PSH20 | 1324.48 | √ | | |
| PSH21 | 1326.88 | √ | | |
| PSH22 | 1326.94 | √ | | |
| PSH23 | 1353.68 | √ | | |
| PSH24 | 1353.81 | √ | | |
| PSH25 | 1388.04 | √ | | |
| PSH26 | 1388.10 | √ | | |
| PSH27 | 1406.28 | √ | | |
| PSH28 | 1406.33 | √ | | |
| PSH29 | 1416.60 | √ | | |
| PSH30 | 1416.65 | √ | | |
| PSV1 | | Failed | | 664.55-664.90 |
| PSV2 | | Failed | | 696.70-697.00 |
| PSV3 | 720.40 | √ | | |
| PSV4 | 965.78 | √ | | |
| PSV5 | 915.00 | √ | | |
| PSV6 | 1226.55 | √ | | |
| PSV7 | 1291.83 | √ | | |
| PSV8 | 1324.70 | √ | | |
| PSV9 | 1353.71 | √ | | |
| PSV10 | 1406.48 | √ | | |

PSH_ : Indicates; Preserved sample horizontal orientation

PSV_ : Indicates; Preserved sample vertical orientation

_FS : Indicates; Flow study sample

CL_ : Indicates; Community Liaison samples

# Preserved Core Inventory

**Well Name:** Harvey-3A

**Client:** Department of Mines and Petroleum

**Job No.:** PRP-15068

| All the below samples are currently in the Warehouse fridge | | | | | | | |
|---|---|---|---|---|---|---|---|
| Core | Sample No | Top Depth | Btm Depth | | Selected | Plugs | Comments |
| **Short Term Preservation** | 1 | 604.25 | 604.65 | | | | 5 inch PVC tube |
| | 2 | 647.55 | 647.90 | | | | 5 inch PVC tube |
| | 3 | 657.00 | 657.20 | | | | 5 inch PVC tube |
| | 4 | 662.70 | 663.05 | | | | 5 inch PVC tube |
| | | | | | | | Basal Eneabba unit |
| | 5 | 664.55 | 664.90 | | RCA-1 | PSH1, PSH2, PSV1 | 5 inch PVC tube |
| | 6 | 673.25 | 673.55 | | | | 5 inch PVC tube |
| | 7 | 696.70 | 697.00 | | RCA-1 | PSH3, PSH4, PSV2 | 5 inch PVC tube |
| | 10 | 716.25 | 716.45 | | | | 5 inch PVC tube |
| | 8 | 717.50 | 717.80 | | | | 5 inch PVC tube |
| | 9 | 720.15 | 720.45 | | RCA-1 | PSH5, PSH6, PSV3 | 5 inch PVC tube |
| | 11 | 725.40 | 725.70 | | RCA-1 | PSH7, PSH8 | 5 inch PVC tube |
| | 12 | 728.60 | 728.90 | | | | 5 inch PVC tube |
| | 13 | 740.50 | 740.80 | | RCA-1 | PSH9, PSH10 | 5 inch PVC tube |
| | | | | | | | Top Yalgorup Member |
| | 14 | 743.75 | 743.95 | | | | 5 inch PVC tube |
| | 15 | 765.55 | 765.85 | | RCA-1 | PSH11, PSH12, PSV4 | 5 inch PVC tube |
| | 16 | 778.25 | 778.55 | | | | 5 inch PVC tube |
| | 17 | 888.05 | 888.35 | | | | 5 inch PVC tube |
| | 18 | 914.70 | 915.00 | | RCA-1 | PSH13, PSH14, PSV5 | 5 inch PVC tube |
| | 19 | 1171.70 | 1172.00 | | | | 5 inch PVC tube |
| | 20 | 1226.35 | 1226.65 | | RCA-1 | PSH15, PSH16, PSV6 | 5 inch PVC tube |
| | 21 | 1291.50 | 1291.90 | | RCA-1 | PSH17, PSH18, PSV7 | 5 inch PVC tube |
| | 22 | 1298.00 | 1298.30 | | | | 5 inch PVC tube |
| | 23 | 1317.20 | 1317.60 | | | | 5 inch PVC tube |
| | 24 | 1324.40 | 1324.85 | | RCA-1 | PSH19, PSH20, PSV8 | 5 inch PVC tube |
| | 25 | 1326.85 | 1327.30 | | RCA-1 | PSH21, PSH22 | 5 inch PVC tube |
| | 26 | 1332.80 | 1333.15 | | | | 5 inch PVC tube |
| | 27 | 1353.65 | 1353.95 | | RCA-1 | PSH23, PSH24, PSV9 | 5 inch PVC tube |
| | 28 | 1377.80 | 1378.10 | | | | 5 inch PVC tube |
| | 29 | 1388.00 | 1388.35 | | RCA-1 | PSH25, PSH26 | 5 inch PVC tube |
| | 30 | 1393.15 | 1393.50 | | | | 5 inch PVC tube |
| | 31 | 1406.25 | 1406.55 | | RCA-1 | PSH27, PSH28, PSV10 | 5 inch PVC tube |
| | 32 | 1416.50 | 1416.85 | | RCA-1 | PSH29, PSH30 | 5 inch PVC tube |
| | | | | | | | Top Wonnerup Member |

# Preserved Core Inventory

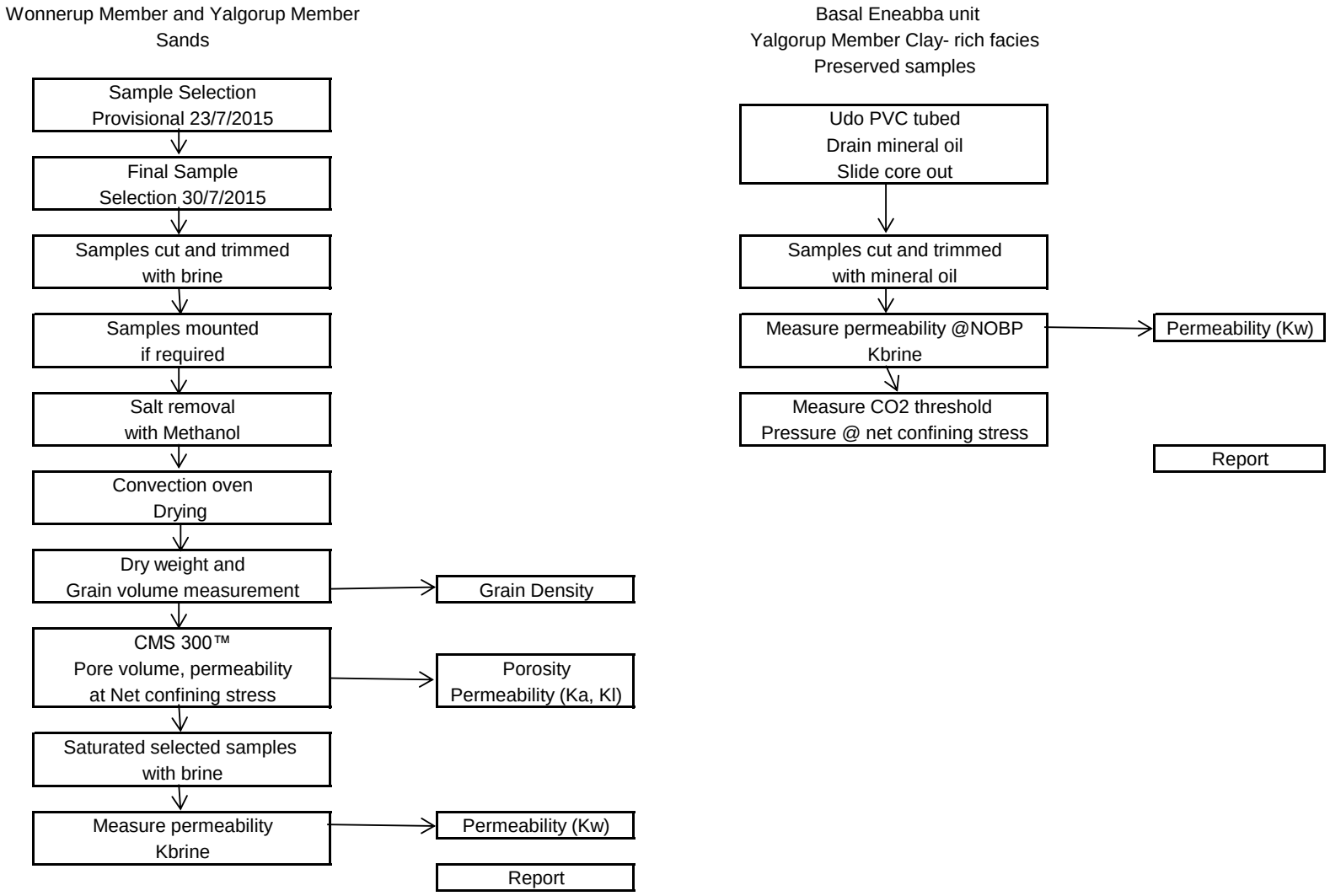
**Well Name:** Harvey-3A

**Client:** Department of Mines and Petroleum

**Job No.:** PRP-15068

| All the below samples are currently in the Warehouse fridge | | | | | | | |
|---|---|---|---|---|---|---|---|
| Core | Sample No | Top Depth | Btm Depth | | Selected | Plugs | Comments |
| **Radio-isotope** | RI1 | 688.55 | 688.85 | | | | 5 inch PVC tube |
| | RI2 | 725.05 | 725.35 | | | | 5 inch PVC tube |
| | RI3 | 735.30 | 735.60 | | | | 5 inch PVC tube |
| | RI4 | 1317.60 | 1317.95 | | | | 5 inch PVC tube |
| | RI5 | 1324.20 | 1324.50 | | | | 5 inch PVC tube |
| | RI6 | 1379.50 | 1379.75 | | | | 5 inch PVC tube |
| | RI7 | 1389.95 | 1390.25 | | | | 5 inch PVC tube |
| | RI8 | 1407.00 | 1407.25 | | | | 5 inch PVC tube |
| **Yalgorup Sandstone** | YS1 | 1290.95 | 1291.95 | | | | 5 inch PVC tube |
| | YS2 | 1286.10 | 1287.05 | | | | 5 inch PVC tube |
| | YS3 | 1348.70 | 1349.70 | | | | 5 inch PVC tube |
| | YS4 | 1396.90 | 1397.85 | | | | 5 inch PVC tube |
| **Long Term Preservation** | LS1 | 1300.95 | 1301.45 | | | | 5 inch PVC tube |
| | LS2 | 1323.70 | 1324.20 | | | | 5 inch PVC tube |
| | LS3 | 1358.65 | 1359.20 | | | | 5 inch PVC tube |

# Analysis Flow Chart



# APPENDIX B

# SWH Project
# Harvey 2, 3, 4 Core Analysis Program
# Routine Core Analysis
# Special Core Analysis

# Planning Document

| Version | Date | Done by | Reviewed by | Approved by |
|---|---|---|---|---|
| Update 9 | June 24, 2015 | TK | LS | |
| Update 8 | June 16, 2015 | LS | | |
| Update 7 | May 26, 2015 | SS | LS | |
| Update 6 | May 20, 2015 | SS/LS | | |
| Update 5 | May 18, 2015 | SS/LS | LS | |
| Update 4 | May 11, 2015 | SS/LS | | |
| Update 3 | April 20, 2015 | SS/LS | | |
| Update 2 | 28 Feb 2015 | SS | LS | DVG |
| Update 1 | 24 Feb 2015 | SS | LS | |
| RFT Scope | Oct 2014 | SS/LS | DVG | |

# 1 SUMMARY OF APPROACH TO CORE ANALYSIS

The DMP RFT scope was discussed and adapted based on the project objectives through discussions with Core Lab (Core Analysis Consultants), ODIN (Modelling and Interpretation consultants) and GSWA. The finalised scope is outlined below and the rationale defined in the subsequent sections.

In terms of classification the core analysis terminology for cap rock refers to the Eneabba basal 'shale' and the Yalgorup paleosols. The reservoir refers to the Wonnerup sands and the Yalgorup sandy facies.

While normally TRA analysis would not be done on cap-rock, in the case of the Lesueur as these are dominated by paleosols a few TRA tests are worth performing in addition to special MICP (SCAL) work.

A specific learning from the Harvey 1 exercise is to perform a CT scan of plugs for SCAL so that the plugs tested are representative.

A certain number of plugs will be required for the ANLEC research projects. Around 5 plugs per well will likely be needed for the paleo-salinity while the requirements for the others is yet to be defined.

Tabulation of Strata tops: predicted vs preliminary actual (updated 16/06/15).

**16/06/2015**

## Depth to strata tops

**Harvey 2 DDH1 Rig 16 (RT = 0.6m)**

| | Odin's 3-D seismic depth prognosis (m AHD) | Approx. actual depth interpretation (m depth) | Approx. strata elevation (m AHD) from Core | Diff between prognosed & prelim actual (m) |
|---|---|---|---|---|
| X : 392052.65 Y : 6347141.74 | | | | |
| G.L (m AHD) | 15.40 | | | |
| Rig table datum (m AHD) | 16.00 | | | |
| Driller's datum (m AHD) | 16.00 | | | |
| Base of Leederville unconformity (m sub sea) | -145 | 135 | -119 | -26 |
| Eneabba basal shale (m sub sea) | -425 | 393 | -377 | -48 |
| Top Yalgorup Member (m sub sea) | -491 | 419 | -403 | -88 |
| Top Wonnerup Member (m sub sea) | -1,237 | 1,245 | -1,229 | -8 |
| Final depth | ~ 1,350 m | 1,351 | -1,335 | -15 |
| Completion depth (m) | | 414.6 | -399 | |

## Harvey 3 DDH1 Rig 16 (RT = 0.6m)

| | Odin's 3-D seismic depth prognosis (m AHD) | Approx. actual depth interpretation (m depth) | Approx. strata elevation (m AHD) from Core | Diff between prognosed & prelim actual (m) |
|---|---|---|---|---|
| X : 387392.24 Y : 6343895.95 | | | | |
| Lat and Long | | | | |
| Ground elevation, as surveyed (m AHD) | 20.20 | | | |
| Rig table datum (m AHD) | 20.80 | | | |
| Driller's datum (m AHD) | 20.80 | | | |
| Base of Leederville unconformity (m sub sea) | -226 | cased | tentatively from GR log ? | |
| Eneabba basal shale (m sub sea) | -628 | 655 | -634 | 6 |
| Top Yalgorup Member (m sub sea) | -713 | 741 | -720 | 7 |
| Top Wonnerup Member (m sub sea) | -1,426 | 1,418 | -1,398 | -28 |
| Final depth | ~ 1,550 m | | | |
| Completion depth (m) | | HQ coring to TD | | |

Installing casing to TD, approx.

1,462 m (16/6/14)

## Harvey 4 DCA Rig (RT = 4.0m)

| | Odin's 3-D seismic depth prognosis (m AHD) | Approx. actual depth interpretation (m depth) | Approx. strata elevation (m AHD) from Cuttings | Diff between prognosed & prelim actual (m) |
|---|---|---|---|---|
| X : 389946.08 Y : 6343842.51 | | | | |
| Ground elevation, as surveyed (m AHD) | 15.89 | | | |
| Rig table datum (m AHD) | 19.89 | | | |
| Driller's datum (m AHD) | 15.89 | | | |
| Base of Leederville unconformity (m sub sea) | -154 | 165 | -149 | -5 |
| Eneabba basal shale (m sub sea) | -837 | 808 | -792 | -43 |
| Top Yalgorup Member (m sub sea) | -1,016 | 1,020 | -1,004 | -12 |
| Top Wonnerup Member (m sub sea) | -1,665 | 1,617 | -1,601 | -64 |
| Final depth | ~ 1,800 m | 1,802 | -1,786 | -14 |
| Completion depth (m) | | 1,802 | -1,786 | |

Drilling finished 21/04/15

### Notes

Well sites surveyed by DMP's surveyor in Nov 14 and again on 25 April 2015.

Actual strata tops are preliminary pending palynology results and wireline logging data

There is difficulty in defining transition between the Eneabba Formation and

Yalgorup Member.

### Intervals Cored

Harvey 2 was fully-cored. Core samples preserved in mineral oil (claystone and/or siltstone- rich facies):

| Sample Number | Depth (m) | | Date |
|---|---|---|---|
| | Start | End | |
| 1 | 402.1 | 402.45 | 12/01/2015 |
| 2 | 411.75 | 412.1 | 14/01/2015 |
| 3 | 417.6 | 417.95 | 14/01/2015 |
| 4 | 424.7 | 425.05 | 14/01/2015 |
| 5 | 433 | 433.35 | 14/01/2015 |
| 6 | 452.1 | 452.45 | 14/01/2015 |
| 7 | 464.7 | 464.95 | 15/01/2015 |
| 8 | 487.4 | 487.75 | 15/01/2015 |
| 9 | 492 | 492.3 | 16/01/2015 |
| 10 | 501.95 | 502.3 | 16/01/2015 |
| 11 | 510.95 | 511.3 | 17/01/2015 |
| 12 | 725.2 | 725.55 | 27/01/2015 |
| 13 | 742.75 | 743 | 27/01/2015 |
| 14 | 748.1 | 748.45 | 27/01/2015 |
| 15 | 754.9 | 755.2 | 27/01/2015 |
| 16 | 767.05 | 767.3 | 28/01/2015 |
| 17 | 775.9 | 776.25 | 28/01/2015 |
| 18 | 790.65 | 790.95 | 28/01/2015 |
| 19 | 815.9 | 816.25 | 29/01/2015 |
| 20 | 835.35 | 835.65 | 30/01/2015 |
| 21 | 961.25 | 961.6 | 04/02/2015 |
| 22 | 968.25 | 968.55 | 04/02/2015 |
| 23 | 979.1 | 979.4 | 05/02/2015 |
| 24 | 988 | 988.25 | 05/02/2015 |
| 25 | 1036.4 | 1036.7 | 07/02/2015 |
| 26 | 1107.85 | 1108.15 | 08/02/2015 |
| 27 | 1119.15 | 1119.4 | 08/02/2015 |
| 28 | 1132.05 | 1132.4 | 09/02/2015 |
| 29 | 1145.25 | 1145.55 | 09/02/2015 |
| 30 | 1166.05 | 1166.35 | 10/02/2015 |
| 31 | 1190.75 | 1191.05 | 10/02/2015 |
| 32 | 1228.55 | 1228.8 | 12/02/2015 |

Radio-isotope samples

| Sample Number | Depth (m) | | Date |
|---|---|---|---|
| | Start | End | |
| R1 | 464.3 | 464.55 | 15/01/2015 |
| R2 | 512.4 | 512.75 | 17/01/2015 |
| R3 | 975.9 | 976.22 | 05/02/2015 |
| R4 | 1085.25 | 1085.55 | 08/02/2015 |

Harvey 3 was fully-cored.

Core samples preserved in mineral oil (claystone and/or siltstone- rich facies):

| Sample Number | Depth (m) | | Date |
|---|---|---|---|
| | Start | End | |
| 1 | 604.25 | 604.65 | 27/03/2015 |
| 2 | 647.55 | 647.9 | 28/03/2015 |
| 3 | 657 | 657.2 | 28/03/2015 |
| 4 | 662.7 | 663.05 | 28/03/2015 |
| 5 | 664.55 | 664.9 | 29/03/2015 |
| 6 | 673.25 | 673.55 | 29/03/2015 |
| 7 | 696.70 | 697.00 | 31/03/2015 |
| 8 | 717.50 | 717.80 | 01/04/2015 |
| 9 | 716.25 | 716.45 | 01/04/2015 |
| 10 | 720.15 | 720.45 | 01/04/2015 |
| 11 | 725.05 | 725.35 | 01/04/2015 |
| 12 | 728.60 | 728.90 | 02/04/2015 |
| 13 | 740.50 | 740.80 | 02/04/2015 |
| 14 | 743.75 | 743.95 | 02/04/2015 |
| Harvey 3A | | | |
| 15 | 765.55 | 765.85 | 09/04/2015 |
| 16 | 778.35 | 778.65 | 09/04/2015 |
| 17 | 888.05 | 888.35 | 17/04/2015 |
| 18 | 914.7 | 915 | 19/04/2015 |
| 19 | 1171.1 | 1172 | 03/05/2015 |
| 20 | 1226.3 | 1226.65 | 08/05/2015 |

Radio-isotope samples

| Sample Number | Depth (m) | | Date |
|---|---|---|---|
| | Start | End | |
| R1 | 688.55 | 688.85 | 30/03/2015 |
| R2 | 725.05 | 725.35 | 01/04/2015 |
| R3 | 735.3 | 735.6 | 02/04/2015 |

Yalgorup Member Sandstone (Glad wrapped)

| Sample Number | Depth (m) | | Date |
|---|---|---|---|
| | Start | End | |
| YS1 | 1250.95 | 125195 | 11/05/2015 |

Harvey 4 was interval-cored (four times), with a special large barrel use to retrieve a broken TCI roller bit in the Yalgorup Member.

| | | |
|---|---|---|
| *Run 1* | | |
| 893.00-894.00 m | placed in oil in PVC tubes | exposed to air for ~ 3 hours, transported to CoreLab on 19/02 |
| 894.00-895.00 m | placed in oil in PVC tubes | exposed to air for ~ 3 hours, transported to CoreLab on 19/02 |
| 895.00-895.96 m | placed in oil in PVC tubes | exposed to air for ~ 3 hours, transported to CoreLab on 19/02 |
| 895.96-896.00 m | dropped | - |
| 896.00-896.30 m | wrapped in plastic, refrigerated | ??? |
| 896.3 | zipped plastic bag | transported to Core Library on 23/04/2015 |
| 896.30-897.30 m | placed in oil in PVC tubes | exposed to air for ~ 6.5 hours, transported to CoreLab on 19/02 |
| 897.30-898.30 m | placed in oil in PVC tubes | exposed to air for ~ 6.5 hours, transported to CoreLab on 19/02 |
| 898.30-899.25 m | placed in oil in PVC tubes | exposed to air for ~ 6.5 hours, transported to CoreLab on 19/02 |
| 899.25-899.30 m | zipped plastic bag | transported to Core Library on 23/04/2015 |
| 899.30 m | zipped plastic bag | transported to Core Library on 23/04/2015 |
| *Run 2* | | |
| 898.40-898.60 m | zipped plastic bag | transported to Core Library on 23/04/2015 |
| 898.60-899.60 m | placed in oil in PVC tubes | exposed to air for ~ 2 hours, transported to CoreLab on 20/02 |
| 899.60-900.60 m | placed in oil in PVC tubes | exposed to air for ~ 2 hours, transported to CoreLab on 20/02 |
| 900.60-901.60 m | placed in oil in PVC tubes | exposed to air for ~ 2 hours, transported to CoreLab on 20/02 |
| 901.60-901.75 m | wrapped in glad wrap, alfoil, refrigerated | transported to CoreLab on 20/02 |
| 901.75-902.75 m | placed in oil in PVC tubes | exposed to air for ~ 2.75 hours, transported to CoreLab on 20/02 |
| 902.75-903.75 m | placed in oil in PVC tubes | exposed to air for ~ 2.75 hours, transported to CoreLab on 20/02 |
| 903.75-904.80 m | placed in oil in PVC tubes | exposed to air for ~ 2.75 hours, transported to CoreLab on 20/02 |
| 904.80-905.05 m | wrapped in glad wrap, alfoil, refrigerated | transported to CoreLab on 20/02 |
| 905.05-905.15 m | zipped plastic bag | transported to Core Library on 23/04/2015 |
| 905.15-906.15 m | placed in oil in PVC tubes | exposed to air for ~ 3.75 hours, transported to CoreLab on 20/02 |
| 906.15-907.15 m | placed in oil in PVC tubes | exposed to air for ~ 3.75 hours, transported to CoreLab on 20/02 |
| 907.15-908.05 m | placed in oil in PVC tubes | exposed to air for ~ 3.75 hours, transported to CoreLab on 20/02 |
| 908.05-908.35 m | 2 x zipped plastic bags | transported to Core Library on 23/04/2015 |
| *Run 3* | | |
| 1665.05-1666.65 m | wrapped in glad wrap and kept in tray | transported to Core Library on 29/4/2015 |
| *Run4* | | |
| 1792.70-1802.55 | kept in tray (except samples below) | transported to Core Library on 29/4/2015 |
| 1795.10-1795.60 | Long term preservation sample - glad wrapped and placed in tubes | transported to Core Labs on 23/04/2015 |
| 1797.60-1798.10 | Long term preservation sample - glad wrapped and placed in tubes | transported to Core Labs on 23/04/2015 |
| 1800.65-1801.15 | Long term preservation sample - glad wrapped and placed in tubes | transported to Core Labs on 23/04/2015 |

The two samples from Run 1 in zip lock bags were crumbled core from the lifter and barrel join. These are estimated to be 0.05 – 0.10 m long.

| Well Name | Sample type | Depth from (m) | Depth To (m) | Sampling and Preservation method | Comments |
|---|---|---|---|---|---|
| Harvey 4 | 6" Core from Yalgorup | 1325.50 | 1326.60 | Washed, placed in tray | Core was recovered during core operations to retrieve metals pieces from the bottom of the hole.<br>Sent to Core Library 13/05/15. |
| Harvey 4 | 6" Core from Yalgorup | 1324.00 | 1325.25 | In PVC tube in mineral oil | Core was recovered during core operations to retrieve metals pieces from the bottom of the hole.<br>Sent to Core Labs 13/05 |

| | | | |
|---|---|---|---|
| 1,324 | 1,327 | Sandstone | Pale grey with thin purple mottled bands. Very fine to very coarse grained - occasional granular grains, moderately to poorly sorted, angular to sub-rounded, predominantly quartz (clear to frosted with grey and purple grains in purple bands), feldspar (white, pink); minor black heavy minerals, trace garnet and glauconite (increasing in purple band). Well cemented with trace argillic (pale green, dark purple) cementation. (Note: core samples are very different from drill cuttings either side, where siltstone/mudstone predominates - possible wash out from hole above, Steve Bolton, 2015). |

**Notes**

- Plug selections to be referenced from Harvey 3 as the well has whole cores over the entire area of interest
- Horizontal Plugs to be taken every 1 m and Vertical Plugs every 3 m (close to 3rd horizontal plug) in wells Harvey 3 and Harvey 4.
- Harvey 4 has fewer plugs as the wells have been interval cored.
- Plug frequency reduced in Harvey 2 as it is not in the fairway of interest.
- The number of plugs has been increased from the original plan of 280 plugs (165 H, 105V).
- SCAL plugs to be CT scanned to check for consistency.
- No provision as yet for additional plugs for R&D. Researchers to advise.
- The well H-2 intercepts the F0 fault. This provides an opportunity to collect some plugs and do some tests in the fault zone. Whilst not visibly obvious, approximate depth of the intercept is between 340 and 440 m. This is largely based on Hylogger data where some distinct markers are seen – amorphous silica (348-385 m), gypsum (from 420 m), wet core signature (430-440 m). Cap rock type tests are planned here with 6 H and 2 V plugs.

## 2 FINAL SCOPE: ROUTINE CORE ANALYSIS (RCA)

| No | Sample | Program | Requirement with estimated volumes | Comments |
|---|---|---|---|---|
| 1. | Caprock (Eneabba and Yalgorup) | Preparation | Harvey 2: F10 investigation 6 horizontal plugs and 2 vertical plugs (normal to bedding)<br>Harvey 2: 10 horizontal plugs and 5 vertical plugs (normal to bedding)<br>Harvey 3: 30 horizontal and 10 vertical plugs (normal to bedding)<br>Harvey 4: 10 horizontal plugs and 5 vertical plugs (normal to bedding) | V plugs should be cut adjacent to relevant H plugs. From original plan number of V plugs reduced. V plugs taken every 2nd or 3rd H plug. |
| 2. | Reservoir Yalgorup and Wonnerup) | Preparation | Harvey 2: 20 H and 10 V in Wonnerup<br>Harvey 3: 140 Hand 50 V in Wonnerup<br>Harvey 3: 20 H and 5 V in Yalgorup | .<br>V plugs should be cut adjacent to relevant H plugs. |

| No | Sample | Program | Requirement with estimated volumes | Comments |
|---|---|---|---|---|
| | | | Harvey 4: 10 H and 5 V in Wonnerup | |
| 3. | Caprock (Eneabba and Yalgorup | Routine rock properties: Caprock analysis | Harvey 2: F10 investigation 5 horizontal plugs and 1 vertical plugs (normal to bedding)<br>Harvey 2: 8 horizontal plugs and 4 vertical plugs (normal to bedding)<br>Harvey 3: 27 horizontal and 9 vertical plugs (normal to bedding)<br>Harvey 4: 8 horizontal plugs and 4 vertical plugs (normal to bedding)<br>Use selected plugs from Item 1 | Kw and threshold pressure for CO2 injection to understand the paleosol properties for containment.<br>Some vertical plugs to include the tree root systems in the Yalgorup |
| 4. | Reservoir Yalgorup and Wonnerup) | Routine rock properties: Porosity and permeability (P&P) to gas and water (Kg and Kw) at NOBP | Harvey 2: 20 horizontal and 10 vertical plugs<br>Harvey 3: 140 H + 50 V plugs—Wonnerup<br>Harvey 3: 20H + 5 V--Yalgorup<br>Harvey 4: 10 horizontal and 5 vertical plugs<br>Use plugs from Item 2 | For evaluating porosity, Ka, Kw and grain density.<br>Kw on 20% of plugs or more to be able to draw a correlation<br>No Kw measurements in Harvey 2.<br>Plugs to be taken in Wonnerup and Yalgorup sands. |
| 5. | Reservoir Yalgorp and Wonnerup) | As in Item 4 but at a different pressure | Use selected plugs from Item 4 | To evaluate the properties in 4 at a different pressure for estimation of KPhi at any NOBP using 2-point fit |
| 6. | Core: Caprock and reservoir | Petrographic analysis: thin section (TS), X-Ray diffraction (XRD) and Scanning electron microscopy (SEM) | Use end-trims from the Caprock and P&P plugs.<br>Caprock – F10 test – 6 samples<br>Caprock: 14 representative samples<br>Reservoir: 20 representative samples (4 Yalgorup and 16 Wonnerup) | For reservoir, plugs to be taken in Wonnerup and Yalgorup sands.<br>For caprock samples, consider in Yalgorup and Eneabba paleosols. Select from those that undergo MICP/Pc tests in the SCAL programme.<br>For the F10 confirm mineralogy particularly Gypsum |
| 7. | Fluid | Fluid compositional analyses | Consider a total of 6 Modular Formation Dynamics Tester (MDT) samples | 3 samples from H4 and possibly 3 from H3.<br>Use 50% of the samples or less for baseline dissolved CO2 in the formation water in addition to the planned tests (10 ions etc.). |

# 3 FINAL SCOPE: SPECIAL CORE ANALYSIS (SCAL)

| No | Sample | Program Name | Details | CoreLabs Discussions |
|---|---|---|---|---|
| 1. | Caprock | Kw and threshold capillary pressure | Capillary Pressure for supercritical CO2 brine: 1) capillary pressure<br>H2 fault—1H + 1V<br>H2 shale—2H+1V<br>H3 shale—3H +1V<br>H4 shale—2H+1V | On *samples from Eneabba Formation/Yalgorup Member.*<br>10 plugs selected from RCA item 1. 7H and 3V.<br>2 plugs from the F10 fault set in H2 (1H and 1V)<br>12 plugs in total |
| 2. | Caprock and Reservoir | Capillary pressure: mercury injection capillary pressure (MICP) | Will provide pore size distribution curves, capillary entry pressure and to establish seal capacity (not suitable in heterogeneous seal) | On *samples from Eneabba Formation/Yalgorup Member.*<br>Trim ends of 10 plugs from SCAL item 1. This is a destructive test.<br>2 plugs from the F10 fault set in H2 (trim-ends from SCAL item 1).<br>Trims of 6 Krel samples (SCAL item 4).<br>18 samples in total |
| 3. | Caprock and Reservoir | Geomechanical testing:<br>Triaxial compression test with ultrasonic velocities (TXC) | The parameters measured are static/dynamic Young's Modulus, Bulk Modulus, Shear Modulus and Poisson's Ratio for rock stability | Use V plugs from P&P for the Wonnerup reservoir. This is a destructive test but the materials will still be available for other uses. |
| 4. | Reservoir | Relative permeability | Drainage and imbibition and end point measurements for $CO_2$/water (brine) under high pressure and temperature | End point measurement for 4 horizontal plugs.<br>Drainage and imbibition for 2 horizontal plugs.<br>Plugs from porosity and permeability (P&P) testing will be used if suitable (RCA item 4) |

Note: Versions 7 & 8 of this document include input from ODIN Consulting.

**Document developed by Sandeep Sharma, in consultation with Tony Kenniard, Core Lab, 26 May 2015.**

**Reviewed by Louise Stelfox, 16 June 2015**

**Update to sample numbers (in yellow) advised by Tony Kenniard, Core Lab, 24 June 2015.**