



**Mudlogging Data**  
**End of Well Report**  
**(PRELIMINARY REPORT)**

**Origin Energy Resources Limited**

**AMUNGEE NW-1HRE**

<b>Rig:</b>	<b>Saxon 185</b>
<b>Field:</b>	<b>Exploration</b>
<b>Country:</b>	<b>Australia</b>
<b>Date:</b>	<b>16<sup>th</sup> June 2016 to 10<sup>th</sup> July 2016</b>

**Contents**

<b>1.0</b>	<b>INTRODUCTION.....</b>	<b>2</b>
<b>2.0</b>	<b>WELL SUMMARY .....</b>	<b>3</b>
<b>2.1</b>	<b>WELL GENERAL INFORMATION.....</b>	<b>3</b>
<b>3.0</b>	<b>SYNOPSIS: AMUNGEE NW-1HRE .....</b>	<b>4</b>
<b>3.1</b>	<b>RE-ENTRY SUMMARY OF AMUNGEE NW-1HRE .....</b>	<b>4</b>
<b>4.0</b>	<b>LOGGING SERVICES SUPPLIED.....</b>	<b>7</b>
<b>4.1</b>	<b>GEOLOGICAL MONITORING EQUIPMENT .....</b>	<b>7</b>
<b>4.2</b>	<b>SERVICES PROVIDED .....</b>	<b>7</b>
<b>4.3</b>	<b>MONITORED PARAMETERS .....</b>	<b>8</b>
<b>4.4</b>	<b>PERSONNEL.....</b>	<b>8</b>
<b>4.5</b>	<b>SAMPLE COLLECTION .....</b>	<b>9</b>
<b>5.0</b>	<b>BIT RECORDS.....</b>	<b>11</b>
<b>6.0</b>	<b>BHA.....</b>	<b>12</b>

## 1.0 INTRODUCTION

The Schlumberger Land Rig (SLR) 185 was used to re-enter the Amungee NW-1H appraisal well in Permit EP98 on the northern flank of Beetaloo Sub-Basin NT/Australia.

Amungee NW-1H is a horizontal appraisal well with a total depth of 3808mMDRT (2428mTVDRT). The well has ~1200m of lateral landed in the mid-Velkerri B-shale. Prior to drilling the lateral section, the well was drilled as a vertical exploration well to a total depth of 2611.0mTVDRT and then plugged back and abandoned to kick off point, above the mid-Velkerri in the upper-Velkerri. Amungee NW-1H was kicked off at 1932.5mTVDRT.

On reaching TD and pulling out of hole, an attempt was made to run the 4.5" casing. The casing was successfully run through the build section and into the lateral. As the casing was run into the lateral the measured drag, which had tracked well against the model until that point, began to deviate from what was predicted. A decision was made to pull the casing and it appeared to have buckled and failed while running. The root cause is likely to have been cavings from an unstable section of the well causing higher drag than expected coupled with insufficient casing connection torque to allow rotating. The events leading to the suspension was detailed in PCN 042 – Amungee NW-1H Temporary Suspension.

The objection was to re-enter Amungee NW-1H, drill out the cement plugs, clean out the well to TD, run casing into the hole, cement and suspend the well. New casing had been sourced which was heavier walled with a more robust connection that should allow the casing to be rotated to bottom.

A Geoservices (GSS) Schlumberger ALS-3B Mudlogging Unit was contracted by Origin Energy Resources Ltd during the re-entry of Amungee NW-1H exploration well. The unit provided a full Surface Data Logging (SDL) network for the job. This included real time and lagged data acquisition, data processing, data storage, data presentation, Interact, and real time monitoring.

Full surface data logging for Amungee NW-1HRE commenced when the well was re-entered at 22:00 hrs on 18<sup>th</sup> of June 2016 and continued for the duration of the well. The well reached the total depth (TD) of 3808.0 mMDRT at 21:30 hrs on 24<sup>th</sup> of June 2016. Amungee NW-1HRE was cased and suspended on 10<sup>th</sup> of July 2016.

This report is intended as a summary of the information and data collected, processed and monitored as part of the INSITE service agreement.

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## 2.0 WELL SUMMARY

### 2.1 WELL GENERAL INFORMATION

<b>Well Name:</b>	Amungee NW-1HRE
<b>Operator:</b>	Origin Energy Resources Ltd
<b>Classification:</b>	Appraisal
<b>Permits:</b>	EP 98
<b>Surface Location:</b>	
Coordinate Reference System:	GDA94
UTM Easting: 380 859mE	UTM Northing: 8 192 298mN
Latitude: 16° 20' 51.034" S	Longitude: 133° 53' 04.403" E
<b>Country:</b>	Australia
<b>Drilling Rig:</b>	Schlumberger Land Rig (SLR) 185
<b>Type of Rig:</b>	Land/Onshore
<b>Contractor:</b>	Saxon Energy Services Australia Pty. Ltd.
<b>Depth Measured From:</b>	Rig Floor
<b>Permanent Datum:</b>	MSL
<b>RT to MSL:</b>	265.91 m
<b>RT to GL:</b>	5.35 m
<b>Total Depth Amungee NW-1H:</b>	3808.0 mMDRT (2427.97mTVDRT)

### 3.0 SYNOPSIS: AMUNGEE NW-1HRE

#### 3.1 RE-ENTRY SUMMARY OF AMUNGEE NW-1HRE

The 5<sup>1/8</sup>" 10K valve was removed from well head. The 11" 5K BOP stack was nipped up and tested same.

A BHA with 6.75 inch bit in conjunction with MWD's survey tool was made up and run in hole to tag top of cement plug #3 at 1326.21 mMDRT. Cement plugs were drilled out from 1326.21 mMDRT to 1698 mMDRT. The drill string continued to be run in hole to 2267 mMDRT. The wellbore's fluid was displaced to 11.0 ppg mud. The drill string continued to be run in hole to 2298 mMDRT. The wellbore was washed and reamed down to well's total depth at 3808 mMDRT. Tight hole sections were worked until able to pass without rotary. The wellbore was circulated to clean hole.

The drill string was pulled out to 3796 mMDRT, reamed and back reamed from 3796 mMDRT to 3794 mMDRT, washed and reamed from 3794 mMDRT to 3808 mMDRT. The hole was circulated clean, reamed and back reamed from 3799 mMDRT to 3808 mMDRT. Flow check was conducted. The well was shut in and monitored pressures. The well was opened well and flow checked - static. Circulated hole and performed extended flow check. Well static. Back reamed from 3798 mMDRT to 3733 mMDRT. Circulated three times bottoms up. Back reamed out of hole from 3733 mMDRT to 2547 mMDRT. Drill string stalled and packed off at 2547 mMDRT. Worked stuck pipe. Pipe free with jar down at 40 k-lbs and 6 k ft/lbs torque. Gained rotation and circulation. Circulated. Reamed from 2547 mMDRT to 2594 mMDRT. Post jarring mast and TDS inspection and rig service. No issues from inspection. Back reamed from 2594 mMDRT to 1426 mMDRT. RIH from 1426 to 2438 mMDRT. Washed down from 2438 to 2441 mMDRT with 260 gpm. Attempted to run on elevators. Reamed from 2441 to 2546 mMDRT. Circulated three times bottom's up. Attempted RIH on elevators from 2546 to 2558 mMDRT. Reamed from 2546 to 2558 mMDRT.

28<sup>th</sup> June, reaming continued from 2548 to 2569 mMDRT. Attempt was made to run on elevators with continued tight hole encountered. Hole circulated clean and then POOH commenced from unrestricted on elevators from 2256 to 33 mMDRT. BHA was layed out and BOP function tested prior to running casing.

Production casing commenced run in hole on 30<sup>th</sup> June 2016 at 0:00hrs before encountering a rubber packer failure when reaching 47 mMDRT. An interim clean out BHA was made up and ran with hole circulated from 2912 mMDRT. Prior to POOH the flow check showed well flowing with 0.5 bbl gain observed in the trip tank. The well was shut in with 0 psi recorded before POOH.

Casing run resumed on 3<sup>rd</sup> July 2016 at 05:30hrs with intermittent tight spots which were worked through with 20 rpm and 260 gpm. At 3507 mMDRT pit gain was detected and flow check showed well was flowing. Well was shut in with crews mustered. Operations were changed to killing the well which continued until 11:30 on 6<sup>th</sup> July 2016 when flow check revealed static well. Casing reached 3799 mMDRT on 7<sup>th</sup> July 2016 at 22:00 hrs.

Production casing was cemented with a minimum of 43 hrs WOC. BOP was nipped down and rig was released at 0:00, 11<sup>th</sup> July 2016.

Figure 1

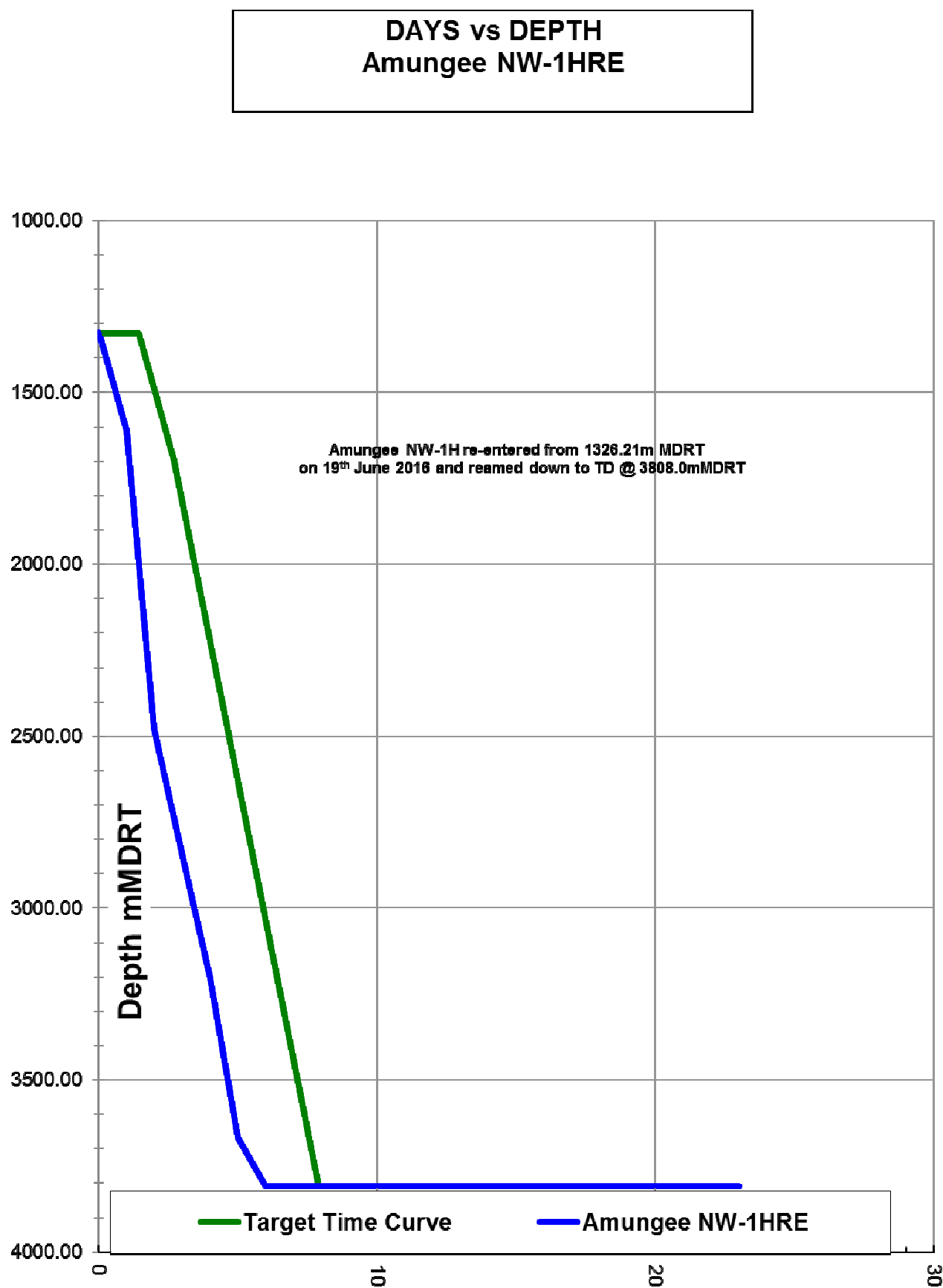
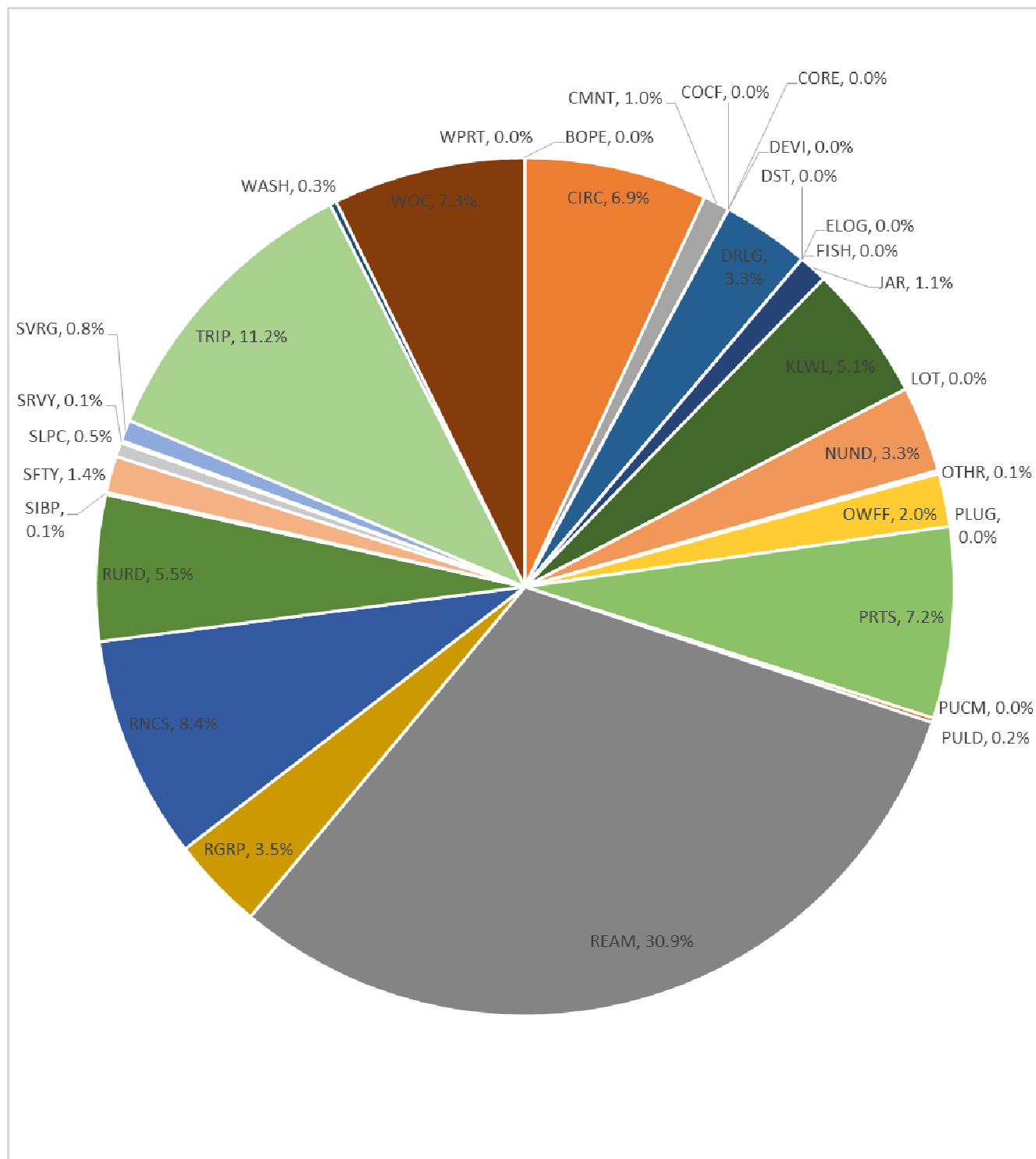


Figure 2

**AMUNGEE NW-1HRE TIME BREAK DOWN**

4.0

## LOGGING SERVICES SUPPLIED

### 4.1 GEOLOGICAL MONITORING EQUIPMENT

- ALS-3B Acquisition PC Network
- Draw Works Depth Encoder
- Hook load sensor, tension meter
- Flowout Paddle
- Pressure Sensor 400 bars
- Reserval for gas detector (x2)
- FID Gas Detector GZG Gas Trap
- Monitors (x3), Rig floor-OCR-Mud office
- Fluoroscope
- H<sub>2</sub>S Detectors (x2)
- HP Officejet 6600
- Isotube Manifold
- Microscope
- Pit Volume Sensors (x7)
- Pump Stroke Counter (x2)
- Mud Density IN sensor
- Mud Temperature IN sensor

### 4.2 SERVICES PROVIDED

- Data files in PDF, ASCII (LAS) format
- Geological and Engineering Reporting
- Hydraulics Computation
- Interpreted Lithology
- Plots of Daily Drilling Activities
- Real Time Drilling Monitoring
- Real Time Monitoring of Drilling Fluids
- Real Time Tabular Display of Data
- Real Time Trip Monitoring
- Sample Collection and Processing
- Timers for Hours and Revolutions on Drilling Assembly
- Realtime streaming into INTERACT



### 4.3 MONITORED PARAMETERS

- Block Position
- Hook load
- On/Off Bottom Status
- Rate of Penetration
- Stand Pipe Pressure
- Revolutions Per Minute of Top Drive
- Swab/Surge Calculation
- Torque
- Weight on Bit Including Drag and Obstruction
- Flow Out
- Continuous Gas Percentage in Depth
- Formation Lithology
- Gas Analysis ( $C_{1-n} - C_5$ )
- $H_2S$  (ppm)
- Hydrocarbon Shows
- Mud Volume
- Percentage  $CO_2$
- Pump Stroke and Volume of Mud Pumped
- Volumes and Lag Calculations
- Mud Density IN
- Mud Temperature OUT

### 4.4 PERSONNEL

ONSITE engineers continuously monitored all operations whilst re-entry Amungee NW-1HRE. They provided any well and drilling data upon request, notified the appropriate personnel of any irregularities or anticipated problems, provided daily reports, print outs of data and prepared daily time logs and final reports.

#### **DATA ANALYSTS**

Duc Nguyen

Cuong Le

Andrew Papadopoulos

Neville Luis

#### **MUDLOGGING ANALYSTS**

Rhys Hurcombe

Sean Kettle

#### **SAMPLE CATCHER**

## 4.5 SAMPLE COLLECTION

### Drill Cuttings Samples

Sample Type	Number Required
Washed & Air-dried cuttings	50g total weight washed and air-dried cuttings. Collected at various points during reaming and circulation.
Samplex Tray cuttings	None required.

### Summary of drill cuttings collected:

Depth Intervals (mMDRT)		Cuttings Samples
<b>Hole Section 4</b> – 6.75 inch (Re-Entry of Production section)	1932.5m to 3808.0m	As required

### Mudgas Samples

Isotubes and Isojars were collected during drilling of Amungee NW-1HRE as below

Well Section	Sample Type	Background Sampling Spacing	Peak Sampling
<b>6.75" Hole Section</b> (Production Section)  1671.0 – 3805.0m	Isotubes	As required. Refer to sample check sheet.	At gas peaks over 3 times background gas. Or CO2 above 5%

A total of 16 Isotubes were collected for Amungee NW-1HRE, refer to sample check sheet.

## Mud and Mud Filtrate Samples

One liter of Mud and mud filtrate samples (prepared by the mud engineer, 50ml) were collected from either the active pit or the return flow line at:

- The beginning of re-entry of hole section.
- Make up of completion brine.

No	DATE	Time Taken hrs	Reason	Sample Type	Air/Mud Drilling	Comment
				Mud/Filtrate		
1	18/06/2016	19:25	Re-entry of 6.75" section	Mud	Mud	Sample taken from Active mud
1	18/06/2016	19:25	Re-entry of 6.75" section	Filtrate	Mud	Sample taken from Active mud
2	08/07/2016	06:00	Completion fluid	Mud		Sample taken from Active mud

**5.0 BIT RECORDS**

Bit Size (mm)	BIT RUN	MAKE/TYPE	TFA (in <sup>2</sup> )	JETS (/32 <sup>nd</sup> )	Depth In (mMDRT)	Depth Out (mMDRT)	Meters Drilled (m)	Eff. On Btm (hrs)	AV ROP (m/hr)	WOB (klbs)	RPM	KREV	SPP (psi)	FLOW (GPM)	TRQ (kft-lb)	IADC BIT GRADING
172	1	Smith PDC MDSi713 WUPX	0.91	7x13	-	-	-	-	-	-	-	-	-	-	-	6-6-CT-A-X-0-LT-TD
172	2	Smith PDC MDSi713 WUPX	0.91	7x13	-	-	-	-	-	-	-	-	-	-	-	6-6-CT-A-X-0-LT-TD

## 6.0 BHA

### BHA-1

BHA-1 was utilized to re-enter Amungee NW-1HRE.

DATE	BIT MFG		BIT TYPE		BIT NOZZLES	
17/06/16	Smith / PDC		MSi713 WUPX		7x13	
ITEM	OD (inches)	ID (inches)	Length (m)		Cumulative Length (m)	
BIT	6 ¾	1 ½	0.19		0.19	
Bit sub with float	4 15/16	Port	0.91		7.2	
PONY NMDC	4 ¾	2 ¾	3.07		4.17	
NM CROSSOVER	4 ¾	2 ½	0.36		4.53	
HDS 1	4 ¾	2 13/16	8.60		13.13	
NMDC X 2	4 ¾	2 ¼	18.68		31.81	
FILTER SUB	4 ¾	2 ¼	1.02		32.83	
CROSSOVER	5 ¼	2 1/8	0.66		33.49	
4" HWDP X 3	4	2 ¼	39.26		72.75	
CROSSOVER	5 ¼	2 1/8	0.61		73.36	
HYDRA JARS	4 13/16	2 ¼	9.11		82.47	
CROSSOVER	5 ¼	2 1/8	0.71		83.13	
4" HWDP X 6	4	2 ¼	78.54		161.67	
4" DP X 123	4	3.24	1621.43		1783.10	
4" HWDP X 11	4	2 ¼	143.89		1926.99	

**BHA-2**

BHA-2 was utilized as clean out assembly.

DATE	BIT MFG		BIT TYPE	BIT NOZZLES	
30/06/16	Smith / PDC		MSi713 WUPX	7x13	
ITEM	OD (inches)	ID (inches)	Length (m)	Cumulative Length (m)	
BIT	6 ¾	1 ½	0.19	0.19	
Bit sub with float	4 15/16	1 ¾	1.12	1.31	
Drill Collar X 3	4 ¾	2 ¼	28.14	29.45	
Cross over	4	2	0.66	30.11	
4" HWDP X 3	4	2 ¼	39.3	69.41	
Cross over	5 ¼	2 1/8	0.61	70.02	
Jars	4 13/16	2 ¼	9.11	79.13	
CROSSOVER	5 ¼	2	0.71	79.84	
4" HWDP X 6	4	2 ¼	78.55	158.39	