4. GEOLOGY

4.1. Pre-Spud Geological Well Prognosis

Well Name: GLYDE #1 ST1

Target Formation: Barney Creek Formation and Coxco Dolomite

Table 6: Geologic description of the formations.

Formation	Top [m]	Probable Content
Bukulara Sandstone	Surface	The Bukulara Sandstone is a medium to coarse quartzlithic sandstone with subordinate green and red mottled clay. The green colour increases towards the base. The basal 5 m becomes very gritty and almost conglomeratic.
Barney Creek Formation	61	Thin bedded to laminated, dolomitic, carbonaceous, bituminous and pyritic shale and siltstone, doloutite, tuff beds and breccia and sandstone; occasional gypsum casts; talus slope breccia adjacent to Emu Fault.
Teena Dolomite - (Coxco Dolomite Member)	501	Grey to pink crystalline massive to laminated dolomite with upward radiating, needle-like gypsum crystal pseudomorphs (normal to bedding); rare conical stromatolites; thin intervals of dolomitic shale and siltstone. Bitumen and hydrocarbon clots with common collapse breccias.

4.2. Along Hole and True Vertical Depth of Seismic Marker and Reservoir Horizons

4.3. Geological Interpretation of the Well Data

Table 7: Well log formation tops for GLYDE #1 ST1, EP171, TD = 840 m.

Geologic Tops	True Vertical Depth (TVD) [m]	Structural Tops [m]
Bukulara Sandstone	57	Surface
Barney Creek Formation	499	57
Teena Dolomite (Coxco Dolomite Member)	504.7	499
Barney Creek Formation	503	504.7

4.3.1. Log Adjusted Lithology Description

Bukulara Sandstone

The Bukulara Sandstone unconformable overlies the Umbolooga Subgroup of the McArthur Group. The Bukulara Sandstone is a medium to coarse quartzitic sandstone with subordinate green and red mottled clay. The green colour increases towards the base. The basal 5 m becomes very gritty and almost conglomeratic.

In GLYDE #1 ST1 - The Bukulara Sandstone is cream to white becoming light green towards the base. It is moderately weathered, fine to medium grained, quartzose sandstone, with minor feldspar grains which have been weathered to clay. The sandstone contains minor porosity and has no visible fluorescence under ultraviolet light. The basal 5 m becomes very gritty with common Pyritic bands and infill between a quartz groundmass.

Umbolooga Subgroup

The top of the Umbolooga Subgroup consists of the Reward Dolomite, Barney Creek Formation (HYC Pyritic Shale Member, W-Fold Shale Member), Coxco Dolomite and Teena Dolomite progressing down stratigraphy, respectively.

Reward Dolomite

The Reward Dolomite is a widespread, highly variable dolostone unit which marks the top of the Umbolooga Subgroup. The thickness ranges from a few tens of metres in the west to several hundred metres in the vicinity of the McArthur River mine. The contact with the Barney Creek Formation is generally conformable and often gradational. The lower part of the formation consists of pink, buff and grey, laminated and thin bedded dololutite with interbeds of dolomitic siltstone and sandstone, sandy dolarenite and sandy intraclast breccia. Dolomitic beds often contain small chert spheroids. Thin beds of potassium-rich, pink, siliceous, possibly tuffaceous material occur at some levels. The upper part of the formation is marked by a zone of intense silicification. In the west it is deeply weathered, silicified, chaotic breccia containing large, unsorted, angular dolostone clasts in a coarse, poorly sorted sandstone matrix with thin interbeds of dololutite and dolomitic sandstone. The Reward Dolomite often contains minor base metal mineralisation along the disconformity where the dololutite is black and has a bituminous odour when broken. The Reward Dolomite was deposited in an environment similar to the Barney Creek Formation, very shallow water to emergent conditions under which sediments accumulated in small bodies of standing water.

In GLYDE #1 ST1 – The Reward Dolomite was not expected to be encountered in this well, based on previous drill results, and this was found to be the case.

Barney Creek Formation

The Barney Creek Formation is a unit of dolomitic shale, siltstone and dololutite which is usually only poorly exposed in low, discontinuous rubbly ridges in the west, northeast and southeast of the McArthur River Region. The formation is usually less than 150 m thick but thickens to about 700 m near the Emu Fault Zone near the McArthur River deposits. The formation is divided into three members: the HYC Pyritic Shale Member, W-Fold Shale Member and the Cooley Dolomite Member. The Cooley Dolomite is restricted to the HYC Sub-basin to the west of the Western Fault, and 20 km north, near the Caranbirini Waterhole so is unlikely to be found in this well.

HYC Pyritic Shale Member: The HYC Pyritic Shale Member mainly consists of very thin-bedded to laminated dolomitic siltstone characterised by high carbonaceous content. Pyrite is the major sulphide component with galena and sphalerite present in the HYC deposit. Sedimentary structures include scour marks, flame structures, soft sediment slumping and graded bedding. Sedimentary breccias are recognised in the areas around the HYC deposit in close proximity to the Emu Fault Zone.

W-Fold Shale Member: The lowermost member, W-Fold Shale Member, consists of green and red, dolomitic siltstone and shale with interbeds of green vitric tuff. The proportion of tuffaceous material increases toward the top of the member.

In GLYDE #1 ST1 - Barney Creek Formation was found to contain dark grey to dark brown to black microcrystalline, blocky, interbedded dolomitic siltstones and sandstones. It was markedly carbonaceous, containing bitumen blebs and fine grained disseminated pyrite up to 5%. The sediments exhibited variable weak to strong orange to brown, bright green towards the contact with the Teena Dolomite, residual fluorescence with a milky white/green acetone cut. The chips had no visible porosity. Increased carbon content with depth was associated with increased pyrite content.

Gas was intersected at the base of the Barney Creek Formation where small fragments of the below Teena Dolomite made up part of the grains seen in the siltstone (unconformity), 648 mMD (499 m, TVD). The gas, on average, consisted of C1 (25%), C2 (4%), C3 (4%), C4 (0.2%) and C5 (0.05%) with very minor live oil seen in the acetone cuts of the siltstone sediment chips.

The W-Fold Shale was not recognised at this site.

Teena Dolomite

The Teena Dolomite is a recessive dolostone unit with the upper part of the formation called the Coxco Dolomite Member. The Formation is up to 70 m thick in the southern McArthur River Region.

Coxco Dolomite Member: The Coxco Dolomite Member is almost certainly evaporitic and is a massive, dark grey, sometimes vaguely bedded dololutite unit. It contains numerous interbeds of pink, buff or orange-weathering, potassium rich, possibly tuffaceous, and mudstones in the area adjacent to the McArthur River deposits. The Coxco Dolomite Member is characterised by the presence of acicular crystal casts which typically take the form of radiating aggregates of needles, rarely more than 2 mm in diameter and up to 6 cm long. Minor disseminated sphalerite, galena and chalcopyrite have been noted at several localities in the Coxco Dolomite Member.

In GLYDE #1 ST1 - The Coxco Dolomite Member is a light brown (tan)/brown to white, microcrystalline dolomite. It has a sucrose texture with visible porosity which contains minor white chalcedonic cavity infill in some parts and some trace pyrite and bitumen blebs. The white and tan coloured dolomite has a dull to bright yellow fluorescence under ultraviolet light. It develops a milky green fluorescence when cut with acetone.

Gas was intersected at the top of the Coxco Dolomite Member 648 mMD (499 m, TVD). The gas on average approximately consisted of C1 (25%), C2 (4%), C3 (4%), C4 (0.2%) and C5 (0.05%) with very minor live oil seen in the acetone cuts of the dolomitic sediment chips.

Lower Teena Dolomite: It consists of very thin bedded, massive, dark pink and grey dololutite. To the east near the McArthur River, the unit has greater sand and silt content and contains beds of ooids and intraclast breccia including flake breccia. Some of the sandy intervals contain cross-beds and ripple marks. Thin beds of stromatolites including conical, domal, columnar and stratiform types are often present near the top and bottom of the unit. Thin beds of pink, cryptocrystalline, possibly tuffaceous siliceous rock are present at some levels. The lower Teena Dolomite was probably deposited in a hyper saline lacustrine environment in which very shallow water and emergent conditions alternated.

In GLYDE #1 ST1 - The lower Teena Dolomite units were not found.

4.3.2. Reservoir Quality

The reservoir quality penetrated in the Glyde #1 ST1 is very good to excellent based on mud-log shows, electric-logs, well testing, chip samples and a continuous flare.

4.3.3. Source Rock Quality

Based upon the gas accumulation in the brecciated Coxco Zone it is believed that the Barney Creek Shale has sourced the hydrocarbons. **Figure 10** illustrates correlative stratigraphy between the Glyde #1 and Glyde #1 ST1 wells and associated gas shows with 'hot' gamma readings. Further exploration and coring in the area has been proposed to high grade its full potential as a source rock and unconventional target. The Barney Creek Formation is a highly carbonaceous, naturally fractured and gas-charged in both Glyde wells and substantiates the estimated Mean Prospective Resource of 11.2 TCF in EP 171, as reported in the Armour Energy Replacement Prospectus, 20 March 2012.

4.3.4. Hydrocarbon Indications

A significant gas kick was penetrated at 646 mMD (498.5 mTVD). The well was underbalanced and immediately flowed and produced a 10 meter flare. The gas constituents from this interval are 77% Methane (C1), 11% Ethane (C2), 11% Propane (C3), 0.6% n-Butanes (C4), 0.2% n-Pentanes (C5) with negligible Carbon Dioxide, based on gas chromatography undertaken during drilling of the interval. This gas makeup was used to estimate the gas gravity and gas properties used in the Monte Carlo analyses. The lateral well has been cased and cemented in a configuration that will allow Armour Energy to perform further cased hole testing and stimulation in the well (**See Figure 12**).

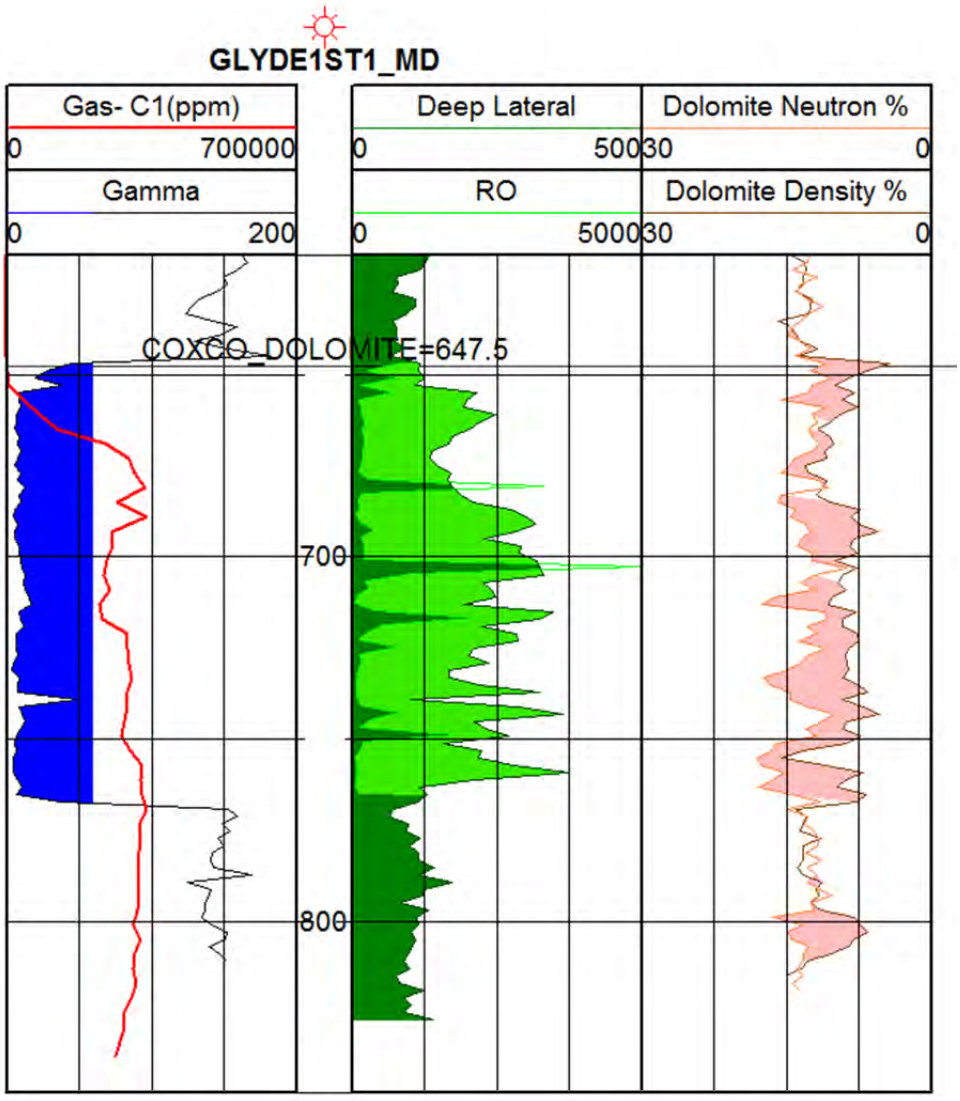

Figure 10: Glyde #1 ST1, measured depth log showing dolomitic density-neutron 'gas-effect' and associated gas kick at the top of the Breccia Coxco Member.

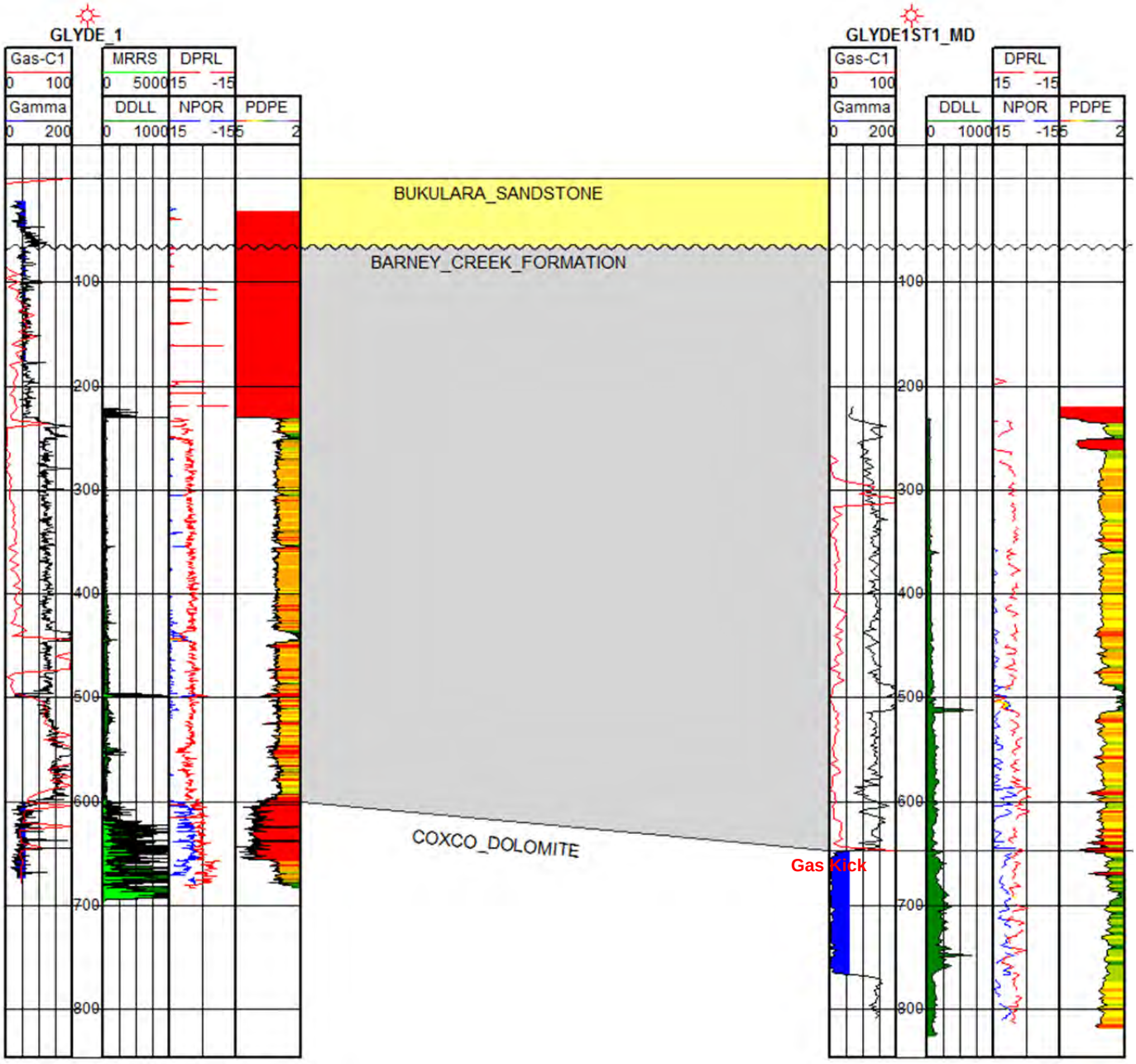

Figure 11: Glyde #1 and Glyde #1 ST1, measured depth cross-section and associated gas shows with 'hot' gamma readings in the Barney Creek Formation.

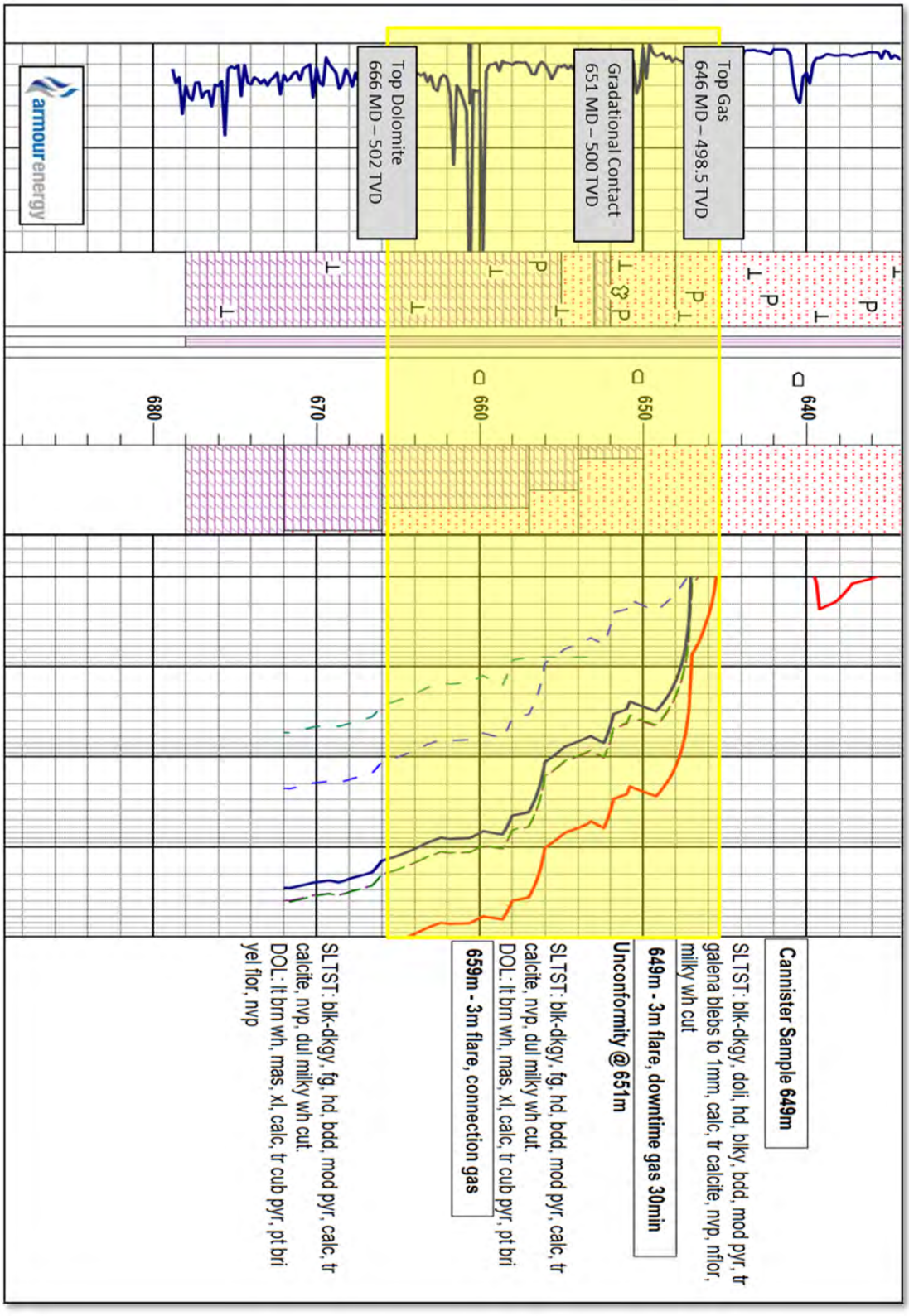

Figure 12: Glyde #1 ST1, major show interval on mudlog; first gas 10/08/2012 at 0530 hrs.

4.3.5. Trap integrity

The well penetrated a stratigraphic wedge of brecciated dolomite or dolomitic talus debris within the Barney Creek Shale. It is also suggested, because the well was horizontal and did not penetrate any deeper to identify additional formation changes, that the top of the Coxco Dolomite was penetrated and had been naturally hydraulically-fractured by circulating geothermal fluids along a structural weaknesses like that of the Emu Fault. A combination of both trap styles is also likely and additionally located around an up thrown horst block. This trap was sealing, had a sharp contact, charged with hydrocarbons and when penetrated immediately flowed gas to surface.

4.4. Discussion of the relevance of the Well Data to the Evaluation of the Hydrocarbon Potential of the Area

Estimate of Petroleum-in-Place, 'Glyde 1 Gas Accumulation', EP 171

In accordance with Part V- Drilling and Workover Operations, Division 2- Reporting and Data Submission, Clause 533- Discovery of Petroleum and Estimate-of In-Place Petroleum of the "Schedule of Onshore Petroleum Exploration and Production Requirements 2012" Armour Energy is submitting an Estimate of Petroleum-in-Place discovered at the 'Glyde 1 Gas Accumulation' in the 'Greater Coxco Field' of the Glyde Sub-Basin located in EP 171 that is based on the results of the Glyde #1 and Glyde #1 ST1 wellbores.

In addition to fulfilling the requirements of the Act with respect to reporting a discovery to the Minister from the 'Glyde 1 Gas Accumulation' in EP 171 and conveying in writing to the Director within three (3) months of the discovery date, Armour Energy has compiled under Clause 533, Sub-Clause 4- Part A, Error! Reference source not found. that identifies the location of the 'Glyde 1 Gas Accumulation' in the 'Greater Coxco Field' of the Glyde Sub-Basin.

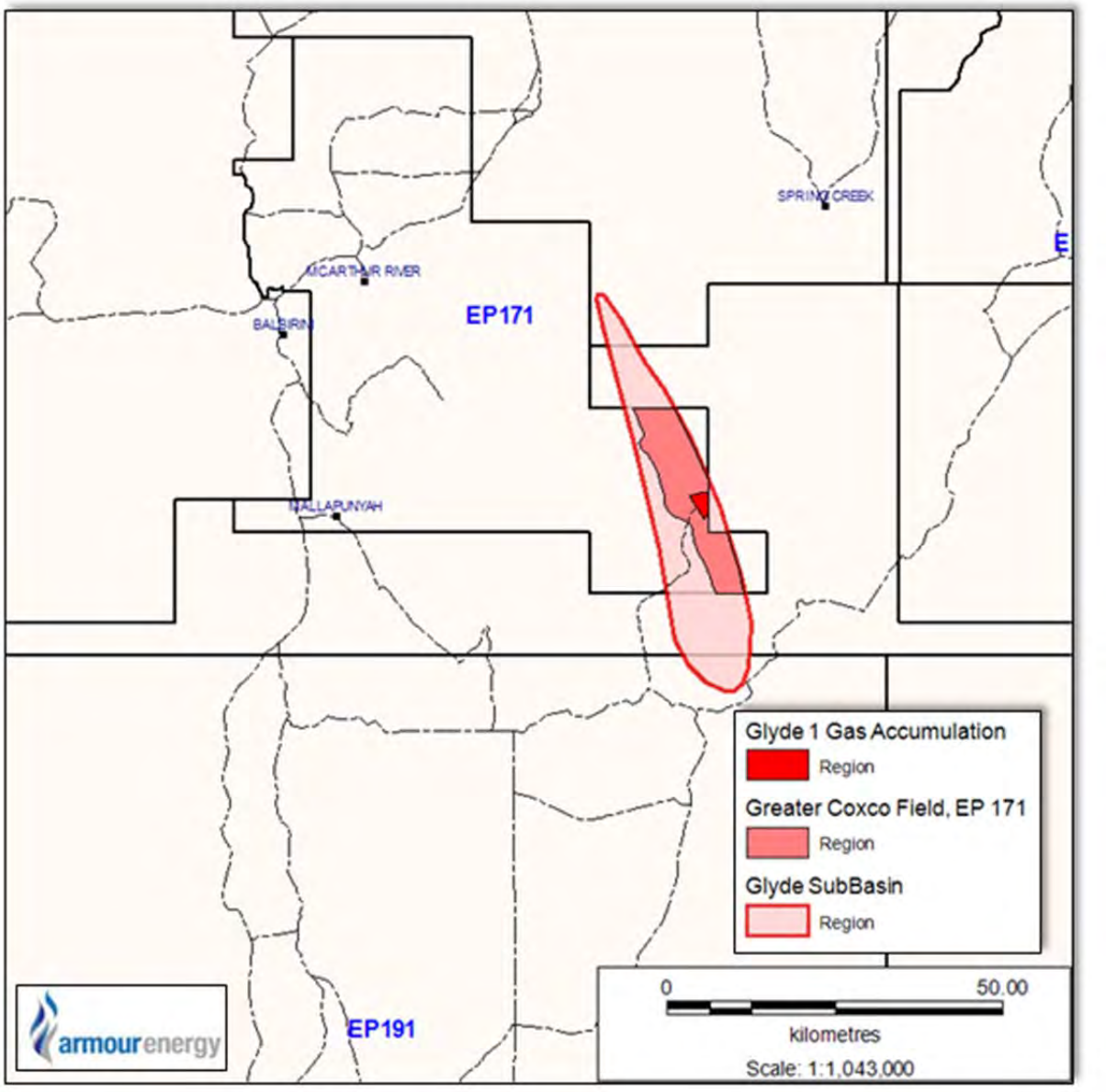

Figure 13: Location Map of the 'Glyde 1 Gas Accumulation' of the 'Greater Coxco Field' in the Glyde Sub-Basin.

Under Clause 533, Sub-Class 4- Part B, the quantity of gas-in-place in the pool by formation at the 50% and 90% probabilities is outlined in **Table 8**.

Table 8: Clause 553, Sub-Clause 4 "Probability Table 1". Part B- 'Glyde 1 Gas Accumulation'.

Formation	Area [km²]	GIP P-50	GIP P-90
Coxco Member, Teena Formation	7	7.84	3.36

Under Part C, the data upon which the estimate is based; the 'Glyde 1 Gas Accumulation' located in EP 171 covers a mean area of 7 km² and consists of a covered structural high that has an accumulation of gas around the Glyde #1 and Glyde #1 ST1 wellbores in the Coxco Member of the Teena Formation. The 'Glyde1 Gas Accumulation' was originally identified by the Amoco Mineral Hole GR 79-9 that reported gas to surface in 1979 and confirmed by Armour Energy with the Glyde #1 and Glyde #1 ST1 wells drilled in August 2012. Weatherford's Compact Shuttle geophysical logs from the Glyde #1 ST1 show density-neutron cross-over or 'gas-effect' associated with a substantial gas kick at the top of the Coxco, 646 m MD and 498 m TVD (**See Figure 10**).

Assumptions of the parameters used in the Monte Carlo simulation that derived 'Glyde 1 Gas Accumulation' P-50 & P-90 values are outlined in **Table 8**. The minimum and maximum values of the uniform and triangular distributions chosen were based on drilling data, micro-resistivity image logs, and petrophysical analyses of neutron-density and resistivity logs.

The Glyde #1 ST1 well flowed 606 thousand standard cubic feet per day equivalent (mscf/d) at 412 psi pressure, after 45 minutes of testing on a 16/64 inch choke from. A 30 minute, surface shut in, pressure of 554 psi was observed after flowing on a 16/64 inch choke. Then, after 10 minutes of testing with a full open choke of 64/64 inch, the Glyde #1 ST1 lateral well was flowing at 3.33 million standard cubic feet per day equivalent (mmscf/d) at a pressure of 125 psi. A picture of the well flowing in the Coxco Member is noted in **Figure 14**. Detailed analysis of this test is reported and noted in **Figure 5** of this report; these values were used to form the 'most likely' values in the Monte Carlo analysis where a triangular distribution was used.

Armour Energy has also defined a 'Greater Coxco Field' (**See Figure 13**), or a broader area around the 'Glyde 1 Gas Accumulation', that may have similar properties and thus prospective resources in the Coxco Member of the Teena Formation. The estimated mean prospective resource for the 'Greater Coxco Field' is noted as a larger area; however at this time Armour Energy is only able to report to the NTDME the GIP in the region around the discovery where a higher level of certainty exists. Further exploratory and appraisal drilling will be required to delineate this area into a larger "discovered" area or to advise on its expected commerciality.

Table 9: Reservoir Assumptions.

Variables		Units	Distribution	Data Source
Area	A	km^2	Uniform	Stratigraphy/Structure Mapping
Average Pay	H	meters	Triangular	Electric Logs, specifically the Image, Neutron-Density & Resistivity Logs; offset Amoco Mineral Holes
Matrix porosity	ϕ_m	fraction	Triangular	Electric Logs, specifically the Image, Neutron-Density & Resistivity Logs
Water Saturation of matrix porosity	Sw_{i-m}	fraction	Uniform	Electric Logs, specifically the Image, Neutron-Density & Resistivity Logs
Fracture porosity	ϕ_f	fraction	Uniform	Electric Logs, specifically the Image, Anisotropy, Neutron-Density & Resistivity Logs
Water Saturation of fracture porosity	Sw_{i-f}	fraction	Uniform	Electric Logs, specifically the Image, Anisotropy, Neutron-Density & Resistivity Logs
Initial gas expansion factor	Bg_i	Rbbls/scf	Uniform	Estimated Gas Composition from Gas Chromatagraph Readings
Initial gas expansion factor	Eg_i	scf/Rscf	Uniform	Estimated Gas Composition from Gas Chromatagraph Readings

Initial geological interpretations indicate a potentially larger structure of up to 163.6 km^2 in EP 171 with reasonable depth; stratigraphy and structure to the Glyde 1 Gas Accumulation, noted as the 'Greater Coxco Field' **(See Figure 15)**. The mean Prospective Resources for this area is 130.7 Bscf using the same parameters and assumptions as the 'Glyde 1 Gas Accumulation' and based on SPE-PRMS definitions.

Further appraisal drilling and testing is required before a more definitive discovery area or higher certainty in gas-in-place estimates can be made for the 'Greater Coxco Field', as this area defines a large volume of undiscovered resources. Thus, when any revision to the quantity of in-place-gas, resources, or data provided herein is revised, a report of these revised estimated results will be sent to the Director in accordance with Clause 533.

Figure 14: Glyde #1 ST1 gas flare at 756 mMD.

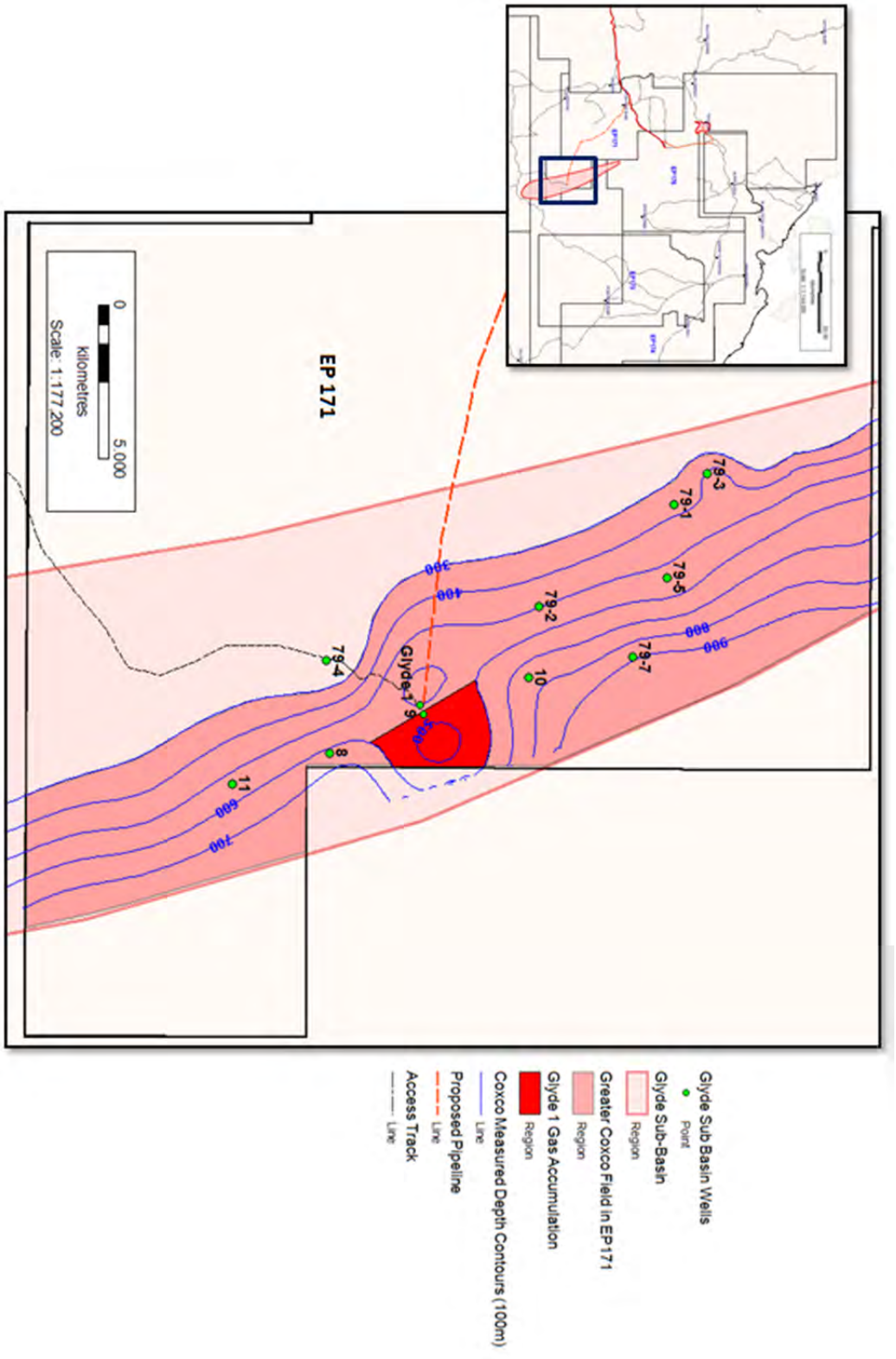

Figure 15: Location of the Greater Coxco Field in the Glyde Sub-Basin.