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## SUMMARY

EL 30613 is being explored for rock phosphate. The EL covers rocks intersected in waterbores near Singleton Station homestead which were previously interpreted by NuPower/Central Australian Phosphate to be prospective Cambrian carbonates and siltstones. During Year 1 of tenure, Rum Jungle Resources (as the company was then), undertook a detailed study of all available information on 14 waterbores in and near Singleton EL 30613. There are possibly up to five different aquifers in this area. Groundwater is present in modern creek alluvials, Cenozoic clastic rocks, various Cambrian Formations/lithologies with combinations of vuggy, fracture and clastic porosity, and in Proterozoic “basement” rocks. The study carefully considered whether the Cambrian target stratigraphy is above or below the standing water level. This led to the conclusion that the northwestern half of the original title, closest to the railway, was least prospective for Cambrian phosphate. There is little evidence that Cambrian rocks are even present in this area and, if they were, they would be below the watertable. An AAPA Register Search revealed five Recorded Sites each surrounded by relatively small Restricted Work Areas. Consequently, based on the waterbore study and no-go areas, 35 blocks were voluntarily relinquished from the original 56 within the first year of tenure. The southeast remains prospective based on three waterbores and this area still warrants drill testing. Drilling would be constrained by a CLC Cultural Site, but overall, sufficient area remains to justify a modest drilling program if undertaken in conjunction with other work in the nearby Ammaroo Project. No on-ground work was undertaken in Year 2. The area could be drill tested with only a few holes when funds become available.

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## INTRODUCTION

### *Location*

The Singleton Phosphate Project consists of the single EL 30613. It is located on the Bonney Well 1:250,000 sheets and Wauchope 1:100,000 map sheets, roughly equidistant between Tennant Creek and Barrow Creek. The centroid of the EL is 15 km northeast of the township of Wycliffe Well on the Stuart Highway.

Figure 1 and 2 are location maps of the Singleton Project.

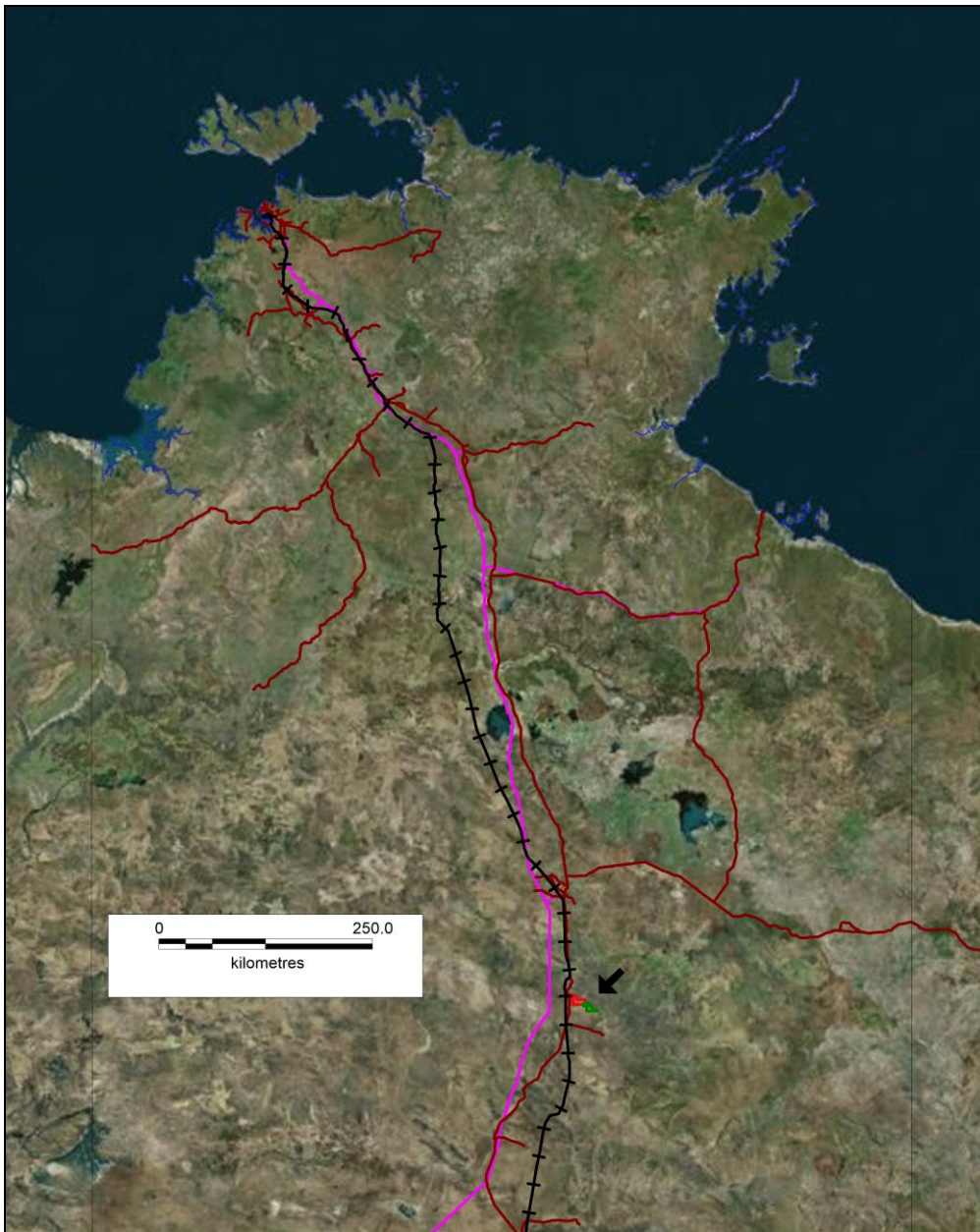


Figure 1. Location map of the Singleton Project (arrowed). Main roads (brown), gas pipeline (pink) and railway are shown. The area relinquished in Year 1 is shown in red.

## Access and Logistics

The project is close to the Central Australian Railway, the main north-south Stuart Highway and the gas pipeline. The project area can be accessed via the Stuart Highway thence via station tracks to the east (see Figure 6).

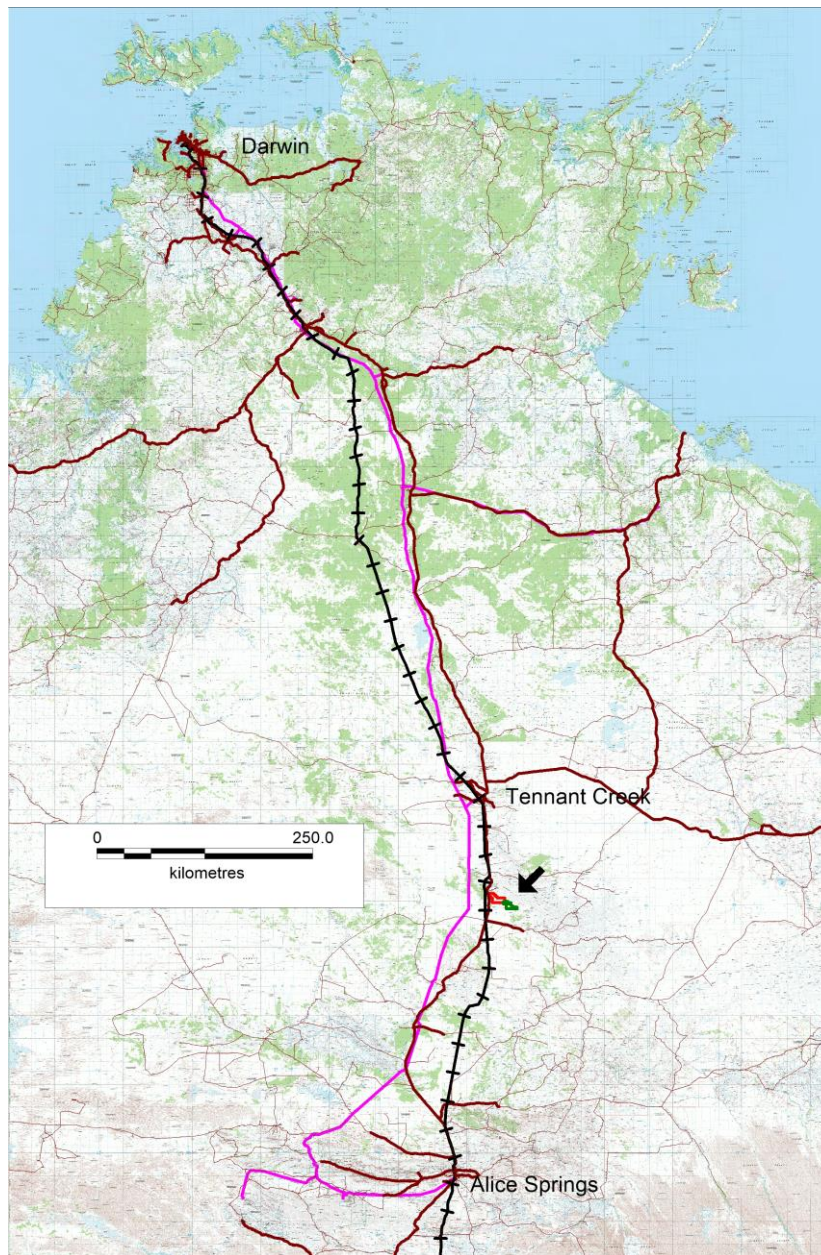


Figure 2. Access to the Singleton Project area (arrowed). Main roads (brown), subsidiary roads and tracks (red), gas pipeline (pink) and railway.

## Climate

The climate is described as arid tropical by Baker et al 2005. The year is notionally divided into two main seasons, a short, hot summer (December to March) featuring the bulk of the annual rainfall and a longer mild to cold and dry winter (June to October). These two dominant seasonal patterns are separated by shorter transitional periods. The summer rains are somewhat influenced by the monsoonal rain patterns from the north and particularly those troughs and cyclones which cross the West Australian coast. Overall, rainfall is highly variable and unpredictable and annual records range from 86.4 mm to 914 mm. As shown below, January 2007, much of 2010 and the start of 2011 were atypically wet (Figure 3). The end of 2016 and the beginning of 2017 were also unseasonably wet, but no BOM rainfall data are yet available.

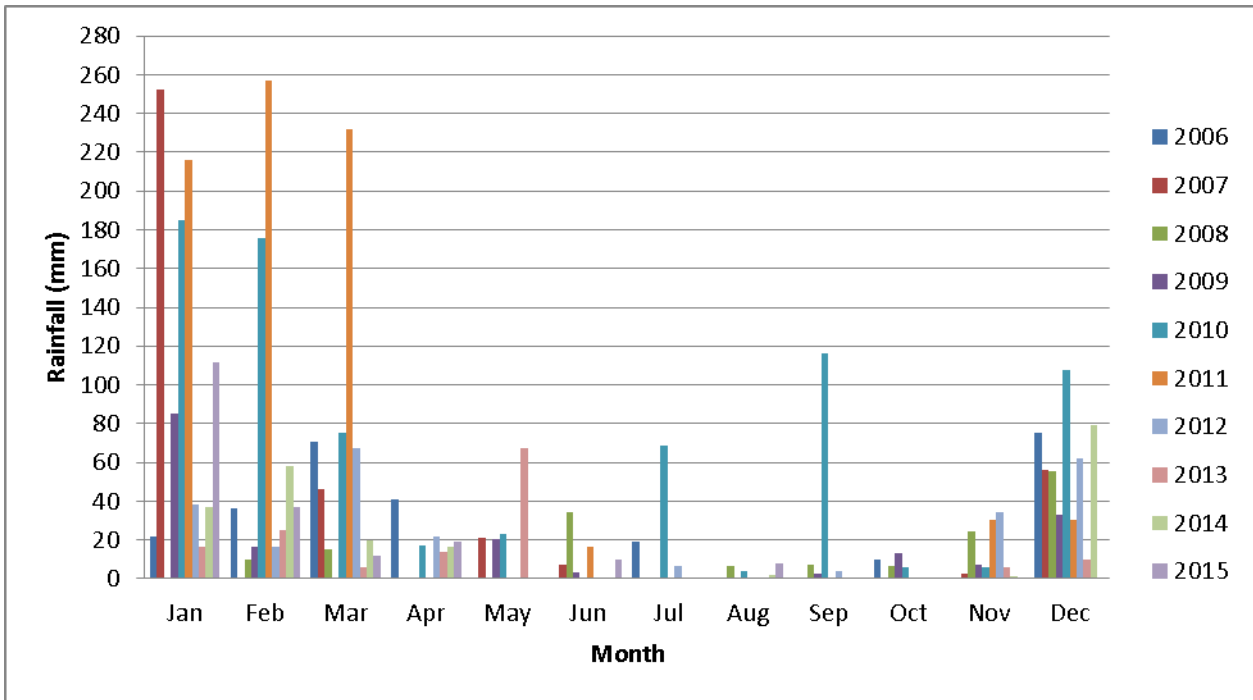


Figure 3. Average rainfall for the project area.

The average monthly relative humidity at 9 am (derived from the previous 16 years) fluctuates between 31 to 52 percent with an average of 42 percent (Error! Reference source not found.4). The average monthly relative humidity at 3 pm is about 11-21 percent lower than the 9 am recorded humidity.

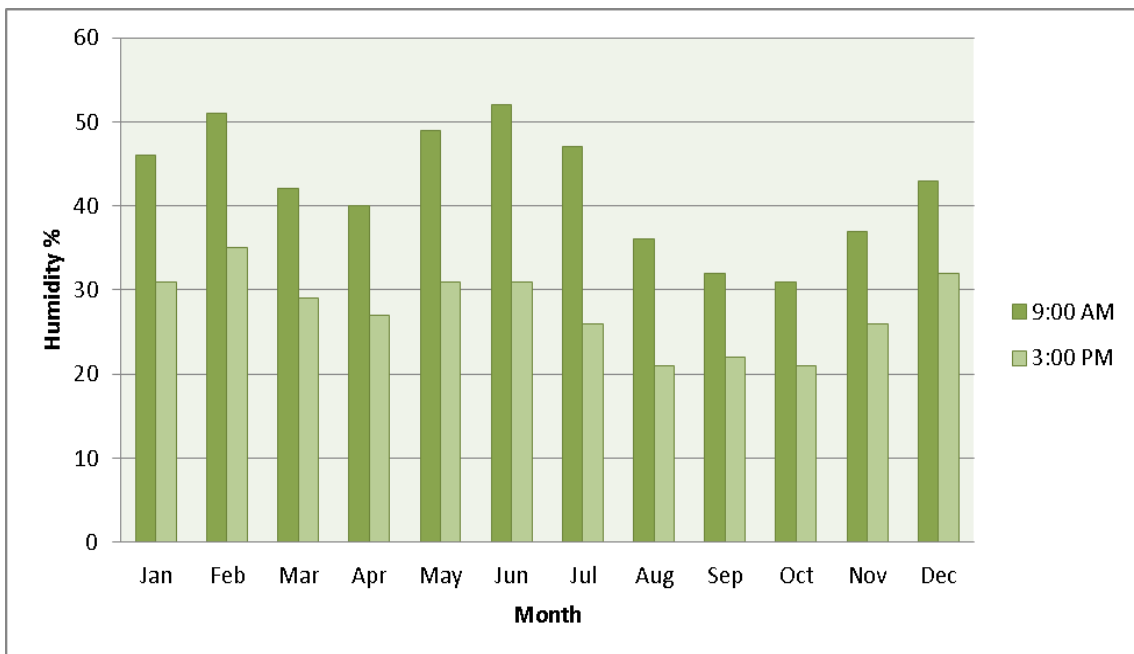


Figure 4. Mean monthly relative humidity (%) at 9am and 3pm at Ali Curung, NT (BOM 2015).

Average summer temperatures can fluctuate between 21 and 38 degrees Celsius and the winter temperatures can flux between 7 and 27 degrees Celsius. Sub-zero temperatures occur occasionally during July and August and there have been instances of surface water freezing at night. During the 2014 field season, maximum temperatures exceeded 40

degrees Celsius on several occasions. Figure 5 shows the mean monthly maximum and minimum temperatures recorded at Ali Curung from 1988 to 2014.

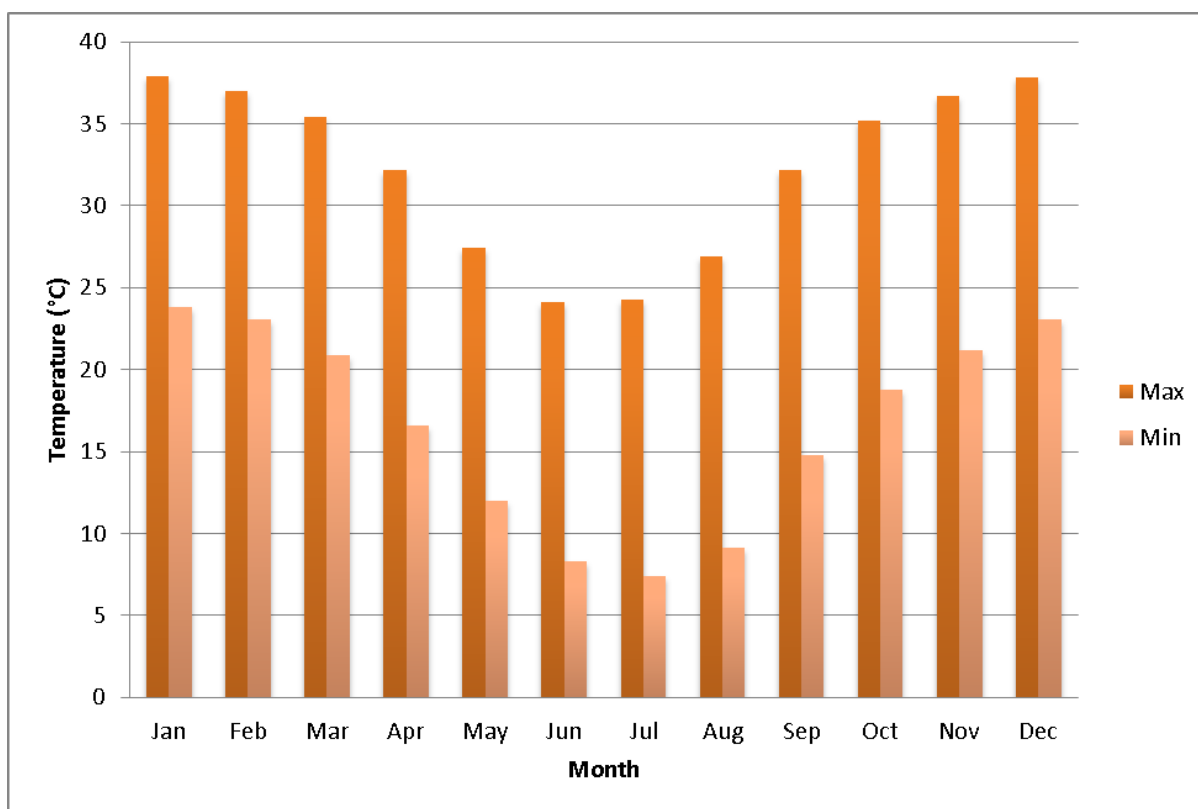


Figure 5. Mean maximum and minimum monthly temperatures (°C) at Ali Curung, NT (BOM 2015).

### ***Physiography, Land Systems, Flora and Fauna***

Figure 1 and 2 (previous) shows the physiography. The project is located in the Tanami Bioregion south of the Davenport Ranges. This bioregion is comprised mainly of red sand plains with underlying rock strata occasionally exposed as hills and ranges. The sand plains are vegetated with mixed shrublands of *Acacia*, *Eucalyptus* or *Hakea* over *Triodia* hummock grasslands. On the ranges, *Acacia* shrublands occur over hummock grasses. This bioregion contains many plant taxa that are endemic to the region or the Northern Territory and several flora and fauna species that are of conservation significance.

Using the system devised by Perry, the area contains two major land systems; the Alinga and Singleton. The Alinga Land System can generally be described as a system of undulating plains interspersed by low rounded ridges with shallow stony soils, red earths and red clayey sands. The land system is dominated by *Acacia aneura* (Mulga) or *Acacia georginae* (Gidgee) woodlands over short grasses and forbs. On shallow stony soils, sparse shrublands occur over *Triodia sp* (Spinifex). The Singleton land system includes red sands forming undulating plains and sand rises, separated by moderately wide, flat swales. Alluvial flats and drainage floors may also be present. Vegetation is dominated by sparse shrublands over *Triodia* (Spinifex), with *Acacia* woodlands also being present.

### ***Land Use***

EL 30613 is mostly on Singleton Perpetual Pastoral Lease. A small area in the southeast of EL 30613 is on Murray Downs Perpetual Pastoral Lease. Both stations run cattle.



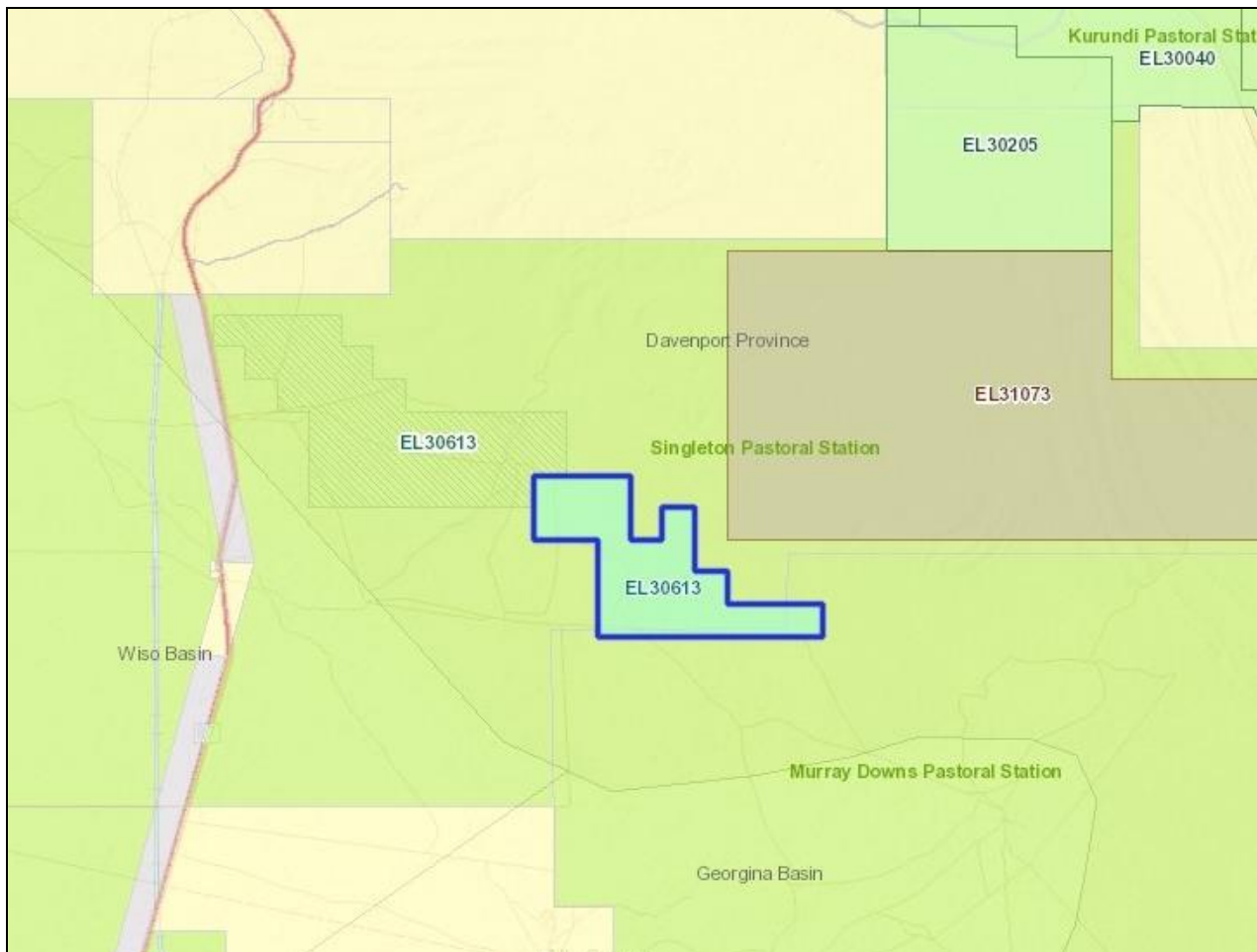


Figure 6. Cadastre over the Singleton Project area. Pastoral lease in green and Aboriginal Land in yellow. The area relinquished in Year 1 is shown in green hatching. Station tracks are also shown.

### ***AAPA Register Search for EL 30613***

An AAPA Register Search revealed five Recorded Sites each surrounded by relatively small Restricted Work Areas. All these are in area previously relinquished.

### ***CLC Sites***

As a result of previous work in the surrounding area, Verdant Minerals is aware of a large CLC area of restricted access, coincident with two of the AAPA sites. This CLC area impinges on the area previously relinquished.

### **HISTORY OF TENURE**

EL 30613 was applied for on 09/10/2014 and granted as 56 blocks, or 179.86 km<sup>2</sup>, on 15/06/2015. A partial relinquishment was undertaken before the first anniversary, reducing EL 30613 to 21 blocks.

### **EXPLORATION AND PROJECT RATIONALE**

Exploration is directed at locating Cambrian rock phosphate where it is shallow (low strip ratios), not entirely weathered (predictable rock properties amenable to mining), and highest grade and thickest (palaeo-coast and potentially draped over palaeo-highs) and above the watertable. Verdant Minerals' approach, which has worked successfully to date at the nearby Ammaroo Phosphate Project, is to initially undertake reconnaissance RC or aircore drilling on existing tracks and fences. Samples are analysed in the field with a handheld XRF and potential phosphate is sent for laboratory analysis. Depending on success, follow-up drilling usually involves cleared drill lines and/or grid drilling.

## GEOLOGICAL SETTING

EL 30613 is located near the “arch” that connects the Wiso and Georgina Basins. The latter contains the largest sedimentary rock phosphate deposits in Australia. The Wiso Basin also contains known phosphate deposits. Georgina Basin stratigraphic nomenclature is used in this report and includes rocks of Neoproterozoic to Devonian age, with Cambrian platform carbonate rocks dominating basin fill.

The southern Georgina Basin includes a thick sequence of Cambrian-Ordovician sediments, deposited within the Dulcie Trough and on the adjoining Elkedra Shelf. Work by previous explorers and NTGS identified an extensive area of shelf-facies marine carbonate and clastic sediments of the Middle Cambrian Arthur Creek Formation within the southern Georgina Basin (Figure 7). This area is prospective for sedimentary phosphate mineralisation.

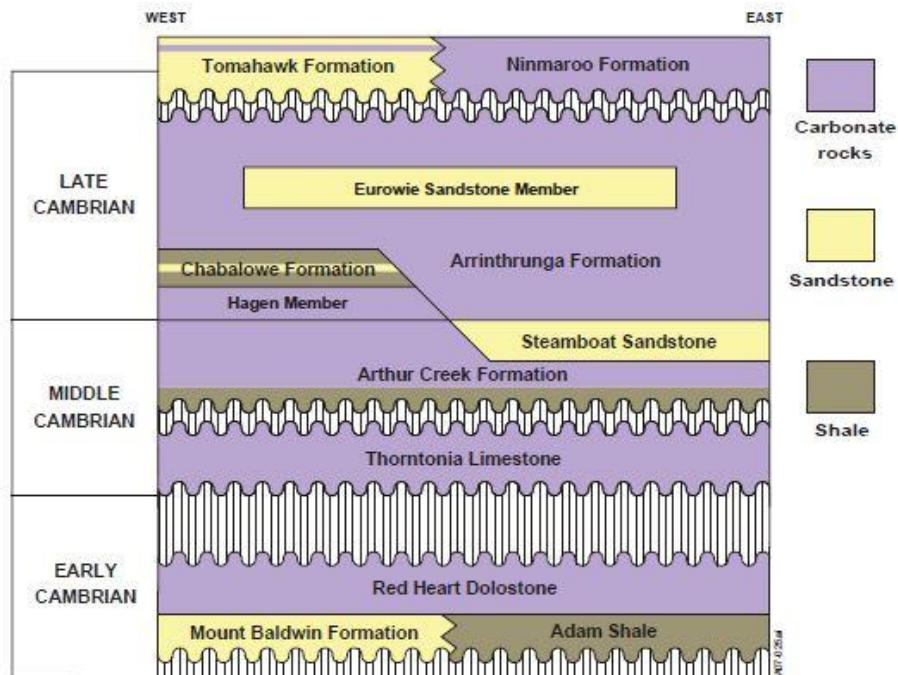


Figure 7. Simplified Cambrian lithostratigraphy of the southern Georgina Basin, from NTGS.

### ***Local Geology and Prospectivity***

The local published geology of EL 30613 is shown below.

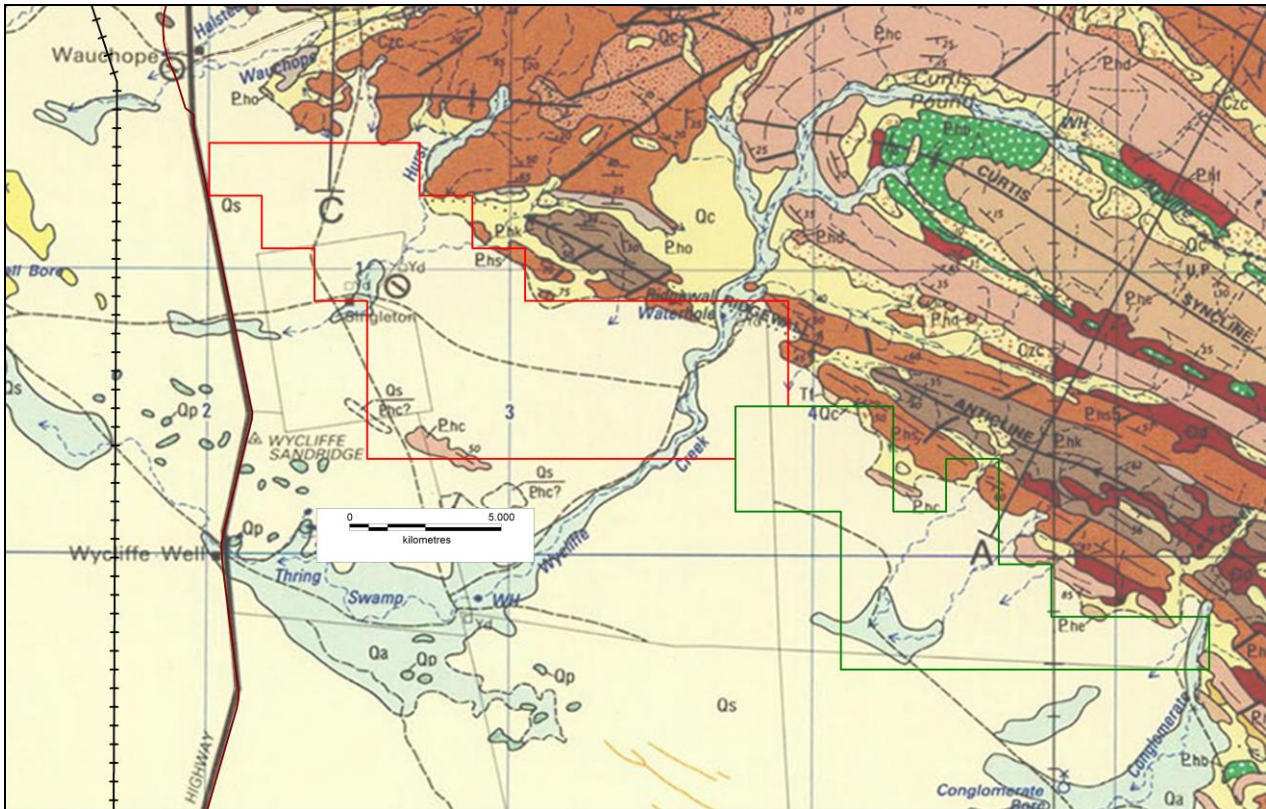


Figure 8. Geological map of EL 30613. Based on published geology

Several lithostratigraphic formations in the southern Georgina Basin contain very similar carbonate, mixed carbonate and siliciclastic packages and recessive shale units that can be very difficult to tell apart. In particular, it has long been recognised that the Thornton Limestone, Arthur Creek Formation (in the sense as used by NTGS in 2007), contain basal high-TOC shales and phosphatic intervals. The Red Heart Dolostone (former Errarra formation) is also thought to host phosphate at the Patanella Prospect on the other side of the basin. It could be almost impossible to tell these apart without some other form of stratigraphic control. Difficult as it is even with core and other datasets, it is impossible in shallow percussion holes drilled under cover with no other geological reference, as is the case for exploration holes over most of this area. Furthermore, drilling is targeting the shallowest phosphate meaning that the phosphatic rocks and any basement rocks intersected are almost always deeply weathered. Any carbonate rocks that might be present have been weathered and leached to the point of appearing to be a clastic rock in percussion drill chips.

There is no chronostratigraphic control on the stratigraphy in the project area.

Biostratigraphic control is not available for all units mapped or even for all cored drillhole intercepts. Where such biostratigraphy is available, it is sometimes done on disparate faunas (trilobites vs brachiopods) and previous biostratigraphic correlations of key drillholes in the project area are debatable. The most recent biostratigraphic correlations in the NT are by John Laurie at Geoscience Australia. Based on his work the oldest to youngest units are: the Thornton Limestone which is thought to be Ordian; the Arthur Creek Formation Templetonian to Undillian, and the Chablowe Formation to be Boomerangian to Mindyallan. However, lithostratigraphic units can be diachronous and probably could be expected to be so, especially when correlating the large distance from NT to Qld. Faunas can also be dependant on basin-edge facies changes which are particularly complex in the Ammaroo Project area. A typical facies mosaic probably existed here during the Cambrian in which lithostratigraphic mappable units such as basal transgressive clastics, beach sands, evaporitic subaerially-exposed mixed carbonate/siliciclastics, shallow water marine carbonates and deep water shales all existed simultaneously.

Petroleum explorers have traditionally relied on lithostratigraphic gamma log correlations tied to seismic sections, but many of the key cored holes have no gamma logs and there is little seismic coverage of the project area. Recently,

isotope stratigraphy and hydrogeology data have been acquired for some cores, but not all the information is in the public domain yet. That data which is available seems to only add additional complexity to an already confusing lithostratigraphy.

The published 1988 NTGS geological maps and explanatory notes contain numerous examples of mismatched and misassigned stratigraphy. This is particularly true of the Elkedra 250K mapsheet on which the previously mapped Tomahawk beds have been completely reassigned to several other formations. The mapped Errarra Formation is actually Red Heart Dolostone and a carbonate unit variously assigned to the Arthur Creek Formation and Tomahawk beds is now thought to be Thornton Limestone which had not been recognised on the mapsheet previously. The outdated published map also shows the Chabalowe Formation as being partially laterally equivalent to all of the Arthur Creek Formation and the lower Arrintringa Formation, whereas the actual Chabalowe Formation is only laterally equivalent to the Arrintringa Formation not the Arthur Creek Formation. The Chabalowe Formation *can* directly and conformably overlie the Arthur Creek Formation, but they are distinctly different ages. To further complicate things, Geoscience Australia has found that the Thornton Limestone in NT is a different age to that in its type area in Queensland. Thus, what was recognised as Thornton Limestone in the project area might be more correctly Hay River Formation or its equivalent with another name. This change is yet to be reflected on any maps or publications, or indeed even be accepted by Geoscience Australia itself.

Much of EL 30613 is under Cenozoic cover up to tens of metres thick being shed as palaeochannels from the Proterozoic ranges. There is no Cambrian rock outcrop and only rare Proterozoic outcrop.

## LOCAL STRUCTURAL SETTING

The EL occupies a trough within a Phc basement syncline (see Figure 8). Those rocks dip 50 degrees to the northeast on the southern edge of the EL and 55 degrees to 75 degrees towards the southwest on the northern edge of the EL. Many of the waterbores discussed in the Year 1 annual report occupy the deepest portion of the trough.

## NTGS WATERBORE STUDY AND RE-INTERPRETATION

An NTGS waterbore study (Khan 2005) reported RN006257 at Wycliffe Well intersected 3 m at 2.2% P<sub>2</sub>O<sub>5</sub> from 3 m depth. This was assigned to the Cambrian by NTGS. Rum Jungle Resources subsequently held tenure over the area. After the physical locations and logs of nearby bores RN000437, RN006443, RN015244, RN15245 and RN 015175 were examined and the nearby area drill tested, Rum Jungle Resources concluded that the NTGS interpretation is suspect and that the reported P<sub>2</sub>O<sub>5</sub> is not an indicator of potentially economic Cambrian phosphate. This area is no longer considered prospective by Rum Jungle Resources / Verdant Minerals and is not discussed further in this report.

## WORK BY NUPOWER / CENTRAL AUSTRALIAN PHOSPHATE

NuPower originally considered the area prospective for Cenozoic-hosted uranium. During their research, they identified what they believed to be Cambrian rocks intersected in waterbores near Singleton Station homestead. These Cambrian rocks were not considered prospective for uranium and initially ignored. However, after NuPower became Central Australian Phosphate and switched target commodities, the Cambrian rocks were reappraised and considered prospective for phosphate. Central Australian Phosphate did not drill test them.

## WORK IN YEAR 1 - RUM JUNGLE RESOURCES WATERBORE STUDY

### Waterbore Study and Interpretations

During Year 1 of tenure, Rum Jungle Resources undertook a comprehensive in-house study of 14 waterbores in, and near, Singleton EL 30613. Driller's logs, Water Resources' data and interpretation and gamma logs were used. The results were presented in detail in the first annual report. In summary, there are possibly up to five different aquifers in this area. Groundwater is present in Cenozoic clastics, various Cambrian lithologies with combinations of vuggy, fracture and clastic porosity, and in Proterozoic "basement" rocks. The study carefully considered whether the target stratigraphy is above or below the standing water level. On this basis, some areas were determined to be less prospective and were subsequently relinquished.

