Partial relinquishment report on EL 28205, Karinga Lakes Potash Project

Authors: John Dunster

Corporate Author: Rum Jungle Resources Ltd

Target Commodity: Potash, schoenite

Date of Report: 30/01/2015

Datum/Zone: GDA94/ Zone 52

250K map sheets: Ayers Rock SG5208

100K map sheets: Curtin 5247

Address: PO Box 775, Darwin NT 0801

Phone: 8942 0385

Fax: 8942 0318

Contact Email: jdunster@rumjungleresources.com.au

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SUMMARY
EL 28205 is one of several contiguous ELs and ELAs in Rum Jungle Resources’ Karinga Lakes Potash Project. The project is targeting potassium- and magnesium- sulfate-salts in subsurface salt lake brine to eventually produce potassium sulfate (SOP) and potassium magnesium sulfate (schoenite) fertiliser probably using staged solar evaporation in ponds and flotation in an onsite plant. The project has a JORC 2012 brine potash resource of 8.4 million tonnes K\textsubscript{2}SO\textsubscript{4} including over 70% in the Measured and Indicated category. This is equivalent to 19 million tonnes of schoenite. The Karinga Lakes Brine Potash Project has advanced beyond exploration with the results of the scoping study announced recently. The mandatory reduction of EL 28205 has resulted in the surrender of 20 sub-blocks on which there has been no on-ground work by Rum Jungle Resources.
LOCATION, PHYSIOGRAPHY AND LAND USE

Location
EL 28205 is located in semi-desert country 280 km southwest of Alice Springs and 34 km northwest of Gosses Bluff on the Ayers Rock 1:250 000 map sheet (Figure 1). It is the western-most EL in the project.

Access and Logistics
Access to EL 28205 is from the Lasseter Highway which runs east-west through the project area and south of the EL (Figure 2, 3). The EL is also serviced by numerous station tracks and exploration tracks maintained by Rum Jungle Resources. The Main North Road is a station track running north from Curtin Springs Roadhouse (Figure 3). Curtin Springs Station and roadhouse was used as a logistic base as was Rum Jungle Resources’ transportable donga camp located in the south of the project area. The camp has now been removed.

Lake access for the overall project requires specialist equipment. It was necessary to purchase tracked AWD amphibious vehicles and a trailer all with a ground footprint of less than one psi. Hovercraft, helicopter support and equipment lift were also used extensively. In other cases, tracked equipment such as a rig and compressor mounted on morooka crawler carriers were moved on the lakes by driving on supamats.
Climate
The climate is classified as semi-arid with long hot summers and relatively mild winters. A feature of the winter months is the marked diurnal fluctuations in temperature, which can range from sub-zero overnight to mid twenties (°C) or higher during the day. Daytime summer temperatures rarely fall below 30°C and there are often long periods with days in excess of 40°C. On the salt lakes themselves, temperatures can be even higher because of reflected heat. The temperature controls what suite of evaporite minerals are produced by solar evaporation with a different product mix anticipated summer and winter.

The average rainfall is about 250-300 mm, most of which falls in the mid to late summer, and the average annual evaporation is 3,000-4,000 mm.

Land Systems, Flora and Fauna
Several flora and fauna studies have been undertaken and reported under the Mining Management Act.

Habitation and Land Use
EL 28205 is on Curtin Springs pastoral station which runs cattle (Figure 4). This is the only land use of the EL.
Apart from the pastoral stations, the nearest points of habitation are Aboriginal communities, the largest of which is Imanpa (population between 180 and 250), 7 km north of the Lasseters Highwya and about 17 km from Mt Ebenezer Roadhouse which is owned and run by the community. The community is predominantly Pitjantatjara and Yankunytjara although Walpuri, Luritja and Arrernte people also live there. The community is split into three camps, the bottom, the middle and the top camp. The bottom and the middle camps are for Anangu and the white staff who work in the community live in the top camp. Imanpa has a clinic which was built in 1986 and one registered nurse with an ambulance.

Heritage Sites
A search of the NT Heritage Register held by NRETAS shows no Declared Heritage Sites in the area covered by this report. Individual archaeological surveys have also been conducted elsewhere in the project by specialist contractors on behalf of Rum Jungle Resources and have been reported under the Mining Management Act.

On-Country Meeting
On 13 November 2014, an on-country courtesy meeting was held with Traditional Owners and the Central Land Council at Imanpa to discuss the overall Karinga Project.

MINING MANAGEMENT ACT
The Karinga Lakes Project is being worked under DME Authorisation 0565-02 and the associated MMP. The MMP for 2014 field work covered only track clearing and the drilling of monitoring bores. DME referred this MMP to the EPA and a second MMP had to be written. Very little on-ground work was undertaken in 2014 because the project had advanced beyond the exploration phase.

HISTORY OF TENURE
EL 28205 was applied for on 05/08/2010 and was granted on 09/03/2011 for a period of six years. It covered 39 sub-blocks or 121.17 km². It had not been reduced prior to this relinquishment. EL 28205 was jointly owned 50%:50% by Rum Jungle Resources and Reward Minerals, but operated by Rum Jungle Resources. The JV has now been rationalised with Rum Jungle Resources buying out the remaining proportion held by others. Upon completion of the dealings, EL 28205 was transferred 100% to Rum Jungle Resources.
GEOLOGICAL AND HYDROGEOLOGICAL SETTING

EL 28205 overlies the southwestern sector of the Amadeus Basin in the Northern Territory. The Amadeus Basin covers approximately 150,000 km² and extends into Western Australia. It is comprised of a Neoproterozoic to mid-Palaeozoic succession of predominantly shallow marine sedimentary rocks and attains a thickness of up to 14,000 m. The siltstones of the central Amadeus Basin have weathered into a modern topographic low. This depression contains a chain of Cenozoic playa salt lakes. Quaternary sand dunes, up to 30 m high, encroach onto the depression. The dunes are mostly vegetated and stable. The playas presently occupy only the lowermost topographic depressions in swales between dunes. Quaternary calcrite and silcrete duricrusts (of vadose origin) are characteristically superimposed on Amadeus Basin outcrops, forming escarpments, several metres high along the margins of some of the playa lakes. Low-relief gypsum-sand “islands” are also present in some of the playas.

The sediments in the modern playa lakes and parts of their palaeo-drainages contain brines formed by the evaporation of surface and near-surface water from infrequent and largely unpredictable rain and flooding events and, most importantly, from groundwater discharge in the Central Australian Groundwater Discharge Zone as described below.

![Figure 5. Regional view of the Central Australian Groundwater Discharge Zone](image)

Figure 5. Regional view of the Central Australian Groundwater Discharge Zone (outlined in light blue) running from Lake Hopkins in WA through to Karinga Creek, nearest the railway. The blue arrows indicate sub-surface flow. Rum Jungle Resources Ltd and JV titles are shown in green.
The Devonian Horseshoe Bend Shale forms low mesas around many of the lakes and constitutes the lake “floor”. Where it is fractured and/or deeply weathered, the Horseshoe Bend Shale is a brine aquifer in its own right; being the local discharge point for the Central Australian Groundwater Discharge Zone. It is hydraulically connected to the brine in the modern lake sediments. The Horseshoe Bend Shale was/is evaporitic, containing sulfate and chloride evaporites. It also contains locally abundant detrital biotite. The evaporites have been leached out over geological time and have almost certainly contributed to the brine, both within the shale and within the lake sediments. These migrating brines have also liberated additional potassium from the weathering biotite. Furthermore, there is good evidence, based on seismic interpretation, that Amadeus Basin Gillen / Bitter Springs Salt diapirs are sufficiently close to the surface to have affected the Central Australian Groundwater discharge.

**EXPLORATION AND PROJECT RATIONALE**

The Karinga Creek salt lakes and sub-surface aquifers are being explored for potassium- and magnesium-rich sulfate brines as part of Rum Jungle Resources’ Karinga Creek Potash project. It is hoped to produce potash and/or schoenite fertiliser by simple staged solar evaporation and flotation and/or other onsite treatments.

Australia has no producing potash mines. Around 350,000 tonnes of potash is imported into Australia annually from Canada and is worth around $200 million. Potash of sulfate and schoenite are utilised as high-end fertiliser products globally, as they have a lower salt index than muriate of potash and are often preferred in crops sensitive to chloride or susceptible to fertiliser burn. Sulfate of potash and schoenite attract premium pricing in comparison to the more common muriate of potash. The Karinga Creek Salt Lake Project is strategically well located adjacent to the Lasseter Highway and within close proximity of the Central Australian Railway line, providing access north to the port of Darwin and proximity to Asian markets and south to domestic markets.
On 20/02/2104, the Karinga Lakes brine potash resource estimate was increased to a total of 8.4 million tonnes $K_2SO_4$ including over 70% in the Measured and Indicated category. This is equivalent to 19 million tonnes of schoenite.

<table>
<thead>
<tr>
<th>Resource Category</th>
<th>Potassium (tonnes)</th>
<th>$K_2SO_4$ (tonnes)</th>
<th>Schoenite (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured</td>
<td>2,600,000</td>
<td>5,800,000</td>
<td>13,000,000</td>
</tr>
<tr>
<td>Indicated</td>
<td>210,000</td>
<td>460,000</td>
<td>1,100,000</td>
</tr>
<tr>
<td>Inferred</td>
<td>950,000</td>
<td>2,100,000</td>
<td>4,900,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,800,000</strong></td>
<td><strong>8,400,000</strong></td>
<td><strong>19,000,000</strong></td>
</tr>
</tbody>
</table>

Table 1. Karinga Lakes Brine Resource (entries have been rounded).

The Karinga Lakes Potash Resource is a brine-hosted resource. The potassium is dissolved in brines that are contained in aquifers below the dry salt lake surface. The JORC code was not designed for use in connection with minerals that are dissolved in brines. It is generally accepted that geological uncertainties are greater when dealing with the estimation of brine resources.

The sulfate of potash tonnage represents the in-situ brine with no recovery factor applied. It will not be possible to extract all of the contained brine by pumping of trenches; the amount which can be extracted depends on many factors including the permeability of the sediments, the drainable porosity, and the recharge dynamics of the aquifers.

Brine is hosted within two stratigraphic units:
- Modern lake bed sediments
- Devonian weathered siltstone of the Horseshoe Bend Shale

Potassium tonnage was calculated individually for each stratigraphic unit at each lake. Potassium tonnage was calculated as:

- Bulk volume x porosity x brine concentration.

Ordinary kriging interpolation was used for resource estimation at a cut-off of 3,000 mg/L potassium. The average potassium grade of the lakes using this cut-off is 4,760 mg/L.

Porosity values were assigned to each stratigraphic unit on the basis of measured porosity in 142 samples obtained from the 2013 sonic drill core samples. 71 porosity samples were sent to E-Precision laboratory in Perth and 71 porosity samples were sent to the British Geological Survey Hydrogeological Properties and Processes Laboratory in Wales. Median porosity values for each stratigraphic unit were determined as follows:

- Modern lake bed sediments – 33%
- Devonian Horseshoe Bend Shale – 36%

The total resource is contained beneath 25 lakes with a total area of 132 km². The average thickness of the identified resource is 17 m.

The potash brine resource is based on data acquired over four years, including:
- 93 brine samples from hand dug pits
- 4 small backhoe trenches which were pump tested
- 8 vibracore drill holes
- 73 sonic drill holes
- 200 aircore drill holes
- 42 installed 50 mm piezometers around drill holes and 48 piezometers around trenches
- 47 installed 100 mm wells
- 10 pumping tests from 100 mm wells
- 4 long term pump tests from 3 trenches and a well
- 142 porosity samples

The brine resource has been estimated by Ben Jeuken, consulting hydrogeologist from Groundwater Science Pty Ltd. The full JORC 2012 Resource Statement, the ASX announcement and all the relevant JORC reporting tables have been previously submitted to DME.
SCOPING STUDY

The Karinga scoping Study was announced 14 December 2014. A review of the extractable brine resource, chemical composition and processing analytics, process flow sheet design, mass balance work and general brine extraction and processing facility layout was completed by China International Chemical Consulting Corporation (CICCC). GHD Australia completed estimates of Australian capital and operating costs, based on the CICCC design. Baseline regional market studies for both sulphate of potash and potassium magnesium sulphate were also conducted.

Two development scenarios were studied to a scoping study level of accuracy (+/- 40% capital and operating costs):

**Scenario 1**
- 125,000 tonnes per annum of sulphate of potash (SOP) for a minimum of 10 years of production. 75% of the in-situ potash brine resource is in the Measured and Indicated JORC (2012) categories.

**Scenario 2**
- 100,000 tonnes per annum of potassium magnesium sulphate (schoenite) for a minimum of 15 years of production. For scenario 2, it is considered that there are sufficient recoverable brines in the known in-situ resource and without recharge to support the 15 year operation envisaged.

Schoenite is an intermediate product of the sulphate of potash process. Scenario 2 is approximately one fifth the size of scenario 1 and represents the potential to develop a small scale start up, using a smaller number of lakes thus decreasing the environmental footprint and significantly lower energy usage due to lower volumes of brines being pumped smaller distances and avoiding the need to create steam that is used to convert schoenite to SOP.

The following table summarises the scoping study level economic assumptions for the project:

<table>
<thead>
<tr>
<th></th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOP Sold</td>
<td>125,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Schoenite Sold</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Life</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Estimated wholesale market price</td>
<td>$700-$800</td>
<td>$400-$450</td>
</tr>
<tr>
<td>Estimated operating costs including transport</td>
<td>$300-$370</td>
<td>$140-$160</td>
</tr>
<tr>
<td>Estimated Total Capex Contingency included in Total Capex</td>
<td>340</td>
<td>93</td>
</tr>
<tr>
<td>$/t</td>
<td>50</td>
<td>14</td>
</tr>
<tr>
<td>$AM</td>
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</tr>
</tbody>
</table>

Table 2. Summary of Scoping Study results.

The Opex range provided in the table above is determined by the gas supply scenario. The upper bound is when gas is delivered by CNG from Alice Springs and the lower bound assumes gas supplied via pipeline from emerging regional production. In order to take one of the development scenarios forward to a bankable feasibility study, it will be necessary to secure funding through the establishment of a joint venture. As previously announced to the ASX, Flagstaff Partners have been engaged to facilitate a formal investment process.

PREVIOUS EXPLORATION AND WORK BY OTHERS

There is very little previously documented mineral exploration over what is now EL 28205. In the early 1980s, Uranez Australia drilled their CS series of shallow holes looking for uranium on EL 3468. Ten holes to a maximum of 20 m plot within the area being relinquished. These holes were away from the modern lakes and drainages and of little relevance to potash exploration. Petroleum exploration in the area is also of little relevance to the potash search, although seismic
lines have been checked looking for basement fracture zones. Water Resources have drilled some holes looking for fresh water.

**BLOCK DESCRIPTION OF AREA BEING RELINQUISHED**

The sub-blocks being relinquished are outlined in the pink polygon below.

![Figure 7. Block ID map of area being relinquished (outlined in pink). Note that there is no Rum Jungle Resources drilling or other sampling plotting within the area being relinquished.](image)

**WORK ON THE AREA RELINQUISHED BY RUM JUNGLE RESOURCES**

Rum Jungle Resources has not undertaken any on-ground work on the 20 sub-blocks being relinquished. They are outside the area of the defined JORC resource, but had been included in a watching brief on possible energy developments in the area.

**CONCLUSIONS AND RECOMMENDATIONS**

The Karinga Lakes Brine Potash Project is currently advanced beyond exploration with the scoping study already announced. The mandatory reduction of EL 28205 has resulted in the surrender of 20 sub-blocks on which there has been no on-ground work by Rum Jungle Resources.