Fingerboards Mineral Sands Project Inquiry and Advisory Committee
Technical note

TN No: TN 020
Date: 17 May 2021

Subject: Fingerboards project feasibility with centrifuges

The EES (at 2.3.3) stated that, based on prevailing prices, the ore has an estimated value of A$27 per tonne, well above the total operating cost of A$13.50 per tonne of ore.

This document provides an update to that statement that is consequential on the introduction of centrifuges and the deletion of the fine tailings storage facilities.

A summary of the results reported in the EES and a summary of the results consequential on the introduction of centrifuges is provided below.

1 Summary of project financials presented in the EES

Revenue per tonne	AUD 27.00 / t Ore
Cost per tonne	AUD 13.50 /t Ore

2 Adjustments due to the introduction of the centrifuges on the financial analysis

2.1 Capital Costs

Capital costs impact is the net difference between the estimated cost of the fines tailings TSFs and their associated infrastructure and the estimated cost of centrifuge buildings, equipment and their associated infrastructure.

Capital cost of TSF removed	AUD (17.9) Million
Capital cost of centrifuge plants	AUD 30.2 Million
Net Capital Change	**AUD 12.3 Million**

2.2 Operating Costs

Operating cost impact changes are described in sections a) and b) below. For ease of comparison, all costs have been calculated to an equivalent cost of AUD/tonne ore. The relative maintenance cost of both the centrifuges and the TSF's have not been included as they are a comparatively small portion of the operating cost.

(a) TSF case (EES)

Amphirol tailings dewatering cost (plant, labour, fuel)	AUD 0.38 /t Ore

(b) Centrifuge case

Power consumption	AUD 0.34 /t Ore
Flocculant consumption	AUD 0.27 /t Ore
Fines cake load and haul	AUD 0.25 /t Ore
Overburden haul distance reduction	AUD (0.43) /t Ore
Net Operating Cost - Centrifuge	**AUD 0.43 /t Ore**

Relative Operating Cost Increase - (b) minus (a) **AUD 0.05 / t Ore**

It can be seen that the reduction in overburden haul cost is the main financial impact resulting from the introduction of the centrifuges and largely offsets the additional flocculant and power costs. This can be attributed to the fact that the annual overburden haul task is 23.6 Million tonnes (wet) against a fines handling task of 3.4 million tonnes (wet).

It should be understood in the context of the overall project operating cost, that the changes to the cost of processing is a relatively minor contributor to the project's financial viability. Operating cost can be apportioned as shown in Table 1:

Table 1 -Operating Cost Breakdown

Operating Cost Category	% Contribution
Logistics costs	28%
Mining Costs	47%
Processing Costs	12%
Other Costs	12%

It can be seen from the above that the operating costs are dominated by mining and logistics and therefore any optimisation of the mining process is likely to dominate the overall financial impact. Even if the processing operating cost were to increase by 50%, the impact would only be a 6% increase on the overall operating cost. Based on the earlier assessment the nett increase is only 0.05 AUD of a total operating cost of 13.50 AUD / t Ore, which represents less than 1% change. This is within the accuracy of the estimate.

3 Product Pricing and Sensitivity

The project as exhibited in the EES is based on a set of commodity prices estimated during 2018 at the times of preparing the EES. These are shown in Table 2.

Table 2 – Adopted Mineral Prices

Mineral	USD/t CIF 2018
Zircon	1,485
TREO	3,700
TiO2 (rutile)	1,140
TiO2 (Ilmenite)	220

It is important to note that the above is the final reference price paid by customers for final products rather than the price received by Kalbar for the intermediate concentrate. However, it is a sound reference point for changes in revenue to be received by Kalbar due fluctuating market conditions. Based on the above prices, the estimated life-of-mine revenue (in current dollar values) of the project to Kalbar is ~ 4,900 Million AUD.

Kalbar has conducted its own sensitivity analyses to assess the sensitivity to variance in mineral prices. A simplified sensitivity analysis is shown in Table 3 and 4.

Table 3 – Mineral Pricing

			USD/t CIF 2018	
Case	**Zircon**	**TREO**	**Rutile**	**Ilmenite**
High	1,800	4,500	1,400	270
Base	1,485	3,700	1,140	220
Low	1,230	2,800	880	125

The results of the sensitivity is shown in Table 4 below.

Table 4 – Sensitivity Results

Case	Revenue AUD M	Revenue AUD / t Ore
High	6,072	36
Base	4,878	27
Low	3,690	22

The results show that the project remains financially viable even in a "low" price environment.

For comparison, recent commodity price forecasts are shown in table 5 below, which shows that the base case pricing assumptions remain reasonable.

Table 5 – 2022 Mineral Price Forecasts

Mineral	USD/t CIF 2022 (forecast)
Zircon	1,600
TREO	5,000
TiO2 (rutile)	1,300
TiO2 (Ilmenite)	210

Source: TZMI (2021)

Should the forecast prices in Table 5 be realised, the estimated revenue per tonne will increase to 33 AUD / t Ore.