Proof of Concept

1 INTRODUCTION

Since 2011 Globe Mineral Resources Investments (GRMI) has conducted an exploration program for heavy minerals (HM) on its 100% owned Kulgera tenements. The exploration work has focused primarily on;

- Defining the resource by air-core drilling,
- Measuring the HM concentrate grade by heavy liquid separation,
- Metallurgical test work to define some potential product streams, and
- Mineralogy to determine the mineral composition of the HMC in the product streams.

At the completion of the 2013 field program a JORC reportable resource estimate was made for the Arrakis Prospect by independent consultants, CSA Global. They reported grades in to two sets of perimeters which were defined by geology and grade distribution. The resource estimates are displayed in the table below:

Estimate Year	Inferred	Unclassified	SG	Cut-off
2012	2.3 Bt @ 4.2% HM	2.1Bt @ 4.1% HM	1.59g/cm^3	2% HM
2013	2.46Bt @ 4.2% HM	2.24Bt @ 4.1% HM	1.7g/cm^3	2% HM
2013	**Inferred**	**Indicated**		
Blue Domain	135.2Mt @ 6% HM	210.7Mt @ 6.5% HM	1.7g/cm^3	~4% HM
Red Domain	39.7Mt @ 6.8% HM	110.7Mt @ 7.4% HM	1.7g/cm^3	~6% HM

The Blue Domain is defined with a HMC cut-off of 4% whilst the Red Domain uses a HMC cut-off of 6%. In Australia, most HM deposits are defined using a 1% or 2% cut-off however, the mineralization at the Arrakis Prospect is sufficiently robust and evenly distributed that a much higher-grade cut-off is useable.

The metallurgical test work, completed on a 300kg bulk sample compiled from the drilling sample residues has shown that there are three potential product streams; a low titanium-high iron stream suitable for the production of a steel mat product, a high titanium – lower iron stream suitable for the production of titanium slag and a zircon product. A simpler way to understand the potential product streams is consider the results of separating a 100 tonne sample.

From a 100 tonne sample of a similar material as submitted to the laboratory as a bulk sample we would expect to get:

- 6.64 tonnes of concentrate.
- Of the 6.64 tonnes; 1.44 tonnes or 22% would report as 18% TiO_2 and 80% Fe_2O_3 and 2% others.
- Of the 6.64 Tonnes; 3.77 tonnes or 57% would report as 40% TiO_2, 58% Fe_2O_3 and 2% others
- Of the 6.64 tonnes; 1.39 tonnes reports to the electrostatic non-conductor (ENC) stream. Of the 1.39 tonnes, 1.21 tonnes is quartz, 0.11 tonnes is zircon and 0.07 tonnes is mixed ilmenite, magnetite and haematite.

The work completed to date has demonstrated the characteristics of the Arrakis and the potential for the successful exploitation of the resource but a lot more work is need to investigate the economic viability of the project

2 PROJECT VALUATION

In April 2014, CSA Global were asked to review the status of the project and complete a project valuation in accordance with the rules and guidelines established under the Valmin code. CSA Global valued the project using two different methods,

1. A comparison method in which the value is derived from examining other transactions completed for similar styles of deposits, and
2. An appraised value method in which the exploration expenditure on the project is used to measure it value.

CSA Global concluded that a fair and reasonable value for the project, as it stands (22/5/14) is $10M as shown in the table below.

Summary of Technical Valuations (100% basis) for the Kulgera Project

Valuation Approach	Hi	Lo	Preferred
Appraised Value	12.5	9.7	11.0
Comparable Transactions	15.3	3.3	9.0

The valuation lies at the lower end of the ranges of the various approaches because of the early stage of the project reflected in the lower confidence resource classification (predominantly Inferred with some Indicated), the small proportion of the resources in higher resource categories from the overall global resource target, the preliminary stage of metallurgy and processing paths, the lack of financial and mining costs (especially transport costs), and the absence of robust marketing information for the likely Arrakis products, all combine to favour a valuation at the lower end of the range.

CSA Global were further asked to indicate what they thought the net in-situ value of the Arrakis Project might be. Predicting the in-situ value requires assumptions to be made regarding the mineral products current value and does not address the cost of recovering the minerals. Based on the assumptions in the table below the net in-situ value of Arrakis has been listed as:

- Blue Resource = 21.8Mt HMC $3.4B
- Total Inferred Resource = 103Mt HMC $16B

Assumed Commodity prices		
HM	*USD/T*	*AUD/t*
Ilmenite (Ti54)	225	243
Ti40	166	180
Rutile	677	730
Zircon	1148	1238
Iron	120	129
Iron Ti18	102.85	94

3 FINANCIAL MODELS

At the completion of the 2013 field program it was recognised that the next step in the exploration process was to define some broad economic parameters for the project to determine if the resource could be profitably mined. The lack of a financial model and associated marketing study was highlighted by CSA Global as the main reason the project has a low current value despite the robustness of the resource. To address this issue two financial models have been considered as described below.

3.1 CONVENTIONAL MINING METHOD 1

The first financial model created was based on conventional mining method using scrapers, trucks and rail freight. The model was constructed with 3 mining rates, 1Mt/month, 1.5Mt/month and 2Mt/month. Several assumptions were made relating to the mining cycle time, ore-grade and products value. The key assumptions were:

- The mined head grade is 7%HM
- 50% of the HMC reports to the Ti40% stream
- 25% of the HMC reports to the Ti18% stream
- 25% of the HMC goes to stockpile with no assumed value attributed to this material
- Each month consists of 30 days
- A scraper can self-load and carry 35m^3 with a cycle time of 15 minutes
- Earthmoving plant, trucks and generators each use 750ltr/day and light vehicles use 50ltr/day
- The value of our Ti40% products was assumed to be 70% of the TiO2 54% quoted in Concensus economics
- The Ti18% product has the same value as “Fines” iron ore
- The $AUD : $USD exchange rate is 0.90
- The proposed mine operates on only one 12 hour shift per day.

The model was constructed using the assumptions listed above and the proposed mining rates. Manpower was assigned based on the number of vehicles requiring drivers, the necessary management, accounts, maintenance, mill workers, camp workers and cooks. Total manpower requirements for the three proposed mining rates were 92.5, 127 and 157. Each of the workers was placed into one of seven categories as shown below:

	Pay Categories	Est Cost/ annum	Description
1	Mine Manager	$250,000	Manage and co-ordinate all aspects of the operation
2	Manager	$200,000	Manage assigned areas of responsibility
3	Professional Worker	$175,000	Surveyors, Geologists, Accountants, engineers, Env Scientist
4	Tradesman	$150,000	Fitters, boiler makers, electricians, Chief
5	Skilled Worker	$125,000	Foreman, Storeman, Grader operator, Hydraulics, Cook
6	Worker	$100,000	Mobile plant operators, General Hands,
7	Assistant	$75,000	Cleaners, Trade Assistants, fieldies,

Using the above assumptions and wages figures the monthly Earnings before tax, royalty, depreciation and capital costs was calculated for the three different mining rates. The results from the model are displayed below for the three mining rates and three different commodity values taken from the Concensus forecasts.

Mining Rate (t/month)	Total income Sept 2013	Total Production Cost	EBTRDC
1,000,000	$9,177,778	$5,860,500	**$3,317,278**
1,500,000	$13,766,667	$9,089,346	**$4,677,321**
2,000,000	$18,355,556	$11,890,649	**$6,464,907**
Mining Rate (t/month)	**Total income Sept 2014**	**Total Production Cost**	**EBTRDC**
1,000,000	$8,077,222	$5,860,500	**$2,216,722**
1,500,000	$12,115,833	$9,089,346	**$3,026,487**
2,000,000	$16,154,444	$11,890,649	**$4,263,796**
Mining Rate (t/month)	**Total income Sept 2015**	**Total Production Cost**	**EBTRDC**
1,000,000	$7,684,444	$5,860,500	**$1,823,944**
1,500,000	$11,526,667	$9,089,346	**$2,437,321**
2,000,000	$15,368,889	$11,890,649	**$3,478,240**

3.2 BENCHMARK VERIFICATION

The financial model described above was sent to Joan Bath at CSA Global, an experienced sand mining engineer for independent validation or benchmarking of the key assumptions. Using her experience and the costs reported from several similar mining operations Joan compared the proposed mining methods and costs to those at existing mines.

Joan indicated that the financial model need to be adjusted to account for grade dilution and material losses due to mining but agreed with the assumed values for the product streams. Her work showed a positive cash flow of between $14M and $40M depending on the mining rate, long term commodity prices and exchange rates. Joan recommended that additional work on the proposed mining method and metallurgy was needed to reduce the mining costs and add value to the product stream. Transport costs were identified as being the major factor influencing the projects viability.

The benchmark study recommended the following costs are used:

- Mining cost of $2.81 to $2.59 /tonne for the 1Mt to 2Mt month scenarios
- Mill processing costs of $1.21/ tonne
- Road transport from the mill to the rail head $11.50 / tonne
- Rail freight from rail head to port of $16.85 / tonne
- Port costs of between $10 and $7.5 / tonne depending on throughput rate
- Shipping costs of $10.11 / tonne

To calculate the potential revenue from the project the commodity prices and exchange rates tabled below were used.

	Sept 13	Sept 14	Sept 15
$US 54% TiO2	$260	$226	$225
Exchange Rate	0.85	0.85	0.85
$AU 54% TiO2	$305.88	$265.88	$264.71
Kulgera 42% TiO2	$214.12	$186.12	$185.29
Kulgera 18% TiO2*	$120	$120	$120
• Iron ore spot price			

Encouragingly, the work done by Joan has confirmed, with some variation the Financial Model and the projects potential to produce a positive cash flow of between $1M and $4M / month.

3.3 CHAIN BUCKET EXCAVATOR

Review of the Conventional Mining method Financial Model showed that to produce a through- put of 2M tonnes per month would require more than twenty-three 35 cubic metre scrapers operating on 12hr/ day shifts or 12 scrapers operating on two 12hr shifts per day. Moving to a 2 shifts per day roster would reduce the initial capital outlay by reducing the number of machines needed. However, the operating costs and manpower requirement would be the same as listed in the conventional model for 2M tonnes per month.

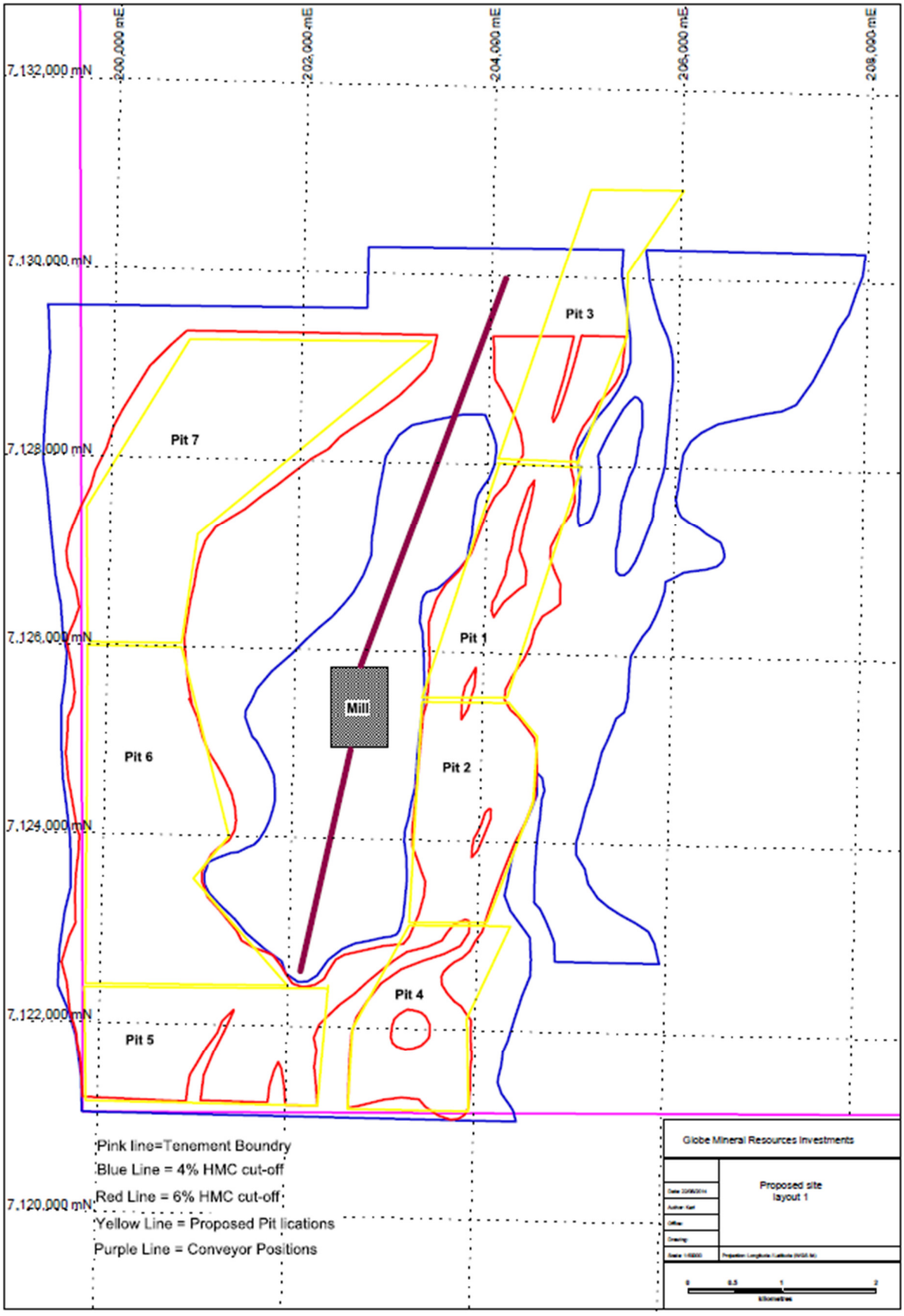
The total number of machines which require drivers and maintenance personnel along with accommodation and messing requirements are one of the major cost centres of the proposed project and to reduce the manpower costs alternative mining strategies have been considered. To further refine the Financial Models several service suppliers have been asked to provide indicative pricing. Their responses have been used where appropriate.

Chain Bucket Excavator

The picture above is an example of a chain bucket excavator (CBE). Machines like this are purpose built and designed to move large volumes of material very cost effectively. In effect, one person can replace many with real cost savings. The machine pictured (Tenova Ers (k) 800) has a nominal capacity of 1400lm^3/h with a maximum capacity of 12,250lm^3/h. The digging height is 19m and the digging depth is 16m. The length of the discharge boom is 36m.

A machine like the one pictured above would be quiet capable of replacing the entire fleet of scrapers required in the Conventional Mining Financial Model.

The First Financial Model was also deficient in that it did not refer in any way to the distribution of mineralisation and a scraper cycle time if 15 minutes was assumed with no real reason behind it. To address this issue a site layout plan (below) has been included which presents only one of several possible designs.


200,000 mE
202,000 mE
204,000 mE
206,000 mE
208,000 mE
7,132,000 mN
7,130,000 mN
7,128,000 mN
7,126,000 mN
7,124,000 mN
7,122,000 mN
7,120,000 mN
Pit 3
Pit 7
Pit 1
Mill
Pit 6
Pit 2
Pit 4
Pit 5
Pink line=Tenement Boundry
Blue Line = 4% HMC cut-off
Red Line = 6% HMC cut-off
Yellow Line = Proposed Pit lications
Purple Line = Conveyor Positions
Globe Mineral Resources Investments
Proposed site
layout 1

The site layout plan is a scaled drawing which displays the positions of the two resource categories in red and blue, seven proposed mining pits in yellow arranged around a central mill. The key elements of the design are:

- The Mill is positioned in an area of no mineral grade. The area is a flat lying sheet of calcrete which provides easy access irrespective of the weather.
- The seven pits are positioned to maximise the recovery of the Red mineral resource, 150mt @ 7.2% HM using a 6% cut-off
- The Red resource represents a six year supply of sand if the mining rate is 2mt/month.
- The Blue resource contains 350mt @ 6.3% HM with a cut-off of 4%. Mining at 2Mt/ month this represents 14 years supply.
- Both the Red and Blue resources are open to the north.
- The distance from the proposed mill site to the farthest point of Pit 3 is 5 kilometres.

The proposed mining method is to use a purpose built CBE discharging into dump trucks which transport the sand to the mill and return with the processed barren sand. In the Site layout plan two possible conveyor positions are shown which could be used to reduce the tramming distance.

A Financial Model for the CBE has been created from First Principal calculations as was done for the Conventional mining method. However, where needed the costs assigned for each task have been taken from the Benchmark Report. The figures used for the ship loading are from an indicative quote from Flinders Logistics.

Flinders Logistics propose to use specially designed tipping containers (Rotainer) to load the ship. The containers are filled on site and then trained to the Port. Flinders have a purpose built container handler which lowers the container into the ships hold, removes the lip, tips the contents out and then restores the container and removes it from the ship. They have used this method in the past and continue to do so. A discussion with the Darwin Port Authority has indicated that they are looking at a similar loading system for Darwin.

The containerised transport and loading system has several advantages, some of which are:

- Once loaded the containers are sealed so there is no moisture content issues,
- The same applies to dust and contamination of the rail line or port area.
- The containers are easy to store and handle
- There is no need for specially built rail cars
- We can store the various product on site until we have an export quantity, ie Zircon and other mineral products.

Flinders Logistics quote is an all in price to unload the train and then replace the empty containers for movement back to the mine site. It includes all labour, machines and storage. Note: Flinders Port will only take ships to 30,000 tonnes and they require more than 55,000 tonnes per month.

At this stage, despite numerous attempts to talk to the Development Manager of Genesse and Wyoming about the cost of rail freight, we have not had any success. The cost of rail freight is a major component of the total production cost and further efforts in this regard will be made. A rail access application form is present on their website and we may need to use this.

The CBE Financial Model relies on one chain bucket excavator operating at 3000m3 per hour and 5, 200 tonne Haulpac trucks running the sand to and from the mill. Key assumptions in the model are:

- Mineral head grade is 7%, 0.2% less than the resource estimate
- 57% 0f the HMC is TI40%
- 22% of the HMC is Ti18%
- 21% of the HMC is other heavy mineral species.

The model works on a single 12 hour shift per day and an average 30 day month. At 3000m3 per hour the monthly production rate is 1,836,000 tonnes of sand per month.

Changing the mining method from scrapers to a chain bucket has resulted in a substantial reduction in the work force from 157 people to 106 people. Most of the reduction comes from scraper operators and maintenance people required to keep the scrapers operating. The reduction in personnel numbers has a flow on effect in the size of the accommodation camp and messing requirements. The full model appears in the excel spreadsheet, CBE Financial Model.

The table (below) contains a summary of the monthly costs associated with the CBE Model.

Monthly Cost Summary

Mining Rate (t/month)	Labour	Mining	Mill	Camp	Freight	Overheads
1,836,000	$1,221,188	$1,778,983	$1,569,000	$277,500	5,270,464	$150,000
	11.9%	17.3%	15.3%	2.7%	51.3%	1.5%

The total monthly operating cost is $10.2 million. The percentage breakdown of the monthly operation cost is shown above. Clearly, the freight costs (51.3%) of the total operating are the most significant factor.

The Overheads provision is made to cover the costs associated with:

- Tenement rentals,
- Water supply costs,
- Landowners compensation
- Payments to Traditional Owners
- Transporting the work force to and from Alice Springs where most employees will reside
- Environmental costs such as seed collection but not earthworks to restore the dunes
- Compliance and departmental inspections.

To calculate the likely revenue generated by the mining proposal several assumptions have to be made, key amongst these are:

- Concenses Economics predicts the long term value of ilmenite is $225US from 2016
- $AUD = 0.85$USD exchange rate
- Product 1 is 42%TiO2 and worth 70% of the predicted ilmenite value

- Product 2 is 18% TiO2 and it has the same value as the predicted Australian Iron Ore fines
- Product 3 is zircon. An assumption of recovering 50% of the zircon present has been made.

Based on the above assumptions, then:

Monthly Income from Concentrate Sales

Mining Rate (t/month)	Ti40%(t)	Ti18%(t)	Zircon(t)	Value 2016 Ti40%	Value 2016 Ti18%	Value 2016 Zircon	Total
1,836,000	73,256	28,274	1,067	$13,573,980	$3,326,400	$1,666,587	**$16,900,380**

The monthly gross margin has been calculated but this figure does not take into account, tax, royalties or the repayment of capital nor capital costs. The Table below show the gross margin based on the CBE model and the effects of increasing costs by 10%, 20%, 30% and 40% and the effect of reducing the income by 10%, 20% and 30%. The income remains positive over the range of conditions shown but the margin is obviously reduced.

Gross Margin (Monthly)

Model as stated	Model +10% costs	Model +20% costs	Model + 30% costs	Model + 40% costs	Model minus 10% income	Model minus 20% income	Model minus 30% income
$6,633,246	**$5,606,532**	**$4,579,819**	**$3,553,106**	**$2,526,392**	**$4,943,208**	**$3,253,170**	**$1,563,132**

4 CONCLUSIONS

Using a Chain Bucket Excavator rather than a fleet of scrapers has had a marked effect on the number of employees required and this is reflected in the gross monthly margin. The table above indicates that a positive cash flow is still achieved if the costs are raised by up to 40% or the revenue is reduced by 30%. Naturally, the model relies on the assumptions made and over the next few months the model will be refined as more hard data is received.

Included in the Financial Model is a series of tables referred to as Variation 1. Variation 1 examines the extra costs and savings to be made if the entire HMC is shipped to China. Once in China the HMC can be separated and refined into various product streams suitable for the Chinese market. Shipping the entire HMC to China will have significant savings, particularly in the capital outlay as the mineral processing stream will be vastly simplified and so only a simple mill will have to be built. Additional operational savings will come from a reduced work force in the mill and the mill maintenance areas.

Variation 1 does have some increased costs associated with it, particularly in freight which is the most significant cost associated with the project. Mineralogical studies need to be completed to assess the value of the non-iron (ENC) HMC component to determine if it has sufficient value to warrant transport to China.