



ASX ANNOUNCEMENT

9 October 2018

## Scoping Study Highlights Strong Economic Potential of Manono Lithium Project

### Highlights

- Scoping Study confirms potential for a world class, high margin, long life mining project.
- AVZ intends to proceed to a Full Feasibility Study (FFS) which it expects to be completed in Q2 2019.
- The potential for tin by-product credits was not taken into consideration in this analysis. It is expected that these credits will be included in the FFS.

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### Cautionary Statements: Scoping Study Parameters

*The Scoping Study referred to in this announcement has been undertaken to determine financial aspects of potential future operations at the Manono Lithium Project and to help drive future work programs. It is a preliminary technical and economic study of the potential viability of the Manono Lithium Project. It is based on low level technical and economic assessments that are not sufficient to support the estimation of Ore Reserves. Further exploration and evaluation work and appropriate studies are required before AVZ Minerals Limited (AVZ) will be in a position to estimate any Ore Reserves or to provide any assurance of an economic development case.*

*All costings and projections in financial modelling were prepared based on Measured Resources (16.5%), Indicated Resources (40.3%) and Inferred Resources (43.17%) as announced by AVZ on the 2<sup>nd</sup> August 2018<sup>1</sup>. The Company has concluded that it has reasonable grounds for disclosing the economic assessment or production target that includes a modest amount of Inferred material. However, there is a low level of geological confidence associated with Inferred Mineral Resources and there is no certainty that further exploration work will result in the determination of Measured or Indicated Mineral Resources or that the production target or the economic assessment will be realised. Furthermore, there is no certainty that further exploration work will result in the conversion of Measured and Indicated Mineral Resources to Proven and Probable Ore Reserves.*

<sup>1</sup>Announcement dated 2<sup>nd</sup> August 2018: Maiden Mineral Resource – Manono Lithium Project

### Directors

Managing Director: Nigel Ferguson  
Technical Director: Graeme Johnston  
Non-Executive Director: Rhett Brans  
Non-Executive Director: Hongliang Chen  
Non-Executive Director: Guy Loando

### Issued Capital

1,888 M Ordinary Shares

### Market Cap

\$180 M

### ASX Code: AVZ

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*The Scoping Study is based on the material assumptions tabulated below. These include assumptions about the availability of funding. While AVZ considers all of the material assumptions to be based on reasonable grounds, there is no certainty that they will prove to be correct or that the range of outcomes indicated by the Scoping Study will be achieved.*

*To achieve the range of outcomes indicated in the Scoping Study, funding in the order of approximately \$150M to \$160M (**C5 ±35% and includes US\$36m contingency**) will likely be required for Case 1 (2Mtpa).*

*Investors should note that there is no certainty that AVZ will be able to raise the amount of funding for Case 1. It is also possible that such funding may only be available on terms that may be dilutive to or otherwise affect the value of AVZ's existing shares.*

*It is also possible that AVZ could pursue other 'value realisation' strategies such as a sale, partial sale or joint venture of the project. If it does, this could materially reduce AVZ proportionate ownership of the project.*

*Given the uncertainties involved, investors should not make any investment decisions based solely on the results of the Scoping Study.*

## Summary of Findings

- Case 1 (2 Mtpa) pre-tax pre-royalties NPV<sub>10</sub> of approximately US\$1.6 Billion (Bn) (AVZ's 60% share is approximately US\$0.93Bn) with an estimated IRR greater than 90% based on ±35% accuracy and including US\$36M in capital contingency.
- Scope for annual production of approximately 440,000 tonnes per annum (tpa) at a minimum of 5.8% Li<sub>2</sub>O concentrate from Case 1 throughput of 2 million tonnes per annum (Mtpa) of pegmatite ore with low strip ratio of 0.7:1.
- F.O.B. Operating costs to Dar-es-Salaam estimated at approximately US\$355 per tonne (t) of concentrate for 2Mtpa.
- Metallurgical test work indicates recoveries in excess of 80% are achievable.
- Capex estimated for Case 1 throughput at approximately US\$150 to \$160 Million (accurate to ±35% and includes US\$36M contingency).
- Study for Case 2 for 4Mtpa and Case 3 for 10Mtpa in progress and will be completed as soon as practicable.
- The potential for tin by-product credits was not taken into consideration in this analysis. It is expected that these credits will be included in the FFS.

**AVZ Minerals Limited (ASX:AVZ) "AVZ" or "the Company"** is pleased to announce the results of the Scoping Study (Study) on the Manono Lithium Project (Project) in the Democratic Republic of Congo (DRC).

The independent Study was undertaken by CPC Project Design Pty Ltd (CPC) and completed in late September 2018. In addition, an independent economic model & financial analysis was undertaken and completed by Alan Dickson & Associates (ADA). Both documents utilised Measured, Indicated and Inferred Resources as the basis for completion.

AVZ Minerals Managing Director, Nigel Ferguson, said that *"The AVZ Minerals Board is extremely pleased with the results of the independent Studies and intends to immediately commence a Full Feasibility Study. The Studies undertaken not only demonstrate the potential for excellent economic outcomes, but also highlight the long-life, low-cost qualities typical of world-class Tier 1 assets. The Manono Lithium Project is now the largest undeveloped hard rock lithium project globally in terms of grade, mine life and expandability."*

*"The Manono Lithium Project is unique in many ways, with key attributes of: homogeneous deposit; low levels of deleterious elements; an extremely low strip ratio of 0.7:1 and therefore direct access to clean ore for the majority of the mining life as modelled to date. We are in no doubt of being able to achieve a superior product for end-users."*

*"We are confident that the project economics can be improved further, especially in the areas of transport, processing, power costs by utilising a refurbished hydro plant at Piana Mwanga and the recovery of tin as a by-product which can add considerable value to the bottom line and has not been included in any financial modelling."*

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*“Additionally, there are considerable financial benefits available to the Company in pursuing the 5-year tax concession offered by the DRC Government for “projects of significance”, which has not been taken into account in the independent financial modelling and will be pursued vigorously. Given that Manono is seen as a catalyst for investment in Tanganyika Province by local and federal Government representatives we believe that we are well placed to achieve success in this matter.”*

*“Manono will not stay as a 2 Mtpa operation for long as it is the Company’s intention to self-fund further expansions from retained earnings. Given the tier-one nature of Manono in terms of size, quality and homogeneity of resource, unsurprisingly, we are working quickly to bring a 4Mtpa and 10Mtpa study for release to the market. We will be particularly focussed on leveraging economies of scale and optimisation of proposed expenditures in the 4Mtpa and 10Mtpa studies to further improve on the excellent results already contained in the 2Mtpa study. We anticipate the additional 4Mtpa & 10Mtpa study will be completed in November and further support our intention to achieve a globally dominant position in the lithium market place.”*

## Robust Financial Outcomes

Key outcomes of the Study for Case 1 (2Mtpa) pre-tax and pre-royalties NPV<sub>10</sub> are based on the following parameters as per Table 1 below. Estimates presented in Table 1 are on the basis of a 100% project interest. AVZ holds 60% of the Manono Lithium Project.

Parameter Value	2Mtpa
Potential Mine Life (Years) As Modelled	20
Measured Resources (t)	43.0 M
Indicated Resources (t)	104.7 M
Inferred Resources (t)	112.2 M
Annual throughput (Mtpa) Base Case	2.0
Production Target (t)	40 M
Strip ratio (t waste : t ore)	0.7:1
Average feed grade (%Li <sub>2</sub> O)	1.58
Recovery (%)	80%
Potential Annual Production (t 5.8% Li <sub>2</sub> O concentrate - rounded down)	440,000
Open pit mining costs (US\$/t dry concentrate)	56
Processing cost (US\$/t dry concentrate)	64
Transport cost (US\$/t dry concentrate)	221
Administration & sustaining capital costs (US\$/t dry concentrate)	14
Average Cash Cost (US\$/t concentrate)	355
Concentrate Price (US\$/t)	920
Accuracy	±35%
Contingency (US\$)	36M

**Table 1 Study Key Operating Parameters**

### Notes to Table 1 Study Key Operating Parameters

1. Estimates are based on the lithium mining operations only. The Study excludes the potential for tin by-product credits as these were not taken into consideration in this analysis.
2. Estimates presented in Table 1 are on the basis of a 100% project interest. AVZ holds 60% of the Manono Lithium Project.
3. The Mineral Resource estimate reported in accordance with the JORC Code 2012 Edition and announced on 2<sup>nd</sup> August 2018 forms the basis of the mining and financial estimates referred in this announcement.
4. The Scoping Study utilised the Measured, Indicated and Inferred tonnages as the basis for completion. Inferred Mineral Resources do not determine the economic viability of the Manono Lithium Project as assessed in this Scoping Study. There is a low level of geological confidence associated with Inferred Mineral Resources and there is no certainty that further exploration work will result in the determination of Indicated Mineral Resources.

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5. *Technical and economic estimates in the Scoping Study are based on low level technical and economic assessments.*
6. *Funding costs, taxes and royalties have not been considered in these Study figures.*

A summary of the key economic analysis results is presented below.

US\$/t Concentrate		Case 1 – 2 Mtpa (accurate to ±35%)
<i>Project Interest</i>	<i>100% Interest</i>	<i>AVZ 60%</i>
-30% (\$644)	0.8	0.5
-20% (\$736)	1.1	0.6
-10% (\$828)	1.3	0.8
<b>US\$ 920<sup>#</sup></b>	<b>\$1.6 billion</b>	0.9
+10% (\$1012)	1.8	1.1
+20% (\$1104)	2.1	1.2
+30% (\$1196)	2.3	1.4

**Table 2 NPV<sub>10</sub> on Production Targets concentrate sale prices sensitivity**

<sup>#</sup> Based on current pricing achieved in China for 5.8% Li<sub>2</sub>O concentrate

**Notes to Table 2 NPV<sub>10</sub> on Production Target concentrate sale prices sensitivity:**

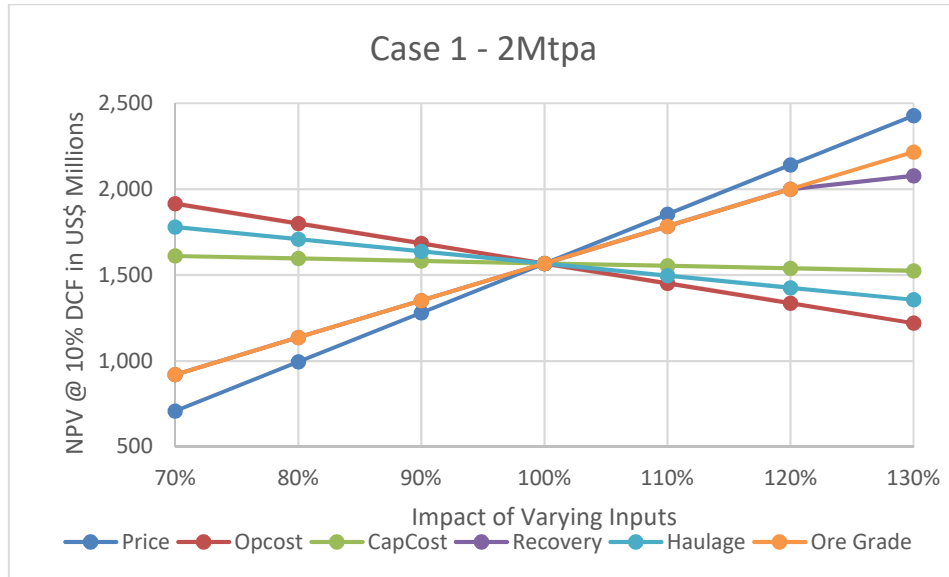
1. *Net Present Value calculated after applying a 10% real discount rate.*
2. *Estimates are based on the lithium mining operations only. The Study excludes the potential for tin by-product credits as these were not taken into consideration in this analysis.*
3. *The Study utilised the Measured, Indicated & Inferred Resource tonnages as the basis for completion. Inferred Mineral Resources do not determine the economic viability of the Manono Lithium Project as assessed in this Scoping Study. There is a low level of geological confidence associated with Inferred Mineral Resources and there is no certainty that further exploration work will result in the determination of Indicated Mineral Resources. The company is confident that financial impact of the inclusion of Inferred Resources in this model is acceptable and would have a minimal impact on the overall project economics.*
4. *Estimate presented is based on 100% project interest. AVZ holds 60% interest in the Manono Lithium Project.*
5. *Estimate is accurate to ±35% and includes US\$36M contingency.*
6. *Technical and economic estimates in the Scoping Study are based on low level technical and economic assessments.*
7. *Funding costs, taxes and royalties have not been considered in these Study figures.*

The Study returned an IRR of greater than 90% for Case 1 (C5 ±35%) on the basis of a 100% project interest. AVZ holds 60% of the Manono Lithium Project.

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## Sensitivity Analysis

A sensitivity analysis has been completed on the cash flow model. Concentrate price, metallurgical recovery, haulage costs, ore grade, opex and capex were flexed between a range of -30% to +30% in increments of 10% (Figure 1). Case 1 net present value (NPV) when each parameter is flexed individually is reported in the graph below. The graph below are based on 100% project interest. AVZ holds 60% interest in the Manono Lithium Project.



*Figure 1 Single parameter sensitivity analysis for the NPV - Case 1 (2Mtpa) (accurate to  $\pm 35\%$  and includes US\$36M contingency)*

## Transport Overview

The completion of the Scoping Study and in country investigations have clarified the optimum transport route for the Manono Lithium Project. The traditional route for copper & cobalt concentrate exports in the DRC is via Lubumbashi to Durban in South Africa.

After first-hand verification of key locations and consultation with the DRC and Tanzania Governments, has confirmed the route via either Kalemie & Moba in the DRC to Kigoma and Dar es Salaam in Tanzania, is the most viable, cost effective option for the Project. It is both shorter in distance and is expected to have lower costs than via road/rail to Durban.

The capex and FOB opex numbers utilised in the study have assumed **Route 3** (shown below in Figure 2) as the selected option this transportation route, it is a key outcome of the study and a significant step forward in commercialising the Project.

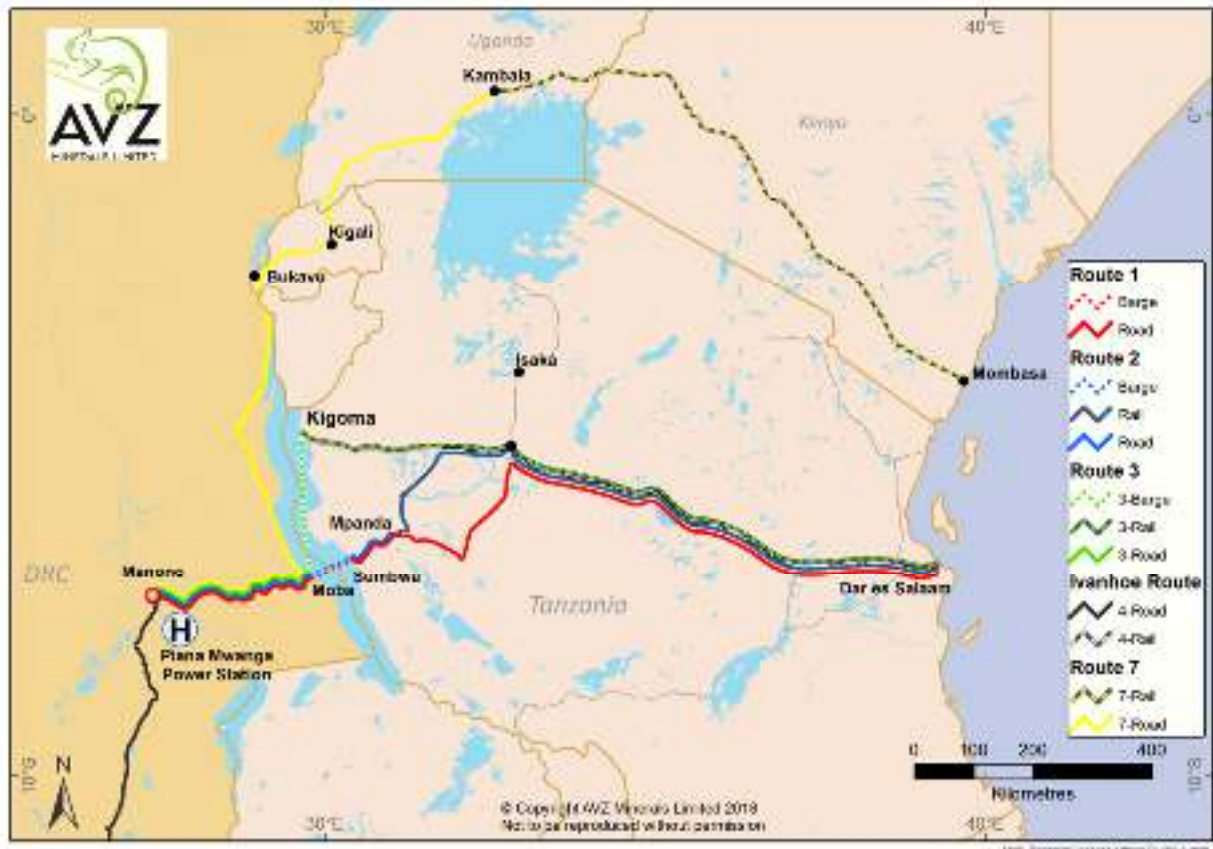


Figure 2 Transportation Route Options

**Notes to Figure 2**

1. Route 7 “The Northern Route” shown above was investigated as an option but was not included as part of this Scoping Study

AVZ is continuing to optimize the identified routes above with a view to lowering rail transport charges given the costings included in the study have not considered the likely discounts typically available to bulk operations or the optimisation of logistics solutions for operations similar in size and scale to the proposed Manono Lithium Project.

**Transport Background**

The Manono Project is located approximately 500km due north of Lubumbashi in the south of the Democratic Republic of Congo (DRC) in central Africa. The project area can be accessed from Lubumbashi by a 1.5-hour flight or by road.

Traditionally, the path to market in the DRC is via Lubumbashi to Durban in South Africa however given the project’s location in Manono, this is not considered an optimal route.

The Tanzanian Government commented in January 2017, that it was to receive a US\$305 Million loan from the World Bank to expand its main port. Port of Dar es Salaam, the main commercial port in Tanzania, is currently being expanded from 20 Mt annual capacity to 28 Mt annual capacity by China Harbour Engineering. These works are expected to be completed in 2020.

Initial discussions with the Tanzanian Port Authorities’ management have indicated that sufficient capacity exists for AVZ’s scoped tonnages. There exists sufficient laydown area for stockpiling of the product prior to shipment.



At Kalemie there is a fleet of public and private barges with capacities ranging between 500 to 1,000 tonnes. The DRC government is currently rehabilitating additional barges to satisfy increased demand. The barges are designed for transporting complete rail cars from Kalemie to Kigoma in Tanzania, with no need to unload or re-load rail cars, with rail cars continuing to the port of Dar es Salaam. AVZ will not be relying on third party barge operators as it will be acquiring its own barges.

Transport of mining supplies and consumables and other supplies for the operation phase will be imported through a preferred transport corridor. A further, more detailed freight and logistics study will identify preferred transport corridors, which may include from ports at Durban, South Africa; Dar es Salaam, Tanzania; Beira, Mozambique; and Luanda, Angola.

The current road from Lubumbashi to Manono is via the town of Likasi and then, heading north passing through the town of Mitwaba. Sealed road exists between Lubumbashi to the west and then north to a point approximately 180km north of the Likasi - Kolwezi road, on the road to Manono.

A Chinese funded road upgrade is currently underway with committed funding of some US\$285M and the intent to upgrade the entire 400km of road from the Likasi turnoff with refurbishment and reconstruction of dilapidated areas to provide an all-weather dirt road in the first phase of construction that is expected to take approximately 18 months and then a sealed "black top" road for its entire length, during the second phase, which is expected to be completed by 2020.

The transit time from Lubumbashi to Manono would be greatly improved with large trucks being able to reach Manono site within one day compared to the current three days in the dry season and up to 7 days in the wet.

AVZ has made initial investigations into the transport of product and consumables out to the lake side port town of Moba on Lake Tanganyika and thence by barge to Sumbwa in Tanzania, then trucked to Mpanda and loaded into the train for further transport to Dar es Salaam. AVZ will investigate further the expected route to Moba and capital cost for improvement should it decide to move ahead with this as the preferred route.

The refurbishment and sealing of the Lubumbashi to Manono road would greatly reduce both time and cost of delivery of product from site to a railhead and to site for consumables. These will be factored into any future detailed studies that AVZ undertakes.

### **Site Access**

A program of refurbishment of water drains and roads is currently being undertaken by AVZ utilising some 300 labourers displaced from artisanal mining activities, prior to the onset of the wet season at Manono. It is expected that this long dilapidated, but necessary infrastructure, will greatly improve the longevity of the roads at site and around the town. Site access is easily achievable at present, but the refurbished infrastructure at site will improve this further.

### **Transport Costs for Concentrate**

The proposed transport route is adopting closed containers of approximately 30t. These will be truck loaded at site and transferred to the port town of Moba on the west coast of Lake Tanganyika, a distance of about 360km.

Containers will be loaded on to a custom-made barge carrying 50 containers and sailed approximately 240km to the Tanzanian port of Kigoma on the east coast of the lake. There they will be offloaded directly to flat tops for rail to Dar es Salaam some 1,450km away.

This cost represents the largest operating cost amounting to some US\$211/t of dry concentrate which when 5% moisture is taken into account equals US\$221/t representing about 66% of all operating costs.

Operating costs have been estimated based on similar projects in the region. A haulage cost of US\$0.09/t/km has been used for this study and is similar to publicly released data from Ivanhoe Mines Kipushi Mine<sup>1</sup> located in the DRC which through back calculation indicates a haulage costs of US\$0.07/t/km to Durban which is a slightly longer route.

Rail costs were based on published data from the Tanzania-Zambia Railway Authority (TAZARA) for Dar es Salaam to Kigoma and factored for the slight difference in distance to Mpanda. As these are public rates, there may be an opportunity to reduce the rail costs through negotiation of a long-term consistent contract.

Operating costs have also been included for ferry operating and port charges which include:

- lifting containers from haul trucks
- leasing of hardstand area at the port
- terminal handling charges
- container handling
- documentation
- customs clearance charges
- agency fees
- wharfage
- container leasing costs
- truck hiring and operating costs
- export costs

## Project Funding

The Board of AVZ believes there is a reasonable basis to assume the necessary funding for the Manono Lithium Project will be obtained for the following reasons.

- A mix of debt, equity and off-take financing is the Company's most likely funding model. AVZ has an active ongoing dialogue with potential financing and investment partners and continues to receive unsolicited expressions of interest with regard to assisting the Company with its financing needs. These parties include substantial mining funds and companies including global diversified Chinese companies, Chinese off-take parties and Sub Continent interests. AVZ still has live MoU's with some Chinese entities that remain in discussion with AVZ on the project.
- As at 30 June 2018 AVZ had approximately \$16.3M cash on its balance sheet. In the Board's view these are sufficient funds to complete the outstanding infill resource drilling, upgraded resource estimate, metallurgical test-work and commencement of the feasibility study.
- The Company has a total of 203,649,049 listed options exercisable at 3 cents expiring 24 May 2020 and 207,428,573 unlisted options exercisable at 10 cents expiring 15 April 2019. Should all of the "in the money" options (the 3 cent options) be exercised by the expiry date this will raise a total of approximately A\$6.1M. In the event the 10 cent options are exercised, an additional total of approximately A\$20.7m will be raised, although this will be dependent on the share price prior to the expiry date of 15 April 2019 and the Company is not reliant on the options being exercised to complete the works set out in the paragraph above.

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<sup>1</sup> <https://www.ivanhoemines.com/news/2017/ivanhoe-mines-announces-an-outstanding-pre-feasibility-study-for-the-rebirth-of-the-historic-kipushi-zinc-copper-silver/>

- The Board and Management have a strong track-record in mining project financing and equity raising for numerous ASX listed companies, aside from AVZ, over the last 20 years. By way of example, funding for Moto Goldmines Limited, African Metals Corp, Alphamin Resources, Amani Gold, Taruga Minerals and Perseus Gold.
- AVZ and the Board have previously demonstrated their ability to raise exploration and development funding for the Manono Lithium Project;
  - i) Completion of A\$15.0M fund raising at a price of 25 cents each on 28 February 2018
  - ii) Completion of A\$13.0M placement to strategic investor, Huayou Cobalt Group on 16 August 2017
- The Manono Lithium Project will produce a premium product having the lowest level of deleterious elements of any Australian listed hardrock lithium project. This receives a price premium as it reduces the need for expensive processing to remove these impurities. The Board is confident that The Manono Lithium Project will be able to deliver an attractive economic return.
- The Company is also able to pursue other methods of value realisation to assist funding the project, such as a partial sale of the asset, long term offtake and joint venture arrangements.
- The positive financial metrics of the project and the continuous demand growth for lithium.
- Other companies at a similar stage in development have been able to raise similar amounts of capital in recent capital raisings. This includes Galaxy Resources through the sale of a portion of their Argentinian Salar del Hombre Muerto licences for US\$280m to fund the remaining licences and other operations within the group; Pilbara Minerals with funding of up to US\$100M of debt and or prepayments from Gangfeng Lithium and Great Wall and an equity arrangements with POSCO for A\$80M and Kidman Resources entered into offtake agreements with Tesla and earlier into a Joint Venture (“JV”) with SQM whereby Kidman received US\$25M and the JV received US\$60M of funding, and Argosy Minerals have had several financings and offtake arrangements with Qingdao Qiabyun High Tec New Material Co.
- The Company previously rejected funding base on providing off take of product being mindful of the need for economic value to be ascribed to the project and the dilutive effect on shareholders at that time. The Company can now engage in discussions with potential off-takers for advanced funding based on securing long term off-take for product given the project economics.
- Announcement of the project financial metrics in this report can now allow AVZ to advance discussions with selected potential customers. AVZ believes these advances in the Manono project firmly underpin a more favourable climate to engage with and conclude, binding off take arrangements.
- The Company will also enter into discussions with Project financiers and advisers and believes, that given the key findings of this study and ongoing uplift of the project, it is in a strong position to secure the necessary funding to place the project into production.

## Next Steps

The Company intends progressing the Manono Lithium Project to FFS immediately. As well as improving the accuracy of cost estimates, the Study will provide additional definition on the Project's infrastructure requirements such as water, power and transport.

AVZ believes there is potential to enhance the Project's economics by:

- Improving flowsheet design through the various feasibility test work studies.
- Optimisation of transport and logistics costings.
- Investigation into the rehabilitation of the Piana Mwanga hydro facility.
- Completing further test-work on credits for tin recovery.

In addition, infill and exploration drilling programs are in progress. These programs are designed to:

- Infill and expand the current resource base.
- Select core to be utilised in the expanded metallurgical test-work programs.
- Upgrade the resource classification from the maiden Resource estimate.
- Confirm geotechnical parameters for open pit mine planning.
- Confirm plant, associated infrastructure, waste dump and tailings storage facility locations.

The metallurgical test work and FFS is expected to take 6 months to complete and planned to be available by Q2 2019. The company looks forward to updating the market regarding its progress. In parallel, the Company intends to continue engaging with potential off-takers and finance providers.

Activity	CY2018				CY2019				CY2020			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Complete Scoping Study	■	■	■									
Complete Resource Drilling		■	■	■								
Met Test Work Study			■	■	■							
Feasibility Study				■	■	■						
Transport Route Confirmed					■	■						
Licensing, Permitting & Environmental Approvals					■	■	■					
Detailed Engineering and Procurement						■	■	■				
Construction								■	■	■		
Commissioning										■		

Table 3 Estimated Timeline to Commissioning

## Scoping Study provides options for up to a 10 Mtpa open pit mine

The positive outcome from the Scoping Study for 2Mtpa provides options for up to a 10Mtpa open pit mining operation. The Scoping Study for the 4Mtpa (Case 2) and a 10Mtpa (Case 3) is currently in progress and will be completed as soon as practicable.

The Study evaluated the technical, transport, power and potential economic viability of an open pit mine development at the Company's Manono Lithium Project deposit, where a maiden JORC Mineral Resource of 259.9 million tonnes (Mt) of 1.63% Li<sub>2</sub>O has been defined<sup>1</sup>.

All costings and projections in the financial model were prepared on all classifications of resources namely, Measured, Indicated and Inferred Resource tonnages. These Measured and Indicated portions combined account for approximately 57% of the existing Mineral Resource. The Inferred category resources accounts for the remaining 43%, this lower categorized resource provides a lower level of confidence in the figures and reduces the reliability of the estimated returns. However, the company is confident that the financial impact of the inclusion of Inferred Resources in this model is acceptable and would have a minimal impact on the overall project economics.

Various processing options were considered to optimise throughput capacity and recoveries, with consideration given to managing early stage cash flow and upfront capital costs. Mining and processing parameters were investigated at US\$920/t selling price (base price based on 5.8% Li<sub>2</sub>O concentrate).

The scoping study plan is to initially develop Manono as a 2 Mtpa high grade open pit mine to supply material to a conventional dense media separation (DMS) and flotation plant (Case 1).

The estimates presented in this Scoping Study are based on 100% project interest. AVZ holds 60% interest in the Manono Lithium Project.

Case 1 (2Mtpa) capital costs for the processing plant and associated project infrastructure are estimated at approximately US\$150 to \$160M (*C5 ±35% and includes US\$36M contingency*).

A Resource Block Model was generated as part of the Mineral Resource Estimate. This is represented below in a series of images.

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<sup>1</sup> Announcement dated 2<sup>nd</sup> August 2018: Maiden Mineral Resource – Manono Lithium Project

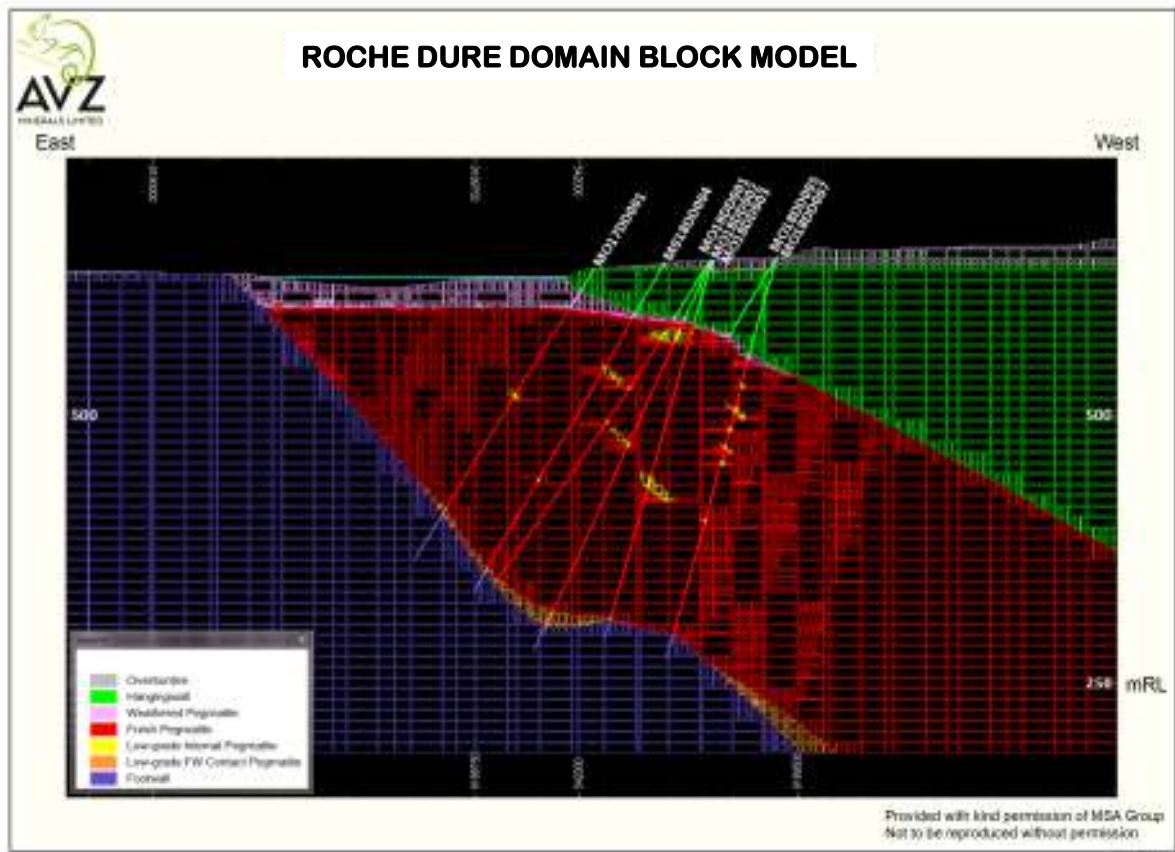
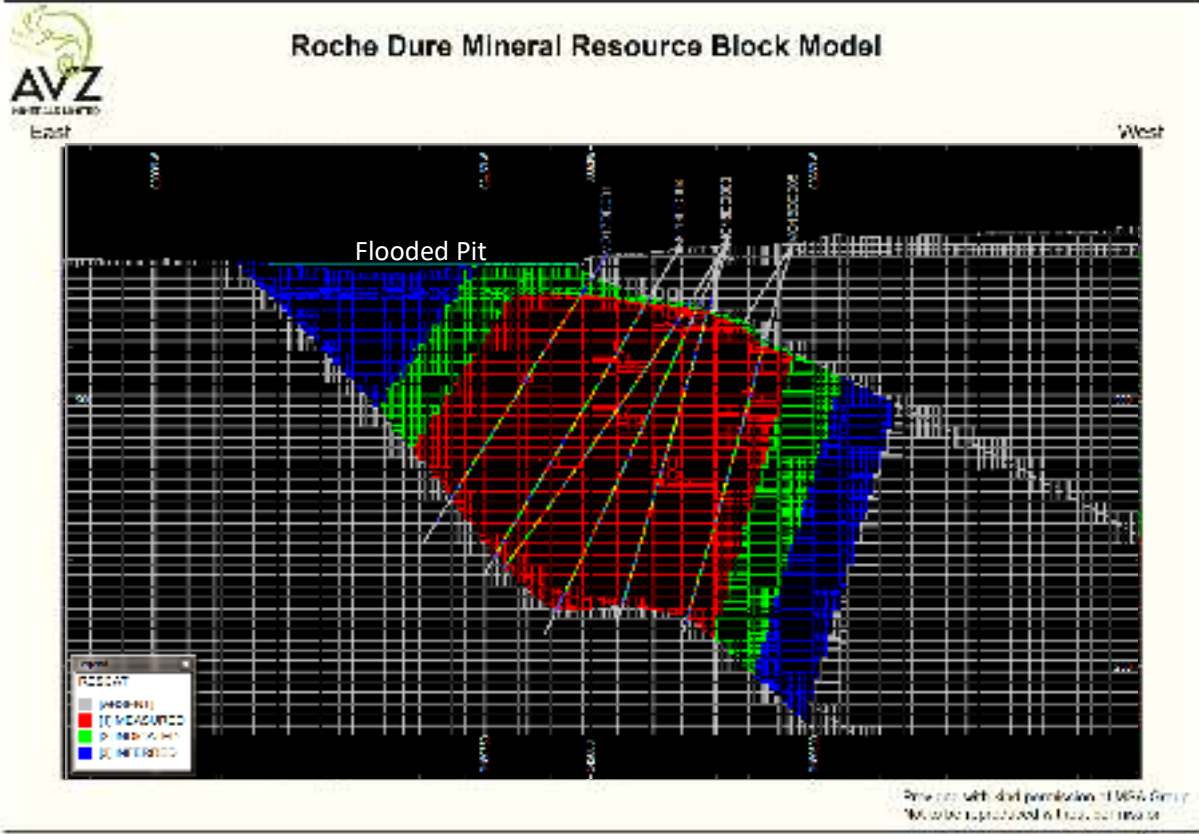


Figure 3 Roche Dure Geologic Domain Block Model

The figure above, highlights the strength of the geological domain block model with little variation between the main pegmatite (red) the weather and altered pegmatite (pink and orange) and the wall rocks shown in blue and green. Note the flooded pit shown in pale blue at the surface directly above the weathered (pink) pegmatite. The Company has concluded that there is no reason other than access for drill rigs, to not be able to convert the area directly below the flooded pit to a higher resource category given pierce points are achieved. There is no guarantee that this is achievable and thus Inferred resources may not be uprated into Indicated or Measured category.



The figure above shows the resource block model by category with Measured (red), Indicated (green) and Inferred (blue) as constructed and reported by The MSA Group. In order to access the higher category resources, some tonnage of Inferred resources will need to be mined beneath the flooded Roche Dure pit floor.

The Mineral Resources currently identified at Manono amount to: Measured 43Mt at 1.71% Li<sub>2</sub>O, Indicated 104.7Mt at 1.64% Li<sub>2</sub>O and Inferred 112.2Mt at 1.60% Li<sub>2</sub>O for a total of 259.9Mt at 1.63% Li<sub>2</sub>O.

The current drilling has been restricted to areas where there has been ready access. The proposed mine underlies a previous open pit mine that has closed and is now flooded to a depth up to about 20m (See Figure 3 and 4 above). To intersect the ore body under the pit has been spatially challenging and hence a substantial portion of the Resource has been classified as Inferred. This can be seen on Figure 4 cross-section through the orebody showing the Measured (red), Indicated (blue) and Inferred (green) blocks on that section.

It is proposed to dewater the existing pit to gain access for further drilling. In the mean-time shallow dipping holes are planned, with some already completed, but awaiting assay information, to confirm the resource in further detail as close to the base of the flooded pit as can be achieved using conventional diamond drilling techniques.

At this stage of the project, no further guidance can be given as to the probability of the current Inferred Resource being converted to Measured and Indicated classifications without dewatering the pit and drilling shallow holes from the pit floor and west wall to the top of the underlying Measured Resources.

At this early stage of the project no detailed mine planning or scheduling has been carried out. However initial pit shell construction and definition has been used to satisfy one aim in this case, that is to target the Measured and Indicated Resource tonnages, as can be seen on Figures 4 & 5, these are located to the right of the section, away from the flooded old pit. It is expected as that area is drilled and the Resources come into the Measured and Indicated categories, mining would commence there and the

overall strip ratio would be greatly reduced. Three basic pit shapes have been developed to mine successively the Measured and Indicated Resources with the balance to be mined beyond the 20 year mine life at a production rate of 2Mtpa of Ore. These nominal pit shells, no ramp designed at this stage, are shown on the Figure 7.

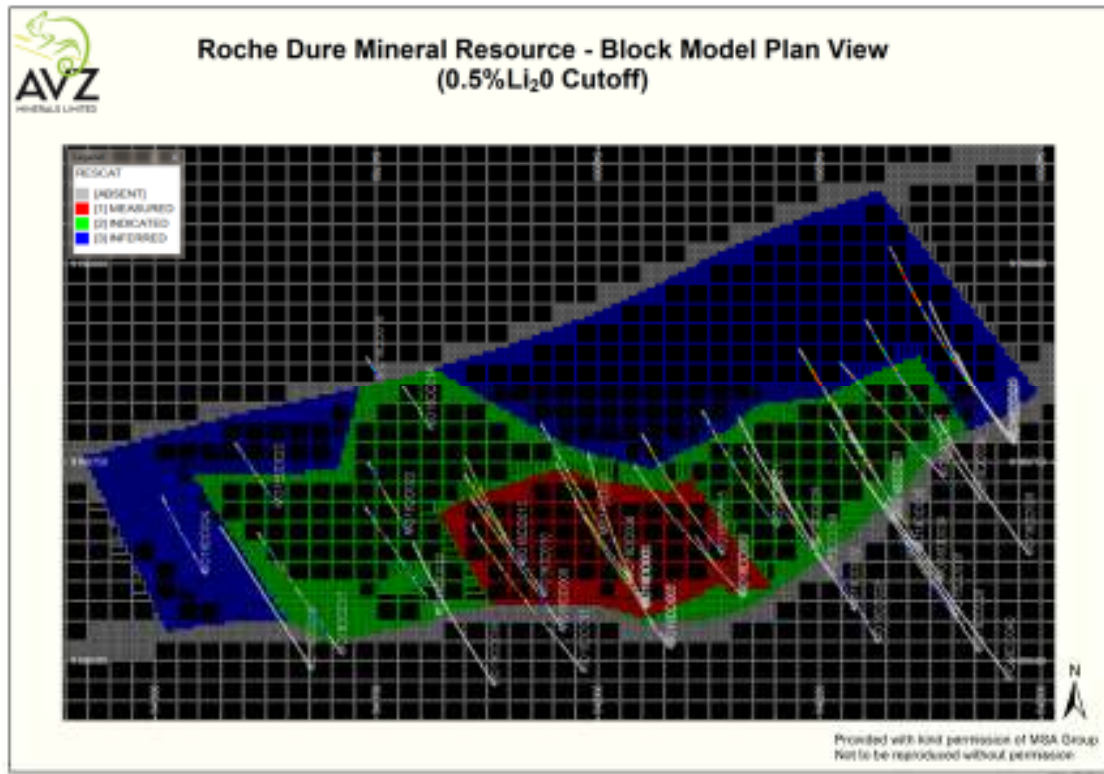


Figure 5 Roche Dure – Plan View of Resource Block Model Projected to Surface

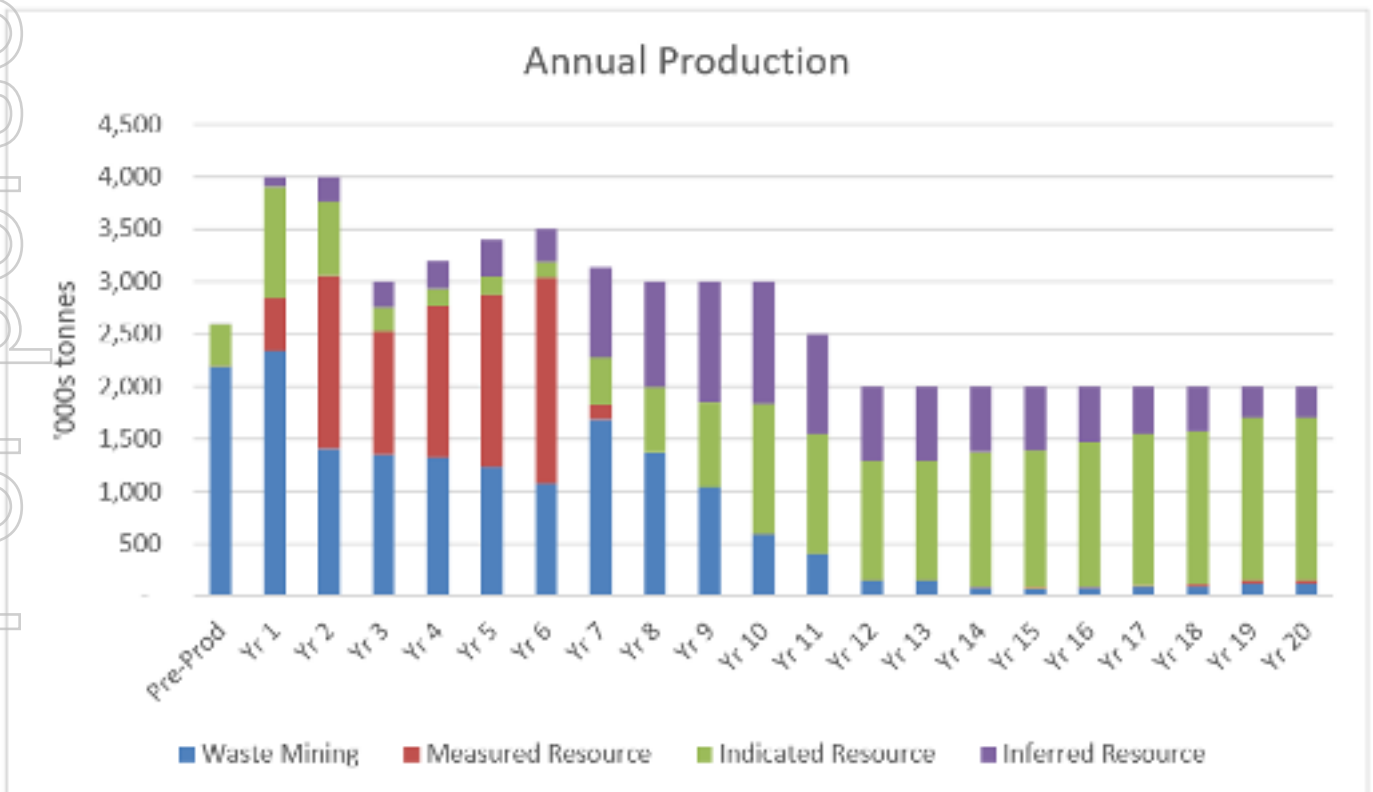


Figure 6 Production Schedule by Mining Category

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The estimated capital costs and LOM cash costs based on the design outlined in this report are presented in Table 4 and Table 5. The costs are based on 100% of project interest. AVZ holds 60% interest in the Manono Lithium Project.

Production Rate	US\$M	Accuracy %	Contingency
Case 1 – 2 Mtpa throughput	150-160	±35%	US\$36M

*Table 4 Capital Cost Summary, Accuracy and Contingency*

Cost Centre	US\$/t feed 2Mtpa	US\$/t concentrate 2Mtpa
Mining	12	56
Processing	14	64
Transport	49	221
Admin and Sust. capital	3	14
<b>Total Operating Costs</b>	<b>78</b>	<b>355</b>

*Table 5 Operating Costs Estimates for Case 1 (2Mtpa)*

## Financial Analysis

### *Introduction*

The Financial Analysis Model has been prepared on a Microsoft Excel spreadsheet to industry standards. The model has been developed by Alan Dickson & Associates Pty Ltd, an independent consultant to AVZ Minerals Limited, using inputs supplied by CPC Engineering. Other consultants employed on the project such as The MSA Group for the Mineral Resources, Nagrom for metallurgical testing and Peter Spitalny on the drilling results and interpretation.

The Financial Model has been built with flexibility in order to allow sensitivity studies to be carried out to determine the main project drivers. The main inputs have been supplied in a form that does not allow all the main drivers to be varied in a way to determine some of the main drivers, such as the ideal throughput rate to be adopted.

### *Basis of Economic Analysis*

The principal method adopted to carry out the valuation is that of Net Present Value (NPV) and Internal Rate of Return (IRR) on Real (non-escalated), rather than Nominal (escalated) costs and revenue. Discount Factors of 10% per annum (pa) and 15% pa have been assessed. The financial modelling is carried out by an independent financial expert and the choice is based on their experience and expert determination. In the case of Manono, the Discount factor of 10% per annum used is considered to be industry standard and comparable against other mining companies operating in Africa (Ivanhoe Mines NPV<sub>8</sub> – Kipushi Zinc Project in DRC, Birimian Limited NPV<sub>10</sub> – Goulamina Lithium Project in Mali) and by peers in Australia (Kidman Resources NPV<sub>10</sub> – Earl Grey Lithium Project, Altura Mining Limited NPV<sub>8</sub> – Pilgangoora Lithium Project, Pilbara Minerals Limited NPV<sub>10</sub> – Pilgangoora Lithium and Tantalum Project).

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The analysis has been based on a base case production rate of 2Mtpa of ore fed to the plant, the costs for this case has been developed to a scoping study level of detail.

The basis for the valuation has been to adopt current (mid 2018) costs and not applying any escalation to those costs between now and the completion of the project. Revenue figures have similarly been adopted, though in the case of revenue the sensitivity calculations have been more extensive.

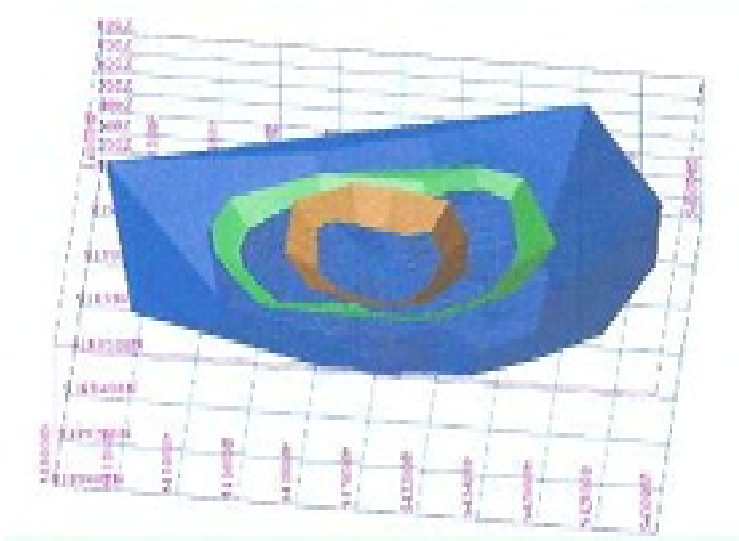
**Summary of Results**

The estimates presented in this Scoping Study are based on 100% project interest. AVZ holds 60% interest in the Manono Lithium Project.

The current “Base Case” (Case 1 – 2Mtpa) provides a pre-tax pre-royalties NPV at 10% DCF of approximately US\$1.6Bn and at a 15% DCF of US\$1.0Bn (AVZ’s 60% share is US\$0.93Bn and US\$0.6Bn respectively). The IRR has been assessed as greater than 90%. The basis for this Base Case are: Throughput 2M tpa, Production Life 20 years, Price US\$920/t of concentrate at 5.8% Li<sub>2</sub>O, based on an ore grade of 1.58% Li<sub>2</sub>O and metallurgical recovery of 80.9% of the Li<sub>2</sub>O. All costs have been assumed to occur in the period of activity and the revenue has been deferred 3 months from the time of processing on site.

**More Detailed Description of Case 1**

Case 1 (2Mtpa) has a start of construction period of 4 quarters and then starting with a gradual build-up of production to the full rate of 2 Mtpa. It is assumed the former workings which are now flooded will be pumped out sufficiently to allow preparation for confirmation resource drilling and mining prior to the start of plant production. One aim in this case has been to target the Measured and Indicated Resource tonnages, these as can be seen on Figures 4 & 5 are located to the right of the section, away from the flooded old pit. It is expected as that area is drilled and the Resources come into the Measured and Indicated categories mining would commence there and the overall strip ratio would be greatly reduced. Three basic pit shapes have been developed to mine successively the Measured and Indicated Resources with the balance to be mined beyond the 20 year mine life at a production rate of 2Mtpa of Ore. These nominal pit shells, no ramp designed at this stage, are shown on the Figure 7.



**Figure 7 Nominal Pit Shells**

The production scenario has been based on the metallurgical testwork carried out by Nagrom on two composite ore samples sourced from the drilling program. The grades of these samples were 1.762% and 1.397% Li<sub>2</sub>O respectively for an average grade of 1.58%Li<sub>2</sub>O.

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The Mineral Resource grades determined by The MSA Group were: Measured 43Mt at 1.71% Li<sub>2</sub>O, Indicated 104.7Mt at 1.64% Li<sub>2</sub>O and Inferred 112.2Mt at 1.60% Li<sub>2</sub>O (*Refer <sup>1</sup>*) for a total of 259.9Mt at 1.63%Li<sub>2</sub>O. This study adopted a mining grade of 1.58% Li<sub>2</sub>O, which allows for some dilution, about 3% which as the orebody is very wide should be sufficient. The bulk of the orebody is exposed under flooded old pit workings and so the strip ratio will be minimal, a strip ratio of 0.7 t waste to 1 t of ore has been assumed.

The Mineral Resource is reported in Table 6 below at a cut-off grade of 0.5% Li<sub>2</sub>O and has been classified as Measured, Indicated or Inferred Resources in accordance with the guidelines of the JORC Code (2012).

Fresh Pegmatite Category	Tonnes (Millions)	Li <sub>2</sub> O %	Sn ppm	Ta <sub>2</sub> O <sub>5</sub> ppm	Fe <sub>2</sub> O <sub>3</sub> %	SG
Measured	43.0	1.71	871	42	0.96	2.73
Indicated	104.7	1.64	844	43	0.85	2.73
Inferred	112.2	1.60	834	43	0.88	2.73
<b>Total</b>	<b>259.9</b>	<b>1.63</b>	<b>844</b>	<b>43</b>	<b>0.88</b>	<b>2.73</b>

*Table 6: Manono Roche Dure – Mineral Resource at a 0.5% Li<sub>2</sub>O cut-off*

The Study utilised all Resource categories as the basis for the study.

The recovery factor based on Nagrom's testwork was 93.04% at a 5.8% Li<sub>2</sub>O concentrate grade (Sample 1) and 58.85% at a 5.9% Li<sub>2</sub>O concentrate to give an average recovery of 80.95% at 5.8% Li<sub>2</sub>O. Even at a recovery of only 59% the NPV<sub>10</sub> is US\$1.1 Bn (*AVZ's 60% = US\$0.64 Bn*).

Case 1 has been assumed to operate for 20 years.

There are no guarantees that this will be achieved, as it requires most of the resources classified as Inferred to be brought into the Measured or Indicated categories. There is substantial geological information to suggest that a higher resource tonnages and classification can be achieved at the project. However, if for example the 2Mtpa case had a reduced production life and is shortened to 10 or 15 years, the NPV<sub>10</sub> is reduced to US\$1.0 Bn and US\$1.4Bn respectively (*AVZ's 60% share = US\$0.6Bn and US\$0.8Bn respectively*).

The capital costs of the project have been primarily estimated by CPC Engineering, other capital costs such as pit dewatering, ROM pad building have been conservatively made in conjunction with AVZ technical personnel.

<sup>1</sup> Announcement dated 2<sup>nd</sup> August 2018: Maiden Mineral Resource – Manono Lithium Project

The operating estimates have been made by a combination of personnel. The mining operation by contractors Teichmann, a South African firm already operating in the DRC. The process plant operation, including power generation and the mine accommodation camp by CPC Engineering, labour costs including flight costs were supplied by AVZ who also provided the operating estimates for concentrate haulage to the port at Dar Es Salaam in Tanzania and the miscellaneous staff associated, on site, with the operation such as General Manager, Accounts, Human Resources, Environmental Management, Community Relations and Security teams.

A provision of US\$1M annually has been allowed for a trust to assist the local community.

AVZ personnel developed the concentrate haulage costs, with assistance from CPC for the capital components. It has been assumed the trucks and containers used for transporting the concentrate will be sourced on a hire basis.

The concentrate is assumed to be shipped at a moisture content of 5%.

The revenue has been based on a mixture of public disclosures by other Lithium producers and from Asian Metals and Platts, internationally recognised data providers. The price has been based on a Free on Board (F.O.B.) basis. The base price adopted was US\$800/t of dry concentrate at 5% Li<sub>2</sub>O, plus US\$15 for every 0.1% above the 5% figure. Thus, for a concentrate grade of 5.8% Li<sub>2</sub>O the price is US\$800 + 8 x \$15 = US\$920/t.\*, this approach is consistent with that reported by Galaxy Resources Limited<sup>#</sup>.

*\*The Asian Metals link is <http://www.asianmetal.com/LithiumPrice/Lithium.html>*

*\*The Platts link is <https://mp.weixin.qq.com/s/6NFYHoerCk5vIDpe871Oxw>*

*<sup>#</sup>Refer to Galaxy Resources Limited ASX announcement date 14 December 2016*

### **Key Assumptions**

A number of key assumptions have been made in the financial assessments, the main ones are:

- The geological interpretation, block modelling and grade estimation are according to JORC guidelines and standards of accuracy as reported by The MSA Group.
- The mining rate proposed and build-up in production is achievable, this should present no problems in the 2 Mtpa.
- The production head grade, taking into account dilution and ore losses, can be maintained at an average scheduled grade of 1.58%Li<sub>2</sub>O. It is apparent from the drill results to-date that the mining must be carefully scheduled to maintain a reasonably consistent feed grade.
- The process plant can achieve the average recovery and concentrate grade scheduled, even though this has only been based on the average of a two (2) sample metallurgical test-work program. For the Pre-Feasibility Study and/or Feasibility Study stages further test-work must be done and some of this must target where the early plant feed will be sourced from.
- The bulk of the labour required for the project can be sourced in Manono and the DRC, and that expat staff can be sourced from other African nations and/or European ones. No allowance has been made to import staff on a FIFO basis from Australia.
- The proposed concentrate haulage method and costs are achievable.
- Sufficient detail has been incorporated for the study to achieve a Scoping Study status.

## Key Variables

The Key variables are those variables that are believed to have the greatest impact on the economic value of the project. These items are: Concentrate Sale price, project production life, transport costs of the Concentrate, Ore Grade and metallurgical recovery. The other operating and capital costs are not major value drivers for this project.

### Concentrate Sale Price

Concentrate sale prices have been highly variable over the last few years. The base case adopted uses a price of US\$800/t concentrate based on a 5%Li<sub>2</sub>O grade and then adds US\$15 for each 0.1% Li<sub>2</sub>O grade.

The concentrate sale price has been performed using four pricing assumptions as outlined below. The general consensus of external price studies (Benchmark Minerals & market experts<sup>1</sup>) in the market is that the long-term lithium carbonate price will range from US\$12,000 to US\$14,000 which is 50% higher than today in China.

It should be noted that Manono Lithium Project will produce a premium product having the lowest level of deleterious elements of any Australian listed hardrock lithium project. This receives a price premium as it reduces the need for expensive processing to remove these impurities.

1. Manono Lithium Project will be producing a 5.8% Li<sub>2</sub>O or potentially higher lithium concentrate which receives a material premium above the 5% Li<sub>2</sub>O price. Galaxy Resources<sup>2</sup> publicly stated that a US\$15 applied for each 0.1% lithium grade higher than 5.0% Li<sub>2</sub>O. Therefore at a 5.8%+ Li<sub>2</sub>O grade, the additional 0.8% would receive a further US\$120/t or US\$920/t in total.
2. Recent scoping study by Premier African Minerals Ltd also located in Southern Africa and a lithium concentrate proposed project using a long term 5% Li<sub>2</sub>O price of US\$800<sup>3</sup>. Manono Lithium Project will be producing a 5.8% premium product.
3. In addition, Mineral Resources announced on 11 April 2018 advising that the sale price for 6% Spodumene concentrate from their Mt Marion lithium project has been revised to US\$960/t up from US\$900/t. This revised price will be effective until the end of the financial year.

<sup>1</sup>Benchmark Minerals link <https://investingnews.com/daily/resource-investing/energy-investing/lithium-investing/lithium-outlook/>

<sup>2</sup>Refer to Galaxy Resources Limited ASX announcement date 14 December 2016

<sup>3</sup>Premier African Minerals Ltd – Zulu Scoping Study link <https://markets.ft.com/data/announce/full?dockey=1323-13437914-571J6B829GTIA4S78DF61SNOCO>

As quoted on Asian Metal\* (AM) the 5% lithium concentrate price as of 27<sup>th</sup> September 2018 was US\$820/t. Platts\*\* reported on 27<sup>th</sup> September 2018 that the price of 5.0-5.5% Lithium concentrate FOB Australia was RMB 6,500/t which is equivalent to US\$ 944.61/t. Additionally, Platts reported the 5.0-5.5% lithium concentrate price within China was RMB 7,000/t - 8,000/t which is equivalent to US\$ 1,017.27/t to US\$ 1,162.60/t.

\*The Asian Metals link is <http://www.asianmetal.com/LithiumPrice/Lithium.html>

\*\*The Platts link is <https://mp.weixin.qq.com/s/6NFYHoerCk5vIDpe871Oxw>

AVZ believes that there is significant upside for lithium concentrate pricing in the mid-term. However, it is the Company's view that the Manono Lithium Project must be economically viable in low priced market conditions. AVZ has therefore used a price of US\$920/t for the purpose of this Scoping Study.

The sensitivity looked at prices for the 5.8% Li<sub>2</sub>O concentrate from US\$600 to US\$1200/t (Refer Figure 1).

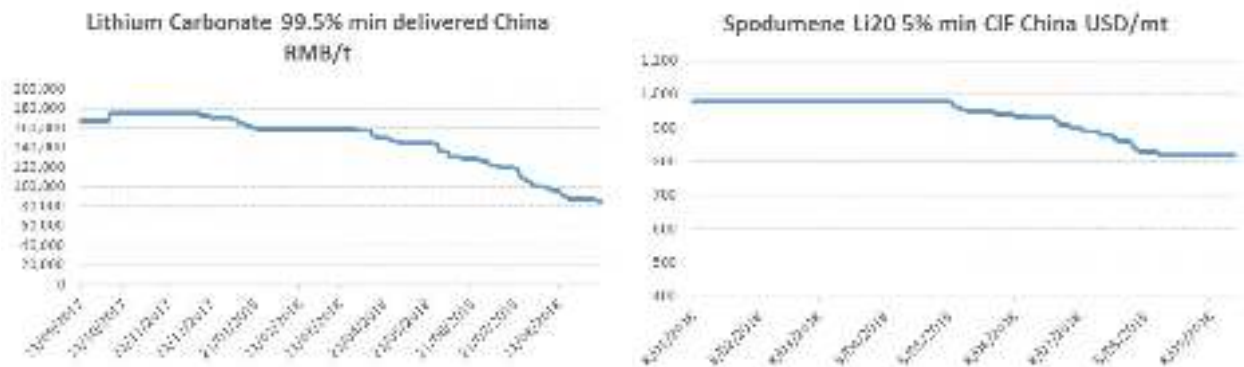


Figure 8 Trends in Lithium Carbonate and Lithium Concentrate pricing 2017 to 2018

### Project Life

Virtually all scenarios studied for the sensitivities, the IRR was generally very high at over 50%, this is because the payback period tends to be quite short and within 3 years of production commencing. Thus high positive cash flows in the future do add to the NPV, but this impact reduces by time as can be seen on the graph below.

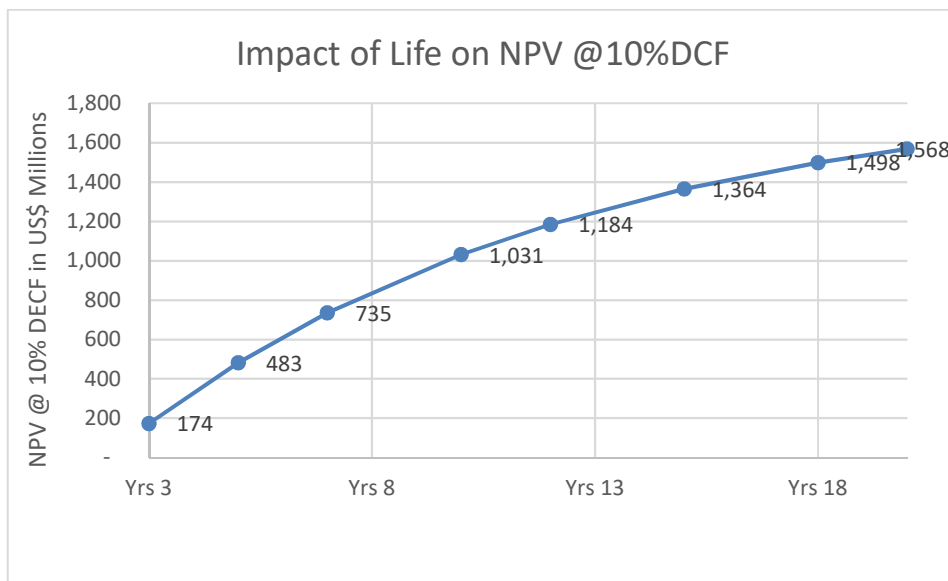


Figure 9 Impact of Changing Production Life

(Estimate based on 100% project interest. AVZ holds 60% interest in the Manono Lithium Project)

### Transport Costs of Concentrate

The proposed transport route is adopting closed containers of approximately 30t. These will be truck loaded at site and transferred to the port town of Moba on the west coast of Lake Tanganyika, a distance of about 360km. There the containers will be loaded on to custom- made barges carrying 50 containers and sailed about 240km to the Tanzanian port of Kigoma on the east coast of the lake. It will be offloaded directly to flat tops for railing to Dar es Salaam some 1450km away. This cost represents the largest operating cost amounting to some US\$211/t of concentrate which when 5% moisture is taken into account equals US\$221/t dry concentrate representing about 66% of all operating costs.

Refer to Figure 1 for sensitivity analysis on NPV<sub>10</sub> on transport costs.

### Metallurgical Recovery and Grade Background

Metallurgical test work completed by consultants, Nagrom a privately owned independent Western Australian company, and was completed on two drill hole samples of pegmatite ore from the Roche Dure deposit. From the 83 samples received by Nagrom, totalling approximately 262kg of material, two composites were created (MO17DD001 Comp and MO17DD002 Comp). The initial characterisation test work completed by Nagrom was released to the market. These samples do not fully represent the entire orebody but given the orebodies lack of variability and its homogenous nature, the two samples are considered to be representative for the accuracy of this level of study.

Sample ID	Mass (kg)	Li <sub>2</sub> O (ppm)	Fe <sub>2</sub> O <sub>3</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	SiO <sub>2</sub> (%)
MO17DD001 Comp	151	17620	0.953	16.050	74.305
MO17DD002 Comp	111	13970	0.902	16.006	73.589

*Table 7. Mass and head grades of the two samples for initial characterization test work*

The two drill holes, from which material was sourced are located within the Roche Dure pegmatite body, approximately 400m apart, were drilled through the thickest section of the Roche Dure pegmatite where it is thought initial mining may take place.

Further test work has commenced with the initial drill hole in the program. This complementary data will form the basis of the metallurgical test work for the expected full feasibility study of Roche Dure. This sampling process will be more spatially representative of the first 20 years of the expected mining life.

Nagrom developed two flowsheets and processed a sub-sample for each of the two composite samples through each methodology. Flowsheet A (processing via Batch Reflux, DMS and flotation) was tested and compared against Flowsheet B (processing a whole of ore via cyclone deslime and flotation) to evaluate potential Li<sub>2</sub>O recoveries and grades.

MO17DD001 had the highest circuit grade and recovery via Flowsheet B with a combined concentrate grade of Li<sub>2</sub>O of 58001ppm (5.8% Li<sub>2</sub>O) with a recovery of 93.04% and mass yield of 28.76% with the selected circuit summary units.

MO17DD002 had the highest circuit grade via Flowsheet B with a combined concentrate grade of Li<sub>2</sub>O of 59050ppm (5.91% Li<sub>2</sub>O) with a recovery of 58.85% and mass yield of 14.25% with the selected circuit summary units.

Given that the test work detailed within this report was conducted by experienced personnel at Nagrom's Kelmscott Metallurgical Facility under the supervision of the senior metallurgist and senior management team with extensive experience within the lithium industry in Australia and abroad, Flowsheet A was the selected treatment process.

The test-work program identified that both MO17DD001 and MO17DD002 were amenable to Density Separation with successful Silica rejection into a SG 2.7 Overflow stream. MO17DD001 Comp displayed 73.34% of the Li<sub>2</sub>O reported to the SG 2.95 Underflow fraction at a grade of 63120ppm (6.31% Li<sub>2</sub>O) and mass yield of 24.09%. MO17DD002 Comp displayed 66.44% of the Li<sub>2</sub>O reported to the SG 2.95 Underflow fraction at a grade of 63490ppm (6.35% Li<sub>2</sub>O) and mass yield of 17.85%.

The test work program identified that both MO17DD001 and MO17DD002 were amenable to flotation with only a cyclone deslime separation stage upfront to reject silicates and fines. The highest flotation  $\text{Li}_2\text{O}$  grade was achieved where the grind size was P80 0.18mm and Flotinator 7801 was used. Test 1 reported 81.49% of the  $\text{Li}_2\text{O}$  was recovered to the combined concentrate fraction at a grade of 51212ppm (5.12%  $\text{Li}_2\text{O}$ ) and mass yield of 22.47%. Test 5 reported 64.18% of the  $\text{Li}_2\text{O}$  was recovered to the combined concentrate fraction at a grade of 51538ppm (5.15%  $\text{Li}_2\text{O}$ ) and mass yield of 15.91%.

The average grade of the concentrates produced from the two composite samples is 5.8%  $\text{Li}_2\text{O}$  and this has been adopted for this report until further met test work can be completed on additional sample material. In addition, metallurgical recovery for the two samples averages 80.9% and this too has been adopted as a conservative recovery figure on which this Study has been based.

The available metallurgical test work results have been combined with standard industry practice and CPC's experience to develop the process plant flowsheet and design criteria. Further details on Ore Grade and Metallurgical Recovery are detailed below.

### **Ore Grade**

The ore grade adopted for the study was based on the average grade of the two metallurgical samples used to design the process plant flow sheet. The two samples were at grades of 1.76% and 1.40%  $\text{Li}_2\text{O}$ . The results from these samples gave quite different recoveries even if the final concentrate grades were fairly close at 5.8% and 5.9%  $\text{Li}_2\text{O}$  with the first sample achieving a yield of 25.33% of the feed to concentrate, whereas the second sample only achieved a yield of 19.1%. The first sample achieved a  $\text{Li}_2\text{O}$  recovery to concentrate of 84% whereas the second sample only achieved 77%. It may be important that the higher grade of material achieved considerably better results. The sensitivity analysis shown on Figure 1 above assumes the average recovery of 80.9%. Even adopting the lower yields and recoveries then the project still has a  $\text{NPV}_{10}$  of US\$1.3Bn (AVZ's 60% share is US\$0.78Bn).

### **Metallurgical Recovery**

The test-work completed by Nagrom indicated recoveries of 84.33% for sample 1 and 77.56% for sample 2. The study has adopted an 80.9% recovery. The project is robust enough to stand a sharp drop in recovery. Even at 50% recovery the  $\text{NPV}_{10}$  for the base 2Mt/pta case is US\$0.9 Bn and an IRR greater than 50%. Recovery has to drop to 22.2% for the  $\text{NPV}_{10}$  break-even.

Refer to Figure 1 for sensitivity analysis on impact of metallurgical recovery on the  $\text{NPV}_{10}$  for Case 1.



9,000 Gauss Magnetic 1



Non-Magnetic

*Microphoto images of pre and post extraction of magnetic minerals from the concentrate*



## Process Plant

The 2Mtpa base case plant flowsheet is based on unit operations that are well proven in industry, including three stage crushing, dense media separation, milling, magnetic separation and flotation. The key criteria for equipment selection are suitability for duty, reliability and ease of maintenance. The plant layout will provide ease of access to all equipment for operating and maintenance requirements whilst maintaining a compact footprint that will minimise construction costs.

The process plant will operate continuously (24 hours per day, 365 days per year) with a mechanical availability of 65% for the crushing plant and 85% for the treatment plant. Shutdowns for routine maintenance will occur as required.

A high-level process design criteria (PDC) was developed based on the test work and CPC in-house experience on similar projects.

The supporting documents for the design include:

- process design criteria
- simplified process flow diagram
- mechanical equipment list
- preliminary process facility layout
- preliminary site plan

In more detail the plant design consists of a 2 Mtpa DMS, flotation spodumene plant and consists of the following unit operations:

- Three stage crushing and screening circuit utilising an HPGR as the tertiary crusher to produce a final crushed product with a P100 of 3.35 millimetre (mm).
- A scalping screen to separate crushed ore to  $\pm 0.5$  mm.
- Two stage DMS cyclone circuit on the +0.5 mm material to produce the following streams:
  - 2.7 SG DMS floats (reporting to tailings)
  - 2.95 SG DMS floats (combining with the -0.5 mm material in the milling circuit)
  - DMS sinks (forming part of the final concentrate).
- Ball milling and classification circuit, with a final grind size of P80 of 180  $\mu$ m.
- Magnetic separation circuit, removing waste magnetic material before flotation.
- Magnetic separation circuit, removing waste magnetic material on the DMS sinks final concentrate.
- Rougher, cleaner and recleaner flotation cells producing a spodumene flotation concentrate.
- Concentrate thickener and pressure filter for reducing moisture in the spodumene flotation concentrate prior to shipping offsite.
- A tailings thickener to increase the pulp density to 60% prior discharge to a tailings storage facility (TSF) in future phases of work the need for a tailings thickener should be further considered.
- Reagents storage, mixing and dosing and water storage to support the process.

Professional Cost Consultants (PCC) were engaged by CPC to determine the factors to be used for developing the capital costs for each option due to their expertise with similar mineral processing projects and their local region experience.

The estimate covers the design and construction of the process plant and some site infrastructure. The estimate has a base date of the third quarter Q3 2018 (3Q18), is reported in US dollars (US\$) and is based on the supply and installation of new equipment.

The basis of estimate for the base case of 2 Mtpa is in accordance with the CPC Project Design Guidelines for Capital and Operating Cost Estimates. An equipment factored estimating method was used to achieve a Class 5 estimate with an accuracy of  $\pm 35\%$ .

An equipment factored estimate is based on a limited level of information and project definition. The mechanical supply costs are estimated with factors then applied to this amount to derive the other associated discipline costs.

Discipline factors were provided by PCC based on their experience on a combination of two projects located within the DRC and two Australian based lithium projects.

### **Environmental Updates**

Prior to work commencing at Manono, a Programme of Assessment and Adjustment of Mitigation and Rehabilitation Measures (PAR) was compiled and lodged on the Joint Venture's behalf by Cominière SARL, the DRC joint venture partner of AVZ on the Manono Lithium Project.

The PAR, which is a basic summary of existing environmental and flora and fauna conditions, was lodged with the relevant authorities in May 2017 and the subsequent granting of the PAR with the DRC Mines Department allowed AVZ to receive an authority to commence formal exploration activities on the concession in June 2017.

In April 2018, AVZ sub contracted local environmental specialists Congo Environment and Mining Consulting SARL (CEMIC), to carry out a baseline environmental study on PR13359. CEMIC are a long-established exploration and mining environmental consultancy with many large mining companies as clients including several non Congolese companies both past and present.

These foreign clients include Banro Corporation and SMK Anvil Mining as well as many large DRC domiciled mining companies including the state government copper and cobalt company Gécamines. As such they are well versed in the complexities of the Congolese environmental law.

The baseline study report can be used to determine the initial characterization of the environmental baseline and the quantification of impacts and development of management plans. Field surveys or seasonal measurement of relevant parameters in the fields of hydrology, soils, air quality, noise, aquatic ecology and terrestrial flora and fauna have been completed and this initial report will be used to gauge the effectiveness of ongoing rehabilitation and future changes to the environment of the mining concession.

To further record the local situation, AVZ are in the process of establishing an on-site weather station as well as using CEMIC to assist AVZ in regular sampling of the various environmental aspects including the water and soil quality as well as gathering data on the socio-economic impact of AVZ's presence in Manono.

These data will be used for regular reporting to the Government environmental regulatory authorities and as a basis for developing future management plans. Through a planned process of census survey and public consultation, the refinement of social impact management plans will be established.

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## Government Engagement Updates

AVZ Minerals Limited is the most recent exploration company to arrive in Manono. Various government departments have actively sought to enter into discussions regarding AVZ's presence and future plans. AVZ have had active talks with the DRC Customs authorities regarding the taxes paid to bring drilling equipment and consumables into the country, the DGM or Immigration Department concerning the status of expatriate workers, the tax authorities to ensure AVZ remains in compliance regarding tax laws and payments as well as the Mines Departments at both federal and provincial levels.

In June 2018, discussions were held with the Governor of Tanganyika Province, the Honourable Mr. Richard Kitangala at the government offices in the provincial capital of Kalemie. Following on from a successful 2 days site visit in early June attended by the Provincial Minister for Mines, Mr. Erick Banza, AVZ was invited to meet with the Tanganyika Governor and his staff to brief the Governor on the progress being made at Manono.

The Governor was pleased with the Company's progress and agreed to assist with the development of the project by allowing access to his staff to provide us with information on potential haul routes for export of product. He also made several suggestions regarding putting aside sole use lands for product handling at both Kalemie and Moba ports for our consideration to ensure smooth product handling to Tanzania and the railheads located there.



*Site visit by Provincial Mines Minister Mr Erick Banza (centre)*

## Community Involvement

AVZ recognises the importance in involving with community programmes. Manono is home to many foreign NGOs ranging from the Red Cross, CONCERN, Medicine Sans Frontiers, to PACT, an American organisation that tracks the source of tin, tantalum and tungsten used in the American electronics industry. It is AVZ's intention to assist these organisations where possible in simple humanitarian activities until the mine is re-established. The region suffers from chronic unemployment as well as health issues caused by endemic malaria as well as other diseases.

The most effective source of assistance is by way of employment and by the end of March 2018 it is estimated that AVZ had employed over 600 local people on a casual basis and distributed over US\$340,000 to the local people by way of wages. The current team consists of just over 70% local employees. The Company priorities on hiring local people wherever possible as well as encouraging ethnic minorities to apply for positions including women.

AVZ recently paid for the logistical support on a recent polio vaccination scheme in the greater Manono district. It is estimated that slightly over 95% of the local children in and around Manono who were targeted in the programme received their vaccination.



*Registering day for casual employment opportunities (above) and local workers working at site (below)*

AVZ has recently provided safe casual employment to approximately 320 artisanal workers who were illegally mining alluvial tin and tantalum on the Company concession to rehabilitate the main road that leads from the town to the Company camp site. This work is ongoing and is providing regular employment for 320 workers who are providing a vital community service by fixing the main road and its drainage system ahead of the coming rainy season.

AVZ plans to establish a Foundation Trust to transparently and fairly assist the local community to allocate royalties from mining. The current DRC Mining Law ensures that a portion of future production will be set aside for community programmes and the AVZ Foundation Trust will ensure the funds will be allocated and utilised accordingly.



## Tin Opportunity

The MSA Group defined total Measured, Indicated and Inferred Mineral Resources of 259.9Mt grading 1.63% Li<sub>2</sub>O containing 4.25Mt of lithium oxide (Li<sub>2</sub>O), 219Kt of tin as cassiterite and 11.2Kt Tantalum.<sup>1</sup>

Nagrom completed spodumene concentration test work on drill hole samples of pegmatite ore from the Roche Dure deposit. From the 83 samples received by Nagrom, two composites were created (MO17DD001 Comp and MO17DD002 Comp) as per instructions from AVZ.

The head assays for the two composite samples are shown in the table below:

Sample ID	Mass (kg)	Li <sub>2</sub> O (ppm)	Fe <sub>2</sub> O <sub>3</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	SiO <sub>2</sub> (%)	SnO <sub>2</sub> (%)
MO17DD001 Comp	151	17620	0.953	16.050	74.305	0.126
MO17DD002 Comp	111	13970	0.902	16.006	73.589	0.101
Average	-	15795	0.928	16.028	73.947	0.114

*Table 8 Composite Sample Head Assays*

The composite samples were split into two charges and tested via Flowsheet A and Flowsheet B, of which Flow Sheet A was selected and is discussed further in the following paragraphs.

Tin and tantalum recoveries to the final concentrate of Flowsheet A were recorded as SnO<sub>2</sub> and Ta<sub>2</sub>O<sub>5</sub> as shown below.

Sample ID	Mass Yield to Concentrate (%)	SnO <sub>2</sub> Calculated Feed Grade (%)	SnO <sub>2</sub> (%)	SnO <sub>2</sub> (% recovered)	Ta <sub>2</sub> O <sub>5</sub> Calculated Feed Grade (%)	Ta <sub>2</sub> O <sub>5</sub> (%)	Ta <sub>2</sub> O <sub>5</sub> (% recovered)
MO17DD001	25.33	0.152	0.500	83.3	0.003	0.010	84.4
MO17DD002	19.10	0.092	0.370	76.8	0.003	0.012	76.4

*Table 9 Flowsheet A SnO<sub>2</sub> and Ta<sub>2</sub>O<sub>5</sub> Overall Recovery and Grade*

Further test work was conducted on the tin and tantalum recovery with a sighter wet table test conducted on the P100 1 mm cyclone underflow material from the MO17DD001 composite sample to investigate the recovery of tin (as SnO<sub>2</sub>) and tantalum (as Ta<sub>2</sub>O<sub>5</sub>). Mass deportments and grades are shown in the table below.

<sup>1</sup> Announcement dated 2<sup>nd</sup> August 2018: Maiden Mineral Resource – Manono Lithium Project

Product Fraction	Mass Yield (%)	SnO <sub>2</sub> (%)	SnO <sub>2</sub> (distribution %)	Ta <sub>2</sub> O <sub>5</sub> (%)	Ta <sub>2</sub> O <sub>5</sub> (distribution %)
Cut 1	2.58	2.655	51.10	0.055	49.59
Cut 2	10.07	0.341	25.56	0.005	17.56
Cut 3	18.89	0.056	7.88	<0.01	0.00
Cut 4	21.05	0.026	4.08	0.002	14.69
Cut 5	15.66	0.023	2.68	<0.01	0.00
Cut 6	12.88	0.030	2.88	0.002	8.99
Cut 7	5.71	0.022	0.93	<0.01	0.00
Cut 8	0.01	0.022	0.00	<0.01	0.00
Slimes	13.14	0.050	4.89	0.002	9.17
Calculated Head	100	0.134	100	0.003	100

*Table 10 Tin and Tantalum Recoveries from a Sighter Wet Table Test*

The combined cut 1 and cut 2 fractions recovered 76.66% of the SnO<sub>2</sub> at a grade of 0.814% and 67.15% of the Ta<sub>2</sub>O<sub>5</sub> at a grade of 0.015% with a mass yield of 12.65%.

As can be seen from the preliminary test work a significant tin recovery can be achieved using conventional gravity recovery techniques. This has significant potential benefit to the project and it is the company's intention to complete further test work to determine the optimum processing route for tin recovery.

## Cautionary Notes: Forward Looking Statements

*The findings contained in this study reflect an ongoing analysis and therefore there is no certainty that all the conclusions reached in this study will be realised. This report contains forward-looking statements. All statements, other than statements of historical fact, that address activities, events or developments in respect of which it is believed, expected or anticipated will or may occur in the future (including, without limitation, statements regarding estimates and/or assumptions in respect of production, revenue, cash flow and costs, estimated project economics, mineral resource and mineral reserve estimates, potential mineralization, potential mineral resources and mineral reserves, projected timing of possible production and exploration and development plans and objectives) are forward-looking statements.*

*These forward-looking statements reflect current expectations or beliefs based on information currently available. Forward-looking statements are subject to a number of risks and uncertainties that may cause the actual results of AVZ to differ materially from those discussed in the forward-looking statements, and even if such actual results are realized or substantially realized, there can be no assurance that they will have the expected consequences to, or effects on AVZ.*

*Factors that could cause actual results or events to differ materially from current expectations include, among other things: uncertainties relating to the availability and costs of financing needed in the future; uncertainty of estimates of capital and operating costs, production estimates and estimated economic return; the possibility that actual circumstances will differ from the estimates and assumptions used in the Manono Scoping study; failure to establish estimated mineral resources or mineral reserves; fluctuations in lithium and tin prices and currency exchange rates; inflation; metal recoveries being less than those indicated by the metallurgical test work carried out to date (there can be no assurance that lithium and tin recoveries in small scale laboratory tests will be duplicated in large tests under on-site conditions or during production); changes in equity markets; political developments in the DRC; lack of infrastructure; failure to procure or maintain, or delays in procuring or maintaining, permits and approvals; lack of availability at a reasonable cost or at all, of plants, equipment or labour; inability to attract and retain key management and personnel; changes to regulations affecting AVZ's activities; the uncertainties involved in interpreting drilling results and other geological data; and the other risks disclosed under the heading "Risk Factors" and elsewhere in the Company's public documentation.*

*Any forward-looking statement speaks only as of the date on which it is made and, except as may be required by applicable securities laws, any intent or obligation to update any forward-looking statement, whether as a result of new information, future events or results or otherwise, is disclaimed. Although it is believed that the assumptions inherent in the forward-looking statements are reasonable, forward-looking statements are not guarantees of future performance and accordingly undue reliance should not be put on such statements due to the inherent uncertainty therein.*

*The mineral resource figures referred to in this report are estimates and no assurances can be given that the indicated levels of lithium will be produced. Such estimates are expressions of judgment based on knowledge, exploration and mining experience, analysis of drilling results and industry practices. Valid estimates made at a given time may significantly change when new information becomes available. While it is believed that the resource estimates included in this report are well established, by their nature resource estimates are imprecise and depend, to a certain extent, upon statistical inferences which may ultimately prove unreliable. If such estimates are inaccurate or are reduced in the future, this could have a material adverse impact on AVZ.*

*Mineral resources are not mineral reserves and do not have demonstrated economic viability. There is no certainty that mineral resources can be upgraded to mineral reserves through continued exploration.*

*Due to the uncertainty that may be attached to inferred mineral resources, it cannot be assumed that all or any part of an inferred mineral resource will be upgraded to an indicated or measured mineral resource*



*as a result of continued exploration. Confidence in the estimate is insufficient to allow meaningful application of the technical and economic parameters to enable an evaluation of economic viability worthy of public disclosure (except in certain limited circumstances).*

For further information, visit [www.avzminerals.com.au](http://www.avzminerals.com.au) or contact:

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**AVZ Minerals Limited**  
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**Email: [admin@avzminerals.com.au](mailto:admin@avzminerals.com.au)**

### **Competent Person Statement**

*The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the 'JORC Code') sets out minimum standards, recommendations and guidelines for Public Reporting in Australasia of Exploration Results, Mineral Resources and Ore Reserves. The Information contained in this announcement has been presented in accordance with the JORC Code.*

*The information in the document to which this statement is attached that relates to the geology of the Roche Dure pegmatite is based upon information compiled by Mr Michael Cronwright (M.Sc.), who is a fellow of The Geological Society of South Africa and Pr. Sci. Nat. (Geological Sciences) registered with the South African Council for Natural Professions. Mr Cronwright is a Principal Consultant with The MSA Group (Pty) Ltd (an independent consulting company). Mr Cronwright has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activity he is undertaking to qualify as a Competent Person as defined in the 2012 edition of the JORC Code.*

*The Mineral Resource estimate has been completed by Mr Anton Geldenhuys (BSc Hons, MEng) who is a geologist with 17 years' experience in exploration and mining as well as Mineral Resource evaluation and reporting. He is a Principal Mineral Resource Consultant for The MSA Group (an independent consulting company), is a member in good standing with the South African Council for Natural Scientific Professions (SACNASP) and is a Member of the Geological Society of South Africa (GSSA). Mr Geldenhuys has the appropriate relevant qualifications and experience to be considered a Competent Person for the activity being undertaken as defined in the 2012 edition of the JORC Code.*

*The company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and, in the case of estimates of Mineral Resource or Ore Reserves, that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The company confirms that the form and context in which the competent person's findings are presented has not been materially modified from the original market announcement.*

## Summary Extract from CPC Scoping Study Report

CPC Project Design Pty. Ltd. (CPC) was retained by AVZ Minerals Limited to manage and complete a scoping study on the proposed Manono Lithium Project processing facilities and all non-process infrastructure. CPC has developed the process plant engineering design, operating cost and capital cost estimates for the project. AVZ sourced several additional quotes for various other items required to complement the study outcomes and these have been incorporated into the study results.

Alan Dickson and Associates (ADA) was retained by AVZ Minerals Limited to complete the financial modelling of the project. This too has been incorporated into the study results.

Scoping of processing facilities and all non-process infrastructure studies were undertaken on the current Measured, Indicated and Inferred Mineral Resource tonnages. Results from the initial characterisation metallurgical test work of the ore at Roche Dure were used to determine metallurgical recoveries and determine the processing flow sheet. Infrastructural and site services were refined for the project.

An economic model and financial analysis was also undertaken and completed by Alan Dickson and Associates, again only utilising Measured and Indicated Mineral Resource tonnages.

The results of the study encompass:

- Design is for a 2 Mtpa (Case 1) spodumene processing facility producing both DMS and flotation lithium oxide ( $\text{Li}_2\text{O}$ ) concentrates which are combined for shipping offsite.
- A proposed processing circuit including crushing, DMS via DMS cyclones, ball milling, rougher/cleaner/recleaner flotation, concentrate thickening and filtration, reagents and tailings pumping
- Design is based on a 1.58% lithium oxide ( $\text{Li}_2\text{O}$ ) feed grade.
- Assessment of four concentrate transport route options including more detail analysis of one of these options.

### Property Description

The project is situated adjacent to the town of Manono, Tanganyika Province, approximately 500 km north of Lubumbashi, the capital of the Haut Katanga Province in the DRC. The area is centred on 7°19' south latitude, 27°25' east longitude. The project site covers approximately 188 km<sup>2</sup>.

It is possible to reach the project area by road from Lubumbashi although sections of the road are in poor condition. Using a suitable four-wheel drive vehicle in the dry months, the trip can be completed in a day. During the wet months trucks may take up to 10 days to complete the distance. This road is currently subject to a US\$285M refurbishment by others with phase 1 expected to be completed within 18 months.

A local airline conducts regular flights between Manono and Lubumbashi with a flying time of approximately 1.5 hours.

## Exploration and Geology

The current exploration commenced in January 2017 and by September 2018, a total of 62 diamond drill holes had been completed. The programme included the extensive geological mapping along the +12.5 kilometre long pegmatite outcrop strike, which hosts the two principal zones of Kitotolo and Manono. Lithium and tin mineralisation is hosted in Lithium Caesium Tantalum (“LCT”) pegmatites which have intruded a sequence of chlorite schist along the margins of a major granite filled anticlinal structure.

The historic Manono Mine was mined for its tin content between 1919 and 1982, during which time a total of 100 million cubic metres (Mm<sup>3</sup>) (approximately 150 million tonnes) of ore were processed to produce 185,000 tonnes (t) of cassiterite concentrate, sourced mainly from eluvial and weathered pegmatite from which was recovered an average of 1,850 gram of cassiterite concentrate per cubic metre (g/m<sup>3</sup>) (0.185%) or approximately 1,330 g/m<sup>3</sup> tin. (0.133%)

Except for some exploration work carried out on the old mine dumps, aimed at determining cassiterite and spodumene grades, little prospection has taken place since 1960.

## Mining

A conventional open pit shovel and truck method will be used for the mining of sufficient ore to supply 2 Mtpa of ore throughput. It has been assumed that the mining functions of the operation will be carried out by contract miners. Equipment required will include two to three excavators, up to 8 ore trucks, associated dozers and graders and support equipment. Ore will be blasted and loaded into trucks for transport to the process plant which will be located within 1.5km of the main pit.

At this early stage of the project no detailed mine planning or scheduling has been carried out. However initial pit shell construction and definition has been used to satisfy one aim in this case, that is to target the Measured and Indicated Resource tonnages, as can be seen on Figures 4 & 5 above, these are located to the right of the section, away from the flooded old pit. It is expected as that area is drilled and the Resources come into the Measured and Indicated categories, mining would commence there and the overall strip ratio would be greatly reduced. Three basic pit shapes have been developed to mine successively the Measured and Indicated Resources with the balance to be mined beyond the 20 year mine life at a production rate of 2Mtpa of Ore. These nominal pit shells, no ramp designed at this stage, are shown on the Figure 6 above.

AVZ will engage in more detailed mine planning and scheduling around pit optimisation studies as part of the full feasibility study to be undertaken. Modelled mine life has been kept to a maximum of 20 years which is well within the current total defined JORC compliant resource tonnages of 147Mt for Measured and Indicated categories.

## Metallurgical Testing & Process Plant

Nagrom, a privately owned independent Western Australian company was engaged to perform metallurgical test work on drill hole samples of pegmatite ore from the Roche Dure deposit. Composite samples were created based on instructions from AVZ and tested against two proposed standard flowsheets.

Flowsheet A (Figure 10) was the selected treatment process which resulted in an average recovery of approximately 81% and an average mass yield of approximately 22% from the two composite samples. The average grade of the concentrates produced from the two composite samples is 5.8% Li<sub>2</sub>O.

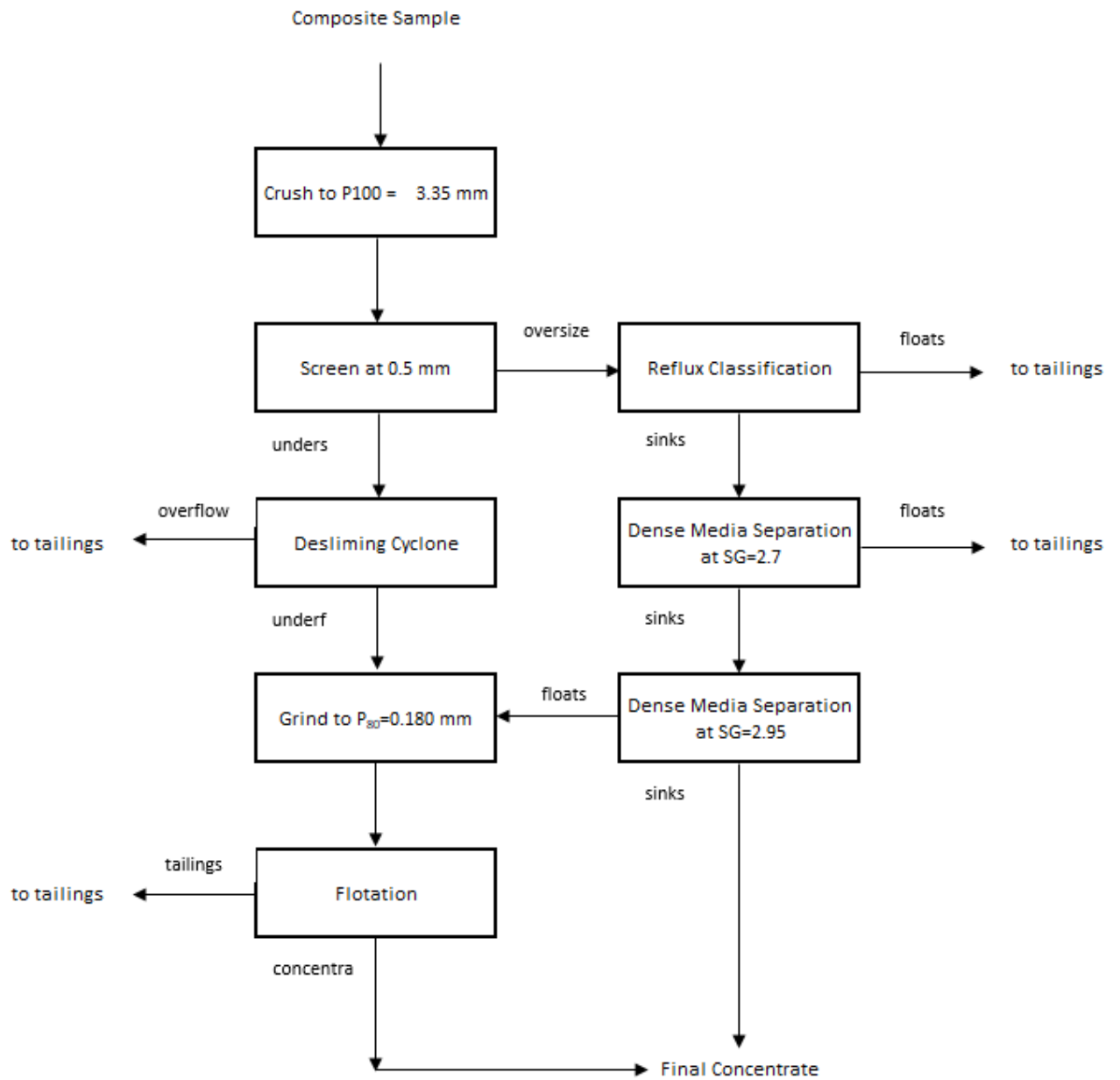


Figure 10 Flowsheet A

Preliminary test work indicates that significant tin recovery can be achieved using conventional gravity recovery techniques as a benefit to the project. Further test work should be considered to determine the optimum processing route for this recovery.

## Process Plant

The Manono Lithium Project consists of a 2 Mtpa DMS, flotation spodumene plant and consists of the following unit operations:

- Three stage crushing and screening circuit utilising an HPGR as the tertiary crusher.
- A scalping screen to separate crushed ore to coarse and fines streams
- Two stage DMS cyclone circuit on the coarse stream to produce two float streams and a single sinks stream which reports to the final concentrate.
- Ball milling and classification circuit.
- Magnetic separation circuit, removing waste magnetic material before flotation.
- Magnetic separation circuit, removing waste magnetic material on the DMS sinks final concentrate.
- Rougher, cleaner and recleaner flotation cells producing a spodumene flotation concentrate from the scalping screen fines.
- Concentrate thickener and pressure filter for reducing moisture in the spodumene flotation concentrate prior to shipping offsite.
- A tailings thickener to increase the pulp density prior discharge to the tailings storage facility (TSF).
- Reagents storage, mixing and dosing and water storage to support the process.

## Concentrate Transport

Traditionally, the path to market in the DRC is via Lubumbashi to Durban in South Africa however given the project's location in Manono, this is not considered an optimal route shown in Figure 10.

Through ongoing consultation and collaboration with local and regional government officials in the DRC and more recently with their counterparts in Tanzania, AVZ has determined that transport to Dar es Salaam in Tanzania is a more viable option for the project and is both shorter in distance and is expected to have lower costs than via road/rail to Durban.

## Transport Routes

There are three options for transporting spodumene concentrate from Manono to Dar es Salaam via alternate routes with varying configurations of road, motorised barge across Lake Tanganyika and rail, shown in Figure 11.

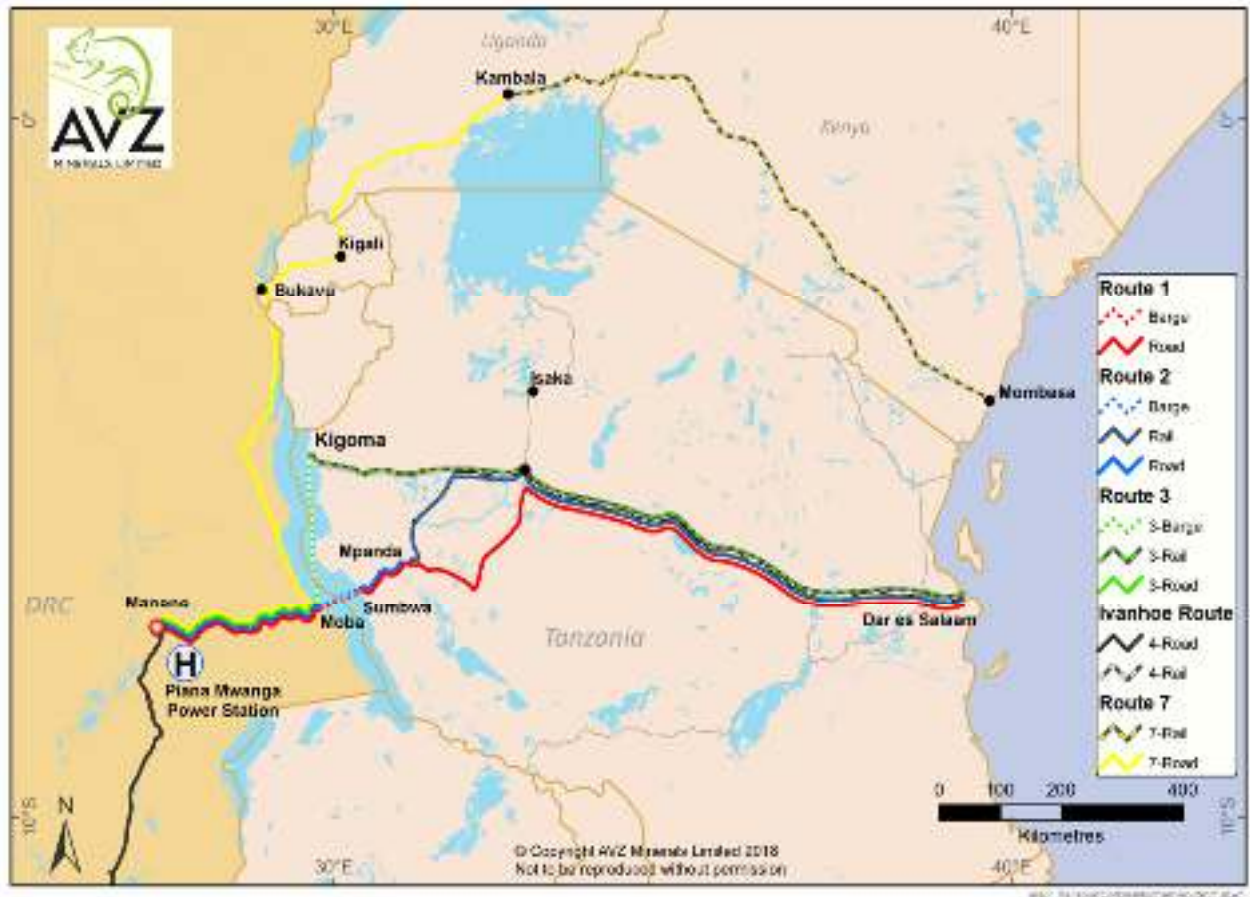


Figure 11 Transport Routes Overview

### Notes to Figure 11

1. Route 7 "The Northern Route" shown above was investigated as an option but was not included as part of this Scoping Study

### Concentrate Loadout

Spodumene concentrate will be reclaimed into tipping containers by FEL and transported from site by truck. Each container will hold approximately 30 t of material. Containers will be transported to Dar es Salaam as outlined in the section above.



*Movement of Tipping Containers*

At the wharf the containers are picked up and tipped into the shipping vessel shown in the figure below. Empty containers are then returned to the project site for refilling. Reagents and consumables are transported to site in the empty containers.



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Route	Transport Method	Distance
<b>Route 1</b>		
Manono to Moba	Road	360
Moba to Sumbwa	Ferry	75
Sumbwa to Dar es Salaam	Road	1,270
<b>Total</b>		<b>1,705</b>
<b>Route 2</b>		
Manono to Moba	Road	360
Moba to Sumbwa	Ferry	75
Sumbwa to Mpanda	Road	115
Mpanda to Dar es Salaam	Rail	1,450
<b>Total</b>		<b>2,000</b>
<b>Route 3</b>		
Manono to Moba	Road	360
Moba to Kigoma	Ferry	240
Kigoma to Dar es Salaam	Rail	1,450
<b>Total</b>		<b>2,050</b>

*Table 11 Transport Route Options and Approximate Distances*

### Transport Costs

Costs were developed for the three routes outlined including capex and opex to a scoping study level and were provided by AVZ as outlined in Table below. Further investigation into transport options is ongoing, however the preliminary costs provided are considered suitable for this level of study.

Route	Capex (US\$M)	Opex (US\$/t dry concentrate)
Route 1	12.5	232.49
Route 2	13.1	240.63
Route 3	14.1	221.34

*Table 12 Capital and Operating Costs of Transport Route Options*

Based on the summary table above, Route 3 is the selected option for this study and the capex and opex costs for this route have been included below.

Publicly released data from Ivanhoe Mines Kipushi Mine<sup>2</sup> located in the DRC which transports concentrate in similar quantities and distance, shows a back calculated transport cost of US\$232/t which is comparable to the costs shown in the table above. Trucks and containers are included in the operating costs and are not purchased by AVZ.

<sup>2</sup> <https://www.ivanhoemines.com/news/2017/ivanhoe-mines-announces-an-outstanding-pre-feasibility-study-for-the-rebirth-of-the-historic-kipushi-zinc-copper-silver/>



## Capital Costs

All routes require tipper spreaders for the container handling at the destination port. The spreader connects to the bulk cargo container and has a lifting mechanism that removes the lid and rotates the container tipping the concentrate into the ships hold in a single continuous operation. Based on production tonnages, it is assumed that three tipper spreaders will be required at a budget price of US\$500,000 each.

For Route 2 and Route 3 where containers are moved from the haul trucks onto rail cars at Mpanda and Kigoma respectively, two container forklifts will be required at an approximate cost of US\$300,000 each.

Each route will need a purpose-built barge for ferrying the containers from Moba. Route 1 and Route 2 will require a barge that is approximately 70 m long by 20 m wide for 5 rows of 5 long double trailers. Each container will hold approximately 30 t which means each ferry trip will contain 1,500 t of concentrate. The longer barge is required for these two routes as the fully loaded haul trucks will drive directly onto the ferry as the journey continues by road on the other end. It is assumed that each barge will cost US\$5,000,000.

For Route 3, containers are unloaded onto the ferry deck as they are directly loaded onto train on the other end, reducing the required length of the barge. The ferry distance for this route however is over three times longer therefore two purpose-built barges will be required. The barge dimensions will be approximately 50 m long by 20 m long and will hold 50 containers. It is assumed that the barges will cost US\$4,500,000 each.

Kigoma is the only town with suitable existing port facilities and no allowance has been made for any upgrades or modifications. Ports will have to be built at Moba for all options and at Sumbwa for Route 1 and Route 2, an allowance of US\$3,000,000 for each port upgrade has been allowed for in the capex. Trucks and containers are included in the operating costs and are not purchased by AVZ.

## Operating Costs

Operating costs have been estimated based on similar projects in the region. A haulage cost of US\$0.09/t-km has been used for this study and is similar to publicly released data from Ivanhoe Mines Kipushi Mine located in the DRC which through back calculation indicates a haulage costs of US\$0.07/t-km to Durban which is a slightly longer route.

Rail costs were based on published data from the Tanzania-Zambia Railway Authority (TAZARA) for Dar es Salaam to Kigoma and factored for the slight difference in distance to Mpanda. As these are public rates, there may be an opportunity to reduce the rail costs through negotiation of a long-term consistent contract.

## Transport Operating Costs

Operating costs have also been included for ferry operating and port charges which include:

- lifting containers from haul trucks
- leasing of hardstand area at the port
- terminal handling charges
- container handling
- documentation
- customs clearance charges

- agency fees
- wharfage
- container leasing costs
- truck hiring and operating costs
- export costs.

## Tailings and Water Management

### *Tailings*

The TSF will be located within a short distance of the processing facility. The most likely location will be an area between the existing waste dumps from the earlier mining operations. Further detailed studies will be undertaken during the Feasibility Study and will allow for safe confinement of the LOM process waste.

### *Water Supply*

Raw water supply will be sourced from the nearby Lake Lukushi which has an existing dam. Raw water will be transferred from the dam, via a pump station, to a raw water pond located at the plant site through approximately 8 km of polyethylene pipe installed on the surface.

## Infrastructure and Logistics

### *Airstrip*

There is an existing airstrip in the township of Manono, approximately 8 km from the proposed plant location. The airstrip is serviced regularly by local airlines.

No allowance has been made to upgrade airstrip facilities and infrastructure.



### ***Accommodation Village***

Accommodation on site will be provided for the expat and technical workforce and will be constructed as part of the project. A 50-man camp already exists on site and when upgraded can be utilised for ramp up and construction purposes.



### ***Administration Facility***

The site administration offices will be located at the entry to the process plant and include a medical treatment facility adjacent to the complex. Offices, meeting rooms, a training facility, lunch rooms and toilets will be included in the administration facility complex which will be a transportable style building.

Existing administration blocks are already refurbished and operational on site. These may provide sufficient office space for only site office blocks to be required.



*Image of the Refurbished Office Block at Site*

### **Workshop, Stores and Laboratory**

The workshop and stores facilities will be located at the process plant site and consist of a series of containers, domes and structural clad buildings. The following facilities will be provided:

- workshop, tooling area and store
- road train maintenance bay, oil storage and filter store
- light vehicle maintenance bay, tyre fitting area and light vehicle stores
- workshop office, crib room and ablution facilities
- store area and store office
- mobile equipment washdown facility.
- A laboratory will be constructed to provide analyses of both mining and metallurgical samples. The building will be air-conditioned and comprise a dry lab, offices, storage areas and semi-enclosed wet and dry areas and will be equipped with standard laboratory testing equipment, sample preparation equipment and consumables.

Some additional refurbishment of historic buildings and steel framed buildings may provide cost savings to the operations and remove the need for new construction of buildings as noted above.



***Refurbished Core yard and logging facilities including diesel storage tanks (100,000lts capacity)***

## Power Supply and Distribution

The project requires an estimated 9 megawatt (MW) maximum demand of electricity. The electricity is required to satisfy the estimated electrical energy requirement of the processing plant and non-process infrastructure.

Power will be supplied by diesel fuelled generators which will be constructed on site by AVZ and operated by a contractor. A local fuel storage facility will be constructed with diesel procured locally and delivered via tankers on a periodic basis.

Initial investigations into the potential of a stand-alone hydroelectric power generation for the Piana Mwanga project have been undertaken by AVZ Engineers. These investigations have indicated that the development of a hydroelectric facility to supply power to the Manono project is most probably feasible and viable.

The initial study is based on a 34 MW, run-of-river hydroelectric scheme on the Luva River (some 85 km from Manono site), utilising a natural drop in the river over approximately 2 kilometres. Further studies are required to fully understand the feasibility and implications of this hydro facility on the Manono Project.



*Images of the Piana Mwanga 32Mw Hydro Facility*

### Communications

A satellite link (with limited bandwidth but sufficient for voice and internet services) is proposed with a dish antenna linked to an onsite mobile network, servicing mobile phones.

The satellite and mobile tower facilities will be integrated into the site wide telecommunications network consisting of optical fibre cabling with built in redundancy running between key site locations.

The onsite telephone system will be a Voice Over Internet Protocol (VOIP) system utilising the site internet services and router to the site satellite and mobile tower service.



*Image of the Communications Tower within the Camp Site*

### Environmental Assessment

The present phase of the environmental assessment work comprises initial characterization of the environmental baseline, quantification of impacts and development of management plans. Field surveys or seasonal measurement of relevant parameters in the fields of hydrology, soils, air quality, noise, aquatic ecology and terrestrial flora and fauna will need to be undertaken by appropriate specialists.

AVZ are in the process of establishing an on-site weather station and regular sampling of these environmental aspects including the air quality and noise impacts of the project, socio-economic studies included development of a social baseline and impact assessment, and health and safety study, as a basis for developing management plans. Through a planned process of census survey and public consultation, the refinement of social impact management plans will be completed.

## Capital and Operating Cost Estimate

The capital cost and operating costs estimate was developed for a 2 Mtpa throughput shown in Table 13 and Table 14 respectively. The costs are based on 100% of project interest. AVZ holds 60% interest in the Manono Lithium Project.

AREA	US\$M	Estimate Class	Accuracy %	Estimate Method
Case 1 – 2 Mtpa Throughput	150-160	Class 5	±35%	Equipment Factor Estimate

*Table 13 Capital Cost and Accuracy of Estimates*

Cost Centre	US\$/t feed	US\$/t concentrate
Mining	12	56
Processing	14	64
Transport	49	221
Admin and Sust. capital	3	14
<b>Total Operating Costs</b>	<b>78</b>	<b>355</b>

*Table 14 Summary of Operating Costs*

The Opex includes costs for:

- contract mining preliminary and generals (P&G's)
- contract mining unit rates for drill and blast and haulage
- processing labour
- flights and accommodation for non-local personnel
- power
- reagents and consumables
- process maintenance
- mobile vehicles for the process operations
- other direct general and administrative (G&A) costs relative to the process plant and non-process infrastructure.

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## Opportunities and Recommendations

Further future test work campaigns should be undertaken in all areas to fully understand the behaviour of the ore. Additionally, investigation into tin and potentially tantalum recovery should be undertaken to determine the optimal processing route given that significant recoveries have been indicated in the preliminary test work program.

Risks to opex are more significant due to the major impact of reagent consumption on costs, and limited test work regarding reagent dosages required. In addition, several opex cost inputs (e.g. diesel) are based on international goods that are historically price volatile and are impacted by foreign exchange rates.

Investigation into alternative power sources should be reviewed as this is currently a major contributor to the process opex and a reduction in unit cost could positively impact the project financials. In Piana Mwanga, approximately 85 km from site, there is a hydroelectric power facility that was in operational until 1999 and while some work would be required for upgrading/updating of the plant, there may be considerable cost savings should hydro power be available for the project. This should be further investigated.

Caution needs to be exercised in utilising the outputs of this study. The design is based on selected design parameters from minimal test work, with aspects of the selected flow sheet not fully laboratory tested. No variability data is available to determine how the process plant will perform over the life of the project, for example, ore significantly harder than design will cause the throughput rates to reduce below nameplate capacity.

A detailed logistics study should be completed to further refine the costs of transporting the concentrate and backhauling of supplies as this is a large portion of the operating cost.

Further investigation into downstream processing options for spodumene concentrate should be conducted on the Manono Lithium Project material. A cost benefit analysis should be completed for each potential option as they each have unique advantages and drawbacks. Pyrometallurgical processing is energy intensive process while hydrometallurgical processing is mainly driven the chemicals costs.

Possible downstream processing of spodumene concentrate would potentially improve the value chain and may be considered in future studies.



## Definitions

Terms	Definition
AVZ	AVZ Minerals Limited. Also referred to as the Company
ADA	Alan Dickson & Associates
Bn	billion
CPC	CPC Project Design Pty Ltd
DMS	dense media separation
FOB	free on board
IRR	internal rate of return
LOM	life of mine
mt	million tonnes
Mtpa	million tonnes per annum
NPV <sub>10</sub>	net present value with 10% discount rate
ROM	run of mine
tpa	tonnes per annum
Case 1	2 million tonnes per year throughput
Case 2	4 million tonnes per year throughput
Case 3	10 million tonnes per year throughput

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