



23 December 2021

ASX: GRR

## Savage River Prefeasibility Study confirms technical and financial viability of an underground operation

Savage River Operations, Tasmania

- The Prefeasibility Study presents a standalone underground case that informs the decision to transition from open pit to an underground mine in the future.
- Demonstrated ore continuity at depth with a 30% (approximately 120 million tonne) increase in Mineral Resources.
- Potential 6 million tonne per annum production rate with an underground mine life of more than 10 years, utilising underground caving methods.
- Potential for increase in mine life.
- In line with company Environment, Social Governance (ESG) initiatives to investigate Green Pellet Production.
- Definitive Feasibility Study to proceed to next level of evaluation subject to board approval in H1,2022.

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The Prefeasibility Study referred to in this ASX release has been undertaken for the purpose of initial evaluation of a potential development of an underground mine at Savage River in Tasmania. It is a preliminary technical and economic study of the potential viability of the North Pit Underground Project.

The Prefeasibility Study has been completed to a level of accuracy of +/- 25% in line with a prefeasibility level study accuracy. No Ore Reserve has been declared from the underground project. Further exploration and evaluation work and appropriate studies are required before Grange will be in a position to estimate any Ore Reserves related to underground mining or to provide any assurance of an economic development case. Given the uncertainties involved, investors should not make any investment decisions based solely on the results of the Prefeasibility Study. The Mineral Resources scheduled for extraction in the Prefeasibility Study production plan are classified as Measured and/or Indicated.



Grange Resources Limited (ASX:GRR) (**Grange**) is pleased to provide an update regarding the Prefeasibility Study (PFS) into the potential for underground mining in North Pit. The financial outcomes demonstrate that an underground mine is technically and economically feasible for the North Pit ore body. A number of improvements will be incorporated into the Definitive Feasibility Study (DFS) which should provide further operational and cost efficiencies to the current PFS study.

### Project Highlights

- Demonstrated ore continuity at depth with a 30% (approximately 120 million tonne) increase in Mineral Resource, ore body remains open at depth.
- In line with company ESG initiatives to investigate Green Pellet Production.
- A potential 6 million tonne per annum underground mine life of 10+ years utilising underground caving methods.
- Estimated underground production life of 25 million tonnes of magnetite concentrate.
- Preproduction capital requires a further investment of A\$160 million in addition to use of existing infrastructure, processing plant and equipment at Savage River Operation.
- Life of mine capital requirement of approximately A\$710M.
- Underground mining costs in the range of A\$15 to A\$22 per tonne of ore during operation utilising a combination of sublevel caving and block caving mining methods to optimise resource recovery and provide early production.
- Technically and financially feasible with approximately 20% reduction in C1 costs compared to current open pit mining costs.
- A range of underground transport options are viable including conveying, twin decline trucking and shaft material handling systems.
- 2.5 kilometres of underground development, including bulk sample drives, completed to assess viability of underground mining and provide access to developing the ore body.
- Potential to increase mine life by exploiting the high-grade resource at depth.
- Full mine automation and reduced carbon emissions footprint review in scope for DFS.
- Grange to move forward to the next level of study in 2022, subject to board approval.
- Confirmation for the optimal transition from open pit to underground mining will be assessed during the DFS.

Commenting on the delivery of the North Pit Underground PFS, Grange CEO Mr Honglin Zhao said:

*“The magnetite deposit at Savage River continues to deliver high quality ore. This successful prefeasibility study provides us with continued confidence in the long-term future of the Tasmanian operations.*”

*“The Study provides justification for our view that the Underground is technically and commercially viable. The planned DFS will be completed in parallel with current open pit mining of the deposit and with ongoing resource extension drilling. It would also be a consideration of the DFS to complete further value adding studies on automation with the final goal of significantly reducing the C1 operating cost of the mine”*



## Introduction

An underground concept study and a mining options study was commissioned in 2018 to evaluate the potential for underground mining at Savage River's North Pit. This suggested that underground mining Block Cave (BC) or Sub Level Cave (SLC) could be a viable and economically attractive alternative to increasing the depth of the North Pit. A Prefeasibility Study (PFS) was commissioned by Grange to investigate the viability of an underground mine and commenced in 2019.

Current mining operations comprise two active open pits, North and Centre Pits. North Pit is approximately 360 metres in depth and future cutbacks and extensions have the potential to extend to approximately 450 metres below the natural land surface. North Pit is the primary ore source, producing approximately 5 million tonnes per annum of ore.

A concept study and a mining options study was commissioned in 2018 to evaluate the potential for underground mining. This recommended that underground mining using Block Cave (BC) or Sub Level Cave (SLC) could be viable and competitive with the life of mine North Pit. A Prefeasibility Study (PFS) was commenced in 2019 to investigate the viability of underground mining below the current North Pit.

An Exploration Decline was developed from March 2019 to September 2020 and included 2,423 metres of development, 11,340 metres of resource drilling and collection of a 20,000 tonne bulk sample of ore. The decline portal was located in the south-east corner of North Pit with the decline developed in the eastern wall of the pit and traversing from the southern end of the resource to the north.

The ground conditions encountered are similar to what was expected from the drilling and geotechnical interpretations. The decline ground conditions have generally been considered good and hydro-geological observations indicated that the eastern wall is generally tight and dry.

A Bulk Sample Drive (BSD) was developed through the ore at the -60mRL. Several breakaway headings were developed successfully from the BSD to test intersections and breakaways in the ore. The ground conditions in the ore ranged from fair to very poor.

## Location

The Savage River Mine and concentrator plant is located in north-west Tasmania, approximately 100km south-west by sealed road from Burnie. The Mine has been in operation for more than 53 years, extracting magnetite from a series of open pits. Grange owns the mine and the downstream processing facilities which include a concentrator on site and a pelletising plant at Port Latta which is located on the Bass Strait coast. The pelletising plant and dedicated port facilities at Port Latta are located 70 kilometres northwest by sealed road from Burnie. Magnetite concentrate slurry is pumped from the mine to the pelletising plant through an 85km pipeline. The pipeline currently has capacity for delivering up to 2.75 million tonnes per annum.



Figure 1 Location of Savage River Mine



## Strategic Fit

The strategic rationale for the underground project is to profitably extend the life of the operation. The underground mining option is, from a strategic perspective, directly comparable to the deepening of the existing North Pit. Current open pit designs and the underground options in the PFS address the extraction of magnetite ore defined as Mineral Resources in North Pit.

Key requirements were to:

- Extend the mine life.
- Reduce the operating cost.
- Minimise preproduction capital for the project.
- Improve the internal rate of return.
- Transition to the underground with no disruption to ore supply.

The mining options analysed were based on findings of the concept study which recommended that low-cost caving methods be assessed.

The options assessed in the PFS included:

- Block Cave with Scavenge mining - Trucking to the ROM via twin declines.
  - (Block Cave Trucking Option)
- Block Cave with Scavenge mining - Trucking to Vertical Haulage Shaft.
  - (Block Cave Shaft Option)
- Block Cave with Scavenge mining - Trucking to inclined conveyor.
  - (Block Cave Conveyor Option)

The Scavenge Mine utilises a sub-level caving mining method to extract ore remaining around the margins of the open pit. This provides access to ore production in the early part of the development while access is established to the Block Cave.



## Key Assumptions & Outcomes

The project financial analysis includes all downstream and overhead cost allocation to the project. These costs are allocated to the underground project based on the percentage of underground concentrate relative to the total concentrate produced. Exchange rate ranges and product price for pellet and chips, are based on forecasts provided by CRU (2021).

The Physicals and financial evaluations are summarised in Table 1.

**Table 1 Summary of the physicals & financials for the mining options evaluated in the PFS.**

Physicals & Financials		Block Cave
<b>Physicals</b>		
Ore Produced	Mt	55.2
Ore Grade	%DTR*	47.8
Concentrate Produced	Mt	25.0
Pellet Produced	Mt	24.4
Chips Produced	Mt	1.0
<b>Price and Revenue</b>		
Average Pellet Price	US\$/t	107
Average FX	A\$/US\$	0.75
Total Revenue	A\$M	3,435
Capital Cost	A\$M	628 - 710
Operating Cost	A\$M	1,969 - 2,040
Free Cash Flow	A\$M	982 - 994

*Note that the average specific gravity of the ore is 3.6 t/m<sup>3</sup>*

*\* ore grade is expressed as Davis Tube Recovery (DTR%)*

The Block Cave Trucking option is most favourable financially when compared with the other material handling options studied, however it is less amenable to scaling up and more carbon emission intensive. The Shaft and Conveyor options provide more scalability with an improved carbon footprint. The production and cash flow profiles for the Conveyor option are shown in Figure 2 and Figure 3, below:



### Production BC-Conveyer

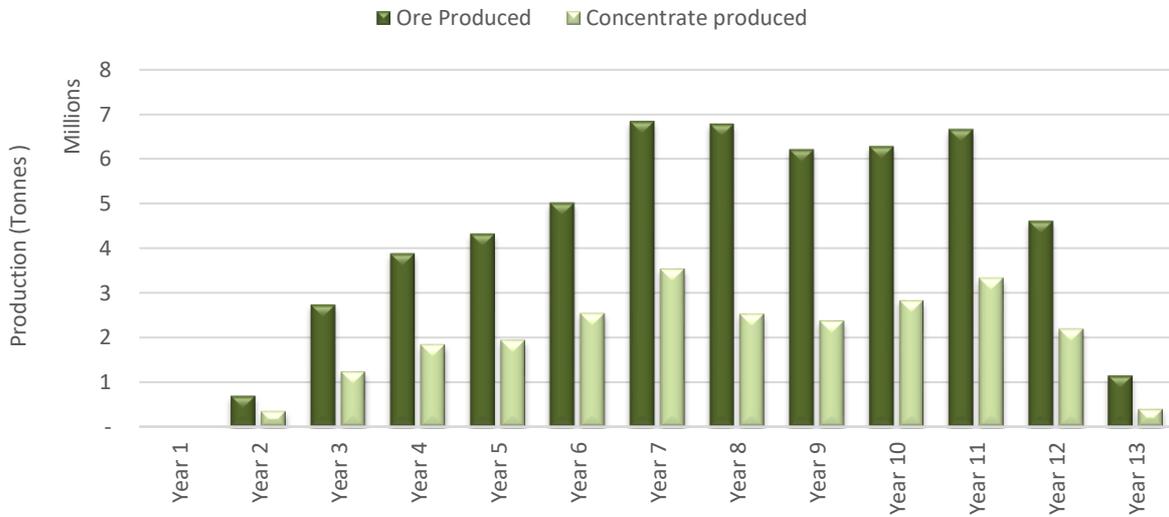


Figure 2 Annual production profile for BC-Conveyer option

### Free Cash Flow Analysis

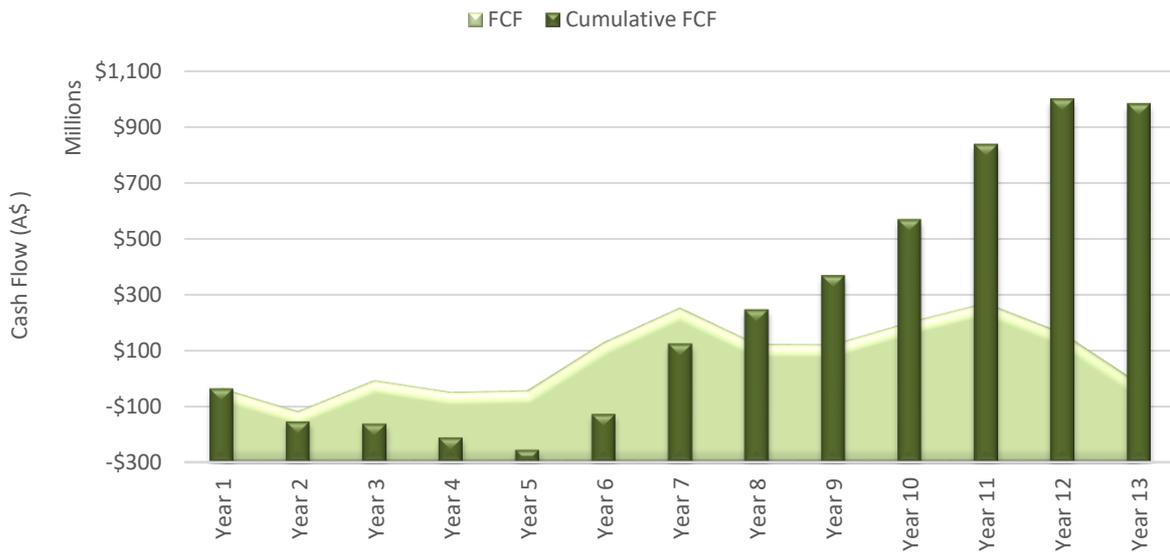
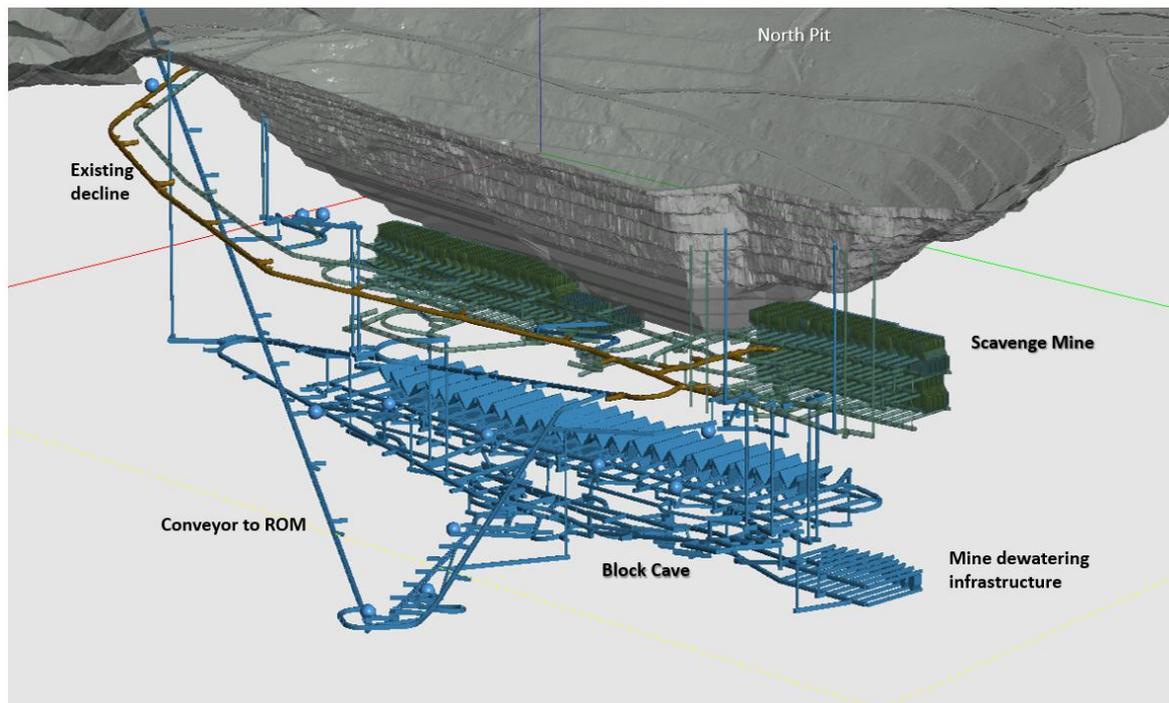


Figure 3 Annual cash flow profile for BC-Conveyer option.



## Mining Operation Overview

The PFS considered the underground mining methods of block caving (BC) and sublevel caving (SLC). In addition, a Scavenge Mine was designed to recover the ore left in the walls of the North Pit. The Scavenge mine uses the SLC mining method. Non-caving mining methods were not considered in the PFS as they had been ruled unfavourable during earlier concept studies due to higher mine operating costs.



**Figure 4 Underground mine layout (looking southwest)**

The underground mining layout and interaction with the open pit is displayed in Figure 4. The Exploration Decline (shown in brown) has been constructed and provides a platform to access the Scavenge mine (shown in green). The Scavenge mine commences above the pit floor and does not require extensive dewatering infrastructure for first production and provides access to ore remaining at the margins around the pit. This provides early production while the decline is progressed to the undercut and extraction levels (shown in blue).

The target annual underground mining production rate is limited by the capacity of the pipeline that delivers concentrate slurry from the mine to the pellet plant in Port Latta. Underground development for both the BC and SLC mining options is based on extending and expanding the existing exploration decline development.

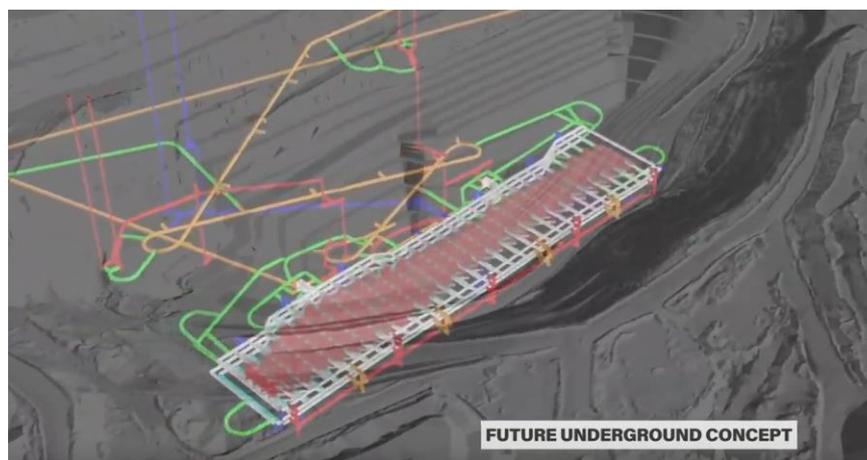
The BC will operate with a maximum of 7 loaders feeding 4 truck loading stations. 6 trucks will be utilised to feed the underground crusher, delivering approximately 500,000 tonnes per month of ore to the surface run-of-mine stockpile.



The BC designs and schedules are based on the following design criteria:

- Extraction level elevation at -290 metres Reduced Level (mRL) with a cave Height at 190 metres restricted by footprint width of 80 to 100 metres.
- Maximum tonnes per draw point brow capped at 250,000 tonnes with rehabilitation and construction of a new draw point brow after this.
- Maximum draw per Draw Bell capped at 1 million tonnes.
- Draw Bell Opening Rate is 1.5 draw bells per month
- Advanced undercut strategy is used with a Modified New Afton layout (no Apex Drive)
- Draw Bell Spacing is 34 metres x 20 metres with a drive layout based on the El Teniente configuration. The level spacing is to maximise pillar size and geotechnical stability and is considered the upper limit for drilling and blasting of the undercut level.
- Steady-state production of 6 million tonnes per annum is achieved with a 3.5-year ramp-up due to the existing decline development and the supporting production from a combination of development ore, sublevel caving, and block caving.
- The SLC provides a steady-state production of 3.25 Mtpa in the early years of the underground operation providing half the production requirement of the concentrator and subsequently the block cave ramps up to full production.
- Cave production is scheduled from two panels separately, each with similar quantity of ore tonnes

The cave production dilution and recovery were generated from numerical modelling analysis coupled with two flow models which produced cave material flow and associated subsidence progression with all material within the cave subsidence zones reported as cave inventory tonnes. The cut-off grade used in this study for the flow and recovery modelling was 28% DTR for the SLC and 23% DTR for the BC. Numerous iterations of caving widths and damage due to increased plastic strain were simulated to assess the sensitivity to draw and recovery.



**Figure 5 Underground mine concept under pit surface**



## Materials Handling Options

The PFS has considered several haulage options with associated underground configurations and underground and surface infrastructure. Three material handling systems were evaluated including:

- Truck haulage with twin declines
- Shaft haulage and
- Conveyor haulage

The truck haulage to the surface is the most financially favourable. It is also the easiest to construct as it does not require specialised engineering skills or procurement of specialised equipment. 6 million tonnes per year trucking with twin declines is at the upper limit of capability and as such there is very little upside for future expansion.

Shaft haulage and conveyor haulage offer more flexibility for increasing production and reduced diesel consumption. Not only does this reduce the carbon footprint, it also reduces the ventilation demand. The conveyor option has slightly better financials compared to the shaft option. A detailed material handling study will be conducted to finalise a go forward option.

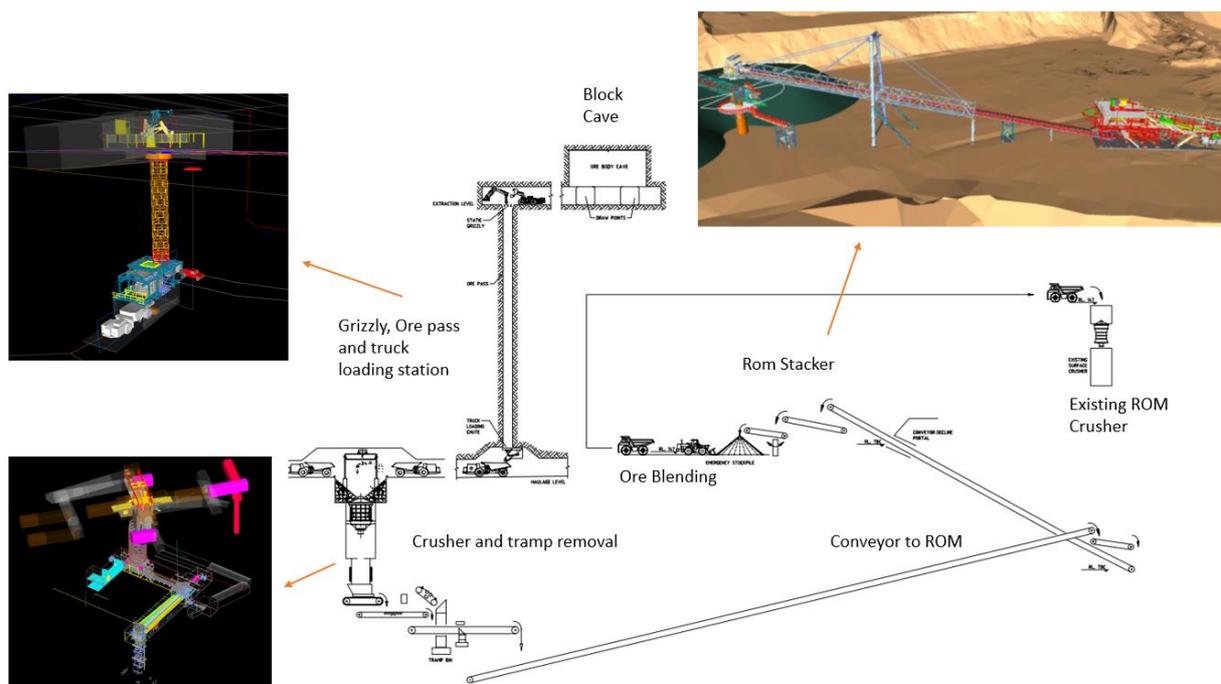


Figure 6 Material Handling System for underground crusher and conveyor system



## Processing

The ore from underground will be processed through the existing plant at Savage River. The existing ore processing facilities include a crusher and magnetite concentrator at Savage River mine site and a pellet plant at Port Latta, which is located 80km north of the mine site on the north-west coast of Tasmania. At Savage River the ore, which comprises massive magnetite with accompanying sulphide and silicate minerals, is crushed, ground, and then concentrated using magnetic separation as the primary mineral separation technology. The magnetite concentrate, produced at a sizing of 85% finer than 43 microns, is pumped to the pellet plant.

A single pump station operates at the mine site using positive displacement pumps to pump the slurry through a 229 mm diameter pipeline. The pipeline crosses rugged terrain, ranging from 360 metres above sea level down to sea level.

At the pellet plant, the pipeline discharge is received into the tank farm, and is filtered and agglomerated. The agglomerated pellets are then indurated in vertical shaft furnaces. Furnace discharge is screened and stockpiled, and then loaded into bulk ore carriers for shipment to customers. The shiploading facility comprises a 1.6km long jetty, on which a belt conveyor transports the pellets to an offshore shiploader.

Over the last 53 years the understanding of mineralogy and metallurgical characteristics of the ore and impurities has been well advanced. Some testing of underground ore has been completed in the PFS and it demonstrates the same mineralogical and processing characteristics. There will be no major change to the processing plant operations for the underground mining operations.

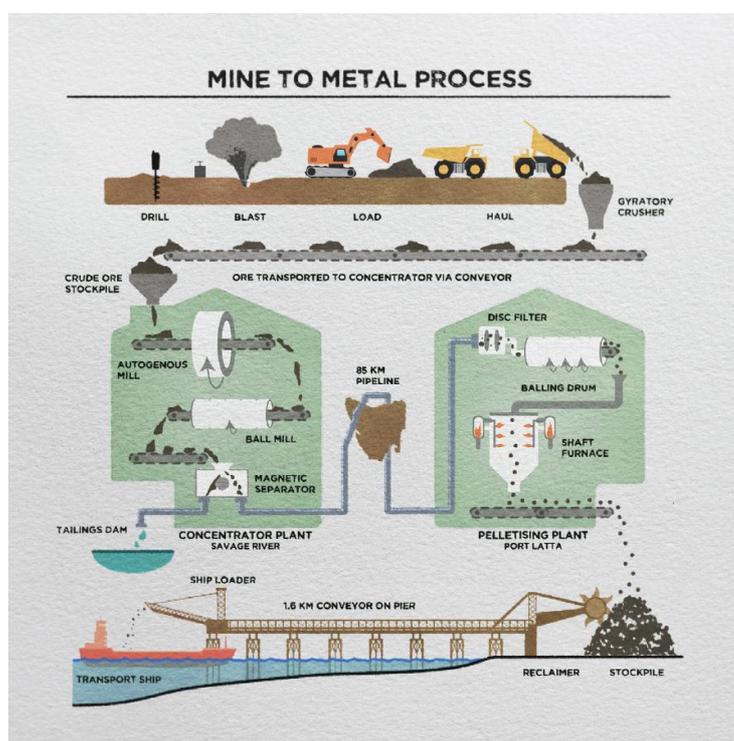


Figure 7 Savage River & Port Latta existing mine to metal process



### Production Profile

PFS underground production is designed to commence with Scavenge Mining around the existing pit using SLC methods. These mining blocks can be accessed via the existing exploration decline and are designed to supplement the open pit ore during transition to full underground production (Figure 8).

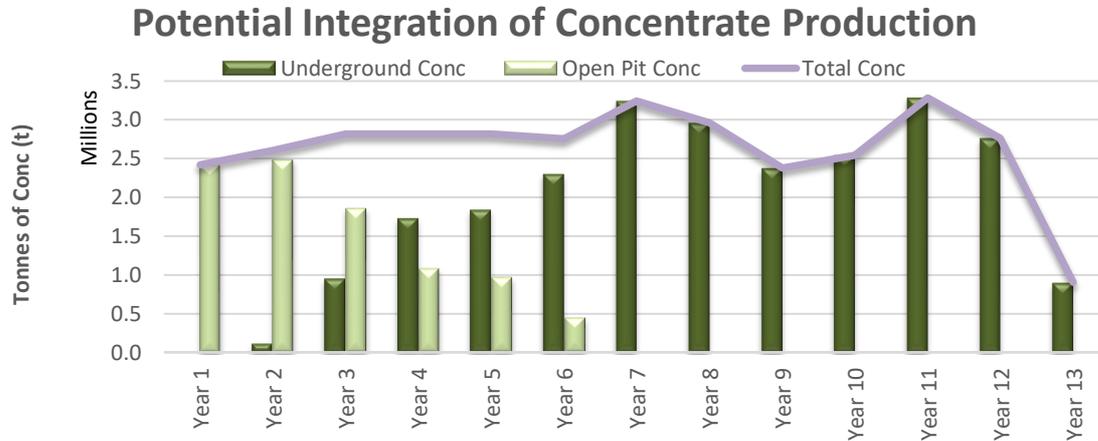


Figure 8 Potential production integration for transition from Open Pit to Underground

The underground material movement is shown in Figure 9. Production commences early in the development profile, utilising the existing decline to access ore around the Pit. The waste rock is disposed in the pit via a tip head within 500m of the portal.



Figure 9. Underground material movement for Conveyor Option



### Capital Cost Estimate

The costs for the PFS have been built from first principles to the general standard required and have been assessed to be within the accuracy level required by a PFS.

Preproduction capital costs of A\$160M consists of lateral development, vertical development, ventilation infrastructure, dewatering infrastructure, underground power reticulation, and a tramp removal system at surface. Capital costs for the BC with material handling by conveyor including downstream capital is estimated to be in the order of \$710M. The cost estimates prepared by AECOM and Grange comply with the criteria requirement for a PFS accuracy range of  $\pm 25\%$ . Mine operating costs for the Block Caving Options are based on contractor workforces with diesel, explosives and power supplied by Grange. Unit costs have been estimated by Grange using first principles and correlating with third-party estimates. Costs for the underground mining capital have been estimated around \$15-\$22 per tonne of ore during production utilising a combination of BC and SLC mining methods.

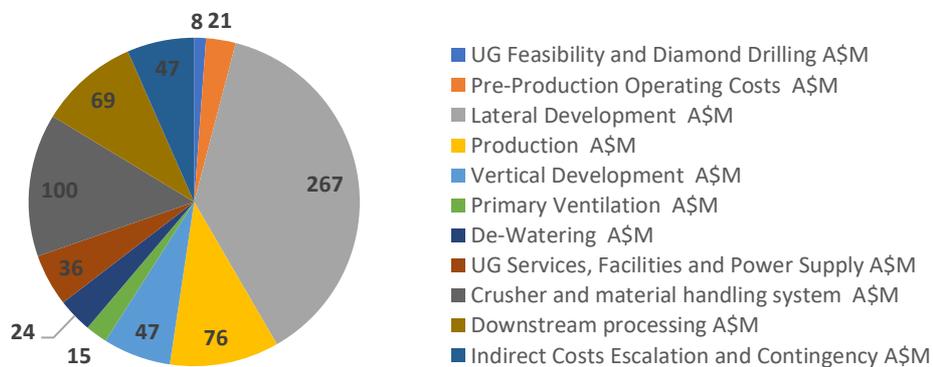


Figure 10 Underground project capital expenditure

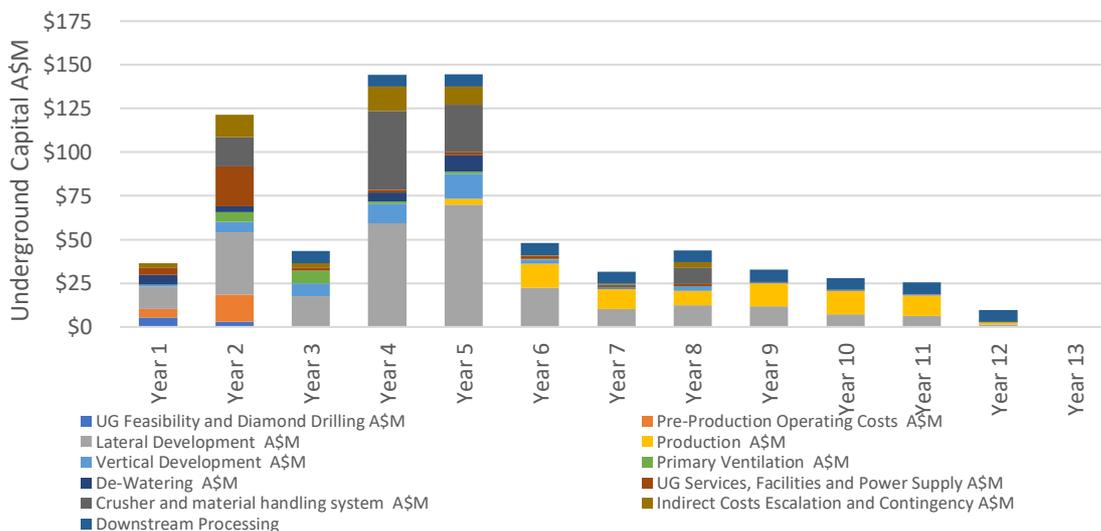


Figure 11 Underground Project Capital expenditure by year



### Operating Cost Estimate

Costs have been built up from first principles and in many cases used actual costs, such as labour rate, from site activities and were finalised in February 2021. Infrastructure operating costs have been derived from estimates provided by AECOM, BBE (for ventilation), Worley and from costs at similar mining sites. C1 costs are total cash operating costs including mining, concentrating, pelletising, and overheads. C1 costs are estimated to be an average of approximately \$75/tonne of concentrate.

Further financial analysis is being undertaken through the Enterprise Optimisation Study to determine the optimal transition and integration of open pit mining to underground operation. This work will inform the scope of the next stage of the project for the Feasibility Study.

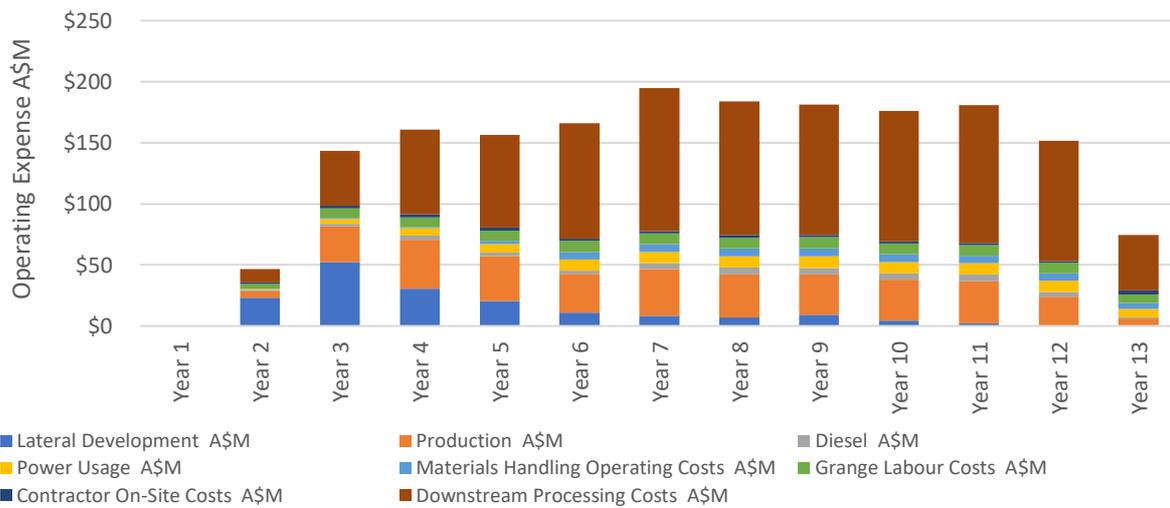


Figure 12 Annual Operating Cost for the PFS Underground Mine

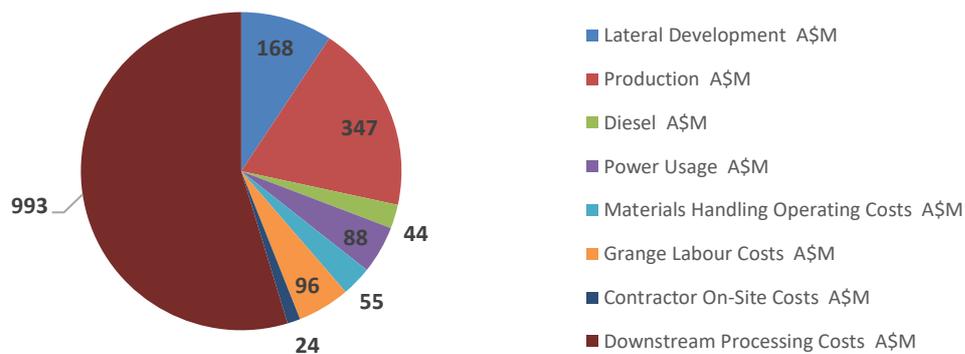


Figure 13 Operating Cost by Area for the PFS Underground Mine



## Mineral Resource

Over the period of the PFS a total of 29,880 metres of diamond drill core targeted the North Pit ore deposit. 18,540 metres were drilled during Stage 1 and 2 of the study. This included 19 holes from the top of the Eastern Wall and north of North Pit. Stage 3 drilling comprised 18 drill holes for 11,340 metres collared from underground drilling platforms.

An in-pit-wall decline was developed in the Eastern Wall of North Pit, to facilitate data acquisition from underground mapping, diamond drilling, conceptual structural interpretation, and a suite of geochemical analyses on pulps.

After the completion of the Stage 3 drilling, Mineral Resources for the North Pit deposit were estimated at 245.0 Mt at 49.6% DTR, an increase of 120Mt contained magnetic material.

The 2020 North Pit Magnetite Deposit Mineral Resource (Table 2) was classified under the guiding principles of the JORC Code (JORC, 2012). Drill spacing, estimation search pass, and geological / grade continuity were taken into account in the generation of resource classification wireframes used to delineate Measured, Indicated and Inferred material. A detailed statement of the Mineral Resources can be found in the ASX announcement dated 31 March 2021. Grange confirms in reproducing the Mineral Resources in this subsequent report, that it is not aware of any new information or data that materially affects the information included, and all the material assumptions and technical parameters underpinning the estimates in this report continue to apply and have not materially changed.

**Table 2 North Pit Mineral Resources as at December 2020**

	Measured Resources	Indicated Resources	Inferred Resources	TOTAL Resources
<b>Tonnes (Mt)</b>	117.9	87.8	39.3	245.0
<b>DTR (%)</b>	56.4	42.8	44.9	49.7
<b>Fe (%)</b>	67.7	67.8	68.3	67.8
<b>Ni (%)</b>	0.04	0.05	0.05	0.05
<b>TiO<sub>2</sub> (%)</b>	0.96	0.89	0.82	0.91
<b>MgO (%)</b>	1.99	1.69	1.42	1.79
<b>P (%)</b>	0.010	0.010	0.010	0.010
<b>V (%)</b>	0.35	0.33	0.34	0.34
<b>S (%)</b>	0.05	0.08	0.09	0.07

- Elemental compositions were measured from Davis Tube Concentrate
- Above a cut-off grade of 15% DTR



## Independent Review

The geotechnical, mining and business and financial components of the project were assessed through an independent review process by industry experts. The reviewers confirm that the geotechnical and mining components of the PFS have demonstrated the technical and financial viability of the NPUG project based on the development of a block cave mine to a level which is commensurate with generally accepted standards of project development practice.

The reviewers were of the view that the selected base case offers a fair representation of the ore reserve for the accuracy required of a PFS, and that the PFS base case is appropriate for use as input to the Enterprise Optimisation Study.

The reviewers provided conditional endorsement for gating the PFS to Feasibility Study based on the completion of further work as the first component of the next stage of study. As the PFS forms part of a broader project to determine an integrated and optimal life of mine plan for the Savage River deposits, the reviewers recognised that the study was ready to proceed to the next level of evaluation. The further work that is required in the initial part of the Definitive Feasibility Study (DFS) was noted as follows:

- The full PFS will be reviewed based on the findings of the Enterprise Optimisation Study
- A Forward Work Plan is prepared for the FS based on the findings of the EOS, and
- The Forward Works Plan include review of development design, draw strategy and other relevant aspects to assess the case for providing improved stability outcomes that require less remediation.
- Should trucking remain the preferred materials handling option, the reviewers suggested this incorporate a transition to electrification.

No fatal technical or economic flaws were identified by the reviewers, and they consider the work has been completed to the standard required for a PFS.



## Key Opportunities & Threats

**Table 3 Project Opportunities**

Opportunity	Area	Potential Improvement	Rank
Mine automation	Mining & Safety	Increase productivity and improve safety	Medium
Trial mining	Geotechnical & Mining	Test geotechnical and mining assumptions	High
Early mining of ore stopes used to create water storage and generate early revenue	Hydrogeological & Financial	De-risk mining dewatering	Medium
Electric trucks underground	Mining & Safety	Reduce ventilation requirements and for improved mine safety	Medium
Potential for higher underground advance rates	Mining	Reduce mining operating costs	Medium
Blending with open pit ore as a supplementary feed	Processing	reduce production risk	Medium
Increased resource/reserve at depth	Geology	improve revenue	High

There is potential for recovering additional ore considering the PFS mining options using hybrid caving methods which may not meet the total production requirements for the concentrator. This additional ore would supplement material delivery (Table 4). These options would include potential recovery levels for a block cave. These can be explored further in subsequent stages of project development.

**Table 4 Potential for additional production round the Block Cave**

Area	Ore Tonnes	Ore Grade (DTR)	Potential C1 Range
1.Recovery Level	11Mt	46%	\$80-\$90
2.North Block	8 Mt	44%	\$85-\$95
3.South Block	6 Mt	25%	\$90-\$100
Total Tonnes	25Mt	40%	\$80-\$100



## Project Threats

Geotechnical and hydrogeological analysis and risks have informed the mine designs for all options considered. The footprint for the BC is expected to cave readily despite its relatively narrow span, but has the potential to cave preferentially along structures, adversely affecting the recovery. Secondary fragmentation is expected to be fine. This combined with clay and water could result in mud-rushes. The assessment also indicated that the poor ground and numerous faults in the ore zone would adversely affect stability on the extraction level of a block cave. This is mitigated by using wide draw bell spacings resulting in larger pillars and limiting the life of the draw point. Extensive ground support and rehabilitation has also been factored, including rehabilitation of access drives and construction of new draw points after 250kt of draw.

The Independent Peer Review (IPR) noted that the geotechnical conditions are forecast to be severe in comparison to other underground caving operations however, various design and planning strategies have been put in place to help mitigate these impacts. Due to the nature of the forecast ground stability, the IPR team considered there remains some residual risk to the proposed mining strategy that is worthy of review. The purpose of the development design and draw strategy review would address the predicted “extreme damage to the extraction level pillar because of imposed stresses” and seek ways to reduce the damage by design and draw strategy rather than the inclusion of remediation works and discounting of the results to allow for “poor” performance, as documented in the PFS.

The IPR also suggested that:

- Should trucking be the preferred materials handling option, that the FS study incorporates an assessment of transition to electrification.
- Grange assess the risk / benefits of a faster draw strategy through less active / open drawpoints to minimise damage and maximise draw from active drawpoints.
- Grange review / test the sensitivity of the “stability” analysis to rock strength assumptions on the predicted conditions.

A risk assessment was also conducted. The key findings are summarized as follows:

- Several risks were classified as Extreme. They include:
  - Mud rush for mining method options (BC or SLC).
  - Asbestiform material affecting occupational health and safety.
  - Sub-optimal value proposition in the transition from OP to UG.
- A total of sixteen risks were classified as High. They cover geotechnical, mine flooding, air blast, mining, infrastructure permitting and approvals risks.

Some of these high and extreme risks (e.g. geotechnical and asbestiform minerals) are already managed through the existing Grange safety management systems for underground development. These and other identified risks will need to be further evaluated and mitigated during the Feasibility Study.



## Further Project Development

The positive results of the PFS provides Grange with a range of opportunities to maximise the long-term value of the Savage River operation. The results from the PFS are currently being assessed as a part of a company Enterprise Optimisation process. The Enterprise Optimisation is tasked to determine the optimum transition point and timing to move from open pit mining to underground. The enterprise optimisation is also determining the best allocation of capital between the mine and downstream processing to generate the maximum value for the company. This will also provide the scope for the next level of evaluation and Definitive Feasibility Study in 2022.

A trial underground mine is currently in planning to verify the mining conditions including cavability, ore recovery, drill and blast, and stability of underground workings. The trial mine is proposed for the northern end of North Pit where it is least likely to affect the active pit. Diamond drilling is in progress to define the trial mine area and develop a viable mine plan.

Grange looks forward to continuing to report to the market the ongoing company development strategy and our vision towards delivering the next 50 years of magnetite mining.

**Table 5 Proposed Development Timeline**

Key Development	Timeframe
Complete material handling study	H1, 2022
Determine optimum transition point	H1, 2022
Scope of DFS and Board approval	H1, 2022
Completion of DFS	H1, 2023
Grange Board approval to proceed	H2, 2023

This announcement was authorised by the Board of Directors.