

# ASX Announcement

30 January 2018



## Mulga Rock Project Definitive Feasibility Study Confirms World-Class Uranium Project

### Highlights

- Robust pre-tax NPV<sub>8</sub> of A\$530M, 25% IRR and a 3.1 year payback
- Free cash flow of A\$134M per annum (EBITDA) after royalty payments
- Life-of-Mine (LOM) of 15 years with an annual production of 3.5Mlbs U<sub>3</sub>O<sub>8</sub>
- Cash operating cost of US\$25.11/lb U<sub>3</sub>O<sub>8</sub> for first 5 years
- Estimated capital cost A\$493M, including \$41.7M in contingencies
- Test pits and comprehensive process piloting have de-risked the project

Vimy Resources Limited (ASX:VMY) is pleased to advise that the Definitive Feasibility Study (DFS) on its Mulga Rock Project (MRP) in Western Australia has confirmed the Project's robust financials and simple, low cost mining process. The key physical and financial metrics for the MRP are summarised in Table 1.

The DFS reinforces the status of the MRP as Australia's largest and most advanced uranium project based on a low risk, open pit mining operation that will underpin production of 3.5Mlbs U<sub>3</sub>O<sub>8</sub> per annum for 15 years.

The results confirm the Project's competitive cash operating costs, which for the initial five years of operations – the all-important pay-back period – are estimated at US\$25.11/lb U<sub>3</sub>O<sub>8</sub>. Over LOM the cash operating costs are forecast to be US\$27.95/lb with a pre-tax NPV<sub>8</sub> at a robust A\$530 million, generating free cash flow of A\$134 million per annum (EBITDA) after royalties. These metrics assume a uranium contract price of \$60/lb U<sub>3</sub>O<sub>8</sub> at the time of first production which is targeted for 2021.

The positive results, which significantly improve upon the Mulga Rock Pre-Feasibility Study (PFS) released in November 2015, along with increasingly favourable market conditions, lay the foundation for Vimy to become Australia's next supplier of uranium oxide and operator of Western Australia's first uranium mine.

*"The DFS is the result of two years of incredibly diligent work by the Vimy team and demonstrates the robustness of the Mulga Rock Project and its potential to become a strategically important supplier of uranium for nuclear power stations all over the world,"* said Vimy Chief Executive Officer Mike Young. *"The report's release comes at a pivotal time for Vimy as we accelerate negotiations with future offtake partners and aim to secure project finance ahead of a final investment decision in the second half of 2018."*

#### MINE LIFE



#### PRODUCTION



#### FINANCIALS

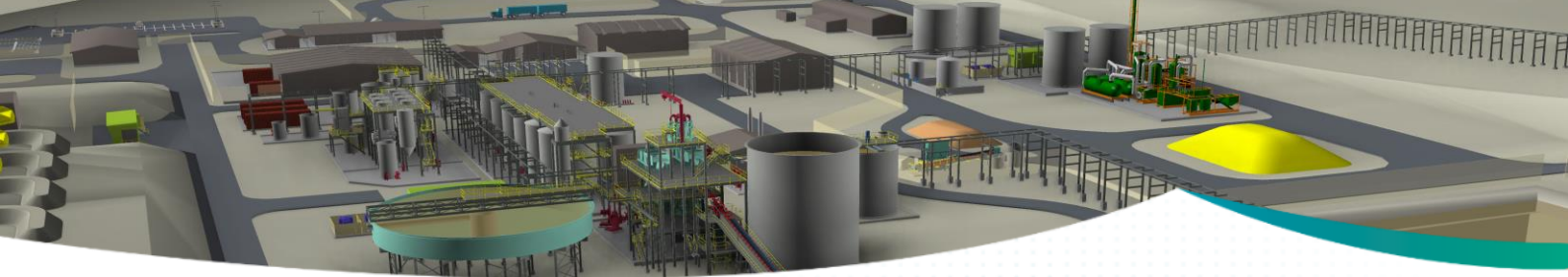


#### OPERATING COST








#### CAPITAL COST





**Table 1: Mulga Rock Project Key Physical and Financial Metrics**

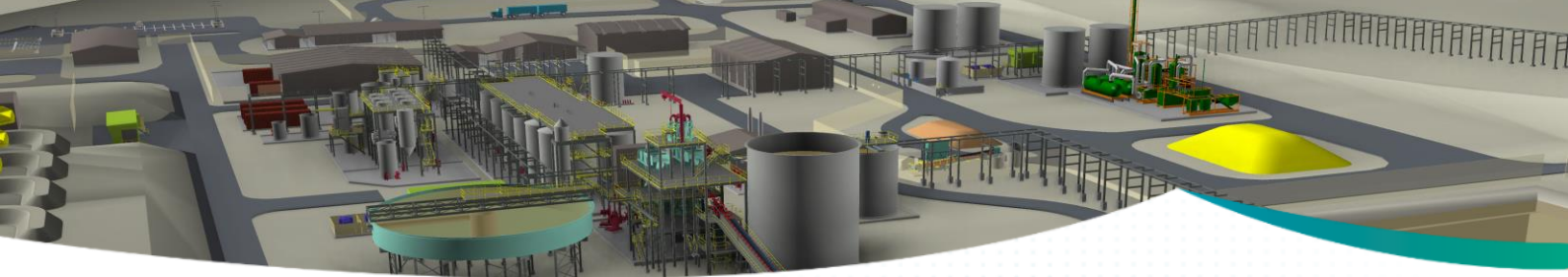
	Key Metric	Unit	DFS
 <b>RESOURCE</b>	Life-of-Mine (LOM)	Years	15
	Plant Ore Throughput	Mtpa	2.4
	Run-of-Mine (ROM) Uranium Grade (Years 1-5)	ppm U <sub>3</sub> O <sub>8</sub>	1,010
	ROM Uranium Grade (LOM)	ppm U <sub>3</sub> O <sub>8</sub>	770
 <b>PRODUCTION</b>	Uranium Metallurgical Recovery	%	87.3
	Annual Uranium Production	Mlbs U <sub>3</sub> O <sub>8</sub> pa	3.50
	Total Uranium Production (LOM)	Mlbs U <sub>3</sub> O <sub>8</sub>	47.1
 <b>CAPITAL</b>	Pre-Production Mining Costs (Pre-Strip)	A\$ million	36.3
	Mining, Plant, Infrastructure and Indirects	A\$ million	415.0
	Growth Allowance and Contingency	A\$ million	41.7
	Total Capital	A\$ million	493.0
 <b>OPERATIONS</b>	Exchange Rate	AUD : USD	0.70
	Uranium Cash Operating Cost (Years 1-5)*	US\$/lb U <sub>3</sub> O <sub>8</sub>	25.11
	Uranium Cash Operating Cost (LOM)*	US\$/lb U <sub>3</sub> O <sub>8</sub>	27.95
	Uranium AISC <sup>#</sup> Operating Cost (LOM)	US\$/lb U <sub>3</sub> O <sub>8</sub>	34.00
 <b>PROJECT FINANCIALS</b>	Contract Uranium Price (from 2021 onwards)	US\$/lb U <sub>3</sub> O <sub>8</sub>	60
	Project NPV <sub>8</sub> (inclusive of Royalties, pre-tax)	A\$ million	530
	Project IRR (inclusive of Royalties, pre-tax)	%	25.3
	Payback from Start of Production	Years	3.1

\*Cash operating cost include all mining, processing, maintenance, transport and administration costs, but excludes royalties and sustaining capital. # All-in sustaining costs

## Substantial Increase in Ore Reserves

The DFS includes a substantial increase in Ore Reserves at the Mulga Rock Project as announced to the ASX on 4 September 2017. Approximately 85% of the contained uranium inventory within the optimised pit designs for the Ambassador, Princess and Shogun deposits is classified as Ore Reserves. More importantly, over 90% of the first 10 years of production is supported by Ore Reserves.

The DFS also includes a revised mining plan to maximise metal output during the initial phase of production, and new supply side assumptions following recent decisions by the world's largest uranium producers to cut production.



## Ministerial approvals secured and quality assurance confirmed

Vimy completed the DFS with a number of important elements of the project already achieved.

These include:

- The securing of all Ministerial approvals required to develop and mine the MRP. The State Government granted final Ministerial approval in December 2016, which was followed by Federal approval in March 2017; and
- Quality assurance provided to nuclear utility offtakers. The three commercial converters have sampled and confirmed the quality of uranium oxide concentrate (UOC) produced from the MRP following successful trials at a pilot plant established in Perth in 2016. Quality assurance was a vital step for the MRP, with developers required to prove that their UOC meets global industry standards before the signing of long term offtake agreements.

## Uranium market: a supply side strike

In late 2017, the world's largest uranium producers Cameco, Kazatomprom and Areva announced their intention to cut production at various operations around the world, which confirmed a widely-held view that current low uranium prices cannot sustain primary uranium production.

This "supply side strike" is expected to drive uranium prices higher over the short to medium term, with production from impacted operations expected to remain idle until prices warrant a resumption in mining.

Nuclear generating capacity is expected to increase by 38% in the next ten years. Based on the future growing demand for nuclear power, existing mines must remain open and new mines need to come onstream.

The supply side response to unsustainably low prices establishes a foundation for stronger uranium prices going forward. The advanced nature of the MRP means Vimy is well positioned to capitalise on these positive developments and lock in offtake agreements as prices improve.

## Benefits to Western Australia

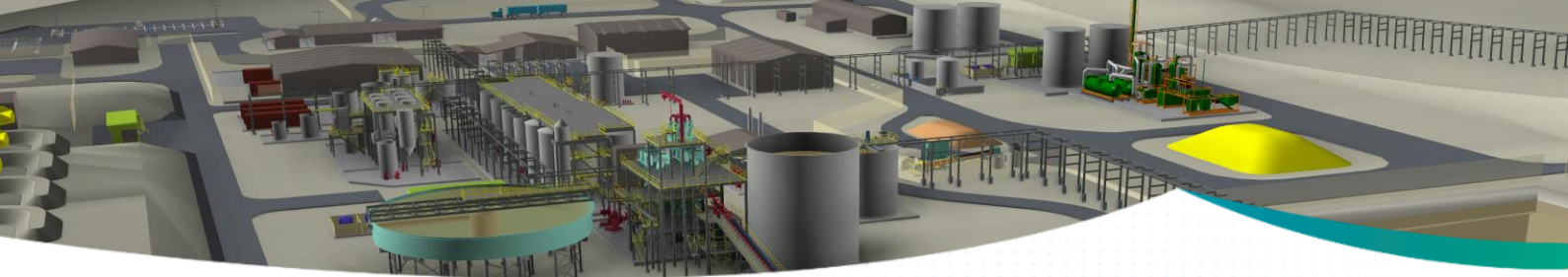
The MRP is poised to become Western Australia's first uranium mine. The benefits to the local economy are significant, with the Project expected to generate \$200 million in state royalties over its 15-year mine life and create approximately 350 site-based permanent jobs. More than 550 people will work on the project during construction.

## Supplier of reliable clean energy

The MRP will be mined to the highest environmental standards, and will generate a carbon-free energy source that will offset approximately 70 million tonnes of CO<sub>2</sub> each year, representing 13% of Australia's annual greenhouse gas emissions.

Nuclear energy is an increasingly important part of the global clean energy mix, providing the cleanest, cheapest and most efficient source of baseload power and significantly reducing a reliance on fossil fuels to produce electricity.





Growing demand for reliable energy requires an emissions-free energy source that delivers reliable electricity 24 hours-a-day. As countries like India and China continue to develop their economies, they will increasingly turn to nuclear power as a source of clean, baseload power. This is already happening, with more nuclear power plants currently under construction globally than at any time in the past 25 years. The DFS reinforces the robustness of the MRP and the role it will play in meeting growing global demand for clean energy.

**Mike Young**  
**Managing Director and CEO**

Tel: +61 8 9389 2700

30 January 2018

#### **COMPLIANCE STATEMENT**

*The information in this announcement is extracted from ASX announcement entitled “Significant Resource Update – Mulga Rock Cracks 90Mlbs” released on 12 July 2017 and available to download from [asx.com.au](http://asx.com.au) ASX:VMY. The Company 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 Resources 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 have not been materially modified from the original market announcement.*

*The information in this announcement is extracted from ASX announcement entitled “Major Ore Reserve Update – Moving to the go line” released on 4 September 2017 and available to download from [asx.com.au](http://asx.com.au) ASX:VMY. The Company 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 Resources 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 have not been materially modified from the original market announcement.*

#### **FORWARD-LOOKING STATEMENT**

*This announcement may contain some references to forecasts, estimates, assumptions and other forward-looking statements. Although the Company believes that its expectations, estimates and forecast outcomes are based on reasonable assumptions, it can give no assurance that they will be achieved. They may be affected by a variety of variables and changes in underlying assumptions that are subject to risk factors associated with the nature of the business, which could cause actual results to differ materially from those expressed herein.*



## About Vimy Resources

Vimy Resources Limited (ASX: VMY) is a Perth-based resource development company. Vimy's primary focus is the development of the Mulga Rock Project, one of Australia's largest undeveloped uranium resources which is located 290km ENE of Kalgoorlie in the Great Victoria Desert of Western Australia.

Vimy harnesses science and technology to maintain the environment.

### Directors and Management

The Hon. Cheryl Edwardes AM  
Chairman

Mike Young  
CEO and Managing Director

Julian Tapp  
Executive Director

David Cornell  
Non-Executive Director

Mal James  
Non-Executive Director

Andy Haslam  
Non-Executive Director

Dr Vanessa Guthrie  
Non-Executive Director

Ron Chamberlain  
Chief Financial Officer and Company Secretary

Tony Chamberlain  
Chief Operating Officer

Xavier Moreau  
General Manager, Geology and Exploration

For a comprehensive view of information that has been lodged on the ASX online lodgement system and the Company website please visit [asx.com.au](http://asx.com.au) and [vimyresources.com.au](http://vimyresources.com.au) respectively.

#### Principal Place of Business

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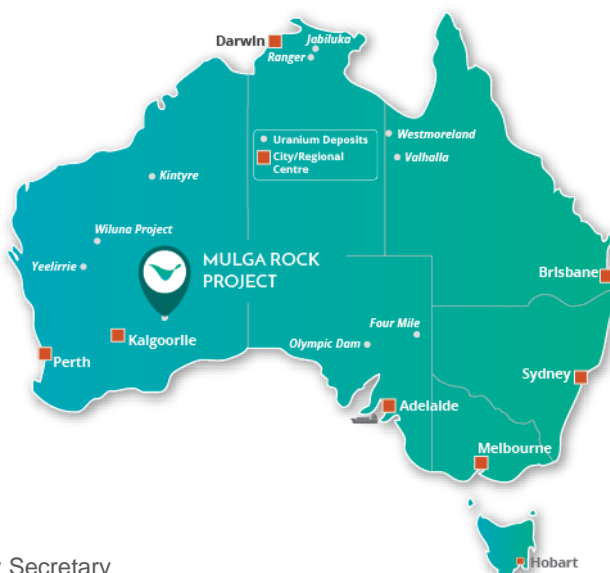
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#### Share Registry

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W: [www.computershare.com](http://www.computershare.com)  
E: [www.investorcentre.com/contact](http://www.investorcentre.com/contact)



THE MULGA ROCK PROJECT  
CONTAINS A RESOURCE OF



U<sub>3</sub>O<sub>8</sub>



The creation of approximately  
**350 direct site jobs**  
IN WESTERN AUSTRALIA

Royalty and payroll tax  
payments of around

**A\$17m**

PER YEAR TO THE  
STATE GOVERNMENT

The amount of uranium produced  
when used in nuclear power plants to  
displace coal fired electricity would  
offset more than



**70 million tonnes**  
of carbon dioxide equivalent  
emissions which is  
**around 13%**

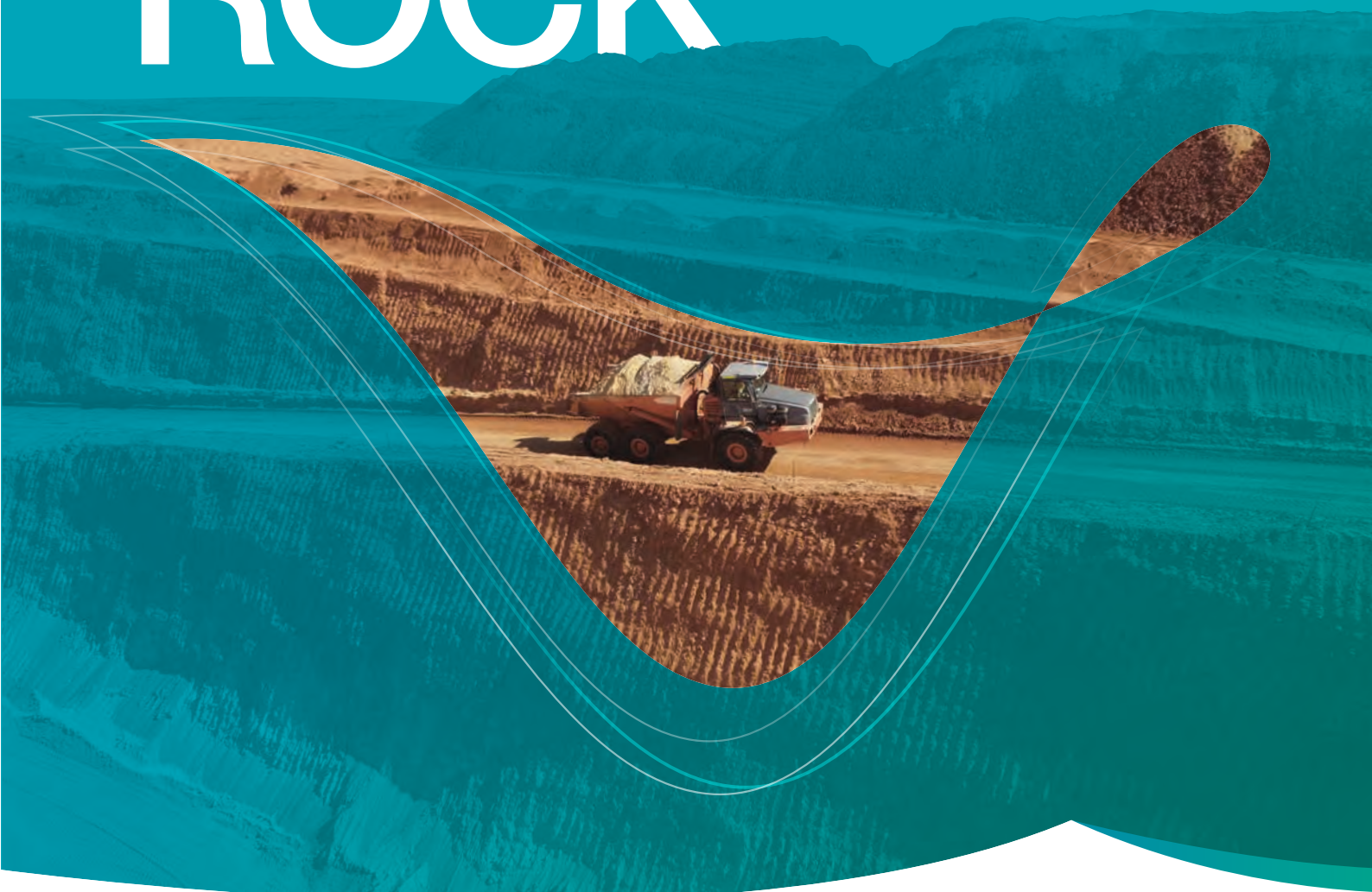
of Australia's total greenhouse  
gas emissions.



**STATE & FEDERAL  
MINISTERIAL  
APPROVALS**

DEFINITIVE FEASIBILITY STUDY

# MULGA ROCK PROJECT



## Executive Summary

30 January 2018

Our mission is to become a reliable and respected uranium producer.







## On behalf of Vimy Resources, I am pleased to present the Definitive Feasibility Study (DFS) on our flagship Mulga Rock Project in Western Australia.

The DFS demonstrates the project's robust financials and simple, low cost mining process; reinforcing its position as Australia's largest advanced uranium project, and a strategically important supplier of uranium oxide to nuclear power providers around the world.

This report is the culmination of two years of intensive studies conducted by the extremely talented Vimy team and a range of experts who shared their knowledge of a mining industry that has contributed billions of dollars in export revenue to the Australian economy.

### **DFS confirms robust financials**

The results of the DFS significantly improve upon the Mulga Rock Project Pre-feasibility Study released in late 2015 and confirm the project's strong financials and low risk, low cost open cut mining operation.

The Study includes a substantial increase in ore resources and reserves at the Mulga Rock Project, a revised mining plan to maximise output during the initial phase of production, and new supply-side assumptions that reflect an important shift in market dynamics that we saw in late 2017. The decision to cut production by Cameco, Kazatomprom and Areva, who together contribute 60 percent of global production, demonstrates committed supply-side discipline that we expect will change the supply-market paradigm resulting in a higher, sustainable uranium price.

Breaking down some key results, the Mulga Rock Project will produce 3.5 million pounds of uranium oxide a year, taking total production over a projected 15-year mine life to 47.1 million pounds. Cash operating costs for the initial five years of the project, the all important pay back period, are forecast at US\$25.11 per pound  $U_3O_8$ . Cash costs over the life of project are forecast at US\$27.95 per pound, and the project will generate A\$134 million per annum of free cashflow (EBITDA) after royalties.

The completion of the DFS comes at a pivotal time for Vimy as we accelerate negotiations with future offtake partners and aim to secure project finance ahead of a final investment decision in the second half of 2018. Based on this timetable, construction of the Mulga Rock Project will begin in 2019, leading to first production in 2021.

### **Quality Assurance confirmed**

As we advance discussions with potential customers, we have a distinct advantage in that major nuclear fuel cycle operators in North America and Europe have confirmed the quality of our uranium oxide product. We established a pilot plant in Perth in 2016, successfully processing and exporting uranium oxide samples to all three commercial converters who have

stringent quality assurance standards. We're pleased to report that the product from the Mulga Rock Project received a tick of approval from all three converters.

### **Environment**

With State and Federal Ministerial approvals required to develop the Mulga Rock Project already secured, the DFS highlights the significant benefits the project will bring to the local economy, with the payment of \$200 million in State royalties over its 15-year mine life and the creation of 350 permanent site jobs.

All stakeholders can be assured that Vimy will employ the highest environmental standards and world's best practices to construct the Mulga Rock Project. The simple, open pit operation will reach a maximum depth of only 74 metres, while the process plant will adopt a simple method of extraction involving atmospheric acid leaching and resin-in-pulp processes.

Vimy is moving ahead with the project as nuclear energy becomes an increasingly important part of the global clean energy mix. Growing demand for energy, particularly in the developing world, requires an emissions-free energy source that can deliver reliable, dispatchable electricity 24/7. The uranium oxide produced at the mine will be used in nuclear reactors and so will offset approximately 70 million tonnes of  $CO_2$  each year - approximately 13 percent of Australia's annual greenhouse gas emissions.

As the non-OECD world, particularly India and China, continue to develop their economies, they will increasingly turn to nuclear power as a major source of clean electricity and base load power. We can see this happening today, with more nuclear power plants currently under construction globally than at any time in the past 25 years.

At Vimy, we're proud that the Mulga Rock Project will play a vital role in meeting this growing demand for clean energy as we transition into a secure, reliable producer of uranium oxide.

### **Mike Young**

CEO & Managing Director  
Vimy Resources



# DEFINITIVE FEASIBILITY STUDY

## MULGA ROCK PROJECT

### Executive Summary

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# PROJECT HIGHLIGHTS

The Mulga Rock Project is fully approved and project metrics provide a compelling investment case.



## LONG MINE LIFE AND SECURE SOURCE OF URANIUM

The Mulga Rock Project is the largest advanced uranium development project in Australia.

Total resource estimate of 71.2Mt at 570ppm  $U_3O_8$  for a contained 90.1Mlbs  $U_3O_8$

Life-of-Mine of 15 years with an estimated total production of 47.1Mlbs  $U_3O_8$

Over 90% uranium mining inventory for first 10 years supported by Ore Reserves.



## LOW CASH COST, ROBUST FINANCIALS

Cash operating cost for Life-of-Mine of US\$27.95/lb  $U_3O_8$

Robust pre-tax NPV<sub>8</sub> of A\$530M, 25% IRR and a 3.1 year payback at US\$60/lb  $U_3O_8$

Breakeven price of US\$44.58/lb  $U_3O_8$  (capital payback @ 8% discount rate).

The project generates A\$134M free cash flow per year (EBITDA) after royalties.









## LOW RISK AND LOW-COST MINING PROCESS

Simple open pit mining operation with an average depth of 43 metres.

Process plant to use low-cost atmospheric acid leaching and resin-in-pulp.

State and Federal Ministerial approvals received and secondary permitting well advanced.

## KEY PHYSICAL AND FINANCIAL METRICS

	Key Metric	Unit	DFS
 RESOURCE	Life-of-Mine (LOM)	Years	15
	Plant Ore Throughput	Mtpa	2.4
	Run-of-Mine (ROM) Uranium Grade (Years 1-5)	ppm U <sub>3</sub> O <sub>8</sub>	1,010
	ROM Uranium Grade (LOM)	ppm U <sub>3</sub> O <sub>8</sub>	770
	Average Strip Ratio (LOM)	BCM/tonne ore	12.1
 PRODUCTION	Uranium Metallurgical Recovery	%	87.3
	Annual Uranium Production	Mlbs U <sub>3</sub> O <sub>8</sub> pa	3.50
	Total Uranium Production (LOM)	Mlbs U <sub>3</sub> O <sub>8</sub>	47.1
 CAPITAL	Pre-Production Mining Costs (Pre-Strip)	A\$ million	36.3
	Mining Capital	A\$ million	107.8
	Process Plant and Infrastructure Capital	A\$ million	211.4
	Indirects, Owner's Costs and Contingencies	A\$ million	137.5
	Total Capital	A\$ million	493.0
 OPERATIONS	Exchange Rate	AUD: USD	0.70
	Uranium Cash Operating Cost (Years 1-5)*	US\$/lb U <sub>3</sub> O <sub>8</sub>	25.11
	Uranium Cash Operating Cost (LOM)*	US\$/lb U <sub>3</sub> O <sub>8</sub>	27.95
	Uranium AISC# Opex (Years 1-5)	US\$/lb U <sub>3</sub> O <sub>8</sub>	30.16
	Uranium AISC Opex (LOM)	US\$/lb U <sub>3</sub> O <sub>8</sub>	34.00
 ROYALTIES	WA Royalty	%	5.00
	Resource Capital Fund VI Royalty	%	1.15
 PROJECT FINANCIALS	Uranium Price Assumption	US\$/lb U <sub>3</sub> O <sub>8</sub>	60
	Project NPV <sub>8</sub> (inclusive of Royalties, pre-tax)	A\$ million	530
	Project IRR (inclusive of Royalties, pre-tax)	%	25.3
	Payback from Start of Production	Years	3.1

\* Cash operating costs include all mining, processing, maintenance, transport and administration costs, but exclude royalties and sustaining capital. # All-In Sustaining Cost



## ABOUT VIMY

Vimy Resources Limited (ASX:VMY) is a uranium exploration and development resource company located in Perth, Western Australia.

Vimy's primary focus is the development of the 100% owned and operated Mulga Rock Project (MRP). Our mission is to become a reliable and respected uranium producer, targeting supply of 3.5Mlbs U<sub>3</sub>O<sub>8</sub> per annum.

Vimy's board and executive team have proven track records in building mines and exceptional uranium experience. Vimy has a 'can-do' culture and a supportive shareholder base. The outstanding fundamentals of the MRP have led to consistent achievement of milestones.

## KEY PEOPLE



**Hon. Cheryl Edwardes AM**  
Non-Executive Chairman

***Significant networks in Government and in Asia's business community***

Former State Government Minister holding Ministries of Environment, Labour Relations and Attorney General.



**Mike Young**  
CEO and Managing Director  
***Building mines***

Founding Managing Director of BC Iron Ltd. First drill hole to first ore on ship in under four years. Uranium experience in Canada and Australia.



**Julian Tapp**  
Executive Director  
***Expertise in regulatory approvals***

Previous Head of Government Relations and Director of Strategy at Fortescue Metals Group.



**Tony Chamberlain**  
Chief Operating Officer  
***Considerable experience with Australian uranium projects***

Extensive operational and capital delivery experience. Experience with several global uranium projects.



**Xavier Moreau**  
General Manager –  
Geology and Exploration  
***Our in-house uranium encyclopedia***

French-born and trained with extensive experience with Areva, U3O8 Limited, and Vimy Resources.



**Ron Chamberlain**  
CFO and Company Secretary  
***Finance professional with uranium experience***

Significant experience in funding and development of uranium projects – Former CFO at Paladin.

## PROJECT LOCATION

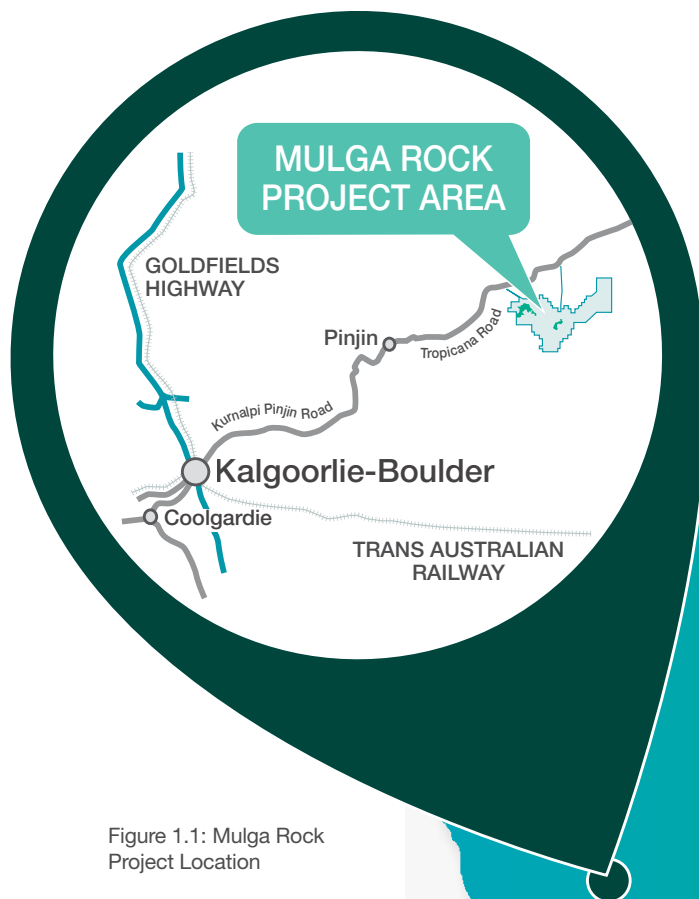


Figure 1.1: Mulga Rock Project Location

Western Australia is a stable mining jurisdiction. In the 2016 Fraser Institute ranking of most attractive jurisdictions for mining investment, WA was ranked third in the world.



The Mulga Rock Project lies approximately 290km by road east-northeast of the regional mining city of Kalgoorlie-Boulder in the Shire of Menzies. The MRP comprises two granted Mining Leases (M39/1104 and M39/1105) and associated Miscellaneous Leases covering critical infrastructure.

The MRP is the largest advanced uranium project in Australia with an Ore Reserve of 22.7Mt at 845ppm  $U_3O_8$  for 42.3Mlb  $U_3O_8$ . The Ore Reserve is a subset of the Mineral Resource which stands at 71.2Mt at 570ppm  $U_3O_8$  for a contained 90.1Mlb  $U_3O_8$  at a cut-off of 150ppm  $U_3O_8$ .

Final Ministerial Approval was granted by the State of Western Australia under s.45(5)(b) of the *Environmental Protection Act 1986* (EP Act) in December 2016. The Australian Federal Government granted final approval under s.133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in March 2017. This completes all the Ministerial approvals for the development of the project.

# THE MULGA ROCK PROJECT (MRP)

## PROJECT HISTORY

Initial discovery occurred in the late 1970s as a result of systematic uranium exploration undertaken by the Power Nuclear Corporation (PNC) owned by the Japanese government. PNC discovered the project in 1978 and named it after the actual 'Mulga Rock' water hole which lies 67km to the southwest of the project outside of the Great Victoria Desert on the eastern margin of the Yilgarn Craton.

From 1978 to 1990, PNC explored the Narnoo Basin for uranium, drilling approximately 1,600 diamond and reverse circulation drill holes for a combined total of 100,000m across the Emperor, Shogun and Ambassador deposits. In late 1983, a test pit was developed at the Shogun deposit to obtain a bulk sample which was intended for a piloting program in Japan. PNC withdrew from Australia after the Asian financial crisis.

The project was acquired by Eaglefield Holdings Pty Ltd who subsequently sold the project to Vimy which originally listed as Energy and Minerals Australia Limited on the ASX in 2008.

A key development for the project was the discovery, in 2013, of a large brackish groundwater resource (167-200 GL) which was delineated within 35km of the MRP to support the development of the project.

A Scoping Study was completed by Amec Foster Wheeler and Coffey Mining in May 2015, which updated the results of the previous studies.

The 2015 Scoping Study was based on the MRP producing 1,360t/a  $U_3O_8$  or 3Mlb/a  $U_3O_8$  over a 16-year mine life, and the project economics confirmed the MRP as a potential low-cost uranium producer.

In November 2015, Amec Foster Wheeler and AMC Consultants completed a Pre-Feasibility Study (PFS) which built on the project scope defined in the 2015 Scoping Study. Breakthrough beneficiation testwork was completed to support the PFS engineering. This proved to be significant as testwork showed the light carbonaceous mineralised ore can be easily recovered from the heavy non-mineralised silica sands using simple gravity separation. This resulted in over half the original ore feed being rejected, significantly reducing capital and operating costs.

In July 2017 there was a significant Mineral Resource update resulting in the Mulga Rock Project cracking 90Mlbs. As part of this resource estimate, high-grade zones were identified at Ambassador to boost the project economics during the critical pay back period.

The maiden Ore Reserve was released back in March 2016, and further Ore Reserve updates were issued during November 2016 and September 2017. The MRP now has over ten years of Ore Reserves, and further inferred resources, available to underpin project development.

The project consists of two separate mining areas over a total length of 30km with the individual deposits ranging in length from 1km to 8km. The Mulga Rock East mining centre comprises the Ambassador and Princess deposits and the Mulga Rock West mining centre comprises the Shogun and Emperor deposits.

The MRP is classed as a carbonaceous-sedimentary hosted, supergene enriched, uranium deposit. Mineralisation is hosted predominantly by unconsolidated Eocene sediments (39 Ma) which are rich in organic matter and comprise river and estuarine-lake sediments. The organic matter originated primarily from land-based plant matter that washed into the channels and deposited into tributaries along the edge of an oxbow bend, forming peat.

The MRP has been extensively drilled with 3,559 aircore and reverse circulation holes completed across the entire deposit for a total combined depth of 216,682m. In addition, 715 diamond holes have been completed for a total depth of 36,612m.

Emperor still remains open at depth and to the south. There is potential to increase the mine life at the MRP through further resource drilling at Emperor.

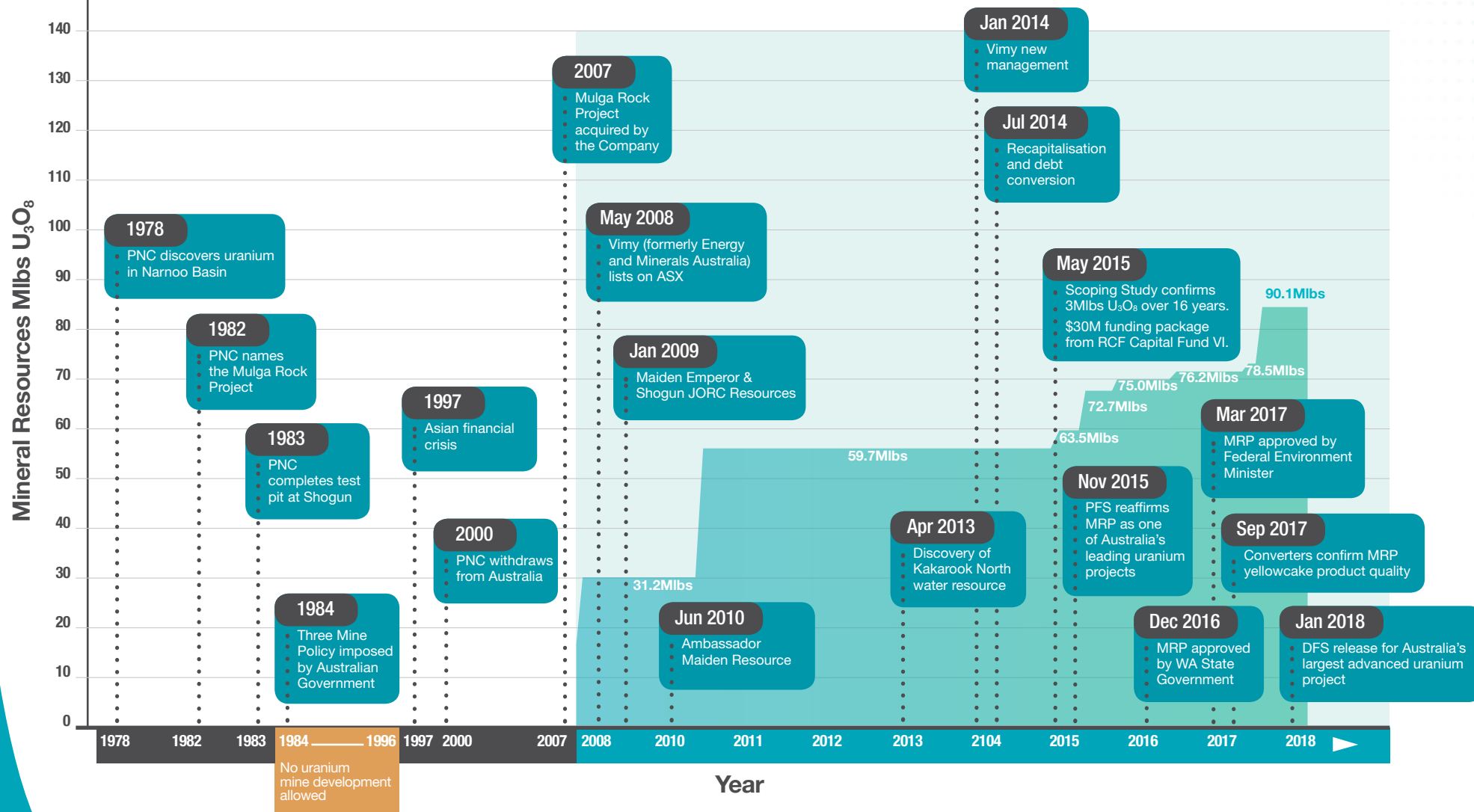
The deposits will be mined using large-scale open pits to produce 1,590t/a (3.5Mlbs)  $U_3O_8$ . The overburden is free-digging as verified by the two bulk test pits completed at Ambassador.

**Every year Vimy plans to mine enough uranium to fuel eight 1GWe nuclear power stations.**





Figure 1.2: Timeline of the Mulga Rock Project



## DFS TEAM

Numerous technical studies have been completed as part of the Definitive Feasibility Study (DFS), including the excavation of two large test pits located within the Ambassador deposit. These test pits provided important geotechnical mine design information, with two bulk ore samples totalling 100 tonnes of ore extracted for further testwork. Extensive metallurgical pilot plant scale testwork was completed and generated 7.3kg of final uranium oxide concentrate (UOC) or yellowcake product. The UOC product has been certified at all three commercial uranium conversion facilities, Cameco Corporation in Canada, New Areva in France and ConverDyn in the USA.

Vimy's project development and exploration team consists of high calibre, experienced professionals. The project team was supported by a number of specialist consultant companies. These companies, and their respective components of the DFS are provided in the table opposite.

Test pit at Ambassador West



Table 1.1: DFS Consultants and Scope

Consultant	Component	Scope of Work
GR Engineering Services (GRES)	DFS Engineering	<ul style="list-style-type: none"> <li>» Overall DFS lead consultant</li> <li>» Process plant design and infrastructure</li> <li>» Overall capital and operating cost estimates</li> </ul>
AMC Consultants	Geology and Resource	<ul style="list-style-type: none"> <li>» Resource estimation</li> </ul>
Piacentini and Son	Geotechnical Investigation Trenches	<ul style="list-style-type: none"> <li>» Geotechnical test pits</li> <li>» Mining contractor</li> </ul>
AMC Consultants	Mine Geotechnical Design	<ul style="list-style-type: none"> <li>» Geotechnical field studies</li> <li>» Pit wall and haul ramp design</li> <li>» Overburden landform design</li> </ul>
Mining Plus	Ore Reserve	<ul style="list-style-type: none"> <li>» Ore Reserve estimation</li> </ul>
Vimy	Mine Planning & Scheduling	<ul style="list-style-type: none"> <li>» Resource optimisation</li> <li>» Detailed mine planning and scheduling</li> </ul>
Mining Plus	Mining	<ul style="list-style-type: none"> <li>» Detailed staged pit designs</li> <li>» Equipment sizing and selection</li> <li>» Mining capital and operating cost estimates</li> </ul>
Rockwater Hydrogeological and Environmental Consultants	Hydrogeology	<ul style="list-style-type: none"> <li>» Ground water resource estimation</li> <li>» Reinjection borefield design</li> </ul>
Advisian (WorleyParsons Group)	Pit Dewatering Design	<ul style="list-style-type: none"> <li>» Pit dewatering borefield design</li> <li>» Pit dewatering capital and operating cost estimate</li> </ul>
InfraTech Consulting	Civil Geotechnical Design	<ul style="list-style-type: none"> <li>» Civil geotechnical studies</li> <li>» Civil geotechnical design for roads, airstrip &amp; plant</li> </ul>
Walker Newman & Associates	Communication Infrastructure	<ul style="list-style-type: none"> <li>» Telecommunications design and engineering</li> <li>» Telecommunications capital and operating cost estimates</li> </ul>
Project Consultancy Services	Power & Fuel Supply	<ul style="list-style-type: none"> <li>» Pre-qualification tender evaluation for power station</li> <li>» Evaluation of natural gas and diesel fuel options</li> </ul>
Vimy	Marketing	<ul style="list-style-type: none"> <li>» Uranium market study and forward pricing</li> </ul>
Vimy	Economic Modelling	<ul style="list-style-type: none"> <li>» Development of project financial model</li> <li>» Project economic evaluation</li> </ul>
ALS Metallurgy	Ore Beneficiation Piloting	<ul style="list-style-type: none"> <li>» Ore beneficiation pilot program</li> </ul>
Allied Mineral Laboratory	Ore Beneficiation Piloting	<ul style="list-style-type: none"> <li>» Piloting supervision</li> </ul>
SGS Minerals Metallurgy	Uranium and Base Metals Piloting	<ul style="list-style-type: none"> <li>» Uranium pilot program</li> <li>» Base metals pilot program</li> </ul>
Australian Nuclear Science and Technology Organisation (ANSTO)	Flowsheet Development	<ul style="list-style-type: none"> <li>» Metallurgical flowsheet development</li> <li>» Piloting supervision</li> </ul>
Vimy	In-Pit Tailings Disposal	<ul style="list-style-type: none"> <li>» In-pit tailings stability testing</li> <li>» In-pit tailings capacity</li> <li>» In-pit tailings operating philosophy</li> </ul>



# TENURE & LAND ACCESS

p10-p13





## Highlights

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The Mulga Rock Project exploration tenement package covers approximately 757km<sup>2</sup> of unallocated Crown land.

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Tenure is unencumbered by other leases or claims.

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The Mulga Rock Project area is covered by granted Mining Leases and Miscellaneous Licences covering all infrastructure required for the Life-of-Mine.

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The Mulga Rock Project tenement package covers approximately 757km<sup>2</sup> of unallocated Crown land in the Shire of Menzies, within the Mt Morgans district. Due to the arid nature and deep sandy soils of the local environment, the project area cannot sustain stock and so is devoid of any pastoral lease or settlements, past or present.

The project comprises two granted Mining Leases (M39/1104 and M39/1105) and twelve Miscellaneous Licences (L39/193, 219, 239 to 243, 251 to 254, 269) nine granted and three under application, covering all infrastructure required for the Life-of-Mine. In addition, there are eight granted Exploration Licences (E39/876, 39/877, 39/1148, 39/1149, 39/1150, 39/1551, 39/1902 and 39/1953) and two under application (E28/2710 and E39/2049). Two Prospecting Licences, P39/5844 and P39/5853, are also under application.

Details of all tenements and applications within the MRP as of 31 December 2017 are shown in Table 2.1.

Vimy holds all Ministerial approvals required to carry out development and mining activities at the MRP, subject to

Shogun-Emperor access track



endorsement of Mining Proposals and Works Approvals (State and Commonwealth) and secondary licences.

## MINING LEASES

Mining Leases M39/1104 and M39/1105 were granted on 19 October 2016 for 21 years, and replaced the previous Mining Leases M39/1080 and 1081 (granted in July 2012). M39/1104 covers the Mulga Rock East mining area and the proposed hydrometallurgical process plant, while M39/1105 covers the Mulga Rock West mining area. Both Mining Leases can be renewed for a further 21 years in the year 2037.

## MISCELLANEOUS LICENCES

Miscellaneous Licence L39/193 covers the area surrounding the Kakarook groundwater resource northeast of the MRP. It is overlain in part by L39/239, which covers the Kakarook North process water borefield, access road and associated pipeline. The Kakarook North borefield is licenced to extract up to 3GL/a of raw water which is ample to meet the requirements of the MRP.

Licence L39/254 covers the proposed mine dewatering reinjection borefield and associated pipeline, from the southern boundary of M39/1104 to that borefield.

Licence L39/240 and application L39/243 cover an access corridor for a gas pipeline lateral, through to the Eastern Goldfields gas pipeline, owned and operated by the APA Group.

Applications for L39/251 and L39/269 cover the MRP main access road to the Tropicana Gold Mine access road and its ancillary infrastructure.

Licence L39/252 encompasses the accommodation village, aerodrome and waste water treatment plant.

## ROYALTIES

Western Australia has a 5% royalty on uranium production, which is estimated to provide the State approximately A\$200M over fifteen years based on the base case uranium price and exchange rate used in this study.

In addition to the WA State royalty, Vimy granted Resource Capital VI L.P. (RCF VI) a mineral royalty of 1.15% of gross revenue from all products produced from the MRP for A\$10M cash payment, which formed part of a funding package with RCF VI finalised in August 2015.



Figure 2.1 Mulga Rock Project Tenement Map

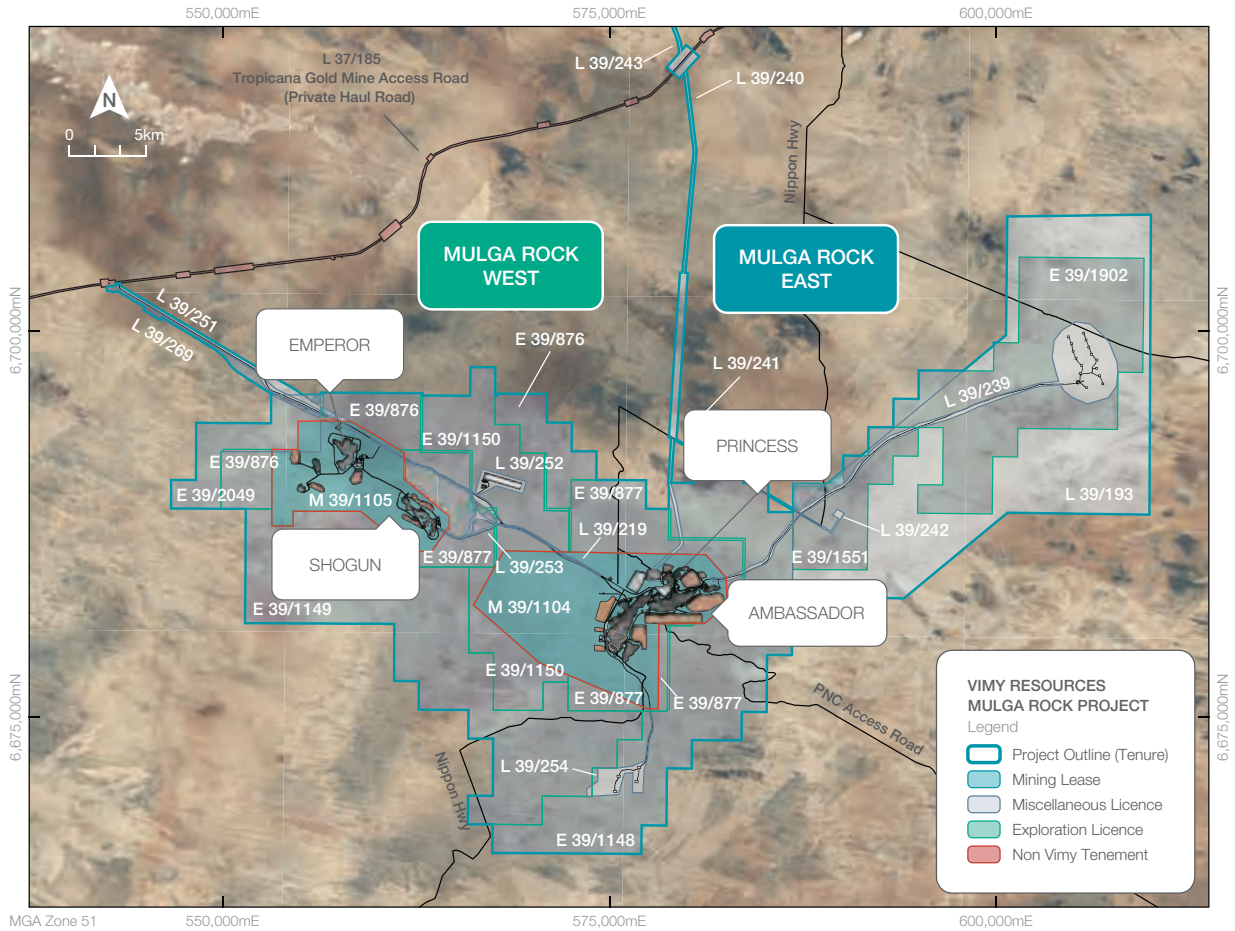



Table 2.1: Mulga Rock Project Tenement Map

Tenement	Area (km <sup>2</sup> )	Status	Grant Date
M39/1104	104.60	Granted	19/10/2016
M39/1105	56.82	Granted	19/10/2016
E39/876	67.41	Granted	28/02/2003
E39/877	91.05	Granted	28/02/2003
E39/1148	156.7	Granted	09/05/2007
E39/1149	177.8	Granted	09/05/2007
E39/1150	76.38	Granted	09/05/2007
E39/1551	62.5	Granted	04/10/2010
E39/1902	137.0	Granted	23/08/2016
E39/1953	59.61	Granted	14/08/2017
L39/193	316.41	Granted	08/10/2009
L39/219	2.39	Granted	07/12/2012
L39/239	23.43	Granted	30/03/2016
L39/240	11.02	Granted	30/08/2016
L39/241	0.91	Granted	30/08/2016
L39/242	0.62	Granted	30/08/2016
L39/252	3.03	Granted	10/02/2017
L39/253	3.49	Granted	10/02/2017
L39/254	5.30	Granted	10/02/2017
E28/2710	104	Application	Pending
E39/2049	3.49	Application	Pending
P39/5844	0.26	Application	Pending
P39/5853	0.22	Application	Pending
L39/243	11.08	Application	Pending
L39/251	6.62	Application	Pending
L39/269	6.31	Application	Pending

# ENVIRONMENT

p14-p19

A photograph of a Sandhill Dunnart mouse, a small grey and white marsupial, standing on sandy ground. The mouse is positioned in the lower right of a curved, semi-transparent inset that shows a desert landscape with sparse green grass and a dirt path. The background of the entire page is a solid orange-brown color with a subtle pattern of small white dots at the top.

Sandhill Dunnart photo courtesy of A. McLean.



## Highlights

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Final State and Federal Ministerial Approvals granted.

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Environmental and social risks, and potential impacts of the Mulga Rock Project have been thoroughly assessed under the regulatory framework.

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The nearest inhabited regional town to the Mulga Rock Project is Laverton which is located approximately 200km to the northwest.

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## The environmental and social risks, and potential impacts of the Mulga Rock Project have been thoroughly assessed under the Australian and Western Australian regulatory framework.

This stringent regulatory structure, which satisfies the World Bank Group Equator Principles, provides an appropriate mechanism for determining, assessing and managing environmental and social risks for projects, ensuring they are developed in a socially responsible manner, and reflect sound environmental management practices.

The Environmental and Social Assessment of the MRP was fully discussed and disclosed in the Public Environmental Review (PER), which was approved by both the State and Federal Environment Ministers, and is publicly available on the Vimy website.

During the PER process, there were two public and stakeholder comment periods; one was associated with the initial Environmental Scoping Document (ESD) and the other with the PER process. This was followed by an appeals period that allowed interested parties to voice their concerns about the proposed development and the assessment process that was undertaken. The public and stakeholder comment periods were open for a total of fourteen weeks, with the ESD being two weeks and the PER twelve weeks. These periods were publicly advertised in all major local and regional newspapers as well as on the websites of the various regulatory agencies. In addition, members of the public were able to request hard copies of the PER document to review.

After reviewing the PER document, interested parties submitted comments on the project. A total of 1,192 public submissions were received and Vimy adequately addressed each comment to the satisfaction of the Environmental Protection Authority (EPA). This process ensured that the Environmental and Social Impact Assessment (ESIA) was undertaken with transparency and that all interested parties were involved in the assessment process, and their grievances acknowledged and appropriately responded to. There were 24 appeals against the final decision that were dealt with by the Office of the Appeals Convenor, who made 16 recommendations concerning amendments to the conditions to address the matters that had been raised under appeal.

Final Ministerial Approval was granted by the State of Western Australia under s.45(5)(b) of the *Environmental Protection Act 1986* (EP Act) in December 2016.

The Australian Federal Government granted final approval under s.133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in March 2017. The assessment process was undertaken under a bilateral agreement between the State of Western Australia and the Commonwealth, but the approvals are granted separately under State and Commonwealth Acts.

On 20 June 2017, the Western Australian Government confirmed that they will not prevent the four uranium projects (including Vimy's Mulga Rock Project) that have received State Ministerial approvals from progressing, as they have clear legal advice they cannot legally deny secondary approvals for the purpose of frustrating approvals already granted. (See Vimy's release to the ASX, 20 June 2017).

## ENVIRONMENT

The MRP is located in the Eastern Goldfields region of Western Australia, within the regionally extensive Yellow Sand Plain of the Great Victoria Desert, which occupies around 1.7 million hectares (17,000km<sup>2</sup>). The area is very remote, with no other mining operations present (i.e. no cumulative impacts). The environmental impacts of the project are negligible and site-specific, with only 3,787ha (0.2% of the total Yellow Sand Plain) expected to be disturbed.

As part of the PER, detailed environmental baseline and impact studies were undertaken covering flora and vegetation, terrestrial and subterranean fauna, soils, geochemistry, hydrology, and hydrogeology.

## FLORA

The flora and vegetation within the MRP are well represented within the broader Yellow Sand Plain, so any site-specific impacts will not have a detrimental effect on the representativeness of the flora and vegetation. There are no Threatened Ecological Communities within the MRP, and while 335 vascular plant taxa have been recorded, representing 140 genera and 43 families, there are only 14 conservation significant flora species and only one Matter of National Environment Significance (MNES) flora species registered under the Australian Department of the Environment and Energy. The MRP will impact less than 1% of the P1 MNES species, and thus the project will not have an adverse impact on any conservation significant flora species or vegetation community.

## FAUNA

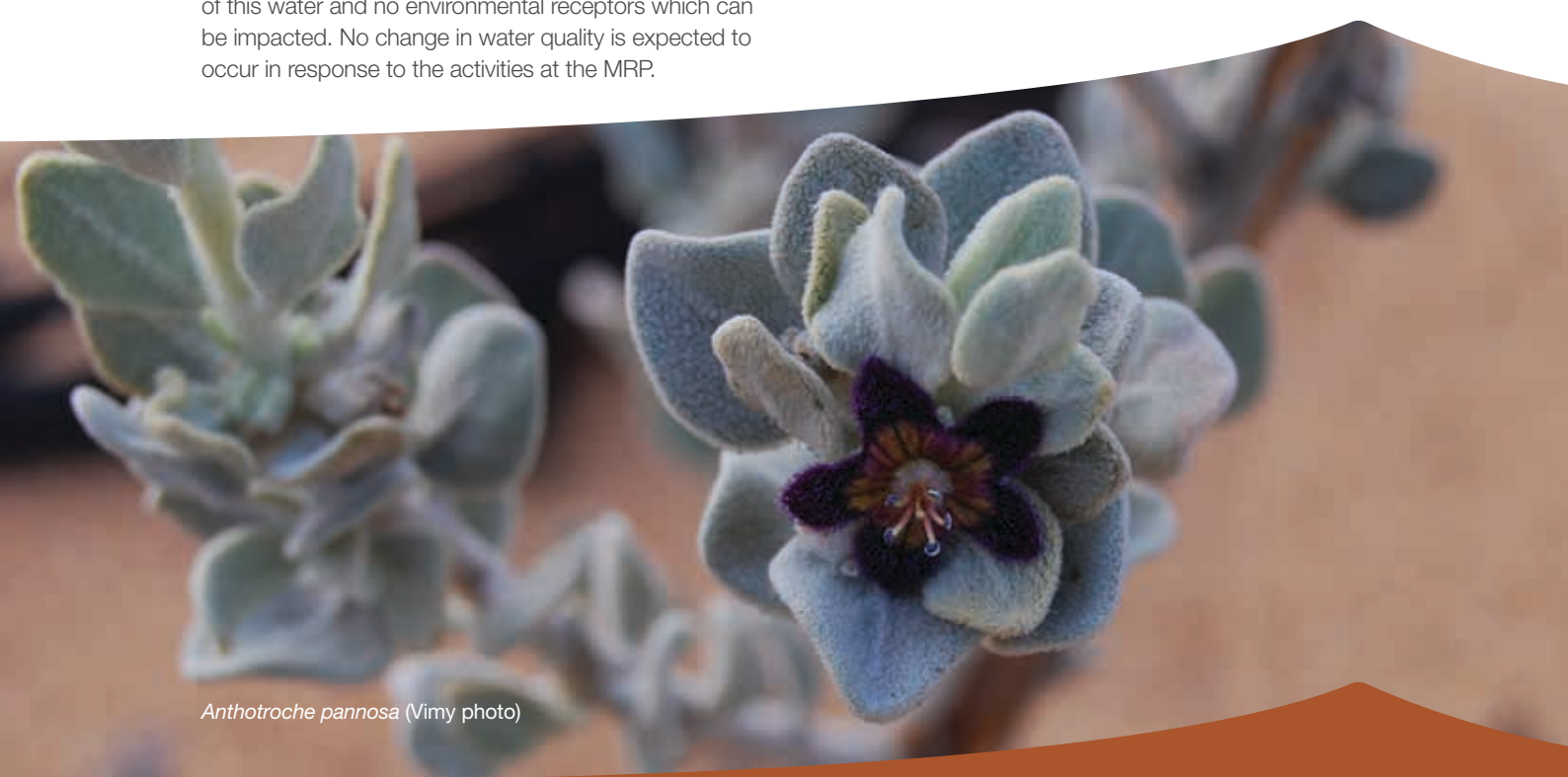
The surface geology across the MRP is dominated by unconsolidated sands which have high transmissivity to rainwater and therefore no surface water occurs across the site. This scarcity of surface water and the prevalence of large bushfires limits the fauna assemblages occurring within the MRP. As a result, there is a general absence of macro-fauna (i.e. kangaroos), except for reptiles and small marsupials, which can burrow and seek shelter within the prevalent spinifex groundcover.

Only one conservation significant fauna species occurs in the MRP – the Sandhill Dunnart (*Sminthopsis psammophila*). This species is listed as Endangered, and prior to 1985, its presence in Western Australia was undocumented. Vimy has established an innovative camera trapping protocol that has been used to specifically identify the Sandhill Dunnart in the MRP area, and distinguish it from other Dunnart species. This fauna work has greatly improved the knowledge of this elusive nocturnal species. Through the environmental impact assessment process, it has been established that the MRP will not have a significant residual environmental impact on any fauna species or habitat.

## GROUNDWATER

The groundwater within the MRP, wherein the uranium orebody is hosted, has a significantly degraded water quality due to contemporaneous acid sulphate rock processes. Consequently, there are no beneficial users of this water and no environmental receptors which can be impacted. No change in water quality is expected to occur in response to the activities at the MRP.

BASELINE STUDIES COMPLETED DURING THE PUBLIC ENVIRONMENTAL REVIEW PROCESS SHOW THAT THE MULGA ROCK PROJECT WILL NOT HAVE A SIGNIFICANT RESIDUAL ENVIRONMENTAL IMPACT. ANY IMPACT IS EXPECTED TO BE LOCALISED AND NEGLIGIBLE IN MAGNITUDE.



*Anthotroche pannosa* (Vimy photo)





Mulga Rock water hole

## SOCIAL CONTEXT

The nearest neighbour to the MRP is located over 100km away. This limits the project's influence on surrounding communities and peoples. The project is on unallocated Crown land and does not support stock.

The nearest inhabited regional town to the MRP is Laverton, which is located approximately 200km to the northwest of the project, while the regional City of Kalgoorlie-Boulder is located 290km by road, southwest of the project. The Pinjin Homestead is located 105km to the west, and the Tropicana Gold Mine is located 110km to the northeast of the MRP.

The nearest inhabited Aboriginal community is situated at the Mt Margaret Mission, located approximately 337km by road northwest of the MRP.

The MRP is located in a region where no surface water occurs and the groundwater is deep and of such low quality that it has no beneficial users. Owing to the scarcity of water in this region and limited presence

of macro-fauna, there is no evidence of permanent habitation within the project area. Furthermore, the area cannot support livestock and so any utilisation of the region was purely transitory.

The actual 'Mulga Rock' water hole is the nearest exposed hard rock capable of trapping rain water and is located 67km to the southwest of the MRP outside of the Great Victoria Desert on the eastern margin of the Yilgarn Craton. PNC, the original uranium explorers, named the project after this location when they began pushing the first roads eastwards from there into the Narnoo Basin.

The Mulga Rock water hole exhibits prolonged human utilisation, but east of this point and at the MRP, the basin sediments form a thick sedimentary cover over all hard rock, hence the scarcity of water and lack of evidence of prolonged habitation within the MRP.

## BENEFITS TO WESTERN AUSTRALIA

The MRP will produce just over 47Mlbs of refined yellowcake, which will provide A\$200M in State





royalties (based on the base case uranium price and exchange rate used in this study) over LOM. Vimy will also pay approximately A\$34M in payroll tax to the state.

During construction, it is anticipated that 550 personnel will be directly employed on the project. This workforce will transition to an operations team consisting of 350 site-based full-time employees and 25 Perth-based support personnel. The majority of the construction and operational workforce will be based in Perth, on a two weeks on and one week off fly-in fly-out (FIFO) roster.

Vimy has a 'Buy and Use Local' policy which encourages the use of local resources (personnel and businesses) to promote sustainable growth of nearby towns. In light of this policy, Vimy will establish an office in Kalgoorlie and use best endeavours to source some of the workforce from Kalgoorlie-Boulder, applying the same FIFO roster as Perth-based employees.

The DFS capital estimate is based on 72% local content and a further 7% sourced from interstate suppliers, with the remainder sourced from overseas suppliers.

THE MULGA ROCK  
WATER HOLE IS  
LOCATED 67KM FROM  
THE PROJECT AND IS  
THE LOCATION AFTER  
WHICH THE ORIGINAL  
URANIUM EXPLORERS  
PNC NAMED THE  
PROJECT.

# GEOLOGY

p20-p25







## Highlights

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Uranium mineralisation is hosted in a flat-lying carbonaceous sediment deposit, covered by approximately 38m of free-dig overburden.

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The primary host is, in layman's terms, a 'sandy-lignite' and uranium mineralisation is entirely hosted by the carbonaceous organic matter. This association is important as metallurgical processing can easily recover the light carbonaceous material from the heavy silica sand through simple gravity separation techniques.

---

The uranium deposition process by the 'redox' front is very common in many uranium deposits in the world, particularly the 'roll-front' deposits in the USA and Kazakhstan.

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## INTRODUCTION

The Mulga Rock Project is classed as a carbonaceous-sediment hosted, supergene enriched uranium deposit. Mineralisation is hosted predominantly by unconsolidated Eocene sediments (39 Ma) which are rich in organic matter and comprise river and estuarine-lake sediments. The organic matter originated primarily from land-based plant matter that washed into the channels and deposited into tributaries along the edge of an oxbow bend, forming peat.

The resultant primary host is, in layman's terms, a 'sandy-lignite' and uranium mineralisation is entirely hosted by the organic matter. This association is important as metallurgical processing can easily recover the light carbonaceous material from the heavy silica sand through simple gravity techniques.

## EARLY FORMATION

From approximately 39 to 36 Ma, at a time of higher sea levels and higher rainfall, the drainage system known today as Lake Raeside was a significant river system that flowed through the MRP area in a large sweeping, u-shaped bend. The river also formed several smaller oxbows, which now host the Shogun and Emperor deposits, and was fed by several tributaries, one of which hosts the Ambassador and Princess deposits (see Figure 4.2). The deposit sites also contained significant concentrations of organic matter and sulphides as a result of the reducing environment in

those sediments. In addition to the MRP oxbow, the thinner west and east arms of the palaeochannel formed the host to the smaller Shelf and Highway deposits (Figure 4.1), also associated with localised organic matter accumulation.

From 36 Ma onwards, as the sea level receded and regional water tables fell, associated with a regional uplift of the southern Australian plate, the bend was cut off as the Lake Raeside drainage re-aligned to its present-day course. The remnant oxbow lake became stagnant allowing further accumulation of sediments and eventual burial.

The pile of Eocene river sediments in the oxbow, which hosts the uranium, is known geologically as the 'Narnoo Basin'.

## SUPERGENE ENRICHMENT

As a result of prolonged exposure associated with a depositional hiatus, a widespread duricrust (silcrete) developed across the range of outcropping formations, providing a hard, protective capping most pronounced at the top of the palaeochannel. That initial weathering period was associated with warm and humid conditions.

The host sediment deposition process was followed by a period of aridification and deep lateritic weathering known to have occurred throughout Western Australia (from about 20 Ma, and most pronounced from 10 Ma onwards), and partly coincided with sedimentation during the Miocene. The gradual lowering of the water table during this phase resulted in a downward-moving weathering front, known as a reduction-oxidation (redox) boundary, oxidising the uppermost carbon and sulphides-rich material and remobilising uranium (and other metals) to create a supergene enriched zone just below the weathering front. The resulting low pH of groundwaters increased the metals content in solution, including uranium, sourced from the proximal basement rocks below and upstream of the channels. As the metals-bearing groundwaters came into contact with the carbon-rich sediments, the carbon acted as a water filter, and the metals were adsorbed, or ionically bonded onto, the carbon. Base metal and iron sulphides also formed at this time.

## OVERBURDEN SEQUENCE

The Narnoo Basin was subsequently buried during another period of high sea levels during the Miocene (~15 Ma), when the shoreline of the Southern Ocean lay few tens of kilometres to the southeast, and a lake

DFS diamond core sampling



formed over the Narnoo Basin. Further fluvial and lacustrine sediments were deposited during that period, forming the thick, reddish overburden sequence above the Eocene sediments (see Figure 4.4).

The final stage of the overburden sedimentary sequence at the MRP is comprised entirely of wind-blown (Aeolian) sands that are Quaternary in age (100,000 years or less) forming large dunes and sand sheets that are oriented at 120° and are between 5m to 15m in height. The sands have high rain transmissivity resulting in no surficial water courses or lakes in the area.

## BASEMENT

The ancient river that formed the Narnoo Basin incised a low-relief landscape. This comprises a package of glacial sedimentary units of the Gunbarrel Basin, which are Permian in age (~300 Ma), as well as the much older (1,800-1,700 Ma) metasedimentary rocks of the Barren Basin. The Barren Basin is thought to be the source of the high base metal concentration found in the Ambassador and Princess deposits. The Gunbarrel

Basin overlies an important geological terrain contact between the Yilgarn Craton to the northwest, and the Albany-Fraser mobile belt to the southeast (Figure 4.1). This 'suture zone' contains many regional faults and shear zones, some of which influence the ancient river course. These have also influenced the shape and boundaries of the subsequent Narnoo Basin.

The units at the base of the Narnoo Basin form an impermeable barrier at the base of the palaeochannel.

The MRP is a 'blind deposit' and was found only through 'wildcat' exploration drilling across the entire Gunbarrel Basin. At the time, the existence of the host Narnoo Basin was not known. The carbonaceous sediments that host the MRP deposits are flat-lying and under a considerable thickness of oxidised overburden. As a result, the deposits do not exhibit any radiometric or chemical signature at surface.

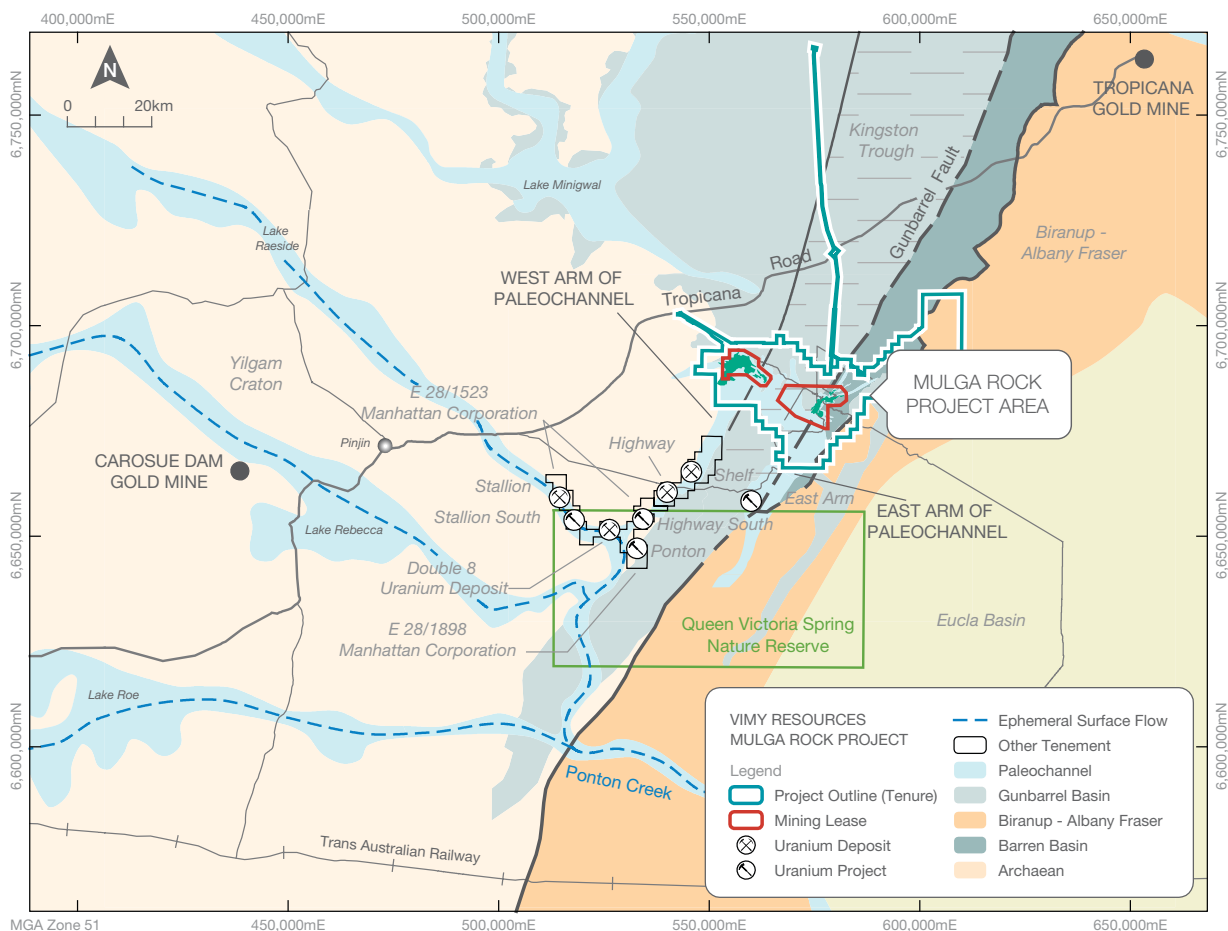


Figure 4.1: Regional Geological Setting of the MRP

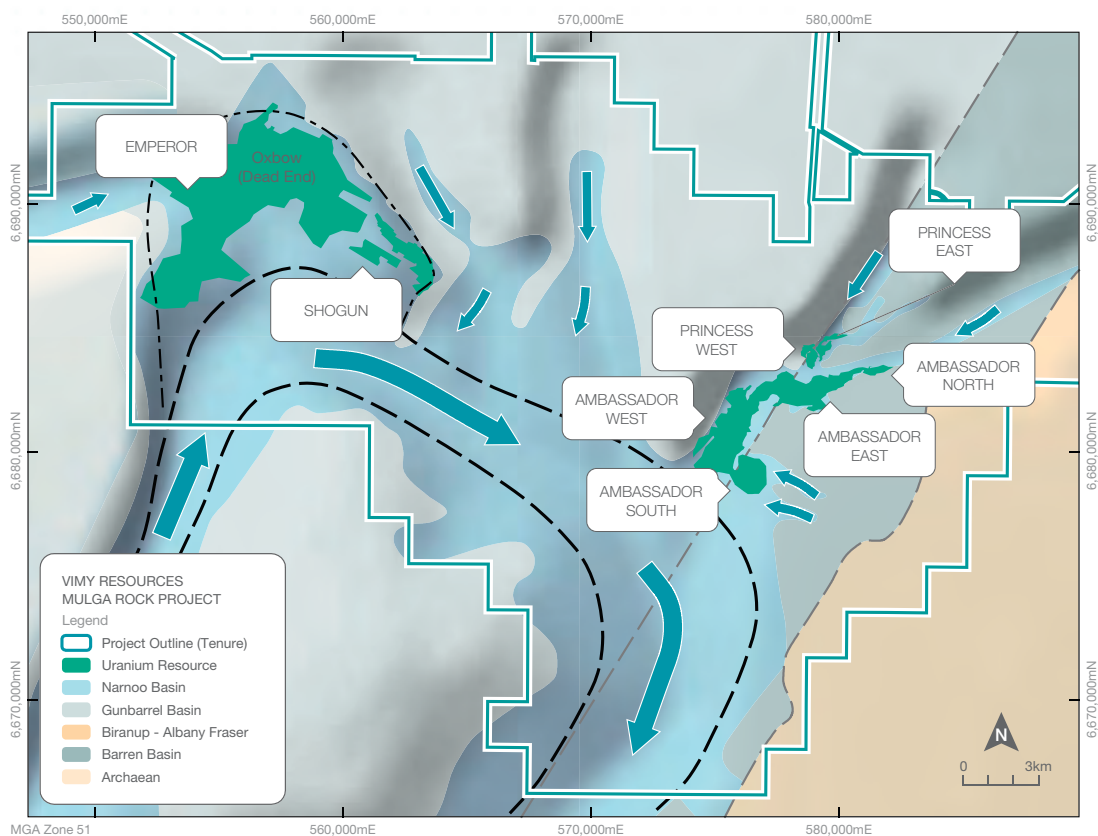


Figure 4.2: MRP Paleochannel and Tributaries

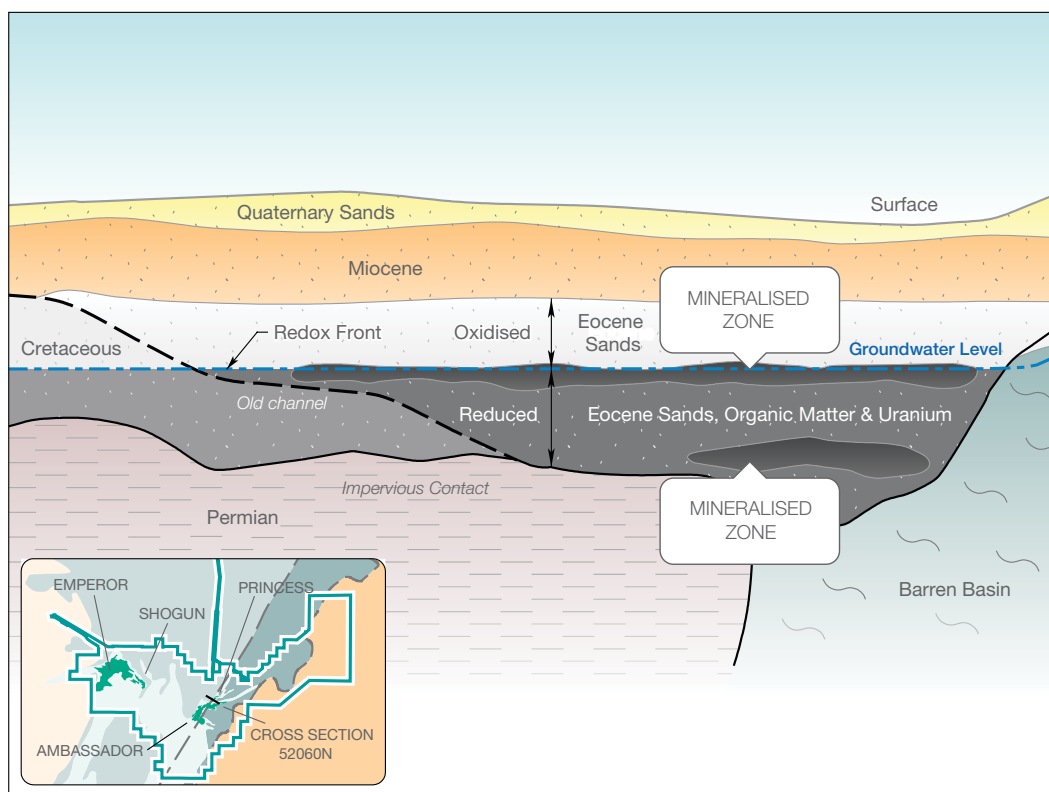


Figure 4.3: Schematic Cross Section of the Ambassador tributary



## URANIUM MINERALISATION

The uranium mineralisation is hosted by the organic matter in the reduced sediments below the redox front. Most of the uranium is adsorbed onto organic matter in an ionic form (i.e. uranium metal). The remainder of the mineralisation comprises ultra-fine grained uraninite ( $\text{UO}_2$ ) and mixed uranium oxides. The individual uranium-rich units consist of stacked lenses that have strong lateral continuity, and are spatially associated with the redox front that coincides with the present-day water table.

Uranium mineralisation is hosted by flat-lying, carbonaceous clastic sediments which are in turn overlain by weathered, oxidised sediments that range in thickness from 19m to 62m of waste overburden.

Most of the uranium is contained in the top mineralised lens (Figure 4.3). The ore zones are up to 38m thick, inclusive of interburden, with Ambassador and Princess deposits averaging 4.5m in thickness, and up to 8m in thickness at Shogun and Emperor with an average of 2.3m.

Ambassador and Princess mineralisation is strongly polymetallic in nature, with the majority of base and other metals adsorbed on to organic matter, with sulphides and sulphates accounting for the remainder. None of the other metals occur in a form or concentration which allows for eventual economic extraction and are therefore not reported as a Mineral Resource under the JORC Code (2012).

Figure 4.4: Stratigraphy of Overburden



# RESOURCES & RESERVES

p26-p33





The background of the page features a photograph of a mining operation in a desert environment. Two large white trucks are visible, one in the foreground and another slightly behind it. The terrain is arid with sparse vegetation. Overlaid on the left side of the image is a semi-transparent map showing a specific area highlighted in orange, with a white line indicating a boundary or path. The overall color scheme is dominated by the teal and orange tones of the design.

## Highlights

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The Mulga Rock Project has a total Mineral Resource of 90.1Mlbs  $U_3O_8$  being 71.2Mt at 570ppm  $U_3O_8$

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The Mulga Rock East mining area contains a high-grade mineral inventory totalling 25Mlbs at 1,500ppm  $U_3O_8$

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A 34% increase in the Mulga Rock East mineral resource has been achieved since the release of the PFS.

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The Mulga Rock Project has total Ore Reserves of 22.7Mt at 845ppm for 42.3Mlbs  $U_3O_8$

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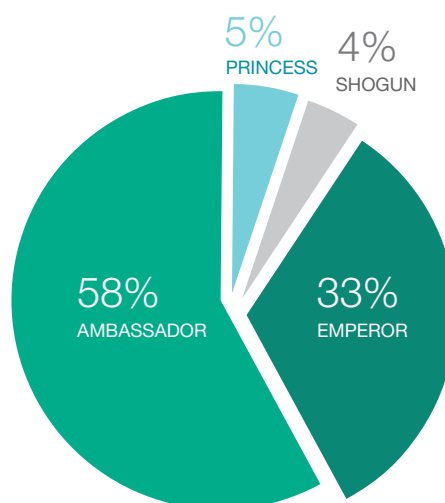
In July 2017, a significant Mineral Resource update for the Mulga Rock Project was released to the ASX and reported in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code 2012); the modifying factors for this resource update are provided in the Appendix of that release. AMC Consultants Pty Ltd independently verified the Mineral Resource estimate. The July 2017 Mineral Resource block model forms the basis of the DFS mine plan and design.

The MRP Uranium Mineral Resource is 71.2Mt at 570ppm  $U_3O_8$  for 90.1Mlb  $U_3O_8$  (see Table 5.1). This represents an increase of 20% in contained  $U_3O_8$  metal for the global resource when compared to the PFS Mineral Resource released to the ASX in September 2015. The increase in contained metal comprises a 10% increase in uranium grade and 9% increase in tonnage. More importantly, Mulga Rock East (Ambassador and Princess) has increased by 34% in contained metal comprising a 17% increase in grade and a 13% increase in tonnage when compared to mineral resource used for the PFS.

There is a high-grade component within the Ambassador and Princess deposits containing 25Mlb  $U_3O_8$  at an average uranium grade of 0.15% (1,500ppm)  $U_3O_8$ , with 91% in Measured and Indicated status. Vimy plans to mine three major high-grade pit shells that will be the focus of initial mining activities during the project payback period. Figure 5.2 shows a uranium grade 'heat map' for the Mulga Rock East area.

There is 45.4Mlb  $U_3O_8$  in Measured and Indicated status representing 50% of the total global resource as summarised in Figure 5.1.

#### CONTAINED METAL BY DEPOSIT



#### RESOURCE STATUS

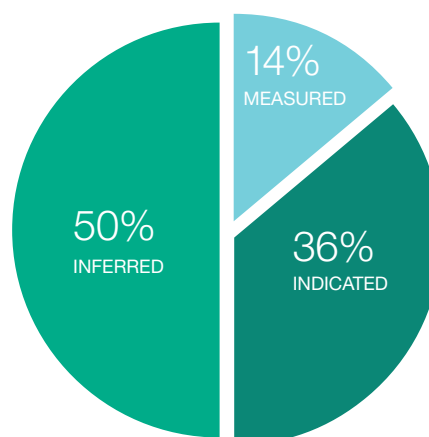


Figure 5.1: MRP Distribution and Resource Status



Table 5.1: Mulga Rock Project Mineral Resource, July 2017

Deposit / Resource	Classification	Cut-off Grade (ppm U <sub>3</sub> O <sub>8</sub> )	Tonnes (Mt) <sup>1</sup>	U <sub>3</sub> O <sub>8</sub> (ppm) <sup>2</sup>	U <sub>3</sub> O <sub>8</sub> (Mlbs)
<b>Mulga Rock East</b>					
Ambassador	Measured	150	5.2	1,100	12.6
Ambassador	Indicated	150	14.8	800	26.0
Ambassador	Inferred	150	14.2	420	13.1
Princess	Indicated	150	2.0	820	3.6
Princess	Inferred	150	1.3	420	1.2
<b>Sub-Total</b>			<b>37.4</b>	<b>680</b>	<b>56.4</b>
<b>Mulga Rock West</b>					
Shogun	Indicated	150	2.2	680	3.2
Shogun	Inferred	150	0.9	290	0.6
Emperor	Inferred	150	30.8	440	29.8
<b>Sub-Total</b>			<b>33.8</b>	<b>450</b>	<b>33.6</b>
<b>Total Resource</b>			<b>71.2</b>	<b>570</b>	<b>90.1</b>

1. t = metric dry tonnes; Appropriate rounding has been applied, and rounding errors may occur.

2. Using cut combined U<sub>3</sub>O<sub>8</sub> composites (combined chemical and radiometric grades).

The information in the table above is extracted from ASX announcement entitled 'Significant Resource Update – Mulga Rock Cracks 90Mlbs' released on 12 July 2017 and available to download from [www.asx.com.au](http://www.asx.com.au) ASX:VMY. The Company 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 Resources 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 have not been materially modified from the original market announcement.

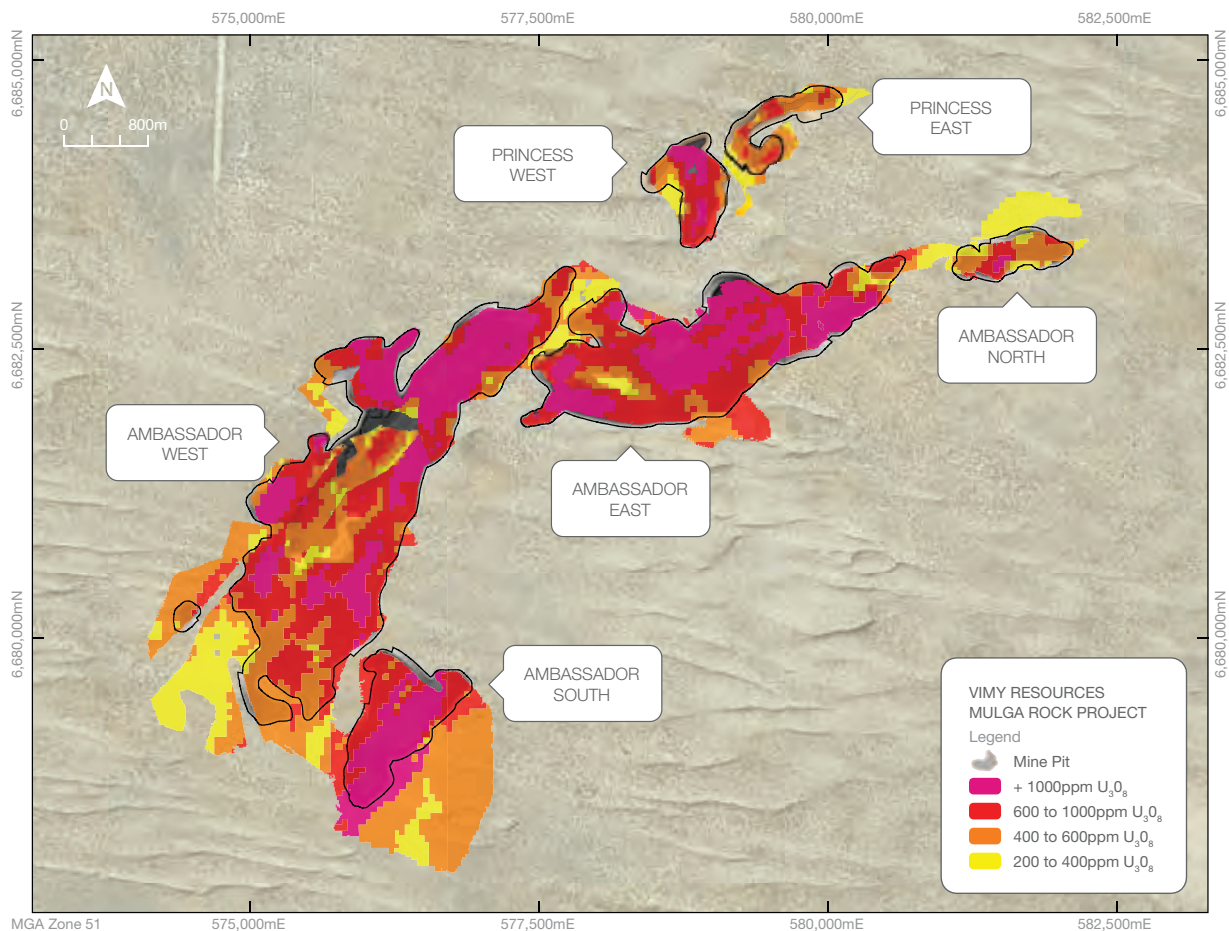


Figure 5.2: Ambassador and Princess Uranium Grade Heat Map



## MULGA ROCK EAST RESOURCE

The Mulga Rock East mining centre comprises the Ambassador and Princess deposits and contains a Mineral Resource of 37.4Mt at 680ppm  $U_3O_8$  for 56.4Mlb  $U_3O_8$  and will feed the process plant for approximately the first thirteen years of production.

The Mulga Rock East mining centre represents 63% of the global resource. The Ambassador resource is a large, flat-lying deposit that is approximately 9km in length and 1km wide. It has been extensively drilled with 1,606 aircore (AC) and reverse circulation (RC) holes completed for a combined total depth of 101,174 metres, and 366 diamond drill holes for 20,065 metres (see Figure 5.3).

The Princess resource is a more compact deposit approximately 2km long and 0.5km wide. It has been drilled with 204 AC and RC holes for a combined total depth of 11,605 metres, and 21 diamond drill holes for 1,108 metres.



Diamond drilling at Ambassador

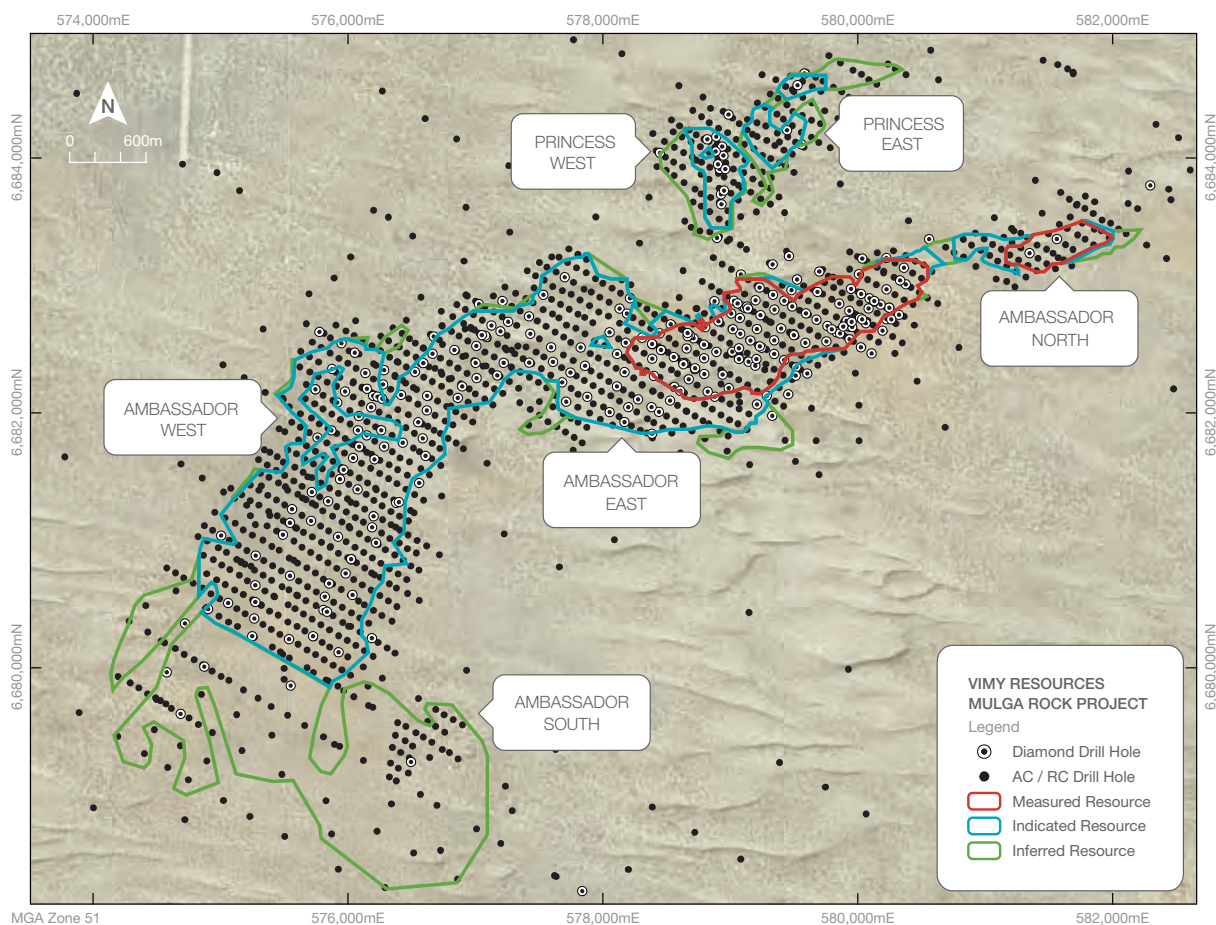


Figure 5.3: Ambassador and Princess Deposits Collar Location Map



## MULGA ROCK WEST RESOURCE

The Mulga Rock West mining centre comprises the Shogun and Emperor resources. The Shogun Resource Estimate (Table 5.1) is 3.1Mt at 565ppm  $U_3O_8$  for 3.8Mlb  $U_3O_8$ , with 85% of the Mineral Resource now classified as Indicated.

There have been 429 AC and RC holes drilled at Shogun for a total depth of 22,973m and 49 diamond holes for 2,303m of core. Figure 5.4 provides a drill collar map for the Mulga Rock West area. Additional infill drilling was completed at Shogun as part of the DFS, which has improved the radiometric correction factors applied to the resource and increased the majority of the resource to Indicated status.

The Emperor resource has also increased by 6% in contained metal since the release of the PFS, primarily as the result of changes to bulk density assumptions and corrections for radiometric disequilibrium. Emperor still remains open to the south and at depth.

There is potential to increase the contained metal of the existing Emperor resource with further infill drilling. This provides possible upside to extend the MRP mine life.

The overall Mineral Resource for Mulga Rock West contains 33.8Mt at 450ppm  $U_3O_8$  for 33.6Mlb  $U_3O_8$  using a 150ppm  $U_3O_8$  cut-off.

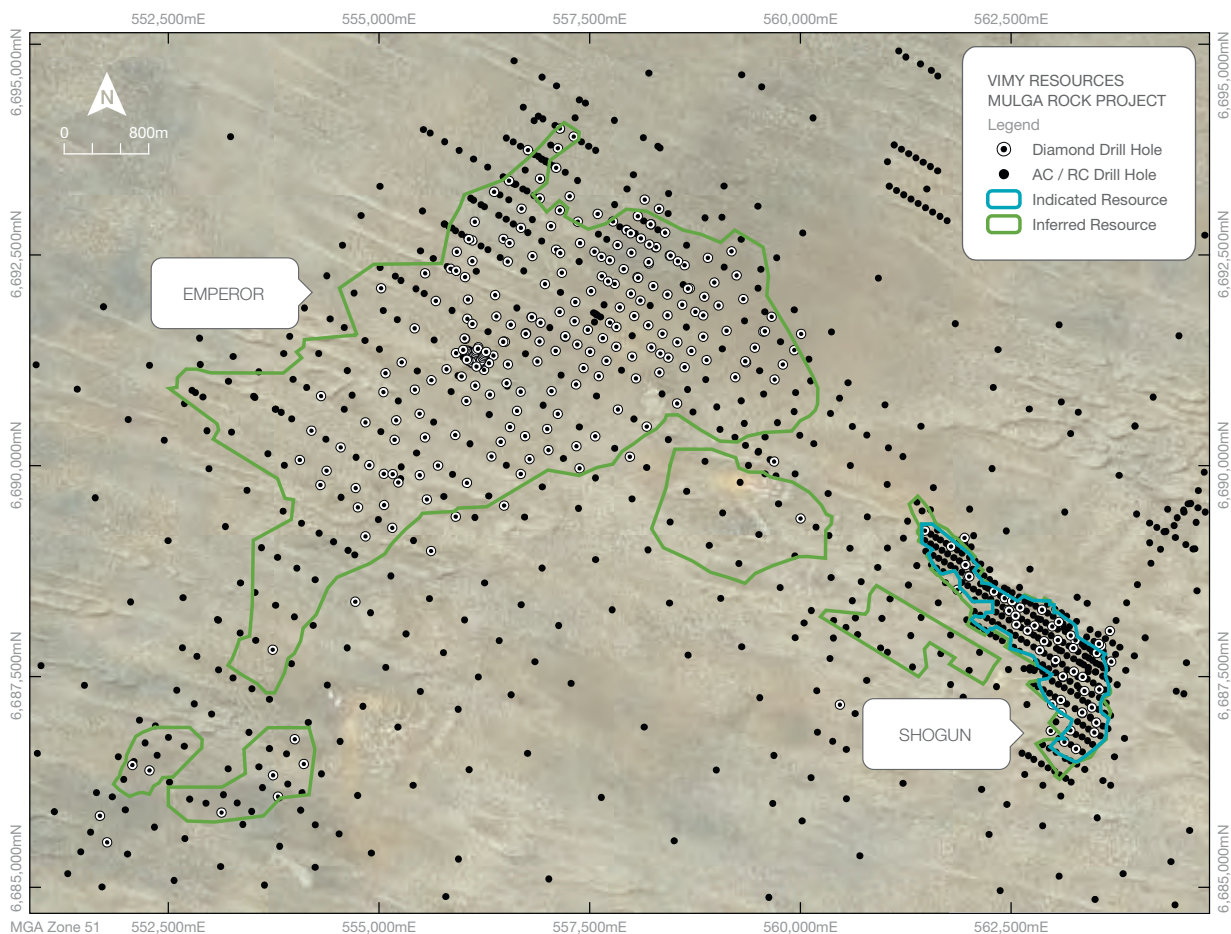


Figure 5.4: Emperor and Shogun Deposits Collar Location Map

## ORE RESERVES

Currently the Ore Reserve comprises 22.7Mt at 845ppm U<sub>3</sub>O<sub>8</sub> for a total of 42.3Mlbs of U<sub>3</sub>O<sub>8</sub> (ASX announcement 4 September 2017) as detailed in Table 5.2. The Ore Reserves are derived from, and are a subset of, the MRP Mineral Resource as released to the ASX on 12 July 2017. The modifying factors for this Ore Reserve update are summarised in Appendix 1 - 'JORC Code – Table 1 Mulga Rock Project – Ore Reserve Update' provided to the ASX on 4 September 2017.

The classification of the MRP Ore Reserve has been carried out in accordance with the principles of the JORC Code 2012 Edition. It reflects drilling and sampling density, estimation methodology, understanding and confidence of the orebody continuity, and the proposed mining and metallurgical recovery methods.

The mining cost estimates used for this Ore Reserve have been developed by Mining Plus. Equipment vendors, mining contractors, and

other mining service providers have submitted cost estimates used to develop the current DFS mining cost models built from first principles to meet the mine production schedule.

For planning and design purposes, the optimised pits and subsequent DFS pit designs are derived using all available Mineral Resources, including Inferred material. The material in the Inferred Resource does not determine the economic viability of the MRP and does not contribute materially to the first ten years of the mine schedule as ore to be mined between Years 1 to 10 comprises 90% of the Ore Reserves. Overall, the optimised pit designs for Ambassador, Princess and Shogun contain 85% of Proved and Probable Ore Reserves. There was a 98% conversion of Measured resources into Proved Ore Reserves, and 91% conversion of Indicated material into Probable Ore Reserves.

Table 5.2: Mulga Rock Project Ore Reserves, August 2017

Deposit / Resource	Classification	Cut-off Grade (ppm U <sub>3</sub> O <sub>8</sub> )	Tonnes (Mt) <sup>1,2</sup>	U <sub>3</sub> O <sub>8</sub> (ppm) <sup>3</sup>	U <sub>3</sub> O <sub>8</sub> (Mlbs) <sup>4</sup>
<b>Mulga Rock East</b>					
Ambassador	Proved	150	5.3	1,055	12.3
Ambassador	Probable	150	14.1	775	24.0
Princess	Probable	150	1.7	870	3.3
<b>Sub-Total</b>			<b>21.1</b>	<b>850</b>	<b>39.6</b>
<b>Mulga Rock West</b>					
Shogun	Probable	150	1.6	760	2.7
<b>Sub-Total</b>			<b>1.6</b>	<b>760</b>	<b>2.7</b>
<b>Total Reserves</b>			<b>22.7</b>	<b>845</b>	<b>42.3</b>

1. Tonnages and grades are reported including mining dilution.

2. t = metric dry tonnes; appropriate rounding has been applied and rounding errors may occur.

3. Using cut combined U<sub>3</sub>O<sub>8</sub> composites (combined chemical and radiometric grades).

4. Metallurgical plant recovery factors are not applied to Total Metal content.

The information in the table above is extracted from ASX announcement entitled 'Major Ore Reserve Update – Moving to the go line' released on 4 September 2017 and available to download from [www.asx.com.au](http://www.asx.com.au) ASX:VMY. The Company 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 Resources 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 have not been materially modified from the original market announcement.



OVER 90% OF THE  
MINE SCHEDULE IN  
THE FIRST TEN YEARS  
IS IN ORE RESERVE.



Aircore drilling at Ambassador



# MINING

p34-p45



The background of the page is a photograph of a mining site. In the foreground, there are several large yellow mining trucks parked on a dirt road. To the left, a large satellite dish is mounted on a structure. The background shows a hilly, arid landscape with some sparse vegetation. The entire image is overlaid with a semi-transparent teal color.

## Highlights

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The DFS mine schedule supports 15 years of production at 3.5Mlb of uranium per annum.

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The optimised pit designs for the DFS remain economic under a broad range of uranium prices both at current-term contract prices and expected future pricing.

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The DFS has a high-grade start-up strategy to maximise cash flow during initial production ramp-up, whilst maintaining mine life.

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Excavation of two bulk test pits at Ambassador verified the free-dig nature of the overburden.

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Mining Plus was engaged by Vimy to undertake the mining components of the DFS. As part of this work, Advisian (a member of the WorleyParsons Group) was also engaged by Vimy to undertake the advanced pit dewatering design and cost estimation components of the DFS, which form part of the total mining capital cost estimate. Vimy completed the resource optimisation and mine scheduling components of the DFS, with Mining Plus reviewing the work completed by Vimy.

### PIT OPTIMISATION

Vimy completed resource optimisations for the Ambassador, Princess, Shogun and Emperor deposits using the July 2017 resource block model, and input parameters developed as part of the DFS. Resource optimisation was completed using Hexagon Mining's MineSight Economic Planner software programme using the Pseudoflow algorithm.

Measured, Indicated and Inferred (MII) mineral resources were included in all optimisations as potential mineral inventory.

The optimisations for all deposits were performed over a range of Revenue Factors (RF), i.e. uranium offtake contract price, between US\$25/lb and US\$95/lb  $U_3O_8$ , at US\$10/lb increments, to analyse the sensitivity of the deposits to the changing metal price. Undiscounted cash flows were generated for each optimised pit shell at each respective revenue factor. The individual pit shell cash flows were then stress-tested to changing metal prices to produce a range of cash flow curves for all the optimised pit shells, an example of which is shown in Figure 6 1. For example, the US\$55/lb optimised pit shell has been selected for Ambassador, which is anticipated to generate A\$2,000M of free cash flow (after production costs and ignoring cost of capital) assuming a uranium price of US\$60/lb. By increasing the size of the pit shell from US\$55/lb (DFS) to US\$75/lb (PFS) there is no additional cash flow generated because the additional mineral inventory within the larger pit shell (US\$75/lb) only covers the cost of production. A higher uranium metal price (greater than US\$60/lb) would be required to select a larger pit shell in the above scenario.

Apart from free cash flow, other key metrics were assessed for each optimised pit shell including:

- » Ore tonnes;
- » Waste tonnes;
- » Total material movement;
- »  $U_3O_8$  grade;
- » Contained metal ( $U_3O_8$ );
- » Strip ratio (waste tonnes:contained metal); and
- » Calculated breakeven price.

Ambassador East test pit





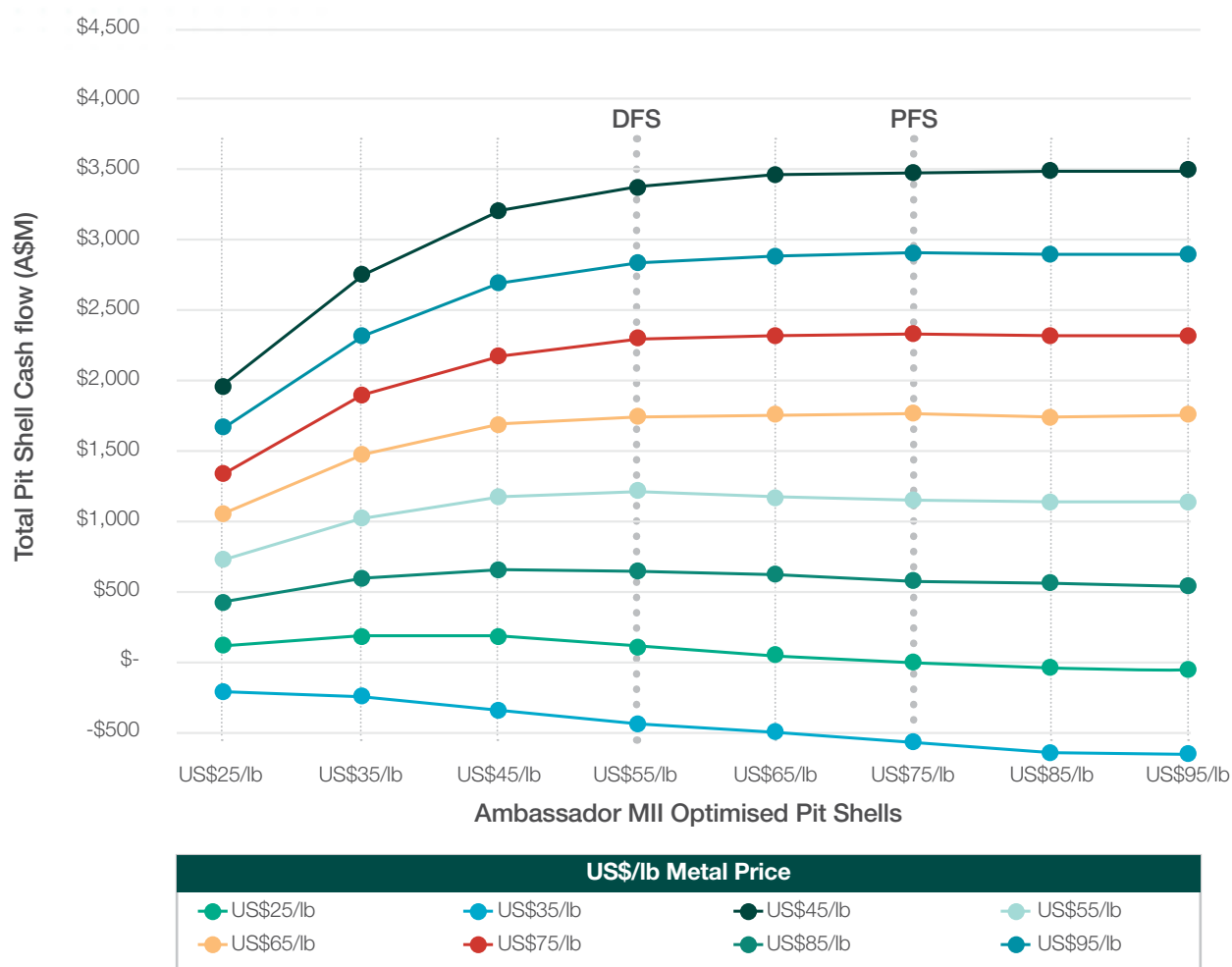


Figure 6.1: Optimised Pit Shell Cash Flow Analysis (Ambassador Resource)

The breakeven price was back-calculated to determine at what metal price the costs for each optimised pit shell equalled the calculated revenue. This is an important value to recognise during a low uranium price market environment, and assists in understanding the economic robustness of each deposit. The contained metal and total material movement quantities were also plotted to assist in the resource optimisation analysis.

There were some variations in pit shell selection for each deposit, depending on proposed timing within the mine plan and project development timeframe, mining methodology and operational factors, and sensitivity analysis results. The pit shells selected for the DFS are provided in Table 6.1. As a result of the increase in contained metal in the July 2017 Mineral Resource estimate, the DFS pit shells yield the same uranium metal production at a significantly lower uranium price when compared to the PFS pit designs.

Table 6.1: Comparison of Selected Optimised Pit Shell Revenue Factors

Deposit	PFS Pit Shell Revenue Factor (US\$/lb U <sub>3</sub> O <sub>8</sub> )	DFS Pit Shell Revenue Factor (US\$/lb U <sub>3</sub> O <sub>8</sub> )
Ambassador	75	55
Princess	65	45
Shogun	90	65
Emperor	82	35
MRP Average	78	50

The pit shells used to derive the optimised pit designs for the DFS remain economic under a broad range of uranium prices both at current-term contract prices and expected future pricing. For example, the weighted average price of term contracts for uranium purchased by owners and operators of US civilian nuclear power reactors in 2016 was US\$46.11/lb  $U_3O_8$  equivalent. Based on this average price, Vimy considers that the pit design price ranges are appropriate.

The DFS is based on optimised pit shells derived at an average of US\$50/lb  $U_3O_8$ . This compares to the PFS which was based on optimised pit shells derived at US\$78/lb  $U_3O_8$ . Despite a US\$28/lb reduction in the uranium price used, the total contained uranium metal within the optimised pit shells has only reduced by 5Mlbs  $U_3O_8$ , from 59Mlbs for the PFS to 54Mlbs for the DFS. More importantly, the total material movement has reduced by approximately 375Mt (wet) over LOM when comparing the pit shells between the PFS and DFS.

economically robust and there is virtually no change to the width or depth of the Ambassador pit between US\$45 to US\$75/lb  $U_3O_8$ . Only 7% of the Ore Reserve is lying outside the optimised pit designs at a uranium contract price of US\$45/lb  $U_3O_8$ . The southern end of Ambassador is more sensitive to price due to increasing overburden thickness. This characteristic is also reflected in the flat curves in Figure 6.1 and is a direct result of the flat-lying nature of the orebody. This is significant since the mine design will not change to any great extent irrespective of uranium contract prices above US\$45/lb.

The optimised pit shells for Shogun and Emperor are shown in Figure 6.3 and Figure 6.4 respectively. Emperor is much more sensitive to the uranium contract price due to the thinner ore zones and higher strip ratio.

Figure 6.2 shows the pit shells for Ambassador and Princess for a range of uranium prices between US\$35 to US\$75/lb  $U_3O_8$ . The optimised pit designs are

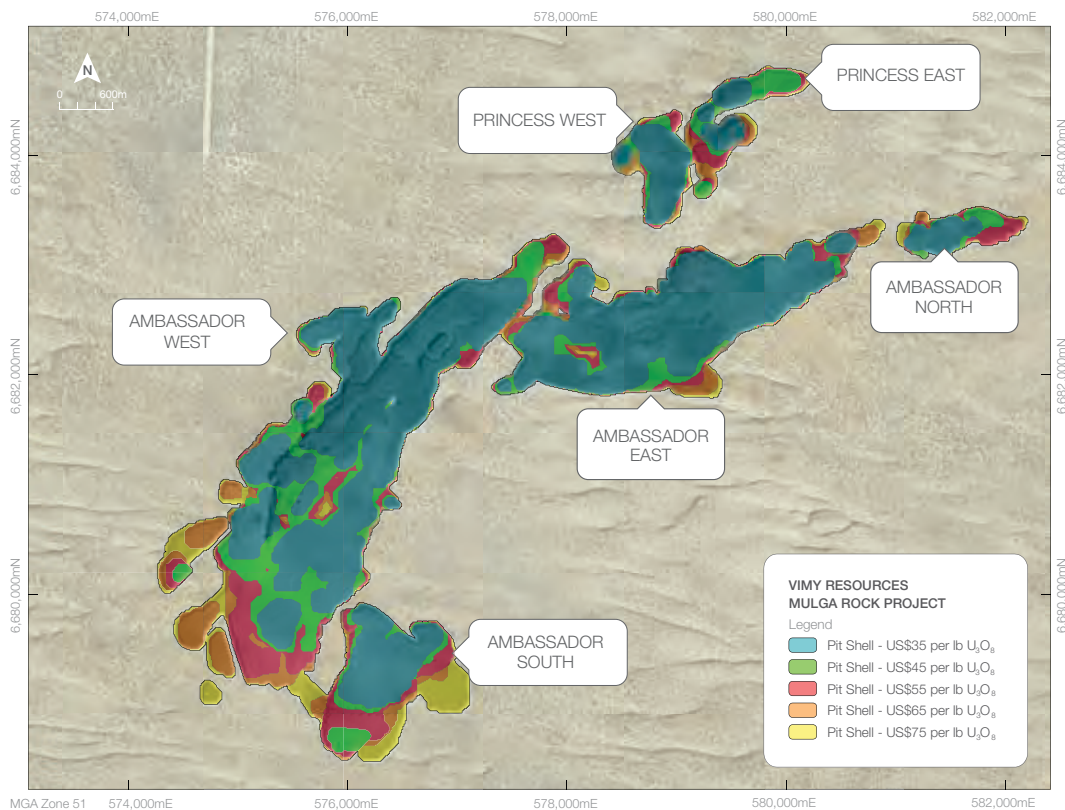


Figure 6.2: Ambassador Pit Shell Optimisation

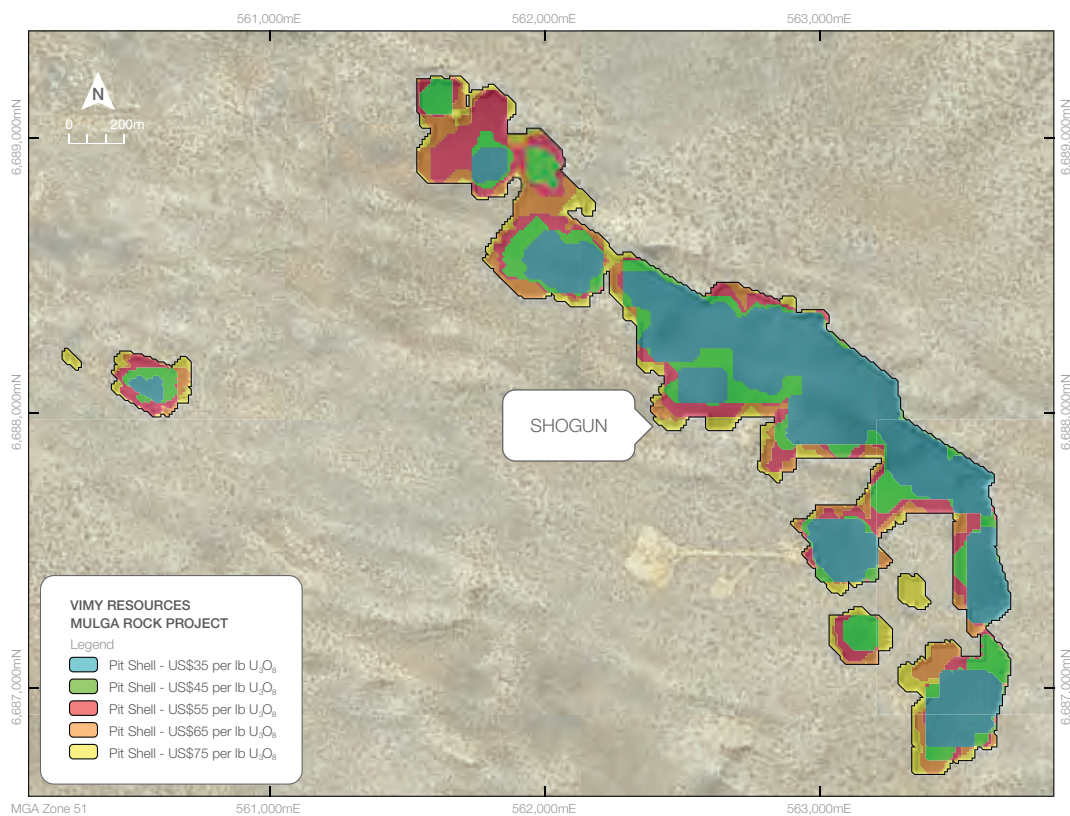


Figure 6.3: Shogun Pit Shell Optimisation

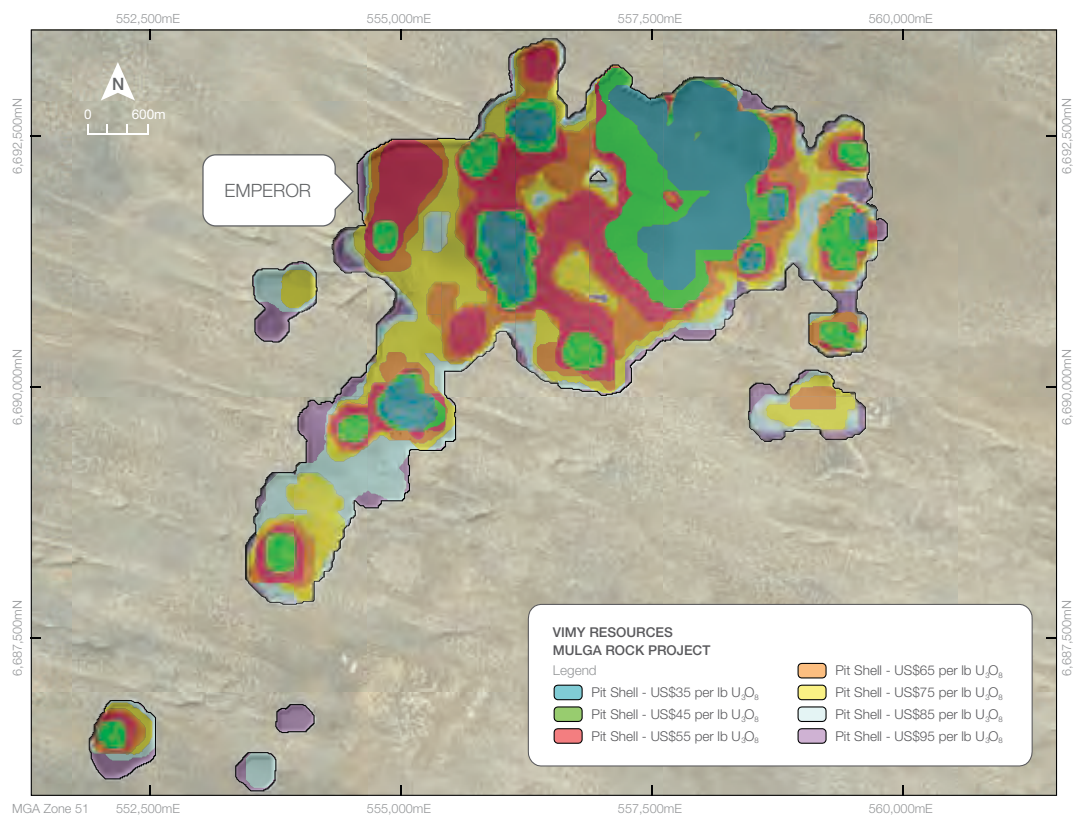


Figure 6.4: Emperor Pit Shell Optimisation



## HIGH-GRADE START-UP

Vimy examined a high-grade start-up strategy to maximise metal output, and therefore value, during the initial ramp-up phase. A separate optimisation study was conducted for the Ambassador and Princess deposits using adjusted optimisation parameters to represent direct feed (instead of through the beneficiation circuit first) into the semi-autogenous grinding (SAG) mill. The adjusted parameters along with variation in the revenue factor provided nested pit shell results to determine areas suitable to support the high-grade production ramp-up phase within the ultimate economic pit limits identified in the previous section.

Figure 6.5 shows the Ambassador deposit at different targeted ROM feed grades.

During start-up, ore will be fed directly to the SAG mill at 2,355ppm  $U_3O_8$ , bypassing the beneficiation plant, and maintaining a production rate between 3.0-3.5Mlbs  $U_3O_8$  per annum. The Ambassador pit will provide high-grade ore to the process plant for the first twenty months. Figure 6.6 shows the location of the three high-grade pits. Ore will be excavated to the final LOM floor level and excess ore below the selected initial high-grade feed cut-off grade will be stockpiled for future processing. Figure 6.11 shows the closing stockpile inventory at the end of each year. Stockpiled ore will then be reclaimed from Year 2 Month 9 and notably will have negligible mining cost.



Ambassador West test pit

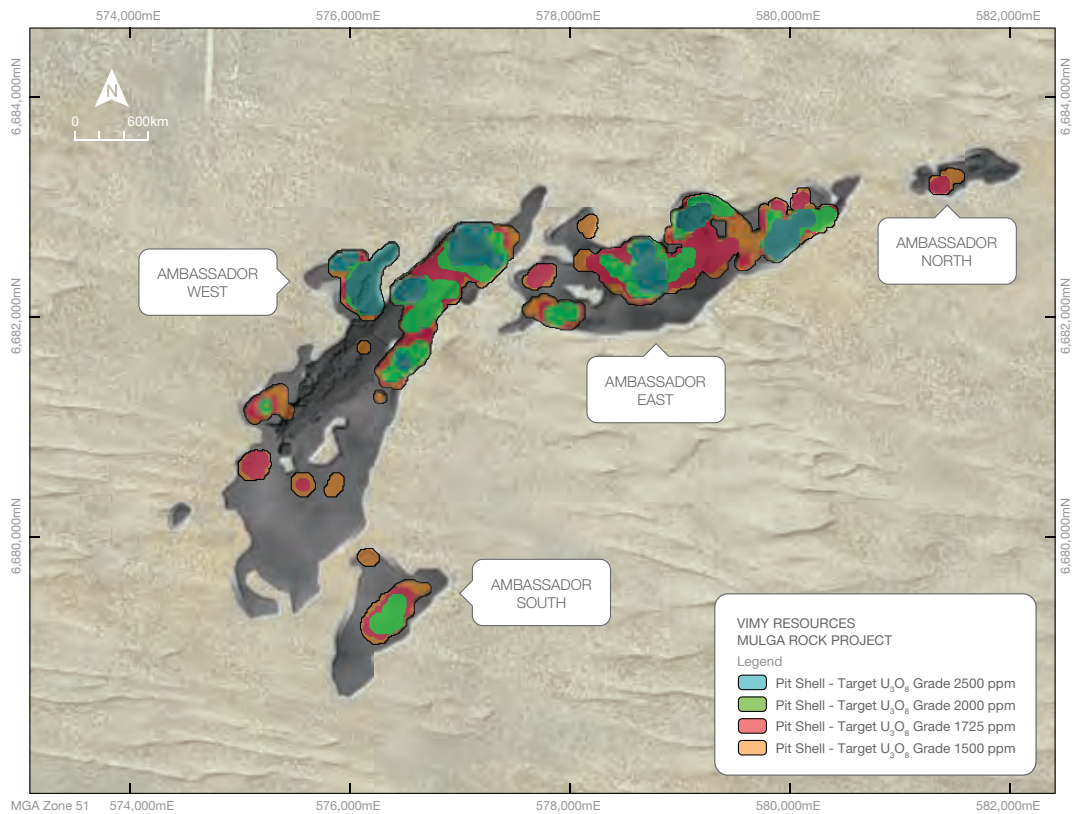


Figure 6.5: Nested Pit Shells at Targeted Uranium ROM Feed Grades

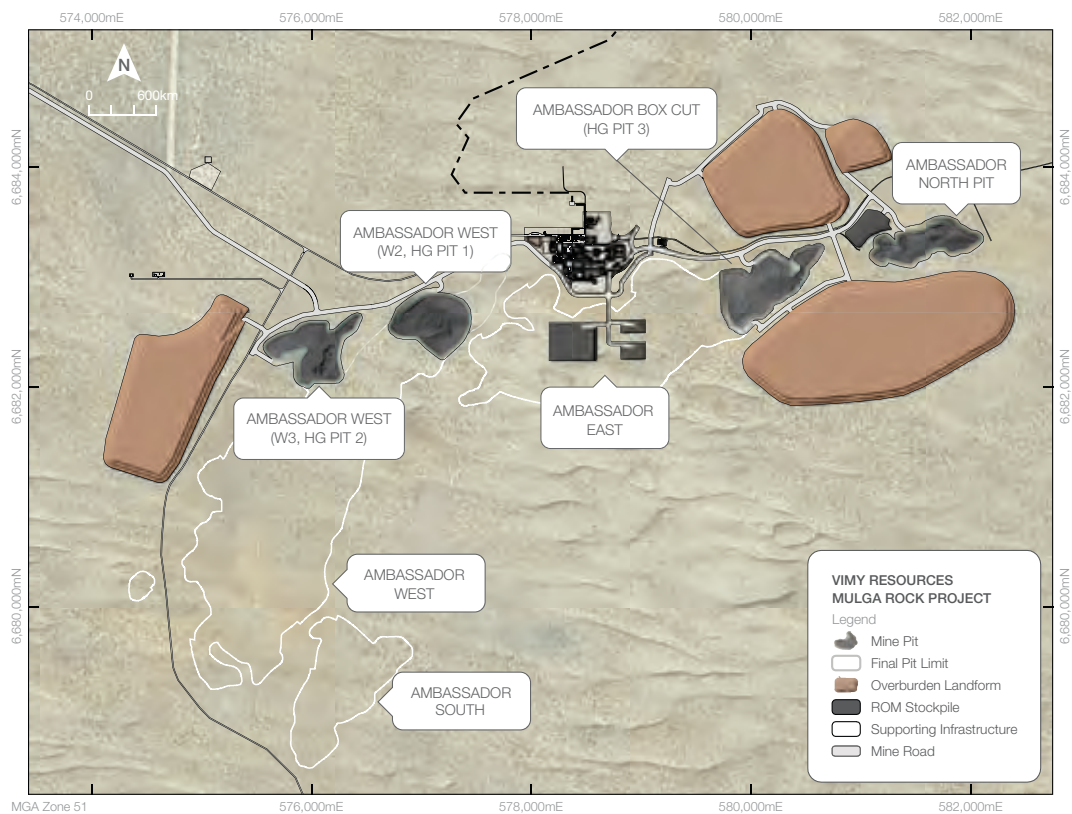


Figure 6.6: Ambassador High-Grade Pit Designs



## MINE DESIGN

Following on from the resource optimisation, Mining Plus developed the pit designs and defined the mineral inventories for the deposits using the optimised pit shells.

Geotechnical pit wall slope design parameters were fully supported by an extensive geotechnical diamond drilling program undertaken at Ambassador, Princess and Shogun. The parameters were subsequently verified by two geotechnical test pits excavated as part of the DFS in March 2016. AMC supervised all geotechnical work undertaken as part of the DFS. The pit design parameters, based on geotechnical assessment across all pits, were:

- » 15m benches with 5m berms;
- » The top berms are below the surface Quaternary sand layer;
- » The batter angles vary to suit the material and heights of walls;
- » Operating bench heights, 10m for waste and 5m for ore;

- » Minimum mining widths, 80m for cutbacks and 40m at pit base;
- » Final pit floor to follow contour of footwall ore contact;
- » Ramp widths, 40m dual lane and 25m for single lane; and
- » Ramp gradients maintained at less than 10%.

The overburden is free-digging as verified by the two bulk test pits completed at Ambassador. The overburden sequence will be mined by two face shovels operating on 10-15m high faces.

The pit design inventories are summarised in Table 6.2 and include Measured, Indicated and Inferred regularised mineral resources as process plant feed.

Figures 6.7 and 6.8 show the final pit designs for Mulga Rock East and Mulga Rock West. Overburden landforms have been designed to accommodate required ex-pit volumes.

Table 6.2: Pit Inventory by Deposit

Deposit	Ore (Mt dry)	Ore Grade (ppm U <sub>3</sub> O <sub>8</sub> )	Metal (Mlbs U <sub>3</sub> O <sub>8</sub> )	Waste (Mt dry)	Total (Mt dry)	Strip Ratio (BCM: tonne)
Ambassador	25.5	765	42.9	456	482	10.6
Princess	2.0	815	3.5	39	41	11.6
Shogun	1.6	755	2.7	55	57	20.2
Emperor	2.6	835	4.8	107	110	24.2
<b>Total</b>	<b>31.7</b>	<b>775</b>	<b>53.9</b>	<b>658</b>	<b>690</b>	<b>12.1</b>

BCM = bank cubic metre



Ambassador West 'Go-Line'



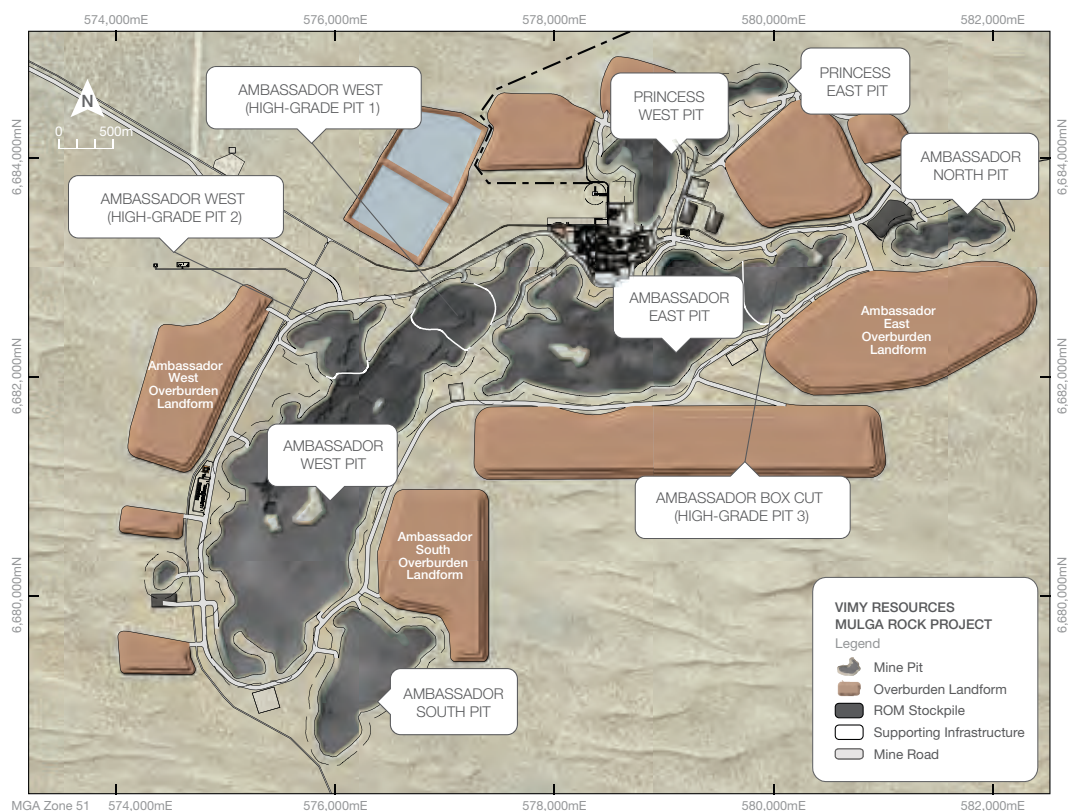


Figure 6.7: Mulga Rock East Mining Centre Layout

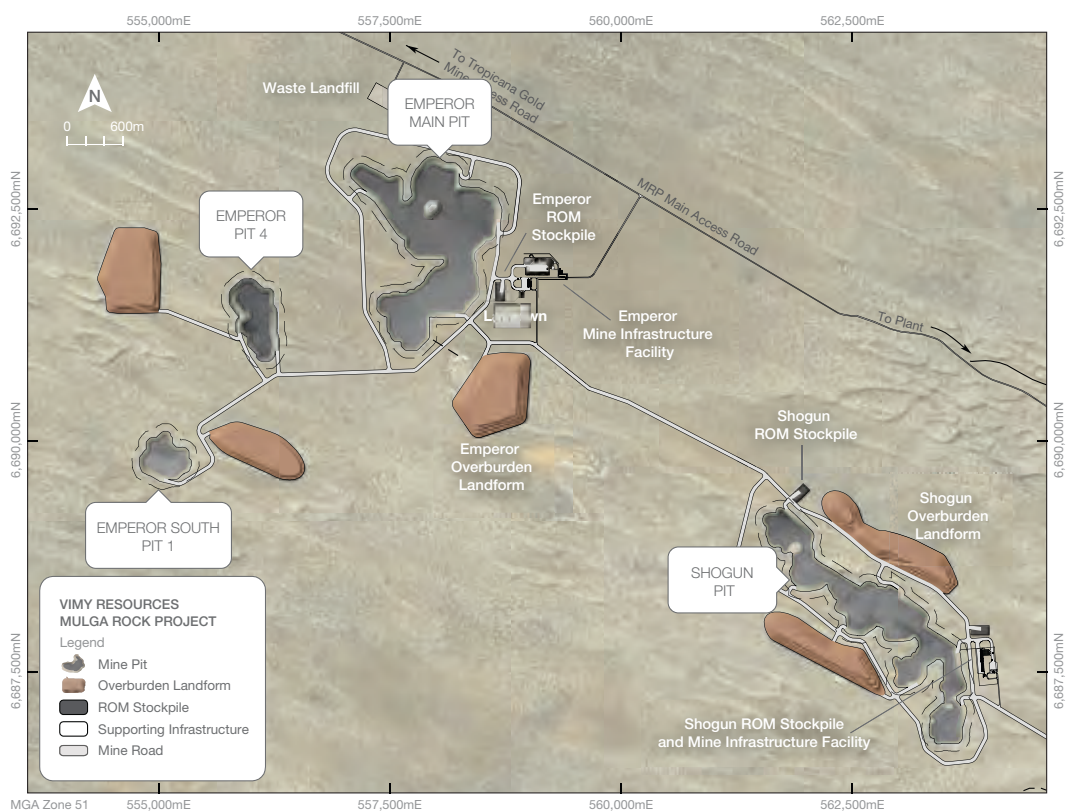


Figure 6.8: Mulga Rock West Mining Centre Layout

## MINE SCHEDULE

The project consists of two separate mining areas over a total length of 30km with the individual pits ranging in length from 1km to 8km. The ore zones, including interburden, are up to 38m thick at Mulga Rock East with an average thickness of 4.5m, and up to 8m in thickness at Mulga Rock West with an average of 2.3m.

Uranium mineralisation is hosted by flat-lying, carbonaceous clastic sediments which are in turn overlain by weathered, oxidised sediments that range in thickness from 19m to 62m of waste overburden. Owing to the nature of the host rock and overburden, most of the mining is free-dig, with only a small requirement for drill and blast of silcrete layers.

Due to the large lateral extent and horizontal geometry of the deposits, Vimy is proposing to use large-scale open pit 'strip' mining techniques like those used in mineral sands and other bulk mining operations. Strip mining commences with the excavation of an initial box cut to expose the ore, with the overburden placed in a surface landform. After mining the ore exposed by the first box cut, the resulting pit void is available to take the overburden from the next mining strip as mining moves along strike. In general, mining advances one strip at a time with previously mined areas progressively backfilled and rehabilitated. This mining method will result in 'real-time rehabilitation' leading to a smaller environmental footprint and significant savings in waste movement and end of mine life rehabilitation liability.

The regular geometry of the mining operation, with a fixed distance from the active mine face and backfill, lends itself to either a truck and shovel (T&S) operation, or continuous mechanised waste haulage system such as an in-pit crushing and conveying (IPCC) system. Vimy has investigated a number of mechanised mining systems, including drag line, dozer trap, bucket wheel excavator, and IPCC. These mechanised mining options have progressively been eliminated due to excessive capital cost or technical risk. For the purposes of the DFS, it has been determined that an owner-operator T&S operation is the most cost-effective mining approach for the MRP.

There are also a number of smaller high-grade and secondary satellite pits within the MRP. A conventional T&S mining method will be utilised for these pits where mining proceeds bench-by-bench in a vertical direction from surface with dumping of waste material ex-pit on overburden surface landforms. This method will also be used within the larger deposits where pit geometries are less favourable for strip mining as described above.

The mine schedule proposes that the Ambassador North pit is mined first (Year -1 to Year 0), prior to uranium production commencing, with ore stockpiled within the ultimate Ambassador pit footprint and adjacent to the process plant. This will create a sterilised pit void to allow process tailings to be discharged into an in-pit tailings storage facility at the commencement of uranium production. Formal commencement of operations is defined by first ore being processed through the SAG mill in Year 1, Month 1.

At the completion of the Ambassador North pit, mining will commence at Ambassador West targeting high-grade ore zones for direct feed to the SAG mill at the process plant. Two conventional T&S pits will be mined at Ambassador West from Year 0 through to Year 2, with a third high-grade pit being mined at Ambassador East from Year 1 through to Year 3. Ore that is not directly fed into the SAG mill from the high-grade pits will be stockpiled according to pre-determined cut-off grades in front of the process plant. Only the high-grade and mid-grade stockpiles will be used to manage the ore feed into the SAG mill during the initial high-grade production ramp-up period. High-grade ore will be maintained from the pits and stockpiles until Year 2, Month 8.

The beneficiation plant commences operation in Year 2, Month 9. Ore is reclaimed from all of the available ROM stockpiles through to Year 4, Month 7 when stockpiles are exhausted. Mining continues at Ambassador East from the void of the high-grade starter pit then along strike using the strip mining method through to Year 7. Depending on uranium grade, ore will be supplemented from the Princess deposit between Years 3 to 6.

Strip mining commences in Ambassador West during Year 6 with operations continuing until Year 14. The ore from Ambassador West is blended throughout this time with ore sourced from Ambassador South, Shogun and Emperor. Ambassador South commences in Year 7 and continues to Year 10, while Shogun and Emperor commence in Years 9 and 11 respectively, and continue to the end of mine life in Year 15. Ore from Shogun and Emperor will be hauled to the beneficiation plant using B-double side tippers along a dedicated haul road within the restricted area of the mine.

Figure 6.9 shows the yearly total material movements for the MRP. Figure 6.10 provides the yearly ore schedule delivered to the process plant and the average uranium grade. The high-grade start-up during the first two years of production is clearly evident. Figure 6.11 shows the yearly stockpile inventory over LOM.

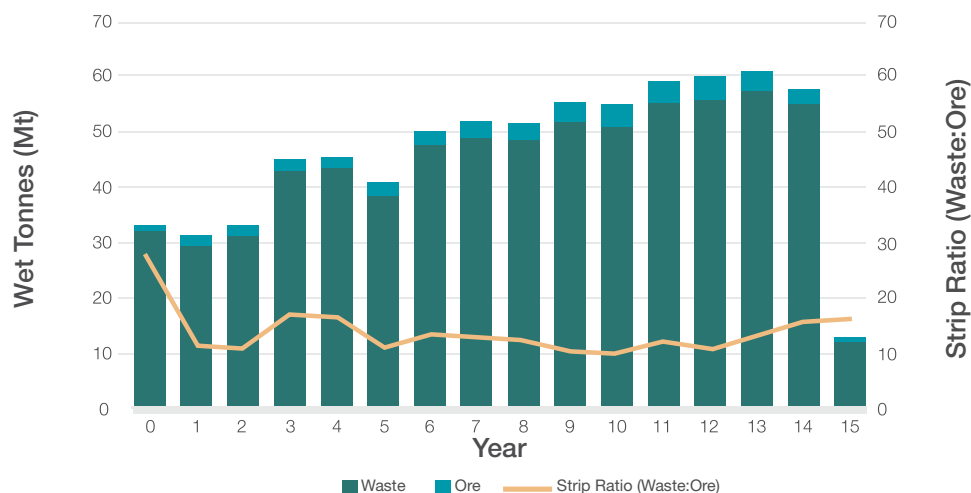


Figure 6.9: Total Material Movements for Mining Operation

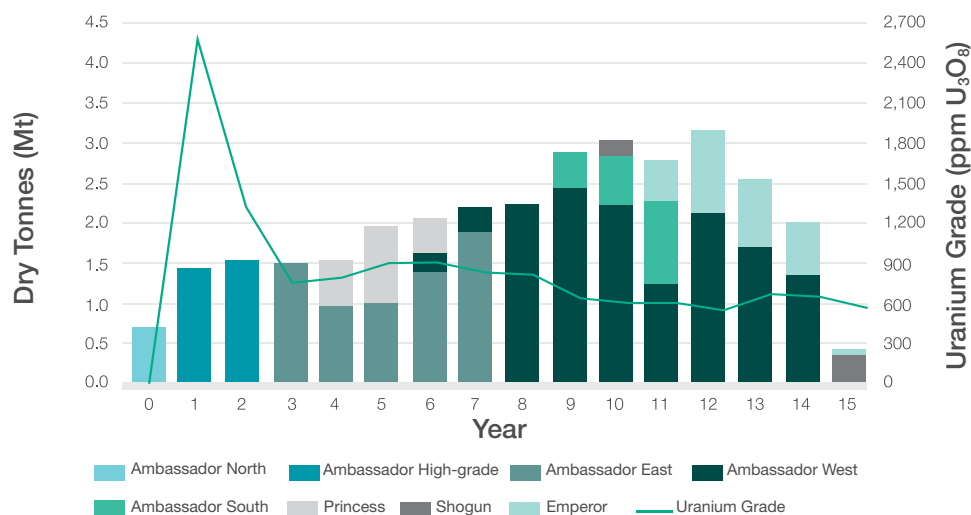


Figure 6.10: Ore Tonnes and Uranium Grade Delivered to the Process Plant

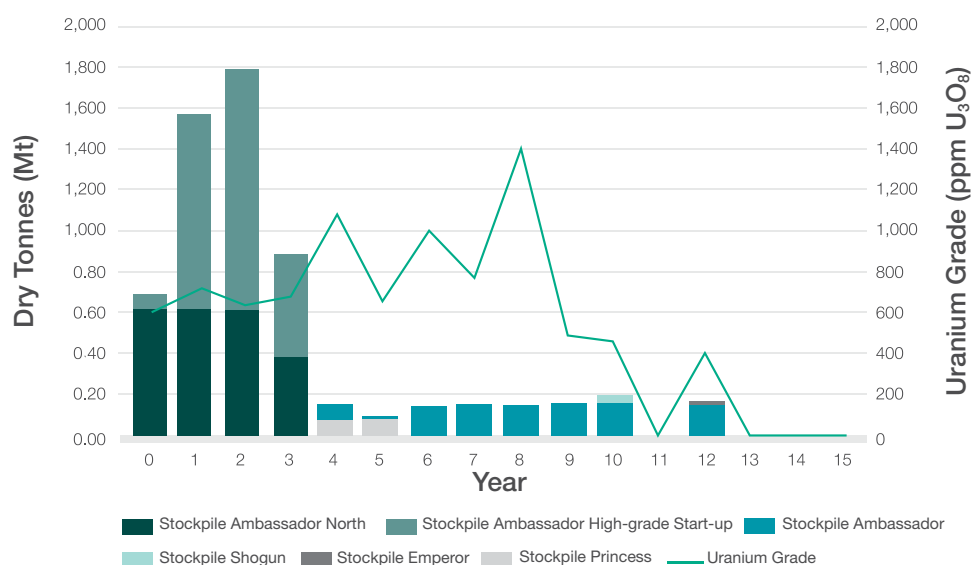


Figure 6.11: LOM Ore Stockpile Inventory



# PROCESS FLOWSHEET

p46-p51





## Highlights

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Simple geology, simple metallurgy.

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Ore beneficiation provides a significant reduction in both process plant capital and operating costs.

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Low-cost atmospheric acid leach process has been selected for the Mulga Rock Project.

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# THE SIMPLE CHEMICAL PROCESS DURING THE DEPOSITION OF THE URANIUM MINERALISATION MEANS THAT EXTRACTION OF THE URANIUM IS ALSO SIMPLE.

The uranium mineralisation at MRP is not complicated in that the organic matter in the sediments has acted as a simple 'carbon filter' to trap uranium which has adsorbed onto the carbonaceous material or precipitated as ultra-fine grained uraninite ( $\text{UO}_2$ ). This process has been amplified by a supergene weathering process which has concentrated uranium mineralisation at the boundary between the oxidised, weathered sediments, and the reduced, unaltered sediments. This chemical boundary is known as a 'redox' boundary. The 'redox process', where uranium minerals precipitate at this boundary, is a common chemical mechanism in a majority of the world's known uranium resources.

The simple chemical process during the deposition of the uranium mineralisation means that extraction of the uranium is also simple. The processing facility consists of four main sections, which are separated by surge tanks between the respective sections in the process flowsheet:

- » Ore beneficiation;
- » Uranium extraction circuit (Leach-RIP-elution);
- » Ultra-filtration/nano-filtration (UF/NF) circuit; and
- » Uranium precipitation circuit.

There are many commercial uranium metallurgical processes applied to the extraction and recovery of uranium. Typically, a uranium hydrometallurgical processing facility will adopt one of two leach systems involving either sulphuric acid (acid leach) or sodium carbonate (alkaline leach). Acid leaching is preferred over an alkaline system due to the lower cost of sulphuric acid compared to sodium carbonate. Some uranium ores such as the calcrete ( $\text{CaCO}_3$ ) deposits are not amenable to acid leaching due to their high acid consumption, and therefore must adopt an alkaline leach process. In the case of the MRP, the uranium ore has a low acid consumption and is, therefore, amenable to the lower cost acid leach process.

Similarly, there are three main process options applied commercially for the recovery of uranium after leaching. The processes include Solvent Extraction (SX), Ion Exchange (IX), or Resin-in-pulp (RIP). For the MRP, RIP has been selected due to the 'preg-borrowing' nature of the carbonaceous material associated with the uranium ore. Preg-borrowing is a phenomenon commonly experienced in carbonaceous gold deposits. When the gold ore is leached with sodium cyanide, some of the resulting gold cyanide complex in solution may be adsorbed back onto the carbonaceous host sediments which decreases the overall gold recovery. A similar preg-borrowing phenomenon occurs when leaching MRP ore, where some uranyl sulphate formed during acid leaching is adsorbed onto the carbonaceous host sediments. Extensive testwork performed on MRP ore has shown that contacting the acid leach slurry with an ion exchange resin in a RIP circuit reverses this preg-borrowing phenomenon. This improvement in extraction is due to the uranyl sulphate complex having a stronger affinity for the resin than for the carbonaceous gangue minerals present, therefore increasing the overall uranium extraction by 10–25%, to greater than 90% overall recovery in RIP.

The resin, now loaded with uranyl sulphate, is recovered from the leach pulp, washed and then eluted (stripped) using sodium chloride. This generates a clean solution containing essentially sodium chloride and uranyl sulphate. The molecular size of sodium chloride is very small when compared with that of uranyl sulphate (uranium is a much bigger atom than sodium). Therefore, ultra-filtration/nano-filtration (UF/NF) is used to remove sodium chloride and water (which is also a small molecule compared to uranium) and concentrate the uranyl sulphate. The sodium chloride solution is recycled to the elution circuit to strip further resin. The UF/NF concentrated uranium-rich solution is now ready for final precipitation.

Uranium has traditionally been precipitated from solution using anhydrous ammonia. However, ammonia is



hazardous and requires specific engineering controls to ensure its safe use. Modern uranium facilities now use hydrogen peroxide, which is far safer to use. Uranium is precipitated from UF/NF concentrate solution using hydrogen peroxide to generate a final uranyl peroxide ( $\text{UO}_4$ ) or 'yellowcake' product. Yellowcake is an industry term used for all uranium oxide concentrates (UOC) with a chemical formula  $\text{UO}_4$ ,  $\text{UO}_3$ ,  $\text{UO}_2$  or  $\text{U}_3\text{O}_8$ . Depending on the uranium precipitation and drying process adopted, a uranium plant may generate any one of these products.

The final uranium product is washed, filtered and dried before being securely packed into steel drums and sea containers for road transport to Adelaide. Approximately nine to ten sea containers per month will be exported through the Port of Adelaide which has established infrastructure for the storage and shipping of yellowcake product.



Figure 7.1: Mulga Rock Process Plant

A schematic of the MRP flowsheet is shown in Figure 7.2. The process flowsheet includes a beneficiation plant operating in front of the main hydrometallurgical process plant described above, comprising the following unit operations:

### BENEFICIATION PLANT

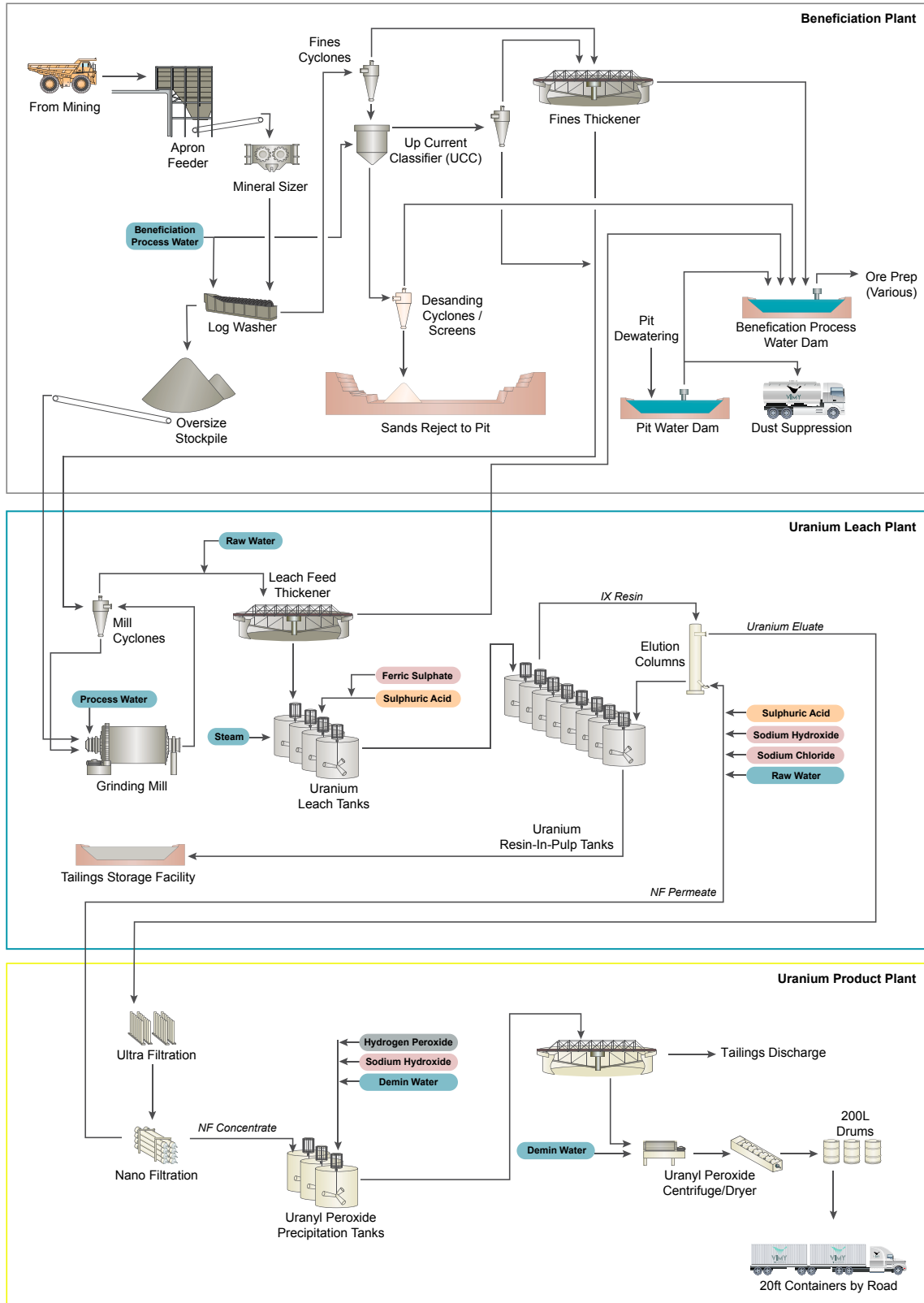
- » Mineral sizer primary crusher and log washer to pulp the ore;
- » Ore screening to recover high-grade oversize comprising hard carbon lumps;
- » Ore cycloning to recover fines comprising mineralised clays and carbonaceous sediments; and
- » Gravity separation circuit to remove non-mineralised, heavy silica sand gangue.

### HYDROMETALLURGICAL PROCESS PLANT

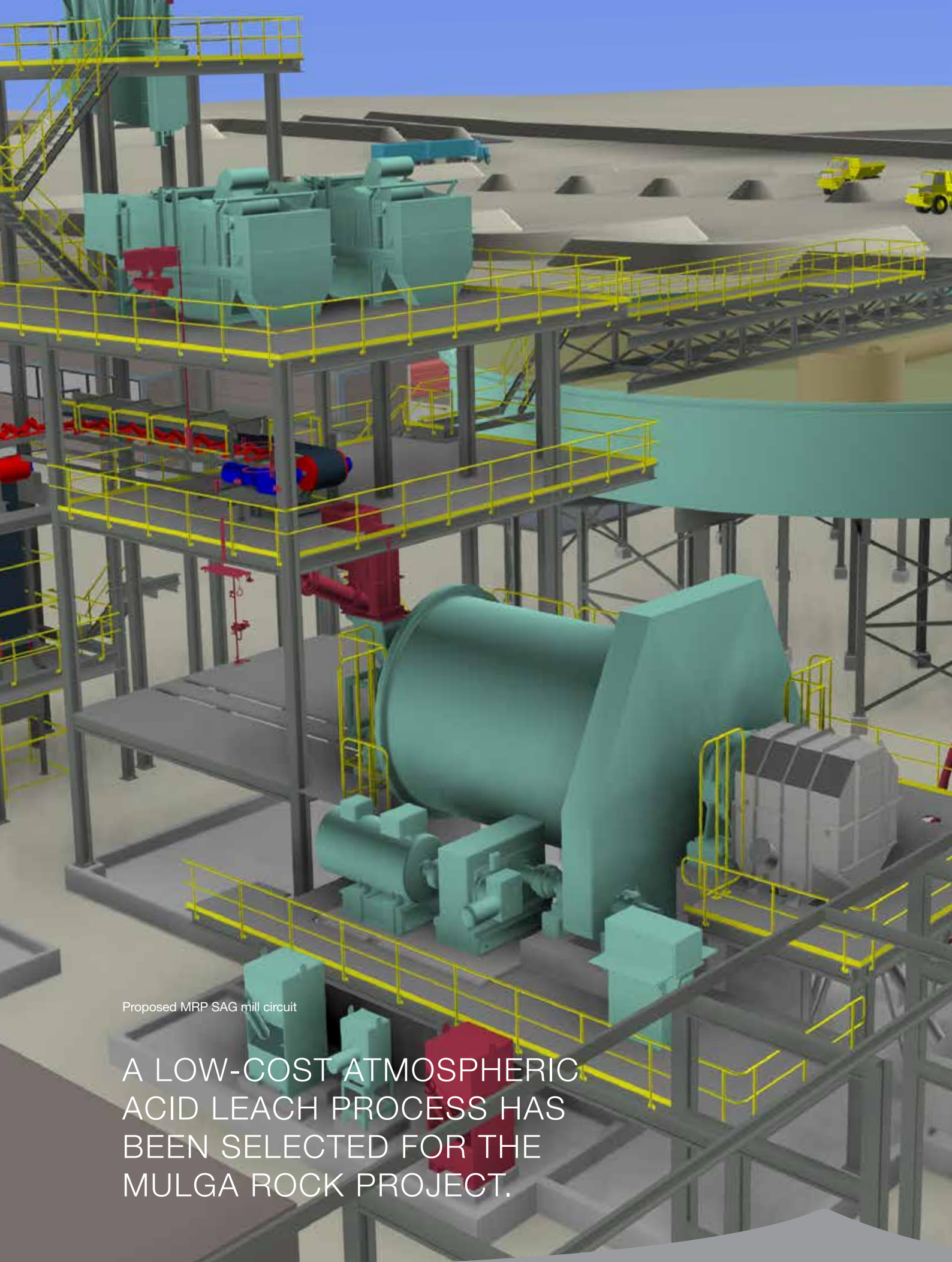
- » SAG mill to grind the ore to 80% passing 150 $\mu\text{m}$ ;
- » Atmospheric acid leach followed by RIP to extract and recover uranium onto IX resin;
- » Elution to strip loaded uranium from the IX resin;
- » UF/NF to concentrate uranium in solution; and
- » Uranium precipitation using  $\text{H}_2\text{O}_2$ , drying and packaging of final product.

Figure 7.2:

## SCHEMATIC OF MULGA ROCK PROCESS PLANT







Proposed MRP SAG mill circuit

A LOW-COST ATMOSPHERIC  
ACID LEACH PROCESS HAS  
BEEN SELECTED FOR THE  
MULGA ROCK PROJECT.



# PROCESS FLOWSHEET PILOTING

p52-p61





## Highlights

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Extensive continuous piloting has been undertaken to demonstrate the Mulga Rock process flowsheet.

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Breakthrough beneficiation process proved to be transformative for the project.

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Overall uranium recovery of 87.3% proven.

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All three commercial converters have confirmed the Mulga Rock UOC product meets their respective specifications without penalties.

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The test pits and pilot plant were significant undertakings, but ones which have significantly de-risked the project.

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The Mulga Rock Project process flowsheet was demonstrated by comprehensive metallurgical piloting, which confirmed metallurgical recoveries and reagent consumptions. The test pits and pilot plant were significant undertakings, but ones which have significantly de-risked the Mulga Rock Project.

### ORE BENEFICIATION PLANT

There is a high portion of barren, silica-rich sands within the mineralised carbonaceous sediments. Removal of the sand prior to leaching reduces the throughput in the hydrometallurgical process plant, with a subsequent reduction in capital and operating costs.

The beneficiation process involves ROM ore being initially processed through a mineral sizer and log washer to fully liberate the lignite and clay materials from the sands. The resulting slurry is then screened into three size fractions: +1.7mm, 1.7mm to 0.15mm, and -0.15mm. Both the coarse and fine particle size streams are high in uranium and sent directly to the process plant. The mid-size fraction (-1.7mm to +0.15mm) is beneficiated using gravity separation via an up-current classifier (UCC). The heavy silicate sand settles to the UCC underflow, while the lighter lignite and clay minerals

containing the uranium are floated to the UCC overflow. The resulting lignite concentrate is thickened and pumped to the process plant. This breakthrough beneficiation process was initially announced to the ASX on 16 March 2015 and proved to be transformative to the project due to the very high mass rejection.

The beneficiation flowsheet was piloted over approximately 55 days at ALS Metallurgy, Western Australia. Allied Mineral Laboratory (AML) provided technical assistance throughout the campaign due to their prior UCC operating experience during the PFS and extensive mineral sands industry experience. Two bulk ore samples from Ambassador East (14.0t dry), representative of Years 3-7, and Ambassador West (13.7t dry), representative of Years 1-2 and 8-13, were processed through the pilot plant. Furthermore, process water used in the plant was drawn from the proposed MRP process borefield at Kakarook North and trucked to Perth to ensure testing was truly representative.

As previously shown in separate pilot testwork for the PFS, the majority of uranium is associated with the coarse and fine particle size fractions. Figure 8.1 shows that 86% of the contained uranium in the Ambassador East feed is associated with coarse and fine fractions, representing 41% of the initial mass, and similarly for Ambassador West, 76% of uranium is in 37% of the initial mass.

Table 8.1: Summary of Results for Ore Beneficiation Pilot Plant

Stream	Ambassador East		Ambassador West	
	% Mass	Uranium Grade (ppm U <sub>3</sub> O <sub>8</sub> )	% Mass	Uranium Grade (ppm U <sub>3</sub> O <sub>8</sub> )
ROM Feed	100%	1,075	100%	765
+1.7mm Oversize	13%	3,115	14%	2,050
-1.7mm +0.15mm Mids	59%	260	63%	295
-0.15mm Fines	28%	1,800	23%	1,255
UCC Concentrate	7%	2,035	11%	1,625
UCC Sand Rejects	52%	100	52%	25
Final Concentrate*	48%	2,140	48%	1,580

\*Note: Final concentrate is UCC Concentrate combined with +1.7mm oversize and -0.15mm fines.



The mid-size fraction (-1.7mm to +0.15mm), representing approximately 60-65% of the initial mass and 15-25% uranium content, was beneficiated using an UCC. Two different UCC configurations were piloted with a rougher/cleaner configuration providing superior uranium recovery over a rougher/scavenger configuration. It should be noted that the uranium recovery for the Ambassador East campaign was lower than the Ambassador West, due to the Ambassador East sample being processed using both UCC configurations, while Ambassador West was piloted using a rougher/cleaner configuration for the entire pilot campaign.

Table 8.1 shows a summary of the overall beneficiation pilot plant results. The mass rejected by the gravity UCC circuit was 52% of the original ROM feed for both Ambassador East and Ambassador West respectively. The overall uranium recovery was 96.6% and 98.3% for Ambassador East and Ambassador West respectively. The final beneficiated concentrate has subsequently been upgraded in uranium by approximately twice the original head grade.

Based on the results from PFS and DFS pilot testwork, a mass rejection of 52.5% has been assumed for the DFS design criteria with a uranium recovery of 97.9%.

URANIUM EXTRACTION CIRCUIT  
(LEACH – RIP – ELUTION)

The uranium extraction circuit (leach-RIP-elution) was piloted in two separate campaigns for 26 days continuously for the Ambassador East (14 days) and Ambassador West (12 days) beneficiated ore concentrates at SGS Metallurgy located in Western Australia. ANSTO Minerals provided technical support for this component of the pilot plant program. Approximately 10 tonnes of ore concentrate (dry basis) from the beneficiation pilot plant was processed through the two pilot campaigns. Pilot plant operating parameters were configured based on the results of testwork completed as part of the PFS. The circuit was optimised during the initial phase of the Ambassador East campaign and then stress tested for the remainder of the campaigns.

The beneficiated ore concentrate was initially milled to an 80% passing size of 150µm (0.15mm) using a ball mill circuit. The milled ore was then leached for 4 hours at 60°C using sulphuric acid at an addition of 35kg acid per tonne of leach feed (equivalent to 16.5kg/t ROM). Ferric sulphate (dosed at an addition rate of 3.5g/L Fe<sup>3+</sup>) was added as an oxidant to ensure complete uraninite dissolution. The majority of uranium was dissolved into solution within one hour.

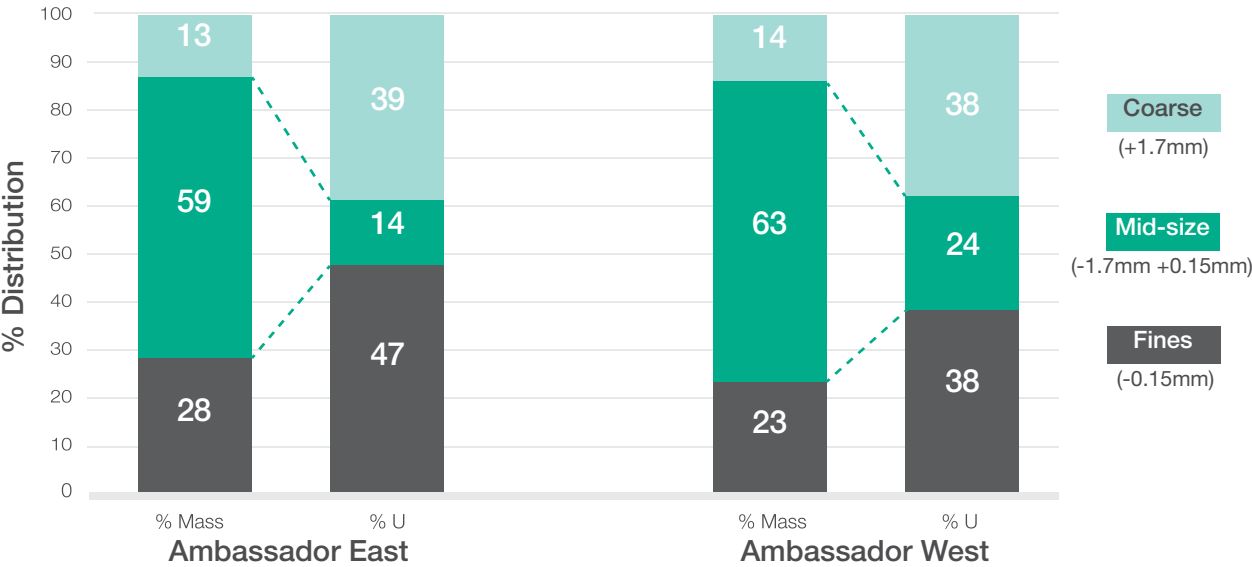


Figure 8.1: Summary of Ore Beneficiation Piloting

The leach discharge was then pumped to the RIP circuit where the slurry was contacted with an ion-exchange (IX) resin to recover the uranium present in solution and any preg-borrowed uranium. Vimy has developed a high-chloride tolerant IX process, which allows saline process water to be utilised. This is a major breakthrough and allows greater flexibility in using saline pit water and brackish borefield water directly. The RIP circuit consisted of eight stages (tanks) and is analogous to a gold carbon-in-pulp circuit except resin is used instead of activated carbon.

The overall slurry residence time in the RIP circuit was 4 hours and the resin residence time was 16 hours. A uranium loading of 25g  $U_3O_8$ /L resin (litre of wet settled resin) was consistently achieved onto the resin in a background chloride concentration of 9-10g/L.

Figures 8.2 and 8.3 show the overall uranium recovery after leach-RIP for the duration of the two campaigns. The process was very robust and demonstrated a large operating envelope.



BULK ORE SAMPLES FROM  
THE TEST PITS AT MULGA ROCK  
WERE SENT TO PERTH FOR PILOT  
PLANT TESTING.

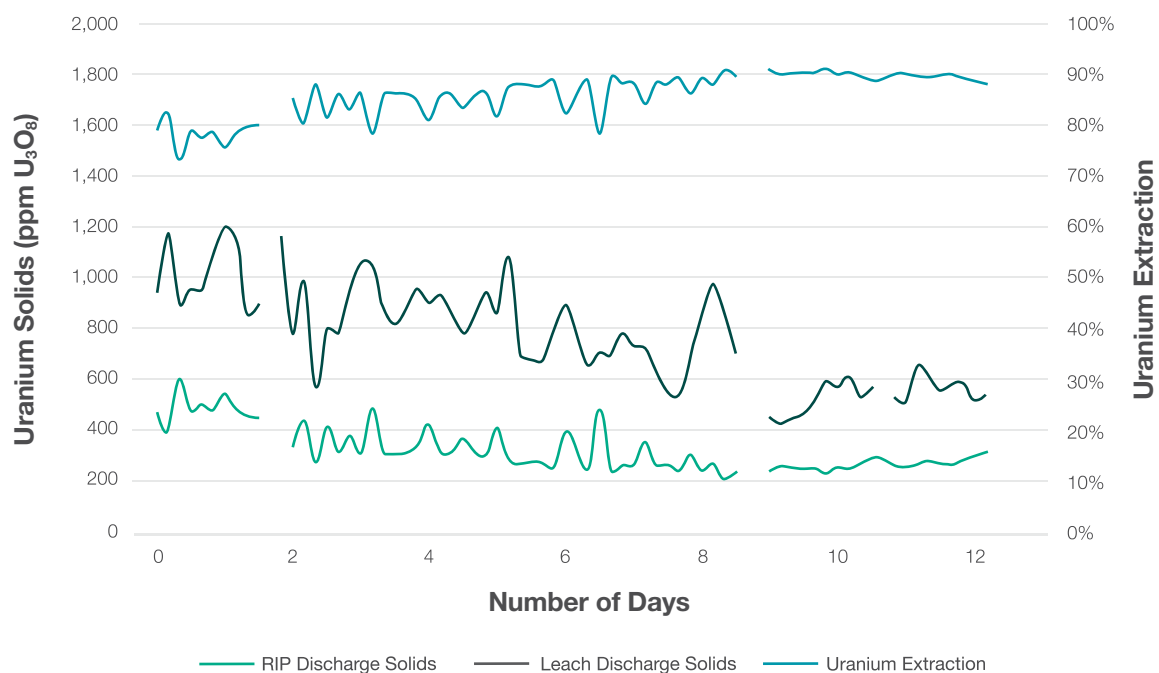


Figure 8.2: Leach-RIP Overall Uranium Recovery for Ambassador East

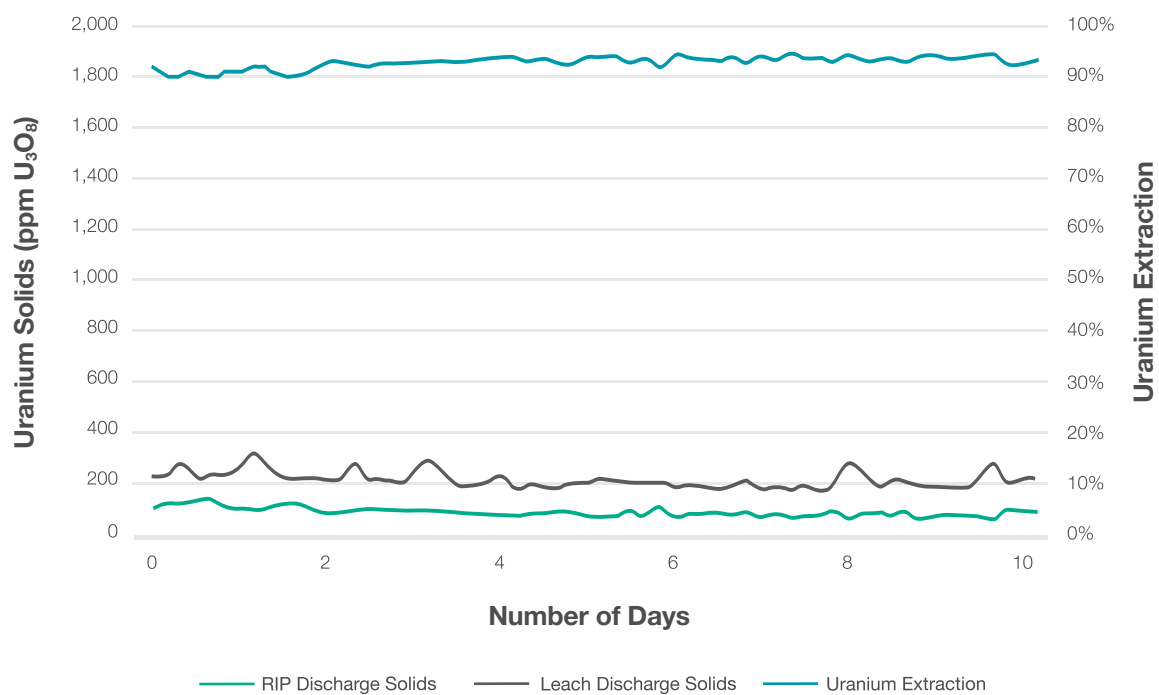


Figure 8.3: Leach-RIP Overall Uranium Recovery for Ambassador West





Leach circuit at SGS Metallurgy pilot plant

After RIP, the loaded resin is recovered from the barren slurry via a vibrating screen. The resin has a particle size range of 0.6-1.2mm compared to the leach discharge which has a 100% passing size of 0.35mm. The loaded resin is washed and then stripped of uranium using a sodium chloride solution before the barren RIP resin is preconditioned with sulphuric acid, then returned to the RIP circuit. During piloting, the elution circuit consistently achieved a barren resin loading of 0.2g U<sub>3</sub>O<sub>8</sub>/L resin, which exceeded the expected performance of <1g U<sub>3</sub>O<sub>8</sub>/L resin.



Resin-in-Pulp circuit at SGS Metallurgy pilot plant

### UF/NF CIRCUIT

The resulting eluate (uranium bearing solution) from elution is concentrated using ultra-filtration/nano-filtration (UF/NF). Approximately 6.7m<sup>3</sup> of product eluate was processed through the UF/NF pilot plant. The UF/NF piloting was conducted by Veolia at SGS Metallurgy by testing three acid resistant NF glass membranes. The preferred NF membrane increased the product eluate (strip) solution from 2.5g/L to 25g/L U<sub>3</sub>O<sub>8</sub> with a uranium recovery of 99%. Concentrating the product eluate solution by an order of magnitude significantly reduces the size of the downstream uranium metals plant and also enables a large portion of the elution circuit reagents to be recycled. The UF/NF plant recovered 79% of the sodium chloride and 88% sulphuric acid for recycling back to the elution circuit to strip further loaded resin.

Table 8.2: Overall Uranium Recovery

Plant Area	% Uranium Recovery		
	Years 1-2	Years 3-8	Year 9-15
Ore Beneficiation	-	97.9	96.4
Leach-RIP-Elution	89.7	89.2	89.2
Uranium Precipitation	99.9	99.9	99.9
Overall Recovery	89.6	87.3	85.9

## URANIUM PRECIPITATION

A comprehensive laboratory test program was undertaken at SGS and ANSTO prior to the uranium precipitation pilot plant to accurately determine the maximum allowable limits of chloride and sulphate that may be present during uranyl peroxide precipitation. The presence of chloride and sulphate anions impact uranium recovery during peroxide precipitation. The upper operating limits for chloride and sulphate were established and the UF/NF uranium concentrate solution adjusted with demineralised water.

The direct uranyl peroxide precipitation pilot plant operated for five days. The pilot plant consisted of a small pre-reactor where uranyl peroxide seed recycle was combined with the incoming UF/NF concentrate and the majority of hydrogen peroxide.

From the pre-reactor, the slurry cascaded down a series of three tanks with a total residence time of twelve hours at ambient temperature. Solution pH was monitored and sodium hydroxide added to maintain the pH at 3.75. The UF/NF concentrate feed solution contained approximately 20g/L  $U_3O_8$  and 99.9% was precipitated from solution resulting in a final barren solution containing only 10mg/L  $U_3O_8$ . The UOC product was thickened, filtered, washed and dried.

Table 8.3 provides a summary of the composition of the final UOC product from the pilot plant. It should be noted that the tolerances accepted by commercial converters for certain impurities listed in ASTM C967-13 (including, zirconium and boron) are generally less stringent than in the ASTM standard.

Table 8.3: MRP Uranium Oxide Concentrate (UOC) Analysis

Impurity	Vimy Yellowcake (Uranyl Peroxide) Product (ppm uranium basis)	ASTM Standard C967-13 <sup>1</sup> Limits (Limit Without Penalty) (ppm uranium basis)	ASTM Standard C967-13 <sup>1</sup> Limits (Limit Without Rejection) (ppm uranium basis)
As	14	< 500	< 1,000
B	180	< 50	< 1,000
Ca	400	< 500	< 10,000
Cl	<100	< 500	< 1,000
F	Below detection	<100	<1000
Fe	1,200	< 1,500	< 10,000
K	130	< 2,000	< 30,000
Mg	130	< 200	< 5,000
Mo	1	< 1,000	< 3,000
Na	500	< 5,000	< 75,000
P	< 100	< 1,000	< 7,000
SiO <sub>2</sub>	<210	< 5,000	< 25,000
S	1200	< 10,000	< 40,000
Th	110	< 1,000	< 25,000
Ti	< 100	< 100	< 500
V	Below detection	< 600	< 3,000
Zr	244	< 100	< 1,000
U <sup>234</sup>	52	< 56	< 62
<b>U</b>	<b>77.1%</b>	<b>&gt; 65%</b>	<b>-</b>

<sup>1</sup> ASTM Standard C967-13 is a specification issued by the American Society for Testing and Materials which is used by the nuclear industry as a general standard for UOC.

## URANIUM OXIDE CONCENTRATE CERTIFICATION

Vimy announced on 24 April 2017 that 4.5 kilograms of UOC product from the MRP was dispatched to all three commercial uranium converters, which are Cameco Corporation in Canada, NEW AREVA in France and ConverDyn in the USA. All three converters have confirmed the MRP UOC product meets their respective specifications without penalties. This is an essential step required by nuclear utilities before entering into long-term offtake agreements.

Vimy has now opened accounts with all three commercial converters as announced to the ASX on 27 February 2017, 23 March 2017 and 30 May 2017, which will enable UOC to be delivered to any of the three conversion plants where ownership transfers to the utility for further processing into nuclear fuel.

## VENDOR TESTING

During the pilot program, a number of equipment vendors and specialist consultants visited the ALS and SGS laboratories to undertake equipment testing, as summarised in Table 8.4. This allowed the vendors to provide firm equipment specifications for each selected duty. Vendor testwork will also allow Vimy to seek performance guarantees as part of equipment supply contracts.

Table 8.4: Vendor Testing Program

Vendor	Plant Area	Scope of Work
MMD Australia	Ore beneficiation	» Mineral sizer ore properties
CDE Global	Ore beneficiation	» Log washer inspection and operation
Astec Australia	Ore beneficiation	» Log washer inspection and operation
Jenike & Johanson	Ore beneficiation	» Bulk materials handling » Stockpile angles » Ore chute design » Conveying angles
Newpark Drilling Fluids	Ore beneficiation	» Slurry rheology
FLSmidth	Ore beneficiation	» Conventional and high rate thickener piloting
Outotec	Ore beneficiation Leach Uranium precipitation	» Deep cone thickener piloting for Ore beneficiation only » Conventional and high rate thickener piloting for all plant areas » Yellowcake filtration
Waterex	Ore beneficiation	» Water clarification
BASF Australia	Ore beneficiation Leach Uranium precipitation	» Flocculant screening » Coagulant screening » Flocculant optimisation
Mixtec Australia	Leach	» Agitator selection and sizing
Extrin	Leach	» Corrosion coupon testing
Veolia Environmental Sciences	UF/NF	» UF/NF piloting



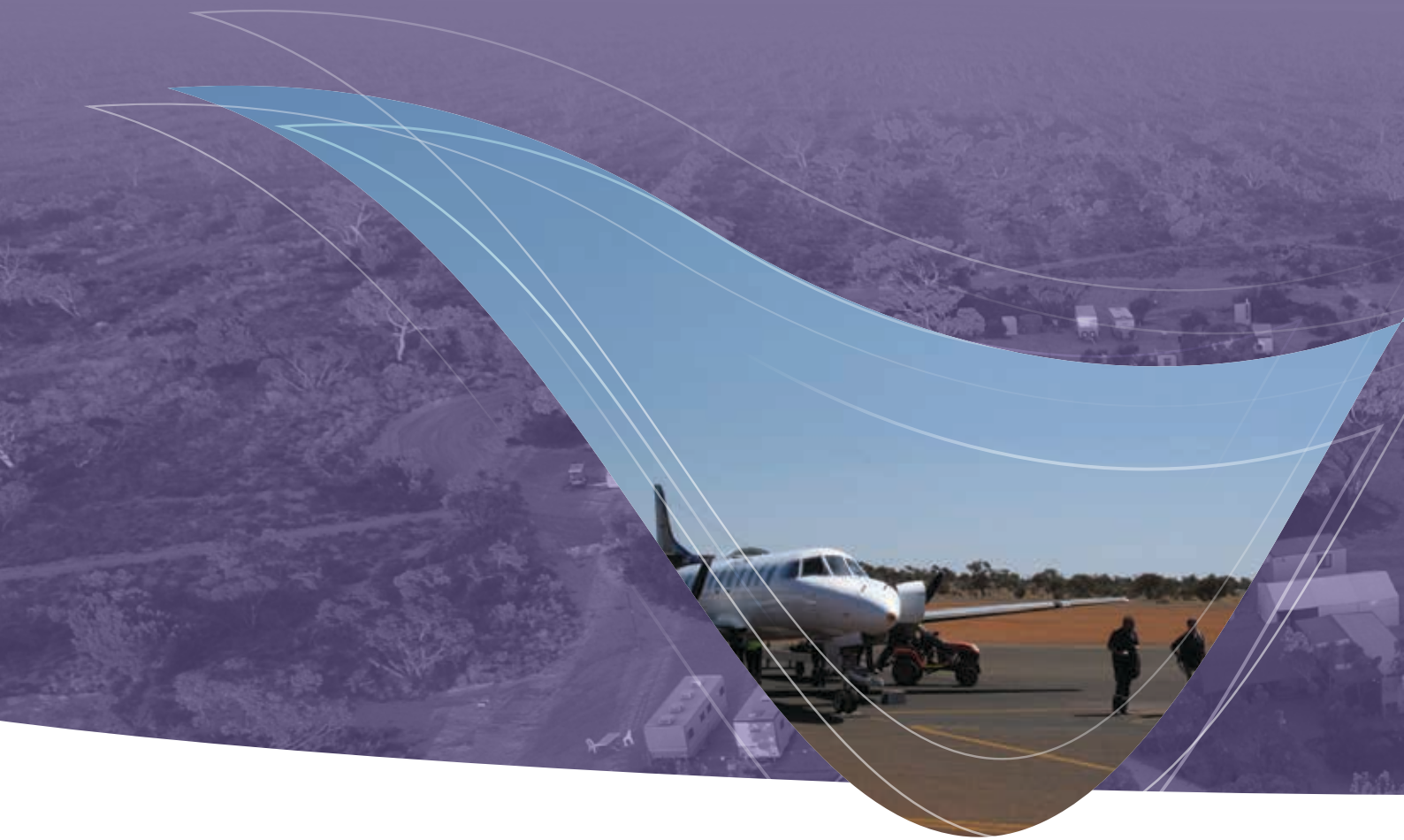


Vimy Yellowcake product

CONVERTERS CONFIRM  
THE HIGH QUALITY OF VIMY'S  
PRODUCT FOLLOWING THE  
TESTING OF SAMPLES FROM  
MULGA ROCK.

# INFRASTRUCTURE & LOGISTICS

p62-p69



An aerial photograph of a mining site, showing a dirt road, several buildings, and a large truck. The image is overlaid with a dark purple gradient. A teal teardrop-shaped graphic is positioned on the left side of the page.

## Highlights

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The Mulga Rock Project is located near Kalgoorlie-Boulder, a major mining service centre.

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The workforce will be fly-in fly-out and accommodated in a site village with a sealed airstrip.

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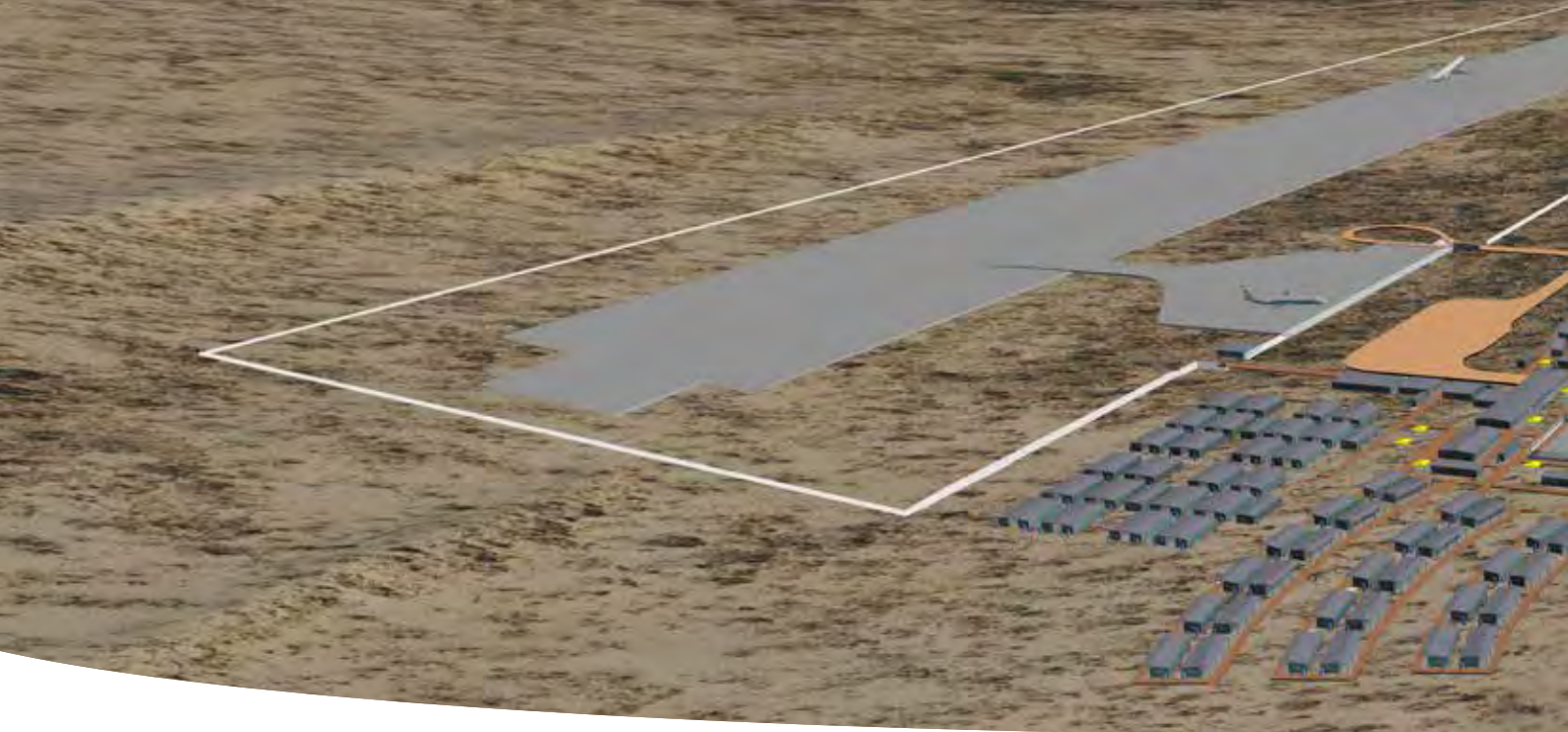
Installation of a private long-term evolution (LTE) 4G network future-proofs the project and allows mining automation to be implemented at a later date.

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Large water borefield secured with 167-200GL of water.

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The infrastructure component of the Mulga Rock Project includes all supporting facilities located outside the mining area. Infrastructure includes the engineering design, procurement and management for the following site infrastructure works:

- » Main access road;
- » Internal access roads and tracks;
- » Bulk earthworks including clearing of all required areas, installations including culverts, box cuts, backfill, hard stands, dams, drains, catchments, services trenching and water storage ponds for the process plant site, mining services area, accommodation village, airstrip, power station, internal roads, borefields, and explosive magazine storage;
- » Accommodation village installation, reticulated services, waste disposal, water treatment and associated infrastructure;
- » Aerodrome and airstrip;
- » Communications system;
- » Transportable buildings including offices, change rooms, crib rooms and ablutions;
- » Steel framed buildings including workshops, warehouse and uranium packaging building;
- » Fuel storage and distribution facility;
- » Power station civils and generator haul building;
- » Power reticulation across the project site;
- » Site fencing and security;
- » Process plant security;
- » Kakarook borefield water supply;
- » Pit water reinjection borefield;
- » Potable water supply and waste water treatment; and
- » Wheel wash system for road-based vehicles.

## ACCESS ROAD

Kalgoorlie-Boulder is the nearest major mining service centre to the MRP, located approximately 290km by road from the site. The majority of construction equipment and reagents will be transported from Kalgoorlie. Access from Kalgoorlie to the MRP site is via Yarri Road (27km) before turning on to the Kurnalpi-Pinjin Road (134km) and then 80km along the Tropicana Gold Mine access road before reaching the MRP access road turnoff.

A 42km main access road will be constructed to a standard suitable for triple B road trains. Several burrow pits have been excavated along the proposed route as part of the DFS and material sent for geotechnical testing. InfraTech (civil geotechnical engineers) provided GRES with the construction and pavement design specifications to allow road construction quotes to be obtained.

A 1.5km MRP village and airstrip access road will be constructed with a width of 9m. There are two internal service tracks required for the MRP. The first of these is an access track to the Kakarook North borefield, which will be used regularly by a diesel tanker and maintenance vehicles. The Kakarook North Road will be 32.5km in length with a 4m wide running surface, including drainage with an adjacent 5m wide buried pipeline corridor.

The second internal service track will provide access to the proposed pit water reinjection borefield to the



Figure 9.1: MRP Accommodation Village, Aerodrome and Water Treatment Plant

south of the Ambassador pit. This road will not experience regular traffic, and the 15km long track will have a 4m wide running surface and including drainage with an adjacent 5m wide pipeline corridor.

### ACCOMMODATION VILLAGE

The MRP accommodation village, containing both temporary and permanent facilities, will be located near the MRP main access road and approximately 15km west of the process plant. The MRP accommodation village will contain 498 rooms in total consisting of:

- » 200 room temporary construction accommodation; and
- » 298 permanent rooms.

Village design specification was developed by GRES with permanent accommodation units consisting of four rooms per module, each with ensuite bathrooms and the following standard specifications:

- » 14.4m x 4.2m room size;
- » Precast concrete floor; and
- » Double insulated walls between all rooms.

The installation at the accommodation village will include all services, equipment and reticulation for phone, data, TV and video entertainment to each room. A temporary satellite link will be provided for the communications until the site-wide communications system is installed.



Tropicana Gold Mine access road



## AERODROME

An aerodrome to service the operation will be constructed adjacent to the accommodation village (see Figure 9.1). The sealed landing strip will be 2,100m in length with a width of 30m and aligned with the prevailing northwest/southeast wind direction. The runway (Code 3C) is suitable for a Fokker F100 (or similar) jet aircraft capable of carrying up to 100 passengers, with aircraft movements planned for daylight hours only. A taxiway and aircraft parking apron will be linked to the runway, as will an adjacent Jet A1 fuel facility, with reception hall, waiting area, toilets and vehicle parking. The obstacle limitation surfaces describing the required 'clear airspace' around the airport were drafted, and no infringements such as terrain or proposed towers or other structures were identified.

Civil geotechnical studies have been completed along the length of the proposed airstrip with geotechnical pits excavated every 400m along the length of the runway.

## COMMUNICATIONS SYSTEM

Walker, Newman and Associates were engaged by Vimy to complete the DFS engineering of the site-wide telecommunications and IT system for the MRP.

Three new communication towers are required to support the communications infrastructure across the MRP. The main 50m guyed mast communication tower will be installed at the process plant. This mast will support the main external data link for telephone/data/internet services via the Eastern Goldfields Goldnet microwave network connection to Kalgoorlie and then fibre-optic link back to Vimy's Perth office. The mast will also support the private Long Term Evolution (LTE) 4G mobile network and microwave dishes that provide data links to the accommodation village and Kakarook North extraction borefield. The process plant communications tower will also have a UHF radio antenna for communication with incoming freight trucks to the security gatehouse.

A second 50m guyed mast tower will be located at the Kakarook North extraction borefield. This mast will provide a private microwave data link between the process plant and the borefield. The tower will also support the private LTE 4G mobile antennae for regional communications and telemetry across the extraction borefield.

A 20m self-supporting mast will be installed at the accommodation village. This will support 4G public

mobile service at the village, and private microwave data link between the process plant and the accommodation village.

The main elements of the telecommunications infrastructure include:

- » Public mobile phone cell at the camp;
- » Private LTE network over the entire project area;
- » Borefield telemetry system;
- » CCTV system;
- » Access control system;
- » Corporate Local Area Network (LAN);
- » Telephone system;
- » MRP PCs/computing infrastructure;
- » Corporate IT infrastructure;
- » Fibre-optic cabling;
- » Camp entertainment system;
- » Communications masts/towers;
- » Communications shelters;
- » Communications power systems;
- » Private microwave radio; and
- » Aerodrome VHF radio communications.

Installation of a private LTE network across the project essentially future-proofs the project to allow mining automation to be implemented at a later date.

## BULK FUEL STORAGE

The main bulk diesel storage facility will consist of two 1,000kL tanks, which is equivalent to approximately three weeks' storage. The main fuel storage area will be located within the process plant adjacent to the bulk unloading facility to allow unloading of triple road trains. The bulk fuel storage area will also include two vehicle refuelling stations complete with dedicated pumps and concrete slabs. The plant bulk fuel storage area will have two main delivery pipelines complete with dedicated supply pumps which will service the power station day tank located 120m away and supply fuel to the mine bulk storage facility located 450m away.

The power station will be serviced by a 36kL self-bunded day tank complete with level sensor and auto shut-off valve. The mine bulk storage facility will house two self-bunded tanks, 100kL capacity each, to refuel the heavy



vehicles (HVs), light vehicles (LVs) and fuel truck. The fuel supplied to the Kakarook North borefield diesel storage tank will be via a site refuelling truck to a diesel storage tank of 17KL located at the borefield.

### POWER STATION

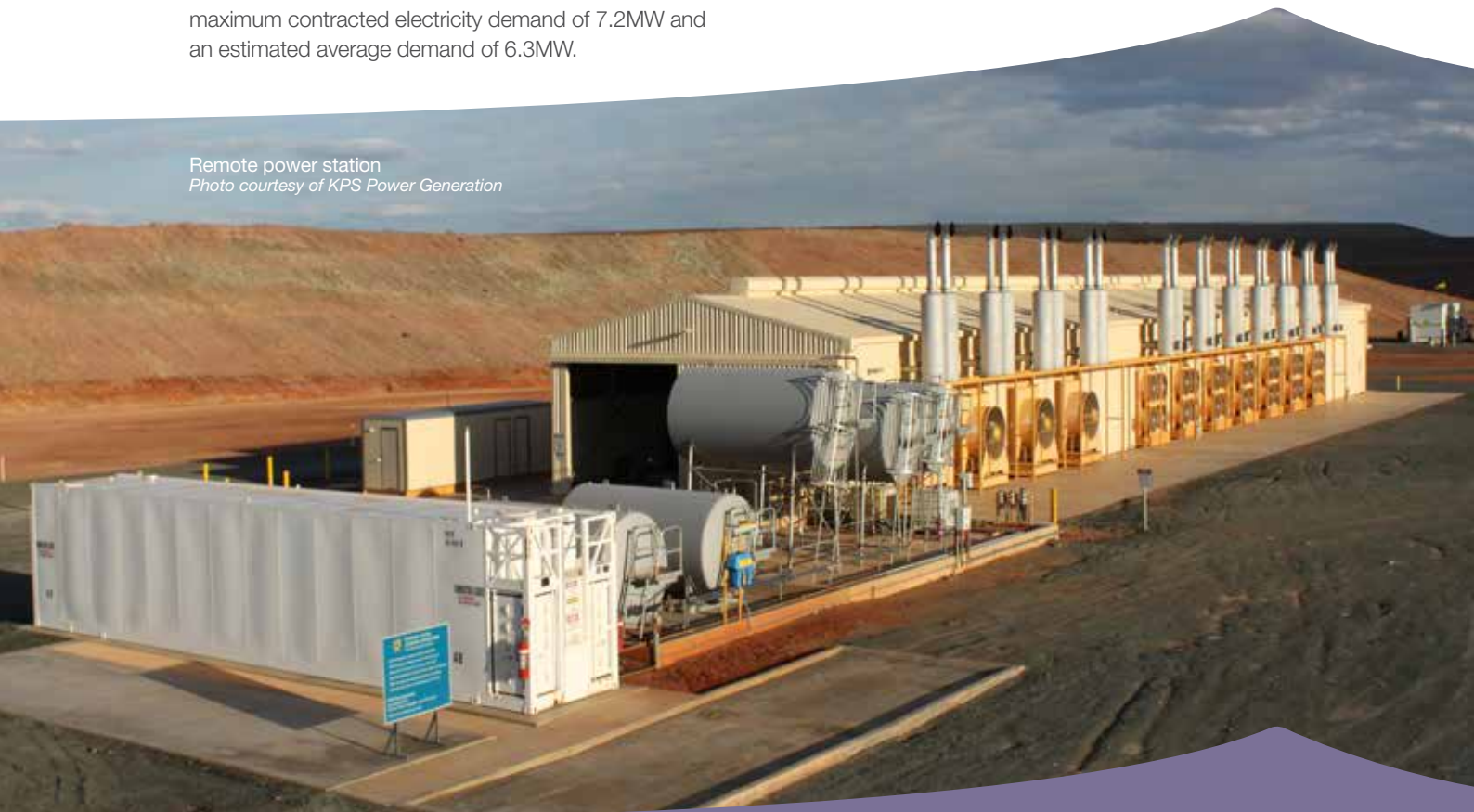
Vimy engaged Project Consultancy Services (PCS) to determine the most economic option for electricity supply to the MRP. Electricity to the project will be supplied over the fence under an electricity service agreement.

PCS completed a pre-qualification tender process aimed at shortlisting the electrical power service providers to three companies for consideration during the final round of tendering for the MRP. Preliminary tender submissions were required to be within +0/-10% accuracy. A nominal ten-year contract term was specified in the electricity supply request for proposal (RFP). The RFP was issued to nine potential independent power providers, who provided separate proposals for a diesel or natural gas fired power station. PCS also obtained a bundled transport tariff over a fifteen-year term from APA Group to construct and operate a gas lateral from the Eastern Goldfields gas pipeline to Mulga Rock.

Based on the tender evaluations and PCS cost analysis, a diesel-fired power station has been selected for the MRP. There is 10.3 MW of total installed load with a maximum contracted electricity demand of 7.2MW and an estimated average demand of 6.3MW.

BASED ON THE  
TENDER EVALUATIONS  
AND PROJECT  
CONSULTANCY  
SERVICES' COST  
ANALYSIS, A DIESEL-  
FIRED POWER STATION  
HAS BEEN SELECTED  
FOR THE MULGA  
ROCK PROJECT.

Remote power station  
*Photo courtesy of KPS Power Generation*



## WATER INFRASTRUCTURE

Raw water for the MRP will be sourced from the Kakarook North borefield located approximately 32.5km by road to the northeast of the process plant site. Rockwater Hydrogeological and Environmental Consultants (Rockwater) has conservatively estimated the borefield to contain 167GL of ground water, which based on the expected total project raw water demand of 1.8 to 2.6GL per annum, will comfortably service the mine well beyond its LOM.

The groundwater at Kakarook North has a relatively low-salinity and is suitable for water make-up requirements to the process plant, as well as feed water to the potable water treatment plant that will supply the MRP site including the accommodation village.

The Kakarook North borefield and raw water distribution system has been designed and costed by GRES with assistance from Rockwater, using in-house experience and budget quotations from Original Equipment Manufacturers (OEM). The water supply and distribution system consists of the following major assets:

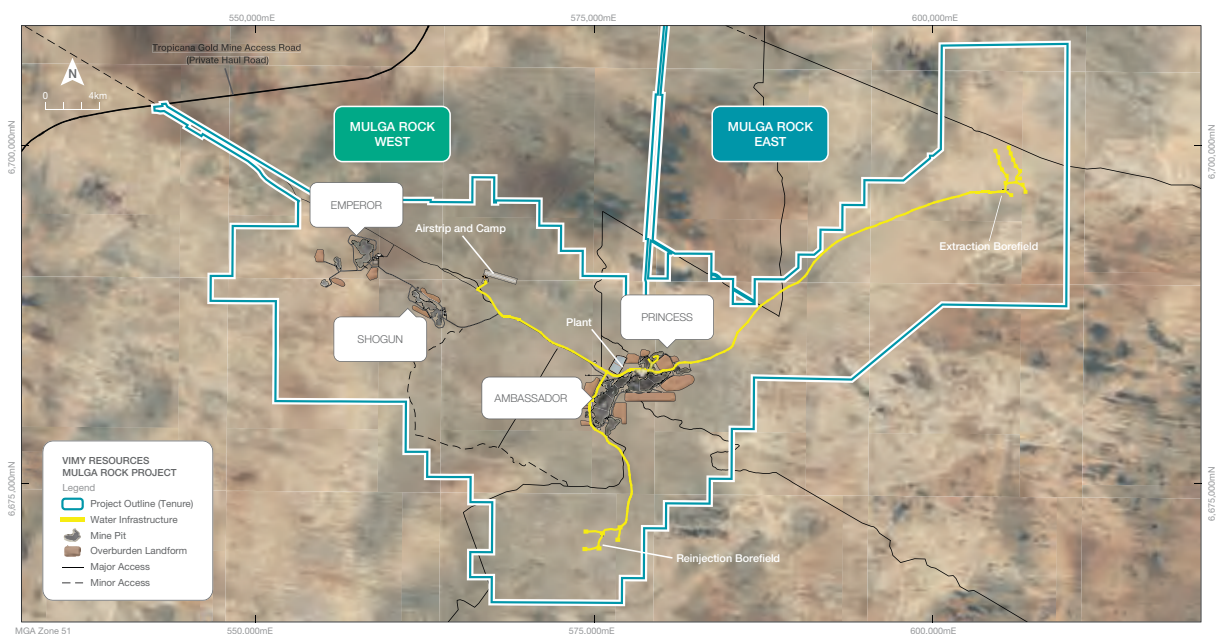
- » Sixteen extraction bores (twelve duty, four standby);
- » 4ML borefield water staging pond (at borefield);
- » Borefield water duty/standby transfer pumps;
- » Package diesel-fired diesel generator set and substation (at borefield);

- » 32.5km buried polyethylene transfer pipeline;
- » Raw water header tank at process plant; and
- » 16ML raw water storage dam at process plant.

Pit water will be used for dust suppression in the mine pit (on haul roads, pit benches, ex-pit overburden landforms and in-pit backfill), and dust suppression for regional and site roads. Any excess pit water will be reinjected downstream of the main Ambassador paleochannel. Rockwater identified an area approximately 7.8km to 12.5km south of the main Ambassador pit within the same paleochannel system as Ambassador, which is deemed sufficiently remote from active mining and well suited for groundwater reinjection.

A reinjection borefield trial was completed in early 2017, confirming reinjection rates that can be sustained. The DFS has made an allowance for the installation of five reinjection bores in Year 7, in preparation for the significant excess pit water quantities expected from Year 9 onwards due to deeper mining depths at Ambassador West, and the commencement of mining activities at Shogun and Emperor.

Figure 9.2: Proposed water infrastructure piping layout







A REINJECTION BOREFIELD  
TRIAL WAS COMPLETED IN EARLY  
2017, CONFIRMING SUSTAINABLE  
REINJECTION RATES.



# PROJECT IMPLEMENTATION PLAN

p70-p75





## Highlights

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Overall schedule is 122 weeks to design, construct and commission the Mulga Rock Project.

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Longest lead item (SAG mill) is 80 weeks from order to commissioning.

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## PROJECT SCHEDULE

The critical path for the project implementation is the procurement, installation and commissioning of the SAG mill, for which the order for supply is scheduled to be placed 18 months ahead of the commissioning date. The duration of this critical path from mill order to the commencement of ore commissioning is 80 weeks.

Mobilisation to site is scheduled backward from the mill delivery date to allow time for mobilisation, site preparation, bulk earthworks, civil installation and concrete curing prior to the commencement of installation of the mill and other equipment.

The MRP is scheduled to be implemented in two stages; Stage 1 consisting of all site activities excluding the installation of the beneficiation plant, and Stage 2 consisting of the installation and commissioning of the beneficiation plant.

The overall schedule for the main project is 122 weeks, which is made up of the following major concurrent durations:

- » 30 weeks of Front End Engineering and Design (FEED);
- » 53 weeks to establish camp and infrastructure;
- » 57 weeks for equipment procurement, fabrication and delivery;
- » 44 weeks to construct mining infrastructure;
- » 88 weeks to construct the process plant;
- » 25 weeks of mining pre-strip activities;
- » 26 weeks of mining ore to establish tailing storage facility; and
- » 30 weeks to commission facilities.

The schedule for delivery of the ore beneficiation plant is expected to take 70 weeks. This construction phase will commence at the end of Year 1, in preparation for the cessation of high-grading at the mine in Year 2, Month 8. The schedule consists of the following activities:

- » 40 weeks for equipment procurement, fabrication and delivery;
- » 30 weeks for equipment installation; and
- » 18 weeks of commissioning.

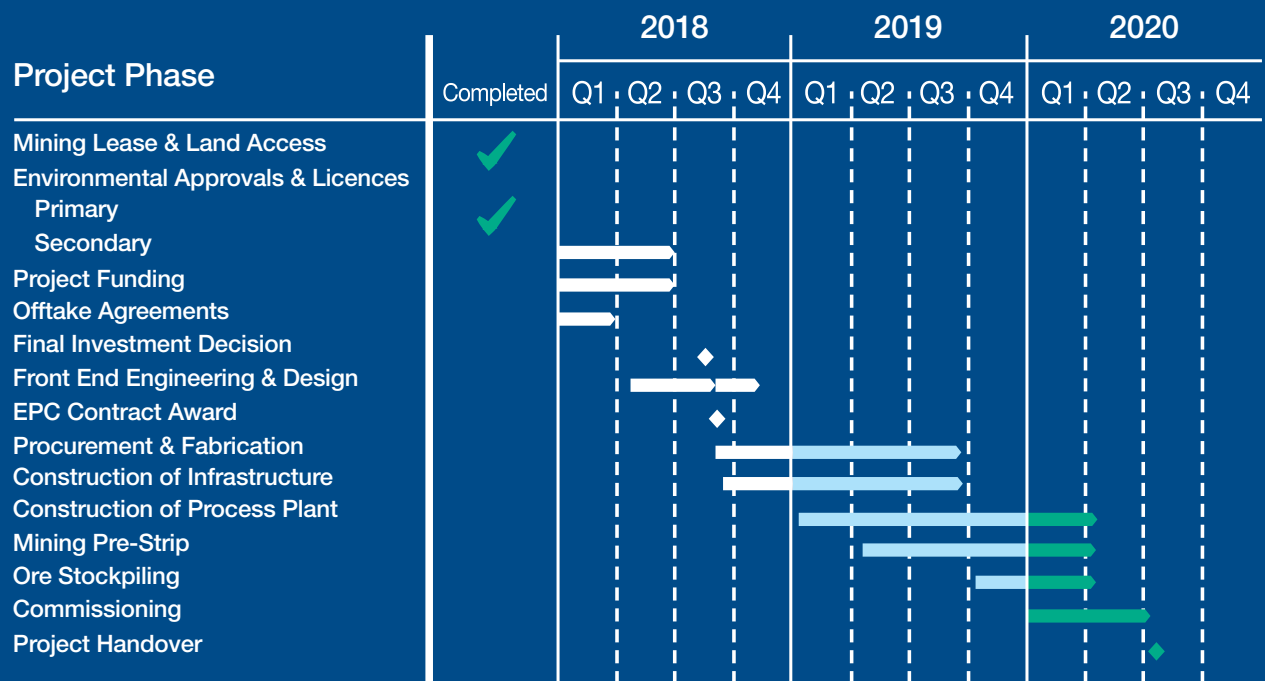


Figure 10.1: Project Schedule – Key Activities and Milestones



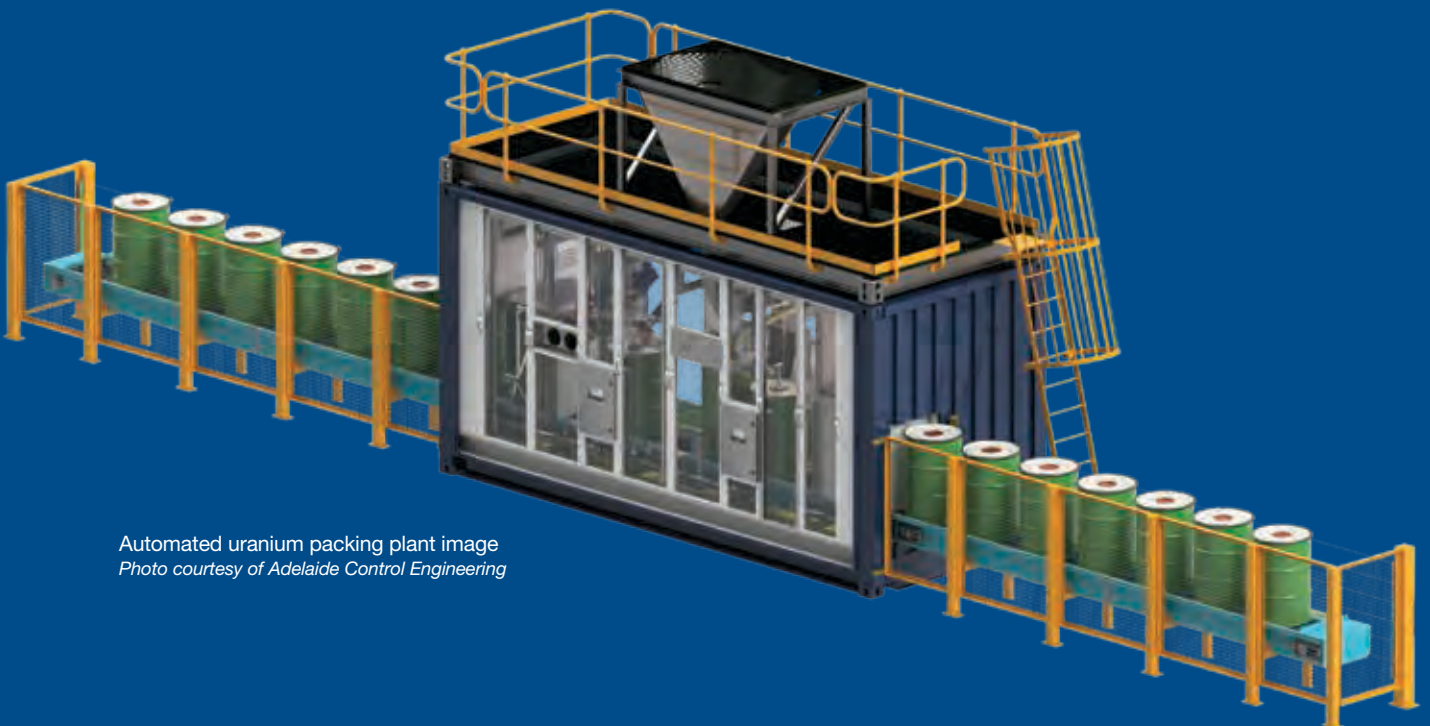
## ENGINEERING AND PROCUREMENT

The engineering design and procurement strategy for the implementation of the MRP will be finalised during the FEED phase of the project. The FEED will be performed by the selected engineering contractor, and will have the following objectives:

- » Specify the MRP implementation scope of work, design and quality criteria;
- » Freeze key process and layout documentation;
- » Engineer and design the MRP to minimise technical risks;
- » Obtain firm quotations for key equipment, evaluate quotations, agree on the preferred suppliers and negotiate final terms and conditions ready for award when the Financial Investment Decision (FID) milestone is reached; and
- » Develop the project schedule encompassing engineering, procurement, construction, commissioning, and ramp-up.

Following FID, an Engineering, Procurement and Construction (EPC) contractor will be engaged to develop the project scope and associated lump sum price to implement the MRP on an EPC basis. A decision will then be made as to whether the MRP will be implemented on an EPC, or an Engineering, Procurement and Construction Management (EPCM) basis.

With the procurement of the SAG mill being on the critical path due to its long lead time, the procurement process is scheduled to commence immediately after FID.



Automated uranium packing plant image  
Photo courtesy of Adelaide Control Engineering

## INFRASTRUCTURE EARLY WORKS

Construction activities at the MRP site will commence with an early works construction program encompassing the installation of the following critical project infrastructure:

- » Kakarook North borefield, including access, boreholes, and associated infrastructure;
- » Sealed airstrip;
- » Village area earthworks and installation of construction village;
- » Regional and area access roads; and
- » Main communication tower and hut.

The above infrastructure will be completed prior to the commencement of the process plant construction phase.

## PROCESS PLANT CONSTRUCTION

The construction of the process plant facilities and associated infrastructure will be performed in two stages. The initial construction phase, expected to take 88 weeks, will consist of the installation of the following process plant scope items:

- » All plant earth and civil works;
- » ROM ore pad, mineral sizer and associated ore transfer conveyors to the concentrate stockpile;
- » All process plant equipment, including SAG mill, leach circuit, RIP, elution, UF/NF plant, and uranyl peroxide precipitation, drying and packaging area;
- » All reagent supply equipment, including the sulphuric acid vendor package plant;
- » All process plant utility equipment, including package steam boilers; and
- » All process plant infrastructure, including power station, fuel storage, power distribution, site communication and process plant control system.

## MINING EARLY WORKS

The Ambassador North pit must be excavated and the ore stockpiled prior to the process plant commencing commissioning to ensure a sterilised pit void is available to be used as an initial tailings storage facility. In addition to Ambassador North, pre-strip activities at Ambassador West must also commence to allow high-grade ore to be available early in the mine schedule. Formal commencement of operations is defined as first ore to the process plant.

Pre-production mining commences in Year -1, Month 11 with the mobilisation of the tractor scoops and associated ancillary equipment to start clearing and grubbing the Ambassador North pit.

Overburden stripping commences in Year 0, Month 1 with the mobilisation of a 250t excavator and 500t excavator, along with six 300t ultra-class overburden trucks and the first fleet of ancillary equipment. Ore mining commences in Year 0, Month 6 when seven articulated ore trucks are mobilised. The Ambassador North pit must be sterilised prior to commissioning of the process plant.

## PROCESS PLANT COMMISSIONING AND RAMP-UP

The act of commissioning involves bringing multiple pieces of plant online in the correct sequence with all safety systems operational to ensure sequences, controls and functionality are correct. A separate commissioning team led by the engineering contractor's commissioning manager will be established to perform this work. The engineering contractor's commissioning manager will manage the pre-commissioning and the dry and wet aspects of the commissioning phase prior to practical completion of the MRP being reached. The engineering contractor's commissioning team will then undertake ore commissioning of the facilities, assisted by Vimy's commissioning manager and operations team.

The facilities will be handed over to Vimy's operations team following successful ore commissioning.

Throughput will be progressively increased until nameplate capacity is achieved and product quality requirements are met.

GRES has determined that the process plant will take 24 months to fully ramp-up, with the plant operating at 83% of design throughput within twelve months.





Photo supplied courtesy of GRES



# CAPITAL COST ESTIMATE

p76-p85



*Photo courtesy of GRES*

## Highlights

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Total capital cost is A\$493M inclusive of growth allowance and contingency totalling A\$41.7M.

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The DFS capital cost has reduced by A\$10.9M when compared to the PFS.

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## CAPITAL COST ESTIMATE

The overall project capital cost estimate was developed by GR Engineering Services (GRES) for the DFS and is based on an Engineering, Procurement, Construction and Management (EPCM) approach for the process plant and infrastructure.

The estimate includes all the necessary costs associated with engineering, drafting, procurement, construction, construction management, commissioning of the processing facility and associated infrastructure, mining infrastructure, first fills of plant reagents, consumables and spare parts.

The estimate is based upon preliminary engineering, material take-offs and budget price quotations for major equipment and bulk commodities.

Unit rates for installation were based on market enquiries specific to the MRP and benchmarked to those achieved

recently on similar projects undertaken in the Australian minerals processing industry.

The estimate pricing was obtained predominantly during fourth quarter 2017 (4Q17) and is in Australian dollars (A\$). Where pricing was received in foreign currency these have been converted to A\$ at the foreign exchange rates provided by Vimy.

The overall capital estimate is considered to be a Class 2 estimate according to the American Association of Cost Engineering (AACE) International with an estimate accuracy of  $\pm 10$  to 15%. The basis of estimate is summarised in Table 11.1.

An Engineering, Procurement, Construction (EPC) allowance has been provided by GRES to enable the estimate to be converted to a lump sum EPC contract.

Table 11.1: Engineering Development and Cost Estimation Methodology

Category	Level of Development	Cost Estimation Methodology
Mining	<ul style="list-style-type: none"> <li>» Excavator, shovel and truck fleet sizes derived from mine schedule</li> <li>» Ancillary equipment fleet sizes derived from review of active open pit areas across mine schedule</li> </ul>	<ul style="list-style-type: none"> <li>» Mobile equipment budget pricing from multiple contractors</li> </ul>
Mining Infrastructure	<ul style="list-style-type: none"> <li>» Advanced pit dewatering requirements designed and estimated by industry specialist (Advisian)</li> <li>» Preliminary general arrangement and layout drawings</li> <li>» Preliminary design and material take-offs by experienced civil engineer</li> </ul>	<ul style="list-style-type: none"> <li>» Pit dewatering equipment budget pricing from multiple vendors</li> <li>» Multiple quotations for earthworks, concrete and structural scope items</li> <li>» Multiple vendor prices for equipment and buildings</li> </ul>
Earthworks	<ul style="list-style-type: none"> <li>» Detailed Light Detection and Ranging (LIDAR) survey</li> <li>» Soil and foundation geotechnical assessment</li> <li>» Preliminary 3D modelling to determine bill of quantities</li> </ul>	<ul style="list-style-type: none"> <li>» Budget pricing from multiple contractors</li> </ul>
Concrete	<ul style="list-style-type: none"> <li>» Preliminary general arrangement and layout drawings</li> <li>» Preliminary design and material take-offs by experienced civil engineer</li> </ul>	<ul style="list-style-type: none"> <li>» Sole source quotation for all-in unit rate to supply and install, including mobilisation and demob costs of the batching plant</li> </ul>
Structural	<ul style="list-style-type: none"> <li>» Preliminary general arrangement and layout drawings of major steel structures to determine bill of quantities</li> </ul>	<ul style="list-style-type: none"> <li>» Multiple quotations for all-in rates to supply, fabricate, paint and deliver</li> </ul>
Equipment	<ul style="list-style-type: none"> <li>» Equipment sizing based on project mass balance derived from process design criteria</li> <li>» Specifications and data sheets developed for all major equipment and packages</li> </ul>	<ul style="list-style-type: none"> <li>» Multiple vendor budget prices for major equipment (&gt;\$50k)</li> <li>» In-house database for minor equipment (&lt;\$50k)</li> </ul>

Continued...



Category	Level of Development	Cost Estimation Methodology
Platework	<ul style="list-style-type: none"> <li>» Fabricated platework component list (covering tanks, bins, chutes and launders) developed from project mass balance</li> <li>» Preliminary general arrangement and layout drawings to determine bill of quantities</li> <li>» Materials of construction determined from corrosion coupon testing</li> </ul>	<ul style="list-style-type: none"> <li>» Multiple quotations for supply, fabrication, surface preparation and painting</li> <li>» Leach and RIP tank datasheets issued for multiple quotations to supply, fabricate, transport to site and erect</li> </ul>
Piping	<ul style="list-style-type: none"> <li>» Preliminary line and valve lists developed from piping and instrumentation diagrams</li> <li>» Piping quantities and pipe supports calculated from layout drawings</li> <li>» Overland piping quantities calculated from layout drawings</li> </ul>	<ul style="list-style-type: none"> <li>» Supply rates from multiple piping suppliers for various specification pipes, valves and fittings</li> </ul>
Electrical & Instrumentation	<ul style="list-style-type: none"> <li>» Electrical, instrumentation and control quantities compiled from single line diagrams, instrument list, piping and instrumentation diagrams, layouts, equipment list and electrical load list</li> <li>» Switchroom requirements based on substation general arrangements</li> </ul>	<ul style="list-style-type: none"> <li>» Budget pricing for major electrical components including transformers, switchrooms, motor control centres, and variable speed drives</li> <li>» Budget pricing for supply and installation of overhead powerlines</li> <li>» In-house database used for electrical cabling, cable ladders, instrumentation and instrument control cabling</li> </ul>
Buildings	<ul style="list-style-type: none"> <li>» Floor plans developed for all buildings and workshops</li> <li>» Accommodation village building specification developed</li> </ul>	<ul style="list-style-type: none"> <li>» Multiple budget quotes including supply, installation and freight</li> </ul>
Installation Labour	<ul style="list-style-type: none"> <li>» Installation man-hours estimated for each equipment and fabrication item to be installed</li> </ul>	<ul style="list-style-type: none"> <li>» GRES construction labour rates used for civil, structural, mechanical and piping</li> <li>» GRES site installation rates used for electrical, instrumentation and control system</li> </ul>
Project Indirect Costs	<ul style="list-style-type: none"> <li>» EPCM estimate based on man-hours required for engineering and project delivery team</li> <li>» EPC allowance estimated by applying a margin to all costs identified as EPC associated costs</li> </ul>	<ul style="list-style-type: none"> <li>» GRES commercial rates used for EPCM disciplines required</li> <li>» Multiple quotations for flights, meals and accommodation services</li> </ul>
Growth Allowance	<ul style="list-style-type: none"> <li>» Growth allowance commensurate with level of engineering completed and estimating confidence for each item within capital estimate</li> </ul>	<ul style="list-style-type: none"> <li>» Overall growth allowance estimated for pre-production, process plant and infrastructure is 6.7% of direct capital cost</li> </ul>
Contingency & Owner's Costs	<ul style="list-style-type: none"> <li>» Owner's contingency is provision for unforeseen costs associated with project execution risk</li> <li>» Owner's costs include allowances for owner's project team, insurances, approvals, computing system, home office costs, systems development and training</li> </ul>	<ul style="list-style-type: none"> <li>» Owner's contingency estimated based on Monte Carlo analysis for all major components of the project</li> <li>» Owner's cost developed from quotations and first principles</li> </ul>

## ESTIMATE STRUCTURE

The capital estimate was prepared using a project Work Breakdown Structure (WBS) which delineates the various areas of the project. Individual estimates were prepared for each area covering all engineering disciplines.

The capital estimate has been structured into the following major categories:

- » Direct costs;
- » Indirect costs;
- » Growth allowance; and
- » Owner's costs.

### DIRECT COSTS

Direct costs are project expenditures that cover the supply of equipment and materials, freight to site and construction labour. These are the costs to build the project and exclude indirect and other costs as described below.

### INDIRECT COSTS

Indirect costs are project expenditures that cover miscellaneous construction costs such as EPCM services, mobilisation/demobilisation, construction facilities, temporary construction accommodation, flights, meals, as well as plant first fills, critical equipment spares and plant commissioning costs.

### GROWTH ALLOWANCE

A growth allowance has been included in the estimate which is commensurate with the level of design and estimating confidence. The allowance is based on the project scope and does not include changes to the process flowsheet, process plant design or major equipment selections. Growth allowance is reserved for errors and omissions based upon data assumed and equipment detailed as the basis for this study.

Growth allowances made in the estimate vary for each discipline item according to the level of accuracy associated with equipment/materials pricing, estimates of material quantities, estimates of equipment and labour requirements and site costs.

### OWNER'S COSTS

Owner's costs have been included in the capital estimate for the following:

- » Owner's project management team;
- » Pre-mobilisation construction costs;
- » Insurances;
- » Approvals;
- » Computing systems (business services systems);
- » Recruitment costs for operational team;
- » Salaries for operational team during commissioning and handover period; and
- » Office costs.

Owner's contingencies and/or risk amounts have also been included in the estimate. Owner's contingency is an allowance to cover costs associated with unexpected items during construction that are not covered by the EPCM contract. These may include such items as scope changes, changes to equipment or material specification changes, rain delays, etc.

The amount has been determined based on a risk workshop conducted by Vimy and GRES. Risk weightings were assigned to the best, most likely and worst-case ranges to the various elements of the estimate. The cost variables were then modelled using a Monte Carlo statistical simulation process. The difference between the P95 scenario and the base case was adopted for the owner's contingency.

### COST ESTIMATE SUMMARY

The estimated total capital cost for the MRP is A\$492.98M, including a growth allowance and owner's contingency totalling A\$41.7M (or approximately 8.5% of total project costs), and capitalised pre-production mining costs of A\$36.3M. Capital breakdown by Work Breakdown Structure (WBS) is presented in Table 11.2 and Figure 11.1, with costs expressed in Australian dollars.

Table 11.2: MRP Capital Cost Estimate Summary

WBS	Cost Area	A\$M	WBS	Cost Area	A\$M
<b>1000</b>	<b>Mining</b>	<b>144.09</b>	<b>5000</b>	<b>Regional Infrastructure</b>	<b>9.51</b>
1010	Mining Pre-Strip	36.34	5010	Regional Roads	8.19
1020	Advanced Pit Dewatering	9.40	5060	Regional Communications	1.32
1050	Heavy Vehicle Washdown	0.78	<b>Project Directs Sub-Total</b>	<b>355.46</b>	
1060	Fuel Storage & Dispensing	0.81			
1090	Explosive Compound	0.22	<b>6000</b>	<b>Miscellaneous</b>	<b>25.39</b>
1110	Mine Buildings & Earthworks	6.64	6010	First Fills & Consumables	7.04
1120	Mining Fleet	89.89	6030	Critical Spares	1.48
<b>2000</b>	<b>Process Plant</b>	<b>127.58</b>	6040	Mobilisation & Demob	13.71
2100	Ore Beneficiation	23.03	6050	Vendor Representatives	0.46
2200	SAG Mill & Leach	16.82	6060	Commissioning Assistance	2.70
2300	Uranium Recovery	22.95	<b>7000</b>	<b>Indirect Costs</b>	<b>53.54</b>
2400	Uranium Precipitation	8.80	7010	Construction Facilities & Services	11.57
2600	Tailings	3.97	7020	Construction Camp	2.38
2700	Water Management	3.20	7030	EPCM	39.59
2800	Services & Utilities	2.41	<b>Project Indirects Sub-Total</b>	<b>78.92</b>	
2900	Reagents	5.88			
2910	Sulphuric Acid Plant	22.12	<b>Total Bare Cost</b>	<b>434.38</b>	
2950	Piping & Cable Racks	18.37			
<b>3000</b>	<b>Plant Infrastructure</b>	<b>34.14</b>	<b>8000</b>	<b>Growth Allowance</b>	<b>23.90</b>
3010	Site Preparation & Improvements	2.56	8010	Design Growth	23.90
3020	Electrical Substations	7.32			
3030	Plant Buildings	9.48	<b>9000</b>	<b>Owner's Costs</b>	<b>34.70</b>
3060	Waste Water Treatment Plant	0.54	9110	Owner's Team	16.93
3070	Mobile Equipment	5.50	9120	Owner's Contingency	17.77
3080	Bulk Fuel Storage Facility	1.62			
3130	High Voltage Switch Yard	0.30	<b>Grand Total</b>	<b>492.98</b>	
3140	Control System	1.19			
3150	Communications	5.06			
3190	Turnkey Plants	0.57			
<b>4000</b>	<b>Area Infrastructure</b>	<b>40.13</b>			
4010	Permanent Accommodation	18.67			
4020	Water Supply & Distribution	9.25			
4030	Electrical Power Distribution	4.02			
4040	Air Strip & Terminal	5.56			
4050	Area Roads	1.99			
4060	Stormwater Protection	0.26			
4070	Area Communications	0.38			



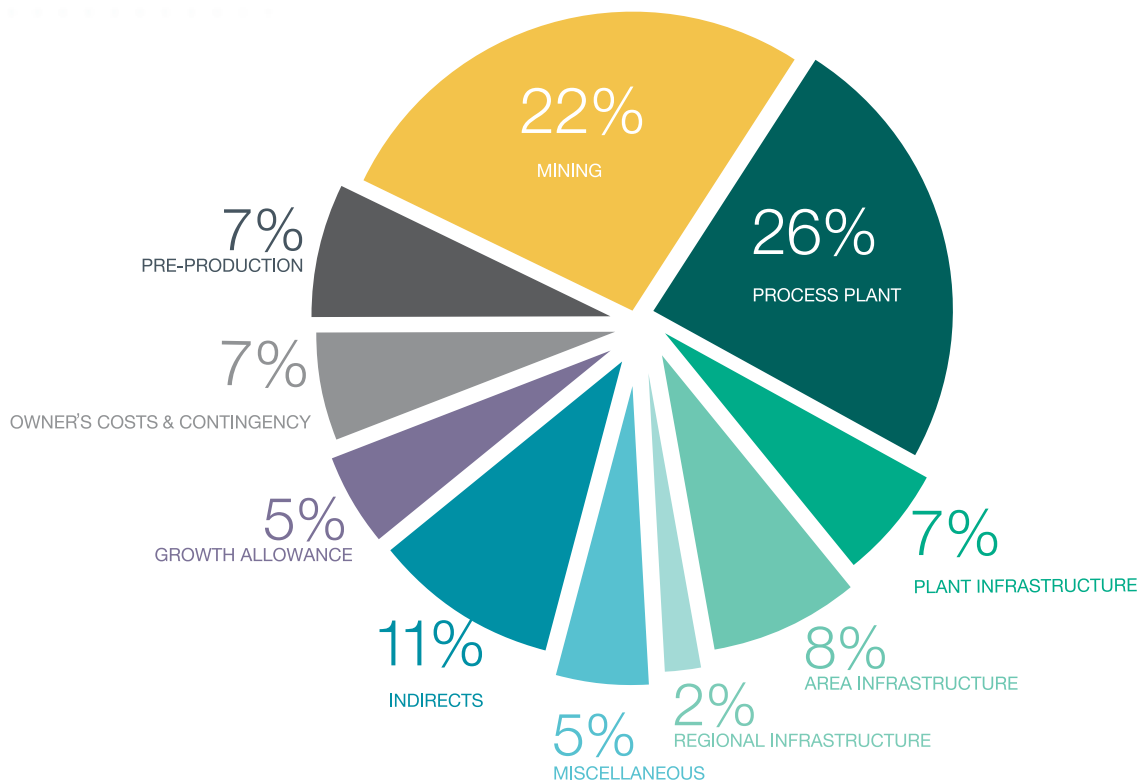


Figure 11.1: MRP Capital Cost Breakdown – by Work Breakdown Structure

## MINING

### PRE-PRODUCTION CAPITAL

Costs associated with the pre-production mining prior to Year 1, Month 1 were developed by Mining Plus and are summarised in Table 11.3. These operating costs include a full complement of management and supervision to support the mining operation as soon as it commences. The costs also include the maintenance personnel which are mobilised in line with the delivery of the mining fleet.

Table 11.3: Pre-production Capital Estimate

Capital Expenditure Area	Year -1 (A\$M)	Year 0 (A\$M)	Total (A\$M)
Labour	3.7	15.1	18.8
Fuel	0.6	9.2	9.8
Other (variable)	0.6	5.4	6.0
Other (fixed)	0.1	0.8	0.9
Pit dewatering	-	0.8	0.8
<b>Total</b>	<b>5.0</b>	<b>31.3</b>	<b>36.3</b>

## MINING EQUIPMENT

Mining equipment is procured from Year -1 through to Year 2, with the cost of this equipment estimated by Mining Plus based on multiple budget quotations. The mining capital cost estimate includes the following equipment items:

- » Mobile mining fleet;
- » Mobile ancillary fleet;
- » Mobile maintenance equipment;
- » Light vehicles;
- » Pit dewatering;
- » Workshop tooling;
- » Equipment spares;
- » Surveying equipment;
- » Grade control equipment;
- » Mobile lighting equipment; and
- » Specialist software.

Vimy is assessing commercial proposals to finance the mining fleet through the equipment suppliers.

## MINING INFRASTRUCTURE

The capital cost of the following mining infrastructure has been estimated by GRES based on in-house experience and quotations:

- » Mining operational and administration buildings;
- » Mining compound including earthworks, civils, fencing, bunding, parking bays, jack pads and laydown areas;
- » Mining workshop and stores;
- » Mining heavy vehicle and light vehicle re-fuelling facility; and
- » Heavy vehicle and light vehicle washdown bays.

## PROCESS PLANT

### ORE BENEFICIATION PLANT

The beneficiation plant has been designed and costed by GRES based on findings of the pilot plant testwork and multiple budget quotations from OEMs, with the plant consisting of the following major unit operations:

- » ROM ore pad and retaining wall;
- » Parallel mineral sizer trains;
- » Parallel logwasher trains;
- » Fines separation cyclone cluster;
- » Rougher Up-Current Classifier (UCC);
- » Cleaner UCC;
- » Fines thickener;
- » Barren sand dewatering module;
- » Various ore, concentrate and barren sand conveyors; and
- » Beneficiated concentrate stockpile.

The beneficiation plant will be constructed and commissioned in two stages, with Stage 1 consisting of the installation of the ROM ore pad and retaining wall, one of the two mineral sizers, ore transfer conveyors, and the concentrate stockpile. This will enable the processing of high-grade ore during the first two years of operation, with the remainder of the ore beneficiation plant equipment installed during the first half of Year 2, in preparation for high-grade ore ceasing in Year 2, Month 8.

### HYDROMETALLURGICAL PROCESS PLANT

The hydrometallurgical process plant has been designed and costed by GRES based on the process design criteria confirmed through continuous piloting. The estimate is supported by multiple budget quotations from OEMs. The process plant consists of the following major unit operations:

- » SAG milling;
- » Leach feed thickener;
- » 6-stage uranium leach circuit;
- » 8-stage RIP circuit;
- » Resin elution;
- » Resin elution reagents make-up;
- » UF/NF plant;
- » 4-stage Uranyl peroxide precipitation circuit; and
- » Uranyl peroxide thickening, washing, drying and packaging.

The design implications of the characteristics of the acidic saline leach and RIP circuit slurries have been carefully considered by GRES. Non-metallic materials for construction have been selected where possible, such as fibre reinforced plastic, high density polyethylene, PVC, butyl rubber and epoxy coatings. Where the use of non-metallics is not practical, conservative metallic materials such as titanium and Hastelloy C276 have been selected predominantly in the leach, RIP and UF/NF areas of the plant, while super duplex stainless steels (SAF2507 and SAF2205) have been used in other areas. Corrosion testing has been conducted to support material selection for the project.

### REAGENTS

The reagents area of the process plant has been designed and costed by GRES based on in-house experience and budget quotations from OEMs, with the plant consisting of the following major unit operations:

- » Sulphuric acid vendor package plant and acid storage;
- » Ferric sulphate generation and storage;
- » Sodium chloride dissolution and storage;
- » Caustic unloading and storage;
- » Hydrogen peroxide unloading and storage; and
- » Flocculant mixing and storage.

The reagents area of the process plant consists mainly of tanks and pumps, with the exception of the sulphuric acid plant. The capital estimate has allowed for the installation of a turn-key 250tpd (85,000tpa) sulphuric acid plant supplied by industry-experts Outotec GmbH & Co. (Germany). The acid plant consists of a skid-mounted, fully pre-commissioned plant which will be supplied, installed and commissioned by and under the supervision of Outotec. The acid plant generates 12t/h of steam through its heat recovery system, which will be used to heat the leach circuit. Sulphuric acid may also be imported via truck if required.

### UTILITIES AND SERVICES

The utilities and services area of the process plant has been designed and costed by GRES based on in-house experience and multiple budget quotations from OEMs, with the plant consisting of the following major areas:

- » Water supply – raw water, pit water, demineralised water, potable water, process water, fire water, gland water, and safety shower systems;
- » Air supply – plant air and instrument air; and
- » Steam supply – boiler to provide low pressure steam.

### PLANT INFRASTRUCTURE

Process plant infrastructure has been designed and costed by GRES based on in-house experience and multiple budget quotations from OEMs, with the plant consisting of the following major assets:

- » Power plant generator haul;
- » Bulk fuel storage and distribution;
- » Sewage disposal and treatment;
- » Plant buildings, including administration, training, gatehouse/first aid, operations, change-rooms, crib rooms, plant control room, workshops, warehouse, etc;
- » Process plant control system;
- » High voltage switch yards, substations buildings, and power distribution;
- » Mobile plant equipment; and
- » Site communication systems, including communication towers, microwave data links, private LTE system, local area network/wide area network (LAN/WAN) data infrastructure, IT equipment and telephone system.

The cost for the supply and installation of all of the above assets, with exception of the power plant, has been included in the capital cost estimate. The power plant will be installed under a build, own and operate (BOO) contract.

### AREA AND REGIONAL INFRASTRUCTURE

All area and regional infrastructure has been estimated by GRES including the accommodation village, aerodrome, airstrip, Kakarook North borefield, raw water distribution system, high voltage electrical distribution system, main access and regional roads, and communications system.



## PREVIOUS CAPITAL COMPARISON

A comparison of the change in the capital cost estimate developed for the DFS, at A\$492.98M, to that released to the ASX in November 2015 for the PFS, at A\$503.9M, is presented in Figure 11.2.

The DFS capital cost has reduced marginally from the PFS cost estimate, with the following cost centres being responsible for the overall 3% reduction in cost:

- » The cost of the process plant has increased marginally by A\$1M with the base metals plant being replaced with a turnkey sulphuric acid plant;
- » The cost of plant and regional infrastructure has increased by A\$1M, due to an increase in costs associated with the communications system and electrical substations, following refinement of the requirements for this part of the infrastructure scope, which has been partially off-set by a reduction in the cost of the accommodation village;
- » The cost of indirects has increased by A\$11M, primarily due to increases in construction mobilisation-demobilisation costs, construction facilities and EPCM hours for the project;
- » The cost of mining and pre-strip has decreased by A\$15M, due to the change from Princess to Ambassador North pit as the initial tailings storage facility;
- » The growth allowance has decreased by A\$9M, commensurate with the higher level of project definition developed as part of the DFS; and
- » The owner's costs have decreased by A\$13M, primarily due to lower owner's contingency with a greater level of definition of project scope and review of the project risk register.

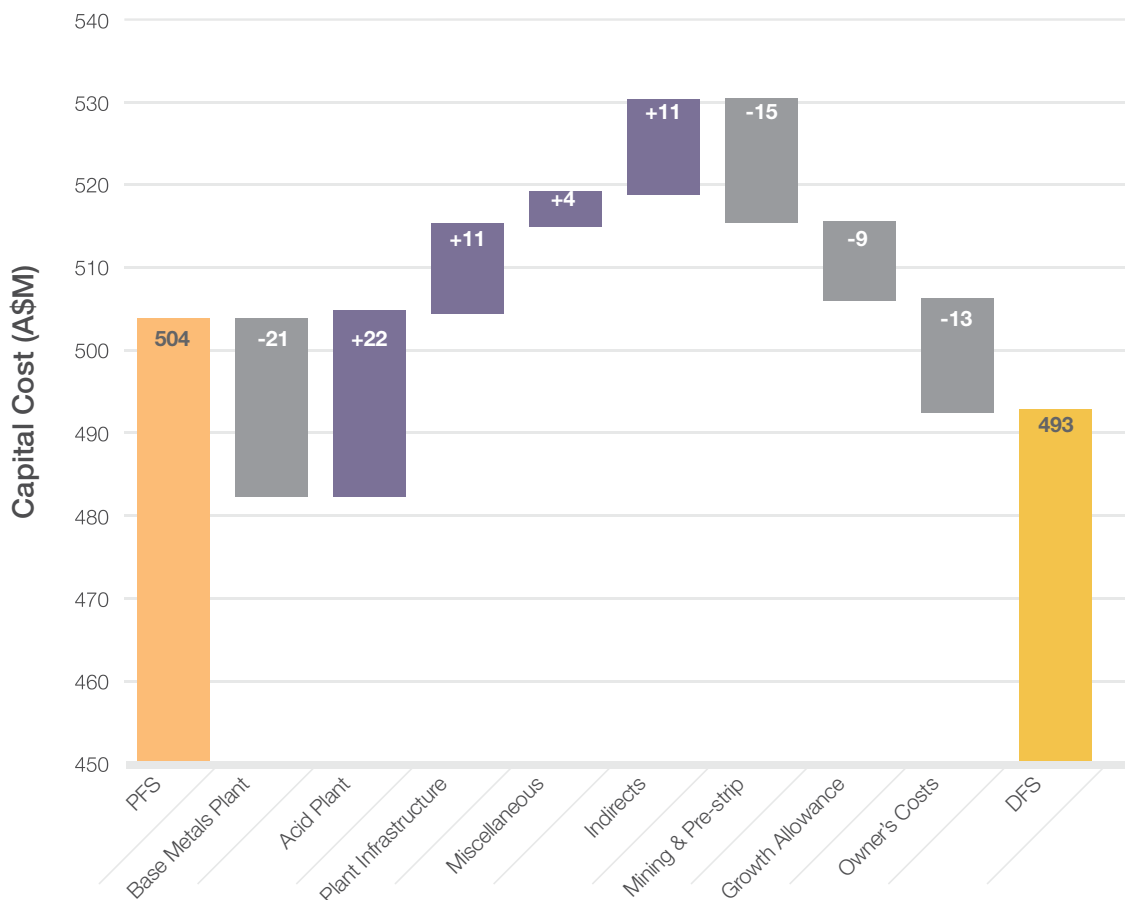


Figure 11.2: Comparison of DFS vs PFS Capital Cost Estimate

# OPERATING COST

p86-p95





## Highlights

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Years 1-5 cash operating cost of production is US\$25.11/lb (exclusive of royalties and sustaining capital).

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Life-of-Mine All-In Sustaining Cost (AISC) of US\$34.00/lb.

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Total Life-of-Mine sustaining capital estimated at A\$159M or equivalent to US\$2.36/lb.

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The DFS Life-of-Mine cash operating cost has reduced by US\$3.40/lb when compared to the PFS.

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## ESTIMATE BASIS

The operating cost estimate for the MRP was developed by GRES with assistance from Mining Plus and is based on the LOM ore schedule, process design criteria, steady-state mass and energy balance, and metallurgical piloting undertaken as part of the DFS.

The estimate includes all costs associated with the production of 3.5Mlbs  $U_3O_8$  per annum, including:

- » Mining;
- » Labour;
- » Fuel;
- » Power;
- » Reagents and consumables;
- » Maintenance;
- » Laboratory;
- » General and administration (including product transportation);
- » Sustaining capital; and
- » Royalties.

The operating cost estimate has been developed in accordance with the GRES standard for a DFS, and is based on costs prevailing in the Australian minerals industry for the fourth quarter 2017 (4Q17). The estimate is considered to be a Class 3 estimate according to the American Association of Cost Engineering (AACE) International with an estimate accuracy of  $\pm 10$  to 15%.

The ramp-up of the MRP process plant to reach nameplate production has been estimated using 'McNaulty ramp-up curves' taking into account the level of piloting undertaken, severity of process conditions and complexity of the process. GRES has assessed the process plant will take 24 months to fully ramp-up, with the plant operating at 83% of design throughput within the first twelve months. The ramp-up profile has been built into the mine schedule and is reflected in the operating costs presented in Table 12.1 and Figure 12.1.

## ESTIMATE STRUCTURE

Operating costs for the MRP have been compiled into the following cost categories:

- » Mining – all-in operating cost inclusive of diesel, labour, maintenance, contractors, tyres, consumables, pit dewatering and insurances;
- » Ore beneficiation – all-in operating cost inclusive of labour, reagents, power, maintenance, general expenses and contractors; and
- » Process plant – costs include labour, power, reagents, maintenance, freight, general expenses and administration costs which include accommodation and flights for all personnel, product transport and Perth office costs.

## COST ESTIMATE SUMMARY

Operating costs have been estimated on a monthly basis for the first two years, then quarterly for a further two years and then annually thereafter. The operating cost varies according to the mine schedule and ROM material being processed through the period. Table 12.1 shows the average All-In Sustaining Cost (AISC) and cash operating cost for the MRP over the first five years and over LOM, with costs expressed in both Australian and US dollars. Uranium is predominantly sold in US dollars and this cost presentation allows direct comparison to uranium contract prices.

OWNER-OPERATOR  
TRUCK AND SHOVEL  
IS THE MOST  
COST-EFFECTIVE  
APPROACH FOR  
THE MULGA ROCK  
PROJECT, ENSURING  
VIMY HAS FULL  
CONTROL OF  
EXPENDITURE.

Table 12.1: MRP Operating Cost Estimate

Cost Category	Operating Cost (Years 1-5)			LOM Operating Cost		
	A\$ '000/y	A\$/lb	US\$/lb	A\$ '000/y	A\$/lb	US\$/lb
Mining	46,473	13.92	9.74	52,608	16.76	11.73
Ore beneficiation	4,743	1.42	0.99	5,360	1.71	1.19
<b>Process plant</b>						
Labour	19,281	5.77	4.04	18,318	5.83	4.08
Power	9,934	2.98	2.08	9,900	3.15	2.21
Reagents	20,208	6.05	4.24	19,465	6.20	4.34
Maintenance	8,008	2.40	1.68	8,102	2.58	1.81
General & Admin	11,144	3.34	2.34	11,591	3.69	2.58
<b>Total cash cost</b>	<b>119,791</b>	<b>35.88</b>	<b>25.11</b>	<b>125,344</b>	<b>39.92</b>	<b>27.95</b>
Sustaining capital	6,492	1.94	1.36	11,165	3.38	2.36
Royalties	17,601	5.27	3.69	17,422	5.27	3.69
<b>AISC</b>	<b>143,884</b>	<b>43.09</b>	<b>30.16</b>	<b>153,931</b>	<b>48.57</b>	<b>34.00</b>

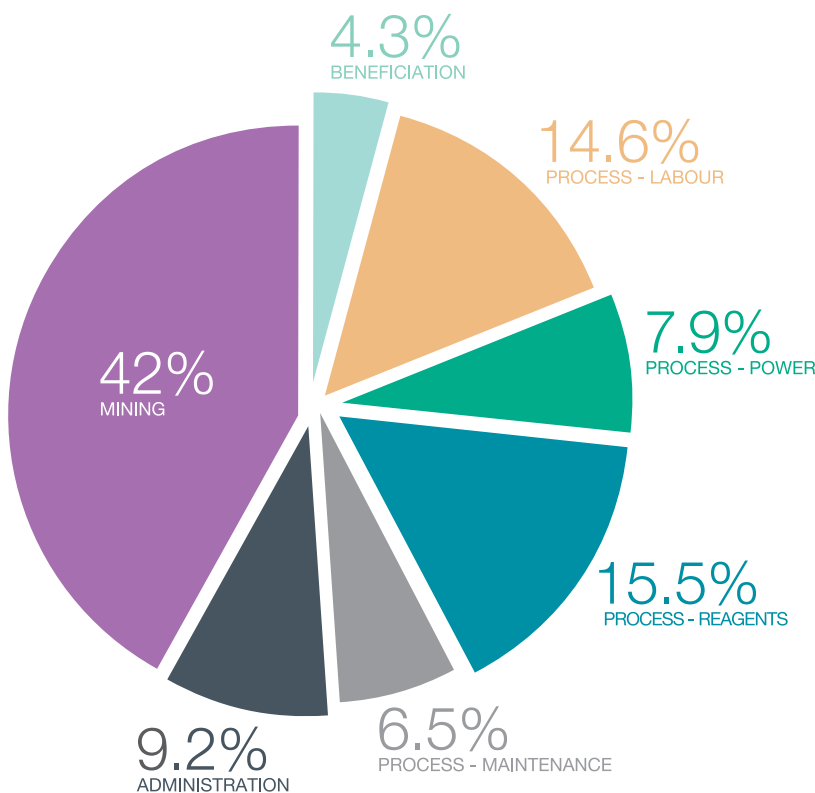


Figure 12.1: Distribution of LOM Cash Operating Costs by Area

## MINING

The operating cost estimate to deliver the DFS mine schedule has been developed by Mining Plus to an accuracy of +/-10%, based on an owner-operator mining philosophy. The mining operating cost estimate includes the operation of the following items:

- » Mobile mining fleet;
- » Mobile ancillary fleet;
- » Mobile equipment maintenance;
- » Ground engagement tooling (GET);
- » Tyres and other consumables;
- » Pit dewatering system;
- » Drill and blasting;
- » ROM ore haulage;

- » Mine surveying;
- » Grade control; and
- » Technical support and administration.

Table 12.2 and Figure 12.2 show the breakdown of the mining costs over the LOM. Unit mining costs are quoted in wet metric tonnes unless stated otherwise.

It should be noted that the low unit mining cost is a result of the large ultra-class mining fleet selected, free-dig nature of the overburden and short haul distance across the pit floor due to the strip mining method adopted.

Table 12.2: Mining LOM Operating Cost – by Activity

Expenditure Area	Cost (A\$ M pa)	Unit Cost (\$/t-wet)	Unit Cost (A\$/lb U <sub>3</sub> O <sub>8</sub> )	Unit Cost (US\$/lb U <sub>3</sub> O <sub>8</sub> )
Labour	18.46	0.39	5.88	4.12
Diesel	12.56	0.25	4.00	2.80
Power	0.13	0.00	0.04	0.03
Ground Engagement Tools	0.30	0.01	0.10	0.07
Tyres	3.57	0.08	1.14	0.80
Maintenance	12.65	0.27	4.03	2.82
Contractors	2.66	0.06	0.85	0.59
General & Administration	2.27	0.05	0.72	0.50
<b>Operating Cash Costs</b>	<b>52.61</b>	<b>1.11</b>	<b>16.76</b>	<b>11.73</b>

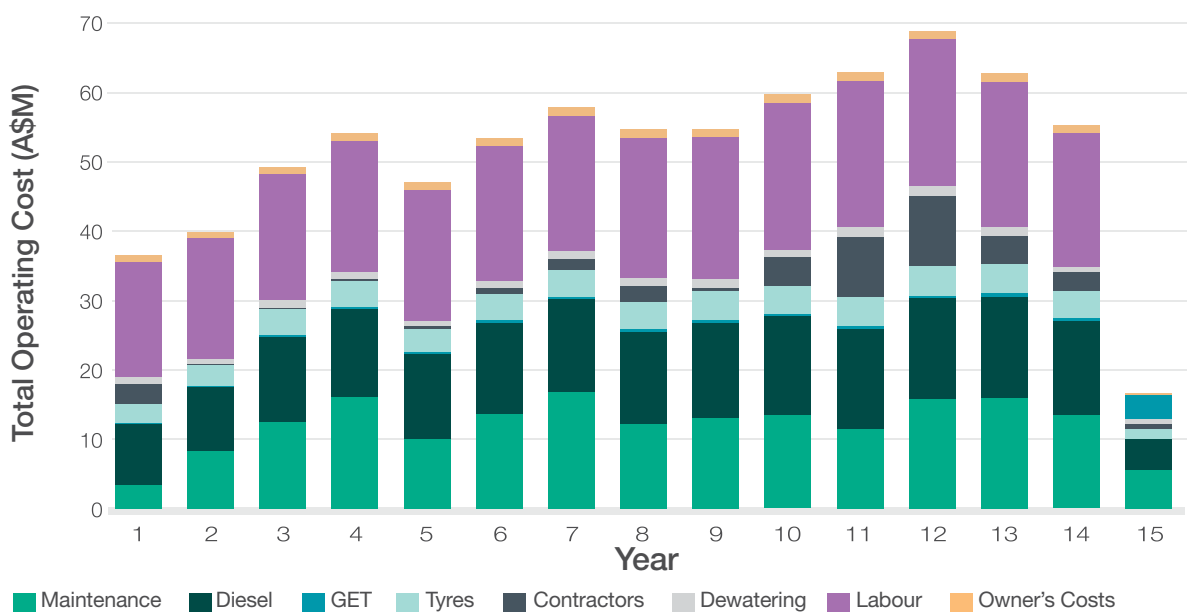


Figure 12.2: Mining Operating Cost Breakdown



## LABOUR

The labour costs for the various personnel categories reflect current market labour conditions and site location. The labour rates were obtained from the following sources:

- » Mercer Total Remuneration Survey Q2, 2017;
- » 2016 Hays Salary Guide; and
- » Stellar Salary Guide 2015-2016.

The labour rates are annualised and inclusive of the following on-costs:

- » Superannuation (9.5%); and
- » Payroll tax (6%);
- » Annual leave (4%);
- » Worker's compensation (0.75%);
- » Long service leave provision (2%); and
- » Miscellaneous (4.5%).

A total on-cost of 26.7% has been applied to the salaries as shown above.

An organisational structure and manning schedule has been developed for the MRP to meet planned production targets. The proposed mining, operations and administrative employee numbers are presented in Table 12.3.

The salary level for each position reflects current market conditions and the site location. Personnel will reside in Perth or Kalgoorlie, with travel to/from the operation being via chartered aircraft. Employees will work a two week on, one week off roster or an eight days on, six days off roster and leave entitlements have been based on the Commonwealth's Fair Work Act 2009.

Piacentini and Vimy mining crew



Table 12.3: MRP Employee Levels

Position	Employee Numbers
Mine management and supervision	9
Mining technical services	9
Mining operations	120
Mining maintenance	29
<b>Total Mining</b>	<b>167</b>
Process plant management and supervision	18
Process technical services	4
Process plant operations	53
Process plant maintenance	35
Laboratory	19
Logistics	4
HSE and training	7
Administration	15
Accommodation village & aerodrome	25
<b>Total Process Plant</b>	<b>180</b>
<b>Total Site Employees</b>	<b>347</b>

Piacentini excavator



## FUEL

As part of investigations undertaken by PCS to determine the most economical option for electricity supply to the MRP, quotations were received from fuel distributors to supply diesel to the MRP inclusive of international and local freight, insurance and handling costs, and margins.

Based on quotations received for diesel supply and delivery as well as the long-term outlook on Singapore Gasoil prices, a diesel price of A\$0.75 per litre delivered (after excise rebate) to MRP inclusive of the fuel tax rebate has been applied to the operating cost estimate.

## POWER

Power will be provided to the MRP via a power station located on the site adjacent to the process plant, under a build, own, operate (BOO) contract. A preliminary tender to provide power to the MRP was issued by PCS to eight potential BOO power providers under a ten-year contract term.

The all-in electrical energy unit cost for the MRP has been estimated at A\$225 per MWh, based on the diesel fuel price of A\$0.75 per litre (after excise rebate).

## REAGENTS AND CONSUMABLES

Reagents and consumables include the following cost elements:

- » Mineral sizer (e.g. roller teeth);
- » Log washer (e.g. paddles);
- » Grinding mill (e.g. liners);
- » Grinding media for the grinding mill;
- » Screen consumables;
- » Product drums and bulk bags;
- » All reagents used in the process;
- » Fuel for mobile equipment assigned to the processing or maintenance groups;
- » Fuel for the steam boiler; and
- » Lubricants, operating tools and equipment, general and operator supplies.

Reagent addition rates were derived from laboratory testwork, vendor testing and DFS piloting. Reagent and steam consumption rates have been calculated on a per tonne of leach feed or per pound of recovered uranium basis, from the steady state mass and energy balance developed using Kenwalt SysCAD software for the MRP process plant.

## MAINTENANCE

Maintenance costs include the cost for spare parts and maintenance consumables necessary to maintain the process plant.

Maintenance costs also include costs for contract re-lining of the grinding mill, plant shutdowns, airstrip maintenance, main access and internal road maintenance, and maintenance to the borefield track.

The direct labour cost for maintenance personnel is included in the labour cost category.

## LABORATORY

Laboratory costs include the costs for assaying of various process streams and mining grade control through the on-site laboratory.

The number of mine grade control assays was calculated based on core samples obtained from 20m x 20m drill spacing. The number of process plant assays has been calculated based on selected process streams and required frequency to monitor the process plant operation, undertake metallurgical accounting and confirm final product specifications.

The MRP laboratory will be operated under a contract service agreement to assay an estimated 77,500 samples per year. The direct labour cost for laboratory personnel has been included in the contracted price. Costs associated with laboratory personnel flights, messing, and accommodation have been included in the general and administration cost category.

## GENERAL AND ADMINISTRATION

General and administration costs have been categorised into the following sub-areas:

- » General expenses; and
- » Contract expenses.

General expenses relate to personnel and site office costs and include:

- » Safety and training;
- » Travel;
- » Software and computing;
- » Office supplies;
- » Vendor support;
- » Government fees and other charges;
- » Insurance;

- » Recruitment;
- » General equipment hire (e.g. vehicles); and
- » Communications.

Contract expenses include:

- » Laboratory contract fees;
- » Consultant fees and environmental monitoring costs;
- » Shutdown contract labour;
- » Product freight costs;
- » Port costs;
- » Camp accommodation and messing; and
- » Chartered flights to and from Perth.

## SUSTAINING CAPITAL

Sustaining capital is the ongoing cost required to sustain mobile and fixed assets and includes costs related to:

- » Replacement of equipment that has reached the end of life;
- » Major maintenance of plant and infrastructure;
- » Capital for mining infrastructure as the mining operation expands; and
- » Incremental debottlenecking of the process plant to maintain nameplate uranium production capacity as the uranium grade decreases in the latter part of the mine schedule.

The total LOM sustaining and deferred capital, presented in Table 12.4, has been estimated by GRES at A\$159.1M, equivalent to A\$3.38/lb U<sub>3</sub>O<sub>8</sub> (US\$2.36/lb). Sustaining capital has been included in the AISC operating costs provided in Table 12.1.



Table 12.4: Sustaining Capital Cost Estimate

Sustaining Capital Item	Sustaining Capital Cost Per Year (A\$M)															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Mining	-	-	11.4	5.6	0.1	2.7	1.1	17.1	6.2	10.7	9.5	2.0	0.7	0.1	-	67.3
Process Plant & Infrastructure	0.8	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	-	24.0
Mobile Equipment	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	1.9
Deferred Capital	0.0	4.5	1.5	0.1	0.7	2.3	7.4	8.8	5.3	13.0	9.5	3.4	0.5	6.6	-	63.4
Road & Airstrip Re-Sheeting	-	-	-	0.1	-	-	1.1	0.1	-	-	-	0.1	1.1	-	-	2.5
<b>Total Sustaining Capital</b>	<b>0.9</b>	<b>6.4</b>	<b>14.8</b>	<b>7.7</b>	<b>2.7</b>	<b>6.9</b>	<b>11.5</b>	<b>27.9</b>	<b>13.4</b>	<b>25.7</b>	<b>20.9</b>	<b>7.3</b>	<b>4.2</b>	<b>8.7</b>	<b>-</b>	<b>159.1</b>

## ROYALTIES

Western Australia has a 5% royalty on uranium production, which is estimated to provide the State with approximately A\$14.2M per annum of revenue over the LOM of the MRP (based on the base case uranium price and exchange rate used in this study).

In addition to the WA State royalty, Vimy granted Resource Capital VI L.P. (RCF VI) a mineral royalty of 1.15% of gross revenue from all products produced from the MRP, for an A\$10M cash payment which formed part of a funding package with RCF VI finalised in August 2015.

## PREVIOUS OPERATING COST COMPARISON

A comparison of the change in the LOM C1 operating cost estimate developed for the DFS, at US\$27.95/lb U<sub>3</sub>O<sub>8</sub>, to that released to the market in November 2015 for the PFS, at US\$31.34/lb U<sub>3</sub>O<sub>8</sub> (after base metals by-product credits), is presented in Figure 12.3.

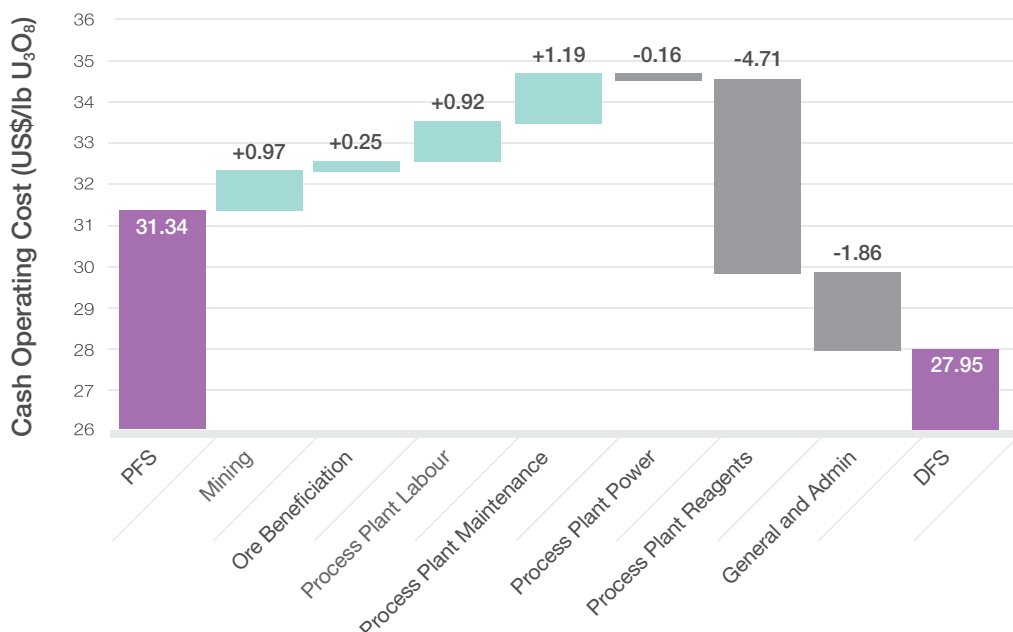


Figure 12.3: Comparison of DFS vs PFS Cash Operating Cost Estimate

The DFS LOM cash operating cost has reduced by US\$3.40/lb  $U_3O_8$  from the PFS cost estimate, with the following cost centres being responsible for the overall 12% reduction in cost:

- » Mining costs have increased by US\$0.97/lb, due to a revision of overburden in-situ wet bulk densities and increased accuracy of surface topography;
- » Ore beneficiation costs have increased marginally by US\$0.25/lb, primarily due to additional maintenance consumables for the mineral sizer and log washer;
- » Process plant labour costs have increased by US\$0.92/lb, due to additional manning and increase in salaries;
- » Process plant maintenance costs have increased by US\$1.19/lb, due to higher maintenance assumptions which are reflective of the corrosive process conditions;
- » Process plant reagent costs have decreased by US\$4.70/lb, as a result of the sulphuric acid plant being incorporated into the project; and
- » General and administration costs have decreased by US\$1.86/lb, primarily due to lower competitive quotations received for accommodation, flights and freight services.



Ambassador West test pit - job done.

# URANIUM MARKET

p96-p103







## Highlights

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Almost all uranium is sold on long-term contracts directly between miners and the utilities; these contracts are confidential and have a very limited relationship with the oft-quoted ‘spot price’.

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As contracts continue to roll off, higher cost producers will need to ‘reposition’. Global stockpiles might be able to sustain demand in the short term, however, this is not a sustainable strategy.

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Nuclear generating capacity is expected to increase by 38% in the next decade.

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Current and growing future demand for nuclear power means existing mines must remain open and new mines need to come on stream.

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Photo credit: [pdac.ca/convention](http://pdac.ca/convention)  
and [envisiondigitalphoto.com](http://envisiondigitalphoto.com)

# AS LONG-TERM CONTRACT PRICES INEVITABLY CORRECT, VIMY'S MULGA ROCK PROJECT WILL BECOME A STRATEGICALLY IMPORTANT URANIUM MINE.

## URANIUM MARKET

The nuclear industry is a somewhat closed club and as a result, many investment analysts often overlook the subtle nuances within the uranium market. For example, an emphasis by some commentators on the 'spot' uranium price belies a fuller understanding of the more important, but less visible, 'long-term contract' market. Moreover, the uranium market is not like typical metal markets in that there is no clearing house like the London Metal Exchange. Almost all uranium is sold on long-term contracts directly between the miners and the utilities; these contracts are confidential and have a very limited relationship with the oft-quoted 'spot price'. However, the spot price is the only visible measure of the uranium price and so has a huge influence on not only market sentiment, but has also created unrealistically low expectations on the part of utilities regarding fair long-term contract prices.

Owing to the mostly conflicting, and therefore mostly incorrect, publicly available data, Vimy has embarked on its own detailed view on the current and future state of the long-term contract market. Various development scenarios are considered for the growth of nuclear power over the period and these scenarios are then converted into an associated UOC demand estimate.

The present uranium market pricing mechanism, both in proposed new contracts and the current spot price, would be inadequate to sustain production of current global uranium demand in a normal metals market. However, most uranium miners are shielded by a portfolio of long-term contracts written at a time of historically high uranium prices. But over the next few years, many of these contracts come to an end and so the industry is entering a period of re-adjustment as the disconnect between utilities and the uranium miners begins to play out.

This situation was demonstrated through the significant announcement by Cameco Corporation (TSX:CCO) on 8 November 2017 about the suspension of operations at the McArthur River Mine in Saskatchewan for ten months from January 2018 (CCO 69.8% ownership).

This single mine produced 18Mlbs  $U_3O_8$  in 2016 and contributes 11% of global primary uranium supply. It is also one of the lowest cost producers on Vimy's uranium cost curve (Figure 13.1). Yet, as Cameco admits, the favourable contracts are running out and it is necessary to reposition the company to sustain cash flows.

Furthermore, on 4 December 2017 Kazatomprom announced a 20% reduction in annual production over the next three years, and approximately 10Mlbs  $U_3O_8$  in 2018 alone. When combined, these are significant reductions amounting to 18% of global uranium production.

As contracts continue to roll off, the higher cost producers will also need to 'reposition' and while global stockpiles might be able to sustain demand in the short term, this is not a sustainable strategy. Current and growing future demand for nuclear power means existing mines must remain open, and new mines need to come on stream.

As long-term contract prices inevitably correct to sustain and grow primary supply uranium production, Vimy's Mulga Rock Project will become a significant and strategically important uranium mine.

## URANIUM FUEL CYCLE

All uranium mines produce a uranium oxide concentrate referred to as UOC, but with slightly differing chemical composition depending on the uranium process used (i.e.  $U_3O_8$ ,  $UO_3$ ,  $UO_4$ ). In any event, all UOC is normalised to  $U_3O_8$  for reporting purposes and this section will refer only to  $U_3O_8$  or UOC interchangeably.

To prepare uranium for use in a nuclear reactor, it undergoes mining and milling, conversion, enrichment and fuel fabrication for use in the reactor. These steps make up the 'front end' of the nuclear fuel cycle.

Figure 13.2 shows the 'nuclear fuel cycle' and a full description is available on the World Nuclear Association website.

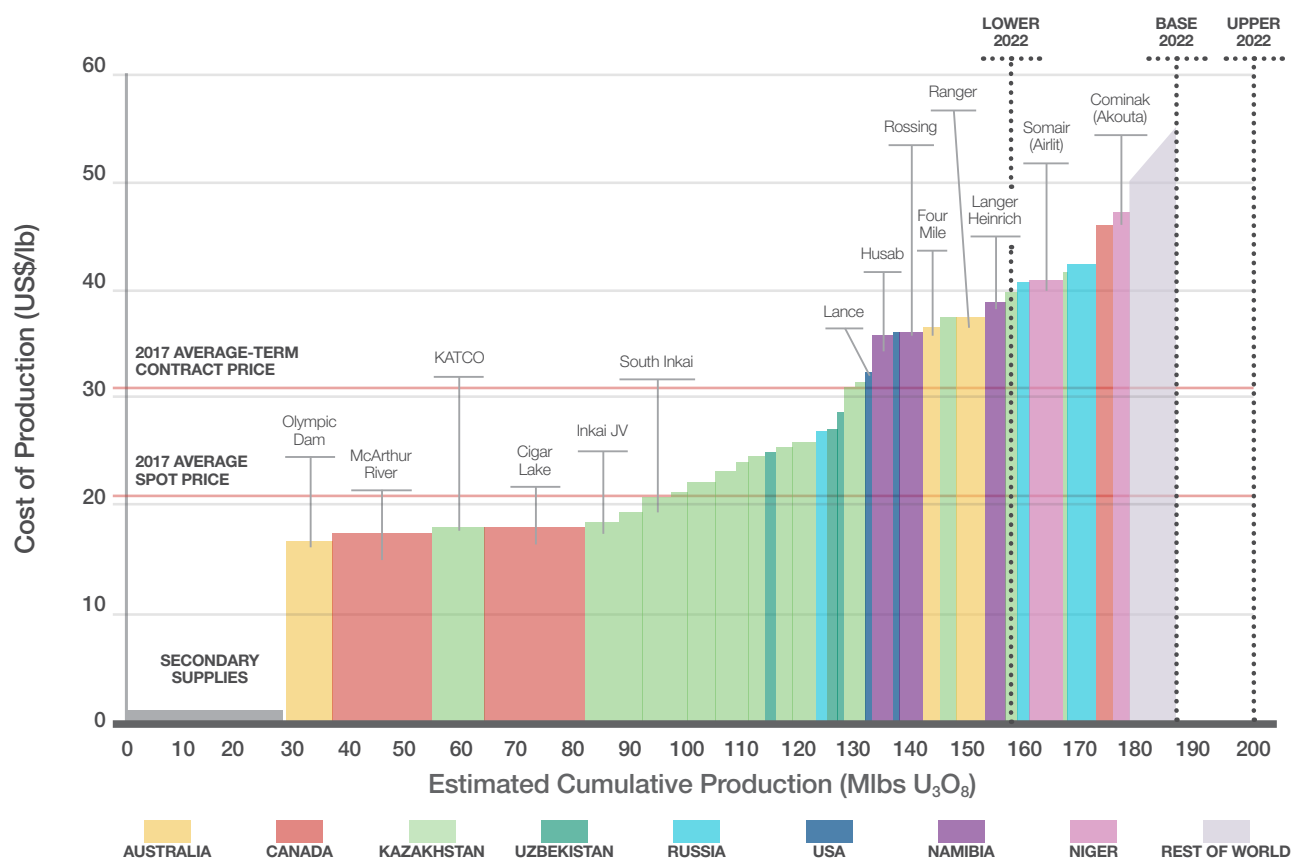


Figure 13.1: Estimated 2017 'All-In Sustaining Cost' of Global Uranium Production - showing Vimy's Demand Cases (Lower, Base, Upper)

Source: Company Data + Analysts' Views + Vimy Calculations, US Energy Information Administration | 2016 U Marketing Annual Report

Uranium sold by Australian mining companies can only be used as fuel in nuclear reactors. Reactors typically burn circa 27t of uranium fuel for each GW of electricity produced. This requires circa 200 tonnes, or 440,000lb of UOC to go into the front end of the fuel cycle.

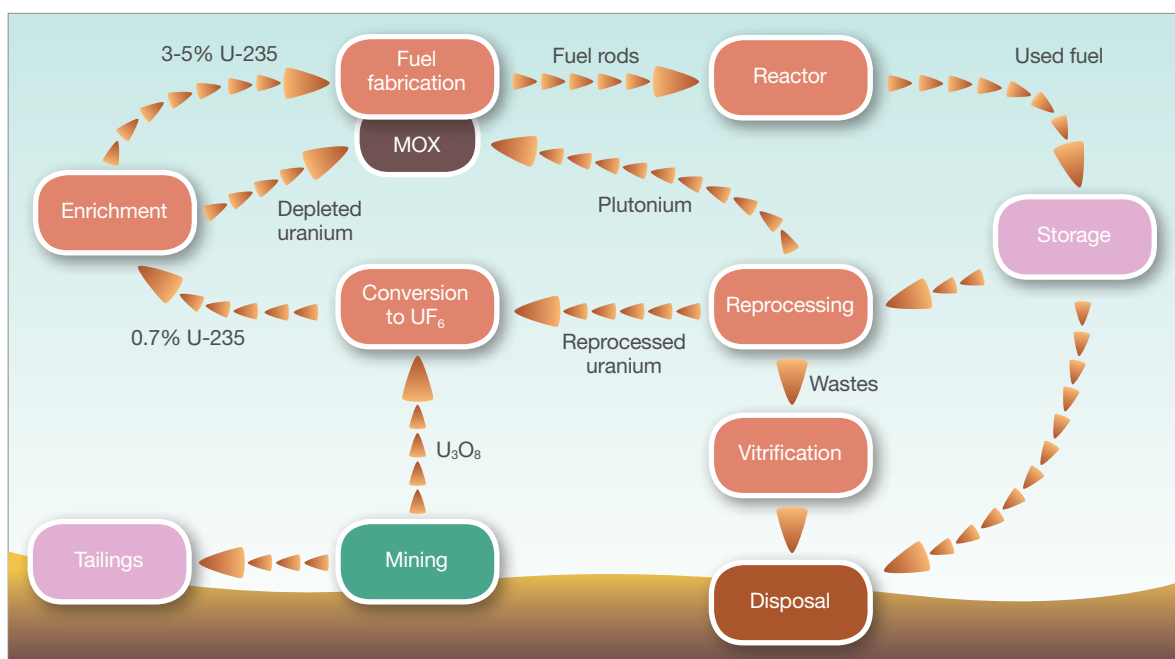


Figure 13.2: The Nuclear Fuel Cycle

Courtesy of World Nuclear Association



## NUCLEAR CAPACITY DEVELOPMENTS

Vimy has developed three scenarios (Base, Upper and Lower) for the development and growth of nuclear capacity. The Company considered the two main variables to total nuclear capacity: new reactors coming on line, and existing reactors being retired.

These are predictable factors as any new reactor coming into operation will have been through a long lead-in and once in the construction phase is subject only to possible construction delays. Reactor life is also relatively long-term and predictable, although life extensions/early retirement decisions can be made with only a few years' notice.

Refurbishments and extensions, particularly in the OECD nations with aging nuclear fleets, will certainly play a bigger role moving forward.

In completing our demand model, Vimy considered five key issues:

- » The restart of Japan's nuclear reactors
  - Japan restarts 55% of its pre-Fukushima reactor fleet (26 GWe)
  - Japan will source all of its uranium requirements from existing stocks
- » China's nuclear build program
  - Inland program commences from 2020
  - Chinese build capacity increases
- » France's continued support of nuclear energy
  - provides 75% of France's electricity
  - Germany's experience pushes France's timing of their reduction of nuclear to 2035
- » American plans to sustain its existing nuclear fleet
  - Nuclear provides 20% of electricity and 60% of its non-emitting electricity generation
  - USA comprises 26% of uranium demand; (40% from Kazakhstan, 40% from Canada)
- » The adoption of nuclear energy by new players particularly in the Middle East and non-OECD countries
  - Non-OECD 'superpowers' Russia, China, and India are ramping up nuclear
  - Middle Eastern countries building and/or considering nuclear power.

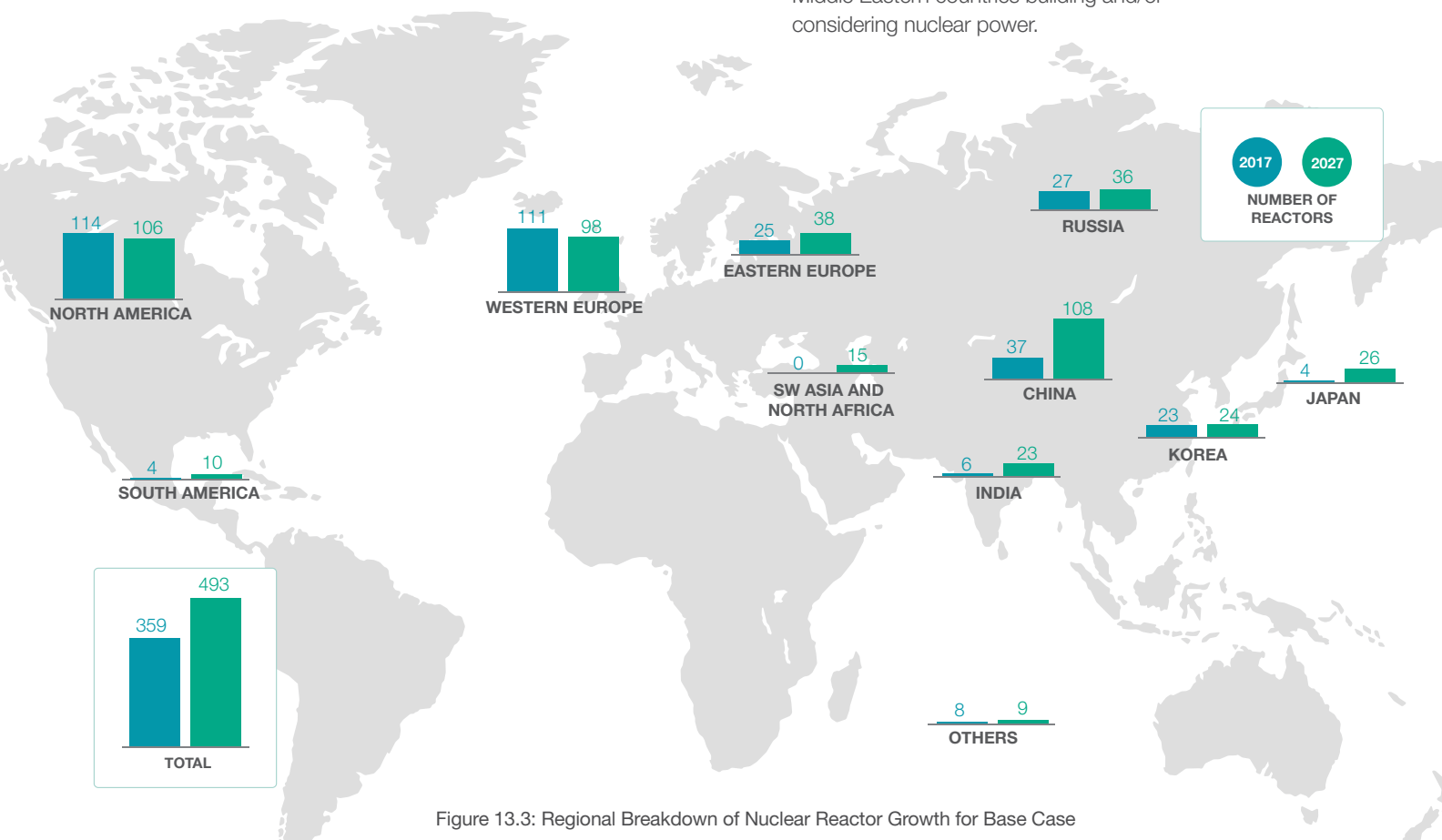


Figure 13.3: Regional Breakdown of Nuclear Reactor Growth for Base Case

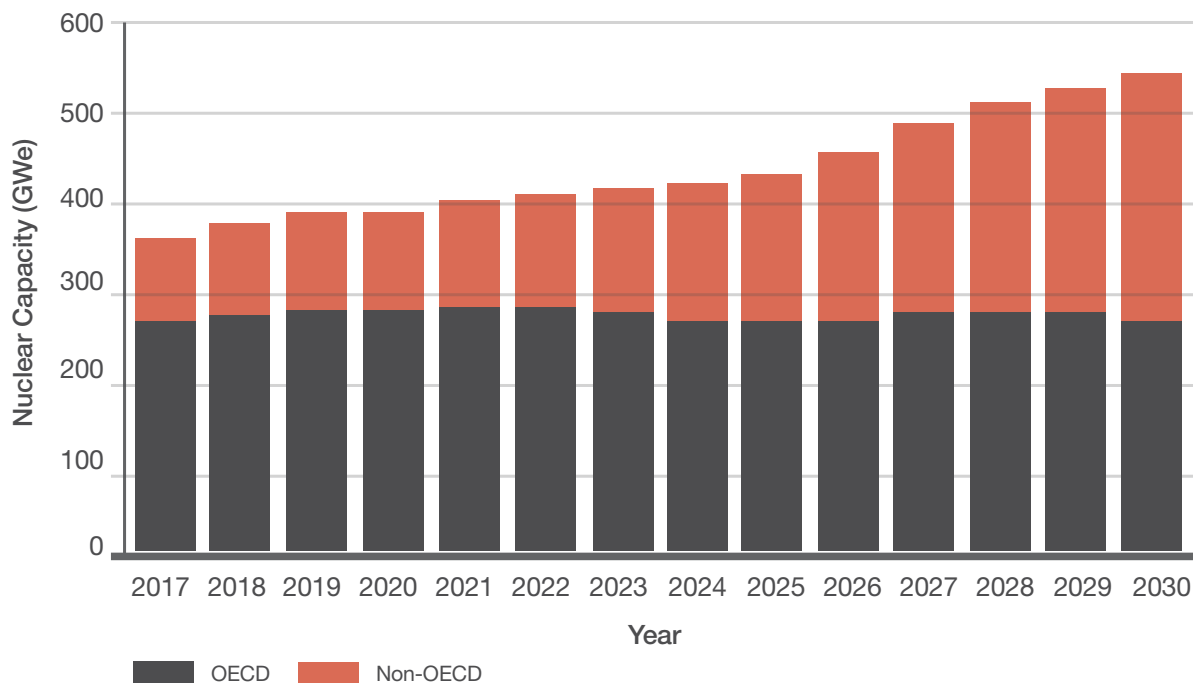


Figure 13.4: Base Case Growth (GWe) in Nuclear Capacity OECD vs Non-OECD

## DEVELOPMENT SCENARIOS

The three nuclear capacity development scenarios were then converted into three scenarios for expected demand of UOC.

The Base Case uses information from the current build programs and planned developments against expected retirements based on announced closure plans and current licencing practices. The Lower and Upper Cases then assess other variables which will cause variation from the Base. This modelling of nuclear capacity growth was done country by country and by individual reactors within each country.

The Base Case was fundamentally conservative as when a range of possibilities was assessed, the modelling used the outcome that had the lowest nuclear capacity (e.g. build times).

The Lower Case assumed all green-left political posturing would be put into effect (i.e. France, Korea), and modelled possible delays to Japanese restarts and global build start-ups.

The Upper Case assumed no politically-based closures and assumed new builds, refurbishments, and restarts being done exactly as scheduled rather than factoring in delays typical of the recent past, which was done for the Base Case.

Vimy's Base Case scenario shows 3.3% annual growth out to 2030 (compared to the World Nuclear Association's 1.7%) and is based on growth from China, India, Russia, Japanese restarts, and the Middle East. China, Russia, and Korea also have aggressive export plans to Eastern Europe and Southeast Asia.

Popular cultural pessimism about nuclear power's prospects is largely derived from the perspective of OECD economies where cheap gas and governments' financial support for renewables has undermined the economics of nuclear power as well as emboldening anti-nuclear sentiment. But growth in nuclear capacity is predominantly in the non-OECD countries that need rapidly increased electricity generating capacity without the corresponding pollution and where nuclear is in competition with coal. The difference in this outlook is starkly illustrated by comparing OECD countries with non-OECD countries as shown in Figure 13.4.

## NUCLEAR FUEL REQUIREMENTS

When assessing fuel requirements for the world nuclear fleet, Vimy considered these factors:

- » Existing fleet, which uses approximately 200t of  $U_3O_8$  annually per GWe;
- » New builds, which have the same burn rate as the existing fleet, but require about two and a quarter years' worth of fuel in the core on initial fuelling; and
- » Japanese start-ups, which do not require initial fuelling and will draw on existing stocks for the assessment period.

The timing and extent of the Japanese restarts is an inexact science. There are 4.2GWe in five reactors currently authorised to operate, and another 2.3GWe in two reactors expected to commence operations early in 2018. A further 19.9GWe have applied for restarts and are undergoing assessment; other reactors will subsequently apply over time.

As a working assumption, the Japanese restart is averaged over the next five years adding 4.4GWe each year and increasing the global fuel burn by around 10Mlbs per year by the end of 2022. However, when modelling the impact of Japanese restarts on aggregate fuel demand, Vimy assumed that Japanese restarts will only use existing stock holdings for refuelling the idled reactors and that there will be no increase in demand caused by the need to build precautionary stocks or to hold product as part of new working inventory.

Adding together overall demand for nuclear fuel as a result of the expected Japanese restart program with expected developments everywhere else results in a demand profile that commences at around 165Mlbs per annum, but grows quickly over the next decade by an average of 7Mlbs per year to reach 235Mlbs per annum by 2027.

## SUPPLY

There are two forms of supply of uranium for use as fuel in nuclear reactors - primary supplies which are stocks of uranium that are mined and sent for immediate use as fuel in nuclear reactors, and secondary supplies which are all other sources of uranium that have been mined in earlier years and held in various parts of the fuel cycle which find their way back to being used as nuclear fuel. These secondary supplies include:

- » Civilian, government and military stockpiles;
- » Reprocessing spent fuel (plutonium);
- » Underfeeding; and
- » Enriching already depleted uranium.

Primary supply of uranium is dominated by a handful of key players; Kazatomprom, Cameco and Areva control around two-thirds of the world's primary supply. All of these companies announced production cuts for 2018 which will remove about 40Mlbs of production compared to 2016 levels.

Although Cameco announced a 'temporary' ten-month suspension of mining at McArthur River, if contract prices remain low, that suspension is expected to be extended until prices have adequately and sustainably recovered. The same holds true for Areva and Kazatomprom in that the announced cuts are unlikely to be reversed until pricing fundamentals improve. Furthermore, the uranium price required to provide an economic incentive to add future production required to meet increasing demand must be substantially higher than current prices and, in Vimy's view, higher than the price required to justify a reversal of the above-mentioned cuts. Accordingly, it can be deduced that a return to full production of those assets would not cause the same oversupply situation to recur for Vimy's base demand case.

Vimy's model assumes that the production cuts are expected to last for three years before being reviewed as the market recovers and achieves equilibrium.

Secondary supplies are expected to remain relatively stable at just below 30Mlbs per annum until 2020 and then fall as a result of the expected decrease in US Department of Energy uranium stockpile transfers. Although third party forecasts suggest this will be offset by additional supplies generated by the enrichment of depleted uranium using laser technology from 2024 onwards, Vimy does not expect this to be implemented until well after 2030.



## MARKET BALANCE AND PRICE

The announced production cuts are expected to be sufficient to generate a significant market deficit with supply falling 25Mlbs and demand increasing by about 5Mlbs, turning an estimated 12Mlb surplus for 2017 into an 18Mlbs deficit in 2018. That market deficit is then expected to grow as new nuclear capacity starts up in Finland (Olkiluoto 3), South Korea (Shin Kori 4 and Shin Hanul 1-2) and the UAE (Barakah 1-4) and further Japanese restarts lead to a burn requirement that outpaces new production ramp-ups and existing miners continuing to maintain their discipline.

It is assumed that by the end of 2020, with the main producers having maintained supply-side discipline, prices will have recovered sufficiently to warrant a reversal of supply-side cuts which would be unwound over the following two to three years. However, under Base Case assumptions, nuclear capacity growth will

have been sufficient to keep the market in a technical deficit, with the shortfall being met by stockpile management and drawdown. With nuclear capacity expected to show strong growth, particularly in China from the early 2020s onwards, the outlook is for growing shortages.

Vimy's view is that once long-term contract prices have reached a level around US\$60/lb, the dominant supply-side participants are likely to be satisfied that prices have recovered sufficiently and that reversing the cuts will not precipitate a price collapse.

The recent relationship, post the 2007 uranium bubble, between the spot price and long-term contract price has shown an average premium for long-term prices of around 25%; this differential indicates that a spot price of around US\$48/lb would be consistent with the long-term contract price of US\$60/lb.

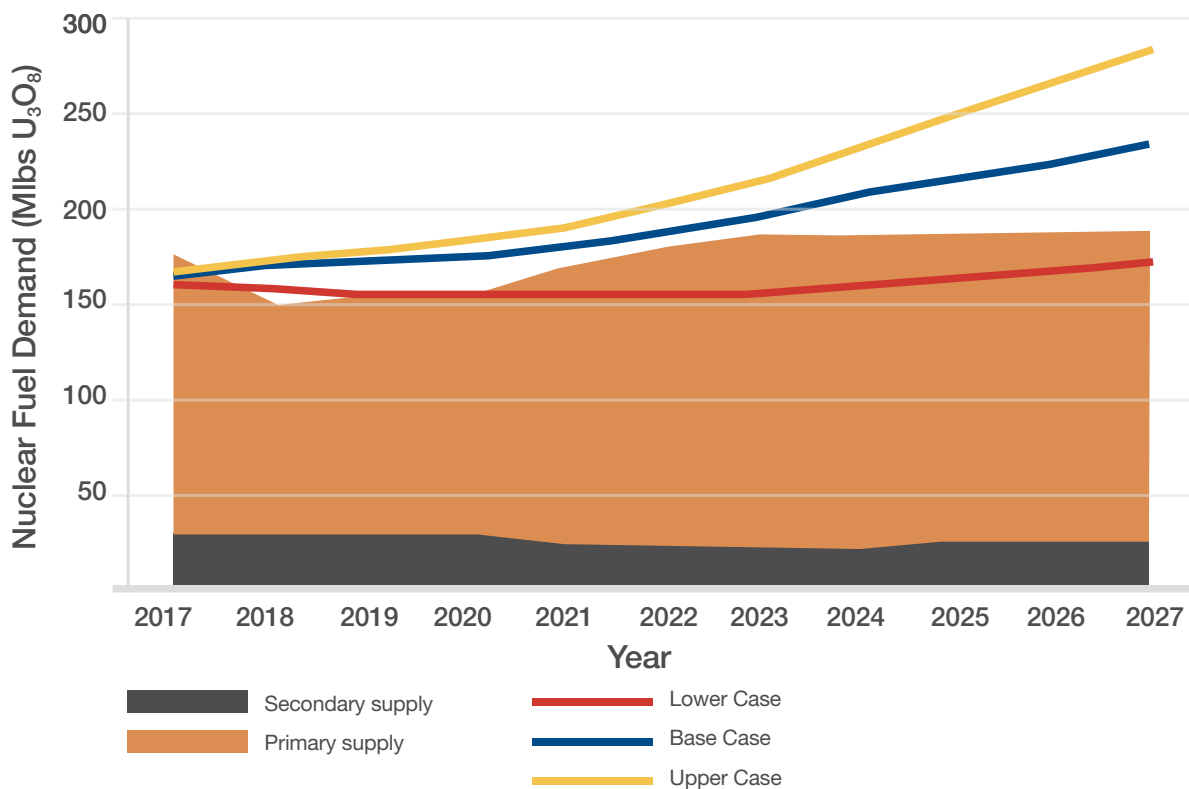


Figure 13.5: Market balance under differing scenarios

Should demand ultimately prove to be closer to Vimy's Upper Case, then a long-term price of US\$60/lb is unlikely to incentivise sufficient new production to replenish depletion of existing production and to meet increasing new demand. Accordingly, at a US\$60/lb long-term contract price, it is foreseeable that further deficits will occur, leading to a further escalation in prices beyond Vimy's price assumption.

# FINANCIAL EVALUATION

p104-p109



Pickering nuclear plant, Ontario Canada



## Highlights

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The project NPV<sub>8</sub> is A\$530M at an assumed long-term uranium contract price of US\$60/lb U<sub>3</sub>O<sub>8</sub>, with an IRR of 25% and project payback period of 3.1 years after commencement of production.

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For every US\$5/lb increase in the uranium price, the project NPV<sub>8</sub> increases by A\$172M.

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The all-in capital breakeven uranium price for the project is US\$44.58/lb U<sub>3</sub>O<sub>8</sub>.

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The project generates an average A\$134M per annum free cash flow (EBITDA) after royalties.

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THE PROJECT  
GENERATES AN  
AVERAGE A\$134M  
PER ANNUM FREE  
CASH FLOW (EBITDA)  
AFTER ROYALTIES.

### PROJECT ECONOMIC ANALYSIS

Project financial analysis is based on a '100% equity' basis and the cost of capital is ignored. All results are inclusive of a 5% Western Australian royalty and a 1.15% RCF VI royalty entitlement as announced to the ASX on 17 August 2015. Results are on a pre-tax basis in A\$, unless stated otherwise. Financial modelling is inclusive of all capital items including mining fleet, mining pre-strip, process plant, project infrastructure and LOM sustaining capital.

A project financial model has been developed with a valuation date of 1 January 2018, coinciding with an expected decision to commence development in the second half of 2018.

Table 14.1 shows the variance in NPV<sub>8</sub>, IRR and project payback period for the different uranium contract prices. The project NPV<sub>8</sub> is A\$530M at an assumed long-term uranium contract price of US\$60/lb U<sub>3</sub>O<sub>8</sub>, with an IRR of 25% and project payback period of 3.1 years after commencement of production.

The all-in capital breakeven uranium price for the project is US\$44.58/lb U<sub>3</sub>O<sub>8</sub> using a discount rate of 8%. The project generates on average A\$134M per annum free cash flow (EBITDA) after royalties.

Ore haulage at Ambassador



Table 14.1: Financial return at different uranium prices

Item	Unit	Uranium Price (US\$/lb U <sub>3</sub> O <sub>8</sub> )				
		US\$44.58/lb	US\$55/lb	US\$60/lb	US\$65/lb	US\$70/lb
NPV <sub>8</sub> (inc. royalties, pre-tax)	A\$M	0	358	<b>530</b>	702	874
IRR	%	8.0	20.4	<b>25.3</b>	29.8	34.1
Payback	Years	5.6	3.7	<b>3.1</b>	2.6	2.2

Figure 14.1 shows the impact of capital and operating costs, production and uranium price on the project economics, within +/-10% accuracy of the DFS. Uranium price has the greatest impact on the project economics with every US\$5/lb increase in the uranium contract price resulting in the NPV<sub>8</sub> increasing by A\$172M.

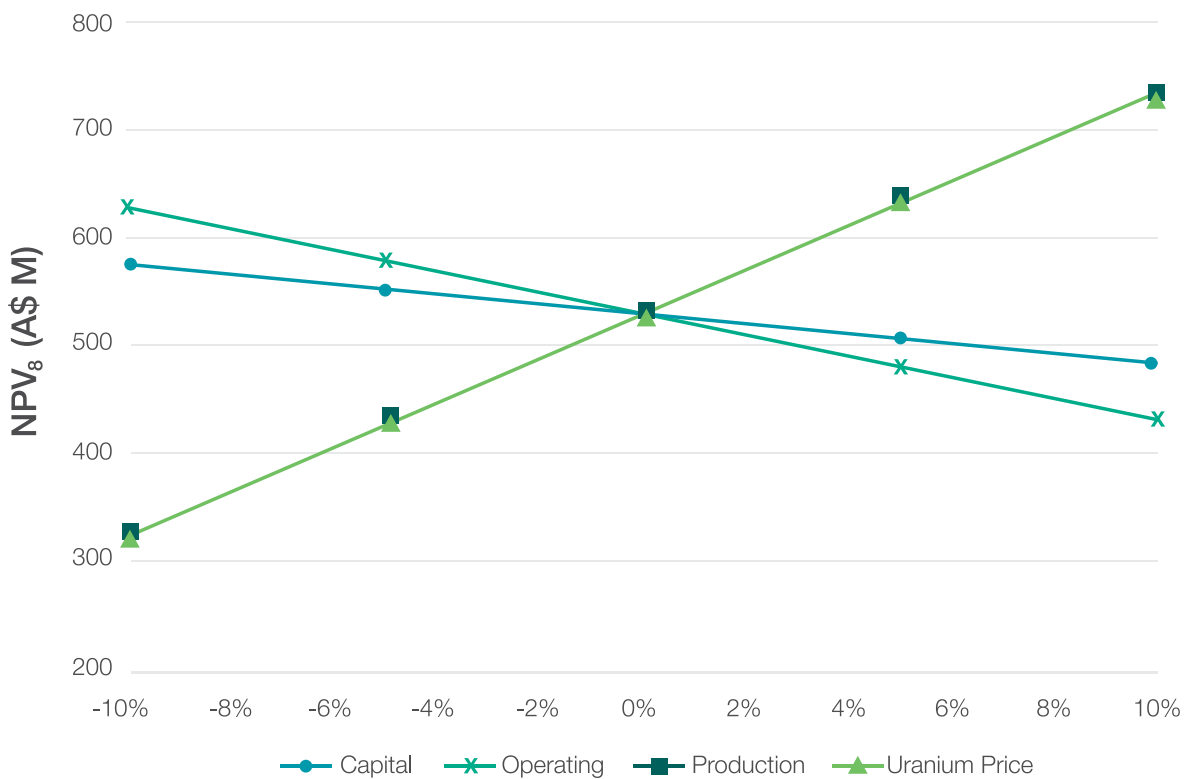


Figure 14.1: Project Sensitivity Analysis at US\$60/lb

## EXCHANGE RATE

The project financials are dependent on the AUD:USD exchange rate due to uranium sales predominantly being in US dollars. Vimy has assumed a flat exchange rate over LOM of A\$1.00:US\$0.70. Figure 14.2 shows the impact of the AUD:USD exchange rate on the NPV<sub>8</sub> and IRR assuming a fixed uranium price of US\$60/lb U<sub>3</sub>O<sub>8</sub>.

Diesel and sulphur are the two main operating cost items that are exposed to changes in exchange rate. These have been included in the exchange rate analysis shown in Figure 14.2. For every A\$0.02 decrease in the AUD:USD exchange rate it has an approximate A\$48M improvement in the project NPV<sub>8</sub>.

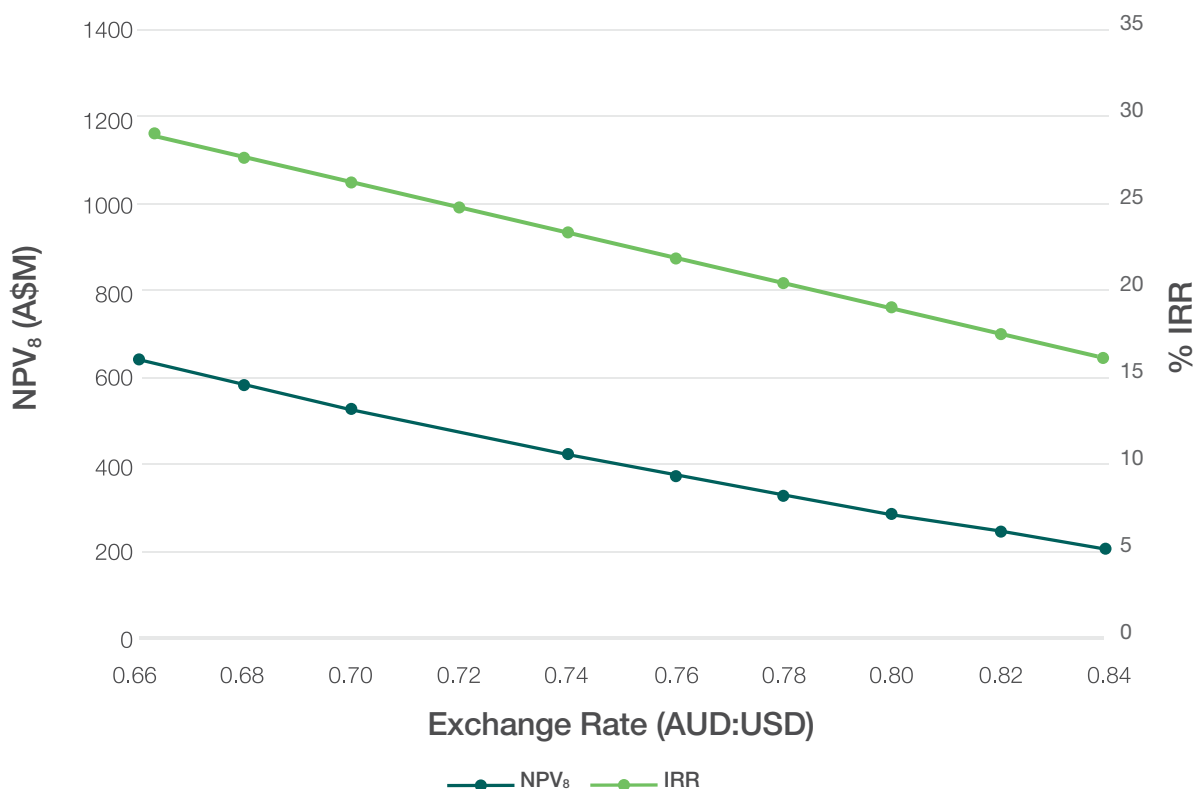


Figure 14.2: Impact of Exchange Rate on MRP Project Economics





## COMPARISON DFS AND PFS

The NPV<sub>8</sub> for the DFS has improved by approximately A\$140M when compared to the PFS using the same uranium price (US\$60/lb) and exchange rate (A\$1.00:US\$0.70). This improvement is primarily attributable to the following items:

- » Higher mineral resource uranium grade;
- » Lower uranium price pit shells selected for the DFS;
- » Inclusion of a sulphuric acid plant in the processing facility;

- » Higher uranium production during initial ramp-up period due to higher grade ore being sourced; and
- » Nameplate uranium production increased from 3.0 to 3.5Mlbs U<sub>3</sub>O<sub>8</sub> per annum.

Figure 14.3 shows a comparison of the project economics between the DFS and PFS over a range of uranium prices. The graph shows the MRP is highly leveraged to an upside in the uranium price.

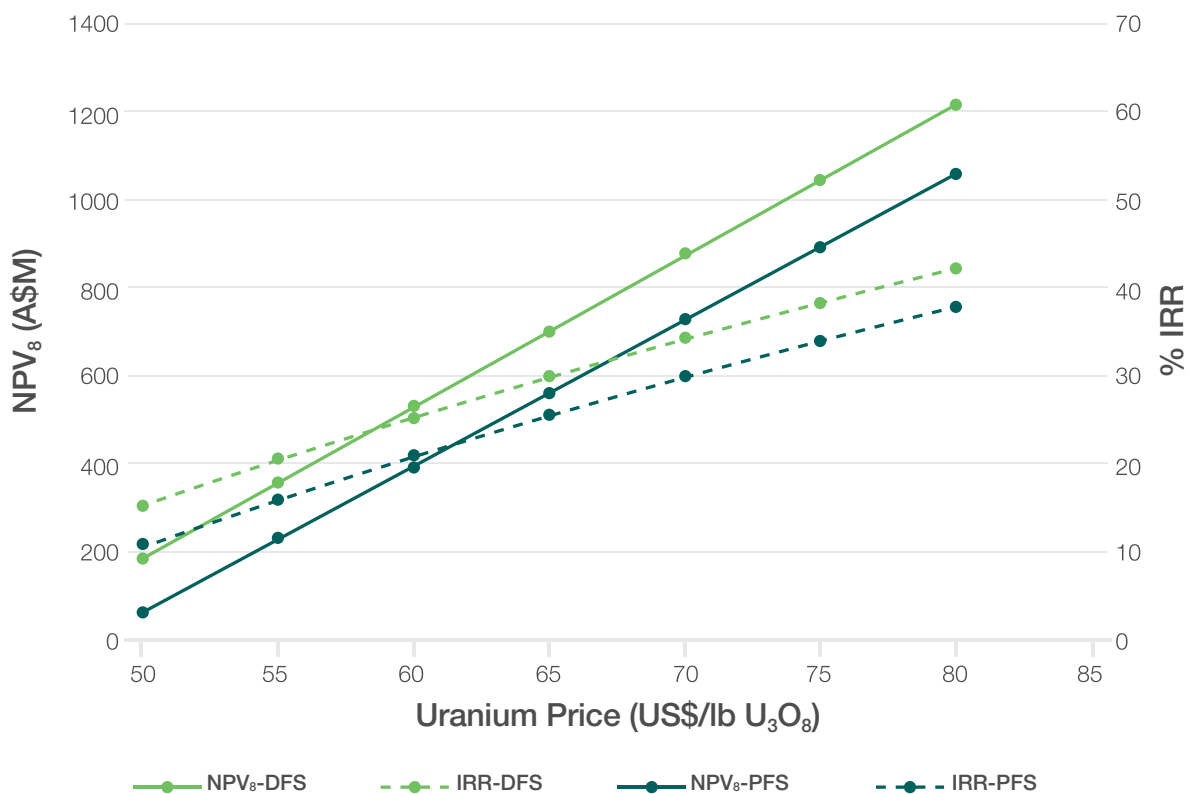


Figure 14.3: Comparison of Project NPV<sub>8</sub> and IRR for DFS and PFS

Piacentini commencing ambassador East test pit

## COMPLIANCE STATEMENT

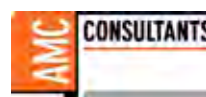
The information in this report is extracted from ASX announcement entitled 'Significant Resource Update – Mulga Rock Cracks 90Mlbs' released on 12 July 2017 and available to download from [asx.com.au](http://asx.com.au) ASX:VMY. The Company is not aware of any new information or data that materially affects the information included in the original market announcement and, in the case of estimates of Mineral Resources 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 have not been materially modified from the original market announcement.

The information in this report is extracted from ASX announcement entitled 'Major Ore Reserve Update – Moving to the go line' released on 4 September 2017 and available to download from [asx.com.au](http://asx.com.au) ASX:VMY. The Company 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 Resources 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 have not been materially modified from the original market announcement.

## FORWARD-LOOKING STATEMENT

This report may contain some references to forecasts, estimates, assumptions and other forward-looking statements. Although Vimy believes that its expectations, estimates and forecast outcomes are based on reasonable assumptions, it can give no assurance that they will be achieved. They may be affected by a variety of variables and changes in underlying assumptions that are subject to risk factors associated with the nature of the business, which could cause actual results to differ materially from those expressed herein.

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