



**ASX  
NTU**



**NORTHERN  
MINERALS**

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**Australia's  
Heavy Rare Earths  
Producer**

November 2018

**Presented by  
George Bauk**

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### Compliance Statement

The information in this presentation that relates to the Mineral Resource Estimates of the Wolverine deposit is extracted from the report entitled “Increased Mineral Resource delivers more good news” dated 23 February 2015 and is available to view on the Company’s website ([www.northernminerals.com.au](http://www.northernminerals.com.au)). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and 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 the announcement that relates to the Mineral Resource Estimates of the Cyclops and Banshee deposits is extracted from the report entitled “Further Increase in Browns Range Mineral Resource” dated 15 October 2014 and is available to view on the Company’s website ([www.northernminerals.com.au](http://www.northernminerals.com.au)). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and 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 the announcement that relates to the Mineral Resource Estimates of the Gambit, Gambit West and Area 5 deposits is extracted from the report entitled “Wolverine Total Resource Doubled in a Major Upgrade of Browns Range HRE Mineral Resource Estimate” dated 26 February 2014 and is available to view on the Company’s website ([www.northernminerals.com.au](http://www.northernminerals.com.au)). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and 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 the announcement that relates to Ore Reserves is extracted from the report entitled Increased Ore Reserve for Browns Range created on 2 March 2015 and is available to view on the Company’s website ([northernminerals.com.au](http://northernminerals.com.au)). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and 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 that relates to Exploration Results or Exploration Targets is based on information compiled by Mr Robin Wilson, a full-time employee of Northern Minerals, a Competent Person, who is a member of the Australasian Institute of Mining and Metallurgy. Robin Wilson has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the “Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves”. Mr Wilson consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

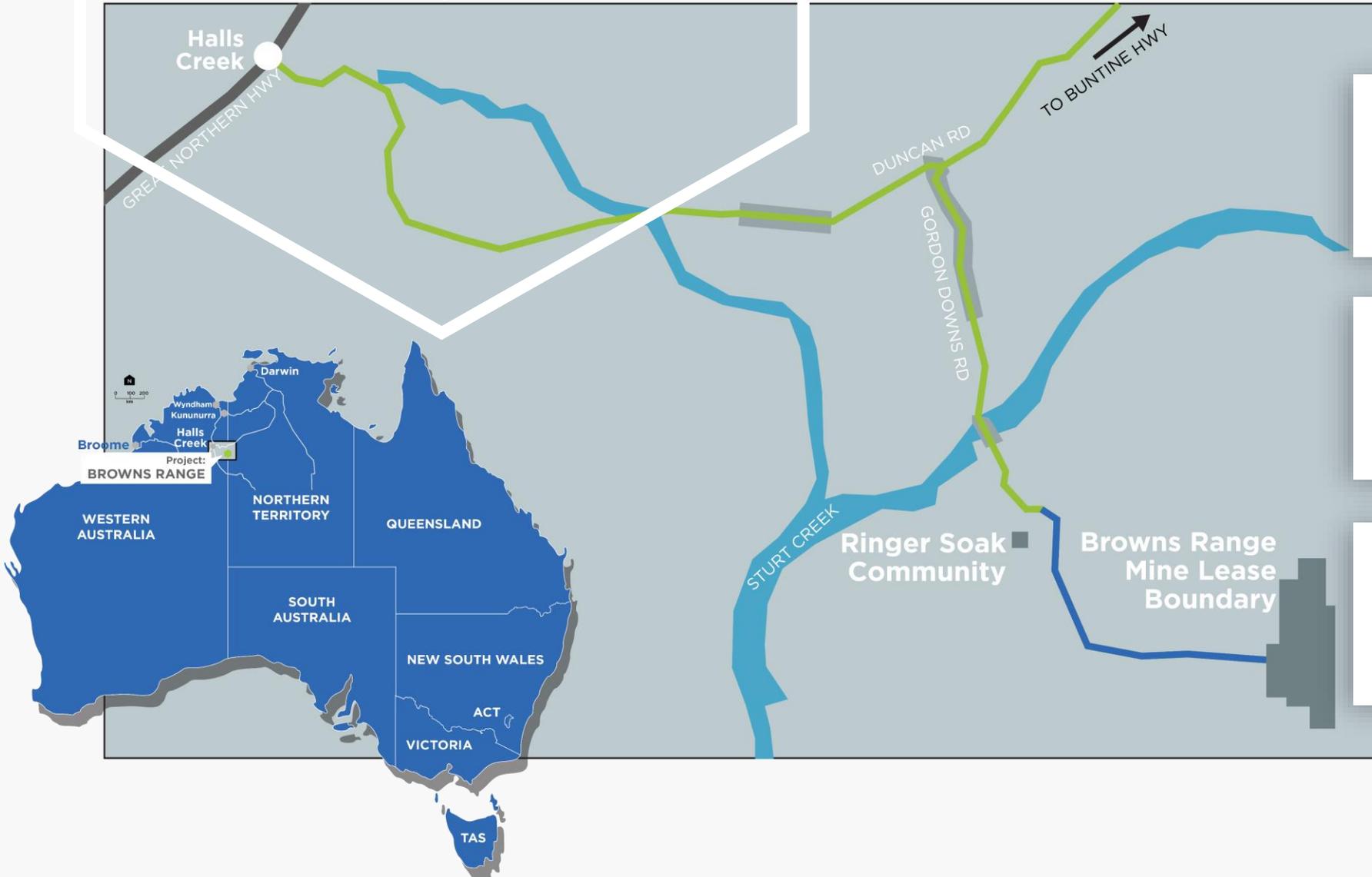
The potential quantity and grade of the Exploration Target is conceptual in nature. There has been insufficient exploration completed in the areas of the Exploration Target and it is uncertain if further exploration will result in the estimation of a Mineral Resource.

The information in the announcement that relates to production targets is extracted from the report entitled “DFS positions Browns Range Project as next dysprosium supplier” dated 2 March 2015 and is available to view on the Company’s website ([northernminerals.com.au](http://northernminerals.com.au)). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and that all material assumptions and technical parameters underpinning the production targets in the relevant market announcement continue to apply and have not materially changed.

TREO = Total Rare Earth Oxides – La<sub>2</sub>O<sub>3</sub>, CeO<sub>2</sub>, Pr<sub>6</sub>O<sub>11</sub>, Nd<sub>2</sub>O<sub>3</sub>, Sm<sub>2</sub>O<sub>3</sub>, Eu<sub>2</sub>O<sub>3</sub>, Gd<sub>2</sub>O<sub>3</sub>, Tb<sub>4</sub>O<sub>7</sub>, Dy<sub>2</sub>O<sub>3</sub>, Ho<sub>2</sub>O<sub>3</sub>, Er<sub>2</sub>O<sub>3</sub>, Tm<sub>2</sub>O<sub>3</sub>, Yb<sub>2</sub>O<sub>3</sub>, Lu<sub>2</sub>O<sub>3</sub>, Y<sub>2</sub>O<sub>3</sub>

HREO = Heavy Rare Earth Oxides – Total of Sm<sub>2</sub>O<sub>3</sub>, Eu<sub>2</sub>O<sub>3</sub>, Gd<sub>2</sub>O<sub>3</sub>, Tb<sub>4</sub>O<sub>7</sub>, Dy<sub>2</sub>O<sub>3</sub>, Ho<sub>2</sub>O<sub>3</sub>, Er<sub>2</sub>O<sub>3</sub>, Tm<sub>2</sub>O<sub>3</sub>, Yb<sub>2</sub>O<sub>3</sub>, Lu<sub>2</sub>O<sub>3</sub>, Y<sub>2</sub>O<sub>3</sub>

# Browns Range East Kimberley, WA



### A local partner

NTU has partnered with the Wunan Foundation for delivery of a Training 2 Work program



### Strategic offtake access

Export via Darwin or Wyndham ports to China



### Commitment to local

Working with local Ringer Soak community for employment opportunities

# Value proposition



## Globally significant

Browns Range is the only non-Chinese producer of dysprosium



## Enhancement initiatives

Several projects underway, including ore sorting, to increase value



## EV growth & military use

A key ingredient in permanent magnets used in EVs and military use



## Exploration upside

New discoveries at Dazzler & Iceman point to improved economics



## In production

Commissioning has commenced and xenotime concentrate produced



## Stable investment jurisdiction

First world economy, infrastructure, environmental and work practices



# Corporate leadership

**Our people** embody the Northern Minerals SPIRIT, a culture of continually striving to deliver exceptional outcomes, leadership and improvements.



**George Bauk, MD/CEO**

Since 2010, George has lead the team from initial discovery to production



**Robin Wilson, Expl. Mgr**

Original Browns Range discoverer, on the hunt for new resources



**Mark Tory, CFO, Comp Sec**

Specialist in innovative finance and capital management



**Bin Cai, Executive Officer**

Strong Chinese connections, critical for finance, construction & offtake



## Operational leadership

**Our team of operational specialists** have years of experience in the production of rare earths. Having experts in their fields allows us to maximise value for shareholders.

**COO**

**Robin Jones, COO**

Driven Browns Range to be the newest dysprosium producer

**EM**

**Eben Van Rooyen – Eng. Mgr**

Charged with building Browns Range as a new greenfields site

**GM**

**Tony Hadley, General Manager**

Experienced rare earths operator, focused on delivering results

**R&D**

**Louis de Klerk, R&D Mgr**

Focus on R&D, continuous improvement & assessment against benchmarks

# Browns Range Project

In **October 2018**, less than 18 months after Board approval, Northern Minerals became the only non-Chinese producer of dysprosium with the commissioning of the three-year Pilot Plant Project, aimed at assessing the technical and economic feasibility of the full-scale operation.



## **\$67m Capital Development**

Three-year project producing 3,300 tonnes of heavy rare earth carbonate



## **Dysprosium & Terbium**

Key heavy rare earth value drivers, required in the EV, turbine and automation sectors



# Dy – critical to the EV evolution

With each electric vehicle using just over 100g of dysprosium, demand is expected to increase to over 3,500tpa by 2030. With over 98% of Dy production from China, there is strong interest in the US and globally for new, sustainable sources of supply.



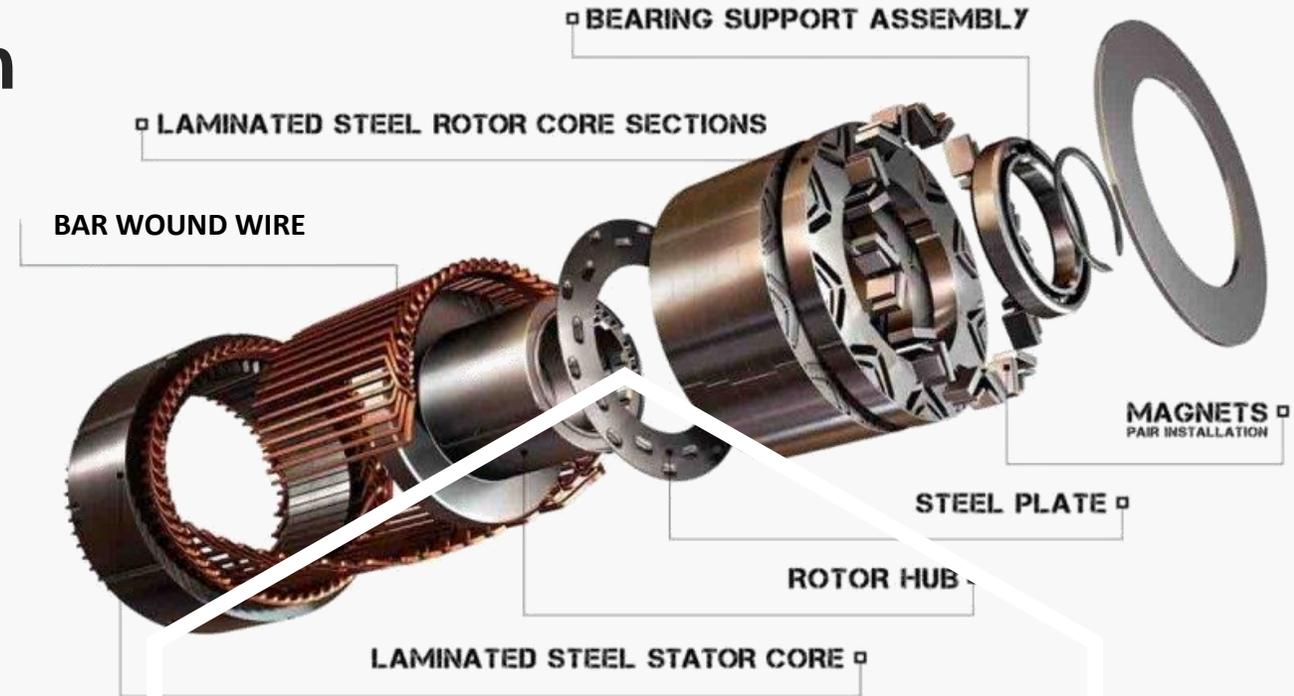
## Chinese dominance

State controlled production from largely dirty in situ leach deposits



## US critical alert

Trump Government identified rare earths as critical to US economic growth

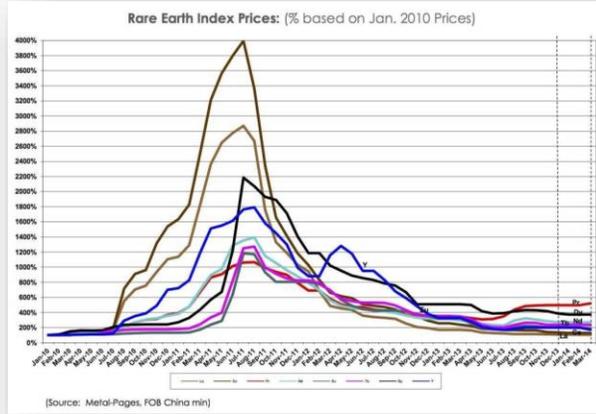


*‘Over 100g of Dysprosium in every electric vehicle’*

# Strategically and politically critical

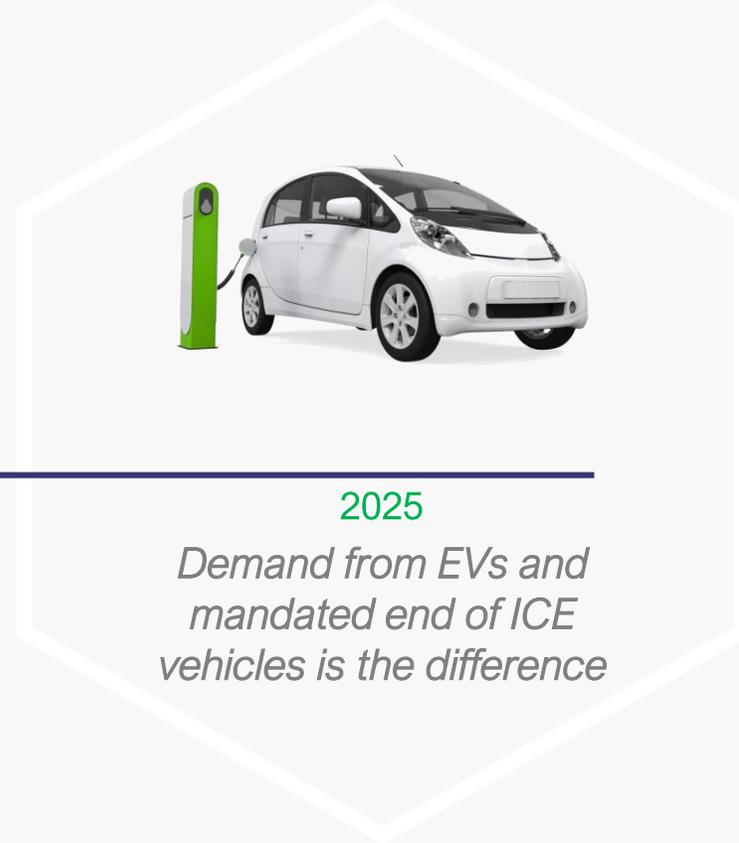
*“Saudi Arabia has oil, but China has rare earths”*

Chinese Premier, Deng Xiaoping



*“This executive order will prioritize reducing the nation’s vulnerability to disruptions in our supply of critical minerals safely and responsibly for the benefit of the American people,”*

US President Donald Trump



1992



2011

*China cuts rare earths exports on South China Sea issues, prices skyrocket.  
US & Japan head to WTO to overturn export quota*

2018



2025

*Demand from EVs and mandated end of ICE vehicles is the difference*

# The competition is unsustainable



Southern China in situ leach mining operation

*China dominates global supply including unsustainable supply, not green not clean.*

- 98% of world's heavy rare earths produced by China;
- Many operations are in situ leach operations, which are dirty and environmentally dangerous;
- Leaching affects the groundwater and water table, making it unsafe for residents;
- Chinese Government has clamped down on illegal operators, either by shutting down or 'legalising' through assimilation into current operators;
- These types of operations are being phased out, however there are no economic alternatives for this type of deposit.



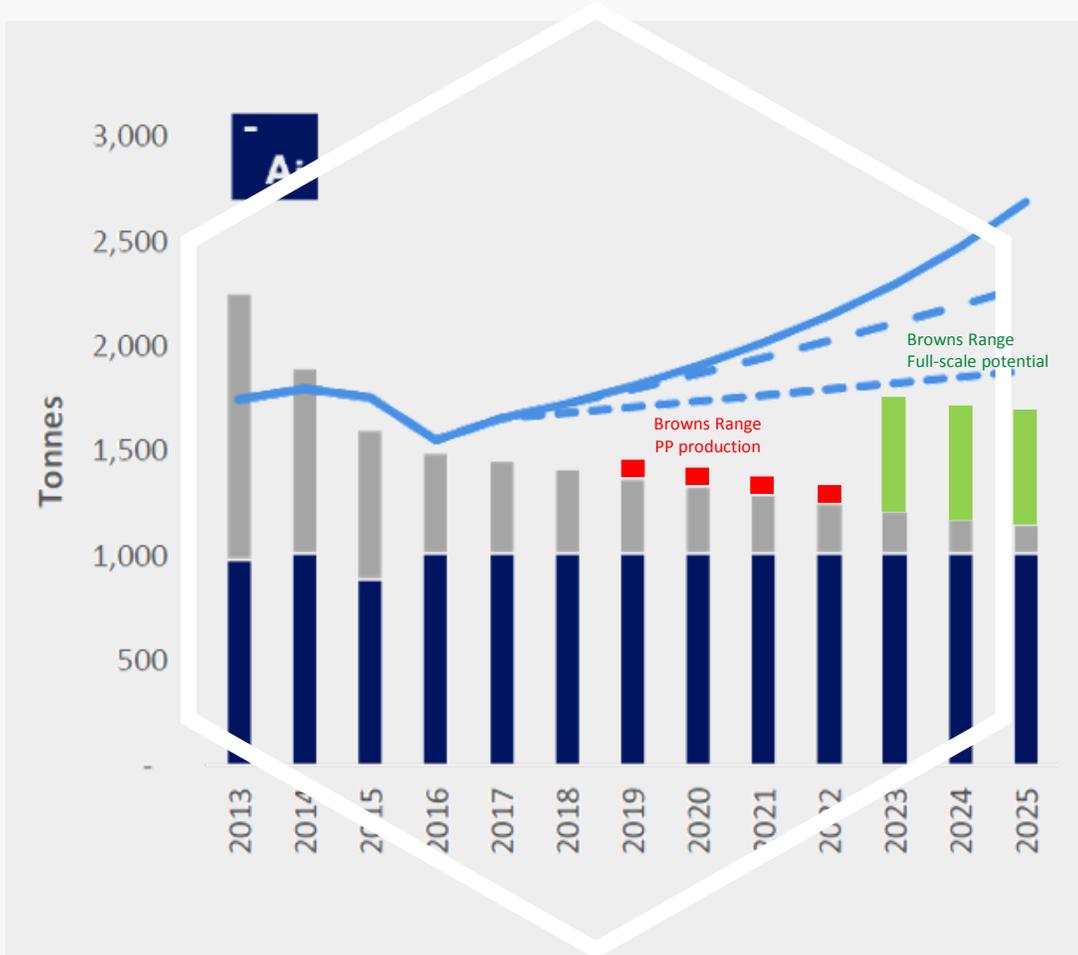
## Australian Dysprosium

**Browns Range** represents a new sustainable, clean source of heavy rare earths.

The Pilot Plant Project incorporates a beneficiation plant and hydrometallurgical circuit, producing heavy rare earth carbonate.

All nameplate offtake for the Pilot Plant Project has been committed to Lianyugang New Materials Sales Co Ltd (JFMAG), a 51% owned subsidiary of Guangdong Rare Earths Group.

**Additional production above the nameplate capacity is not committed and available for offtake.**

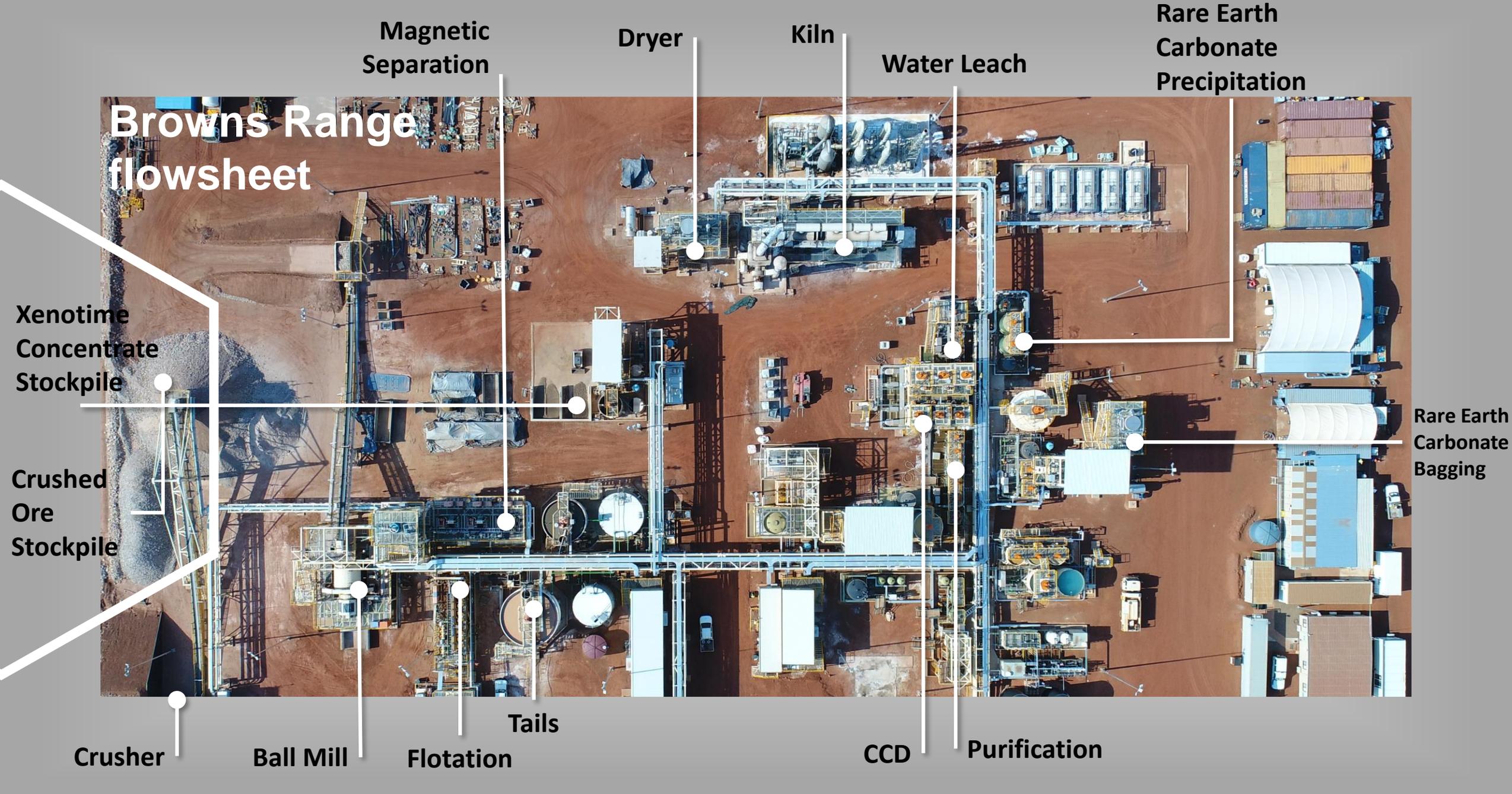


## Filling the supply gap

**Chinese illegal production** is expected to continue falling as the Government cracks down. Even with efficiencies in electric motors, the supply/demand gap is expected to continue widening.



# Browns Range flowsheet



# Staged development plan



## Test Pilot Plant

Mine xenotime ore  
Produce mixed RE carbonate  
Export to offtake customers



## Refine Project

Validate & refine flowsheet  
Implement ore sorting  
Improve xenotime conc. grade  
Investigate plant efficiencies



## Develop Full Project

Economies of scale  
New customer base  
Global disruption to supply



## Downstream Enhancements

Product separation  
Satellite deposits  
New RE revenue streams



## Accelerate Exploration

Increased mine life  
Improve head grade targeting  
Targeting 20+ year mine life





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## First production

On 5 October 2018, just 18 months after the Board approved the project, the Company produced first heavy rare earth carbonate through the hydrometallurgical circuit.

# Ore sorting – a game changer

Following successful trials, the Company is investigating the use of ore sorting technology to reduce the volume of non-mineralized material being processed, therefore allowing more product to be produced.

2.2x

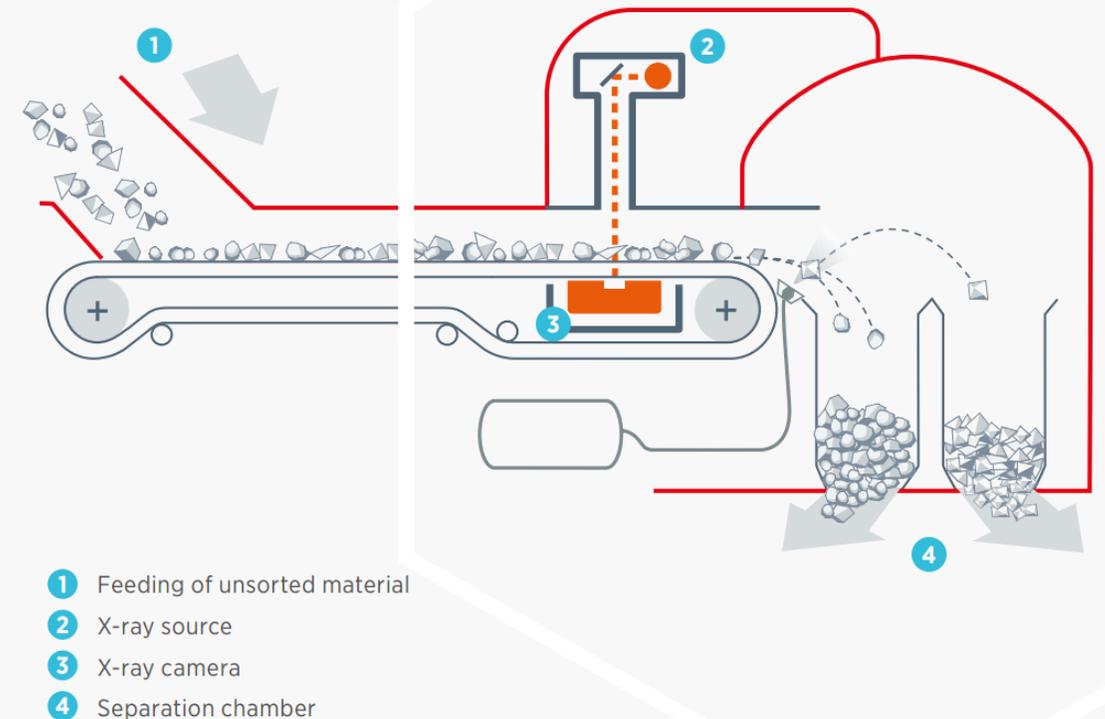
## Head grade improvement

Trials indicate that the head grade into the processing plant can be significantly upgraded

90  
/  
40

## Mass reduction

Approximately 90% of the value can be recovered in 40% of the mass



Higher feed grade = more output at lower cost  
Full development size likely to be materially smaller and significantly cheaper

# Blue sky potential

The Browns Range dome is a massive geological feature covering 1,500km<sup>2</sup> and stretching 60km x 30km most of which hasn't been effectively explored



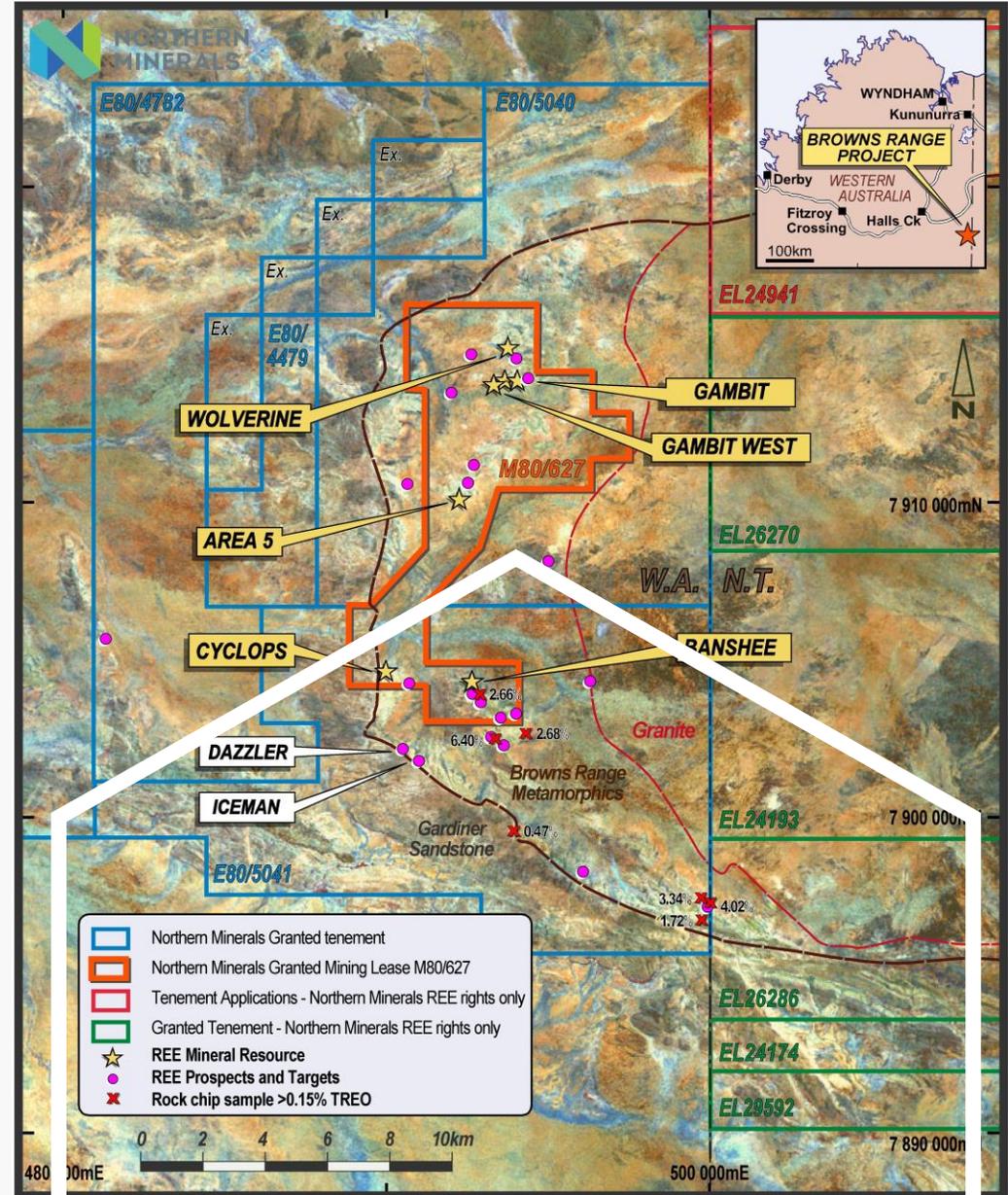
## New discoveries

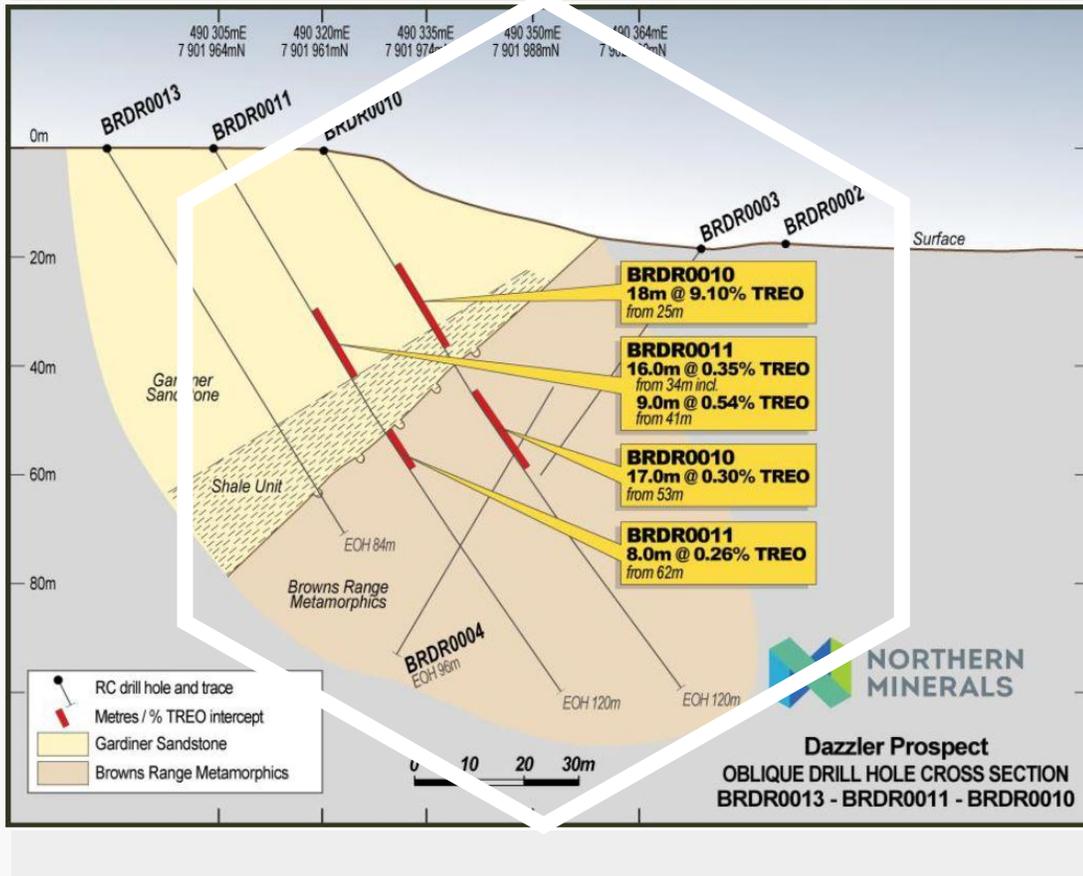
High-grade discoveries made in 2018 at Dazzler and Iceman show excellent potential



## 20+ year life target

Focus on growing mine life from 11 years to +20





# Dazzler discovery

Hole ID	Width (m)*	From (m)	To (m)	TREO %	Estimated pXRF grade
BRDR0008	3	33	36	0.34	0.5%
BRDR0008	3	41	44	0.20	
BRDR0009	3	107	110	0.22	
BRDR0009	4	112	116	0.33	
BRDR0010	18	25	43	9.10	8%
BRDR0010	17	53	70	0.30	
BRDR0011	16	34	50	0.35	0.8%
Incl	9	41	50	0.54	
BRDR0011	8	62	70	0.26	
BRDR0012	2	26	28	0.29	
BRDR0012	13	33	46	0.33	0.4%
BRDR0012	2	64	66	0.27	
BRDR0013				No significant results	
BRDR0014	21	24	45	2.15	2%
BRDR0014	7	48	55	0.29	
BRDR0014	7	59	66	0.42	0.6%
BRDR0015	2	35	37	0.20	
BRDR0015	13	42	55	0.38	0.6%
BRDR0016	4	26	30	0.14	
BRDR0016	32	33	65	0.48	

# Corporate overview



## Major shareholders

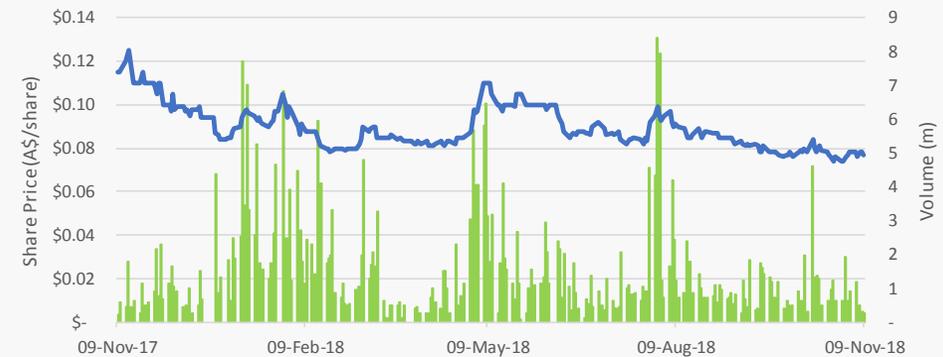
ACIG
Huatai Mining
Citicorp Nominees
Board & Management
Remaining Top 20
Other

28 September 2018

17.1%
14.6%
2.5%
2.3%
19.9%
43.6%

Ordinary Shares	1,161M
Options and Performance Rights	96.2M
Market Capitalisation	\$91M
Cash (30 September 2018)	\$4.6M
Debt (as at 12 September 2018):	
Brevet 2017/18	\$19.5M
Brevet 2018/19	\$3.0M
Lind	\$6.9M
Sinosteel	\$5.8M
R&D tax receivable 2017/18	\$21.5M
Plant book value	\$55M
12 month low - high	\$0.074 - \$0.125
Average daily volume (12 month avg)	1,471,000

Northern Minerals (NTU) Share Price



## In conclusion

First rare earth carbonate production in October 2018, following mechanical completion

Three year project to demonstrate and assess economic and technical feasibility of larger operation

Ore sorting studies indicate potential for doubling of mill head grade

Potential for additional production and new offtake agreements

Browns Range on track to be a globally significant supplier of dysprosium

Quality management and operations team focussed on delivery

An essential part of the EV, automation and military evolution

# Thank you

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## Contacts

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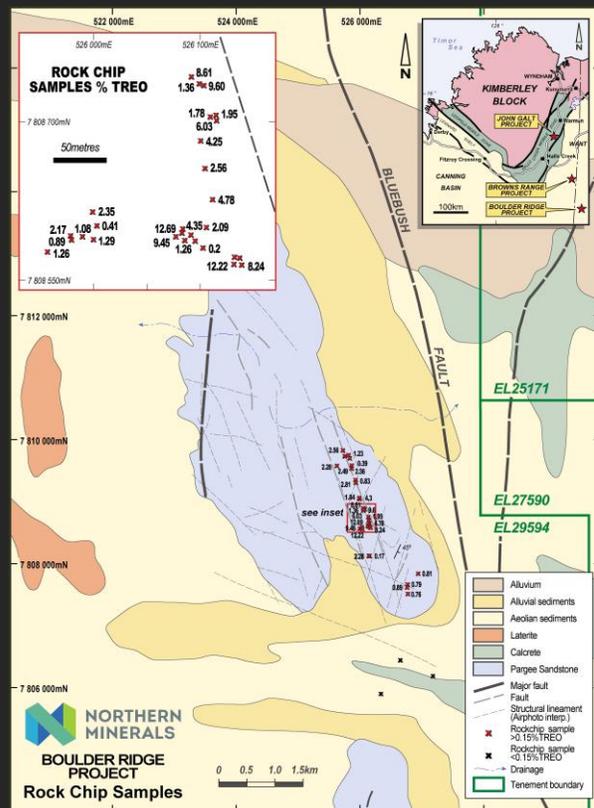


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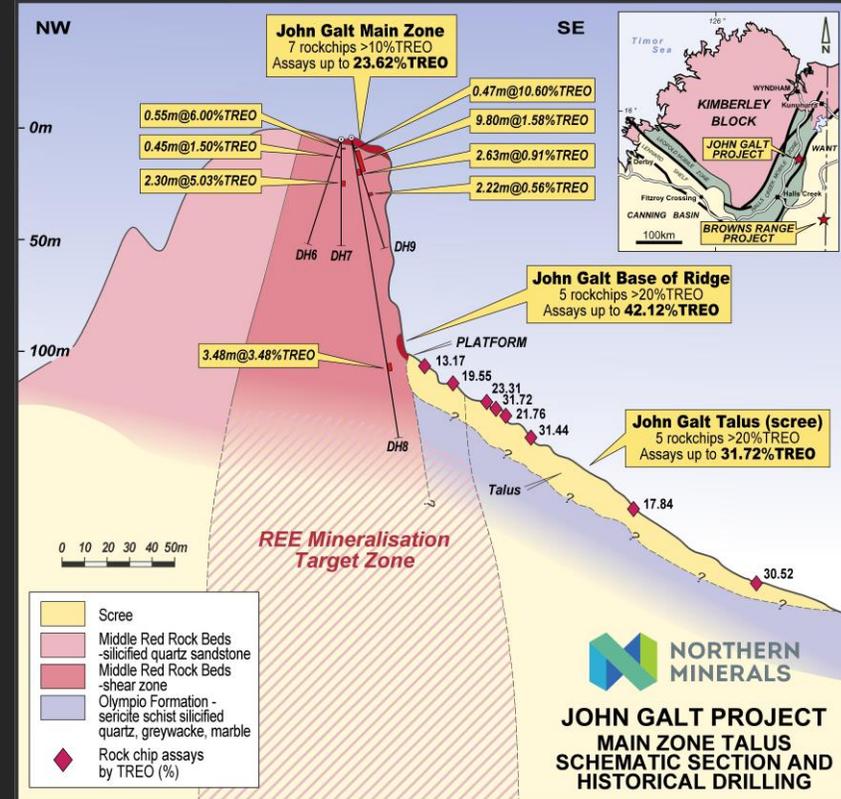
# APPENDICES

# Beyond Browns Range

- Rock chip samples from the Boulder Ridge project confirm high-grade Heavy Rare Earths (HRE)
- Best results exceed 12% TREO, including up to 1.15% Dysprosium, with a dominance of HRE – up to 99%.
- Reinforces significant growth potential in Browns Range and Tanami regions.

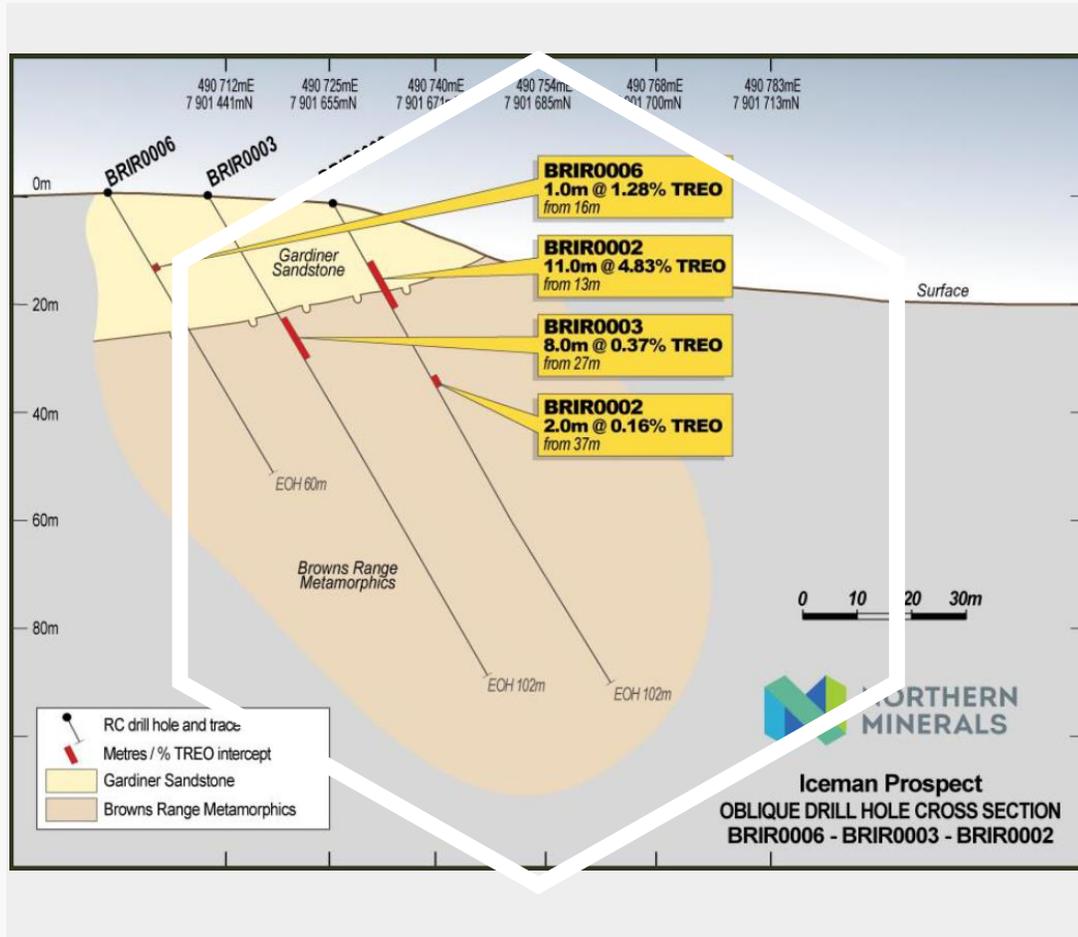


# BOULDER RIDGE



# JOHN GALT

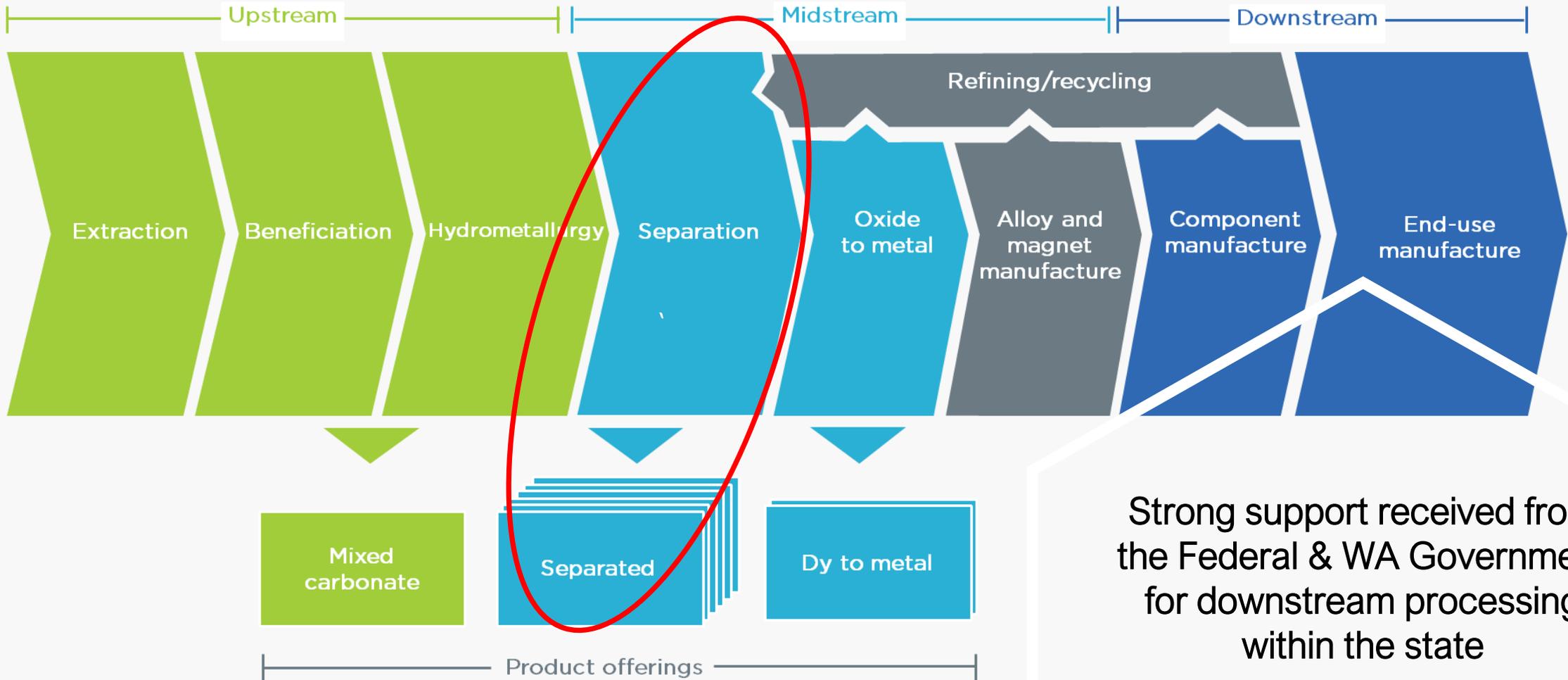
- Rock chip samples up to 42% TREO with approximately 95% Heavy REO
- Preliminary metallurgical tests indicate excellent recovery rates (>90%)
- Potential for concentrate grades >40%
- High grade mineralisation in talus (scree) material
- Hard-rock source of scree is the primary target



## Iceman discovery

Hole ID	Width (m)*	From (m)	To (m)	% TREO	Estimated pXRF grade
BRIR0001				No significant results	
BRIR0002	11	13	24	4.83	4%
BRIR0002	2	37	39	0.16	
BRIR0003	8	27	35	0.37	0.6%
BRIR0004	7	26	33	1.20	3%
BRIR0005				No significant results	
BRIR0006	1	16	17	1.28	
BRIR0007	7	42	49	1.73	1%
BRIR0008				No significant results	
BRIR0009				No significant results	

# Product separation

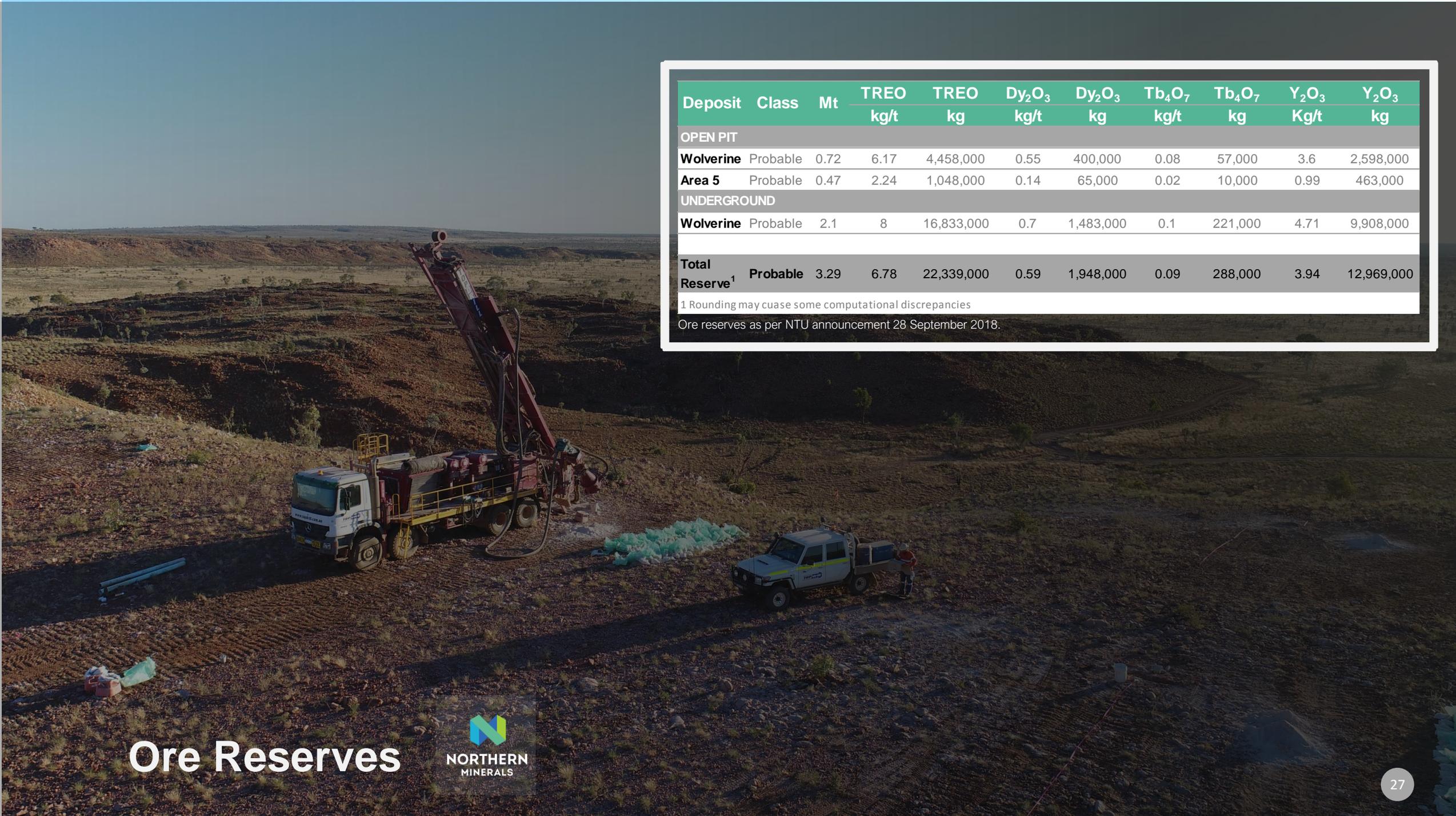


Strong support received from the Federal & WA Government for downstream processing within the state



Deposit	Classification	Mt	TREO %	Dy <sub>2</sub> O <sub>3</sub> kg/t	Y <sub>2</sub> O <sub>3</sub> kg/t	Tb <sub>4</sub> O <sub>7</sub> kg/t	HREO %	TREO kg
Wolverine	Indicated	2.88	0.84	0.74	4.89	0.11	89	24,195,000
	Inferred	1.97	0.89	0.76	5.15	0.11	88	17,588,000
	<b>Total<sup>1</sup></b>	<b>4.85</b>	<b>0.86</b>	<b>0.75</b>	<b>4.99</b>	<b>0.11</b>	<b>89</b>	<b>41,786,000</b>
Gambit West	Indicated	0.12	1.8	1.62	10.98	0.22	94	2,107,000
	Inferred	0.13	0.51	0.4	2.67	0.05	81	674,000
	<b>Total<sup>1</sup></b>	<b>0.25</b>	<b>1.11</b>	<b>0.97</b>	<b>6.56</b>	<b>0.13</b>	<b>91</b>	<b>2,781,000</b>
Pilot Plant Stockpiles	Indicated	0.21	0.97	0.85	5.63	0.12	89	2,049,000
	Inferred	0.04	0.26	0.2	1.35	0.03	79	92,000
	<b>Total</b>	<b>0.25</b>	<b>0.87</b>	<b>0.75</b>	<b>5.01</b>	<b>0.11</b>	<b>89</b>	<b>2,141,000</b>
Gambit	Indicated							
	Inferred	0.21	0.89	0.83	5.62	0.11	96	1,878,000
	<b>Total<sup>1</sup></b>	<b>0.21</b>	<b>0.89</b>	<b>0.83</b>	<b>5.62</b>	<b>0.11</b>	<b>96</b>	<b>1,878,000</b>
Area 5	Indicated	1.38	0.29	0.18	1.27	0.03	69	3,953,000
	Inferred	0.14	0.27	0.17	1.17	0.03	70	394,000
	<b>Total<sup>1</sup></b>	<b>1.52</b>	<b>0.29</b>	<b>0.18</b>	<b>1.26</b>	<b>0.03</b>	<b>69</b>	<b>4,347,000</b>
Cyclops	Indicated							
	Inferred	0.33	0.27	0.18	1.24	0.03	70	891,000
	<b>Total<sup>1</sup></b>	<b>0.33</b>	<b>0.27</b>	<b>0.18</b>	<b>1.24</b>	<b>0.03</b>	<b>70</b>	<b>891,000</b>
Banshee	Indicated							
	Inferred	1.66	0.21	0.16	1.17	0.02	87	3,484,000
	<b>Total<sup>1</sup></b>	<b>1.66</b>	<b>0.21</b>	<b>0.16</b>	<b>1.17</b>	<b>0.02</b>	<b>87</b>	<b>3,484,000</b>
<b>Total<sup>1</sup></b>	Indicated	4.59	0.71	0.6	3.99	0.09	86	32,304,000
	Inferred	4.48	0.56	0.46	3.18	0.07	86	25,001,000
	<b>Total<sup>1</sup></b>	<b>9.07</b>	<b>0.63</b>	<b>0.53</b>	<b>3.59</b>	<b>0.08</b>	<b>86</b>	<b>57,308,000</b>

<sup>1</sup> – Rounding may cause some computational discrepancies (TREO (metal) tonnes estimated from Mt x TREO%)  
 Mineral resources as per NTU announcement 28 September 2018.



Deposit	Class	Mt	TREO kg/t	TREO kg	Dy <sub>2</sub> O <sub>3</sub> kg/t	Dy <sub>2</sub> O <sub>3</sub> kg	Tb <sub>4</sub> O <sub>7</sub> kg/t	Tb <sub>4</sub> O <sub>7</sub> kg	Y <sub>2</sub> O <sub>3</sub> Kg/t	Y <sub>2</sub> O <sub>3</sub> kg
<b>OPEN PIT</b>										
<b>Wolverine</b>	Probable	0.72	6.17	4,458,000	0.55	400,000	0.08	57,000	3.6	2,598,000
<b>Area 5</b>	Probable	0.47	2.24	1,048,000	0.14	65,000	0.02	10,000	0.99	463,000
<b>UNDERGROUND</b>										
<b>Wolverine</b>	Probable	2.1	8	16,833,000	0.7	1,483,000	0.1	221,000	4.71	9,908,000
<b>Total Reserve<sup>1</sup></b>	<b>Probable</b>	<b>3.29</b>	<b>6.78</b>	<b>22,339,000</b>	<b>0.59</b>	<b>1,948,000</b>	<b>0.09</b>	<b>288,000</b>	<b>3.94</b>	<b>12,969,000</b>

<sup>1</sup> Rounding may cause some computational discrepancies  
 Ore reserves as per NTU announcement 28 September 2018.

# Ore Reserves



- Product specification available for REC
- REC samples validated by several downstream separators
- REC suitable for solvent extraction separation
- Low thorium and uranium levels
- First shipment planned for September quarter

REO contained in mixed RE carbonate	Annual production (000s kg)
Lanthanum	5.8
Cerium	15.2
Praseodymium	2.8
Neodymium	10.6
Samarium	11.4
Europium	2.4
Gadolinium	34.8
Terbium	6.7
Dysprosium	49.4
Holmium	13.5
Erbium	39.3
Thulium	5.6
Ytterbium	33.1
Lutetium	4.5
Yttrium	337.6
<b>Total TREO produced</b>	<b>573</b>
<b>Total carbonate produced</b>	<b>1,100</b>

Figures may not add due to rounding.  
 TREO = Total Rare Earth Oxides- Total of Dy<sub>2</sub>O<sub>3</sub>, La<sub>2</sub>O<sub>3</sub>, CeO<sub>2</sub>, Pr<sub>6</sub>O<sub>11</sub>, Nd<sub>2</sub>O<sub>3</sub>, Sm<sub>2</sub>O<sub>3</sub>, Eu<sub>2</sub>O<sub>3</sub>, Gd<sub>2</sub>O<sub>3</sub>, Tb<sub>4</sub>O<sub>7</sub>, Ho<sub>2</sub>O<sub>3</sub>, Er<sub>2</sub>O<sub>3</sub>, Tm<sub>2</sub>O<sub>3</sub>, Yb<sub>2</sub>O<sub>3</sub>, Lu<sub>2</sub>O<sub>3</sub>, Y<sub>2</sub>O<sub>3</sub>

Production table from NTU announcements dated 4 February 2016 in relation to new business plan for Browns Range and presentation of the business plan

# An eight year \$190m journey

	NTU shifts focus to HRE				80t bulk sample processed			\$38m R&D Financing Facility executed	First RE carbonate production
	John Galt acquisition				Maiden JORC Ore Reserve			\$14m Lind Facility executed	Mechanical completion
	Rock Chip samples				EPA approval granted			Fabrication 98% completed in China	Re-commence exploration
	Bench scale NAGROM beneficiation results	Maiden drilling campaign at Browns Range	Bench scale NAGROM/ ANSTO hydro-metallurgy results	Discovery of Boulder Ridge	Mining Licence granted			Mining campaign completed	100% Fabricated and delivered to site
			Maiden JORC Resource released	Upgraded JORC Resource	Native Title agreement		Divestment of non-core HRE assets	Financial Investment Decision (Pilot Plant)	Pilot Plant installed and commissioning completed
				\$26 million capital raised	Pre-Feasibility Study finished		Commitment to the new three stage Business Plan	Offtake Agreement signed with JFMAG	Ore sorting test work and study completed
					JORC Resource doubled	Definitive Feasibility Study released	Pilot Plant Project approved for Browns Range	\$42.0 million capital raised	\$11.7 million SPP completed
	<b>DISCOVERY</b>	<b>EXPLORATION</b>	<b>EVALUATION AND APPROVALS</b>			<b>DFS</b>	<b>NEW PLAN</b>	<b>DEVELOPMENT</b>	
	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>



Colin McCavana

Adrian Griffin

George Bauk

Bin Cai

## NTU Board

01

### Colin McCavana - Non-executive Chairman (appointed 2006)

Mr McCavana has more than 35 years of management experience worldwide in the earthworks, construction and mining industries.

02

### George Bauk - Managing Director / CEO (appointed 2010)

George is an experienced executive, with over 25 years' experience in the resources industry. Prior to Northern Minerals, Mr Bauk is Vice President of the Chamber of Minerals and Energy, WA and Chairman of Lithium Australia.

03

### Adrian Griffin - Non-executive Director (appointed 2006)

An Australian trained mining professional with exposure to metal mining and processing throughout the world, Mr Griffin has been involved in the development of extraction technology for platinum group metals and agricultural commodities.

04

### Ming Lu- Non-executive Director (not in photo) (appointed 2018)

Mr Lu is a CPA qualified senior finance leader with over a decade of commercial experience in successful multinational businesses worldwide.

05

### Yanchung Wang - Non-executive Dir (not in photo) (appointed 2013)

Ms Wang acts as a strategic investor for a number of Chinese based companies. Ms Wang is Vice Chairman of Conglin Baoyuan International Investment Group and also a Director of Huachen.

06

### Bin Cai - Non-executive Director (alternate) (appointed 2013)

Bin is the MD of Conglin International Investment Group Pty Ltd based in Brisbane. He has a record of successful strategic investments in emerging Australian resources companies.



**NORTHERN  
MINERALS**

