



**NTU**

**PROJECTS**

Browns Range **WA**

Boulder Ridge **NT**

John Galt **WA**

**RARE EARTHS**

**Dy** Dysprosium

**Tb** Terbium

**Lu** Lutetium

# Browns Range Dysprosium

121 Investment Conference, Cape Town

George Bauk, MD & CEO

February 2020

# Disclaimer



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## Compliance Statement

The information in this document that relates to the Mineral Resource Estimates of the Wolverine, Gambit, Gambit West, Area 5, Cyclops, Banshee deposits and Pilot Plant Stockpiles is extracted from the Company's ASX Announcement dated 28 September 2018 entitled "Mineral Resource and Ore Reserve Update – Post Trial Mining Operations at June 30 2018" available to view on the Company's website ([www.northernminerals.com.au](http://www.northernminerals.com.au)) and [www.asx.com.au](http://www.asx.com.au), and was completed in accordance with the guidelines of the JORC Code (2012). 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 Mineral Resource 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 document that relates to the Mineral Resource Estimate for the Dazzler deposit is extracted from the Company's ASX Announcement dated 6 March 2019 entitled "Dazzler shines with high-grade Maiden Mineral Resource" available to view on the Company's website ([www.northernminerals.com.au](http://www.northernminerals.com.au)) and [www.asx.com.au](http://www.asx.com.au), and was completed in accordance with the guidelines of the JORC Code (2012). 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 Mineral Resource 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 document that relates to Ore Reserves is extracted from the Company's ASX Announcement dated 28 September 2018 entitled "Mineral Resource and Ore Reserve Update – Post Trial Mining Operations at June 30 2018" available to view on the Company's website ([www.northernminerals.com.au](http://www.northernminerals.com.au)) and [www.asx.com.au](http://www.asx.com.au), and was completed in accordance with the guidelines of the JORC Code (2012). 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 Ore Reserves 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 document that relates to the Exploration Results from the Iceman deposit is extracted from the Company's ASX Announcement dated 11 September 2018 entitled "Assay results confirm Dazzler and Iceman discoveries" available to view on the Company's website ([www.northernminerals.com.au](http://www.northernminerals.com.au)) and [www.asx.com.au](http://www.asx.com.au), and was completed in accordance with the guidelines of the JORC Code (2012). 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 Exploration Results 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 document that relates to production targets and forecast financial information derived from a production target is extracted from the Company's ASX Announcement dated 2 March 2015 entitled "DFS positions Browns Range Project as next dysprosium supplier" available to view on the Company's website ([www.northernminerals.com.au](http://www.northernminerals.com.au)) and [www.asx.com.au](http://www.asx.com.au). The Company confirms that all material assumptions underpinning the production targets and forecast financial information in the announcement released on 2 March 2015 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>



# Corporate Details

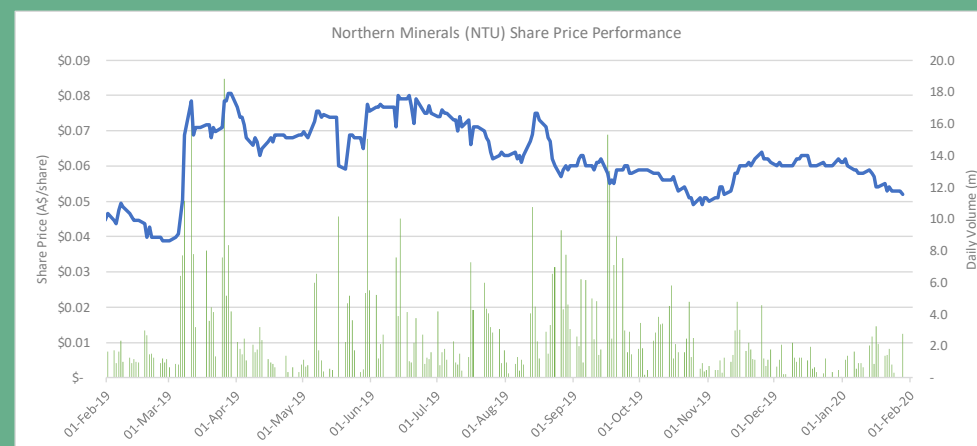


| Major shareholders    | 31 January 2020 |
|-----------------------|-----------------|
| Citicorp Nominees     | 16.4%           |
| ACIIG                 | 8.2%            |
| Congyan Xue           | 5.5%            |
| Huatai Mining Pty Ltd | 5.1%            |
| Remaining Top 20      | 25.2%           |
| Other                 | 39.6%           |

Source: Iress

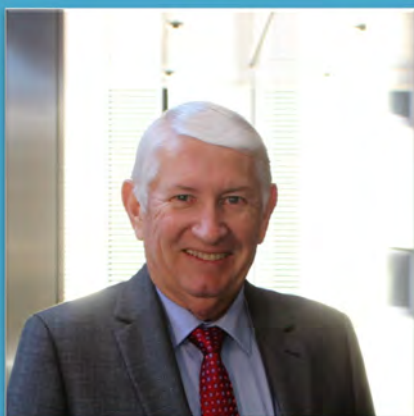
|  |                   |
|--|-------------------|
| Ordinary Shares as at 31 January 2020                | 2,560M            |
| Options and Performance Rights as at 31 January 2020 | 69.7M             |
| Market Capitalisation as at 31 January 2020          | \$128M            |
| Cash (31 December 2019)                              | \$5.7M            |
| Debt (as at 31 December 2019):                       |                   |
| ATO (under appeal with AusIndustry)                  | \$10.3M           |
| Sinosteel  | \$8.3M            |
| Convertible Notes (unsecured)                        | \$11.5M           |
| Plant book value                                     | \$76M             |
| 12 month low - high                                  | \$0.039 - \$0.081 |
| Average daily volume (12 month avg)                  | 2.64M             |

All amounts in AUD



Source: Iress

# Northern Minerals' Board



**Colin McCavana**  
Non-executive Chairman  
appointed 2006



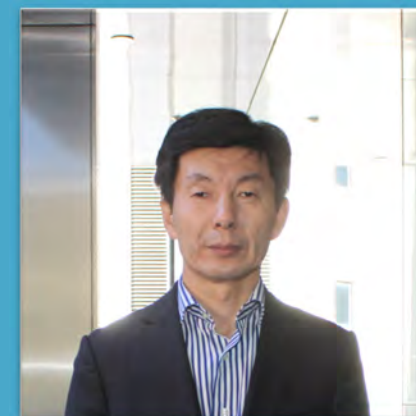
**George Bauk**  
Managing Director / CEO  
appointed 2010



**Adrian Griffin**  
Non-executive Director  
appointed 2006



**Ming Lu**  
Non-executive Director  
appointed 2018



**Bin Cai\***  
Alternate Non-executive Director  
appointed 2013

**Yanchung Wang**  
Non-executive Director  
(appointed 2013) (not in photo)

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

Mr Bauk is an experienced executive, with 30 years' experience in the resources industry. Mr Bauk is Chairman of Lithium Australia and Non-executive Director of BlackEarth Minerals.

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.

Northern Minerals (ASX:NTU)

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

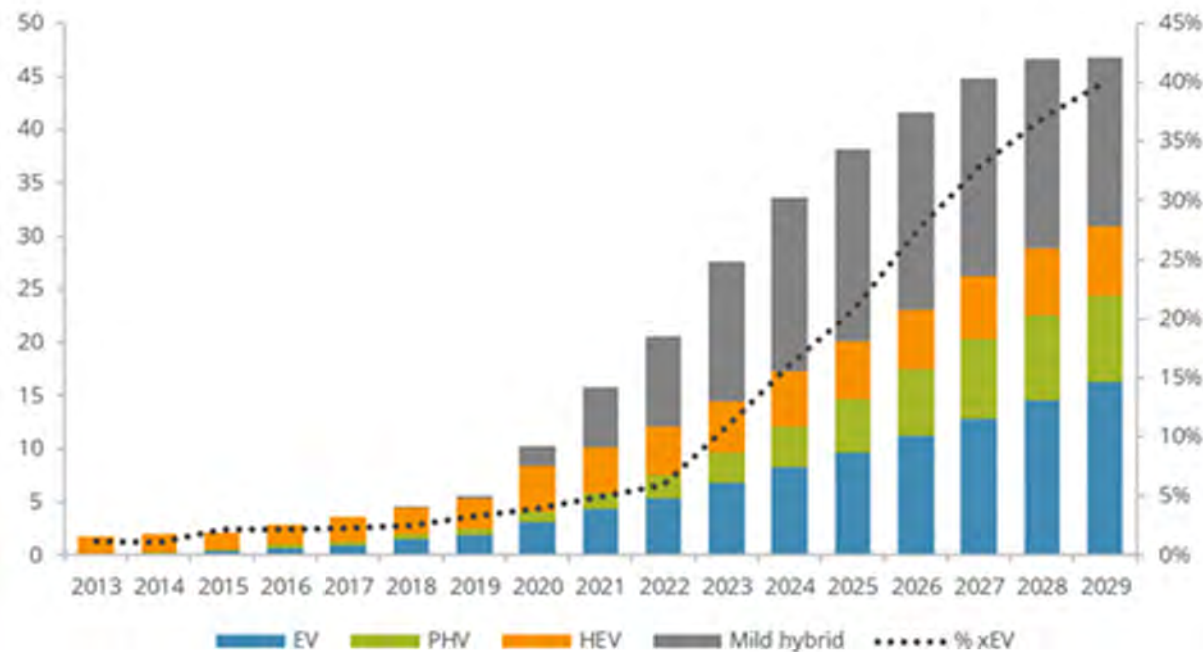
Ms Wang acts as a strategic investor for a number of Chinese based companies.

\*Mr Cai is the MD of Conglin International Investment Group Pty Ltd based in Brisbane.



# Demand for electric vehicles continues to grow

Electric vehicle sales by type, 2013 – 2029 (M units)



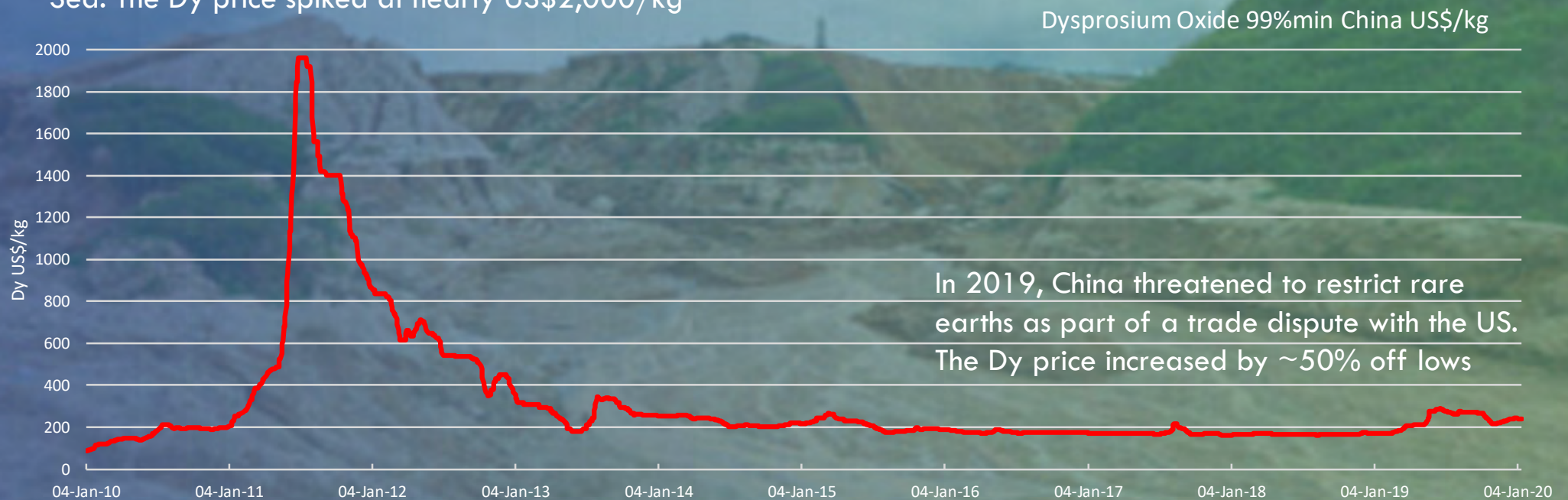
- Electric vehicle (EV) and renewables demand is increasing, with significant uplift expected over the next decade
- EV sales and growth will be limited by access to raw and finished commodities
- Rare earths have been classified as critical minerals as there are limited supply options and China has a monopoly position
- Northern Minerals' Browns Range Project is the most advanced heavy rare earth project that can fill the supply gap and provide surety of supply

# Rare earths – critical for military technology

- 
- ◆ Dysprosium and Terbium have a range of military applications
  - ◆ Missile guidance systems, aircraft engines, control systems, satellite communication and radars all use HREEs
  - ◆ Many defence forces are becoming concerned about continued supply of HREEs
  - ◆ The US Government and Australian Government have formed a Critical Minerals Taskforce to identify and develop new HREE supply

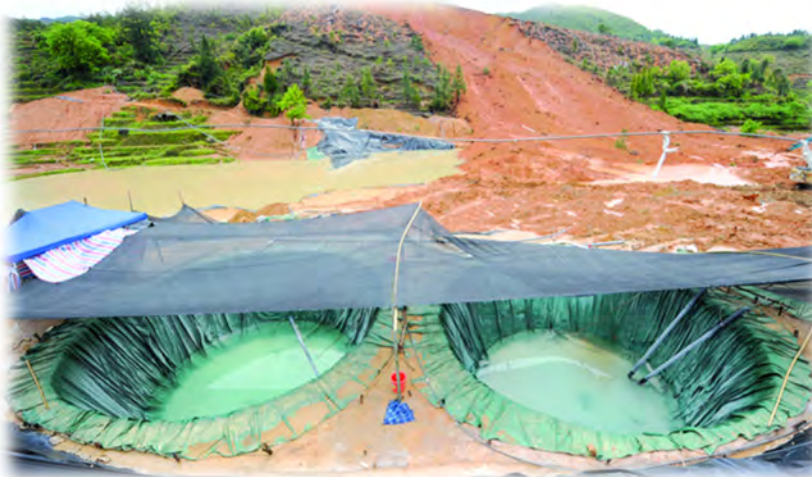
# China currently controls heavy rare earth supply and pricing

In 2010/11, China restricted rare earth exports as part of a dispute with Japan in the South China Sea. The Dy price spiked at nearly US\$2,000/kg





# The competition is unethical



Southern China in situ leach mining operation



Northern Minerals Browns Range Pilot Plant

- 98% of world's heavy rare earths are produced by China;
  - Many operations are in situ leach operations, which are dirty and environmentally dangerous;
  - Chinese Government has clamped down on illegal operators, either by shutting down or 'legalising' through assimilation into current operators;
  - Government is sponsoring research into ammonium-free technologies and pollutant discharge standards, which is expected to increase the cost of production in China.
- Mining and processing methods largely due to low grade ore, 20 - 40 ppm Dy versus Browns Range 600 – 800 ppm Dy.

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



# Australia – First world jurisdiction and logistics

- Focused critical minerals facilitation office established in Canberra in January 2020
- Secure tenement legislation and workings
- Western Australia ranked second in Fraser Institute Investment Attractiveness Index ratings
- Strong environmental framework
- Extensive trade network and economy

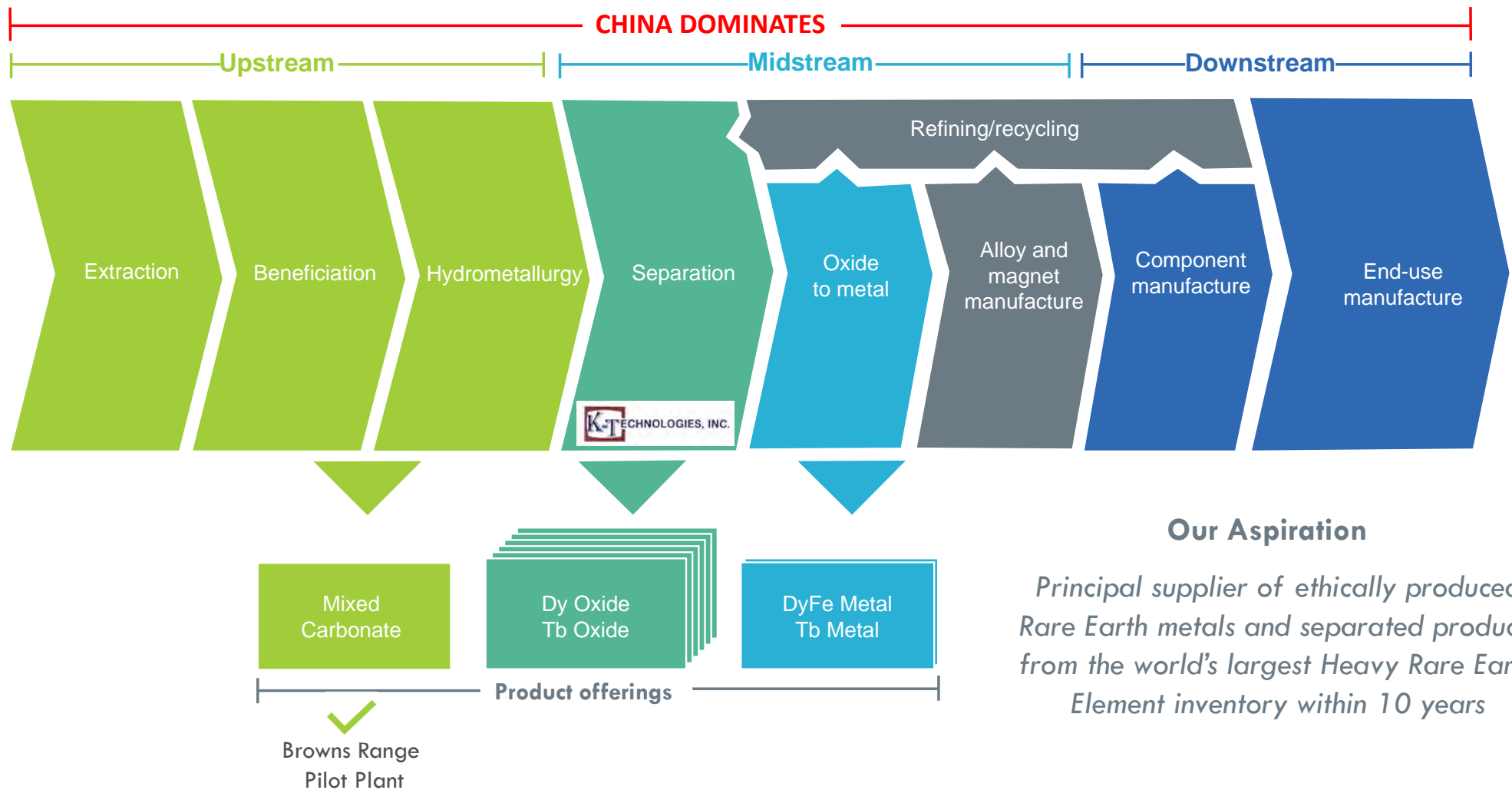




# Browns Range

Critically significant heavy rare earth supply

# Rare earth magnet supply chain

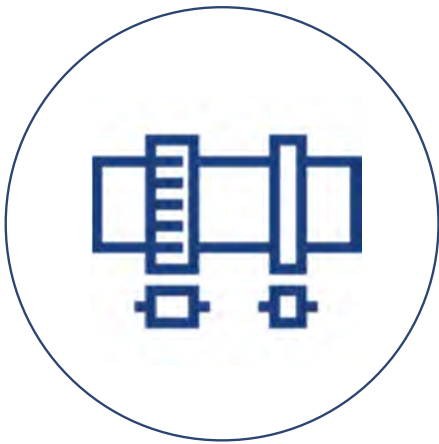




# Browns Range Pilot Plant Flowsheet

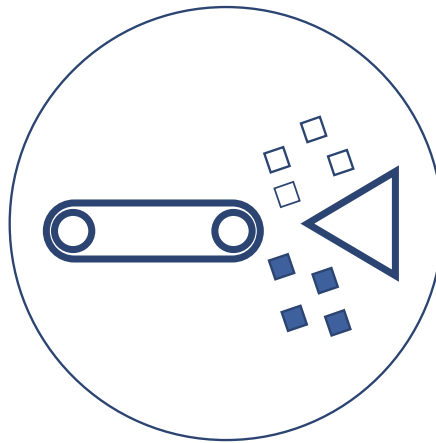


# Browns Range – Learnings to date



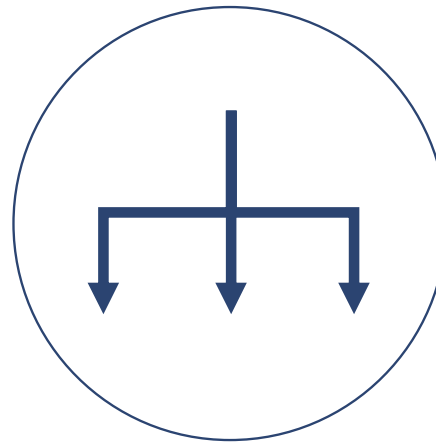
## KILN

The kiln has been modified to allow a new feed system, seals and a mechanism to limit scaling in the kiln



## ORE SORTING

Ore sorting was identified as a low-cost method of increasing the feed grade by 2.2x, increasing production and lowering costs. Implementation underway



## SEPARATION

Product separation scoping study underway with testwork in the US aimed at value-adding and customer diversification



## PERFORMANCE

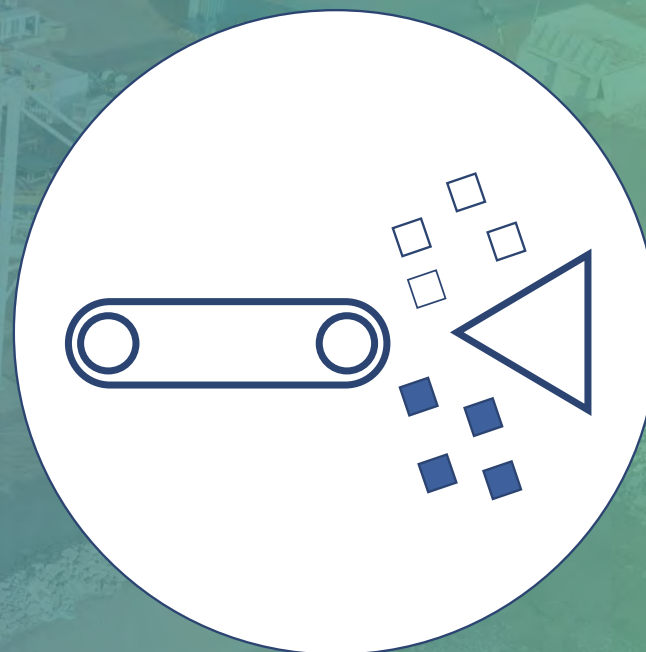
Pilot Plant performance and experiments are on track and delivering the solutions required



# Ore Sorting – A gamechanger for Browns Range



- Ore sorting, using x-ray transmission (XRT) concentrates ore in the beneficiation circuit by selecting ore and rejecting waste based on x-ray radiation
- Trials at Browns Range identified the potential to increase the feed grade by 2.2x
- Higher feed grade = higher production at lower costs
- Steinert ore sorter has been selected and ordered
- Early construction works have commenced
- Subject to approvals, commissioning of the system is expected by mid-2020





# Product Separation – Changing the supply dynamic



- ◆ Browns Range currently produces a mixed heavy rare earth carbonate
- ◆ Further processing to dysprosium oxide/metal and terbium oxide/metal currently occurs in China
- ◆ The Company has commenced a Scoping Study with K-Technologies, Inc. in the US to determine if product separation technologies can be implemented in Australia
- ◆ The production of rare earth oxides and/or metals significantly increases both the value of the product but also the number of potential end-customers
- ◆ The Scoping Study is progressing well, with initial testwork producing positive results



# Australian Government – Critical Minerals Facilitation Office

The Coalition Government in Australia has been working closely with the US Government to develop a framework for co-operation between the two countries with regards to critical minerals.

- In January 2020, The Government established and opened a Critical Minerals Facilitation Office in Canberra;
- The office is the central co-ordination point to help grow Australia's critical minerals sector, including access to the A\$4.4b Defence Export Facility Fund;
- Key to these efforts include:
  - working with state and territory governments, regulators, industry and investors to strengthen the sector;
  - providing national policy and strategic advice on critical minerals;
  - working closely with the [Department of Foreign Affairs and Trade](#) and [Austrade](#) to promote and identify critical mineral investment and off-take opportunities;
  - working with other countries to address supply chain risks and promote ethical sustainable practice;
  - supporting research and development to improve critical mineral extraction, processing and recycling methods; and
  - ensuring Australia's policy and regulatory settings support investment in the sector and unlock downstream opportunities.

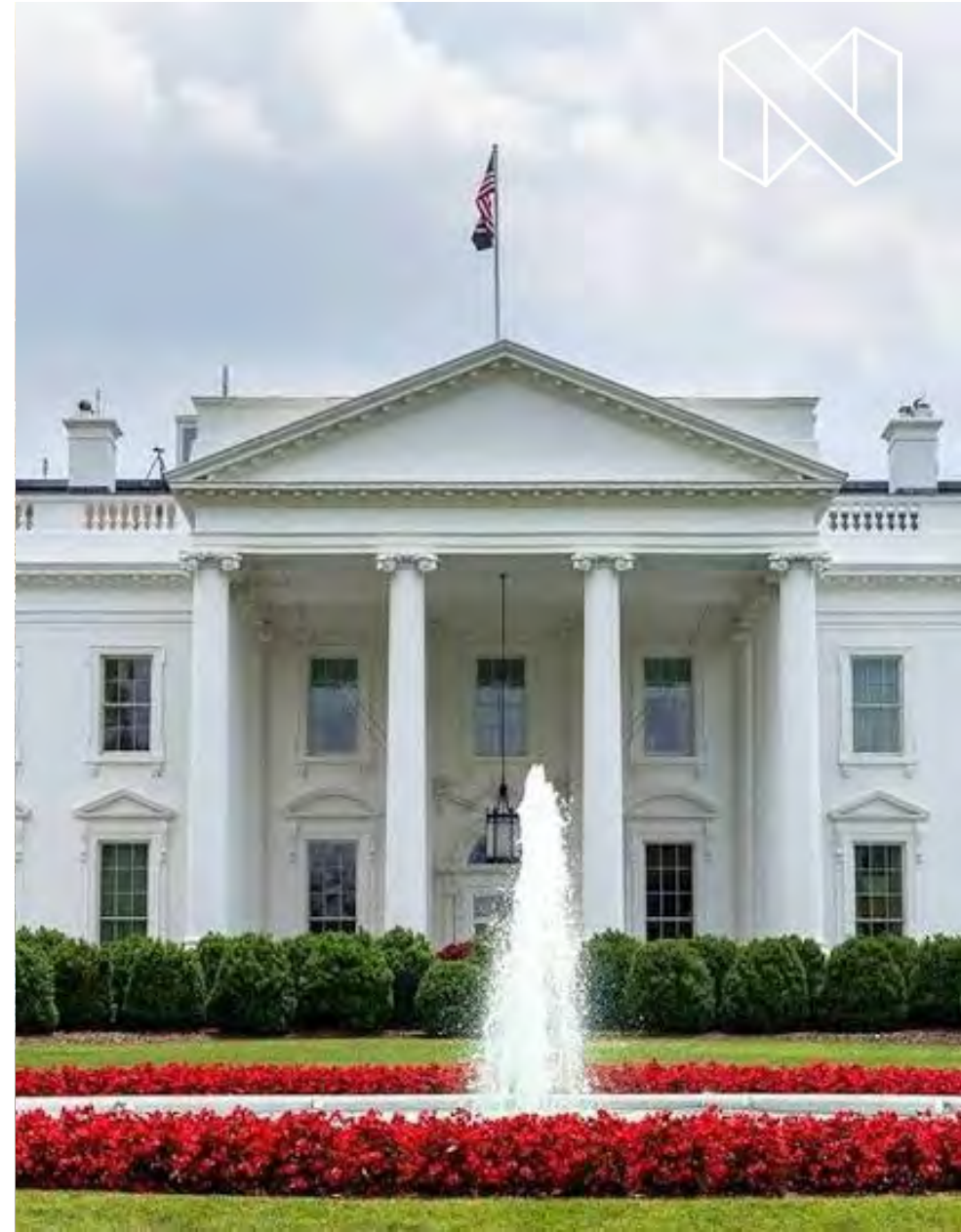




# US Government – Critical Minerals Taskforce

President Trump and various US lawmakers have expressed concerns about US reliance on critical mineral imports and potential disruption of supply chains that use critical minerals for various end uses, including defence and electronics applications.

- Of the 35 elements on the Critical Minerals List, the US has no production in 22 of them, and only by-product production in 5;
- The US is 100% reliant on imports of rare earths, and nearly all comes from China;
- Congress has authorised the acquisition of REEs and other minerals for the 'National Defense Stockpile';
- The US and Australia have formed a Critical Minerals Taskforce to investigate ways of delivering Australian supply to the US stockpile;
- Under the Australia-US Free Trade Agreement, Australia is designated as a 'domestic' supplier to the US;
- On 20 December 2019, President Trump approved a US\$738 Billion defense bill for fiscal 2020.





# Browns Range – 2020 and beyond

We intend to operate the Browns Range Pilot Plant at its design capacity in 2020

Studies are underway assessing a larger, staged development of Browns Range

Our aspiration is to become a principal supplier of ethically produced rare earth metals and separated products from the world's largest heavy rare earth inventory within 10 years

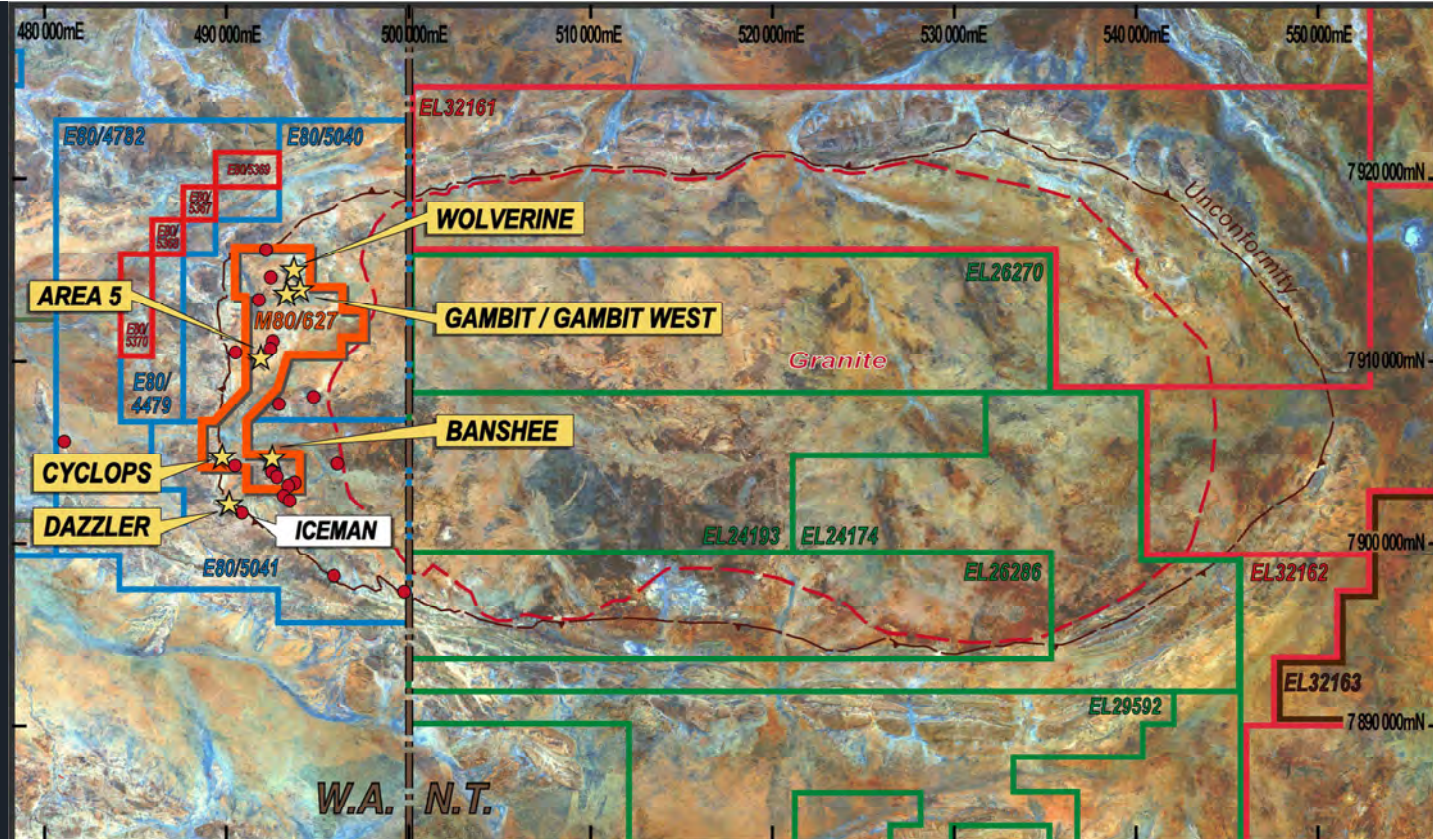




# Exploration

## ‘Own the Dome’ strategy

- 100% owned tenure and/or 100% rare earth rights over the Browns Range Dome;
- Over 2,381km<sup>2</sup> held;
- Numerous high priority targets identified;
- Recent discoveries at Dazzler and Iceman confirm prospectivity;
- Exploration strategy underway to increase mine life to 20+ years.

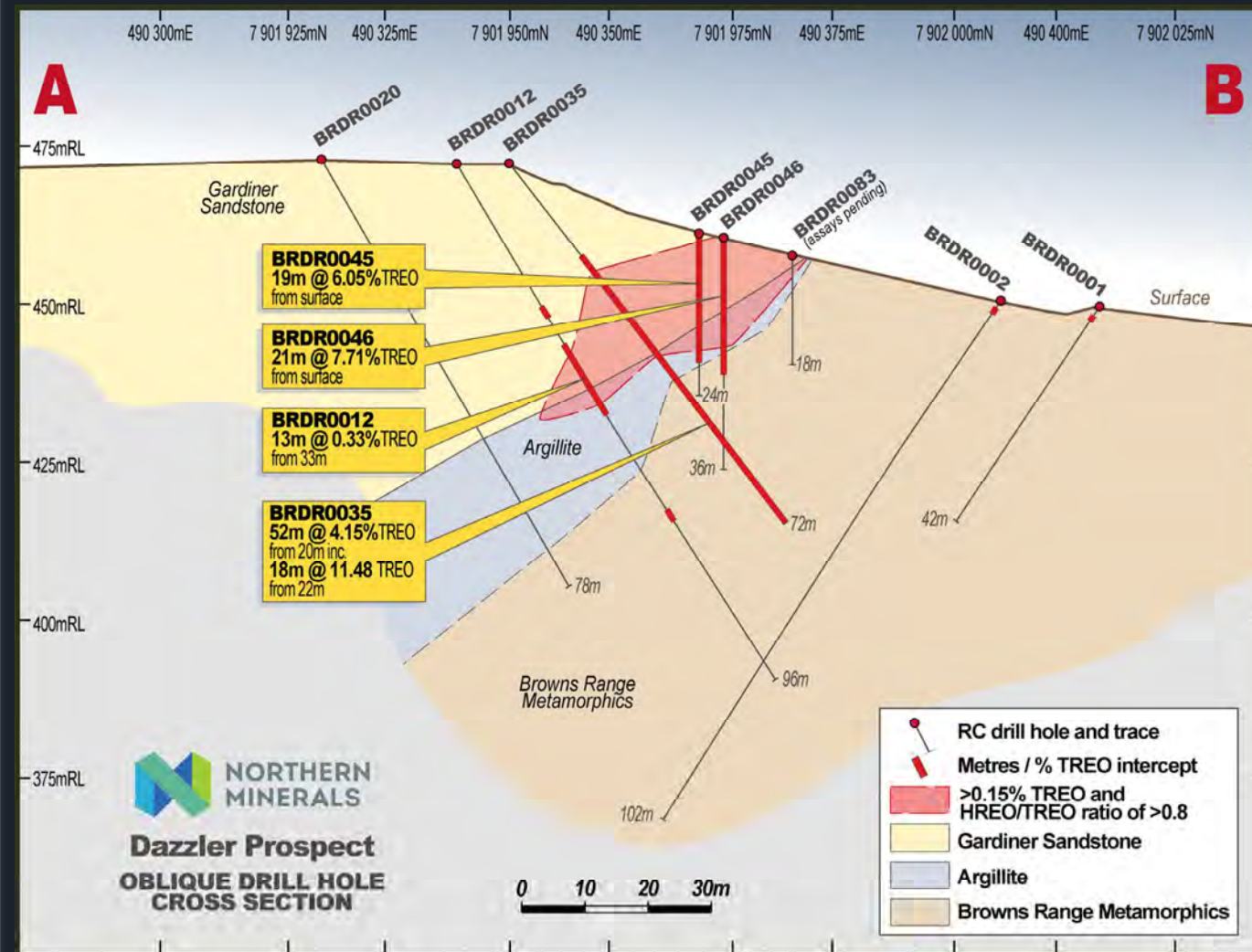






## Dazzler Grade is King



- Dazzler intercepts include:
  - 19m @ 6.05% TREO
  - 21m @ 7.71% TREO
  - 52m @ 4.15% TREO
- Grades are up to 10x the total Browns Range resource grade;
- Mineralisation associated with unconformity and concentrated in Gardiner Sandstone unit;
- Dazzler 'lookalikes' to be focus of exploration in 2020.





# Corporate strategy



|            |   |   |   |
|------------|---|---|---|
| Who we are | Northern Minerals is one of a few non-Chinese producers of dysprosium and terbium. We plan to become the leading reliable supplier of ethically produced HREE products.   |   |   |
| Timeframe  | 2020 - 2021   | 2022 - 2023   | 2024 →  |
| Milestones | Pilot Plant Testing   | Stage 2 Development    | Stage 3 Development    |
| Strategy   | <ul style="list-style-type: none"> <li>• Achieve and sustain nameplate capacity;</li> <li>• Assess and modify plant as required;</li> <li>• Implement ore sorting at Browns Range;</li> <li>• Scoping Studies for separation technologies;</li> <li>• Updated Feasibility Study for staged development;</li> <li>• Accelerate exploration.</li> </ul> | <ul style="list-style-type: none"> <li>• Re-commence mining at Browns Range, including Dazzler;</li> <li>• Construction of full scale plant;</li> <li>• Implement product separation technologies;</li> <li>• Develop and investigate new sales markets for separated rare earth oxides.</li> </ul> | <ul style="list-style-type: none"> <li>• Implement full-scale development with tier 1 customers on long-term contracts;</li> <li>• Sale of rare earth oxides and metals;</li> <li>• Globally significant supplier of dysprosium and terbium outside China;</li> <li>• Investigate development of John Galt and Boulder Ridge Projects.</li> </ul> |



=> Decision point on whether to proceed to next stage

# Why invest in Northern Minerals?



US and Australian Governments have identified a crisis in the supply chain for rare earths, in particular for dysprosium and terbium products.

US and Australian Governments have taken action to facilitate the development of alternative and ethical rare earths supply chains.

Northern Minerals is a producer of rare earths in Australia.

Northern Minerals aspires to be the principal supplier of ethically produced rare earth metals and separated products from the world's largest heavy rare earth element inventory within 10 years.



## Contact Details

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[www.northernminerals.com.au](http://www.northernminerals.com.au)



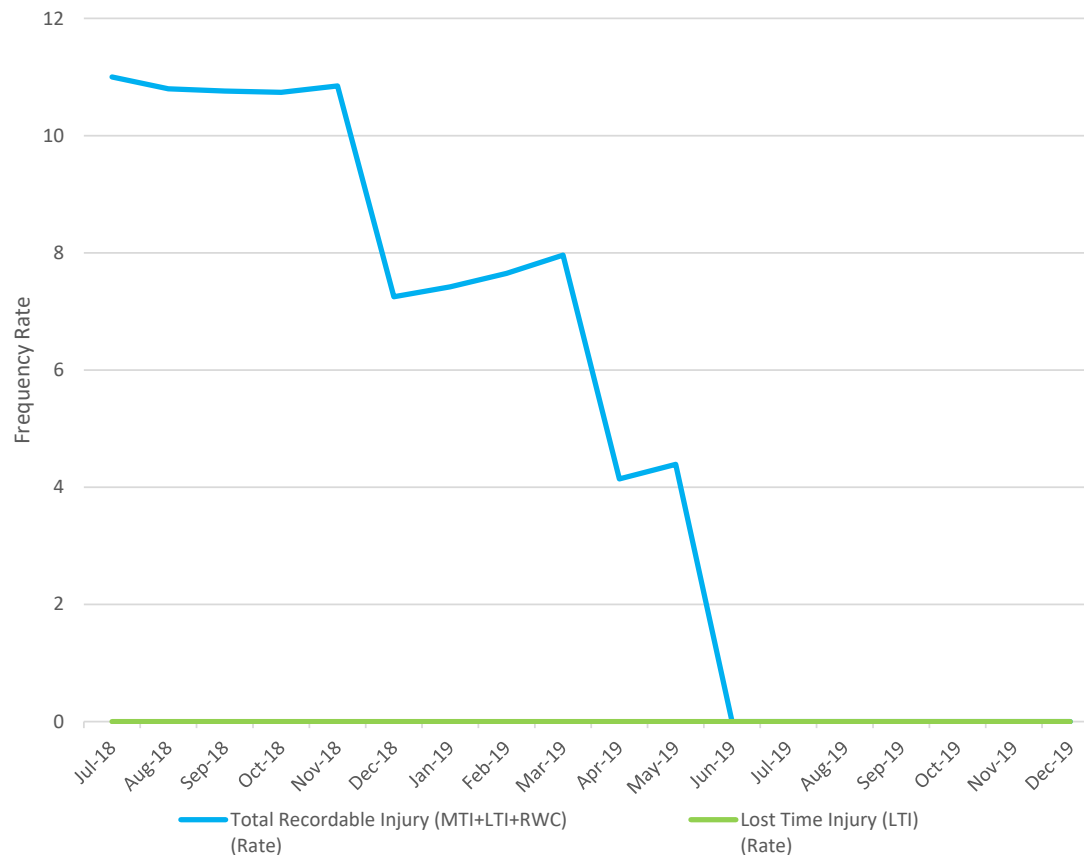


# Appendices



# Health and Safety

**ANNUAL INJURY PERFORMANCE**



\*Total Recordable Injury Frequency Rate calculations measure the total number of recordable injuries (MTI+LTI+RWC, excluding First Aid) per million hours worked, where MTI = Medical Treatment Injury, LTI = Lost Time Injury, RWC = Restricted Work Case

- ◆ No LTI at the operation for 2 years;
- ◆ TRIFR reached zero in June 2019;
- ◆ Emergency Response training – e.g. confined space rescue;
- ◆ Improvement in Safety Culture;
- ◆ Enhancing safety team;
- ◆ Crisis Management Training.





# Environment

- Committed to ethically produced rare earths;
- Environmental Management System in place;
- Updated Mine Closure Plan submitted to DMIRS;
- Progressive rehabilitation as areas become available;
- Expanding the environment team;
- Ore sorter approvals underway;
- Dingo Risk Management Strategy - long-term welfare of the local dingo population and the safety of site personnel and visitors;
- Solar power evaluation for camp underway.





# Corporate leadership



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



## Mark Tory

**CFO and Company Secretary**

Specialist in innovative finance and capital management



## Bin Cai

**Executive Officer**

Bin has a record of successful strategic investments in emerging Australian resources companies.



## Robin Wilson

**Geology and Exploration Manager**

Original Browns Range discoverer, on the hunt for new resources



## Hayley Patton

**Human Resources Manager**

Experienced HR Professional with broad industry experience

# 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

### Chief Operating Officer

Driven Browns Range pilot plant to be the newest dysprosium producer

EM

## Eben Van Rooyen

### Engineering Manager

Charged with building Browns Range as a new greenfields site

GM

## Tony Hadley

### General Manager Operations

Experienced rare earths operator, focused on delivering results

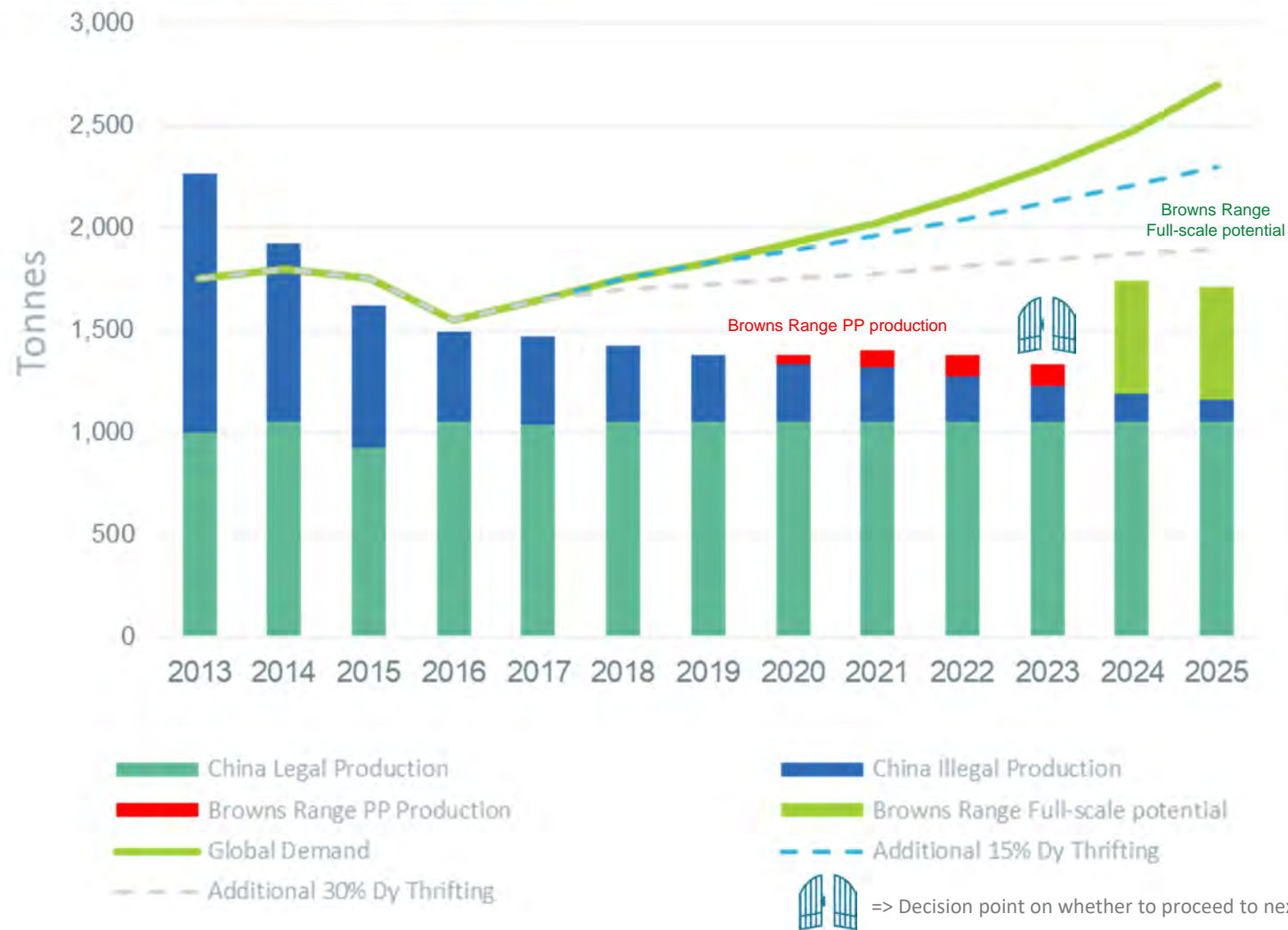
R&D

## Louis de Klerk

### Research and Development Manager

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

# 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.



# Quality offtake partner - thyssenkrupp

Northern Minerals has entered into an offtake agreement with thyssenkrupp Materials Trading GmbH (thyssenkrupp) for all mixed heavy rare earth carbonate from the Browns Range Pilot Plant Project, including all stockpiled product.

The agreement also includes an option for thyssenkrupp to participate in the potential full-scale project.



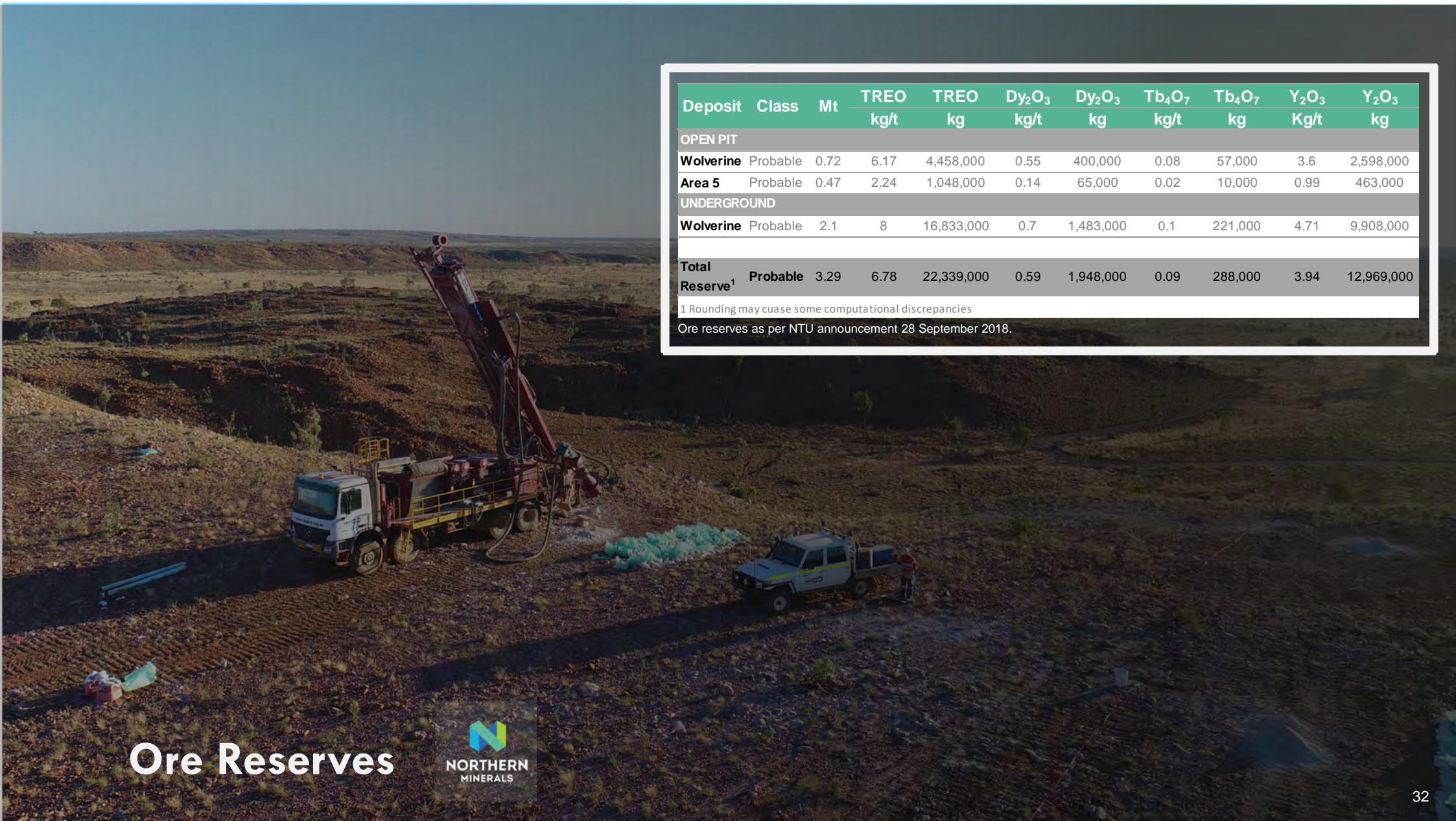
# Mineral Resources

| 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> | 4.85 | 0.86   | 0.75                                | 4.99                               | 0.11                                | 89     | 41,786,000 |
| 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> | 0.25 | 1.11   | 0.97                                | 6.56                               | 0.13                                | 91     | 2,781,000  |
| Pilot Plant Stockpiles   | Indicated                | 0.2  | 0.99   | 0.86                                | 5.73                               | 0.12                                | 89     | 1,934,000  |
|                          | Inferred                 | 0.03 | 0.26   | 0.2                                 | 1.35                               | 0.03                                | 79     | 89,000     |
|                          | <b>Total<sup>1</sup></b> | 0.23 | 0.88   | 0.76                                | 5.08                               | 0.11                                | 89     | 2,022,000  |
| Gambit                   | Indicated                |      |        |                                     |                                    |                                     |        |            |
|                          | Inferred                 | 0.21 | 0.89   | 0.83                                | 5.62                               | 0.11                                | 96     | 1,878,000  |
|                          | <b>Total<sup>1</sup></b> | 0.21 | 0.89   | 0.83                                | 5.62                               | 0.11                                | 96     | 1,878,000  |
| 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> | 1.52 | 0.29   | 0.18                                | 1.26                               | 0.03                                | 69     | 4,347,000  |
| Cyclops                  | Indicated                |      |        |                                     |                                    |                                     |        |            |
|                          | Inferred                 | 0.33 | 0.27   | 0.18                                | 1.24                               | 0.03                                | 70     | 891,000    |
|                          | <b>Total<sup>1</sup></b> | 0.33 | 0.27   | 0.18                                | 1.24                               | 0.03                                | 70     | 891,000    |
| Banshee                  | Indicated                |      |        |                                     |                                    |                                     |        |            |
|                          | Inferred                 | 1.66 | 0.21   | 0.16                                | 1.17                               | 0.02                                | 87     | 3,484,000  |
|                          | <b>Total<sup>1</sup></b> | 1.66 | 0.21   | 0.16                                | 1.17                               | 0.02                                | 87     | 3,484,000  |
| Dazzler                  | Indicated                |      |        |                                     |                                    |                                     |        |            |
|                          | Inferred                 | 0.14 | 2.23   | 2.08                                | 12.79                              | 0.27                                | 93     | 3,200,000  |
|                          | <b>Total<sup>1</sup></b> | 0.14 | 2.23   | 2.08                                | 12.79                              | 0.27                                | 93     | 3,200,000  |
| <b>Total<sup>1</sup></b> | Indicated                | 4.58 | 0.71   | 0.6                                 | 4                                  | 0.09                                | 86     | 32,189,000 |
|                          | Inferred                 | 4.61 | 0.61   | 0.51                                | 3.47                               | 0.07                                | 87     | 28,198,000 |
|                          | <b>Total<sup>1</sup></b> | 9.19 | 0.66   | 0.56                                | 3.73                               | 0.08                                | 86     | 60,389,000 |

<sup>1</sup> – Rounding may cause some computational discrepancies (TREO (metal) tonnes estimated from Mt x TREO%)

Mineral Resources as per NTU 2019 Annual Report Statement of Ore Reserve and Mineral Resources dated 11calc October 2019





# Ore Reserves



| Deposit  | Class    | Mt   | TREO<br>kg/t | TREO<br>kg | Dy <sub>2</sub> O <sub>3</sub><br>kg/t | Dy <sub>2</sub> O <sub>3</sub><br>kg | Tb <sub>4</sub> O <sub>7</sub><br>kg/t | Tb <sub>4</sub> O <sub>7</sub><br>kg | Y <sub>2</sub> O <sub>3</sub><br>Kg/t | Y <sub>2</sub> O <sub>3</sub><br>kg |
|--|----------|------|--------------|------------|--|--------------------------------------|--|--------------------------------------|---------------------------------------|-------------------------------------|
| OPEN PIT   |          |      |              |            |  |                                      |  |                                      |                                       |                                     |
| Wolverine  | Probable | 0.72 | 6.17         | 4,458,000  | 0.55                                   | 400,000                              | 0.08                                   | 57,000                               | 3.6                                   | 2,598,000                           |
| Area 5   | Probable | 0.47 | 2.24         | 1,048,000  | 0.14                                   | 65,000                               | 0.02                                   | 10,000                               | 0.99                                  | 463,000                             |
| UNDERGROUND  |          |      |              |            |  |                                      |  |                                      |                                       |                                     |
| Wolverine  | Probable | 2.1  | 8            | 16,833,000 | 0.7                                    | 1,483,000                            | 0.1                                    | 221,000                              | 4.71                                  | 9,908,000                           |
| Total Reserve <sup>1</sup>                                       | Probable | 3.29 | 6.78         | 22,339,000 | 0.59                                   | 1,948,000                            | 0.09                                   | 288,000                              | 3.94                                  | 12,969,000                          |
| <sup>1</sup> Rounding may cause some computational discrepancies |          |      |              |            |  |                                      |  |                                      |                                       |                                     |
| Ore reserves as per NTU announcement 28 September 2018.          |          |      |              |            |  |                                      |  |                                      |                                       |                                     |



- 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 – December 2018



## Pilot Plant

| REO contained in mixed RE carbonate | Targeted 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

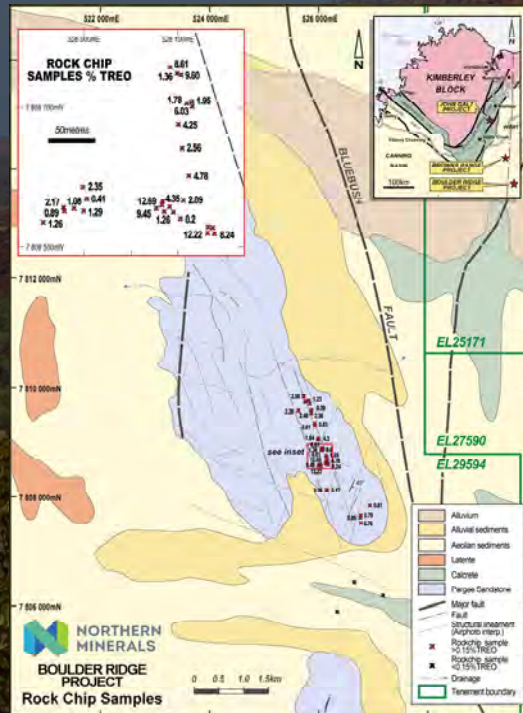
TREO = Total Rare Earth Oxides: Total of Dy<sub>2</sub>O<sub>3</sub>, La<sub>2</sub>O<sub>3</sub>, CeO<sub>2</sub>, Pr<sub>6</sub>O<sub>11</sub>, Nd<sub>2</sub>O<sub>3</sub>, Sm<sub>2</sub>O<sub>3</sub>, Eu<sub>2</sub>O<sub>3</sub>, Gd<sub>2</sub>O<sub>3</sub>, Tb<sub>4</sub>O<sub>7</sub>, Ho<sub>2</sub>O<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 ASX announcement dated 4 February 2016 in relation to new business plan for Browns Range and presentation of the business plan and ASX announcement dated 2 March 2015 in relation to DFS

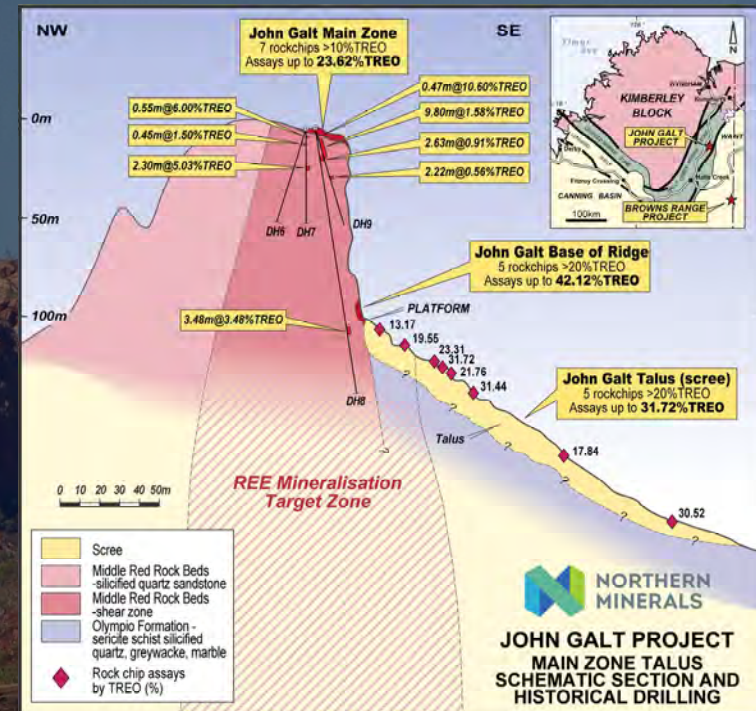


# Beyond Browns Range

- 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



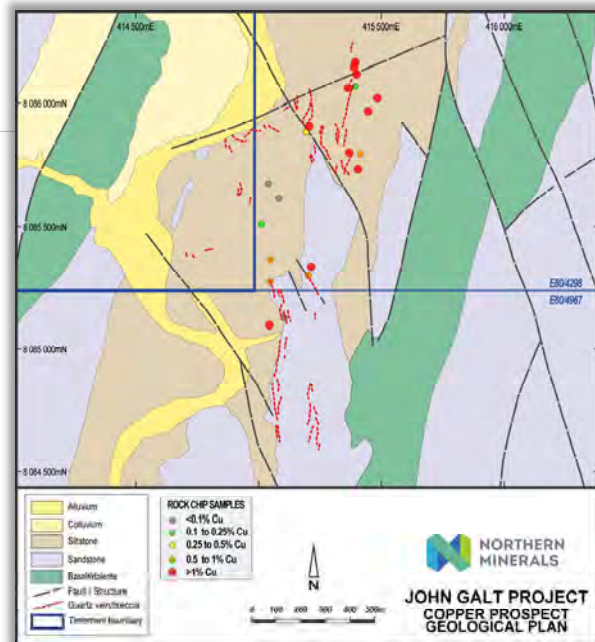
## BOULDER RIDGE



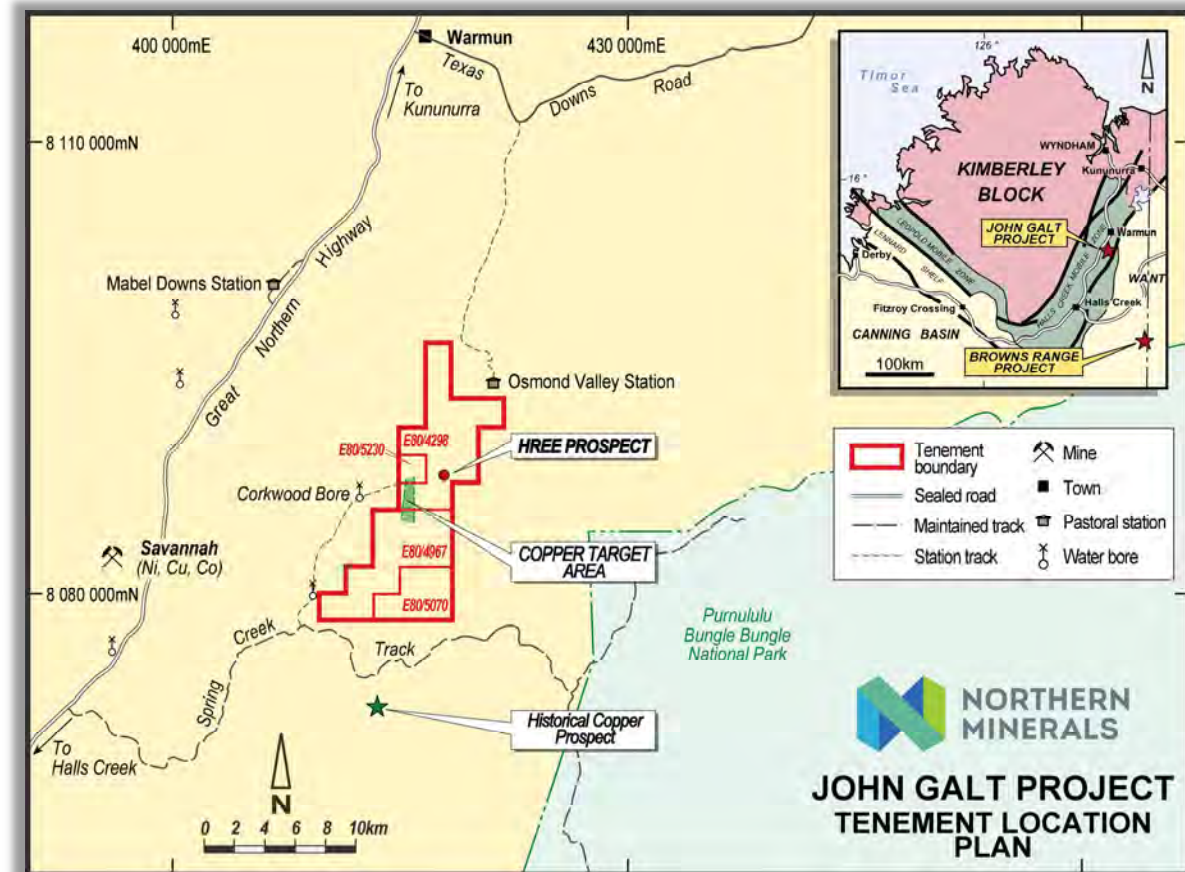
## JOHN GALT

- 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





- Rock chip sampling returned numerous assays greater than 1% copper (Cu);
- Results up to 2.92% Cu returned;
- High grade copper results over 500m strike extent;
- Limited sampling indicates mineralised copper zone is open north and south; and
- Follow-up work will include geological mapping, soil sampling and a ground geophysics program, following the end of the wet season, potentially leading to drilling later in the year.





# What are rare earths?

|                                |  |                                 |  |                                 |  |                                     |  |                                |  |                                  |  |                                 |  |                                 |  |                                  |  |                                    |  |                                   |  |                                |  |                                |  |                                |  |                                |  |                                 |  |                               |  |                               |  |
|--------------------------------|--|---------------------------------|--|---------------------------------|--|-------------------------------------|--|--------------------------------|--|----------------------------------|--|---------------------------------|--|---------------------------------|--|----------------------------------|--|------------------------------------|--|-----------------------------------|--|--------------------------------|--|--------------------------------|--|--------------------------------|--|--------------------------------|--|---------------------------------|--|-------------------------------|--|-------------------------------|--|
| hydrogen<br>1<br>H<br>1.0079   |  |                                 |  |                                 |  |                                     |  |                                |  |                                  |  | helium<br>2<br>He<br>4.0026     |  |                                 |  |                                  |  |                                    |  |                                   |  |                                |  |                                |  |                                |  |                                |  |                                 |  |                               |  |                               |  |
| lithium<br>3<br>Li<br>6.941    |  | beryllium<br>4<br>Be<br>9.0122  |  |                                 |  |                                     |  |                                |  |                                  |  |                                 |  | boron<br>5<br>B<br>10.811       |  | carbon<br>6<br>C<br>12.011       |  | nitrogen<br>7<br>N<br>14.007       |  | oxygen<br>8<br>O<br>15.999        |  | fluorine<br>9<br>F<br>18.998   |  | neon<br>10<br>Ne<br>20.180     |  |                                |  |                                |  |                                 |  |                               |  |                               |  |
| sodium<br>11<br>Na<br>22.990   |  | magnesium<br>12<br>Mg<br>24.305 |  |                                 |  |                                     |  |                                |  |                                  |  |                                 |  | aluminium<br>13<br>Al<br>26.982 |  | silicon<br>14<br>Si<br>28.086    |  | phosphorus<br>15<br>P<br>30.974    |  | sulfur<br>16<br>S<br>32.065       |  | chlorine<br>17<br>Cl<br>35.453 |  | argon<br>18<br>Ar<br>39.948    |  |                                |  |                                |  |                                 |  |                               |  |                               |  |
| potassium<br>19<br>K<br>39.098 |  | calcium<br>20<br>Ca<br>40.078   |  | scandium<br>21<br>Sc<br>44.956  |  | titanium<br>22<br>Ti<br>47.867      |  | vanadium<br>23<br>V<br>50.942  |  | chromium<br>24<br>Cr<br>51.996   |  | manganese<br>25<br>Mn<br>54.938 |  | iron<br>26<br>Fe<br>55.845      |  | cobalt<br>27<br>Co<br>58.933     |  | nickel<br>28<br>Ni<br>58.693       |  | copper<br>29<br>Cu<br>63.546      |  | zinc<br>30<br>Zn<br>65.38      |  | gallium<br>31<br>Ga<br>69.723  |  | germanium<br>32<br>Ge<br>72.64 |  | arsenic<br>33<br>As<br>74.922  |  | selenium<br>34<br>Se<br>78.96   |  | bromine<br>35<br>Br<br>79.904 |  | krypton<br>36<br>Kr<br>83.798 |  |
| rubidium<br>37<br>Rb<br>85.468 |  | strontium<br>38<br>Sr<br>87.62  |  | yttrium<br>39<br>Y<br>88.906    |  | zirconium<br>40<br>Zr<br>91.224     |  | niobium<br>41<br>Nb<br>92.906  |  | molybdenum<br>42<br>Mo<br>95.96  |  | technetium<br>43<br>Tc<br>[98]  |  | ruthenium<br>44<br>Ru<br>101.07 |  | rhodium<br>45<br>Rh<br>102.91    |  | palladium<br>46<br>Pd<br>106.42    |  | silver<br>47<br>Ag<br>107.87      |  | cadmium<br>48<br>Cd<br>112.41  |  | indium<br>49<br>In<br>114.82   |  | tin<br>50<br>Sn<br>118.71      |  | antimony<br>51<br>Sb<br>121.76 |  | tellurium<br>52<br>Te<br>127.60 |  | iodine<br>53<br>I<br>126.90   |  | xenon<br>54<br>Xe<br>131.29   |  |
| caesium<br>55<br>Cs<br>132.91  |  | barium<br>56<br>Ba<br>137.33    |  | lanthanum<br>57<br>La<br>138.91 |  | hafnium<br>72<br>Hf<br>178.49       |  | tantalum<br>73<br>Ta<br>180.95 |  | tungsten<br>74<br>W<br>183.84    |  | rhenium<br>75<br>Re<br>186.21   |  | osmium<br>76<br>Os<br>190.23    |  | iridium<br>77<br>Ir<br>192.22    |  | platinum<br>78<br>Pt<br>195.08     |  | gold<br>79<br>Au<br>196.97        |  | mercury<br>80<br>Hg<br>200.59  |  | thallium<br>81<br>Tl<br>204.38 |  | lead<br>82<br>Pb<br>207.2      |  | bismuth<br>83<br>Bi<br>208.98  |  | polonium<br>84<br>Po<br>[209]   |  | astatine<br>85<br>At<br>[210] |  | radon<br>86<br>Rn<br>[222]    |  |
| francium<br>87<br>Fr<br>[223]  |  | radium<br>88<br>Ra<br>[226]     |  | actinium<br>89<br>Ac<br>[227]   |  | rutherfordium<br>104<br>Rf<br>[261] |  | dubnium<br>105<br>Db<br>[262]  |  | seaborgium<br>106<br>Sg<br>[266] |  | bohrium<br>107<br>Bh<br>[264]   |  | hassium<br>108<br>Hs<br>[277]   |  | meitnerium<br>109<br>Mt<br>[268] |  | darmstadtium<br>110<br>Ds<br>[271] |  | roentgenium<br>111<br>Rg<br>[272] |  |                                |  |                                |  |                                |  |                                |  |                                 |  |                               |  |                               |  |

LRE  
HRE

|                                      |   |  |  |                                       |                                       |   |                                       |   |   |                                      |  |  |   |
|--------------------------------------|---|--|--|---------------------------------------|---------------------------------------|---|---------------------------------------|---|---|--------------------------------------|--|--|---|
| cerium<br>58<br><b>Ce</b><br>140.12  | praseodymium<br>59<br><b>Pr</b><br>140.91 | neodymium<br>60<br><b>Nd</b><br>144.24 | promethium<br>61<br><b>Pm</b><br>[145] | samarium<br>62<br><b>Sm</b><br>150.36 | europium<br>63<br><b>Eu</b><br>151.96 | gadolinium<br>64<br><b>Gd</b><br>157.25 | terbium<br>65<br><b>Tb</b><br>158.93  | dysprosium<br>66<br><b>Dy</b><br>162.50 | holmium<br>67<br><b>Ho</b><br>164.93    | erbium<br>68<br><b>Er</b><br>167.26  | thulium<br>69<br><b>Tm</b><br>168.93     | ytterbium<br>70<br><b>Yb</b><br>173.05 | lutetium<br>71<br><b>Lu</b><br>174.97   |
| thorium<br>90<br><b>Th</b><br>232.04 | protactinium<br>91<br><b>Pa</b><br>231.04 | uranium<br>92<br><b>U</b><br>238.03    | neptunium<br>93<br><b>Np</b><br>[237]  | plutonium<br>94<br><b>Pu</b><br>[244] | americium<br>95<br><b>Am</b><br>[243] | curium<br>96<br><b>Cm</b><br>[247]      | berkelium<br>97<br><b>Bk</b><br>[247] | californium<br>98<br><b>Cf</b><br>[251] | einsteinium<br>99<br><b>Es</b><br>[252] | fermium<br>100<br><b>Fm</b><br>[257] | mendelevium<br>101<br><b>Md</b><br>[258] | nobelium<br>102<br><b>No</b><br>[259]  | lawrencium<br>103<br><b>Lr</b><br>[262] |

