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# Browns Range
# Powering Forward

## Low Emission and Technology Minerals Conference

NOVEMBER | 2016 | ASX: NTU

**powering technology for a better future**

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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). 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 Brown Range Mineral Resource" dated 15 October 2014 and is available to view on the Company's website (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). 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). 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). 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 – $La_2O_3$, $CeO_2$, $Pr_6O_{11}$, $Nd_2O_3$, $Sm_2O_3$, $Eu_2O_3$, $Gd_2O_3$, $Tb_4O_7$, $Dy_2O_3$, $Ho_2O_3$, $Er_2O_3$, $Tm_2O_3$, $Yb_2O_3$, $Lu_2O_3$, $Y_2O_3$
HREO = Heavy Rare Earth Oxides – Total of $Sm_2O_3$, $Eu_2O_3$, $Gd_2O_3$, $Tb_4O_7$, $Dy_2O_3$, $Ho_2O_3$, $Er_2O_3$, $Tm_2O_3$, $Yb_2O_3$, $Lu_2O_3$, $Y_2O_3$

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# Corporate Overview

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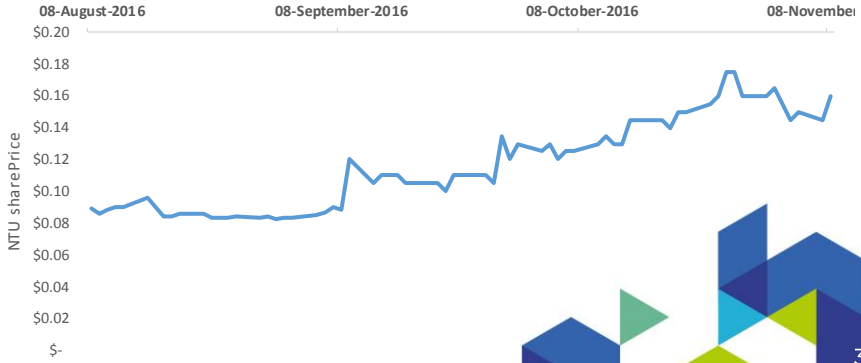
| Major shareholders | As at 11 Nov '16 | Forecast 31 Dec '16 |
|---|---|---|
| Australian Conglin International Investment Group | 32.7% | 26.8% |
| Huatai Mining | 15.9% | 31.0% |
| Jien Mining | 4.4% | 3.6% |
| Board & Management | 3.0% | 2.5% |
| Remaining Top 20 | 16.3% | 13.5% |
| Other | 27.3% | 22.4% |

## Market capitalisation $91M

(at 11 November 2016 @ $0.15)

| | |
|---|---|
| Ordinary Shares | 608M |
| Unlisted Options and Performance Rights | 28M |
| Cash (11 November 2016) | $10.5M |
| Tranche 2 & 3 funds due Nov/Dec 2016 | $18M |
| Debt (11 November 2016) | $1.1M |

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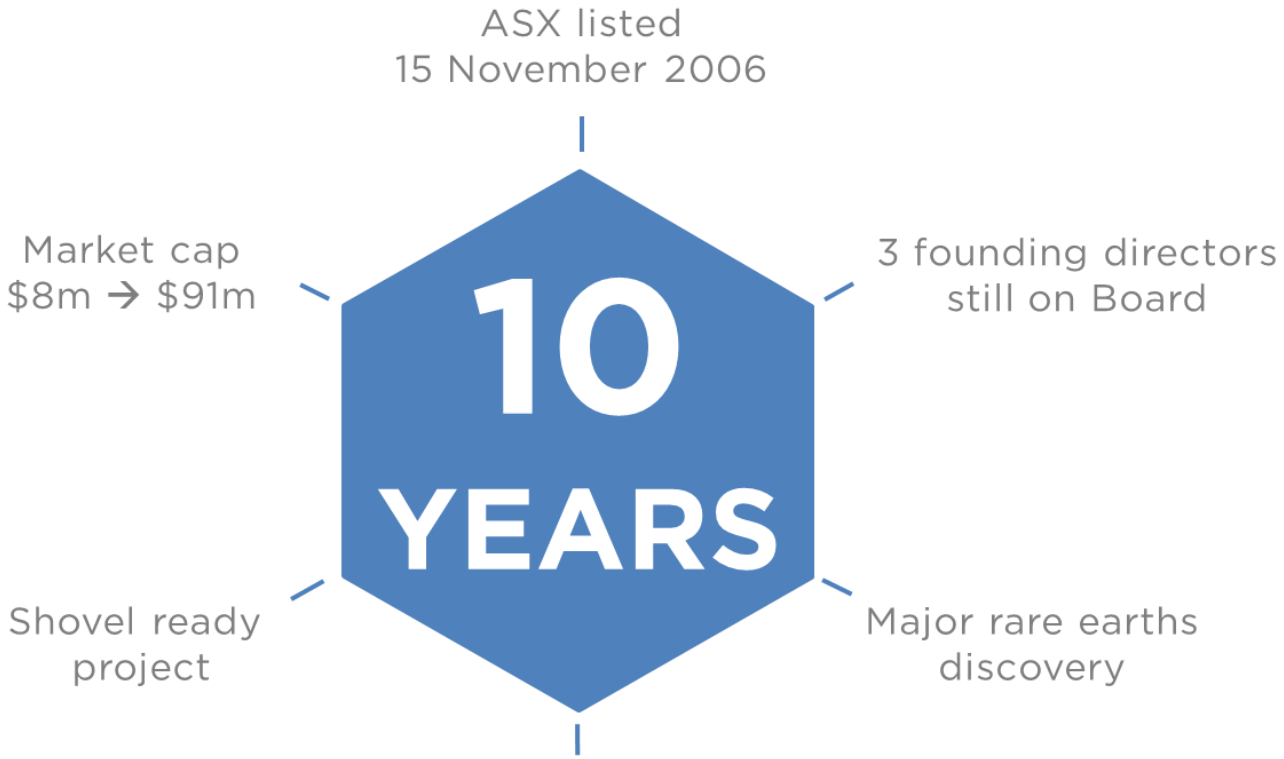
# Focussed and Resilient

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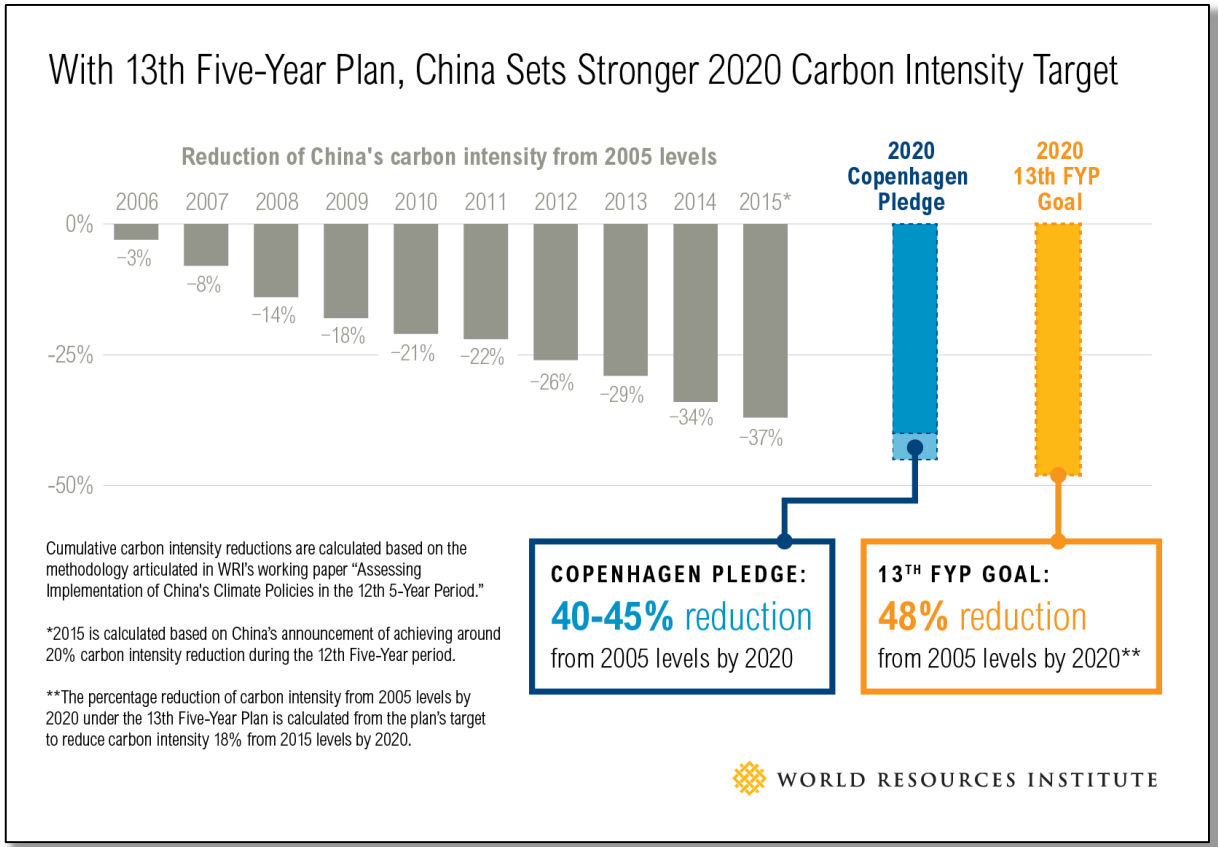
# Climate change is the No. 1 global issue

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# Permanent magnets explained

- NdDyFeB permanent magnets are used by major electric vehicle and wind turbine makers
- Dysprosium enhances magnetic properties at higher temperatures
- Permanent magnets account for 25% of rare earth demand in tonnes and 80% in value
- As a result of climate change policies, higher electric car and wind turbine take up increases permanent magnet market demand
- Electric vehicle sales expected to grow from 1.2 million in 2015 to >20 million by 2020
- Alternatives to rare earth magnets have been explored, however timeframe for commercialisation >10 years

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# Chinese carmakers to dominate EV production

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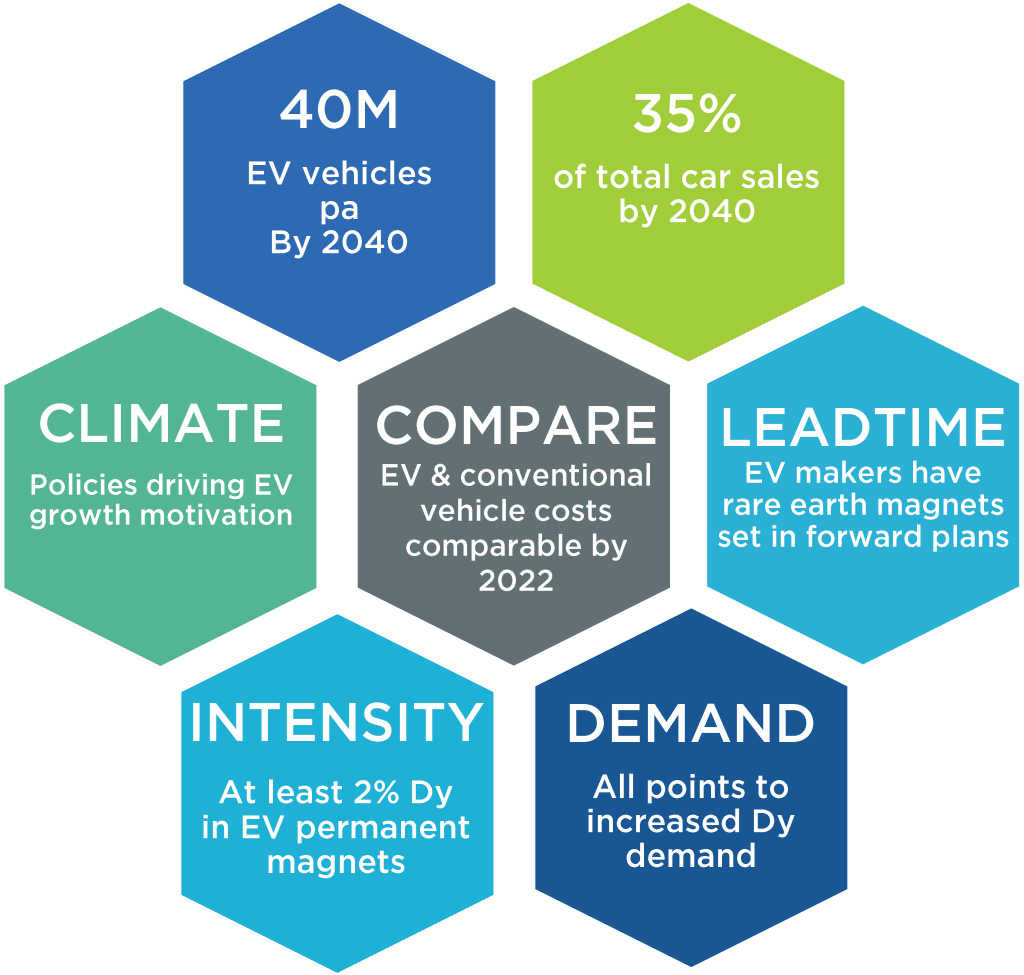
# EV growth = Dysprosium demand

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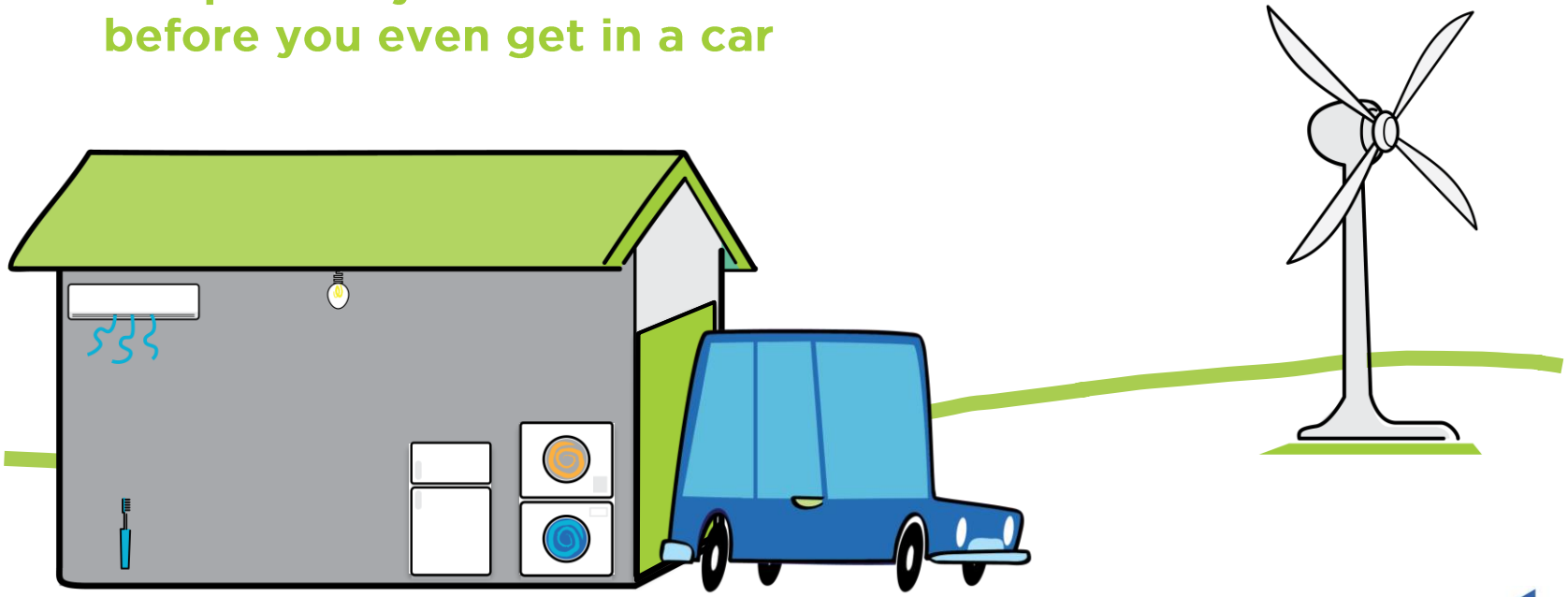
# 50% of all energy is consumed by motors

**You've probably used half a dozen before you even get in a car**



**The focus of the future is making motors more efficient**

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# Recent news stories

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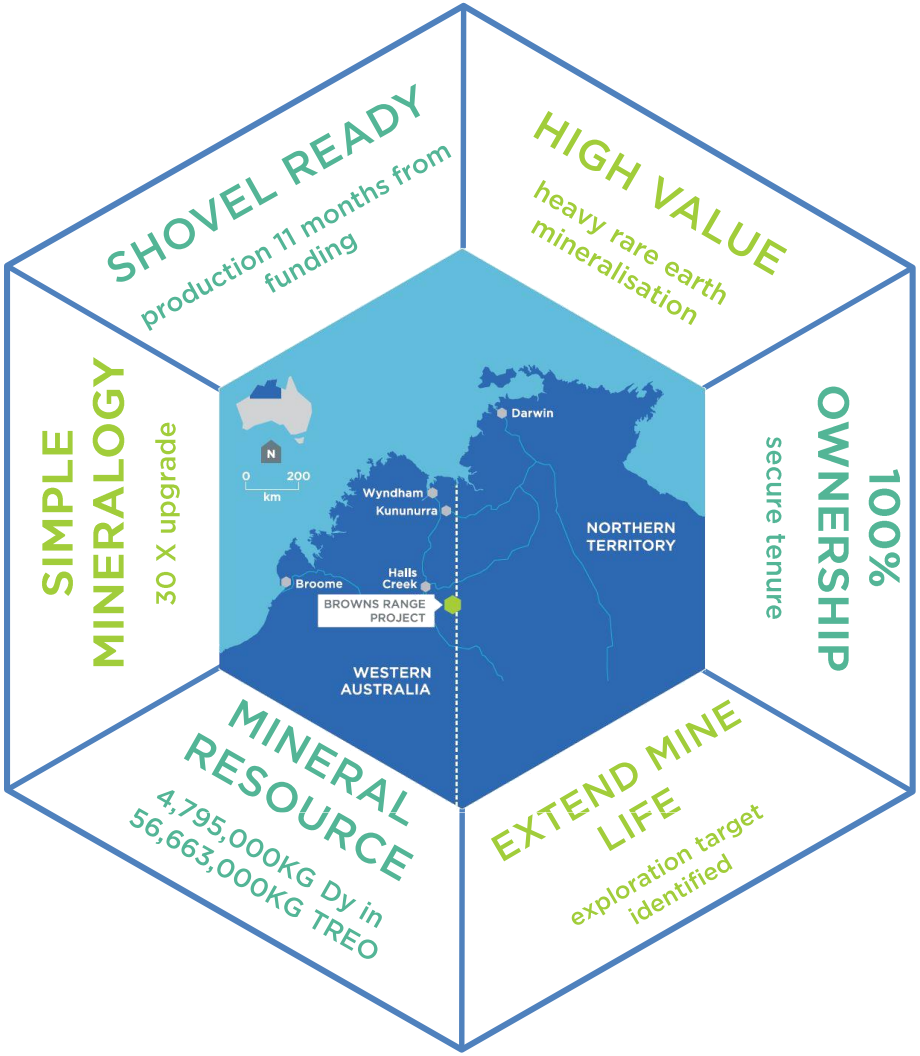
# Positioned for success

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# Browns Range Dome: under explored

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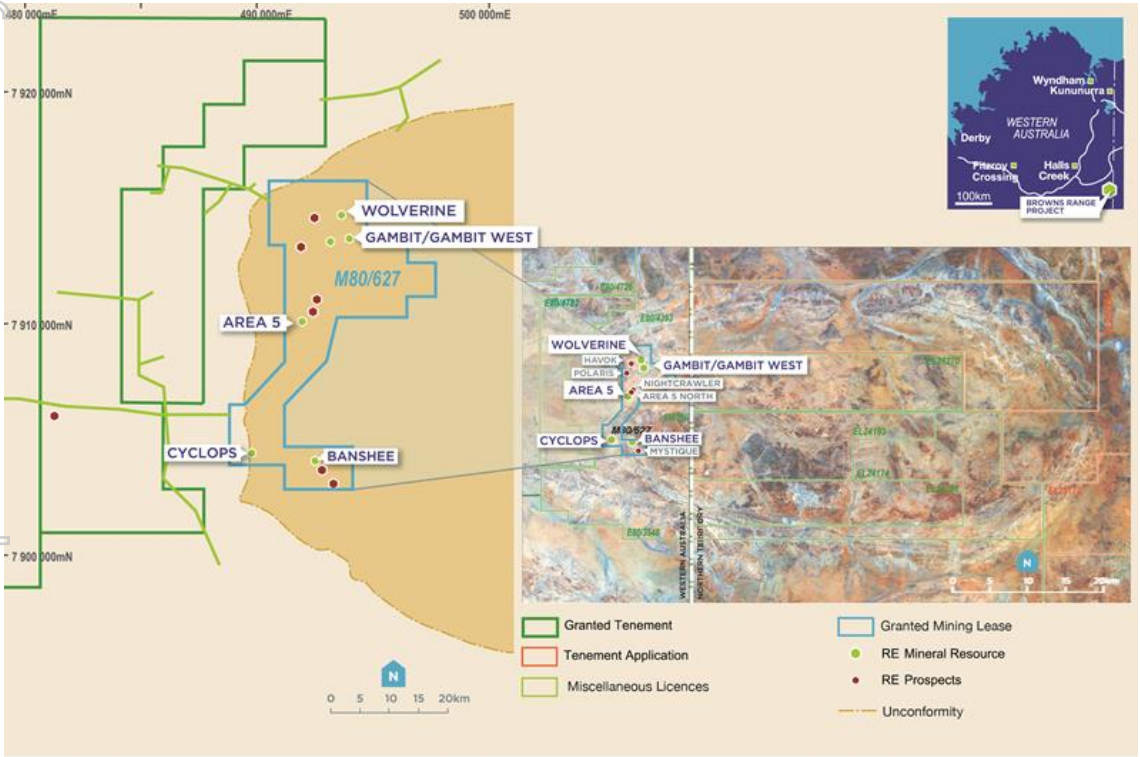


The dome is a massive geological feature covering 1,500km$^2$ and stretching

**60km x 30km** most of which hasn't been effectively explored

## Exploration Target*

4.3 – 9.3Mt at 0.25-0.51% TREO for 10,625 - 47,825t contained TREO

* 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.

# Ionic clay deposits are not sustainable

Declining grades

Declining acceptance

**This is the only competition that Browns Range has**

Source: David Gray/Reuters

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# Three stage approach to full scale production

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## Stage 1

### TEST PILOT PLANT

- 10% of full scale capacity
- Production 11 months from funding
- Low capital cost
- Develop mining, processing & offtake experience

## Stage 2

### DEVELOP PROJECT

- Reduce mining cost - modify mining method
- Boost production – increase head grade
- Develop premium product – yttrium rejection
- Increase reserve - drilling

## Stage 3

### BUILD FULL SCALE

- 585,000tpa operation
- 1,500,000kg TREO in a premium product
- Significant dysprosium supplier
- Initial 11 year life with significant upside

**measured . sustainable . achievable**

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# Funding secured, pre-commitment work under way on Pilot Plant

- $30 million equity investment secured from Huatai Mining following FIRB approval
- $12 million received to date
- Second and third tranches of $9 million each due before the end of November and December respectively
- $3.4 million pre-commitment works program underway for development of Browns Range Pilot Plant including:
  - Mine planning;
  - Drilling;
  - Water supply;
  - Engineering design, and
  - Extension to accommodation camp

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# Why a continuous pilot plant at Browns Range?

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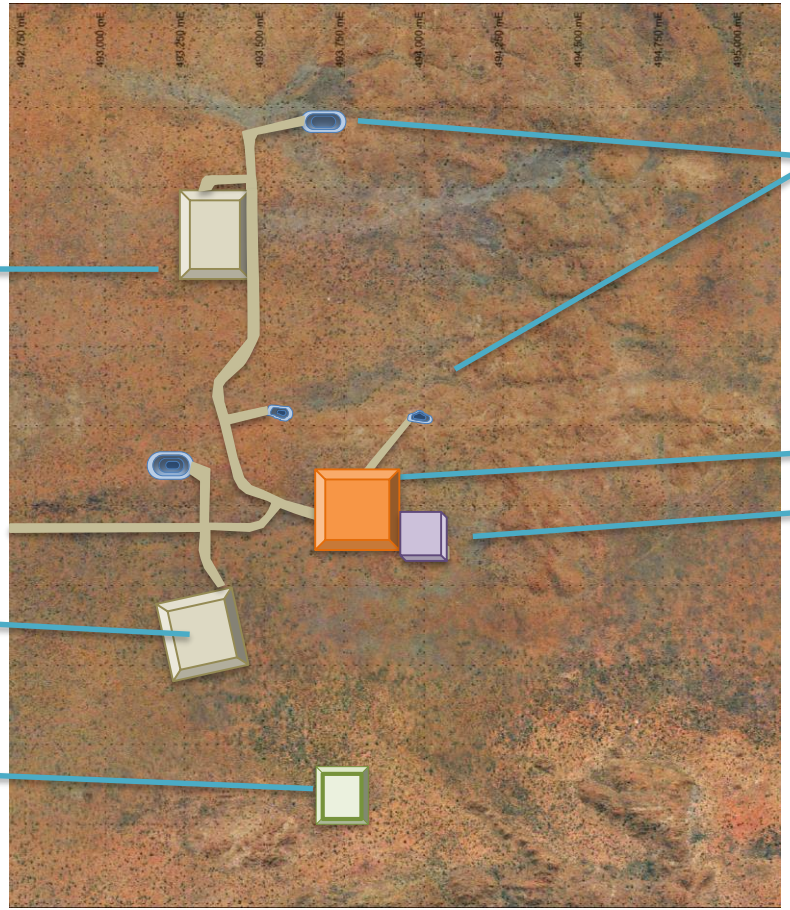
# Browns Range Pilot Plant Key Metrics

# Browns Range Pilot Plant

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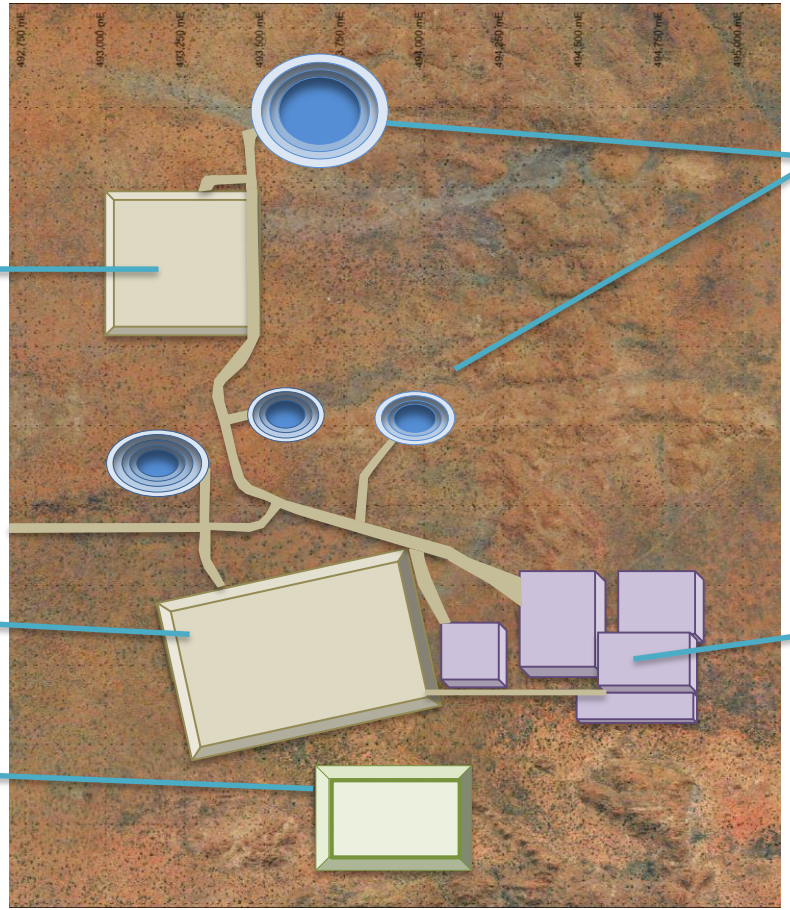
# Browns Range Full Scale Operation

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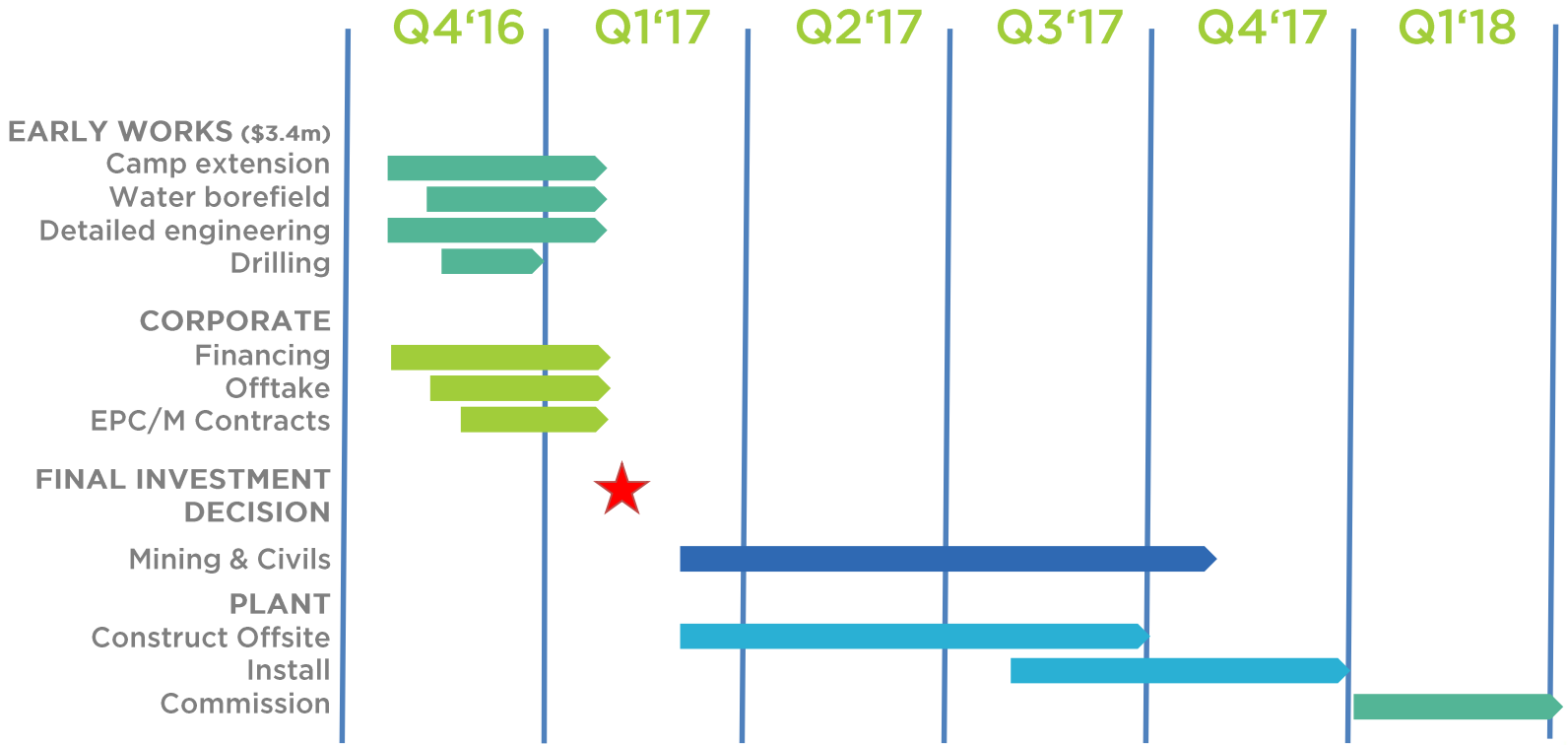
# Browns Range Pilot Plant timeline

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# Rapidly approaching our goal to become the first significant dysprosium producer outside of China

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# APPENDICES

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# The right leadership

A wealth of knowledge and experience to take Northern Minerals from developer to the next dysprosium producer

## BOARD OF DIRECTORS

**Conglin Yue – Executive Chairman**
- Long standing relationship with a number of major steel producing companies in China.

**George Bauk - Managing Director / CEO**
- 25 years' global resource industry experience in senior operational and corporate roles, with particular focus on rare earths, lithium and nickel.

**Kevin Schultz - Deputy Chairman**
- Mining Engineer/Geologist with 40 years record achievement from mineral discovery and appraisal, through to mine development.

**Adrian Griffin - Non Executive Director**
- Significant expertise in mine management and production with corporate experience as MD and Chairman of listed resource companies.

**Colin McCavana - Non Executive Director**
- More than 35 years' global management experience in the construction and operation of resources projects.

**Yanchun Wang - Non Executive Director**
- Strategic investor for a number of Chinese companies.

## EXECUTIVE MANAGEMENT TEAM

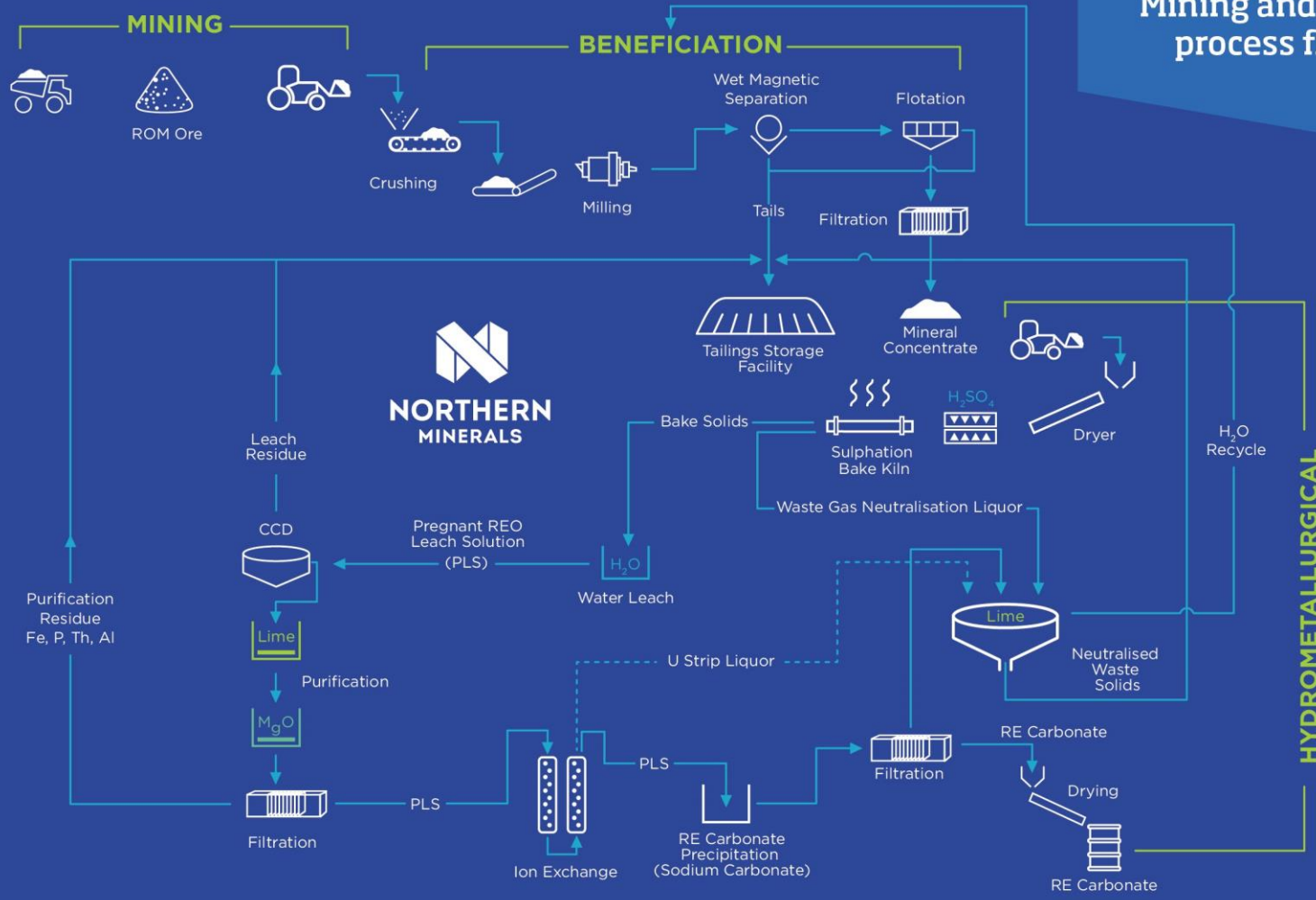
**Robin Wilson – Exploration Manager**
- Geologist, with 25 years' experience in Australia and Africa including the discovery of the Browns Range Project.

**Robin Jones – Chief Operating Officer**
- More than 25 years' experience, in Australia, Africa and Asia with success in taking projects from scoping study through to production.

**Mark Tory – CFO / Company Secretary**
- More than 25 years' experience in the management (operational and finance) of mining companies both national and international.

**Bin Cai – Alternate Director**
- Experience with the China Investment Bank, along with global resource investment.

# Mining and production process flowsheet

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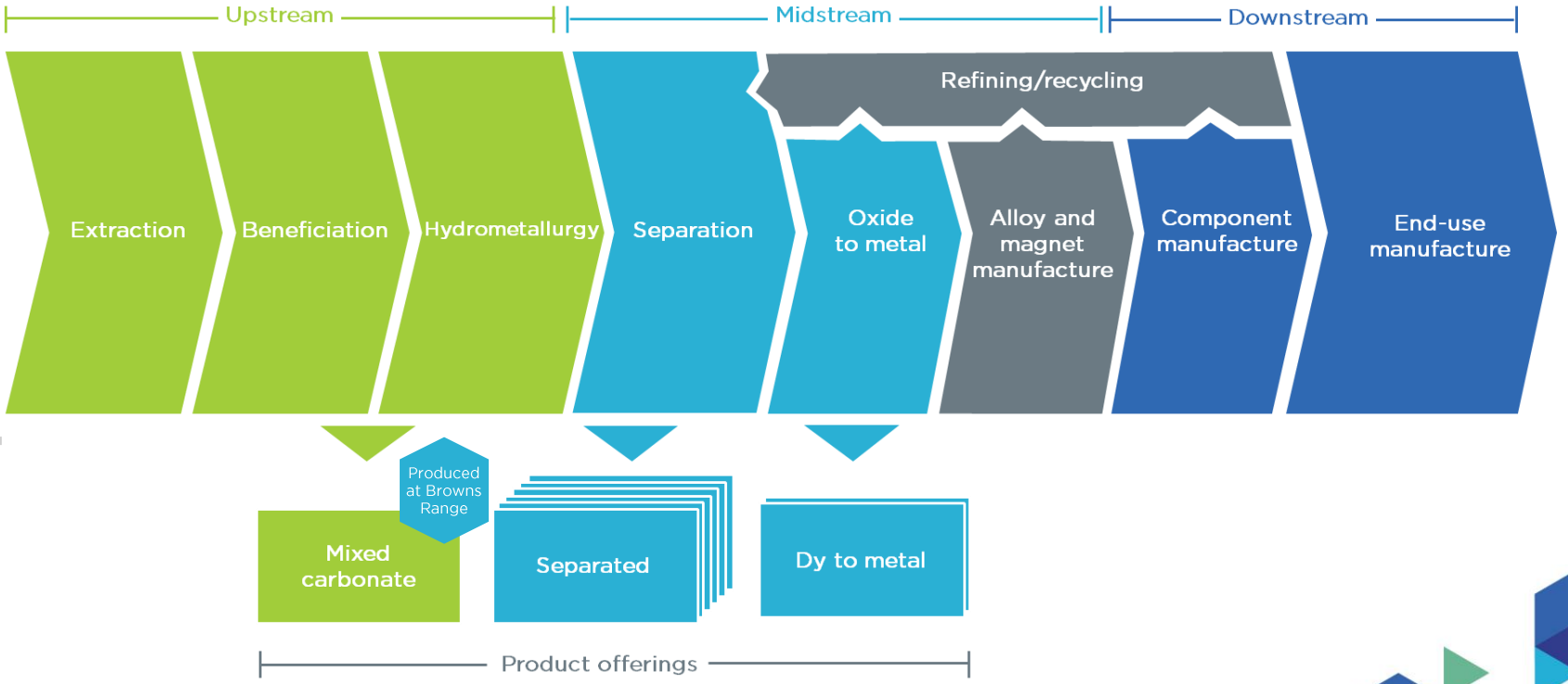
# Expanding the product offering: toll treat SX and metal

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# Mineral Reserve and Resource

## Probable Ore Reserve (March 2015)

| | | | TREO | | $Dy_2O_3$ | | $Y_2O_3$ | | $Tb_4O_7$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| Deposit | Classification | Ore Tonnes | kg/t | kg contained | kg/t | kg contained | kg/t | kg contained | kg/t | kg contained |
| TOTAL[1] | Probable | 3,750,000 | 7.03 | 26,375,000 | 0.61 | 2,294,000 | 4.07 | 15,266,000 | 0.09 | 335,000 |

## Global JORC compliant Mineral Resource Estimate (February 2015)

| Deposit | Category | Mt | TREO % | $Dy_2O_3$ kg/t | $Y_2O_3$ kg/t | $Tb_4O_7$ kg/t | HREO % | TREO kg |
|---|---|---|---|---|---|---|---|---|
| Total[1] | Indicated | 4.69 | 0.70 | 0.59 | 3.95 | 0.09 | 87 | 32,862,000 |
| | Inferred | 4.28 | 0.56 | 0.46 | 3.15 | 0.07 | 87 | 23,802,000 |
| | Total[1] | 8.98 | 0.63 | 0.53 | 3.56 | 0.08 | 87 | 56,663,000 |

[1] The Mineral Resource is inclusive of the Ore Reserves

Note: The Mineral Resource is a complete summation of individual resources reported at Wolverine, Gambit, Gambit West, Area 5, Cyclops and Banshee
The Ore Reserve is a complete summation of the individual Ore Reserves reported at Wolverine, Gambit, Gambit West, Area 5

[1] - Rounding may cause some computational discrepancies (TREO (metal) tonnes estimated from Mt x TREO%)
TREO = Total Rare Earth Oxides – $La_2O_3$, $CeO_2$, $Pr_6O_{11}$, $Nd_2O_3$, $Sm_2O_3$, $Eu_2O_3$, $Gd_2O_3$, $Tb_4O_7$, $Dy_2O_3$, $Ho_2O_3$, $Er_2O_3$, $Tm_2O_3$, $Yb_2O_3$, $Lu_2O_3$, $Y_2O_3$;
HREO = Heavy Rare Earth Oxides – Total of $Sm_2O_3$, $Eu_2O_3$, $Gd_2O_3$, $Tb_4O_7$, $Dy_2O_3$, $Ho_2O_3$, $Er_2O_3$, $Tm_2O_3$, $Yb_2O_3$, $Lu_2O_3$, $Y_2O_3$

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# Pilot plant: targeted production

- Mixed RE carbonate (REC) produced
- Product specification available for REC
- REC samples validated by several downstream separators
- REC suitable for solvent extraction separation
- Low thorium and uranium levels

| REO contained in mixed RE carbonate | Annual production (000s kgs) |
|---|---|
| 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 |
| Total TREO produced | 573.0 |

Figures may not add due to rounding
TREO = Total Rare Earth Oxides- Total of $Dy_2O_3$,$La_2O_3$, $CeO_2$, $Pr_6O_{11}$, $Nd_2O_3$, $Sm_2O_3$, $Eu_2O_3$, $Gd_2O_3$, $Tb_4O_7$, $Ho_2O_3$, $Er_2O_3$, $Tm_2O_3$, $Yb_2O_3$, $Lu_2O_3$, $Y_2O_3$

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