Hartleys

ARU.asx
Speculative Buy

Rare Earths: Developer

ARAFURA RESOURCES LTD (ARU)

Large rare earth (NdPr) development in Australia

Arafura Resources Ltd (ARU) is developing the very large Nolans hardrock (apatite vein-hosted) rare earth project in central Australia. It is a very advanced project, having completed over 10 years of studies and approval processes.

Large volumes of NdPr oxide

Nolans will produce NdPr oxide. Volumes are large at ~4.4ktpa of NdPr oxide (around 10% of the current market), which is slightly lower than LYC.asx current production. Growth in the NdPr market is expected to be very strong based mainly on the outlook for electric vehicles. In addition, the strategic value of rare earths is becoming more mainstream, and ARU's location in Australia should be a premium for reliable supply. Note, ARU's current NdPr offtakes are all with large Chinese magnet manufacturers. The project is also expected to produce phosphoric acid and low value cerium product which, combined, are ~20% of revenue.

Current prices are too low to incentivise production

The current NdPr oxide price is ~US$42/kg, and we estimate that the project is not viable using spot prices. The ARU DFS assumed prices of US$75/kg, for annual EBITDA of ~$377m pa. Our model assumes LOM A$230m EBITDA pa using NdPr prices ~US$69/kg. The DFS estimates capex of A$1b and capital of A$1.15b. We assume a higher capital requirement in our model to err on the conservative.

Mine life extension

The reserve is based on the apatite rich ore, and the process plant has been optimised for only this ore. The lower apatite ore is stockpiled (~9mt). There is study work underway to determine how to process the low apatite ore and add it into the mine plan (extend mine life). Additionally, there is exploration potential near mine and at depth. Drilling is currently underway.

Approvals timeline – mining lease mid CY20?

ARU has received all environmental approvals but in order to be granted the mining lease must reach a formal agreement with traditional owners. This is expected to occur early CY20. On that assumption, it is possible the mining licence may be granted in mid-CY20. Once the mining licence is granted, financing (and in conjunction offtakes) will be the last hurdle for construction.

Initiate coverage with Speculative Buy

Using current NdPr prices, we estimate that Nolans is uneconomic. We believe prices need to increase to incentivise the supply to meet medium term (2025-2030) demand forecasts. Superficially there is substantial possible rare earth supply, and so procurement by end-users appears straightforward. The reality though of very long lead times to arrange environmental approvals and the high capital requirements suggest procurement will be much harder. It is possible that the market will be awakened by a very strong price shock (as has happened before). Geopolitical risks suggest it is possible that industry could move earlier than usual to secure such supply. A key catalyst for ARU will be when and if the Company can demonstrate binding offtakes for the NdPr. This is a risk given it requires multiple counterparties. We initiate coverage with a Speculative Buy recommendation.

	4 Nov 2019
Share Price	$0.091
Valuation	$0.14
Price Target (12 month)	$0.15

Brief Business Description:
ARU is developing the very large Nolans NdPr (rare earth) project in Central Australia.

Hartleys Brief Investment Conclusion
The capital hurdle is a big challenge. However, given the advanced stage, low sovereign risk, strategic importance and high growth outlook, capital maybe available.

Chairman & MD
Mark Southey (Non-Exec Chairman)
Gavin Lockyer (Managing Director)

Top Shareholders

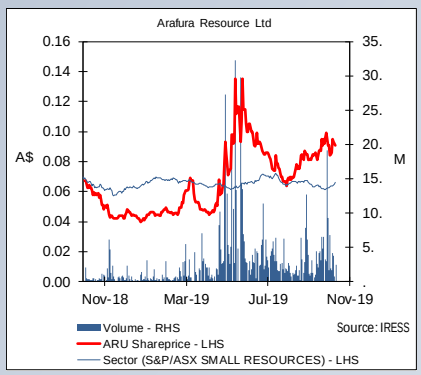
ECE (East China Expl & Dev. Bureau)	10.4%
Talaxis (Noble Group)	5.2%

Company Address
Level 3, 263 Adelaide Tce
Perth, WA, 6000

Issued Capital	1054.0m
- fully diluted	1084.7m
Market Cap	A$96m
- fully diluted	A$99m
Cash (30 Sep 2019)	A$25.0m
Debt (30 Sep 2019)	A$0.0m
EV -current	A$70.9m

Prelim. (A$m)	**FY20e**	**FY21e**	**FY22e**
Prod (NdPr)	0	0	0
Op Cash Flw	-6.9	-11.3	-64.6
Norm NPAT	-5.1	-12.4	-58.6
CF/Share (cps)	-0.9	-0.5	-1.2
EPS (cps)	-0.9	-0.5	-1.2
P/E	-9.7	-19.9	-7.5

	Mt	**TREO%**	**P2O5%**
Resources	**56.0**	**2.8**	**11.6**
Reserves	**19.2**	**3.0**	**13.0**



Trent Barnett
Head of Research
Ph: +61 8 9268 3052
E: trent.barnett@hartleys.com.au

Analyst has a beneficial interest in ARU.

Hartleys does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision. Further information concerning Hartleys' regulatory disclosures can be found on Hartleys website www.hartleys.com.au

Arafura Resource Ltd — **Share Price**
ARU — **$0.091**

4 November 2019
Speculative Buy

Key Market Information	
Share Price	**$0.091**
Market Capitalisation - ordinary	A$96m
Net Cash (Debt)	$25m
Market Capitalisation - fully diluted	A$99m
EV	A$73.7m
Issued Capital	1054.0m
Options	30.7
Issued Capital (fully diluted inc. all options)	1084.7m
Issued Capital (fully diluted inc. all options and new capital)	7236.6m
Valuation	$0.14
12month price target	**$0.15**

Directors	Company Information
Mark Southey (Non-Exec Chairman)	Level 3, 263 Adelaide Tce
Gavin Lockyer (Managing Director)	Perth, WA, 6000
Chris Tonkin (Non-Exec Director)	+61 8 6210 7666
Quansheng Zhang (Non-Exec Director, ECE nominee)	
	https://www.arultd.com/

Top Shareholders	m	%
ECE (East China Expl & Dev. Bureau)	109.70	10.4%
Talaxis (Noble Group)	55.14	5.2%

P&L	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
Net Revenue	**A$m**	**0.0**	**0.0**	**83.2**	**257.4**	**409.2**
- TREO		0.0	0.0	69.9	222.2	360.4
NdPr				64.9	206.3	334.8
Other				5.0	15.8	25.7
- P2O5		0.0	0.0	13.3	35.2	48.7
Total Costs	**A$m**	**-7.1**	**-7.4**	**-62.2**	**-134.5**	**-175.1**
EBITDA	A$m	-7.1	-7.4	21.0	122.9	234.1
- margin	%	-	-	25%	48%	57%
Depreciation/Amort	A$m	-6.5	-19.3	-37.8	-47.8	-50.4
EBIT	**A$m**	**-13.5**	**-26.7**	**-16.8**	**75.0**	**183.6**
Net Interest	A$m	-4.1	-57.1	-62.8	-80.0	-80.0
Norm. Pre-Tax Profit	**A$m**	**-17.6**	**-83.8**	**-79.6**	**-5.0**	**103.6**
Reported Tax Expense	A$m	0.0	0.0	0.0	0.0	0.0
effective rate	%	0.0%	0.0%	0.0%	0.0%	0.0%
Normalised NPAT	**A$m**	**-12.4**	**-58.6**	**-55.7**	**-3.5**	**72.5**
Abnormal Items	A$m	-5.3	-25.1	-23.9	-1.5	31.1
Reported Profit	A$m	-17.6	-83.8	-79.6	-5.0	103.6
Minority	A$m	0.0	0.0	0.0	0.0	0.0
Profit Attrib	**A$m**	**-17.6**	**-83.8**	**-79.6**	**-5.0**	**103.6**

Balance Sheet	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
Cash	**A$m**	**1270.3**	**701.2**	**219.1**	**126.7**	**188.6**
Other Current Assets	A$m	3.9	4.1	51.2	126.6	180.0
Total Current Assets	**A$m**	**1274.2**	**705.3**	**270.3**	**253.3**	**368.6**
Property, Plant & Equip.	A$m	137.2	621.8	985.6	1008.9	1003.3
Exploration	A$m	101.6	102.2	102.8	103.4	104.0
Investments/other	A$m	0.3	0.3	0.3	0.3	0.3
Tot Non-Curr. Assets	**A$m**	**239.1**	**724.3**	**1088.7**	**1112.6**	**1107.6**
Total Assets	**A$m**	**1513.3**	**1429.6**	**1359.0**	**1365.9**	**1476.2**
Short Term Borrowings	A$m	-	-	-	-	-
Other	A$m	1.9	1.9	11.0	22.8	29.5
Total Curr. Liabilities	**A$m**	1.9	1.9	11.0	22.8	29.5
Long Term Borrowings	A$m	572.7	572.7	572.7	572.7	572.7
Other	A$m	0.0	0.0	0.0	0.0	0.0
Total Non-Curr. Liabil.	**A$m**	**572.7**	**572.7**	**572.7**	**572.7**	**572.7**
Total Liabilities	**A$m**	**574.6**	**574.7**	**583.7**	**595.6**	**602.2**
Net Assets	**A$m**	**938.7**	**854.9**	**775.4**	**770.4**	**874.0**
Net Debt (cash)	A$m	-697.6	-128.5	353.6	446.0	384.1

Cashflow	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
EBITDA	A$m	-7.1	-7.4	21.0	122.9	234.1
Working Capital	A$m	-0.1	-0.1	-38.1	-63.5	-46.8
Operating Cashflow	A$m	-7.2	-7.6	-17.1	59.3	187.3
Income Tax Paid	A$m	0.0	0.0	0.0	0.0	0.0
Interest & Other	A$m	-4.1	-57.1	-62.8	-80.0	-80.0
Operating Activities	**A$m**	-11.3	-64.6	-80.0	-20.6	107.3
Property, Plant & Equip.	A$m	-147.2	-503.9	-401.6	-71.2	-44.8
Exploration and Devel.	A$m	-0.6	-0.6	-0.6	-0.6	-0.6
Other	A$m	0.0	0.0	0.0	0.0	0.0
Investment Activities	**A$m**	**-147.8**	**-504.5**	**-402.2**	**-71.8**	**-45.4**
Borrowings	A$m	572.7	0.0	0.0	0.0	0.0
Equity or "tbc capital"	A$m	859.1	0.0	0.0	0.0	0.0
Dividends Paid	A$m	0.0	0.0	0.0	0.0	0.0
Financing Activities	**A$m**	**1431.8**	**0.0**	**0.0**	**0.0**	**0.0**
Net Cashflow	**A$m**	**1272.7**	**-569.1**	**-482.1**	**-92.4**	**61.9**

Shares	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
Ordinary Shares - End	m	6933.3	6933.3	6933.3	6933.3	6933.3
Ordinary Shares - Weighted	m	3857.3	6933.3	6933.3	6933.3	6933.3
Diluted Shares - Weighted	m	3857.4	6933.3	6933.3	6933.3	6933.3

Ratio Analysis	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
Cashflow Per Share	A$ cps	-0.1	-0.8	-0.9	-1.2	-1.2
Cashflow Multiple	x	-85.4	-11.1	-10.0	-7.9	-7.9
Earnings Per Share	A$ cps	-0.5	-1.2	-1.1	-0.1	1.5
Price to Earnings Ratio	x	-19.9	-7.5	-7.9	-126.7	6.1
Dividends Per Share	AUD	-	-	-	-	-
Dividend Yield	%	0.0%	0.0%	0.0%	0.0%	0.0%
Net Debt / Net Debt + Equity	%	-289%	-18%	31%	37%	31%
Interest Cover	X	na	na	na	0.9	2.3
Return on Equity	%	na	na	na	na	8%

Reserves & Resources

				Proportion of TREO in-situ			
Resources	**Mt**	**TREO (%)**	**P2O5 (%)**	Pr6O11	Nd2O3	CeO2	La2O3
M&I	35.0	2.8	11.6	n/a	n/a	n/a	n/a
Inferred	21.0	2.3	10.0	n/a	n/a	n/a	n/a
Total	**56.0**	**2.6**	**11.0**	**5.9**	**20.5**	**48.7**	**19.3**
Reserves	**Mt**	**TREO (%)**	**P2O5 (%)**				
Nolans	19.2	3.0	13.0	n/a	n/a	n/a	n/a

Production Summary	Unit	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25	30 Jun 26	30 Jun 27
Mill Throughput	Mt	-	0.24	0.56	0.74	0.88	0.88
TREO	Grade		3.2%	3.3%	3.3%	3.0%	2.9%
Combined Recovery & Payability	%		29.4%	39.1%	48.5%	51.5%	53.3%
TREO Production	Tonnes	-	2.3	7.3	11.8	13.8	13.9
NdPr Production	Tonnes	-	0.7	2.2	3.5	4.1	4.2
P2O5	Grade		12.6%	13.2%	13.2%	12.6%	13.0%
Combined Recovery & Payability	%		56%	61%	64%	63%	65%
Production	Tonnes	-	17.0	44.9	62.2	70.2	74.1
Modelled mine Life	yr		22.75	21.75	20.75	19.75	18.75
Modelled mining inventory	Mt		18.9	18.4	17.7	16.8	15.9

Costs	Unit	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25	30 Jun 26	30 Jun 27
Cost per milled tonne	$A/t	-	257.2	239.6	236.6	235.3	235.7
EBITDA / tonne milled ore	$A/t	-	86.7	218.8	316.3	306.3	310.4
Total cash costs (no credits)	$A/kg NdPr	-	91.1	61.7	49.5	50.0	50.0
	$US/kg NdPr		66.9	45.6	36.6	37.0	37.0
Total cash costs (with credits)	$A/kg NdPr		64.3	38.3	28.5	29.5	28.8
	$US/kg NdPr		47.2	28.3	21.1	21.8	21.3

Price Assumptions	Unit	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25	30 Jun 26	30 Jun 27
AUDUSD	A$/US$	0.71	0.74	0.74	0.74	0.74	0.74
TREO	US$/kg	22.6	22.6	22.6	22.6	22.6	22.6
NdPr	US$/kg	70.0	70.0	70.0	70.0	70.0	70.0
P2O5	US$/tonne	580	580	580	580	580	580

Hedging	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25	30 Jun 26	30 Jun 27
Hedges maturing?	No	No	No	No	No	No

Sensitivity Analysis

	Valuation	FY24 EBITDA
Base Case	**0.140**	**122.9**
Spot Prices	0.00 (-100.0%)	69.0 (-43.9%)
Spot AUD/USD 0.69, NdPr $41/kg, P2O5 $580/t		
AUDUSD +/-10%	0.00 / 0.36 (-100.0% / 158.7%)	99.5 / 151.5 (-19.0% / 23.3%)
P2O5 +/-10%	0.14 / 0.11 (18.3% / -18.6%)	122.86 / 119.33 (2.9% / -2.9%)
Ce Oxide +/-10%	0.14 / 0.13 (8.8% / -8.9%)	122.86 / 121.27 (1.3% / -1.3%)
NdPr +/-10%	0.17 / 0.00 (118.4% / -100.0%)	126.38 / 102.22 (16.8% / -16.8%)
Production +/-10%	0.34 / 0.00 (143.7% / -100.0%)	148.6 / 97.1 (21.0% / -21.0%)
Operating Costs +/-10%	0.04 / 0.23 (-68.1% / 66.5%)	110.2 / 135.5 (-10.3% / 10.3%)

Unpaid Capital

Year Expires	No. (m)	$m	Avg price	% ord
30-Jun-20	0.0	0.0	0.00	0%
30-Jun-21	0.0	0.0	0.00	0%
30-Jun-22	1.6	0.2	0.15	0%
30-Jun-23	29.1	3.3	0.11	3%
30-Jun-24	0.0	0.0	0.00	0%
TOTAL	**30.7**	**3.5**	**0.00**	**3%**

Share Price Valuation (NAV)	Risked Est. A$m	Est. A$/share
100% Nolans (pre-tax NAV at disc. rate of 12%)	1107.7	0.153
Other Asset/Exploration	50.0	0.007
Hedging	0.0	0.000
Corporate Overheads	-48.9	-0.007
Net Cash (Debt)	25.0	0.003
Tax (NPV future liability)	-126.7	-0.018
Expected future franking credits	0.0	0.000
Options & Other Equity	3.5	0.000
Total	**1010.7**	**0.14**

Analyst: Trent Barnett
+61 8 9268 2805

Last Updated: 04/11/2019

"tbc capital" could be equity or debt. Our valuation is risk-adjusted for how this may be obtained.

Sources: IRESS, Company Information, Hartleys Research

BUSINESS OVERVIEW

ARU is developing the Nolans hardrock (apatite vein-hosted) rare earth deposit in the Northern Territory, Australia. The project is very advanced with a DFS completed in February 2019. The estimated capex is A$1b (A$1.15b including working capital) and the flowsheet is to produce a NdPr oxide. The flowsheet also produces MGA (phosphoric acid, 54% P2O5) and a separate other rare earth (lower value) concentrate. The economics are highly dependent on NdPr prices, with the credits only a minor percentage of revenue.

On a volume basis, the project generates ~4.4ktpa of NdPr, ~9ktpa of low value rare earth concentrate and ~135ktpa of MGA (~73ktpa of contained P2O5).

Fig. 1: Rare earth products

Table 21
Rare Earth Products

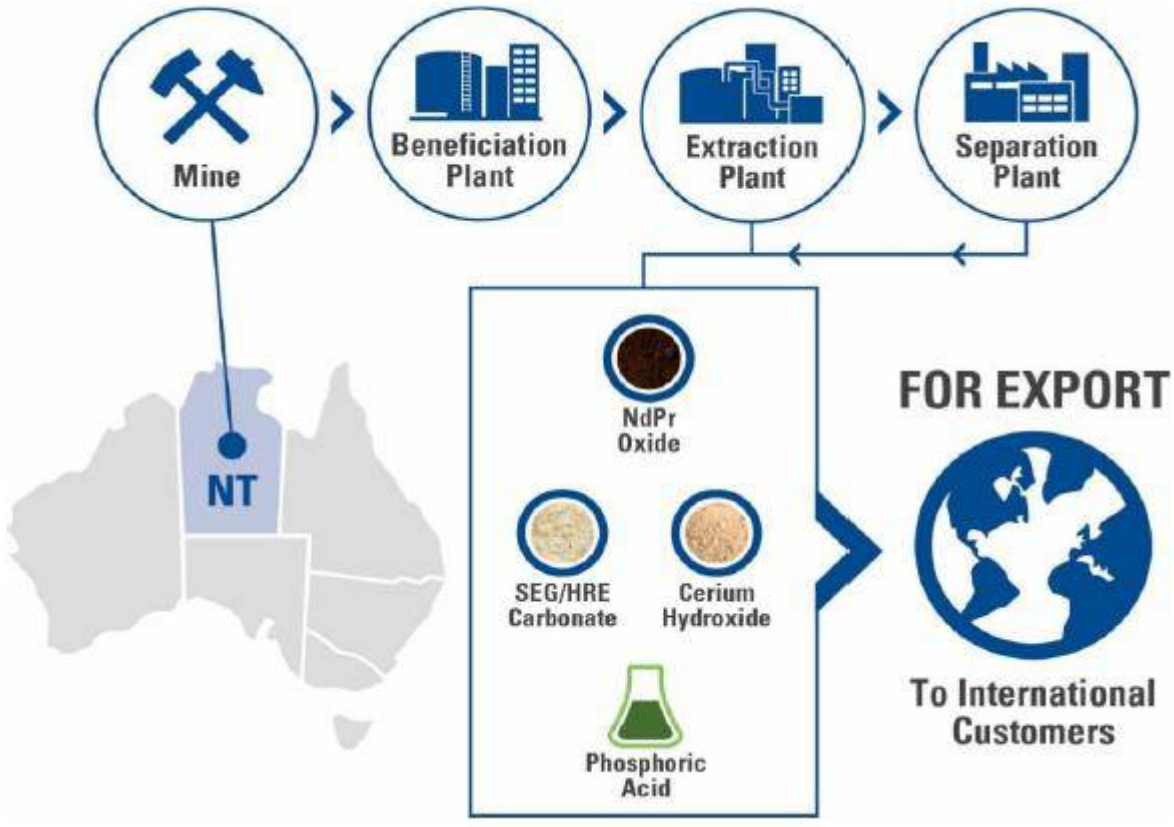
Product	TREO %	REO/TREO %	Average REO* t	Average Product t
Cerium Hydroxide	>95%**	>95%	8,383	10,271
NdPr Oxide	>99%	>99%	4,357	4,379
SEG/HRE Carbonate	>99%**	>99%	603	1,064
Total			**13,343**	**15,714**

* Average production is calculated as the arithmetic annual average following the anticipated three year ramp up period and excluding the partial final year of production.

** % TREO for hydroxide and carbonate products is based on an as calcined (converted to an oxide product) basis.

Source: ARU

Fig. 2: Simplified process plan



Source: ARU

Fig. 3: Reserves and Resources

Table 11
Statement of Mineral Resources for the Nolans Bore Rare Earth Deposit
Announced 7 June 2017 – 1% TREO lower cut-off grade

Category	Tonnes (Mt)	TREO (%)	P_2O_5 (%)	NdPr Enrichment (%)
Measured	4.9	3.2	13	26.1
Indicated	30	2.7	12	26.4
Inferred	21	2.3	10	26.5
Total	**56**	**2.6**	**11**	**26.4**

Note: Numbers may not compute due to rounding. "NdPr Enrichment" is the proportion of TREO comprising neodymium oxide Nd_2O_3 and praseodymium oxide Pr_6O_{11}.

The stated TREO grade is based on the sum of the estimated grades for 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 and Y_2O_3.

The proportion of each rare earth oxide is presented in Table 12.

Table 19
Nolans Project Ore Reserves

Classification	Mt	TREO (%)	P_2O_5 (%)	NdPr Enrichment (%)
Proved	4.3	3.1	13	26.1
Probable	14.9	2.9	13	26.5
Total	**19.2**	**3.0**	**13**	**26.4**

Note: Numbers may not compute due to rounding. "NdPr Enrichment" is the proportion of TREO comprising neodymium oxide Nd_2O_3 and praseodymium oxide Pr_6O_{11}.

Table 12
Percentage Proportion of TREO in the Mineral Resources

	Measured	Indicated	Inferred	Total
La_2O_3	19.5	19.3	19.2	19.3
CeO_2	48.7	48.7	48.7	48.7
Pr_6O_{11}	5.9	5.9	5.9	5.9
Nd_2O_3	20.2	20.5	20.6	20.5
Sm_2O_3	2.3	2.3	2.3	2.3
Eu_2O_3	0.4	0.4	0.4	0.4
Gd_2O_3	0.9	1.0	1.0	1.0
Tb_4O_7	0.07	0.08	0.09	0.08
Dy_2O_3	0.3	0.3	0.3	0.3
Ho_2O_3	0.05	0.4	0.04	0.04
Er_2O_3	0.08	0.09	0.09	0.09
Tm_2O_3	0.01	0.01	0.01	0.01
Yb_2O_3	0.06	0.05	0.05	0.05
Lu_2O_3	0.007	0.007	0.007	0.007
Y_2O_3	1.5	1.3	1.3	1.4

Note: numbers may not compute due to rounding.

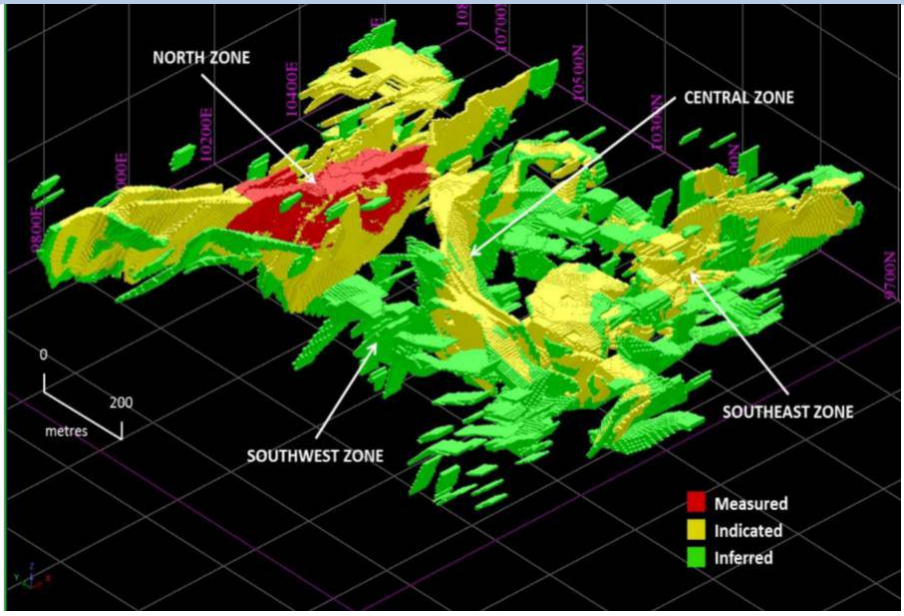
Source: ARU

NOLANS

There are four parts to the operation. The following is extracted from the DFS report.

Mining and stockpiling: An initial pre-strip period of eight months will be undertaken in pit Stage 1 which places 70,000 tonnes of ore on the ROM pad. Average annual mining rate of 3.2 Mtpa for the first seven years before rising to 8.0 Mtpa in year 10. This rate will be maintained until year 15 when the final pit stage will be commenced, at which time the mining rate will rise to 11.2 Mtpa. This rate will be the peak mining rate for the LOM and will be required to be maintained for less than three years before the mining rate will gradually reduce towards the end of the mine life.

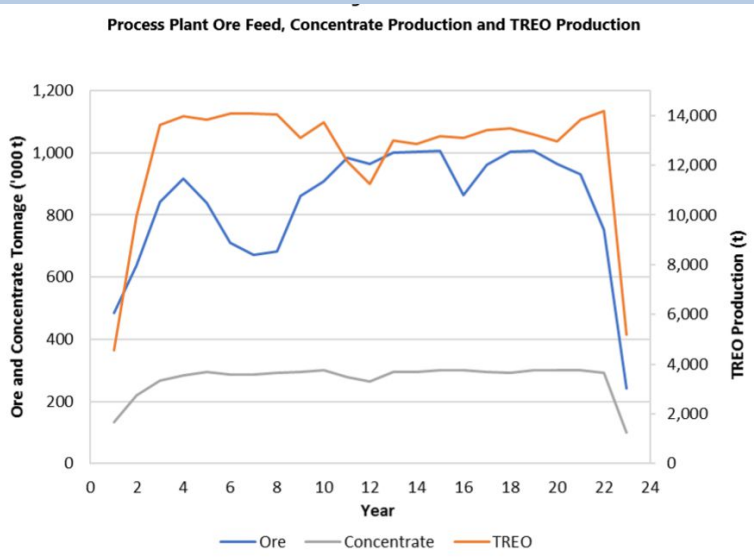
Fig. 4: Nolans Bore block model



Source: ARU

Beneficiation / Concentrator: peak rate 1mtpa. The beneficiation facility will produce a concentrate to feed the extraction plant. The ROM ore will initially be crushed and ground in a single-stage semi-autogenous grinding (SAG) mill to produce a feed to flotation. Flotation will concentrate the phosphate minerals into a high phosphate concentrate containing the majority of the rare earths. Flotation tailings will be pumped as a slurry to the RSF, whilst concentrate will be filtered and sent to the rare earth extraction area for further processing.

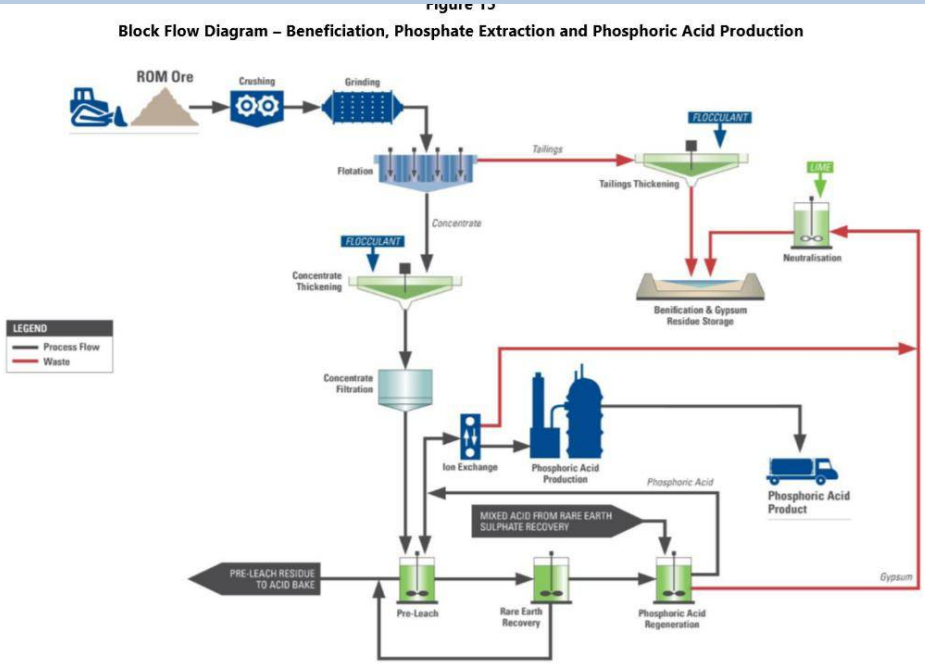
Fig. 5: Production



Source: ARU

Phosphate Extraction: The phosphoric acid pre-leach will leach the majority of the phosphate from the concentrate to leave a rare earth-rich residue. As the concentrate will consist primarily of phosphate minerals, MGA phosphoric acid can be produced as a by-product. The process will begin with pre-leaching utilising a two-stage counter-current leach with phosphoric acid where most of the calcium and phosphate in the concentrate will be leached into solution leaving behind most of the rare earth minerals in the residue. Stage 2 pre-leach will involve the addition of fresh phosphoric acid from phosphoric acid regeneration to the Stage 1 pre-leach centrifuge cake. Solid liquid separation between Stage 1 and Stage 2 pre-leach stages is achieved using centrifuges, while countercurrent centrifuge repulp washing will be applied to the Stage 2 centrifuge cake, with the final washed centrifuge cake repulped and pumped to the pre-leach residue filter. Pre-leach residue will be fed to the rare earth extraction area and Stage 1 centrate will be processed further in the rare earth recovery area to recover remaining rare earths and phosphoric acid.

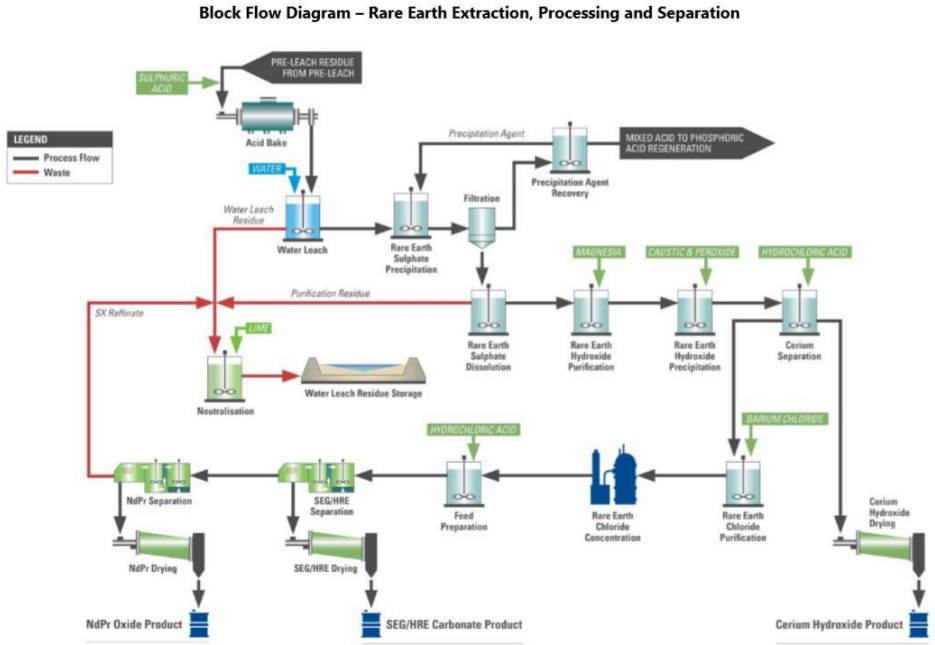
Fig. 6: Phosporic acid flow sheet



Source: ARU

Rare earth extraction: In the rare earth separation area, the concentrated rare earth chloride solution will be treated via SX to produce two separate products: SEG/HRE carbonate and NdPr oxide. The option remains to add a third circuit for the recovery of La oxide, however this has not been included due to the low value of the La oxide.

Fig. 7: Rare earth flow sheet



Source: ARU

The reserve is based on the apatite rich ore, which the process plant is optimised for. he low apatite ore which still contains rare earths is stockpiled. There is current work undertaken to determine how to process the low apatite ore and add it into the mine plan (extend mine life).

Fig. 8: Mine plan and metallurgy important factors to understand

Table 13
Indicative Average Grades and Quantities for the Individual Material Types

MAT2016 Type/Group	Description	Average TREO (%)	Average P_2O_5 (%)	NdPr Enrichment (%)	Volume % Measured & Indicated Resources
0A - Waste	Country rock with no evidence of MIN.	0.11	0.15	21.2	3
0B1 - Waste	Country rock with evidence of minor MIN but <0.5% TREO.	0.21	0.66	23.6	7
0B2 - Waste	Country rock with evidence for minor MIN but >0.5% TREO.	0.69	2.6	24.9	2
0B3 - Waste	Country rock but geochemical evidence for MIN. No obvious MIN in RC chips.	1.6	6.6	25.9	<1
0C - Waste	Altered country rock with <0.5% TREO.	0.20	0.68	23.8	3
1 - PAPLP	Cream/green apatite with <2% allanite (<30% clay and <25% calcsilicate).	6.1	28	27.0	7
2 - PAPLP	Brown apatite with <2% allanite (<30% clay and <25% calcsilicate).	6.4	29	26.6	7
3A - NP1	Fine grained monazite and crandallite-rich MIN >30% clay	9.2	9.5	25.9	1
3B - PAPLP	TREO >0.5% and >30% clay with oxidised apatite, cheralite, kaolin and clay	2.7	12	25.9	27
3C - Waste	TREO <0.5% and >30% clay with mixture of oxidised country rock, apatite, cheralite, kaolin and clay	0.20	0.77	22.6	3
4A - PAPLP	Apatite with 2-10% allanite	5.5	26	27.1	2
4B - NP2	Apatite with >10% allanite	5.0	24	26.8	1
5A1 - PAPLP	>25% OH-free calcsilicates + apatite + <10% allanite	2.3	9.9	26.5	20
5A2 - NP2	>25% OH-bearing calcsilicates + apatite + <10% allanite	1.9	8.2	26.2	14
5B2 - NP2	>25% OH-bearing calc-silicates + apatite + >10% allanite	3.2	13	25.9	1
6B - NP2	>30% clay, >25% calcsilicates + apatite + allanite; TREO > 0.5%	2.1	8.9	25.0	<1
6C - Waste	>30% clay, >25% calcsilicates + apatite + allanite; TREO < 0.5%	0.25	1.5	23.0	<1

Note: Numbers may not compute due to rounding.

Source: ARU

APPROVALS TIMELINE

ARU has received the final environmental approvals but in order to be granted the mining lease must reach a formal agreement with traditional owners. This is expected to occur in early of CY20. On that assumption, it is possible the mining licence may be granted in mid CY20. Once the mining licence is granted, financing (and in conjunction offtakes) will be the last hurdle for construction.

INDUSTRY EXPOSURE

ARU is mainly a rare earths project, and the economics depend almost entirely on the NdPr price. NdPr growth in dependent on magnet growth, which are used in high performance electric motors. Consequently, ARU is dependent on the elective vehicle market outlook.

Fig. 9: Rare earths types and uses

TABLE 1:
Some Key Drivers of Rare Earths Demand

Application	Rare Earths	Demand drivers
Magnets	**Nd, Pr,** Sm, Tb Dy	Laptop computers, mobile phones, cameras, voice coil motors, hybrid vehicles, electrical appliances, cordless power tools, wind turbines, missile guidance systems, medical resonance imaging equipment (MRIs), robots, electric vehicles, e-bikes.
LaNiH Batteries	**La, Ce,** Pr, Nd	Hybrid vehicle batteries. Hydrogen absorption alloys.
Phosphors	**Eu, Y, Tb,** La, Dy, Ce, Pr, Gd	Mobile phones, tablets, LEDs, energy efficient lighting systems..
Fluid Cracking Catalysts	**La,** Ce, Pr, Nd	Petroleum production
Polishing Powders	**Ce,** La, Nd	Mechano-chemical polishing powders for TVs, monitors, tablets, mirrors and (in nano-particulate form) silicon chips.
Auto Catalysts	**Ce,** La, Nd	To lower NOx and SO_2 levels
Glass Additive	**Ce, La,** Nd, Er	Cerium cuts down transmission of uv light. Lanthanum increases glass refractive index for CCTVs and mobile phone cameras..
Fibre Optics	**Er,** Y Tb, Eu	Signal amplification.

Source: Curtin-IMCOA Overview. The statements in this Overview represent the considered views of the Curtin-IMCOA. They include certain forecasts, projections, intentions and expectations which may or may not be achieved ("forward-looking statements"). All statements in this Overview, other than statements of historical facts, that address future market developments, government actions and events, are forward-looking statements. Although Curtin-IMCOA believes the outcomes expressed in such forward-looking statements are based on reasonable assumptions, such statements are not guarantees of future performance and actual results or developments may differ materially from those expressed or implied in forward-looking statements. Factors that could cause actual results to differ materially from those expressed or implied in forward-looking statements include actions by governments, new rare earth applications, the development of economic rare earth substitutes and general economic, market or business conditions. Accordingly, the statements in this Overview should be used for general guidance only and to the maximum extent permitted by applicable laws, Curtin-IMCOA makes no representation and can give no assurance, guarantee or warranty, express or implied as to, and take no responsibility and assume no liability for, the authenticity, validity, accuracy, currency, reliability, suitability or completeness of, or any errors in or omission from, any information, statement or opinion contained in this Overview, or that any particular rate of return will be achieved.

Fig. 10: Rare earths types minerals

3 Global Rare Earths Resources

The most common minerals that are processed to recover the rare earths are listed in Table 4. Almost all the light rare earths produced today are extracted from bastnasite and monazite, while most of the heavy rare earths are extracted from xenotime and ionic (adsorption) clays (which are peculiar to Southern China). The processes used to separate the rare earths from these minerals have changed little in the past 30 years. The route chosen is based upon the economics of the processes available with particular reference to the local costs of sulphuric acid, hydrochloric acid and caustic soda, the primary reagents used to extract rare earths.

TABLE 4:
Composition of Major Rare Earth Minerals

Mineral	Formula	Major Occurrences	REO max (%)
Bastnasite	$LnFCO_3$	China, USA, Africa	75
Monazite	$(Ln,Y,Th)PO_4$	China, Australia, Brazil, India, Malaysia, Africa	65
Loparite	$(Na,Ca,Ln,Y)(Nb,Ta,Ti)_2O_6$	Former Soviet Union	32
Xenotime	YPO_4	China, Australia, Malaysia, Africa	62
Ionic Clays	Weathered Xenotime and Apatite	China	n/a
Eudialyte	$Na_{15}Ca_6(Fe,Mn)_3Zr_3(Si,Nb)Si_{25}O_{73}(OH,Cl,H_2O)_5$	Australia, Canada, USA, Brazil	10

Hard rock deposits of bastnasite and placer deposits of monazite host most of the world's economic concentrations of light rare earths. The majority of rare earth mining operations are based on the exploitation of these minerals. Due to the widespread occurrence of bastnasite and monazite, it is the light rare earths that predominate and account for the largest proportion of rare earth oxides produced. World production of light and medium rare earths is dominated by the processing of bastnasite from the Bayan Obo mine in Inner Mongolia, where it is a by-product of iron ore mining. Processing takes place in Baotou, the capital city of the province.

TABLE 5:
Rare Earths Content of Major Source Minerals (% total REO)

RARE EARTH OXIDE	Bastnasite		Eudialyte	Monazite	Ion Adsorption Clays	
	Bayun Obo, Mongolia, China	Ngualla Project, Tanzania	Dubbo, Australia	Central Zone, Mt Weld, Australia	Xunwu, Jiangxi, China	Lognan, Jiangxi, China
La_2O_3	23.0	27.6	19.5	25.6	42.0	1.8
CeO_2	50.0	48.2	36.7	45.7	2.3	0.4
Pr_6O_{11}	6.2	4.7	4.0	5.4	8.8	0.7
Nd_2O_3	18.5	16.6	14.1	18.6	30.8	3.0
Sm_2O_3	0.8	1.6	2.2	2.4	3.8	2.8
Eu_2O_3	0.2	0.3	0.1	0.6	0.5	0.1
Gd_2O_3	0.7	0.6	2.2	1.0	2.9	6.9
Tb_4O_7	0.1	0.1	0.3	0.1	trace	1.3
Dy_2O_3	0.1	0.1	2.1	0.2	trace	6.7
Y_2O_3	trace	0.2	15.8	0.4	8.0	65.0
Total	**99.6**	**100.0**	**96.7**	**100.0**	**99.1**	**88.7**

Source: Roskill and company information.

Source: Curtin-IMCOA Overview. The statements in this Overview represent the considered views of the Curtin-IMCOA. They include certain forecasts, projections, intentions and expectations which may or may not be achieved ("forward-looking statements"). All statements in this Overview, other than statements of historical facts, that address future market developments, government actions and events, are forward-looking statements. Although Curtin-IMCOA believes the outcomes expressed in such forward-looking statements are based on reasonable assumptions, such statements are not guarantees of future performance and actual results or developments may differ materially from those expressed or implied in forward-looking statements. Factors that could cause actual results to differ materially from those expressed or implied in forward-looking statements include actions by governments, new rare earth applications, the development of economic rare earth substitutes and general economic, market or business conditions. Accordingly, the statements in this Overview should be used for general guidance only and to the maximum extent permitted by applicable laws, Curtin-IMCOA makes no representation and can give no assurance, guarantee or warranty, express or implied as to, and take no responsibility and assume no liability for, the authenticity, validity, accuracy, currency, reliability, suitability or completeness of, or any errors in or omission from, any information, statement or opinion contained in this Overview, or that any particular rate of return will be achieved.

Fig. 11: Rare earths current demand

TABLE 11:
Forecast Global Demand and Supply for Individual Rare Earths in 2020 (±25%)

Rare Earth Oxide	Demand		Supply / Production	
	REO Tonnes	%	REO Tonnes	%
Lanthanum	49,425	24.5%	60,750	27.0%
Cerium	72,175	35.8%	76,950	34.2%
Praseodymium	15,175	7.5%	13,725	6.1%
Neodymium	46,100	22.9%	42,975	19.1%
Samarium	1,600	0.8%	4,725	2.1%
Europium	250	0.1%	675	0.3%
Gadolinium	3,675	1.8%	5,400	2.4%
Terbium	400	0.2%	675	0.3%
Dysprosium	1,850	0.9%	3,150	1.4%
Erbium	900	0.4%	900	0.4%
Yttrium	9,675	4.8%	13,275	5.9%
Ho-Tm-Yb-Lu	275	0.1%	1,800	0.8%
Total	201,500	100.0%	225,000	100%

Source: Curtin-IMCOA estimates

Note: The analyses of the Chinese production are based on NRDC, CREIC and Curtin-IMCOA data on past output; accordingly, while there is no certainty that future production will be in accordance with the past it is a good indication of future production and the reason for the accuracy of the table being ±25%.

*In the view of Curtin-IMCOA phosphor demand in 2020 will remain at current levels due to the increasing use of LEDs domestically and replacing fluorescent lights in commercial and manufacturing facilities.

TABLE 13:
China Rare Earths Demand for Rare Earths - by Element

Rare Earth Oxide	Tonnes 2015	Tonnes 2017	Tonnes 2020	5 Year Annual Growth	Mix %
Lanthanum	24,072	29,483	40,517	10.9%	31.4%
Cerium	33,249	39,447	50,938	8.9%	34.2%
Praseodymium	8,660	9,864	12,294	7.3%	7.1%
Neodymium	22,706	26,180	33,289	8.0%	20.7%
Samarium	564	564	564	0.0%	0.0%
Europium	121	133	144	4.0%	0.1%
Gadolinium	3,433	4,019	5,195	8.6%	3.4%
Terbium	267	312	378	8.3%	0.2%
Dysprosium	856	1,034	1,398	10.8%	1.1%
Holmium	383	446	574	8.4%	0.4%
Lutetium	10	17	38	29.7%	0.1%
Scandium	8	9	11	5.5%	0.0%
Yttrium	3,011	3,308	3,749	4.6%	1.5%
Total	97,340	114,816	149,089	8.9%	100.0%

Note: The forecast demand for for neodymium and praseodymium are consistent with the data in Table 12, but ignore undocumented production. The demands for lanthanum and cerium are significantly less than supply, indicating that prices of these rare earths are likely to remain low due to the surplus.

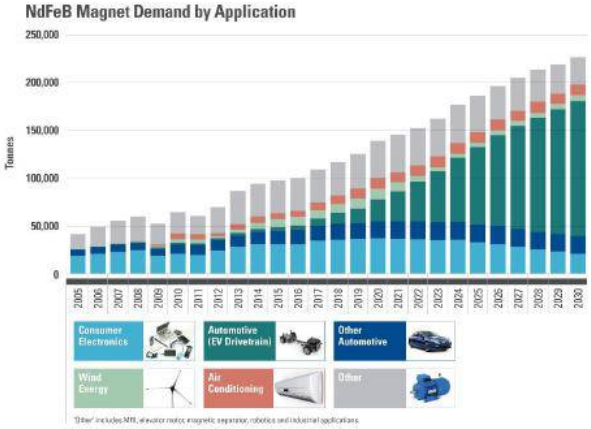
Source: Curtin-IMCOA Overview. The statements in this Overview represent the considered views of the Curtin-IMCOA. They include certain forecasts, projections, intentions and expectations which may or may not be achieved ("forward-looking statements"). All statements in this Overview, other than statements of historical facts, that address future market developments, government actions and events, are forward-looking statements. Although Curtin-IMCOA believes the outcomes expressed in such forward-looking statements are based on reasonable assumptions, such statements are not guarantees of future performance and actual results or developments may differ materially from those expressed or implied in forward-looking statements. Factors that could cause actual results to differ materially from those expressed or implied in forward-looking statements include actions by governments, new rare earth applications, the development of economic rare earth substitutes and general economic, market or business conditions. Accordingly, the statements in this Overview should be used for general guidance only and to the maximum extent permitted by applicable laws, Curtin-IMCOA makes no representation and can give no assurance, guarantee or warranty, express or implied as to, and take no responsibility and assume no liability for, the authenticity, validity, accuracy, currency, reliability, suitability or completeness of, or any errors in or omission from, any information, statement or opinion contained in this Overview, or that any particular rate of return will be achieved.

Fig. 12: Rare earths

NdPr Market Opportunity

14

NdFeB Magnet Demand by Application



- Underlying demand for NdFeB magnets across all applications is forecast to grow by 6% p.a. over the period to 2030
- NdFeB demand growth for EV applications is more dramatic and forecast to grow by 24% p.a.
- Demand in applications for consumer electronics and wind turbines will reduce during the forecast period. For some applications substitution will be traded off against reduced performance and cost.
- Supply-demand balance achieved through demand destruction in lower quality applications and technology innovations that achieve better use of NdPr in magnet manufacturing
- New supply will not come on stream fast enough to meet demand from all applications – NdFeB magnets and NdPr oxide will move to the best value in use
- EV applications require high quality and efficient motors using NdFeB magnets

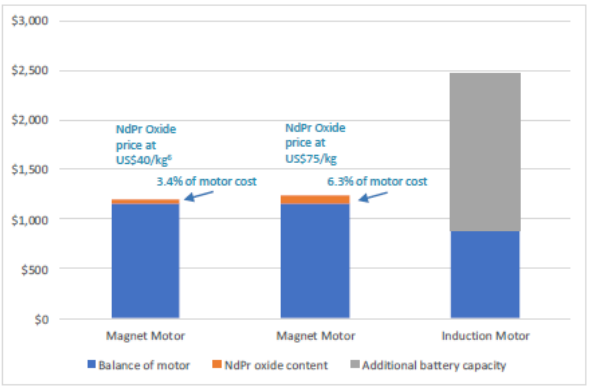
Source: Roskill Consulting (November 2018) – Rare Earths Market Analysis

Arafura Resources Limited (ASX:ARU) August 2019

NdPr Magnet Substitution - EV

15

Modelled effect of increase in NdPr price, NdFeB Magnet v Induction Motor and incremental Li-ion battery pack



- Chevrolet Bolt: 150 kW NdFeB magnet motor with 60 kWh lithium-ion battery pack.[1]
- NdFeB magnet motor cost based on US$8 per kW.[2]
- Estimate of 1 kilogram of NdPr metal per NdFeB motor magnet.[2]
- Induction motor cost calculated as 76% of NdFeB magnet motor.[3]
- Efficiency of induction motor 15% less than NdFeB magnet motor.[4] To compensate, an extra 6 kWh of battery capacity has been allowed for.
- Lithium-ion battery pack costs of US$176 per kWh applied.[5]
- Demand estimates do not include analysis on the impact of drive efficiency

[1] *www.chevrolet.com*
[2] *UBS, "UBS Evidence Lab Electric Car Teardown – Disruption Ahead?", www.ubs.com/investmentresearch, May 2017.*
[3] *Parker Hannifin, "Comparing AC Induction with Permanent Magnet motors in hybrid vehicles and the impact on the value proposition", 2013.*
[4] *Adamas Intelligence, "Spotlight on Dysprosium", www.adamasintel.com/spotlight-on-dysprosium/, April 2018.*
[5] *Bloomberg New Energy Finance, "A Behind the Scenes Take on Lithium-ion Battery Prices", March 2019.*
[6] *Average NdPr oxide EXW China price for April 2019. www.asianmetal.com*

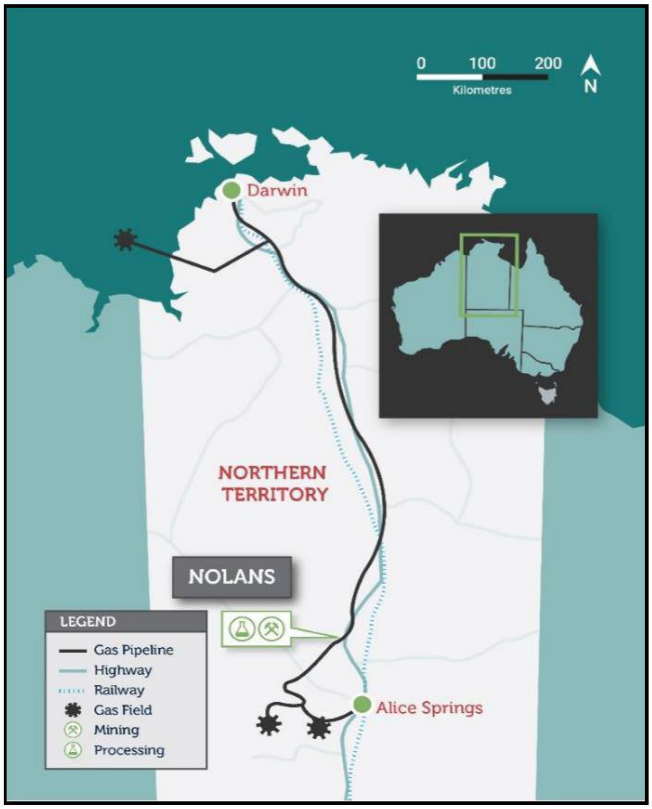
Arafura Resources Limited (ASX:ARU) August 2019

Source: ARU

GEOGRAPHIC EXPOSURE

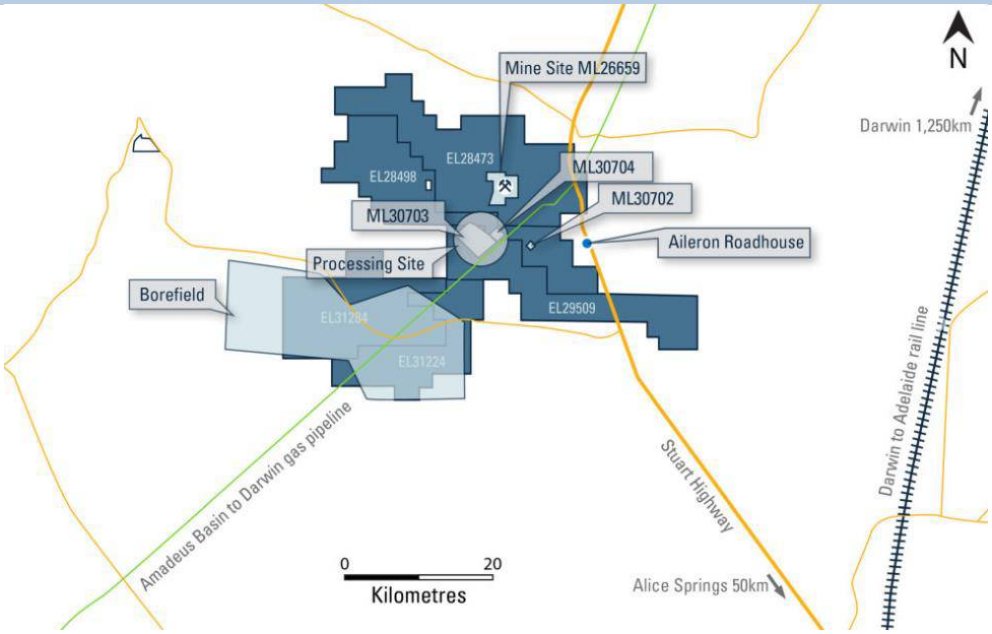
The Nolans project is located 135km north along the Stuart Highway from the town of Alice Springs in the Northern Territory of Australia.

Fig. 13: Project location



Source: ARU

Fig. 14: Project location



Source: ARU

PEERS AND COMPETITORS

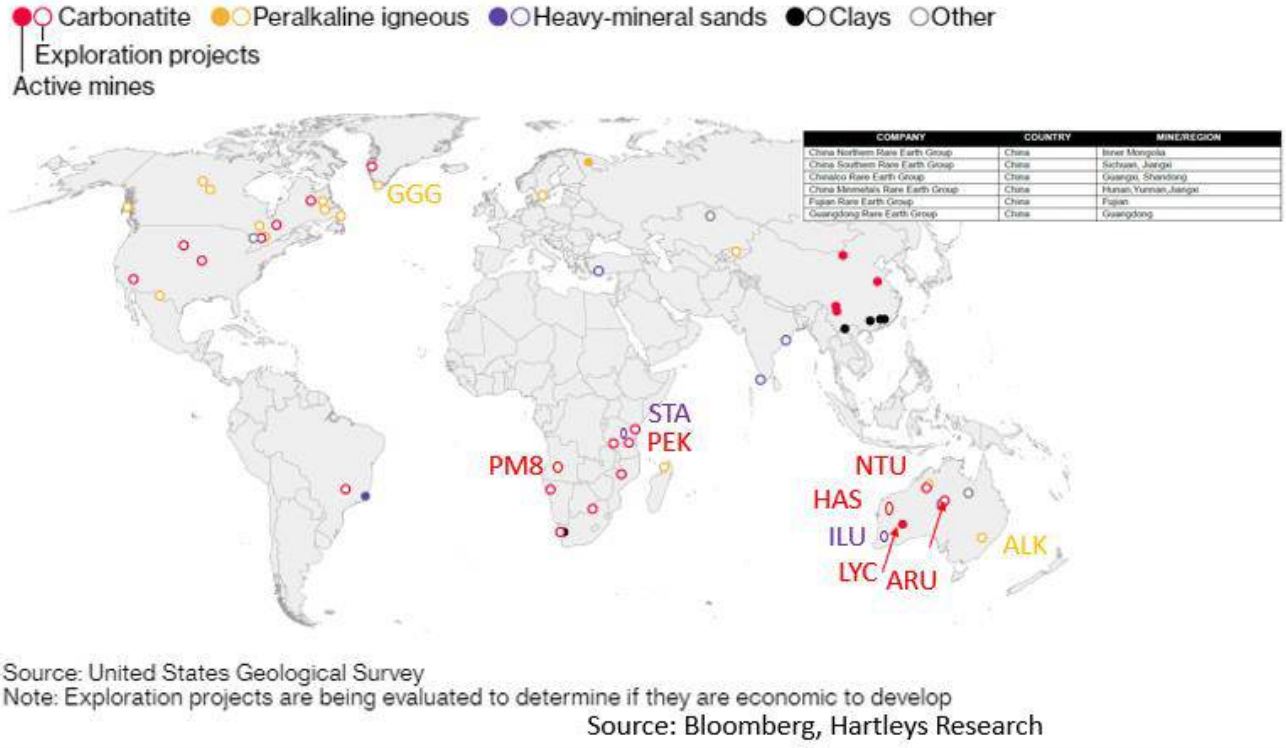
The main peer is LYC.asx (Lynas) although that is in production and hence far more advanced. There are several other rare earth developers on the ASX, although many have different host rock, assemblages or sovereign risks.

Fig. 15: ASX listed peers

	Company	Ticker	Last	Quot. Mkt	Status
	ASX Listed				
1.	Iluka Resources Limited	ILU	8.94	3,803	Mineral sands producer with monazite
2.	Lynas Corporation Limited	LYC	2.52	1,738	Producer
3.	Alkane Resources Limited	ALK	0.685	362	Developer
4.	Hastings Technology Metals Ltd	HAS	0.18	169	Developer
5.	Northern Minerals Limited	NTU	0.051	127	Developer
6.	Greenland Minerals Limited	GGG	0.105	125	Developer
7.	Arafura Resources Limited	ARU	0.091	97	Developer
8.	Strandline Resources Limited	STA	0.125	48	Mineral sands developer with monazite
9.	Peak Resources Limited	PEK	0.043	38	Developer
10.	Pensana Metals Ltd	PM8	0.18	29	Explorer
11.	Minbos Resources Limited	MNB	0.001	6	Explorer

Source: IRESS, Hartleys Research. *Market cap is quoted ordinary shares from IRESS. It does not dilute for options, escrow shares, performance shares, convertible notes, recent placements etc. These can be meaningful adjustments that should be taken into account.

Fig. 16: Rare earth projects

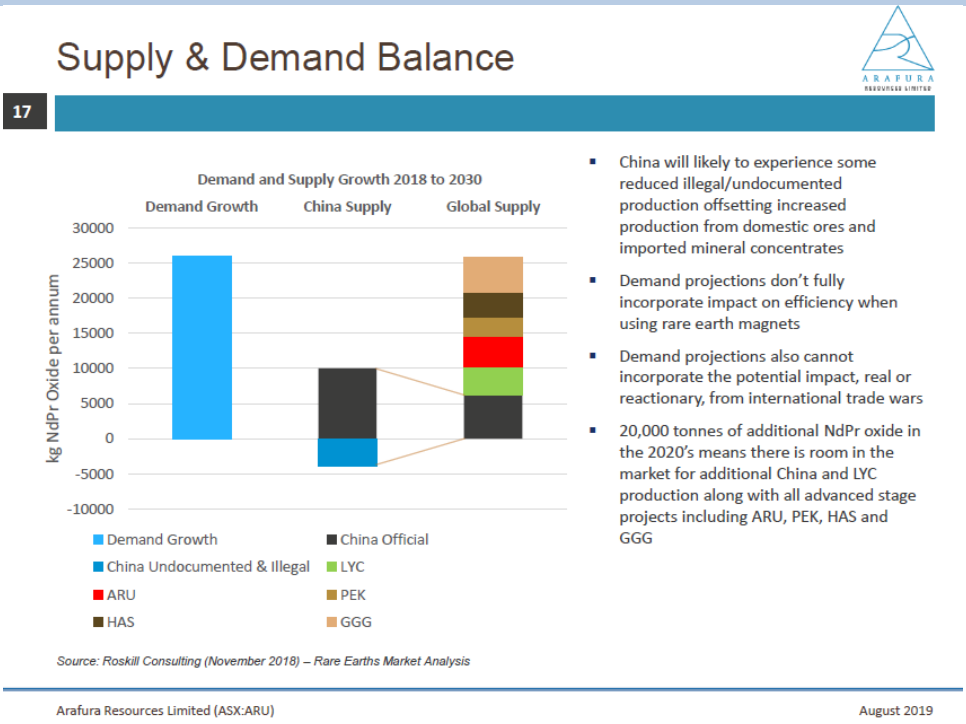


Source: United States Geological Survey
Note: Exploration projects are being evaluated to determine if they are economic to develop

Source: Bloomberg, Hartleys Research

Source: Various, Hartleys Research, Bloomberg

Fig. 17: Rare earth peer growth



Source: ARU

Fig. 18: Rare earths global reserves (2017)

TABLE 6:
Estimated Mine Production and Reserves 2015-2017

Country	Mine Production Tonnes REO			Reserves
	2015	2016	2017	
United States	5,900	-	-	1,400,000
Australia	12,000	15,000	20,000	3,400,000
Brazil	880	2,200	2,000	22,000,000
Canada	-	-	-	830,000
China	105,000*	105,000*	105,000*	44,000,000
Greenland	-	-	-	1,500,000
India	1,700	1,500	1,500	6,900,000
Malawi	-	-	-	140,000
Malaysia	500	300	300	30,000
Russia	2,800	2,800	3,000	18,000,000
South Africa	-	-	-	860,000
Thailand	760	1,600	1,600	N/A
Vietnam	250	220	100	22,000,000
Other Countries	-	-	-	3,000,000
World Total (rounded)	130,000	130,000	133,500	124,060,000

Source: USGS, January 2017 and January 2018. This table is prepared from USGS information on 'rare earths' (excluding yttrium).
Note*: This is the Production Quota which does not include undocumented production

Source: Curtin-IMCOA Overview. The statements in this Overview represent the considered views of the Curtin-IMCOA. They include certain forecasts, projections, intentions and expectations which may or may not be achieved ("forward-looking statements"). All statements in this Overview, other than statements of historical facts, that address future market developments, government actions and events, are forward-looking statements. Although Curtin-IMCOA believes the outcomes expressed in such forward-looking statements are based on reasonable assumptions, such statements are not guarantees of future performance and actual results or developments may differ materially from those expressed or implied in forward-looking statements. Factors that could cause actual results to differ materially from those expressed or implied in forward-looking statements include actions by governments, new rare earth applications, the development of economic rare earth substitutes and general economic, market or business conditions. Accordingly, the statements in this Overview should be used for general guidance only and to the maximum extent permitted by applicable laws, Curtin-IMCOA makes no representation and can give no assurance, guarantee or warranty, express or implied as to, and take no responsibility and assume no liability for, the authenticity, validity, accuracy, currency, reliability, suitability or completeness of, or any errors in or omission from, any information, statement or opinion contained in this Overview, or that any particular rate of return will be achieved.

KEY SUPPLIERS & CUSTOMERS

The Company is progressing offtakes. Given the size of the project, it is likely that several offtakes will be required to place the NdPr product (currently there are two MOUs for ~40% of the product, both Chinese counterparties). Offtake for the Ce concentrate is already under MOU for 100%. Offtake for the MGA is likely to be two counterparties (possibly only one), possibly in India.

Fig. 19: NdPr offtake

Offtake Strategy

FOR EXPORT TO INTERNATIONAL CUSTOMERS

NdPr Oxide	Cerium Hydroxide	SEG-HRE Carbonate	Phosphoric Acid
CHINA JAPAN SOUTH KOREA EUROPE	CHINA	CHINA JAPAN	INDIA

Customer / Target Region	Amount (tonnes p.a.)	Offtake Status	Proportion of Revenue
JingCi Material Science Co.	900	MoU	40%
Baotou Tianhe Magnetics Tech Co	900	MoU	
China	2557	In progress	60%
Japan			
South Korea			
Europe			
SEG-HRE Carbonate – targeting contracts with rare earth processors			
China	606 (TREO equivalent)	In progress	1%
Japan			
Cerium Hydroxide – targeting contracts with rare earth processors			
Baotou Xinyuan Rare Earth Hi-tech	8,383 (TREO equivalent)	MoU	3%

Proportion of revenue for rare earth products only

Source: ARU

Fig. 20: Royalties

15.1.11 Royalties

The Northern Territory *Mineral Royalty Act* (MRA) imposes royalties on minerals extracted in the Northern Territory. The Northern Territory has a hybrid mineral royalty system where the royalty payable in a royalty year is the greater of:

- 20% of the net value, with the net value being the gross production revenue less the direct operating cost of production and a capital recognition deduction.
- 2.5% of the gross production revenue.

For the Project the gross production revenue has been based on the first saleable mineral commodity which is rare earth chloride, cerium hydroxide and MGA phosphoric acid. For a rare earth chloride, Roskill has estimated realisable values for the contained rare earths at 50% for neodymium and praseodymium, 35% for samarium, terbium and dysprosium and 30% for gadolinium. Other rare earths were estimated to have no value.

Source: ARU

Fig. 21: Logistics management

Table 25
Key Reagent Importing Locations

Reagent	Location	Shipment type	Transfer
Sulphur	Darwin Port	Bulk shipment	Ex-vessel
Sulphuric acid	Darwin Port	Bulk Shipment	Ex-tank
Hydrochloric acid	Darwin Port	Isotainers	Ex-port
Quicklime	Darwin Port	Bulk shipment	Ex-works
Precipitation agent	Darwin Port	Isotainers	Ex-port
Sodium silicate	Darwin Port	Isotainers	Ex-port
Sodium hydroxide	Port Adelaide	Bulk shipment	Ex-tank
Sodium carbonate	Port Adelaide	Bulk shipment	Ex-works
Hydrogen peroxide	Port Adelaide	Bulk shipment	Ex-works

The Project will export all products through Darwin Port in the shipment types described in Table 26.

Table 26
Key Product Exporting Locations

Product	Location	Shipment type
NdPr oxide	Darwin Port	Containerised drums
MGA phosphoric acid	Darwin Port	Bulk shipment
Cerium hydroxide	Darwin Port	Containerised bulk bags
SEG/HRE carbonate	Darwin Port	Containerised drums

Source: ARU

MANAGEMENT, DIRECTORS AND MAJOR SHAREHOLDERS

Economic Exposure of Board and key management					
Directors & Management	Position	Performance Rights	Shares Direct/Indirect	Total	Rank
Mark Southey	Non-Exec Chairman	0	250,000	250,000	7
Gavin Lockyer	Managing Director & CEO	3,000,000	1,298,315	4,298,315	1
Chris Tonkin	Non-Exec Director	0	238,637	238,637	8
Quansheng Zhang	Non-Exec Director (nominee of ECE Nolans Investment Company Pty Ltd.)	0	0	0	9
Key Management					
P Sherrington	Chief Financial Officer and Company Secretary	1,450,000	512,273	1,962,273	2
R Brescianini	General Manager Exploration and Development	1,000,000	213,637	1,213,637	4
B Fowler	General Manager of Northern Territory & Sustainability	1,000,000	0	1,000,000	5
L Kaiser	General Manager of Sales, Marketing and Technology Development	1,000,000	0	1,000,000	5
S Watkins	General Manager of Projects	1,350,000	0	1,350,000	3
		8,800,000	**2,512,862**	**11,312,862**	

Source: ARU Annual Report FY19

The following biographies sourced from Company website

Mark Southey, Non-Executive Chairman,
Qualifications: BSc (Hons), MBA. Appointed: 30 January 2018
As the Nolans Neodymium-Praseodymium (NdPr) Project rapidly advances towards a Final Investment Decision, Mr Southey has been appointed to the Arafura Board as Non-Executive Director. A vital position to bring a wealth of mining, project realisation and technical experience, to help guide this transition. Mr Southey holds BSc (Hons) in Engineering with Business Studies from the University of Portsmouth, has an MBA from the University of Sydney Business School, and is a Member of the Australian Institute of Company Directors. He has extensive global experience in the industrial and natural resources sectors covering all aspects of asset management, maintenance, design and engineering, and major capital project development and execution. He is well versed in public company board and institutional investor engagement and has a background in both senior operational and financial roles. Mr Southey has previously held senior executive positions with Honeywell and ABB both in Australia and internationally, and more recently was part of the global executive leadership team within WorleyParsons, a leader in the engineering, procurement and construction of projects in the energy and resources sector where he held the position of Group Managing Director for the Minerals, Metals and Chemicals Sector. He is the Chairman of Arafura's Remuneration and Nomination Committee, and a Member of the Audit and Risk Committee.

Gavin Lockyer, Managing Director
Qualifications: BBus, ACA, FTA. First Appointed 23 July 2013.
Gavin graduated with a Bachelor of Business in Accounting and Finance in Western Australia in 1987 and has subsequently become a member of both the Institute of Chartered Accountants and the Finance & Treasury Association of Australia. He joined Arafura in 2006 as Chief Financial Officer and Company Secretary after having served as Financial Controller with the Tethyan Copper Company Limited. Gavin previously held several senior finance and treasury positions in global mining companies Newcrest and Newmont following a successful international investment banking career with Bankwest and ANZ in Australia, and Bankers Trust and Deutsche Bank in London. Gavin's diverse, global experience has provided management and leadership opportunities in a range of disciplines including; Accounting, Financial & Investment Banking, Major Resource Development & Operations, and Global Bank Treasuries. Over the past 20 years his career has exposed him to business practices in North America, Europe, and Australasia.

Quansheng Zhang, Non-Executive Director
Qualifications: Doctoral degree in Engineering and Masters degree in Geophysical Prospecting. Appointed: 18 November 2016
Quangsheng Zhang holds a Doctoral degree in Engineering and a Masters degree in Geophysical Prospecting. Mr. Zhang is based in Nanjing in the Peoples Republic of China and is the General Manager of Hong Kong East China Non-Ferrous Mineral Resources Co Ltd (HKECE). Quangsheng has over 30 years of mineral prospecting and exploration experience, and expertise in mineral resource surveys and geophysics.

Chris Tonkin, Non-Executive Director
Qualifications: BSc (Hons) Metallurgy and Chemistry, BA Economics and Politics, MBA. Appointed: 1 January 2011
Chris Tonkin has over 35 years' experience as a senior business executive with a broad industry background in business generation, management, and strategy development. He began his career as a metallurgist and environmental specialist, diversifying into commercial roles at several major industrial companies and subsequently project finance, corporate and project advisory roles at AIDC, The Chase Manhattan Bank, KPMG Corporate Finance and ANZ, where he was Head of Natural Resources Project Finance for many years, leading a very successful team of project financiers. In early 2012, Chris was appointed Chief Executive Officer and Managing Director of Arafura Resources Limited and assisted the company through a difficult period before stepping down to concentrate on his project advisory activities as Executive Director of Capital Advisory Services Pty Ltd and Managing Director of Catalyst Capital Solutions Pty Ltd. Chris is a Graduate of the Australian Institute of Company Directors and a Member of the Finance and Treasury Association. He is the Chairman of Arafura's Audit and Risk Committee and a member of the Remuneration and Nomination. Chris is also Chairman of Lakes Oil NL.

MAJOR SHAREHOLDERS

There are two substantial shareholders, both industry players.

Fig. 22: Shareholders

Top Shareholders	m	%
ECE (East China Expl & Dev. Bureau)	109.70	10.4%
Talaxis (Noble Group)	55.14	5.2%

Source: ARU

OPTIONS, CONVERTIBLES AND UNPAID CAPITAL

Most of the unpaid capital are staff and management performance rights.

Fig. 23:Unpaid capital

Number	*Class
1,635,000	Unlisted options expiring 30 June 2021 exercisable at $0.15.
19,075,000	Unlisted options expiring 1 July 2022 exercisable at $0.12.
7,000,000	Performance Rights expiring 21 September 2022.
3,000,000	Performance rights expiring 22 November 2022.

Black-Scholes Pricing Model	2017/2018	2018/2019 - Staff	2018/2019 - MD
Grant Date	31/07/2017	31/07/2018	31/07/2018
Date of Expiry	30/06/2021	01/07/2022	01/07/2022
Vesting trigger date	31/07 each year from 2018	01/07 each year from 2019	01/07 each year from 2019
Exercise Price	$0.15	$0.12	$0.12
Share price (at issue date)	$0.07	$0.096	$0.096
Risk free interest rate	1.85% - 2.00%	2.07% - 2.15%	2.04% -2.12%
Volatility	72.43% - 74.57%	76.35% - 77.00%	72.38% - 74.41%
Years to Expiry	2.42 - 3.42 years	2.42 - 3.42 years	2.11 - 3.11 years
Number of Options Granted	2,055,000	14,605,000	4,750,000
Fair Value per right	$0.016 - $0.023	$0.035 - $0.043	$0.014 - $0.019
Total Fair Value	$40,415	$562,324	$79,007

Source: ARU

FINANCIALS

PRODUCTION / PROFIT & LOSS

Company guidance

The DFS had detailed modelling assumptions.

Fig. 24:DFS production schedule

Table 22
Production by Operating Year (Base Case Mining Schedule)

Year		1	2	3	4	5	6	7	8	9	10	11	12
Ore Processed	kt	484	639	841	918	839	710	670	682	862	910	984	964
Head Grade													
P_2O_5	%	12.6	13.6	12.9	12.4	13.6	16.1	16.9	16.1	14.1	14.1	11.5	10.9
TREO	%	3.2	3.4	3.2	2.9	3.0	3.5	3.7	3.5	3.1	3.1	2.6	2.5
Beneficiation													
P_2O_5 Recovery	%	65.4	75.7	74.2	74.4	77.6	75.9	77.4	81.7	71.4	68.1	71.6	72.2
TREO Recovery	%	65.1	74.7	71.6	71.4	74.9	77.3	77.9	79.6	67.3	66.3	65.0	63.0
Concentrate	kt	133	220	268	285	296	287	288	293	295	301	280	265
Final Production													
Ce oxide	t	3,057	6,297	8,590	8,797	8,696	8,809	8,780	8,756	8,177	8,579	7,693	7,120
NdPr oxide	t	1,279	3,226	4,410	4,526	4,517	4,647	4,661	4,668	4,337	4,536	3,926	3,612
SEG/HRE oxide	t	221	454	618	634	630	634	631	636	589	616	546	507
TREO	t	4,557	9,976	13,618	13,958	13,842	14,090	14,072	14,060	13,103	13,731	12,165	11,240
P_2O_5	kt	34	56	69	72	75	74	75	76	74	74	69	64
MGA Phosphoric Acid	kt	63	104	127	134	139	136	138	141	136	138	127	119

Table 22
Production by Operating Year (Base Case Mining Schedule)

Year		13	14	15	16	17	18	19	20	21	22	23	Total
Ore Processed	kt	1,000	1,003	1,007	864	961	1,003	1,007	963	930	754	243	**19,237**
Head Grade													
P_2O_5	%	11.6	11.7	11.7	13.2	12.1	11.5	11.9	13.2	14.5	16.4	17.1	**13.2**
TREO	%	2.6	2.6	2.6	2.9	2.8	2.7	2.7	2.8	3.1	3.5	3.7	**3.0**
Beneficiation													
P_2O_5 Recovery	%	74.5	73.8	74.1	78.4	75.0	73.3	72.7	69.0	65.1	70.8	73.6	**73.3**
TREO Recovery	%	67.3	67.3	67.9	71.9	68.5	68.1	67.3	64.7	64.9	72.0	74.6	**69.7**
Concentrate	kt	295	295	300	300	295	293	299	300	300	293	101	**6,282**
Final Production													
Ce oxide	t	8,219	8,119	8,309	8,262	8,473	8,498	8,353	8,137	8,645	8,864	3,064	**180,294**
NdPr oxide	t	4,185	4,141	4,267	4,236	4,345	4,389	4,307	4,253	4,558	4,666	1,615	**93,307**
SEG/HRE oxide	t	587	582	602	594	607	613	599	584	625	642	222	**12,973**
TREO	t	12,991	12,842	13,178	13,093	13,426	13,500	13,259	12,974	13,828	14,172	4,900	**286,574**
P_2O_5	kt	73	74	74	76	74	72	74	74	75	75	26	**1,578**
MGA Phosphoric Acid	kt	136	137	137	141	137	133	138	138	138	138	48	**2,922**

Source: ARU

Hartleys Forecasts

We have production forecasts similar to the DFS study, be we run lower NdPr prices.

Fig. 25: Production and Profit and Loss

P&L	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
Net Revenue	**A$m**	**0.0**	**0.0**	**83.2**	**257.4**	**409.2**
- TREO		0.0	0.0	69.9	222.2	360.4
NdPr				64.9	206.3	334.8
Other				5.0	15.8	25.7
- P2O5		0.0	0.0	13.3	35.2	48.7
Total Costs	**A$m**	**-7.1**	**-7.4**	**-62.2**	**-134.5**	**-175.1**
EBITDA	A$m	-7.1	-7.4	21.0	122.9	234.1
- margin	**%**	-	-	25%	48%	57%
Depreciation/Amort	A$m	-6.5	-19.3	-37.8	-47.8	-50.4
EBIT	**A$m**	**-13.5**	**-26.7**	**-16.8**	**75.0**	**183.6**
Net Interest	A$m	-4.1	-57.1	-62.8	-80.0	-80.0
Norm. Pre-Tax Profit	**A$m**	**-17.6**	**-83.8**	**-79.6**	**-5.0**	**103.6**
Reported Tax Expense	A$m	0.0	0.0	0.0	0.0	0.0
effective rate	**%**	0.0%	0.0%	0.0%	0.0%	0.0%
Normalised NPAT	**A$m**	**-12.4**	**-58.6**	**-55.7**	**-3.5**	**72.5**
Abnormal Items	A$m	-5.3	-25.1	-23.9	-1.5	31.1
Reported Profit	A$m	-17.6	-83.8	-79.6	-5.0	103.6
Minority	A$m	0.0	0.0	0.0	0.0	0.0
Profit Attrib	**A$m**	**-17.6**	**-83.8**	**-79.6**	**-5.0**	**103.6**

Source: Hartleys Research Estimates

BALANCE SHEET

Fig. 26: Balance Sheet

Balance Sheet	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
Cash	**A$m**	**1270.3**	**701.2**	**219.1**	**126.7**	**188.6**
Other Current Assets	A$m	3.9	4.1	51.2	126.6	180.0
Total Current Assets	**A$m**	**1274.2**	**705.3**	**270.3**	**253.3**	**368.6**
Property, Plant & Equip.	A$m	137.2	621.8	985.6	1008.9	1003.3
Exploration	A$m	101.6	102.2	102.8	103.4	104.0
Investments/other	A$m	0.3	0.3	0.3	0.3	0.3
Tot Non-Curr. Assets	**A$m**	**239.1**	**724.3**	**1088.7**	**1112.6**	**1107.6**
Total Assets	**A$m**	**1513.3**	**1429.6**	**1359.0**	**1365.9**	**1476.2**
Short Term Borrowings	A$m	-	-	-	-	-
Other	A$m	1.9	1.9	11.0	22.8	29.5
Total Curr. Liabilities	**A$m**	1.9	1.9	11.0	22.8	29.5
Long Term Borrowings	A$m	572.7	572.7	572.7	572.7	572.7
Other	A$m	0.0	0.0	0.0	0.0	0.0
Total Non-Curr. Liabil.	**A$m**	**572.7**	**572.7**	**572.7**	**572.7**	**572.7**
Total Liabilities	**A$m**	**574.6**	**574.7**	**583.7**	**595.6**	**602.2**
Net Assets	**A$m**	**938.7**	**854.9**	**775.4**	**770.4**	**874.0**
Net Debt (cash)	A$m	-697.6	-128.5	353.6	446.0	384.1

Source: Hartleys Research Estimates

Gearing ratios

Fig. 27: Gearing Ratios

Shares	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
Ordinary Shares - End	m	6933.3	6933.3	6933.3	6933.3	6933.3
Ordinary Shares - Weighted	m	3857.3	6933.3	6933.3	6933.3	6933.3
Diluted Shares - Weighted	m	3857.4	6933.3	6933.3	6933.3	6933.3
Ratio Analysis	**Unit**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
Cashflow Per Share	A$ cps	-0.1	-0.8	-0.9	-1.2	-1.2
Cashflow Multiple	x	-85.4	-11.1	-10.0	-7.9	-7.9
Earnings Per Share	A$ cps	-0.5	-1.2	-1.1	-0.1	1.5
Price to Earnings Ratio	x	-19.9	-7.5	-7.9	-126.7	6.1
Dividends Per Share	AUD	-	-	-	-	-
Dividend Yield	%	0.0%	0.0%	0.0%	0.0%	0.0%
Net Debt / Net Debt + Equity	%	-289%	-18%	31%	37%	31%
Interest Cover	X	na	na	na	0.9	2.3
Return on Equity	%	na	na	na	na	8%

Source: Hartleys Research Estimates

Fixed Assets

There are no substantial fixed assets currently on the balance sheet.

Debt

There is no debt but we assume that ARU will finance development with high cost debt.

Hedging

There is no hedging.

CASH FLOW

Fig. 28: Cash Flow Statement

Cashflow	Unit	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
EBITDA	A$m	-7.1	-7.4	21.0	122.9	234.1
Working Capital	A$m	-0.1	-0.1	-38.1	-63.5	-46.8
Operating Cashflow	A$m	-7.2	-7.6	-17.1	59.3	187.3
Income Tax Paid	A$m	0.0	0.0	0.0	0.0	0.0
Interest & Other	A$m	-4.1	-57.1	-62.8	-80.0	-80.0
Operating Activities	**A$m**	-11.3	-64.6	-80.0	-20.6	107.3
Property, Plant & Equip.	A$m	-147.2	-503.9	-401.6	-71.2	-44.8
Exploration and Devel.	A$m	-0.6	-0.6	-0.6	-0.6	-0.6
Other	A$m	0.0	0.0	0.0	0.0	0.0
Investment Activities	**A$m**	**-147.8**	**-504.5**	**-402.2**	**-71.8**	**-45.4**
Borrowings	A$m	572.7	0.0	0.0	0.0	0.0
Equity or "tbc capital"	A$m	859.1	0.0	0.0	0.0	0.0
Dividends Paid	A$m	0.0	0.0	0.0	0.0	0.0
Financing Activities	**A$m**	**1431.8**	**0.0**	**0.0**	**0.0**	**0.0**
Net Cashflow	**A$m**	**1272.7**	**-569.1**	**-482.1**	**-92.4**	**61.9**

Source: Hartleys Research Estimates

Capex requirements

ARU has a substantial capex requirement (in the order of A$1b) and capital of $1.15bn. We are more conservative and assume higher capital.

The DFS assumes the construction of a 750tpd sulphuric acid plant in three stages (Stage 2+3 capex additional A$44m). The first one module is installed during pre-production and the remaining two modules installed during the first two years of operation. If the acid were instead imported, operating costs would rise by ~A$60m pa. There is also assumed a chlor-alkali plant (sodium hydroxide and hydrochloric acid) is constructed in year six for use in process commences in year eight with capex of A$54.2 M (US$39 M). If no chlor-alkali plant is built, operating costs would rise by ~A$20m pa. Our model assumes both acid plants are built.

Fig. 29: Capital requirements

Table 68
Project Funding

	US$M	AS$M
Pre-production Capital	726	1,006
Sulphuric Acid Plant	31	44
Working Capital	37	52
Capital Escalation	32	44
Project Funding	**826**	**1,146**

* Allowance for environmental bonds based on a preliminary assessment only with final amount agreed with DPIR as part of approval of the MMP.

Source: ARU

Free cash flow

We do not expect free cash flow given the Company is in development stage.

Dividends

We do not expect dividends for the foreseeable future.

EQUITY ISSUANCE

We assume substantial equity dilution to fund the project.

SENSITIVITIES

FX exposure

ARU is exposed to AUD/USD given selling prices are in USD and costs are in AUD.

Interest Rate exposure

We assume a substantial debt component will be required to finance the project.

Commodity price exposure

ARU is most sensitive to the NDPR price. It is also exposed to other rare earths but it is relatively insignificant.

P2O5 is an important credit. At high NdPr prices though, the credits become less meaningful.

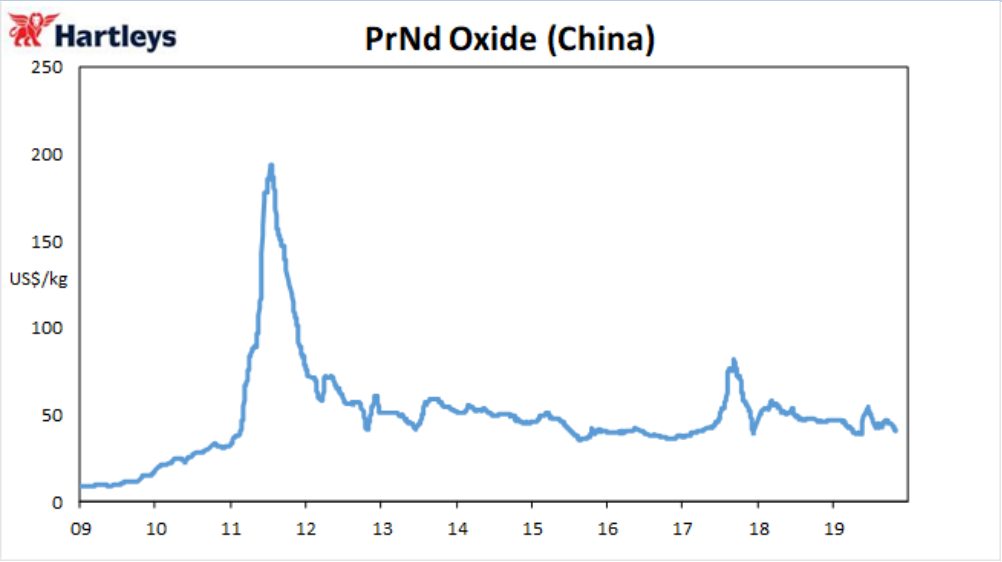
Fig. 30: ARU DFS price assumptions

Table 7
Base Case Price Forecast – Rare Earths US$/kg, P_2O_5 US$/t

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030+
Cerium	1.24	1.21	1.25	1.29	1.26	1.30	1.22	1.20	1.18	1.21	1.23	1.26
NdPr	66.64	66.38	69.53	80.52	83.97	80.79	79.89	82.25	84.76	76.16	81.55	89.70
SEG/HRE	6.41	5.75	5.93	6.28	6.29	6.22	5.98	6.14	6.54	6.17	6.49	6.55
P_2O_5	612	623	630	637	641	648	659	673	683	683	683	683

Source: ARU

Fig. 31: NDPR historic prices



Source: Asian Metals

VALUATION CONSIDERATIONS AND PRICE TARGET METHODOLOGY

VALUATION

We assume model parameters similar to the DFS but more conservative regarding production, pricing and capital.

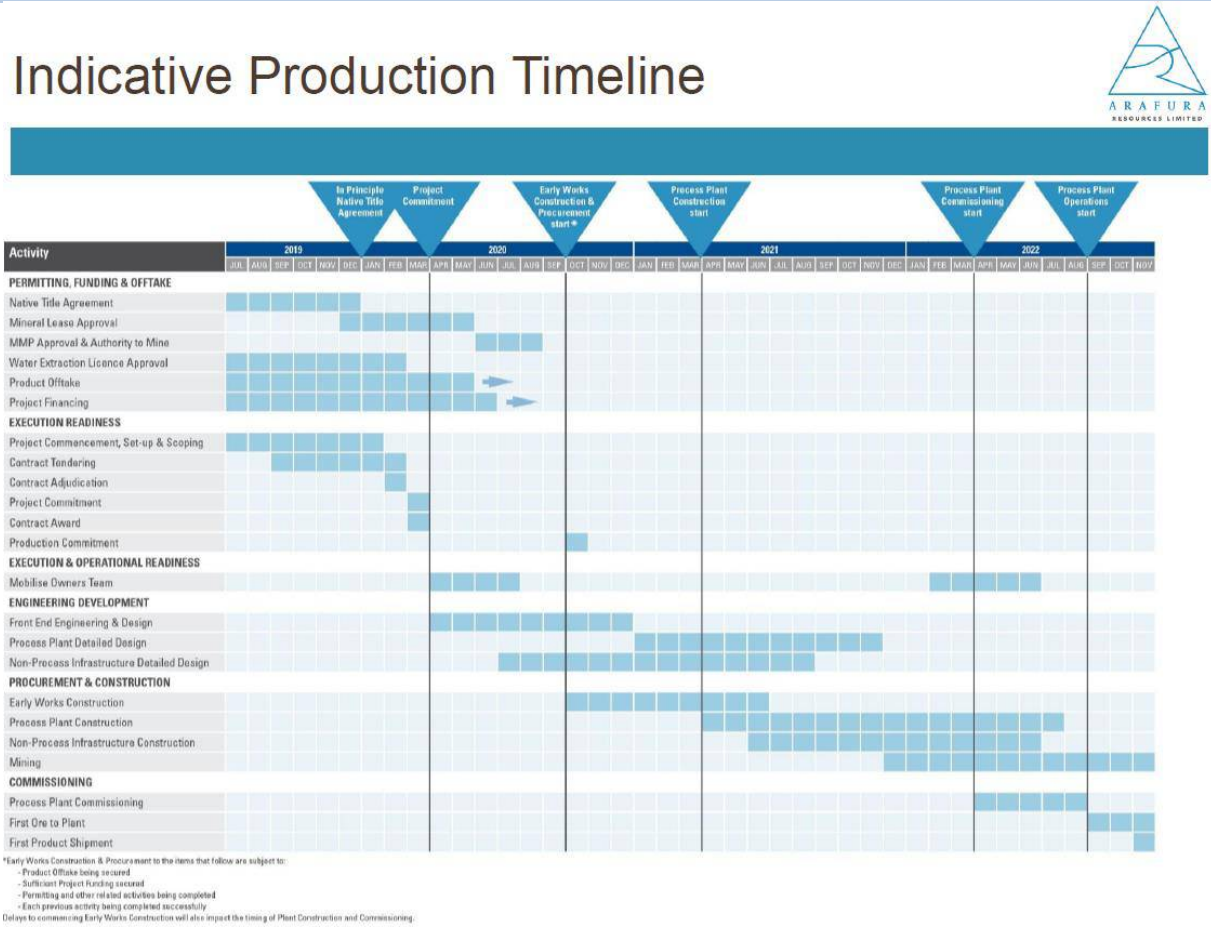
We assume NdPr price of US$70/kg in our model, which is around 50% higher than the current spot price. This is a big risk to our valuation, but we believe higher prices are required to incentivise supply.

We use a 12% discount rate, which is our standard assumption for a project that has completed studies but is still in development. Once in production, or an industry partner, a lower discount rate could be used. Our valuation is very sensitive to discount rate assumptions.

We assume ~A$850m in equity financing and ~$575m of debt. We assume ~6b new shares are issued.

ARU also can earn a 60% interest in the Bonya tungsten project in Northern Territory of Australia (THR.asx 40% : ARU.asx 60%). Exploration is ongoing with plan to generate a resource. We include no explicit value in our ARU valuation.

Fig. 32:Rare earth products



Source: ARU

PRICE TARGET

We have a price target based on weighted possible scenarios.

Price Target Methodology	Weighting	Spot	12 mth out
NPV12 base case	40%	$0.14	$0.15
NPV12 base case at spot commodity and fx prices	10%	$0.00	$0.00
NPV8 base case	6%	$0.50	$0.54
NPV 12 NdPr price US$90/kg	5%	$0.86	$0.94
3x EV/EBITDA five years ahead	5%	$0.00	$0.04
Net cash backing	35%	$0.02	$0.02
Risk weighted composite		**$0.14**	
12 Months Price Target		**$0.15**	
Shareprice - Last		$0.091	
12 mth total return (% to 12mth target + dividend)		**65%**	

Source: Hartleys Research

RECOMMENDATION & RISKS

INVESTMENT THESIS & RECOMMENDATION

Nolans is a very advanced project, with ARU having spent >10years on studies and approvals. Current prices of NdPr mean it is uneconomic, but we believe prices are need to increase to incentivise the supply to meet medium term (2025-2030) demand forecasts. Geopolitical risks suggest it is possible that industry could move earlier than usual to lock in supply. The problem is that superficially there is substantial possible rare earth supply, and so procurement by end-users, on paper, appears straightforward. The reality of long lead times, environmental approvals and high capital requirements suggest procurement will be much harder. Hence, it is possible that market needs a strong price signal. We initiate coverage with a Speculative Buy recommendation.

RISKS

The key risks for Arafura Resources Ltd (like most mine companies in development) is obtaining the necessary funding to complete the project. Other risks are earnings disappointments given the industry is volatile and earnings can disappoint due to cost overruns, project delays, cost inflation, environmental regulations, plant and mine design mistakes or lower production. Although some earnings disappointments can be short term and are only a timing issue, other disappointments can be materially value destructive and can sometimes overhang stocks for a long period of time (for example metallurgy problems). Such disappointments can be very difficult to predict and share price reactions can be severe and immediate upon disclosure by the company. High financial leverage (if it exists at that time) would add to the problem.

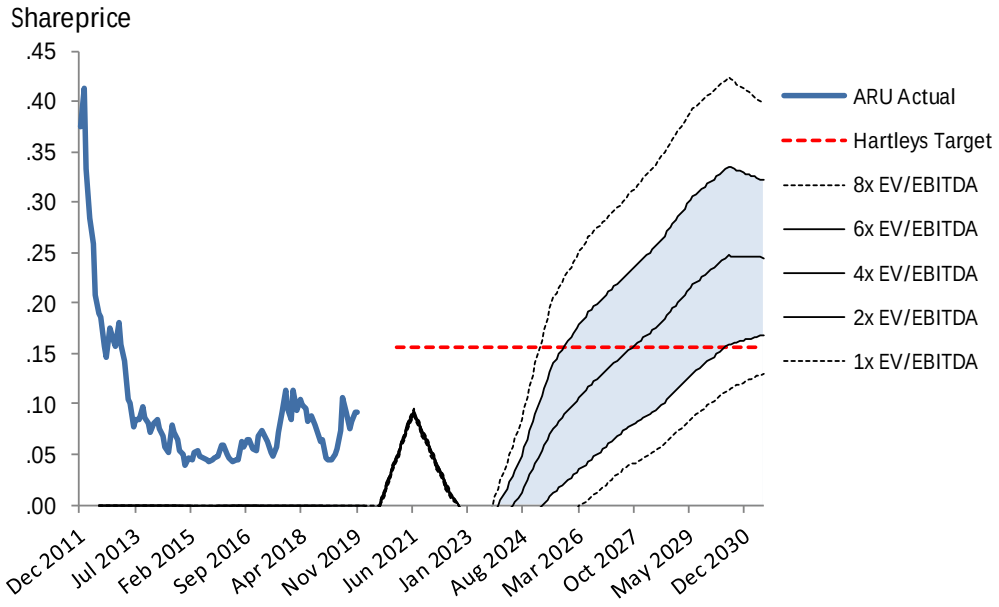
SIMPLE S.W.O.T. TABLE

Strengths	Australian location Very advanced Produces NdPr oxide Other revenue credits Indicative offtakes
Weaknesses	Large capex Rare earth process is complicated Requires higher than current NdPr prices
Opportunities	Expansion
Threats	Access to capital Approvals Counter party risk

Source: Hartleys Research

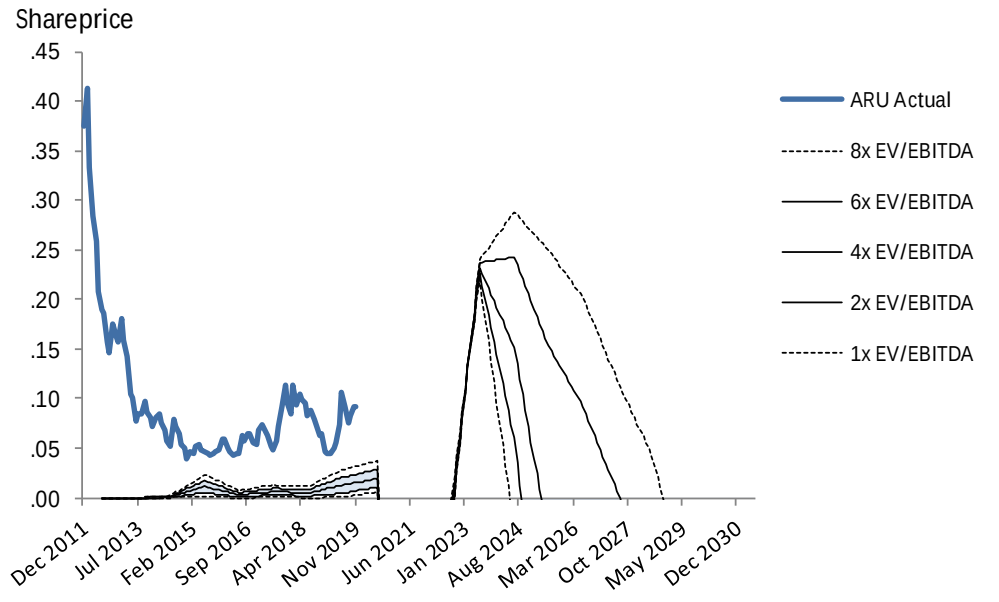
EV/EBITDA BANDS

Fig. 33: Using Hartleys base case commodity forecasts



Source: Hartleys Estimates, IRESS

Fig. 34: Using spot commodity prices



Source: Hartleys Estimates

HARTLEYS CORPORATE DIRECTORY

Research

Trent Barnett	Head of Research	+61 8 9268 3052
Mike Millikan	Resources Analyst	+61 8 9268 2805
John Macdonald	Resources Analyst	+61 8 9268 3020
Paul Howard	Resources Analyst	+61 8 9268 3045
Aiden Bradley	Research Analyst	+61 8 9268 2876
Oliver Stevens	Research Analyst	+61 8 9268 2879
Michael Scantlebury	Associate Analyst	+61 8 9268 2837
Janine Bell	Research Assistant	+61 8 9268 2831

Corporate Finance

Dale Bryan	Director & Head of Corp Fin.	+61 8 9268 2829
Richard Simpson	Director	+61 8 9268 2824
Ben Crossing	Director	+61 8 9268 3047
Ben Wale	Director	+61 8 9268 3055
Stephen Kite	Director	+61 8 9268 3050
Scott Weir	Director	+61 8 9268 2821
Scott Stephens	Associate Director	+61 8 9268 2819
Rhys Simpson	Associate Director	+61 8 9268 2851
Michael Brown	Executive	+61 8 9268 2822

Registered Office

Level 6, 141 St Georges Tce Postal Address:

Perth WA 6000	GPO Box 2777
Australia	Perth WA 6001
PH:+61 8 9268 2888	FX: +61 8 9268 2800
www.hartleys.com.au	info@hartleys.com.au

Note: personal email addresses of company employees are structured in the following manner: firstname.lastname@hartleys.com.au

Hartleys Recommendation Categories

Buy	Share price appreciation anticipated.
Accumulate	Share price appreciation anticipated but the risk/reward is not as attractive as a "Buy". Alternatively, for the share price to rise it may be contingent on the outcome of an uncertain or distant event. Analyst will often indicate a price level at which it may become a "Buy".
Neutral	Take no action. Upside & downside risk/reward is evenly balanced.
Reduce / Take profits	It is anticipated to be unlikely that there will be gains over the investment time horizon but there is a possibility of some price weakness over that period.
Sell	Significant price depreciation anticipated.
No Rating	No recommendation.
Speculative Buy	Share price could be volatile. While it is anticipated that, on a risk/reward basis, an investment is attractive, there is at least one identifiable risk that has a meaningful possibility of occurring, which, if it did occur, could lead to significant share price reduction. Consequently, the investment is considered high risk.

Institutional Sales

Carrick Ryan	+61 8 9268 2864
Justin Stewart	+61 8 9268 3062
Simon van den Berg	+61 8 9268 2867
Digby Gilmour	+61 8 9268 2814
Jayme Walsh	+61 8 9268 2828
Veronika Tkacova	+61 8 9268 2836

Wealth Management

Nicola Bond	+61 8 9268 2840
Bradley Booth	+61 8 9268 2873
Adrian Brant	+61 8 9268 3065
Nathan Bray	+61 8 9268 2874
Sven Burrell	+61 8 9268 2847
Simon Casey	+61 8 9268 2875
Tony Chien	+61 8 9268 2850
Tim Cottee	+61 8 9268 3064
David Cross	+61 8 9268 2860
Nicholas Draper	+61 8 9268 2883
John Featherby	+61 8 9268 2811
Ben Fleay	+61 8 9268 2844
James Gatti	+61 8 9268 3025
John Goodlad	+61 8 9268 2890
Andrew Gribble	+61 8 9268 2842
David Hainsworth	+61 8 9268 3040
Murray Jacob	+61 8 9268 2892
Gavin Lehmann	+61 8 9268 2895
Shane Lehmann	+61 8 9268 2897
Steven Loxley	+61 8 9268 2857
Andrew Macnaughtan	+61 8 9268 2898
Scott Metcalf	+61 8 9268 2807
David Michael	+61 8 9268 2835
Jamie Moullin	+61 8 9268 2856
Chris Munro	+61 8 9268 2858
Michael Munro	+61 8 9268 2820
Ian Parker	+61 8 9268 2810
Matthew Parker	+61 8 9268 2826
Charlie Ransom	+61 8 9268 2868
Heath Ryan	+61 8 9268 3053
David Smyth	+61 8 9268 2839
Greg Soudure	+61 8 9268 2834
Sonya Soudure	+61 8 9268 2865
Dirk Vanderstruyf	+61 8 9268 2855

Disclaimer/Disclosure

The author of this publication, Hartleys Limited ABN 33 104 195 057 ("Hartleys"), its Directors and their Associates from time to time may hold shares in the security/securities mentioned in this Research document and therefore may benefit from any increase in the price of those securities. Hartleys and its Advisers may earn brokerage, fees, commissions, other benefits or advantages as a result of a transaction arising from any advice mentioned in publications to clients.

This report was prepared solely by Hartleys Limited. ASX Limited ABN 98 009 642 691 and its related bodies corporate ("ASX") did not prepare any part of the report and has not contributed in any way to its content. The role of ASX in relation to the preparation of the research reports is limited to funding their preparation, by Hartleys Limited, in accordance with the ASX Equity Research Scheme. ASX does not provide financial product advice. The views expressed in this research report may not necessarily reflect the views of ASX. To the maximum extent permitted by law, no representation, warranty or undertaking, express or implied, is made and no responsibility or liability is accepted by ASX as to the adequacy, accuracy, completeness or reasonableness of the research reports.

Any financial product advice contained in this document is unsolicited general information only. Do not act on this advice without first consulting your investment adviser to determine whether the advice is appropriate for your investment objectives, financial situation and particular needs. Hartleys believes that any information or advice (including any financial product advice) contained in this document is accurate when issued. Hartleys however, does not warrant its accuracy or reliability. Hartleys, its officers, agents and employees exclude all liability whatsoever, in negligence or otherwise, for any loss or damage relating to this document to the full extent permitted by law.