ioneer Limited

ioneer Ltd is a mineral exploration and development company, focused on developing its 100% owned Rhyolite Ridge Project Lithium-Boron Project in Nevada, USA. INR has completed a Pre-Feasibility Study (PFS) envisaging production of 20,200 tpa lithium carbonate and 173,000 tpa boric acid over an initial 31 year mine life. INR is targeting completion of its Definitive Feasibility Study (DFS) in Q3 2019, with a Final Investment Decision (FID) by Q4 2019, and first production in 2021.

Positioned to deliver US lithium and boron supply chain security

ioneer Limited’s (INR.ASX, mkt cap A$258m) Rhyolite Ridge project is one of two known large scale, ‘hard-rock’ lithium-boron deposits globally, and its location in Nevada makes it uniquely placed to meet future US demand for these strategic commodities. Our valuation of A$0.54/sh is underpinned by Rhyolite Ridge modelled on a long term US$12,647/t lithium carbonate price, and INR securing project finance accompanied by a 25% sell-down of the project for US$126m. Our A$0.40/sh price target reflects uncertainty on our assumed financing scenario. Given the deposit’s potential to be the next US lithium producer, and the opportunity to disrupt the borate market, we anticipate INR will have financing optionality to reduce the construction equity requirement, and in our view the stock will start to re-rate as a funding strategy begins to emerge, and as the project progresses through DFS and FID later this year.

Rare, large scale asset in the lowest quartile of the cost curve

Rhyolite Ridge is a large, shallow, open-pittable, long life project which is amenable to acid leaching, and will be in the lowest quartile for lithium carbonate producers due to its significant boric acid by-product credit, which underwrites 75% of operating costs at the current Reserve grade.

Boron market disruptor

Rhyolite Ridge has an opportunity to disrupt the boron market dominated by Etilmine and Rio Tinto, which will be driven by ex-Rio Tinto / US Borax sales and marketing executives now part of the INR management team.

Low ESG footprint

The operation will not require a tailings dam or evaporation ponds, has low water consumption compared to brine operations, can generate surplus ‘green’ electricity, and its outputs are linked to energy efficiency, reduced emissions, and lifting agricultural yields.

Economics likely to improve on drilling, acid plant savings

INR has flagged that recent assays from infill and extensional drilling have returned grades 15-20% above the Resource grade, which we interpret may lift production during the initial years of operations. Capex has also fallen 10% with the award of the acid plant contract to SNC Lavalin.

Quality management with the credentials to deliver

INR’s board has experience in developing and financing lithium projects and running boron operations. Its US based members are also well-placed to work with US investors, corporates, and the US Government, which has bipartisan support for new legislation to secure supply chain for lithium and other minerals critical to its automotive and energy sectors.

---

**Company Data**

<table>
<thead>
<tr>
<th>AXS Code</th>
<th>INR.ASX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share Price (A$/sh)</td>
<td>0.175</td>
</tr>
<tr>
<td>Number of shares (m)</td>
<td>1,475</td>
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<tr>
<td>Market Capitalisation (A$m)</td>
<td>258</td>
</tr>
<tr>
<td>Float (Total - Insiders) (%)</td>
<td>92.1%</td>
</tr>
<tr>
<td>12 month high / low (A$/sh)</td>
<td>0.14 / 0.495</td>
</tr>
<tr>
<td>30 day average turnover (M shares)</td>
<td>2.1</td>
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<tr>
<td>GICS Industry Group</td>
<td>Materials</td>
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</table>

**Earnings Summary (June YE)**

<table>
<thead>
<tr>
<th></th>
<th>2019F</th>
<th>2020F</th>
<th>2021F</th>
<th>2022F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reported Profit ($M)</td>
<td>0.3</td>
<td>(15.9)</td>
<td>(24.7)</td>
<td>(49.9)</td>
</tr>
<tr>
<td>EPS (¢)</td>
<td>0.00</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.02)</td>
</tr>
<tr>
<td>P/E (x)</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>(9.60)</td>
</tr>
<tr>
<td>Free CFPS (¢)</td>
<td>(0.01)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>0.01</td>
</tr>
<tr>
<td>P/CF (x)</td>
<td>(21.6)</td>
<td>(1.6)</td>
<td>(1.6)</td>
<td>18.2</td>
</tr>
<tr>
<td>EV/EBITDA (x)</td>
<td>nn</td>
<td>nn</td>
<td>nn</td>
<td>15.8</td>
</tr>
</tbody>
</table>

(1) Based on fixed, current share price. Na = not applicable; nn = not meaningful.

**Share Price Performance (LTM)**

- **Sum of Parts Valuation (as at 30 June 2020)**
  - NPV: 1,405
  - Undiluted A$/sh: 0.51
  - Diluted A$/sh: 0.51
  - Rhyolite Ridge (100%): 1,405
  - Corporate: (125) (0.05) (0.05)
  - Tax Shield: 100 0.04 0.04
  - Debt: (242) (0.09) (0.09)
  - Cash: 350 0.13 0.13
  - Exploration: - - -
  - Total Value of Common Equity: 1,489 0.54 0.54

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Kerr Allan Financial

Kurt Worden
+61 2 9241 2599
kurt@kerrallan.com.au
### General Assumptions

- **Revenue Inflation**: Real, 7%<br>- **Cost Inflation**: Real, 7%<br>- **Lithium Carbonate grade %**: LiCO<sub>3</sub> 1.17%<br>- **Boric Acid grade %**: H<sub>3</sub>BO<sub>3</sub> 1.17%<br>- **Boric Acid unit price US$/t Li**: 75%<br>- **Boric Acid unit price US$/t Li**: 2024E 75%

### Upper & Lower Zone (1,050m to cut-off and 0.5% B cut-off)

**Tonnage**<br>- **LiCO<sub>3</sub>**: 121,400<br>- **Li<sub>2</sub>CO<sub>3</sub>**: 185,179<br>- **H<sub>3</sub>BO<sub>3</sub>**: 1,153,179<br>- **H<sub>3</sub>BO<sub>3</sub>**: 1,153,179<br>- **LiCO<sub>3</sub>**: 1,153,179<br>- **LiCO<sub>3</sub>**: 1,153,179

**Repayment of borrowings**<br>- **Proceeds from conversion of ITM options**<br>- **Payments for acquired exploration and evaluation activities**

**Cash flows from operating activities**

<table>
<thead>
<tr>
<th></th>
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<td>Add: NPM Tax</td>
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<tr>
<td>Less: NPM Tax</td>
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<td>-</td>
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<tr>
<td>Total Cash Operating Costs (incl NPM tax)</td>
<td>8,807,648</td>
<td>4,512,687</td>
<td>5,164,418</td>
<td>5,650,021</td>
<td>6,525,489</td>
<td>7,079,684</td>
<td>7,874,053</td>
<td>8,601,011</td>
<td>9,356,430</td>
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### Income Statement

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<tr>
<td>Mining</td>
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<tr>
<td>Transport &amp; Selling Costs</td>
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<tr>
<td>Sub-Total Cash Operating Costs</td>
<td>-</td>
<td>-</td>
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<td>-</td>
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### Balance Sheet

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<tbody>
<tr>
<td>End of period Cash and cash equivalents</td>
<td>45,462,403</td>
<td>45,873</td>
<td>46,425,403</td>
<td>137,033</td>
<td>224,628</td>
<td>276,533</td>
<td>351,572</td>
<td>521,451</td>
<td>585,404</td>
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### Net Assets

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<tr>
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<tbody>
<tr>
<td>Contributed Equity</td>
<td>113,300</td>
<td>304,073</td>
<td>304,073</td>
<td>304,073</td>
<td>304,073</td>
<td>304,073</td>
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<td>304,073</td>
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<tr>
<td>Reserves</td>
<td>9,602</td>
<td>9,602</td>
<td>9,602</td>
<td>9,602</td>
<td>9,602</td>
<td>9,602</td>
<td>9,602</td>
<td>9,602</td>
<td>9,602</td>
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<tr>
<td>Retained Earnings</td>
<td>(27,491)</td>
<td>134,076</td>
<td>134,076</td>
<td>134,076</td>
<td>134,076</td>
<td>134,076</td>
<td>134,076</td>
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### Total Equity

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</thead>
<tbody>
<tr>
<td>45,462,403</td>
<td>45,873</td>
<td>46,425,403</td>
<td>137,033</td>
<td>224,628</td>
<td>276,533</td>
<td>351,572</td>
<td>521,451</td>
<td>585,404</td>
<td></td>
</tr>
</tbody>
</table>
Investment Rationale

At a time when end users are securing supply of battery minerals and materials (eg Great Wall, Volkswagen, Tesla), corporates are looking to enter the battery / electric vehicle (EV) supply chain (eg Wesfarmers’ A$2.3 billion bids for Kidman Resources and Lynas Corporation), and the US Government is focused on securing critical minerals supply, ioneer Limited (INR.ASX) warrants assessment.

INR provides exposure to one of two known globally significant lithium-boron development assets through its 100% owned Rhyolite Ridge Lithium-Boron project in Nevada, USA. The other, Jadar, is in Serbia, and owned by Rio Tinto. With a market capitalisation of A$258 million, there is significantly more leverage to a successful development for INR, as indicated by the discrepancy between its market capitalisation and the US$1.82 billion valuation documented in the October 2018 Pre-Feasibility Study. With A$60.1 million in cash at 31 March 2019, INR is fully funded to deliver its DFS, with significant newsflow over the next six-twelve months, including pilot plant results, product specifications for its potential lithium product suite, Mineral Resource and Ore Reserve updates, interim DFS outcomes, and progress on financing (Chart 1).

Chart 1. INR’s timeline to target production date of H2 2021

Our A$0.54/sh Sum of Parts valuation (Table 1) includes modelling of Rhyolite Ridge in line with the PFS outcomes, albeit at a 25% lower long-term lithium carbonate price (US$12,647/t) and higher discount rate (10% post tax, nominal). It assumes a financing strategy akin to Orocobre Limited’s funding for Stage 1 development of its Olaroz project, which was overseen by INR’s Chairman James Calaway. Our A$0.40/sh price target, (229% premium to the current share price), is set in line with the bottom end of the valuation range derived from the financing scenarios we outline in this report. Near-term, the company is leveraged to the results of a fully funded DFS in Q3 2019 and financing strategies that have the potential to reduce the construction equity task for Rhyolite Ridge, leading to increased appetite from institutions, retail, and potentially corporate investors.

Table 1. Sum of Parts Valuation at 30 June 2020

<table>
<thead>
<tr>
<th>Sum of Parts Valuation 30 June 2020</th>
<th>NPV A$’000</th>
<th>Undiluted A$ps</th>
<th>Diluted A$ps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhyolite Ridge (75%)*</td>
<td>1,405,194</td>
<td>0.51</td>
<td>0.51</td>
</tr>
<tr>
<td>Corporate</td>
<td>(124,800)</td>
<td>(0.05)</td>
<td>(0.05)</td>
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<tr>
<td>Tax Shield</td>
<td>100,159</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Debt</td>
<td>(241,729)</td>
<td>(0.09)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Cash</td>
<td>350,431</td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>Exploration</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Value of Common Equity</td>
<td>1,489,255</td>
<td>0.54</td>
<td>0.54</td>
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<tr>
<td>Market Value of Common Equity</td>
<td>475,345</td>
<td></td>
<td></td>
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<tr>
<td>Premium (Discount)</td>
<td>211%</td>
<td>211%</td>
<td>209%</td>
</tr>
<tr>
<td>Shares on Issue</td>
<td>million</td>
<td>2,733</td>
<td>2,754</td>
</tr>
</tbody>
</table>

Source: KAF estimates. *Assumes sale of a 25% stake in the project as part of the construction financing.
Longer term, INR offers leverage to lithium ion batteries and increasing uptake of EVs, forecast by market experts to cause demand to outstrip supply by the mid-2020s. INR is also well placed to capture market share from Rio Tinto and Eltimine for its boric acid production, which underwrites 75% operating costs at Rhyolite Ridge based on existing PFS Reserve grade, which we expect to lift.

**Why should Rhyolite Ridge be considered strategically important?**

In our view, these are the elements that make Rhyolite Ridge a strategic asset:

**Dual commodity exposure:** Rhyolite Ridge offers revenue diversification through lithium carbonate and boric acid production, with the advantage of being able to service customers that require both commodities (e.g., Corning, Apple) or customers in disparate industries (e.g., batteries vs fibreglass).

**Key commodities:** The US Government has identified lithium as one of 35 critical minerals vital to its security and economic prosperity. At a summit in Washington earlier this month Senator Murkowski introduced the American Mineral Security Act, legislation with bipartisan support to secure mineral resources and ensure supply chains of critical minerals for domestic industries such as the automotive and energy sectors. With respect to borates, 30% of global supply is produced at Rio Tinto’s 90-year-old mine at Boron, California. The mine is forecast to close in 2042, and without a new domestic replacement, US end users will likely be wholly reliant on higher priced imported volumes.

**Chart 2. INR’s position in the lowest quartile of the 2018 lithium carbonate cost curve**

![Chart showing INR's position in the lowest quartile of the 2018 lithium carbonate cost curve](source: Roskill 2018, INR)

**Bottom end of the cost curve:** With a published PFS-level operating cost of US$1,796/t lithium carbonate (Chart 2), Rhyolite Ridge falls within the bottom quartile of lithium carbonate producers, a key attribute when being assessed by project financiers and corporates alike. This is largely due to the boric acid by-product, which underwrites 75% of the operating costs for delivered product, assuming the lower grades included in the PFS. Based on recent drilling results, we anticipate higher boric acid production will increase this credit, particularly in the early years.

**Chart 3. Revenue and operating cost comparison – boric acid underwrites 75% of the opex**

![Chart showing revenue and operating costs comparison](source: INR)
Water Use:
Rhyolite Ridge:
3,500 acre feet to produce 33,200 tLCE
=0.11 a/t LCE
Silver Peak:
20,000 acre feet to produce 6,000t LC
=3.33 a/t LC

Location: In the Fraser Institute’s 2018 survey, Nevada was ranked top mining jurisdiction in the world. Rhyolite Ridge offers US end users security of lithium and boron supply, and for other consumers, reduced development risk with minimal sovereign risk issues.

Tick for ESG considerations: Environmental, social and governance factors are becoming increasingly important for investors and corporates. Rhyolite Ridge is a ‘hard rock’ operation, with relatively small annual mining movements. Its environmental footprint will be small, with no need for evaporation ponds, and tailings will be stored in a dry-stacked facility as opposed to a tailings dam. Process water requirements are modest compared to lithium brine operations (Albermarle’s neighbouring Silver Peak operation uses >30x more water than Rhyolite Ridge on a t/LCE produced basis), and acid mine drainage will not be factor, despite the use of sulphuric acid in the process plant, as free acid is reclaimed. From Year 3, INR is planning to generate its own power, and could deliver up to 37.5MW of ‘green’ energy to the Californian or Nevada electricity grid. Finally, both lithium and boron products are linked to environmentally friendly applications, including battery chemicals for EVs and renewable power stations, permanent magnets in electric motors and wind turbines (Nd-Fe-B), fibreglass for improving thermal efficiency (eg housing), as well as micronutrients for fertilisers to increase agricultural yield.

Corporate appeal: With bipartisan US Government support to secure its lithium supply chain, and the boron market being dominated by Turkish Government-controlled Eti Mine and Rio Tinto, Rhyolite Ridge’s long life, position on the cost curve, and its Nevada location should attract attention from end users and/or major miners of both commodities seeking to secure longer term supply. Ultimately, we consider INR will be able to leverage these attributes to finance development of the asset, unlocking its inherent value.

In the meantime, INR has enlisted the services of an investment bank, and added proportional takeover bid approval provisions to its constitution at the 2018 AGM. The company is clearly wary of being subject to opportunistic attention from corporates prepared to recognise the inherent value in the asset before the equity markets are prepared to. This view is justified, given Wesfarmers’ A$1.5 billion bid for Lynas Corporation and subsequent A$776 million bid for Kidman Resources, which would give Wesfarmers entry to the EV market via the rare earths and lithium industries. This is evidence that industrial/chemical companies are eager to leverage their expertise to the strong fundamentals of the EV/battery sector, particularly when equity valuations appear attractive. We view a premature takeover as a key risk to our valuation and target price.

So why the valuation gap?
Weakening Chinese domestic technical grade lithium carbonate prices, and general challenges faced by new lithium producers and developers have seen share prices decline, particularly in December (Chart 3). Recent M&A activity among the spodumene developers and producers has induced a partial recovery for select stocks, while the rest are starting to find a floor. Several additional factors may be exacerbating INR’s share price performance.

Chart 3. lithium sector down but moderating, M&A providing respite for some spodumene developers

Source: Thomson Reuters
**Post capital raise selling pressure**: INR raised A$53 million at A$0.41/sh in June 2018 when sentiment towards the sector was positive, and before market conditions turned in H2 2018. The funds raised were sufficient to fund the company through its PFS and through to conclusion of the DFS in Q3 2019. ASX disclosures and press reports reveal one institution sold down its holding following the capital raise, due to the fund being wound up (JCP). Selling pressure has continued into 2019, although short interest has reduced in recent weeks (currently 1.23%).

**Capex vs market capitalisation hurdle**: The US$599 million funding task revealed in the PFS has been reduced to US$537 million, with US$62 million saved on the acid plant under the contract awarded to SNC Lavalin. However, this still represents a funding task 2.9x INR’s current A$258 million market capitalisation, leading equity markets to question the ability to finance the project.

“**Untested process**”: Given lithium mineralisation at Rhyolite Ridge is associated with searlesite, and there are no lithium mines currently producing lithium carbonate from searlesite deposits, there may be scepticism regarding the flow sheet and potential for issues during commissioning and ramp up. These points are valid for the industry in general, given issues new market entrants have faced with respect to achieving target production and product specification.

However, INR’s flowsheet itself does not involve unproven technology; it is proven technology combined in a novel way: sulphuric acid leaching, as used in copper deposits, matched with mechanical evaporation and crystallisation, understood technologies used in lithium and sulphate of potash brine operations. We had the opportunity to visit the premises of Kappes, Cassiday & Associates (pioneers of heap leaching for Nevada’s Carlin gold deposits), and observed the column and vat leaching testwork that had been undertaken during the PFS. Kemeko is currently operating a pilot plant to further de-risk the flow sheet, determine various lithium product specifications, and provide sample products to potential customers for appraisal.

**Rhyolite Ridge is not a lithium clay deposit**: Western North America hosts a number of lithium clay deposits (eg Thacker Pass in Nevada, Sonora in Mexico). The target ore types for these deposits are lithium-bearing claystones, as opposed to a specific mineral such as searlesite, which comprises up to 40% of the mineralised sediments at Rhyolite Ridge. There are lithium-bearing clays overlying the searlesite mineralisation at Rhyolite Ridge; these will not be processed as part of the initial operation, and will instead be stockpiled.

**Addressing the financing question**

Commercial banks are yet to finance a greenfields lithium operation without a risk mitigant (eg Government or offtake partner guarantee), and financing solutions available to lithium developers have proven expensive (Nordic bonds, hybrid / mezzanine-style debt facilities with equity-linked features, streaming facilities, etc). We have modelled a series of financing structures, based on industry examples for greenfields projects. We’ve also examined funding the acid plant, steam turbine, and mining fleet using off-balance sheet alternatives, and modelling higher operating costs to recover the capital outlay. Key assumptions are presented in Table 2.

**Table 2. KAF Financing Assumptions**

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepayment</td>
<td>3 years of 50% of boron production at US$700t for US$210m</td>
</tr>
<tr>
<td>Project Finance</td>
<td>5 year tenor, sculpted repayments to DSCR* 2.0x, 4.5% interest rate</td>
</tr>
<tr>
<td>High Yield Bond</td>
<td>5 year bond, 3 years interest only, amortising to 50% over 2 years with a 12% interest rate</td>
</tr>
<tr>
<td>Large Sale</td>
<td>US$136m for 50% interest in Rhyolite Ridge</td>
</tr>
<tr>
<td>Small Sale</td>
<td>US$126m for 25% interest in Rhyolite Ridge</td>
</tr>
<tr>
<td>Equity</td>
<td>Raised at A$0.15/sh</td>
</tr>
<tr>
<td>Working Capital</td>
<td>Cash required to maintain a minimum cash balance &gt;A$10m at all times, including future sustaining capital – this is designed to ensure the steam turbine and acid plant upgrade capex is covered at the outset</td>
</tr>
<tr>
<td>Off Balance Sheet Funding</td>
<td>Capital recovered over 7 years through higher operating costs and 1% additional margin, US$1 million acid plant management fee</td>
</tr>
</tbody>
</table>

Source: KAF assumptions. *Debt Service Cover Ratio
The best outcome for shareholders involves project finance accompanied by a project sell down.

The results of our analysis are presented in Table 3, and can be summarised as follows:

- The valuations range from A$0.40/sh to A$0.54/sh, well above the current share price;
- The least dilutive financing outcomes involve sale of an interest in the project;
- A boron prepayment accompanied by sale of a project interest offers the least dilutive outcome for shareholders;
- Financing strategies involving product prepayments require significant working capital to maintain positive cash balances through the repayment period; and
- Conventional project financing works, however, requires unrealistic equity injections.

Project Finance Scenarios

On the assumptions in Table 2, Rhyolite Ridge supports 41-42% gearing. To secure project finance, INR will require offtake agreement(s) with creditworthy counterparties, and likely a guarantee from the offtaker(s) or a government agency. In our view, this is plausible, and has been demonstrated in Orocobre’s financing of Stage 1 of Olaroz, which was overseen by INR’s Chairman James Calaway. For minimal dilution, the financing would likely be accompanied by sale of an interest in the project. We’ve assumed sale of a 25% interest for US$126m, and new equity of A$189m.

On our assumptions, project financing accompanied by boron prepayments impacts on debt serviceability during the repayment term, while straight project finance without a project sell down requires a significant proportion of equity to be raised, irrespective of whether off-balance sheet funding can be arranged for the acid plant and steam turbine.

Nordic Bond - Boron Prepayment Scenarios

Given Nordic bonds have been used by Pilbara Minerals and Nemaska in the funding for their Pilgangoora and Whabouchi projects, we included a Nordic bond financing for Rhyolite Ridge using a structure based on terms disclosed to the market by Pilbara Minerals. Our modelling assumes a 5 year bond with a 3 year interest only period, coinciding with an initial 3 year boron prepayment providing US$210m in funding.

We modelled a US$125m bond including the acid plant and steam turbine, and a US$100m bond excluding these items. Both financing strategies required significant working capital (US$225-300m) to maintain positive cash balances through the financing window, resulting in significant equity-funded requirements of ~A$450-500m.

Project Sell Down Scenarios

Given the discrepancy between project and market valuation, sale of an interest in Rhyolite Ridge is preferable to an investment in the headstock. In Table 4 we detail the transaction metrics for the Toyota Tsusho investment in Stage 1 of ORE’s Olaroz project in Chile, and also SQM’s earn in to Kidman Resources’ Earl Grey spodumene project in Western Australia. We’ve modelled a 25% sell down which compares favourably with the ORE example (51% discount to NPV) as part of a project financing valuation, and also in conjunction with a boric acid prepayment, which requires a further $281m in equity to maintain a minimum cash balance above A$10m.

Our modelling of a KDR interest sale scenario assumes a discount of 56% to NPV compared to the 61% discount to NPV SQM achieved for its 50% interest in Earl Grey. Given the KDR-SQM joint venture was announced immediately before the Scoping Study, and the Toyota Tsusho transaction was concluded at 51% discount following the DFS, we selected a mid-point discount for a post PFS transaction for INR.

When combined with the boron prepayment, the equity requirement under the 50% sell down is A$128m; a standalone sell down requires A$200m in new equity.

We have also included the metrics for Wesfarmers’ recent bid for KDR. While the A$776m acquisition (A$749m enterprise value) represents a 44-47% premium to KDR’s share price, it also equates to a 52% discount to NPV for the integrated LiOH project.
### Table 3. Modelled Financing Scenarios for the Rhyolite Ridge Project

<table>
<thead>
<tr>
<th>Scenario</th>
<th>25% Sale + Project Finance (incl. AP &amp; GT)*</th>
<th>Project Finance Only (incl. AP &amp; GT)</th>
<th>Project Finance Only (excl. AP &amp; GT)</th>
<th>Prepayment + Nordic Bond (incl. AP &amp; GT)</th>
<th>Prepayment + Nordic Bond (excl. AP &amp; GT)</th>
<th>Prepayment + 25% Sale (incl. AP, GT)</th>
<th>Prepayment + 25% Sale (excl. AP, GT)</th>
<th>50% Sale (incl. AP, GT)</th>
<th>50% Sale (excl. AP, GT)</th>
<th>Prepayment + 50% Sale (incl. AP &amp; GT)</th>
<th>Prepayment + 50% Sale (excl. AP &amp; GT)</th>
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</thead>
<tbody>
<tr>
<td>Project Ownership</td>
<td>75%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>75%</td>
<td>75%</td>
<td>50%</td>
<td>50%</td>
<td></td>
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</tr>
<tr>
<td><strong>Uses (1 Apr 19 - 30 Jun 21)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Net Construction Capex (nom., adj. for ownership)</td>
<td>586,010</td>
<td>781,347</td>
<td>619,890</td>
<td>781,347</td>
<td>619,890</td>
<td>586,010</td>
<td>586,010</td>
<td>390,673</td>
<td>390,673</td>
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<td></td>
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<tr>
<td>Exploration (nom., adj. for ownership)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Corporate Overheads (nom., to Jun-21)</td>
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<td>18,659</td>
<td>18,659</td>
<td>18,659</td>
<td>18,659</td>
<td>18,659</td>
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<tr>
<td>Debt Arranging Fees</td>
<td>7,252</td>
<td>9,669</td>
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<td>5,282</td>
<td>4,225</td>
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<tr>
<td>Working Capital</td>
<td>56,000</td>
<td>80,000</td>
<td>93,000</td>
<td>225,000</td>
<td>302,000</td>
<td>210,000</td>
<td>58,000</td>
<td>42,000</td>
<td>266,000</td>
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<td><strong>Total Uses</strong></td>
<td>588,324</td>
<td>798,196</td>
<td>632,711</td>
<td>816,621</td>
<td>652,881</td>
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<td>789,564</td>
<td>489,638</td>
<td>489,638</td>
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<td><strong>Sources (1 Apr 19 - 30 Jun 21)</strong></td>
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<tr>
<td>Boric Acid Prepayment</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>295,775</td>
<td>295,775</td>
<td>295,775</td>
<td>295,775</td>
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<tr>
<td>Lithium Carbonate Royalty</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
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<td>-</td>
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<tr>
<td>High Yield Bond</td>
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<td>-</td>
<td>-</td>
<td>176,056</td>
<td>140,845</td>
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<td>Project Finance</td>
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<td>322,306</td>
<td>260,354</td>
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<td>Strategic Sale</td>
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<td>177,423</td>
<td>177,423</td>
<td>191,549</td>
<td>191,549</td>
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<td>Closing Cash at 31 Dec 2018</td>
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<td>60,149</td>
<td>60,149</td>
<td>60,149</td>
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<td>Exercise of ITM Options</td>
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<td>10,461</td>
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<td>Construction Equity Placement</td>
<td>96,248</td>
<td>388,431</td>
<td>288,926</td>
<td>238,905</td>
<td>112,660</td>
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<td>337,977</td>
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<td>Working Capital</td>
<td>92,515</td>
<td>118,932</td>
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<td>259,544</td>
<td>335,488</td>
<td>239,263</td>
<td>87,263</td>
<td>71,263</td>
<td>128,002</td>
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<tr>
<td><strong>Total Sources</strong></td>
<td>678,525</td>
<td>900,279</td>
<td>749,963</td>
<td>1,040,891</td>
<td>955,378</td>
<td>825,273</td>
<td>673,273</td>
<td>461,936</td>
<td>685,936</td>
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<td><strong>Construction Equity Task</strong></td>
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<td>Equity Raise Price</td>
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<td>0.15</td>
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<td>0.15</td>
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<td>0.15</td>
<td>0.15</td>
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<tr>
<td>Shares issued (m)</td>
<td>1,258.42</td>
<td>3,382.42</td>
<td>2,793.32</td>
<td>3,323.00</td>
<td>2,987.65</td>
<td>1,876.44</td>
<td>2,834.93</td>
<td>1,331.84</td>
<td>853.35</td>
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<td>LOM Minimum Cash Balance</td>
<td>10,544</td>
<td>11,758</td>
<td>11,811</td>
<td>10,447</td>
<td>11,620</td>
<td>10,637</td>
<td>10,163</td>
<td>10,863</td>
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<td><strong>Sum of Shares Valuation</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>30 June 2020</strong></td>
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<tr>
<td>A$ps</td>
<td>0.51</td>
<td>0.38</td>
<td>0.42</td>
<td>0.34</td>
<td>0.36</td>
<td>0.37</td>
<td>0.32</td>
<td>0.33</td>
<td>0.35</td>
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<tr>
<td>Corporate</td>
<td>(0.05)</td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
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</tr>
<tr>
<td>Tax Shield</td>
<td>0.04</td>
<td>0.03</td>
<td>0.03</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.01</td>
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</tr>
<tr>
<td>Debt</td>
<td>(0.09)</td>
<td>(0.07)</td>
<td>(0.06)</td>
<td>(0.04)</td>
<td>(0.03)</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Cash</td>
<td>0.13</td>
<td>0.09</td>
<td>0.09</td>
<td>0.13</td>
<td>0.13</td>
<td>0.15</td>
<td>0.08</td>
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<td>0.20</td>
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<tr>
<td>Exploration</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>Total Value of Common Equity</strong></td>
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<td>0.41</td>
<td>0.45</td>
<td>0.43</td>
<td>0.45</td>
<td>0.50</td>
<td>0.40</td>
<td>0.40</td>
<td>0.51</td>
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<tr>
<td>Shares on Issue (m)</td>
<td>2,754.39</td>
<td>4,878.39</td>
<td>4,289.30</td>
<td>4,818.97</td>
<td>4,483.63</td>
<td>3,372.41</td>
<td>4,330.91</td>
<td>2,827.82</td>
<td>2,349.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INR’s announcement had lifted, without stating the revised NPV. We assume an increase to US$500m. * KDR’s PFS valuation for the integrated LiOH operation is determined on a nominal basis. * The transaction is valued at A$776m (KDR EV is A$749m).

### Table 4. Select JV / Project Interest Transaction Details

<table>
<thead>
<tr>
<th>Project Interest Metrics</th>
<th>Unit</th>
<th>ORE</th>
<th>INR</th>
<th>Model</th>
<th>KDR</th>
<th>INR</th>
<th>Model</th>
<th>KDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Lithium Carbonate Price</td>
<td>US$/t</td>
<td>6,160</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward LiOH Price</td>
<td>US$/t</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15,115</td>
</tr>
<tr>
<td>Acquisition Price</td>
<td>US$m</td>
<td>62</td>
<td>126</td>
<td>126</td>
<td>110</td>
<td>119</td>
<td>136</td>
<td>532*</td>
</tr>
<tr>
<td>Project Interest</td>
<td>%</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Price per % interest</td>
<td>US$m/%</td>
<td>2.5</td>
<td>5.0</td>
<td>5.0</td>
<td>2.2</td>
<td>2.4</td>
<td>3.9</td>
<td>10.6</td>
</tr>
<tr>
<td>NPV (post tax, real)**</td>
<td>US$m</td>
<td>500</td>
<td>1,020</td>
<td>1,020</td>
<td>566</td>
<td>614</td>
<td>614</td>
<td>2,200</td>
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<tr>
<td>WACC</td>
<td>7.5%</td>
<td>7.5%</td>
<td>7.5%</td>
<td>10.0%</td>
<td>10.0%</td>
<td>10.0%</td>
<td>10.0%</td>
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</tr>
<tr>
<td>Ownership Value (NPV interest)</td>
<td>US$m</td>
<td>125</td>
<td>255</td>
<td>255</td>
<td>283</td>
<td>307</td>
<td>307</td>
<td>1,100</td>
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<tr>
<td>Price discount to NPV</td>
<td>%</td>
<td>51%</td>
<td>51%</td>
<td>51%</td>
<td>61%</td>
<td>61%</td>
<td>56%</td>
<td>52%</td>
</tr>
<tr>
<td>Project NPV/Acquisition Price</td>
<td>x</td>
<td>2.02x</td>
<td>2.02x</td>
<td>2.02x</td>
<td>2.57x</td>
<td>2.57x</td>
<td>2.26x</td>
<td>2.07x</td>
</tr>
</tbody>
</table>

Source: Company announcements. * Our model has been adjusted to reflect ORE’s DFS and KDR’s Scoping Study financing assumptions (ie AUDUSD, and WACC, post-tax NPV real basis) while keeping our lithium carbonate price deck constant. ** ORE DFS quoted an NPV of $449m including SOP production, however, when the Toyota Tsusho transaction concluded, the capex and production rates had lifted, without stating the revised NPV. We assume an increase to US$500m. ^ KDR’s PFS valuation for the integrated LiOH operation is determined on a nominal basis. * The transaction is valued at A$776m (KDR EV is A$749m).

### Potential for ECA & US Government Support

INR highlighted the potential for Export Credit Agency (ECA)-backed funding in a presentation released on 3rd April 2019. ECA financing involves a government agency providing assistance (often through a guarantee) to fund a project where it can be demonstrated that to do so would provide economic benefit for its domestic businesses and industries. In Table 5 we list the key partners identified in INR’s presentation. Of note is the presence of large French, Canadian, Danish companies, with the potential to provide professional services including engineering and/or construction of the processing plant and acid plant. These could involve a component of ECA-covered debt from COFACE (France), EDC (Canada), or EKF (Denmark), which may aid in lowering the cost of debt funding and risk for commercial banks to project finance a greenfields lithium-boron project.

### The US Government is committed to securing its lithium supply chain

Another avenue for assistance with financing could come from the US Government. U.S. Government officials held a summit with executives from automakers and domestic lithium miners and developers in early May 2019 to launch a national EV supply chain strategy1, which included announcement of the bipartisan American Mineral Security Act. Whether initiatives can be put in place that meet INR’s timeline is for debate, however, it does offer another potential avenue to assist with financing.

### Table 5. INR’s largest key partners, their businesses, company size, and location

<table>
<thead>
<tr>
<th>INR Key Partner</th>
<th>Business</th>
<th>Mkt Cap (US$Bn)</th>
<th>Domicile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dupont - MECS</td>
<td>MECS - sulphuric acid technologies</td>
<td>69.10</td>
<td>USA</td>
</tr>
<tr>
<td>Emerson</td>
<td>Engineering Solutions (eg automation, process plants etc)</td>
<td>40.07</td>
<td>USA</td>
</tr>
<tr>
<td>Veolia</td>
<td>Water, waste and energy management</td>
<td>12.66</td>
<td>France</td>
</tr>
<tr>
<td>Fluor</td>
<td>Engineering, Construction, Fabrication, Construction &amp; Maintenance</td>
<td>4.19</td>
<td>USA</td>
</tr>
<tr>
<td>SNC Lavalin</td>
<td>Integrated professional services and project management,</td>
<td>3.49</td>
<td>Canada</td>
</tr>
<tr>
<td>FL Smith</td>
<td>Engineering, Equipment &amp; Service Solutions, lithium experience</td>
<td>2.20</td>
<td>Denmark</td>
</tr>
</tbody>
</table>

Source: Company info, Bloomberg

---

1 Source: Reuters, April 2019: United States sets sights on China in new electric vehicle push.

---

Kerr Allan Financial 16 May 2019 9
Sensitivities – the market is pricing in US$7,200/t lithium carbonate

Our Sum of Parts valuation is most sensitive to changes in lithium carbonate price, lithium carbonate grade / recovery, AUDUSD, and discount rate selection (Table 6).

At A$0.175/sh, the market is currently pricing lithium carbonate at US$7,200/t lithium carbonate flat forever, or US$98/t boric acid flat forever.

Table 6. Impact of various sensitivities to our Sum of Parts Valuation

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<tr>
<th>Sensitivities</th>
<th>Δ NPV</th>
<th>A$-300m</th>
<th>A$-200m</th>
<th>A$-100m</th>
<th>A$0</th>
<th>A$100m</th>
<th>A$200m</th>
<th>A$300m</th>
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<tr>
<td>AUDUSD +10%</td>
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<tr>
<td>LC Price +10%</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>LC Price -10%</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>BA Price +10%</td>
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<td></td>
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</tr>
<tr>
<td>BA Price -10%</td>
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<tr>
<td>LC Grade +10%</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>LC Grade -10%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BA Grade +10%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>BA Grade -10%</td>
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<tr>
<td>LC Recovery +10%</td>
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<td></td>
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<tr>
<td>LC Recovery -10%</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BA Recovery +10%</td>
<td></td>
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<tr>
<td>BA Recovery -10%</td>
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<tr>
<td>Opex -1%</td>
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<tr>
<td>Opex +1%</td>
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<tr>
<td>Capex -20%</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Capex +20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest Rates -2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest Rates +2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WACC -1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WACC +1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: KAF estimates.

In the following tables, we present a range of sensitivities on a NPV per share basis.

Table 7. Sensitivity Analysis: Lithium Carbonate Price vs Boric Acid Price

<table>
<thead>
<tr>
<th>Lithium Carbonate Price (US$/t)</th>
<th>NPV per Share (A$/share)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20%</td>
<td>0.270 0.363 0.410 0.457 0.503 0.549 0.641</td>
</tr>
<tr>
<td>-10%</td>
<td>0.312 0.406 0.452 0.499 0.545 0.591 0.682</td>
</tr>
<tr>
<td>-5%</td>
<td>0.333 0.427 0.473 0.520 0.566 0.612 0.703</td>
</tr>
<tr>
<td>0%</td>
<td>0.354 0.448 0.495 0.541 0.587 0.632 0.724</td>
</tr>
<tr>
<td>5%</td>
<td>0.376 0.469 0.516 0.562 0.608 0.653 0.745</td>
</tr>
<tr>
<td>10%</td>
<td>0.397 0.490 0.537 0.583 0.628 0.674 0.766</td>
</tr>
<tr>
<td>20%</td>
<td>0.440 0.532 0.578 0.624 0.670 0.716 0.807</td>
</tr>
</tbody>
</table>

Source: KAF estimates
### Table 8. Sensitivity Analysis: Lithium Carbonate Price vs AUDUSD

<table>
<thead>
<tr>
<th>NPV per Share (A$ per share)</th>
<th>Lithium Carbonate Price (US$/t)</th>
<th>-20%</th>
<th>-10%</th>
<th>-5%</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUDUSD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-20%</td>
<td>0.406</td>
<td>0.512</td>
<td>0.564</td>
<td>0.616</td>
<td>0.668</td>
<td>0.720</td>
<td>0.824</td>
<td></td>
</tr>
<tr>
<td>-10%</td>
<td>0.379</td>
<td>0.478</td>
<td>0.527</td>
<td>0.576</td>
<td>0.625</td>
<td>0.674</td>
<td>0.771</td>
<td></td>
</tr>
<tr>
<td>-5%</td>
<td>0.366</td>
<td>0.463</td>
<td>0.510</td>
<td>0.558</td>
<td>0.605</td>
<td>0.652</td>
<td>0.747</td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td>0.354</td>
<td>0.448</td>
<td>0.495</td>
<td>0.541</td>
<td>0.587</td>
<td>0.632</td>
<td>0.724</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>0.343</td>
<td>0.435</td>
<td>0.480</td>
<td>0.524</td>
<td>0.569</td>
<td>0.614</td>
<td>0.703</td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>0.333</td>
<td>0.422</td>
<td>0.465</td>
<td>0.509</td>
<td>0.552</td>
<td>0.596</td>
<td>0.682</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>0.314</td>
<td>0.398</td>
<td>0.439</td>
<td>0.481</td>
<td>0.522</td>
<td>0.563</td>
<td>0.645</td>
<td></td>
</tr>
</tbody>
</table>

Source: KAF estimates

### Table 9. Sensitivity Analysis: Operating Cost vs Construction Capex

<table>
<thead>
<tr>
<th>NPV per Share (A$ per share)</th>
<th>Operating Cost (US$'000)</th>
<th>-20%</th>
<th>-10%</th>
<th>-5%</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Capex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-20%</td>
<td>0.721</td>
<td>0.658</td>
<td>0.626</td>
<td>0.594</td>
<td>0.562</td>
<td>0.530</td>
<td>0.465</td>
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</tr>
<tr>
<td>-10%</td>
<td>0.694</td>
<td>0.631</td>
<td>0.599</td>
<td>0.567</td>
<td>0.535</td>
<td>0.503</td>
<td>0.438</td>
<td></td>
</tr>
<tr>
<td>-5%</td>
<td>0.681</td>
<td>0.617</td>
<td>0.586</td>
<td>0.554</td>
<td>0.522</td>
<td>0.490</td>
<td>0.425</td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td>0.667</td>
<td>0.604</td>
<td>0.572</td>
<td>0.541</td>
<td>0.509</td>
<td>0.477</td>
<td>0.412</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>0.654</td>
<td>0.591</td>
<td>0.559</td>
<td>0.527</td>
<td>0.496</td>
<td>0.464</td>
<td>0.399</td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>0.640</td>
<td>0.577</td>
<td>0.546</td>
<td>0.514</td>
<td>0.482</td>
<td>0.450</td>
<td>0.386</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>0.613</td>
<td>0.551</td>
<td>0.519</td>
<td>0.488</td>
<td>0.456</td>
<td>0.424</td>
<td>0.360</td>
<td></td>
</tr>
</tbody>
</table>

Source: KAF estimates

### Table 10. Sensitivity Analysis: Changing Sale Price vs Percentage Interest Sold

| NPV per Share (A$ per share) | Sale Price (US$000) | 85,000 | 100,000 | 115,000 | 125,970 | 136,000 | 150,000 | 165,000 |
|------------------------------|---------------------|--------|---------|         |         |         |         |         |
| % Interest Sold              |                     |        |         |         |         |         |         |         |
| 10%                          | 0.498               | 0.518  | 0.540  | 0.558  | 0.575  | 0.600  | 0.630  |
| 15%                          | 0.490               | 0.512  | 0.535  | 0.553  | 0.570  | 0.597  | 0.628  |
| 20%                          | 0.482               | 0.504  | 0.528  | 0.547  | 0.565  | 0.593  | 0.627  |
| 25%                          | 0.474               | 0.496  | 0.521  | 0.541  | 0.560  | 0.589  | 0.625  |
| 33%                          | 0.458               | 0.481  | 0.508  | 0.529  | 0.550  | 0.582  | 0.621  |
| 40%                          | 0.441               | 0.466  | 0.494  | 0.517  | 0.539  | 0.574  | 0.616  |
| 50%                          | 0.412               | 0.439  | 0.469  | 0.494  | 0.519  | 0.559  | 0.608  |

Source: KAF estimates

### Table 11. Sensitivity Analysis: Size of Raise vs Raise Price

<table>
<thead>
<tr>
<th>NPV per Share (A$ per share)</th>
<th>Size of Raise (US$'000)</th>
<th>130,278</th>
<th>148,889</th>
<th>167,501</th>
<th>186,112</th>
<th>204,723</th>
<th>223,334</th>
<th>241,945</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raise Price</td>
<td></td>
<td>0.100</td>
<td>0.125</td>
<td>0.150</td>
<td>0.175</td>
<td>0.200</td>
<td>0.225</td>
<td>0.250</td>
</tr>
<tr>
<td>0.100</td>
<td>0.509</td>
<td>0.483</td>
<td>0.460</td>
<td>0.440</td>
<td>0.422</td>
<td>0.406</td>
<td>0.391</td>
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</tr>
<tr>
<td>0.125</td>
<td>0.562</td>
<td>0.537</td>
<td>0.515</td>
<td>0.495</td>
<td>0.477</td>
<td>0.461</td>
<td>0.446</td>
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</tr>
<tr>
<td>0.150</td>
<td>0.604</td>
<td>0.581</td>
<td>0.560</td>
<td>0.541</td>
<td>0.523</td>
<td>0.507</td>
<td>0.493</td>
<td></td>
</tr>
<tr>
<td>0.175</td>
<td>0.637</td>
<td>0.616</td>
<td>0.596</td>
<td>0.578</td>
<td>0.562</td>
<td>0.547</td>
<td>0.533</td>
<td></td>
</tr>
<tr>
<td>0.200</td>
<td>0.665</td>
<td>0.645</td>
<td>0.627</td>
<td>0.610</td>
<td>0.595</td>
<td>0.580</td>
<td>0.567</td>
<td></td>
</tr>
<tr>
<td>0.225</td>
<td>0.689</td>
<td>0.670</td>
<td>0.654</td>
<td>0.638</td>
<td>0.623</td>
<td>0.610</td>
<td>0.597</td>
<td></td>
</tr>
<tr>
<td>0.250</td>
<td>0.709</td>
<td>0.692</td>
<td>0.676</td>
<td>0.662</td>
<td>0.648</td>
<td>0.635</td>
<td>0.623</td>
<td></td>
</tr>
</tbody>
</table>

Source: KAF estimates
Rhyolite Ridge Asset – PFS estimates vs KAF financial assumptions

Our financial model is based on the October 2018 PFS, which we then adjusted for:

- a reduction in sulphuric acid capex from US$173m to US$111m, in line with the ASX announcement on 3 Apr 2019;
- an increase in initial lithium and boron grades during the first three years of operations, based on our interpretation of recent drilling results announced (20 Feb 2019, 21 Dec 2018), which reveal significant increases in boron and lithium grades from holes drilled at the southern end of the deposit; and
- financing the US$48.2m mining fleet off balance sheet. We believe INR will receive significant interest from yellow goods providers such as Caterpillar and Komatsu that would be able to provide equipment financing at competitive pricing to ensure their fleet is associated with a new lithium / boron mine in Nevada.

For conservatism, we have used a lithium price deck 25% below the Roskill / Benchmark derived PFS pricing, and modelled our cash flows on a nominal basis, using a 10%, post-tax WACC. A comparison of INR’s PFS outputs, our reconciliation to them, and the assumptions applied in our valuation is presented in Table 12. Our annual cash flow summary is included in Table 13. Production, operating metrics, and financials are presented in Chart 4, Chart 5, and Chart 6.

Table 12. Rhyolite Ridge Project Valuation Comparison: PFS Outcomes, KAF’s version, KAF valuation

<table>
<thead>
<tr>
<th>Mining &amp; Processing</th>
<th>Unit</th>
<th>INR PFS Oct 2018</th>
<th>KAF Model (PFS)</th>
<th>KAF Model (Valuation)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Mined</td>
<td>Kt</td>
<td>552,503</td>
<td>552,503</td>
<td>552,503</td>
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<tr>
<td>Ore Mined</td>
<td>Kt</td>
<td>78,996</td>
<td>78,996</td>
<td>78,996</td>
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</tr>
<tr>
<td>Ore processing rate</td>
<td>Ktpa</td>
<td>2,700</td>
<td>2,569</td>
<td>2,569</td>
<td>Nameplate vs schedule</td>
</tr>
<tr>
<td>Total tonnes processed</td>
<td>Kt</td>
<td>78,996</td>
<td>78,996</td>
<td>78,996</td>
<td></td>
</tr>
<tr>
<td>Lithium carbonate grade</td>
<td>%</td>
<td>0.95</td>
<td>0.95</td>
<td>0.96</td>
<td>Increased Years 1-3</td>
</tr>
<tr>
<td>Boric acid grade</td>
<td>%</td>
<td>7.81</td>
<td>7.81</td>
<td>7.91</td>
<td>Increased Years 1-3</td>
</tr>
<tr>
<td>Lithium Recovery</td>
<td>%</td>
<td>81.8</td>
<td>81.8</td>
<td>81.8</td>
<td></td>
</tr>
<tr>
<td>Boron Recovery</td>
<td>%</td>
<td>83.5</td>
<td>83.5</td>
<td>83.5</td>
<td></td>
</tr>
<tr>
<td>Average Annual LC production</td>
<td>tpa</td>
<td>20,200</td>
<td>20,240</td>
<td>20,470</td>
<td></td>
</tr>
<tr>
<td>Average Annual BA production</td>
<td>tpa</td>
<td>173,000</td>
<td>171,467</td>
<td>173,256</td>
<td></td>
</tr>
</tbody>
</table>

Operating and Capital Costs

<table>
<thead>
<tr>
<th>LOM Opex (Mining, Processing, G&amp;A)</th>
<th>Unit</th>
<th>US$/t treated</th>
<th>47.96</th>
<th>49.08</th>
<th>49.85</th>
<th>Off-balance sheet mining fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC Opex (net of BA credit)</td>
<td>US$/t Li2CO3</td>
<td>1,796</td>
<td>1,942</td>
<td>1,957</td>
<td>Higher mining &amp; processing cost assumptions</td>
<td></td>
</tr>
<tr>
<td>Initial Capex</td>
<td>US$'000</td>
<td>599,452</td>
<td>599,452</td>
<td>599,452</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustaining Capex</td>
<td>US$'000</td>
<td>255,790</td>
<td>255,790</td>
<td>206,590</td>
<td>Off-balance sheet mining fleet</td>
<td></td>
</tr>
</tbody>
</table>

Financial Parameters

| CPI | % pa | 0.0 | 0.0 | 2.0 |         |
| Long Term LC Pricing (CIF China)   | US$/t Li2CO3 | 16,892 | 16,892 | 12,647 | 25% reduction on PFS deck |
| Long Term BA Pricing (CIF Asia)    | US$/t H2BO3  | 700 | 700 | 700 |         |
| Steady state revenue (Real basis)  | US$'000 pa   | 450,000 | 452,451 | 373,416 |         |
| Steady state EBITDA (Real basis)   | US$'000 pa   | 297,000 | 296,320 | 214,865 |         |
| After-tax cash flow (Real basis)   | US$'000 pa   | 240,000 | 249,235 | 175,846 |         |
| Total after-tax cash flow (Real basis) | US$'000 | 6,617,000 | 6,535,719 | 4,682,292 |         |

NPV & IRR basis

| Discount Rate (WACC) | % | 7% | 7% | 10% |         |
| Valuation Date       | 30/06/2019 | 30/06/2019 | 30/06/2019 |         |
| NPV                  | US$'000  | 1,820,000 | 1,813,929 | 1,405,194 | Includes FS expenditure |
| IRR                  | % | 27.7% | 23.6% | 22.7% |         |
| Payback (from start of operations) | years | 4.1 | 4.5 | 5.0 |         |

Source: INR, KAF estimates
## Table 13. Annual Rhyolite Ridge Cash Flow Summary

<table>
<thead>
<tr>
<th>Production Year</th>
<th>Units</th>
<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
<th>FY22</th>
<th>FY23</th>
<th>FY24</th>
<th>FY25</th>
<th>FY26</th>
<th>FY27</th>
<th>FY28-52</th>
<th>Total / LOM Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Inflation</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.00%</td>
</tr>
<tr>
<td>AUUSD</td>
<td>USD per AUD</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
</tr>
<tr>
<td>CIF China Lithium Carbonate</td>
<td>US$1 LiCO₂</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CIF Asia Boric Acid</td>
<td>US$1 H₂BO₃</td>
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</tr>
<tr>
<td>Federal Tax Rate</td>
<td>%</td>
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<td></td>
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<td>21.00%</td>
</tr>
<tr>
<td>Nevada Net Proceeds of Minerals Tax</td>
<td>%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
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<tr>
<td>Depletion</td>
<td>%</td>
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<td></td>
<td></td>
<td></td>
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<td>22.00%</td>
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<td>(168,812)</td>
<td>(171,725)</td>
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</table>
Chart 4. Tonnes Mined vs Grade

Source: KAF estimates

Chart 5. LCE Production vs Total Cash Costs

Source: KAF estimates

Chart 6. Revenue, Operating Costs, EBITDA, and Free Cash Flow

Source: KAF estimates
Rhyolite Ridge Lithium Boron Project

Location & Access

The Rhyolite Ridge Lithium Boron Project is located on the western slopes of the Silver Peak Range in Esmeralda County, Nevada, USA. It occurs at 1,880m above sea level, in uninhabited semi-arid desert with an annual average rainfall of 110mm and occasional snowfall during the winter months. By road, Rhyolite Ridge is 340km northwest of Las Vegas, and 367km southeast of Reno. The closest service centre is Tonopah (population 2,500), 60km northeast of the project. Rhyolite Ridge can be accessed via all-weather roads from State Route 95 to the east, and State Route 6 to the west (see Figure 1).

Figure 1. Location of the Rhyolite Ridge Lithium Boron Project in Nevada, USA

Situated 25km west of Silver Peak, currently the only operating lithium operation in the US

Source: INR

The eastern access road from State Route 395 passes through the evaporation ponds of Albemarle Corporation’s Silver Peak lithium brine operation, 25km due east of Rhyolite Ridge. Silver Peak is the only producing lithium operation in the USA (Figure 2 and Figure 3).

Figure 2. Silver Peak evaporation ponds

Source: KAF

Figure 3. Silver Peak processing plant

Source: KAF
Ownership & Tenure

INR owns 100% of Rhyolite Ridge through its wholly owned subsidiary ioneer USA Corporation. The project encompasses an area of 44.6km² comprising 546 claims. The company has an option to acquire a 100% interest in a further 81 claims, which would increase the project area to 51km². All tenure is in good standing on Bureau of Land Management’s (BLM) LR2000 database as at the date of publication. Rhyolite Ridge is located on BLM land, and is not subject to First Nations / Native Title considerations.

Mining and Exploration History

In the early 1870s evaporite-hosted borax mineralisation was discovered at Columbus Marsh and Teels Marsh near Tonopah, and at Salt Wells near Fallon, Nevada. Until the 1890s, boron was extracted from several small mines in the area. Small-scale mining for boron took place in the South Basin, as evidenced by an adit and shaft (see Figure 4 and Figure 5). Regionally, Albermarle Corporation began extracting lithium from brines at its Silver Peak Mine in the Clayton Valley in 1966.

During the 1980s, US Borax (now a subsidiary of Rio Tinto) explored for boron over the South and North Basins. In the South Basin, exploration activities included surface sampling and drilling of an area of two square kilometres, completing 57 holes for approximately 15,000m. The North Basin was also drilled at 1km spacing along a strike length of 30km. While boron mineralisation was identified, the lack of similarity with the water-soluble mineralisation at US Borax’s Boron mine in California (discovered in 1925) led US Borax to pursue boron elsewhere.

From 2010-2011 Canadian company American Lithium Minerals Incorporated together with Japan Oil and Gas and Metals National Corporation (JOGMEC) explored for lithium in the South Basin. Their programs involved collection of 465 surface and trench samples, and drilling of 36 holes.

INR has obtained drill core, drill chips and associated databases and interpretations from both the US Borax and American Lithium Minerals exploration programs.

Geology

Rhyolite Ridge is located in the Basin and Range Province, which borders the eastern flank of the American Cordillera in western USA. Regional geology comprises a metamorphic core complex, with intensely folded Precambrian (Ordovician-Cambrian) phyllites, schists, and marbles intruded by Jurassic granitic rocks. Unconformably overlying the core complex are two thick sequences of felsic-
intermediate volcanic and volcaniclastic rocks, the latter coinciding with emplacement of an extensive Tertiary potassic volcanic complex referred to as the Silver Peak caldera, which occurs to the north, south, and east of the tenements.

In the South Basin, equivalent stratigraphy of the Cave Spring Formation comprises volcanic, volcaniclastic and lacustrine sediments (Figure 6). This sequence appears to have developed locally, within a basin ~7km long, and 3km wide. The basin has retained its geometry, dipping inwards from the margins to 10-20 degrees, with the sediments thickening towards the centre of the present valley. On the eastern side of the valley, it appears a slippage in the basal volcanics has resulted in a slump fan partly covering the basin (Figure 7).

**Figure 6. Outcropping boron-lithium mineralisation**  **Figure 7. View to the east across the South Basin**

Within the Cave Spring Formation, lithium-boron mineralisation is hosted by two horizons of finely bedded marls 20-70m thick, each bounded by yellow-coloured gritstones which form marker beds. Between the two horizons is a thick sequence of unmineralised siltstones and claystones. The current geologic interpretation is that as volcanic basement rocks underwent extension, the basin developed, filling with a series of lacustrine, carbonate and volcanic sequences at ~6Ma, at the same time boron and lithium rich fluids pervaded the basin. These fluids were introduced in two main pulses, with the second reflecting a change in chemistry from lithium-boron to lithium-only, before being largely shut off as further gritstones and carbonates were deposited.

**Figure 8. Cross Section of the Deposit highlighting mineralisation types**

Source: INR
Lithium and Boron Mineralisation

Two mineralisation styles have been observed at Rhyolite Ridge: lithium-boron mineralisation, and lithium-only mineralisation.

Both mineralised horizons described above contain lithium and boron mineralisation, where more than 40% of the carbonate-bearing sediments have been replaced by boron mineralisation in the form of the mineral searlesite (NaB(SiO₃)(OH)₂) and lithium is attributed to lithium present in the matrix of the clay mineral sepiolite (Mg₄Si₆O₁₅(OH)₂×6H₂O). Minor gangue minerals are present (<20%) and include calcium and magnesium carbonates, sepiolite, and adularia (K-feldspar). The highest boron and moderate to high lithium grades occur in the upper horizon, while grades are more variable in the lower horizon.

The second mineralisation type is characterised by lithium-only mineralisation and is restricted to the claystones and marls overlying the upper searlesite horizon. This unit appears to have been mineralised during a transition to a deeper sedimentary environment, and contains a greater clay component. The highest lithium grades are recorded in this unit, together with high magnesium and calcium, associated with more abundant carbonate minerals. In outcrop, this unit can be discerned by a differential weathering pattern, and the increasing laminar appearance of the sediments (Figure 6 and Figure 10). Boron grades are low within this unit, and boron mineralisation terminates with the introduction of a gritstone which caps this sequence. Lithium mineralisation is present in a carbonate sequence which occurs above the gritstone, but this too disappears following deposition of subsequent gritstone. The transition between the searlesite and sepiolite mineralisation is gradational, occurring over a 3-5 metre interval.

Figure 9. Drill core exhibiting searlesite-sepiolite mineralisation
Figure 10. Drill core exhibiting lithium-bearing clay mineralisation

The searlesite mineralisation is competent (Figure 9) and does not disintegrate when placed in water (Figure 11). This is in contrast to the upper lithium-bearing clay sediments, which have strong partings (Figure 10) and fall apart upon submersion in water due to swelling of the clays (Figure 11). Importantly, after leaching the searlesite-bearing ore retains its structural integrity (Figure 12). This is likely due to the presence of adularia and silica, which are not acid-soluble. This characteristic is critical for determining whether the tailings can be dry-stacked. This is not the case for the lithium clay mineralisation. While acid leaching successfully removes the lithium and any boron from the clays, fine particles are not amenable to leaching and may cause blockages, require additional filtration, and removal of other undesired elements from within the clay lattice. The higher abundance of carbonate minerals in the lithium clays also leads to increased acid consumption. INR’s current plant is to stockpile the lithium-rich clay horizon adjacent to the pit for future potential processing.
In October 2018 RungePincockMinarco (RPM) determined two Mineral Resource estimates for mineralisation identified in the South Basin: the first based on lithium-boron mineralisation only (applying a cut-off grade of 1,050ppm Li and 0.5% B), and the second including the lithium-only mineralisation. These resource estimates are included in Table 14 and Table 15. The lithium-boron resource totals 121.4Mt grading 0.9% lithium carbonate and 7.1% boric acid, containing 1.13Mt lithium carbonate and 8.85Mt boric acid. Including the lithium only mineralisation results in a Mineral Resource of 475Mt grading 0.9% lithium carbonate and 2.3% boric acid, containing 4.1Mt lithium carbonate and 10.9Mt boric acid.

The current Resource has been defined over a north-south strike length of 2,450m, has a maximum width of 1,250m and includes the 420m vertical interval from 1,920mRL to 1,500mRL. It is based on drilling and assay information collected from 19 trenches, 42 RC holes and 24 diamond holes for a total of 8,952m within the defined mineralisation. Indicated Resources have been estimated where drillhole spacings are 200m x 200m or closer, with Inferred Resources determined for drill spacings between 200m x 200m and 400m x 400m.

Table 14. October 2018 JORC 2012 Mineral Resource Estimate for Rhyolite Ridge (excluding lithium only clay)

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<th>B ppm</th>
<th>K ppm</th>
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<th>H₂BO₃ %</th>
<th>K₂SO₄ %</th>
<th>Li₂CO₃ kt</th>
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<td>1,820</td>
<td>580</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>121,400</td>
<td>1,740</td>
<td>12,600</td>
<td>0.90%</td>
<td>7.10%</td>
<td>1.90%</td>
<td>1,130</td>
<td>8,650</td>
<td>2,300</td>
<td></td>
</tr>
</tbody>
</table>

Source: INR
Table 15. October 2018 JORC 2012 Mineral Resource Estimate for Rhyolite Ridge (including lithium only clay)

<table>
<thead>
<tr>
<th></th>
<th>Kt</th>
<th>Li</th>
<th>B</th>
<th>K</th>
<th>Li₂CO₃</th>
<th>H₂BO₃</th>
<th>K₂SO₄</th>
<th>Li₂CO₃</th>
<th>H₂BO₃</th>
<th>K₂SO₄</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Zone</td>
<td>149,600</td>
<td>1,890</td>
<td>7,250</td>
<td>1.00%</td>
<td>1.60%</td>
<td>1.510</td>
<td>2,430</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Zone</td>
<td>192,400</td>
<td>1,370</td>
<td>2880</td>
<td>0.70%</td>
<td>1.60%</td>
<td>1.410</td>
<td>3,020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>342,000</td>
<td>1,600</td>
<td>4,800</td>
<td>0.90%</td>
<td>2.70%</td>
<td>2,910</td>
<td>5,450</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inferred</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Zone</td>
<td>49,400</td>
<td>1,860</td>
<td>4,300</td>
<td>1.00%</td>
<td>2.40%</td>
<td>490</td>
<td>1,200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Zone</td>
<td>83,900</td>
<td>1,480</td>
<td>1,080</td>
<td>0.80%</td>
<td>0.60%</td>
<td>660</td>
<td>490</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>133,400</td>
<td>1,600</td>
<td>2,300</td>
<td>0.90%</td>
<td>2.70%</td>
<td>1,150</td>
<td>2,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Zone</td>
<td>199,000</td>
<td>1,880</td>
<td>6,520</td>
<td>1.00%</td>
<td>3.70%</td>
<td>2,000</td>
<td>7,380</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Zone</td>
<td>276,300</td>
<td>1,410</td>
<td>2,340</td>
<td>0.70%</td>
<td>1.30%</td>
<td>2,070</td>
<td>3,550</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>475,400</td>
<td>1,610</td>
<td>4,100</td>
<td>0.90%</td>
<td>2.30%</td>
<td>4,060</td>
<td>10,930</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: INR

Recent drilling of 45 holes has been undertaken to extend mineralisation along strike to the south of the starter pit, and to infill the current Resource to improve the confidence (targeting Measured Resources and a higher proportion of Indicated Resources) with a view to increasing Ore Reserves (targeting Proved Reserves, additional Probable Reserves).

**Figure 13. Location of Recent Drill Intercepts with Mineralised Grades > Ore Reserve**

This drilling has revealed higher lithium and boron grades than those estimated in the maiden Ore Reserve and PFS, with increases of ~15% and 20% for lithium and boron respectively, with the 10 most southerly drill holes averaging 2,162 ppm Li and 1.44% B, as compared with the Indicated Resource grades of 1,900ppm Li and 1.22% B (Figure 13). INR has stated that with respect to boron grades, each 1% increase in the boric acid grade equates to an additional US$15.6 million of revenue per annum, or US$6/t ore processed (at a boric acid sale price of US$700/tonne).

**Figure 14. Zone of potential southern extension**

Additional exploration upside exists along strike to the south (Figure 14). INR is planning to conduct a seismic survey across the basin, and also to the south, to determine the basin’s architecture, detect the presence of any faults that might truncate mineralisation, and establish the thickness and depth to basement before undertaking further drilling to the south and east.
Finally, further exploration potential exists in the North Basin, located 4km of the South Basin. In September 2016 INR published an Exploration Target for the North Basin of 1-1.5Bt grading 1,000-2,000ppm Li and 0.5%-1% B, based on mapping, rock chip sampling, and trenching data. Subsequent interpretation of historic US Borax drill data acquired after announcement of the Exploration Target revealed lithium-boron mineralisation was intersected at widths of up to 260m, starting at 30m below surface, over an area of approximately 5km². Based on the announced results, lithium grades were consistent with the Exploration Target (1,372ppm), while boron grades were slightly lower (0.38%). INR has drilled two holes in the North Basin, which intersected 67m grading 1,212ppm Li and 0.49% B from 30m, and 29m grading 1,517ppm Li and 0.4% B from 3.4m.

Ore Reserves

In December 2018 INR announced its maiden Ore Reserve of 15.8Mt grading 1% lithium carbonate and 7% boric acid, containing 160kt lithium carbonate and 1.1Mt boric acid (Table 16). The Ore Reserve is based on an initial starter pit, underpinning the first seven years of mine life. The starter pit and associated facilities have been constrained to a maximum surface disturbance of 640 acres or one square mile, which allows the project to be considered for permitting under an Environmental Assessment (EA) rather than an Environmental Impact Statement (EIS), which would help expedite the Project’s passage through the approvals process.

Table 16. December 2018 JORC 2012 Ore Reserve Estimate for Rhyolite Ridge

<table>
<thead>
<tr>
<th>Probable</th>
<th>Tonnes</th>
<th>Li</th>
<th>B</th>
<th>Li₂CO₃</th>
<th>H₂BO₃</th>
<th>Li₂CO₃</th>
<th>H₂BO₃</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kt</td>
<td>ppm</td>
<td>ppm</td>
<td>%</td>
<td>%</td>
<td>kt</td>
<td>kt</td>
</tr>
<tr>
<td>Total</td>
<td>15,800</td>
<td>1,900</td>
<td>12,200</td>
<td>1.00%</td>
<td>7.00%</td>
<td>160</td>
<td>1,102</td>
</tr>
</tbody>
</table>

Source: INR

Pre-Feasibility Study

Table 17. Summary of Rhyolite Ridge PFS Outputs

<table>
<thead>
<tr>
<th>Unit</th>
<th>Average LOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicals</td>
<td></td>
</tr>
<tr>
<td>Ore processing rate</td>
<td>Mtpa</td>
</tr>
<tr>
<td>Total tonnes processed</td>
<td>Mt</td>
</tr>
<tr>
<td>Lithium carbonate grade</td>
<td>%</td>
</tr>
<tr>
<td>Boric acid grade</td>
<td>%</td>
</tr>
<tr>
<td>Recoveries - Lithium</td>
<td>%</td>
</tr>
<tr>
<td>Recoveries – Boron</td>
<td>%</td>
</tr>
<tr>
<td>Lithium carbonate production</td>
<td>tpa</td>
</tr>
<tr>
<td>Boric acid production</td>
<td>tpa</td>
</tr>
<tr>
<td>Operating and Capital Costs</td>
<td></td>
</tr>
<tr>
<td>Lithium carbonate operating cost (net of boric acid credit)</td>
<td>US$/t</td>
</tr>
<tr>
<td>Initial capital expenditure (including contingencies and indirects)</td>
<td>US$M</td>
</tr>
<tr>
<td>Sustaining capital expenditure over LOM</td>
<td>US$M</td>
</tr>
<tr>
<td>Financial Performance</td>
<td></td>
</tr>
<tr>
<td>Annual steady state revenue</td>
<td>US$Mpa</td>
</tr>
<tr>
<td>Annual steady state EBITDA</td>
<td>US$Mpa</td>
</tr>
<tr>
<td>Annual steady state after-tax cash flow</td>
<td>US$Mpa</td>
</tr>
<tr>
<td>Total after-tax cash flow</td>
<td>US$M</td>
</tr>
<tr>
<td>After-tax Net Present Value (NPV) @ 7% real discount rate</td>
<td>US$M</td>
</tr>
<tr>
<td>After-tax Internal Rate of Return (IRR)</td>
<td>%</td>
</tr>
<tr>
<td>Payback period (from start of operations)</td>
<td>years</td>
</tr>
</tbody>
</table>

Source: INR
DFS due in Q3 2019

INR published a PFS for the Rhyolite Ridge project on 23rd October 2018. Completed by Amec Foster Wheeler and done to an AACE Class 4 capital cost estimate with 25% accuracy, the study envisages a base case 3,500tpd sulphuric acid plant supplying a 2.7Mtpa ore processing facility to produce 20,200tpa lithium carbonate and 173,000tpa boric acid.

A larger, 4,500tpd acid plant scenario was also contemplated, lifting the ore processing capacity to 3.6Mtpa, and production to 27,900tpa lithium carbonate and 235,000tpa boric acid. A summary of the PFS results is presented in Table 17. The base case revealed an after tax NPV of US$1,820 million, with a post-tax IRR of 27.7% and a payback period of 4.1 years. The DFS is currently underway and is due for release in Q3 2019.

Mining & Haulage

Rhyolite Ridge will be an open cut mining operation, utilising conventional drill and blast techniques (Figure 15). There is no pre-stripping required, as mineralisation outcrops, and dips shallowly to the east. The strip ratio for the starter pit is 5.9:1, with the strip ratio for the 30 year operation published in the PFS being 6.9:1. Mining movements will build up to approximately 20mtpa rate by Year 2 of operations, supplying the base case 2.7Mtpa nameplate capacity of the processing plant. During the first 18 months, contract mining will be undertaken, before a US$49 million mining fleet is purchased as steady state mining movements are achieved. The mining fleet will comprise two Komatsu PC3000 hydraulic backhoe excavators, 21 HD785 trucks (90t), two drilling rigs and support equipment, with the fleet capable of moving 33Mtpa. Contract mining costs will be US$2.66/t in the first year (H2 2021), falling to US$2.50/t in the second year (2022). LOM mining costs (following purchase of the fleet) will average US$2.07/t moved. The PFS mining schedule is based solely on Indicated Resources from within the South Basin.

Figure 15. Overall Site Layout of Rhyolite Ridge

Source: INR

Searlesite ore will be hauled via internal haul road two kilometres to the ROM stockpile, northwest of the open pit. Lithium-only bearing clay stockpiled adjacent to the open pit for potential future processing (Figure 15).

Processing

A plan of the Rhyolite Ridge processing facility is presented in Figure 16. The processing plant comprises crushing, vat leaching using sulphuric acid generated by a purpose-built acid plant, then evaporation and crystallisation of both lithium and boron products in separate processing facilities. (Figure 17).
Crushing

Ore will be crushed to 25mm using two-stage mineral sizers and a tertiary cone crusher. Importantly, the relatively coarse crushing significantly reduces the amount of fines produced, eliminating the need for a tailings dam.

Vat Leaching

INR has opted for vat leaching over heap leaching due to the higher grade of the PLS that can be achieved by controlling temperature during leaching and maximising recoveries from leaching within contained vessels. The ore will be conveyed from the ROM stockpile and loaded into seven vats, each sized 32.5m x 32.5m x 7.4m. It will then be flooded with sulphuric acid water mix, with a four-day
residence time. The residence time is limited by bulk acid delivery, and acid consumption may be affected by gangue minerals such as calcium and magnesium carbonates, sepiolite, and adularia. Carbonate minerals could be floated to reduce acid consumption, however, this would increase wastewater requirements and add dewatering equipment costs to the capex. Spent ore will be removed from the vats using a crane and trucked to a dry stack tailings facility. The pregnant leach solution (PLS) is then piped to the boric acid plant. Acid consumption related to free acid can be minimised using a counter-current leach. The layout of the crushing and leaching sections of the plant is presented in Figure 18.

**Figure 18. Crushing and Vat Leaching Plant**

![Crushing and Vat Leaching Plant](image)

Source: INR

**Acid Plant**

The sulphuric acid used to leach the ore will be generated in a dedicated 3,500tpd sulphuric acid plant (Figure 19). The plant will convert sulphur prill to sulphuric acid in an exothermic reaction, the heat from which will be captured and used to generate steam for processing in both the boric acid plant and lithium carbonate plant. The steam could also be harnessed to drive a future steam turbine power station, powering the operation and delivering surplus electricity into the grid. The flowsheet has been designed to maximise sulphuric acid production, with the ore types fed to the processing plant blended to achieve constant sulphuric acid production.

**Figure 19. Sulphuric Acid Plant**

![Sulphuric Acid Plant](image)

Source: INR
**Boric Acid Plant**

On cooling of the PLS, approximately 50% of the boric acid is recovered. The PLS is then evaporated and cooled again to recover the remaining boric acid and other sulphate salts. The boric acid is recovered via flotation, and the boric acid is recombined before being purified using a wash, filtration and recrystallisation (refer Figure 20). The dried product is packed in 25kg or 1 tonne bulka bags for transport to market. Overall recoveries for the boric acid plant are 81.8%. Single stage boric acid recrystallisation can purify boric acid to meet required technical specifications without precipitating lithium salts (refer Table 24).

**Figure 20. Boric Acid Plant**

![Boric Acid Plant](source: INR)

**Lithium Carbonate Plant**

The residual lithium-rich PLS exits the boric acid plant and is piped to the lithium carbonate plant. Impurities including calcium, magnesium, aluminium and iron are removed via the addition of calcium oxide (quick lime) and sodium carbonate (soda ash) followed by ion exchange. The purified brine then undergoes further evaporation using steam piped from the sulphuric acid plant to concentrate the lithium PLS to saturation point so that it can be precipitated using sodium carbonate (refer Figure 21). Following evaporation, pH modification, and ion exchange, the lithium carbonate is packaged into 1 tonne bulka bags for transport to market. Overall recoveries for the lithium carbonate plant are 83.5%. Lithium brine cleaning and carbonate precipitation is suitable to be processed using conventional technology to produce a technical grade lithium carbonate.

**Figure 21. Lithium Carbonate Plant**

![Lithium Carbonate Plant](source: INR)
Battery Grade Expansion

The processing plant will start producing a 99% pure technical grade lithium carbonate for the first three years, then following expansion and modification, produce battery grade lithium carbonate from Year 4 onwards, with a modest increase in operating expenditure (US$1 million per annum) due to increased power consumption and CO\textsubscript{2} usage. The strategy to start with technical grade lithium carbonate in the initial years reflects the diverse product range potential offtakers may require. For example, glass end users will not require chemical grade lithium carbonate, while battery producers will. It is also a prudent approach, supported by management’s prior experience in developing and operating lithium mines, and the challenges that can be faced in meeting product specifications during commissioning and ramp up.

Power Requirements

A 55kv power line currently runs to Silver Peak, 28km east of Rhyolite Ridge. It will be upgraded to meet the project power requirements, which have been estimated at 9.5MW. Power can be imported or exported to the local utility company Nevada Energy (NVE), with the interconnection point being at NVE’s Silver Peak substation. In the initial years, INR will pay US$0.04342/kW\textsubscript{H} for its electricity requirements. INR’s planned installation of a steam turbine in Year 4 will generate 47MW of power, with 37.5MW able to be exported to the grid as ‘green’ electricity, which can command a premium price. INR anticipates this surplus power can be sold for US$0.0515/kW\textsubscript{H}. At present, regulations in Nevada do not contemplate acid-plant generated electricity as being ‘green’, and so it is unlikely the excess production will attract premium pricing. However, this is not the case in California, and INR could command a premium selling its electricity into the Californian grid. It may make sense to target the Californian market for other reasons, as NVE is owned by Berkshire Hathaway Energy, which supplies 90% of the electricity in Nevada fuelled from natural gas and renewable energy facilities, including its own power stations, and may not welcome additional competition in the Nevada market.

Water Requirements

Process plant net water usage is 1,284 l/t ore, or 119 l/sec (refer Table 18). It is envisaged that fresh water will be supplied via a 2.5km long pipeline from bores located at the perimeter of the open pit. Additional water and water rights may be obtained from the Fish Lake Valley Basin. The State Engineer has determined that the Fish Lake Valley Basin has a perennial recharge of 30,000 acre/feet. For comparison, INR’s water requirements is approximately 3,500 acre/feet. Historically water rights have been granted on a first come, first served basis. Now the basins have been over-allocated and it is unlikely new applicants will be granted water rights without cancellation of existing water rights. New applicants must also demonstrate that the basin will not be adversely affected by the re-allocation of the rights. In the Fish Lake Valley Basin, the water rights are used for irrigation of alfalfa and increasingly hemp. It is likely that INR will need to purchase or lease existing water rights. In September 2017, INR secured the water rights to 1.2GLpa, equivalent to 38 l/sec, or 32% of its requirements.

Table 18. Process Plant Net Water Usage

<table>
<thead>
<tr>
<th>Process Plant Net Water Usage</th>
<th>l/t ore</th>
<th>l/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leach Evaporation</td>
<td>216</td>
<td>20</td>
</tr>
<tr>
<td>Leach Residue (@30% moisture)</td>
<td>358</td>
<td>33</td>
</tr>
<tr>
<td>Cooling Tower</td>
<td>244</td>
<td>23</td>
</tr>
<tr>
<td>Sulphate Salts</td>
<td>155</td>
<td>14</td>
</tr>
<tr>
<td>Impurity Cake</td>
<td>76</td>
<td>7</td>
</tr>
<tr>
<td>Acid Dilution</td>
<td>65</td>
<td>6</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>109</td>
<td>10</td>
</tr>
<tr>
<td>Minor Item Allowance (5%)</td>
<td>61</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>1,284</td>
<td>119</td>
</tr>
</tbody>
</table>

Source: INR
Capital Costs

The initial capital requirement for the base case 2.7Mtpa operation totals US$599 million which includes 11% contingency of US$68 million. A breakdown of the estimate is presented in Table 19. The US$173 million acid plant represents 29% of the estimate, and 41% of the direct costs, and is a key driver in sizing the operation. A comparison of various acid plants and indicative capital intensities is presented in Table 20. The 2.7Mtpa operation, utilising a 3,500tpd acid plant, has a capital intensity of US$18,042/tpa LCE (lithium carbonate equivalent), which has recently been lowered to ~US$15,800 following award of the sulphuric acid plant contract. It is unlikely that INR would opt for a larger operation, given 1) a 4,500tpa acid plant would be near the largest in the world; 2) financing the project would be a greater challenge; 3) to move above 3.6Mtpa, a second acid plant would be required, which would reduce economies of scale, and 4) a larger acid plant would require additional water rights to be secured. The PFS includes an execution timeframe of 25 months from Notice to Proceed (targeted in August 2019) to mechanical completion in August 2021.

Table 19. Capital Cost Breakdown for the 2.7Mtpa operation

<table>
<thead>
<tr>
<th>Initial Capital Expenditure</th>
<th>US$'000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine (excluding Owner equipment) - haul roads only</td>
<td>5,896</td>
</tr>
<tr>
<td>Site preparation and roads</td>
<td>5,660</td>
</tr>
<tr>
<td>Process facilities (excluding 3500 acid plant)</td>
<td>190,366</td>
</tr>
<tr>
<td>Sulphuric acid plant*</td>
<td>173,283</td>
</tr>
<tr>
<td>Tailings / Waste Management</td>
<td>7,065</td>
</tr>
<tr>
<td>Utilities</td>
<td>22,286</td>
</tr>
<tr>
<td>Ancillary buildings and storage</td>
<td>16,022</td>
</tr>
<tr>
<td>Total Direct Cost</td>
<td>420,578</td>
</tr>
<tr>
<td>Owner's cost</td>
<td>21,029</td>
</tr>
<tr>
<td>Indirect cost</td>
<td>89,935</td>
</tr>
<tr>
<td>Total Indirect Costs</td>
<td>110,964</td>
</tr>
<tr>
<td>Total Direct + Indirect Cost</td>
<td>531,542</td>
</tr>
<tr>
<td>Contingency</td>
<td>67,909</td>
</tr>
<tr>
<td>Total Project Cost</td>
<td>599,452</td>
</tr>
</tbody>
</table>

Source: INR. * The acid plant capex is now US$111m, following a shift from a lump sum turnkey contract to an EP contract arrangement with SNC Lavalin and DuPont Clean Technologies, with Fluor overseeing and managing construction of the plant.

Table 20. Capital Intensity Analysis of various Throughputs

<table>
<thead>
<tr>
<th>Nominal Throughput</th>
<th>Mtpa</th>
<th>1.5</th>
<th>2</th>
<th>2.7</th>
<th>3.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Capex incl acid plant</td>
<td>US$M</td>
<td>421</td>
<td>500</td>
<td>599</td>
<td>674</td>
</tr>
<tr>
<td>Lithium Carbonate</td>
<td>ktpa</td>
<td>11.6</td>
<td>15.5</td>
<td>20.9</td>
<td>27.9</td>
</tr>
<tr>
<td>Boric Acid</td>
<td>ktpa</td>
<td>98</td>
<td>113</td>
<td>176</td>
<td>235</td>
</tr>
<tr>
<td>Boric Acid (converted to LCE)</td>
<td>ktpa</td>
<td>6.9</td>
<td>9.1</td>
<td>12.3</td>
<td>16.4</td>
</tr>
<tr>
<td>Total LCE</td>
<td>ktpa</td>
<td>18.5</td>
<td>24.6</td>
<td>33.2</td>
<td>44.3</td>
</tr>
<tr>
<td>Capital Intensity</td>
<td>US$/tpa LCE</td>
<td>22,757</td>
<td>20,325</td>
<td>18,042</td>
<td>15,214</td>
</tr>
</tbody>
</table>

Source: INR

Over the life of mine, a further US$256 million will be spent in sustaining capital (Table 21), with the major items being purchase of a mining fleet in Year 2 (US$49 million), expanding the dry stacked tailings facility capacity (US$41 million), expansion of the plant to enable battery grade lithium carbonate production (US$35 million), and purchase of a steam turbine and heat recovery system in Year 4 (US$39 million).
## Table 21. Sustaining Capital

<table>
<thead>
<tr>
<th>Sustaining Capital</th>
<th>US$’000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining fleet*</td>
<td>49,200</td>
</tr>
<tr>
<td>Residue storage facility expansion - Phase 1</td>
<td>20,350</td>
</tr>
<tr>
<td>Residue storage facility expansion - Phase 2</td>
<td>20,350</td>
</tr>
<tr>
<td>Battery grade process plant expansion</td>
<td>35,420</td>
</tr>
<tr>
<td>Process mobile equipment replacement</td>
<td>6,480</td>
</tr>
<tr>
<td>Plant equipment refurbishment</td>
<td>32,390</td>
</tr>
<tr>
<td>Steam turbine and acid plant heat recovery system</td>
<td>38,600</td>
</tr>
<tr>
<td>Acid plant catalyst exchange</td>
<td>4,300</td>
</tr>
<tr>
<td>Other sustaining capital</td>
<td>48,700</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>255,790</strong></td>
</tr>
</tbody>
</table>

Source: INR. We assume the mining fleet is funded off balance sheet.

## Operating Costs

The life of mine operating cost is US$47.96/t ore processed, with mining representing US$16.52/t processed, and processing and site G&A costs of US$31.44/t processed (Table 22). This equates to an operating cost of US$1.796/t lithium carbonate (inclusive of boric acid by-product credits), placing it at the bottom of the global lithium cost curve. The revenue received from boric acid will largely cover the site operating costs, meaning lithium carbonate will be upside.

Further detail on the processing costs is presented in Table 23. During the first four years, processing costs average US$99.5 million per annum, or US$36.83/t processed. On inclusion of a steam turbine with excess electricity returned to the grid, this falls to US$82 million or US$30.34/t processed from Year 5 onwards. This change includes an increase of US$1 million per annum or US$0.37/t processed for additional operating costs associated with production of battery grade lithium carbonate.

### Table 22. Summary of LOM Operating Costs

<table>
<thead>
<tr>
<th>Summary LOM Operating Costs</th>
<th>US$/t processed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining</td>
<td>16.52</td>
</tr>
<tr>
<td>Processing (Variable)</td>
<td>25.43</td>
</tr>
<tr>
<td>Processing and G&amp;A (Fixed)</td>
<td>6.01</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47.96</strong></td>
</tr>
</tbody>
</table>

Source: INR

### Table 23. Processing Cost Detail

<table>
<thead>
<tr>
<th>Operating Costs - Processing</th>
<th>Years 1-4</th>
<th>Year 5 onwards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US$Mpa</td>
<td>US$/t processed</td>
</tr>
<tr>
<td>Power</td>
<td>4.1</td>
<td>1.51</td>
</tr>
<tr>
<td>Reagents and Consumables</td>
<td>78.9</td>
<td>29.23</td>
</tr>
<tr>
<td>Labour</td>
<td>9.1</td>
<td>3.36</td>
</tr>
<tr>
<td>Mobile Equipment</td>
<td>1.4</td>
<td>0.51</td>
</tr>
<tr>
<td>Laboratory</td>
<td>1.0</td>
<td>0.37</td>
</tr>
<tr>
<td>Maintenance Costs</td>
<td>5.0</td>
<td>1.85</td>
</tr>
<tr>
<td>Battery-Grade Expansion</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>99.5</strong></td>
<td><strong>36.83</strong></td>
</tr>
</tbody>
</table>

Source: INR
Products and Pricing

INR has included pricing derived from forecasts provided by Roskill and Benchmark Minerals in its PFS. The price deck includes technical grade lithium carbonate pricing for the first three years, with battery grade lithium carbonate being produced from Year 4 onwards. The boric acid price of US$700/t is quoted on a CIF Asia basis, while lithium carbonate pricing is quoted on a CIF China basis. Transport costs and insurance for lithium carbonate and boric acid from mine gate to their destination markets are US$154/t and US$160/t respectively. To date, INR has only published achieved product specifications for its boric acid. We note that it is substantially lower in impurities that typical market specifications and has a marginally higher boric oxide content. Depending on the attractiveness of INR's specifications, this could translate to a premium to the realised boric acid price. Following the pilot plant trials at Kemetco, we anticipate INR will reveal the product specifications it has been able to achieve for a potential suite of lithium products.

Table 24. Rhyolite Ridge Product Specifications

<table>
<thead>
<tr>
<th>Compound or Element</th>
<th>Units</th>
<th>Rhyolite Ridge</th>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boric Oxide (B₂O₃)</td>
<td>%</td>
<td>&gt;56.5</td>
<td>&gt;56.25</td>
</tr>
<tr>
<td>Boric Acid (H₃BO₃)</td>
<td>%</td>
<td>&gt;99.9</td>
<td>&gt;99.9</td>
</tr>
<tr>
<td>Sulphate</td>
<td>ppm</td>
<td>&lt;125</td>
<td>&lt;250</td>
</tr>
<tr>
<td>Chloride</td>
<td>ppm</td>
<td>&lt;1</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Iron</td>
<td>ppm</td>
<td>&lt;5</td>
<td>&lt;7</td>
</tr>
<tr>
<td>Calcium</td>
<td>ppm</td>
<td>13</td>
<td>&lt;50</td>
</tr>
<tr>
<td>Sodium</td>
<td>ppm</td>
<td>43</td>
<td>&lt;200</td>
</tr>
<tr>
<td>Chlorine</td>
<td>ppm</td>
<td>&lt;5</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Lead</td>
<td>ppm</td>
<td>&lt;10</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Arsenic</td>
<td>ppm</td>
<td>&lt;10</td>
<td>&lt;100</td>
</tr>
<tr>
<td>D50 particle size</td>
<td>μm</td>
<td>550</td>
<td></td>
</tr>
</tbody>
</table>

Source: INR

Royalties and Taxes

The project is subject to a 21%, corporate tax rate, 5% Nevada Net Proceeds of Mining tax, a 22% depletion allowance, and a 3.02% Esmeralda property tax. A US$3 million success payment is due to the previous claim owners upon a positive final investment decision to develop Rhyolite Ridge.

Environmental Permitting

Rhyolite Ridge is located on public land administered by the BLM. Under the National Environmental Policy Act (NEPA) and BLM regulations, consideration of a proposed mine is a federal action, and so it must prepare an EA or EIS. As the initial operations at Rhyolite Ridge fall within a maximum surface disturbance threshold of 640 acres or one square mile, it is likely that it will qualify for review under an EA. The BLM determines which category is applicable.

Following the NEPA process, a Plan of Operations is submitted to the BLM, along with the key applications for a Nevada Reclamation Permit (four months) Water Pollution Control Permit (eight months), and Air Quality Operating Permit (three months).

INR has appointed EM Strategies, Inc. (EMS) to provide information on environmental considerations, permitting, and social and community impacts. Based on information provided to RPM and released in the JORC 2012 Resource Tables, EMS believes there are no known ongoing environmental issues with any of the regulatory agencies. Baseline studies are underway and indicate that there are limited biological and cultural issues; air quality impacts appear to be within State of Nevada standards; traffic and noise issues are present, but at low levels; and socioeconomic impacts are positive. A plant species known as Tiehm buckwheat (Erigonum tiehmii) was previously identified in the project area, and grows in the vicinity of outcropping boron mineralisation where soil profiles have not developed (Figure 22). Importantly, it was only observed on the fringes of outcropping searlesite mineralisation, and it had also colonised sites where trench mullock had been piled, suggesting the species is relatively easy to cultivate.
Investment Risks

**Commodity Prices:** Given its primary business focus, INR will be affected by market sentiment towards published lithium prices, and to a lesser extent the boron price.

**Currency:** INR’s revenue, operating and capital costs are US dollar denominated. Therefore, the Company’s future earnings are exposed to AUDUSD currency movements when translated to its Australian dollar reporting currency. INR may seek to mitigate this by moving to US denominated accounts.

**Approvals:** The current timetable could be delayed if BLM determines INR requires an EIS instead of an EA for the initial starter pit. There is no guarantee at the moment that INR will receive the approvals necessary to expand past the starter pit, i.e., the initial 7 year mine life.

**Financing:** All operational and cash flow forecasts are made with the underlying assumption that INR is able to raise construction funding required to develop Rhyolite Ridge, as modelled in this research note.

**Water:** To date INR has secured 32% of the water rights required to operate at a 2.7Mtpa throughput. It must find a way to secure the balance of the required water rights ahead of a Final Investment Decision.

**Operating Risk:** Once in production, INR will be subject to the usual operating risks that producers face, which may include weather, processing issues, etc.

Key potential risks identified include:

**Managing acid consumption:** ensuring minimal gangue minerals (e.g., carbonates) are added to the vat leach, which would lead to increased sulphuric acid consumption, while also seeking to minimise levels of free acid in the vats.

**Managing ore types:** while the geology is straightforward and visually distinguishable, it will be important to manage the segregation of searlesite ore from lithium clays, to ensure minimal introduction of clays and carbonate to the vat leach tanks. The lithium clays will still leach.

**Reagent prices and availability:** The operating costs are susceptible to the price of reagents, particularly sulphur prill. Long term supply contracts will also need to be put in place to ensure consistent supply.

**Geotechnical:** The basin sediments dip gently inward, consistent with the topography. On the eastern side, it appears a rockfall / slip from the peaks at the valley margin may have filled the valley with volcanic debris. Appropriate geotechnical examination of the pit wall angles will need to be undertaken.
to minimise the potential for pit wall failures along bedding planes.

**Meeting product specification:** There is a risk that INR may not achieve product specifications in line with negotiated terms with offtakers / end users. This has been partly mitigated by the high quality of both lithium carbonate and boric acid products produced to date. Results of the upcoming pilot plant tests will further help mitigate this risk.

**Capital cost increases:** This could occur due to schedule delay or additional geotechnical information. These can be managed through contract terms at the appropriate time e.g., cost overruns, liquidated damages, maximum contract pricing.

**Lower depletion allowance:** INR has assumed a depletion allowance of 22%, which is correct for lithium. However, the US Internal Revenue Code states borax attracts a 14% depletion allowance. There is a risk that the IRS may determine a lower depletion allowance for INR. Given the US Government is seeking to promote domestic lithium operations, we do not see this as a significant risk. On our modelling, a 14% depletion for both products would lower our NPV by ~A$42m or A$0.01/sh.

**Capital Structure**

**Table 25. INR Capital Structure**

<table>
<thead>
<tr>
<th>Capital Structure</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Paid Ordinary Shares</td>
<td>1,479,983,509</td>
</tr>
<tr>
<td>Options</td>
<td>54,530,840</td>
</tr>
<tr>
<td>Performance Rights</td>
<td>1,391,786</td>
</tr>
</tbody>
</table>

| Undiluted Basis               | 1,479,983,509 |
| Fully Diluted Basis          | 1,535,906,135 |

Source: ASX

**Table 26. Top 10 Shareholders**

<table>
<thead>
<tr>
<th>Major Shareholders</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSBC Custody Nominees (Australia) Limited</td>
<td>112,184,728</td>
<td>7.58%</td>
</tr>
<tr>
<td>Citicorp Nominees Pty Limited</td>
<td>93,949,975</td>
<td>6.35%</td>
</tr>
<tr>
<td>JP Morgan Nominees Australia Limited</td>
<td>75,051,954</td>
<td>5.07%</td>
</tr>
<tr>
<td>Holdrey Pty Ltd (Don Matheson Family A/C)</td>
<td>66,800,000</td>
<td>4.51%</td>
</tr>
<tr>
<td>Mopti Pty Ltd &lt;The Rowe Family A/C&gt;</td>
<td>54,591,402</td>
<td>3.69%</td>
</tr>
<tr>
<td>Ransdale Investments Pty Ltd &lt;The Viking S/F A/C&gt;</td>
<td>53,500,000</td>
<td>3.61%</td>
</tr>
<tr>
<td>Merrill Lynch (Australia) Nominees Pty Ltd</td>
<td>32,292,819</td>
<td>2.18%</td>
</tr>
<tr>
<td>Lithium Investors Americas LLC</td>
<td>31,600,000</td>
<td>2.14%</td>
</tr>
<tr>
<td>UBS Nominees Pty Ltd</td>
<td>30,563,803</td>
<td>2.07%</td>
</tr>
<tr>
<td>Mahsor Holdings Pty Ltd &lt;Rosham Family S/F No2 A/C&gt;</td>
<td>30,420,382</td>
<td>2.06%</td>
</tr>
<tr>
<td><strong>Total Top Ten Shareholders</strong></td>
<td><strong>580,955,063</strong></td>
<td><strong>39.3%</strong></td>
</tr>
</tbody>
</table>

Source: Bloomberg

**Table 27. Board Security Holdings**

<table>
<thead>
<tr>
<th>Board</th>
<th>Shares</th>
<th>Options</th>
<th>% Undiluted</th>
<th>% Diluted</th>
</tr>
</thead>
<tbody>
<tr>
<td>James Calaway</td>
<td>31,600,000</td>
<td>40,357,710</td>
<td>2.1%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Bernard Rowe</td>
<td>61,475,918</td>
<td>0</td>
<td>4.2%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Allan Davies</td>
<td>2,365,898</td>
<td>1,774,310</td>
<td>0.2%</td>
<td>0.3%</td>
</tr>
<tr>
<td>John Hofmeister</td>
<td>1,461,231</td>
<td>857,710</td>
<td>0.1%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Pat Elliott</td>
<td>19,446,722</td>
<td>357,710</td>
<td>1.3%</td>
<td>1.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>116,349,769</td>
<td>43,347,440</td>
<td>7.9%</td>
<td>10.8%</td>
</tr>
</tbody>
</table>

Source: ASX
Board of Directors and Senior Management

James D. Calaway – Non-Executive Chairman

James Calaway is an accomplished businessman, with success in building junior companies into successful commercial enterprises. He has played major roles in the development of both public and private companies engaged in lithium operations, oil and gas exploration and production, enterprise software and solar farm development. Prior roles include eight years as non-executive Chairman of Orocobre Ltd, (ASX:ORE; TSX:ORL), and Chairman of Datacent Inc. He is currently Chairman of Distributed Power Partners Inc. James is involved with various civic organizations, including the past chairman of the PI Center for Houston’s Future, the greater Houston regions “think tank”, and Chairman of the Houston Independent School Districts’ Foundation. He holds a MA from the University of Oxford in Politics, Philosophy and Economics, and is a graduate of the University of Texas with a BA in Economics, Phi Beta Kappa.

Bernard Rowe – Managing Director

Bernard Rowe is a geologist with more than 25 years’ international experience in mineral exploration. His early career was with global diamond miner and explorer, Ashton Mining, including five years in Scandinavia and Russia followed by two years in Mali. His diverse mineral industry experience includes gold, copper, zinc, diamond, lithium and boron exploration in Australia, Europe, Africa, North America and South America. He is a founding shareholder of iioneer and has been Managing Director since the Company listed on the ASX in December 2007. Mr Rowe is a member of the Australian Institute of Geoscientists, the Society of Economic Geologists and the Geological Society of Nevada.

Alan Davies – Non-Executive Director

Alan Davies is a well-known natural resources and industrial executive with a 20-year career with Rio Tinto culminating in being CEO responsible for Energy and Industrial Minerals, including the borax division and the Jadar lithium/borates development in Serbia. Other roles with Rio Tinto included CEO of Rio Tinto’s Diamonds and Minerals Product Group, and from 2012 until 2016, he served as a member of Rio Tinto’s Executive Committee. Alan has led and run mining operations and development projects across the globe, including USA, Canada, South America, India, Africa, China, Europe and Australia, and across commodities, including in iron ore and energy, and a full suite of industrial minerals. Alan is currently CEO of Mexico Resources plc. He is also Global Strategy Advisor to Lionsgold Limited and Chairman of Trigem DMCC.

Patrick JD Elliott – Non-Executive Director

Patrick Elliott has over 40 years’ experience in investment and corporate management and is a company director and venture capital investor specialising in the resources industry. Previous roles included investment analysis and minerals marketing for Consolidated Gold Fields Australia Limited, and Head of Corporate Finance for Morgan Grenfell Australia Limited, and Managing Director of Natcorp Investments Ltd. Patrick is Chairman of Argonaut Resources NL, Cap-XX Limited, Tamboran Resources Limited and Variscan Mines Limited, and a Non-Executive Director of Kirrama Resources Limited. He is also a director of a number of privately owned companies. Patrick holds an MBA in Mineral Economics (Macquarie University) and a B.Comm. (University of NSW).

John Hofmeister – Non-Executive Director

John Hofmeister has an experienced executive, having spent many years at General Electric, Northern Telecom, AlliedSignal/Honeywell International and Royal Dutch Shell, where he retired as Shell Oil President in 2008. Since 2008 he has been a director of Lufkin Industries, Hunting plc, Applus Services Inc., and Chairman of Erin Energy Corporation. John has Bachelor’s and Master’s Degrees from Kansas State University. John has also served as the Chairman of the National Urban League in the US and was formerly Chairman of the Greater Houston Partnership. He currently teaches at Arizona State University, University of Houston and Kansas State University and is the Founder and CEO of Citizens for Affordable Energy.

Ian Bucknell – Chief Financial Officer

Ian Bucknell has more than 20 years of international resource experience including as Chief Financial Officer of AWE Limited, Drillsearch Energy Limited, and Great Artesian Oil and Gas Limited. During this time, he has worked in several high-growth organisations and financed projects from discovery to production. He is a Fellow of the Australian Society of Certified Practising Accountants (FCPA), a
graduate of the Australian Institute of Company Directors (GAICD) and holds a Bachelor of Business (Accounting) from the University of Technology, Sydney (B.Bus).

**Matt Weaver – Senior Vice President of Engineering and Operations**
Matt Weaver has more than 30 years’ experience in project development, execution, and operations, working for companies including BHP, Rio Tinto and Newmont, across bauxite, coal, copper, gold, iron and uranium in the US, Canada, UK, Australia, Africa, and Middle East. He has specific experience in sulphuric acid production, associated power generation, and acid leach processing, having run Rio Tinto’s Kennecott copper smelter, refinery, and acid/power plant at the Bingham Canyon copper mine in Utah. He is a graduate of the Colorado School of Mines and an MBA holder.

**Michael Le Page – Commercial Director, Sales & Marketing**
Michael Le Page is an experienced sales executive, having spent nearly 20 years with the Rio Tinto Group in roles including Chief Commercial Officer, Vice President and General Manager, principally in the Industrial Minerals area. Michael has an in depth knowledge and experience of global sales, marketing and supply chain in borates, salt, gypsum and talc plus project work in lithium and potash.

**Yoshio Nagai – Sales & Business Development Director**
Yoshio Nagai is a highly experienced senior sales and marketing executive with a strong focus on customer relationships. He has spent more than 10 years with the Rio Tinto Group, primarily in Asia and USA as Sales Vice President accountable for borates, salt and talc products.

**Lynette Pierson – National Sales Director**
Lynette Pierson has over 25 years’ experience in sales management with U.S. Borax and Rio Tinto Minerals in the United States and Canada. Her experience includes sales, distribution and account management of talc and borate products in markets such as fiberglass, industrial glass, agriculture, consumer cleaning products and oil & gas.

**Peter Ehren – Lead Process Engineer**
Peter Ehren is an independent consultant with more than 20 years of experience across the lithium, potash, nitrate, iodine and boron industries. His experience includes product applications, supply and price analysis, investment cost estimation process simulations, cost simulations for a variety of minerals and brine deposits, engineering, R&D and product development. He has undertaken work for BHP Minerals and worked for SQM, and since 2009 has been the Consulting Process Engineer for Orocobre’s Salar de Olaroz Project.

**John Reynolds – Exploration Manager**
John Reynolds is an industrial minerals geologist based in Reno, Nevada, with a history of specializing in exploring for lacustrine basins with particular emphasis on borate minerals. He spent 23 years working with US Borax and Rio Tinto, investigating a wide variety of minerals, including borate exploration in California, Nevada, South America, Serbia and other borate provinces. His exploration teams have discovered lacustrine basins and new borate occurrences near Boron, in the Puna region of Argentina, the Kazan trona deposit in Turkey, and the Jadar deposit in Serbia, including being involved in the discovery and naming of the new lithium-boron mineral jadarite.

**Corporate History**
After Pasminco’s takeover of Savage Resources, the board and management of Savage Resources created Paradigm Geoscience as a project generation company. Paradigm Geoscience listed on the ASX in December 2007 as Global Geoscience Limited (GSC) to conduct copper-gold exploration in the Americas.

From 2008 to 2013 GSC undertook exploration on projects in Nevada, Arizona, and Peru, and attracted Osisko Mining, Antofagasta, and Inmet as farm in / joint venture partners. By 2015, these partnerships had ceased. Subsequently the company was recapitalised initially with a view to changing its corporate strategy from mining. However, after appraising a number of projects, GSC secured an option to acquire Rhyolite Ridge in 2016.
Table 28. Major ASX announcements since signing the option to acquire Rhyolite Ridge

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Jun-16</td>
<td>Option to acquire 100% of Rhyolite Ridge</td>
</tr>
<tr>
<td>8-Jun-16</td>
<td>Exploration Target of 200-300Mt of 1,200-2,000ppm Li (0.64-1.06% LCE) and 1.2% boron.</td>
</tr>
<tr>
<td>18-Jul-16</td>
<td>Li could be extracted via weak acid leach</td>
</tr>
<tr>
<td>21-Jul-16</td>
<td>Discovery of new 2.5km long mineralised zone in the South Basin.</td>
</tr>
<tr>
<td>9-Aug-16</td>
<td>A$6 million raised at A$0.075/sh</td>
</tr>
<tr>
<td>16-Aug-16</td>
<td>Review of results from previously undisclosed drill holes - 100-160m thick zones of mineralisation</td>
</tr>
<tr>
<td>10-Oct-16</td>
<td>Maiden Resource for the South Basin of 393Mt grading 0.9% LCE and 2.9% boric acid</td>
</tr>
<tr>
<td>16-Nov-16</td>
<td>Searlesite found to be the predominant boron mineral at Rhyolite Ridge</td>
</tr>
<tr>
<td>5-Apr-17</td>
<td>Appointment of James D Calaway as Non-Executive Chairman</td>
</tr>
<tr>
<td>2-May-17</td>
<td>Excellent Leach Results, Option to acquire 100% of Rhyolite Ridge exercised</td>
</tr>
<tr>
<td>23-May-17</td>
<td>Alan Davies and John Hofmeister appointed as Non-Executive Directors</td>
</tr>
<tr>
<td>28-Sep-17</td>
<td>A$30m raised – 150m shares at A$0.20/sh</td>
</tr>
<tr>
<td>31-Oct-17</td>
<td>New Mineral Resource estimate, double the size of the previous estimate</td>
</tr>
<tr>
<td>28-Nov-17</td>
<td>Matt Weaver appointed as Senior Vice President of Engineering and Operations</td>
</tr>
<tr>
<td>12-Dec-17</td>
<td>Heap leach processing demonstrated - a world first</td>
</tr>
<tr>
<td>19-Dec-17</td>
<td>Mining Study confirms potential 13-21 year mine life for a 2-4 Mtpa operation</td>
</tr>
<tr>
<td>17-Jan-28</td>
<td>Amec Foster Wheeler appointed for Rhyolite Ridge PFS</td>
</tr>
<tr>
<td>21-Feb-18</td>
<td>Process Flowsheet Optimisation Results - Leach time reduced by 60%</td>
</tr>
<tr>
<td>3-May-18</td>
<td>Further Process Flowsheet Optimisation Results - Reduced Leach Time, Lower acid consumption, &gt;90% recoveries</td>
</tr>
<tr>
<td>6-Jun-18</td>
<td>Proposed Site Layout and Process Flow Sheet for Rhyolite Ridge</td>
</tr>
<tr>
<td>7-Jun-18</td>
<td>Michael Le Page appointed as Commercial Director, Yoshio Nagai appointed as Sales and Business Development Director</td>
</tr>
<tr>
<td>14-Jun-18</td>
<td>A$3 million placement at A$0.41/sh (130m shares)</td>
</tr>
<tr>
<td>3-Aug-18</td>
<td>Initial Mining to Target Higher Lithium Grades</td>
</tr>
<tr>
<td>28-Aug-18</td>
<td>Successful Production of Premium Quality Boric Acid</td>
</tr>
<tr>
<td>28-Sep-18</td>
<td>Global Geoscience Limited to become ioneer Limited</td>
</tr>
<tr>
<td>15-Nov-18</td>
<td>Appointment of Ian Bucknell as Chief Financial Officer</td>
</tr>
<tr>
<td>21-Nov-18</td>
<td>Fluor Appointed to Deliver Rhyolite Ridge DFS</td>
</tr>
<tr>
<td>21-Dec-18</td>
<td>Maiden Ore Reserve and Drilling Update</td>
</tr>
<tr>
<td>13-Mar-19</td>
<td>Pilot Plant contract awarded to Kemetco Research Inc</td>
</tr>
<tr>
<td>3-Apr-19</td>
<td>Sulphuric Acid Plant Contract Award</td>
</tr>
</tbody>
</table>

Source: ASX

Chart 7. Share price performance since acquiring Rhyolite Ridge

Source: Thomson Reuters
Boron Themes

Overview

Boron does not occur naturally in its elemental form, instead it combines with hydrogen, oxygen and other elements to form chemical compounds which are known collectively as borates. Mineral deposits containing economic concentrations of borates are rare as they are water soluble so exist in very dry locations and can be processed to produce either concentrated minerals or refined borate chemicals. The end products are used predominately in ceramics, detergents, fertilisers, and glass industries. The borate market is forecast to grow at 4-5% CAGR in the near-term. Current global borate demand is 3.8Mtpa and is worth approximately US$3.2 billion in annual sales.

Occurrences

Borate deposits are rare due to the water solubility of borate minerals. They typically form in active volcanic areas where volcanic / hydrothermal fluids are the source of boron and require arid climates for preservation once deposited. The majority of the world’s economically significant deposits are located in the Alpine-Himalayan belt through southern Asia (Turkey, Serbia, Russia, Kazakhstan, China), the Andes (Peru, Chile, Bolivia, Argentina), and the Mojave Desert region of the USA (California, Nevada). In Table 29 the latest data from the U.S. Geological Survey (USGS) is compared with Eti figures from 2016. The USGS data excludes South American ‘reserves’, as well as Rio Tinto’s Jadar asset in Serbia (no JORC Reserves yet) and development assets in Kazakhstan. Irrespective of inclusion of development assets and non-JORC/CIM reserves, Turkey is host to at least 74% of the world’s known reserves of boron.

<table>
<thead>
<tr>
<th>World Boron Reserves</th>
<th>Etimine 2016</th>
<th>USGS 2019</th>
<th>Blended</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mt</td>
<td>%</td>
<td>Mt</td>
</tr>
<tr>
<td>Turkey</td>
<td>955</td>
<td>74%</td>
<td>950</td>
</tr>
<tr>
<td>USA</td>
<td>40</td>
<td>3%</td>
<td>40</td>
</tr>
<tr>
<td>Non-Producers (Kazakhstan, Serbia)</td>
<td>123</td>
<td>10%</td>
<td>0</td>
</tr>
<tr>
<td>Russia</td>
<td>35</td>
<td>3%</td>
<td>40</td>
</tr>
<tr>
<td>South America</td>
<td>91</td>
<td>7%</td>
<td>4</td>
</tr>
<tr>
<td>China</td>
<td>47</td>
<td>4%</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>1,291</td>
<td>100%</td>
<td>1,058</td>
</tr>
</tbody>
</table>


Table 30. Key Commercial Boron Minerals

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Formula</th>
<th>Solubility</th>
<th>%B₂O₃</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colemanite</td>
<td>2CaO₂B₂O₅·5H₂O</td>
<td>insoluble</td>
<td>47.9</td>
<td>Turkey, USA</td>
</tr>
<tr>
<td>Datolite</td>
<td>CaB₂SiO₅(OH)</td>
<td>insoluble</td>
<td>19.4</td>
<td>Russia</td>
</tr>
<tr>
<td>Hydroboracite</td>
<td>CaOMgO₂B₂O₅·6H₂O</td>
<td>insoluble</td>
<td>47.9</td>
<td>Argentina, Kazakhstan, Turkey</td>
</tr>
<tr>
<td>Jadarite</td>
<td>LiNaSiB₂O₇(OH)</td>
<td>insoluble</td>
<td>47.0</td>
<td>Serbia</td>
</tr>
<tr>
<td>Kernite</td>
<td>Na₂B₂O₅·4H₂O</td>
<td>partially soluble</td>
<td>47.9</td>
<td>Argentina, Turkey, USA, China</td>
</tr>
<tr>
<td>Searlesite</td>
<td>Na₂BSiO₉·(OH)₃</td>
<td>insoluble</td>
<td>16.6</td>
<td>USA</td>
</tr>
<tr>
<td>Tincal (Borax)</td>
<td>Na₂B₂O₅·10H₂O</td>
<td>water soluble</td>
<td>35.4</td>
<td>Turkey, USA, Argentina, Bolivia, India</td>
</tr>
<tr>
<td>Ulexite</td>
<td>Na₂O₂CaO₂B₂O₅·16H₂O</td>
<td>partially soluble</td>
<td>41.8</td>
<td>Chile, USA, Peru, Serbia, Bolivia, China, Turkey, Argentina</td>
</tr>
</tbody>
</table>

Source: INR, RIO, BOREN
There are approximately 250 known borate minerals. Of these, sodium and calcium borates (colemanite, kernite, tincal and ulexite) are the most commercially relevant, comprising >90% of the ore minerals currently being extracted and processed (Table 30). In addition, searlesite and jadarite are present in large pre-development lithium-boron deposits (Rhyolite Ridge and Jadar).

**Uses**

Most boron minerals are typically refined into boric acid and sodium borate products (Table 31). The major uses of boron are within fibreglass in the insulation and construction industries, as an additive in the glass and ceramics industries, and within abrasives, detergents, magnets, semiconductors, and fertiliser as a micronutrient.

In fibreglass, boron improves strength and can act as a fluxing agent to lower the melting temperature of silica to make it more amenable to creating glass fibres. Boron has a low coefficient of thermal expansion, which makes it resistant to thermal shock, and it is used as an additive to glassware used in LCD panels in TVs and computers, laboratories, and consumer cookware and bakeware by firms including Corning and Shott AG in their Pyrex and Duran product ranges. Boron carbide is used in ceramics and body armour for its hardness and toughness, and its ability to absorb neutrons without forming radionuclides renders it attractive as an absorbent for nuclear radiation in nuclear power plants. Boron is also used in detergents and soaps (eg 20 Mule Team brand of Rio Tinto) plus some more modern applications including components of neodymium magnets, MRI imaging, high density drives, and small motors and actuators.

**Table 31. Major Boron Products**

<table>
<thead>
<tr>
<th>Material</th>
<th>Formula</th>
<th>%B$_2$O$_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Refined Chemicals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium borates</td>
<td>Borax pentahydrate</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Na$_2$O.2B$_2$O$_3$.5H$_2$O</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Borax decahydrate</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Na$_2$O.2B$_2$O$_3$.10H$_2$O</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boric acid</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>H$_3$BO$_3$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anhydrous borax</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Na$_2$O.2B$_2$O$_3$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boric oxide</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>B$_2$O$_3$</td>
<td></td>
</tr>
<tr>
<td><strong>Mineral Products</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium borates</td>
<td>Ulexite</td>
<td>36-38*</td>
</tr>
<tr>
<td></td>
<td>Na$_2$O$_2$CaO$_2$B$_2$O$_3$.16$H_2$O</td>
<td></td>
</tr>
<tr>
<td>Non-sodium borates</td>
<td>Colemanite</td>
<td>33-42*</td>
</tr>
<tr>
<td></td>
<td>2CaO$_2$B$_2$O$_3$.5H$_2$O</td>
<td></td>
</tr>
</tbody>
</table>

Source: INR. *not pure minerals

**Demand**

Global borates consumption (mineral and refined) is estimated at around 3.82Mt. Glass comprises the key market (43%), followed by ceramics (19%), agriculture (10%) and other applications including insulation and construction (25%) (Chart 8). Geographically, Asia is the largest consumer (2.14Mt), followed by Europe 670kt (18%), North America 620kt, and Latin America 330kt (Chart 9). In the USA, the major use is fibreglass insulation, while in Europe, detergent is the major use. Borosilicate glass demand is present in all markets.

Borax Argentina (a wholly-owned subsidiary of Orocobre Limited) notes that historically the borates market grows at levels equal to or above GDP in key demand markets. It reports that the refined borates market grew at 4.5% CAGR from 2013-2018, driven by growth in agriculture and borosilicate glass, while the mineral borate market grew at 4% CAGR from 2013-2018, with growth also driven by agriculture, as well as insulation fibre glass, frits and ceramics.
Key drivers of demand are linked to urbanisation, energy efficiency, and technological advances.

The rural-urban shift, particularly in China, is increasing demand for ceramics and consumer products, as well as insulation fibreglass in the Chinese housing market. There is strong leverage to the US housing market given the high level of insulation fibreglass installed in new dwellings (Table 32).

Increased urbanisation has also resulted in a reduction in arable farming land per capita, and improved dietary standards is driving a need to achieve greater agricultural yields. This is anticipated to drive an increase in demand for speciality fertilisers including micronutrients such as boron, which as outlined earlier is highly soluble and easily leached from the soil profile (Chart 10).

New technology applications are expected to drive an increase in boron demand, particularly in the borosilicate market, with greater uptake in solar panels, thin-film-transistor liquid crystal displays (TMT-LCDs), and mobile devices (eg increased demand for Gorilla Glass). Boron is also used in permanent magnets in electric vehicle motors (Nd-Fe-B magnets) and in speciality metal alloys (eg fabrication of wind turbine blades).

INR undertook a marketing study as part of the PFS for Rhyolite Ridge, which concluded that the fundamental drivers of the global borate market remain strong, underpinned by an improving outlook in the largest borates markets, China, India and the USA, with structural changes in the Chinese economy expected to have a positive impact of the demand for raw materials including borates.

The global demand for borates is projected to grow at a CAGR of 4-5 percent over the next five years and will be driven primarily by high growth rates in borosilicate glass, frits, and insulation and agriculture end uses (Chart 10), which are positive for boric acid supply. Most of the growth is
expected in the refined borates segment, while growth in the minerals segment is forecast to be flat.

**Chart 10. Global Borates Demand (cumulative kt B₂O₃ equivalent)**

Source: INR

### Supply

Eti is the dominant global producer, with a production capacity of 2.81 Mtpa, approximately 50% of global refined borate capacity. At present, it produces over 2 Mtpa per annum, equivalent to 50.4% of global supply. Its sales are 1.9-2 Mtpa, equating to 50.8% market share. Eti has operating mines at Kirka (tincal), Emet (colemanite), Bigadic (colemanite and ulexite) and Kestelek (colemanite and ulexite), with tincal and colemanite ores and concentrates refined at Kirka and Bandirma.

RIO owns and operates the Boron mine in Boron, California. Starting as an underground operation in 1927, Boron is the largest open pit mine California and the open pit has been in continuous operation since 1957. The Rio Tinto borates business has been operating for over 100 years. It processes 3Mtpa borate ore (kernite and tincal), with annual production of 500-520ktpa boric oxide and other products (capacity is 576ktpa boric oxide). Boron contributes ~A$200m EBITDA annually to RIO’s accounts. In March 2018 RIO declassified 8.5Mt B₂O₃ contained within calcium borates from Ore Reserves to Mineral Resources, based on a reassessment of its processing assumptions. In the 2018 Annual Report, this material was written down from the Mineral Resource as well. The impact of the change is a 7-year reduction in the forecast mine life, with operations now scheduled to finish in 2042.

Russian Bor claims to be the third largest boron producer, and produces boric acid, boric anhydride, calcium borate, and datolite concentrate from its Dalnegorsk deposit, which has been in operation since 1959. Russian Bor states its reserves will last a further 75 years; little information regarding its production is available publicly. Borax Argentina has mining operations at Tincalayu and Sijes, and production plants at Tincalayu (refined borates borax decahydrate and borax pentahydrate), Sijes (mineral concentrates — ulexite, colemanite, hydroboracite), and Campo Quijano (boric acid and anhydrous borax). In the six months to 31 December 2018, Borax Argentina produced 20,148t of boric acid and tincalayu for US$9.3m in sales, with EBITDAIX of US$583k, suggesting the operations are marginal in comparison with RIO’s.

Borax Argentina was divested by RIO and acquired by Orocobre Limited. Also in Argentina, Minera Santa Rita SRL mines 60ktpa tincalonite and ulexite from Salar Hombre Muerto, with its plant in Salta producing 50ktpa of boric acid and other boron derivative products. It claims to have 2Mt in reserves, though it is not clear whether this refers to B₂O₃. In Chile, Quiborax mines ulexite from the Surire and Ascotan salars, processing ore to produce 36ktpa boric acid and 100ktpa agrochemical products for export. It reports reserves of 30Mt B₂O₃. Inkabor mines ulexite in Peru, producing boric acid, borax, and ulexite concentrate, as well as specialty high solubility borates and sodium octoborate. In Bolivia, it mines ulexite and processes the mineral for inclusion in organic fertilisers. In Nevada, Searles Valley Minerals employs solution mining to produce boric acid, sodium sulphate, specialty borax, and sodium carbonate and sodium bicarbonate. In operation since 1917, it is presently owned by Indian company Nirma.
Development Projects

Outside Turkey, there are few known large scale, potentially long-life borate deposits. These include Jadar in Serbia, Rhyolite Ridge in Nevada, and Fort Cady in California (Table 33).

Rio Tinto (RIO.ASX) owns the Jadar deposit in Serbia. Discovered in 2004, the deposit hosts both boron and lithium mineralisation known as jadarite. The current Mineral Resource at Jadar totals 21Mt B\text{2}O\text{3} and 2.5Mt Li\text{2}O. Mineralisation occurs within four gently dipping lenses, each with thicknesses varying from 1.5-35m, and occurring from 100m-720m depth. RIO has indicated that Jadar would be an underground operation, with cut and fill stoping as the likely mining method. The Mineral Resource reveals a cut-off grade of $300/t. This compares with US$50/t for Rhyolite Ridge. RIO has previously targeted FID in 2020, and initial production in 2023. To May 2018, RIO had spent US$100 million exploring and developing the asset, with the PFS now anticipated by the end of 2020\textsuperscript{2}.

Table 33. Comparison of Significant Boron Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Jadar</th>
<th>Rhyolite Ridge</th>
<th>Fort Cady</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner</td>
<td>Rio Tinto</td>
<td>ioneer</td>
<td>ABR</td>
</tr>
<tr>
<td>Market Capitalisation</td>
<td>A$142.287m</td>
<td>A$258m</td>
<td>A$50m</td>
</tr>
<tr>
<td>Location</td>
<td>Serbia</td>
<td>Nevada</td>
<td>California</td>
</tr>
<tr>
<td>Mineral</td>
<td>Jadarite</td>
<td>Searlesite</td>
<td>Colemanite</td>
</tr>
<tr>
<td>Proposed extraction method</td>
<td>Underground</td>
<td>Open cut</td>
<td>Solution</td>
</tr>
<tr>
<td>Resources</td>
<td>135.7Mt</td>
<td>121.4Mt</td>
<td>120Mt</td>
</tr>
<tr>
<td>Kt B\text{2}O\text{3}</td>
<td>21,000</td>
<td>4,871</td>
<td>7,840</td>
</tr>
<tr>
<td>Kt Lithium Carbonate</td>
<td>6215</td>
<td>1,130</td>
<td>-</td>
</tr>
<tr>
<td>Kt Li\text{2}O</td>
<td>2513</td>
<td>457</td>
<td>-</td>
</tr>
<tr>
<td>Reserves</td>
<td>15.8</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Kt B\text{2}O\text{3}</td>
<td>1,102</td>
<td>4,810</td>
<td></td>
</tr>
<tr>
<td>Kt Lithium Carbonate</td>
<td>620</td>
<td>2,710</td>
<td></td>
</tr>
<tr>
<td>Kt Li\text{2}O</td>
<td>65</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Project Status</td>
<td>PFS Underway</td>
<td>DFS Underway</td>
<td>DFS Complete</td>
</tr>
<tr>
<td>Total Spend to Date</td>
<td>US$100m</td>
<td>US$30m</td>
<td>US$60m</td>
</tr>
<tr>
<td>Construction Start</td>
<td>CY2020</td>
<td>Q1 CY2020</td>
<td>Q4 CY2019</td>
</tr>
<tr>
<td>Target Production Date</td>
<td>CY2023</td>
<td>Q3 CY2021</td>
<td>Q4 CY2020</td>
</tr>
<tr>
<td>Estimated Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boric Acid</td>
<td>-</td>
<td>173ktpa</td>
<td>408ktpa*</td>
</tr>
<tr>
<td>Lithium Carbonate</td>
<td>-</td>
<td>20,200ktpa</td>
<td>-</td>
</tr>
<tr>
<td>SOP</td>
<td>-</td>
<td>109ktpa*</td>
<td></td>
</tr>
<tr>
<td>Construction Capex</td>
<td>-</td>
<td>US$599m</td>
<td>US$526m*</td>
</tr>
<tr>
<td>Initial Project Life</td>
<td>-</td>
<td>&gt;30 years</td>
<td>21 years</td>
</tr>
<tr>
<td>Project NPV(\text{10, post-tax})</td>
<td>-</td>
<td>US$1,104</td>
<td>US$1,083m</td>
</tr>
<tr>
<td>Project IRR</td>
<td>-</td>
<td>42%</td>
<td>41%</td>
</tr>
<tr>
<td>Payback period</td>
<td>-</td>
<td>4 years</td>
<td></td>
</tr>
</tbody>
</table>

Source: INR, RIO, ABR. * ABR’s planned starter operation will cost US$36.8m, producing 5.4ktpa boric acid and 36ktpa SOP.

American Pacific Borate and Lithium owns the Fort Cady Boron Project in California. Fort Cady is a

\textsuperscript{2} Source: Reuters, 14 May 2019: BHP to keep Nickel West, Rio looks to Jadar lithium for battery boom.
brownfields asset, with over US$60 million having been spent on resource definition, permitting and eventual pilot scale production from 1996-2001. Production was via solution mining of colemanite using injected sulphuric acid resulting in the production of approximately 1,942t of calcium borate, which was sold as CadyCal. ABR is seeking to recommence operations at Fort Cady with an initial small-scale operation, which falls within the parameters of the existing Plan of Operations and Environmental Impact Report. ABR is planning to install a Mannheim furnace to produce sulphate of potash (SOP) via reaction of muriate of potash (MOP) with sulphuric acid at 600°C, resulting in production of by-product hydrochloric acid, which will be sold and also used for in situ solution mining of the borate resource 350-450m below. The injected hydrochloric acid will dissolve the colemanite, into a solution containing boric acid and calcium chloride which will be pumped back to surface, recovered, and processed to boric acid. ABR is seeking to start production with initial capex of US$36.8m producing 5.4kt boric acid and 36kt SOP, at an operating cost of US$85.59/t SOP. Over time, ABR is targeting expansion to 408ktpa boric acid and 109ktpa SOP, with total capex of US$526 million. The NPV10 for the full project is US$1.083bn, based on a US$725/t SOP price and US$800/t boric acid price.

The company is targeting construction in Q4 2019, subject to financing and permitting. This includes the key Under Injection Control (UIC) Permit, air quality permit, and waste discharge permit. In addition, anything requiring modification from the original EIS and Plan of Operations (eg SOP operation) will need to be submitted to the BLM for review. Finally, the current Californian Mining / Reclamation plan was issued in 1994, and is good for 25 years, with 5 years for reclamation. While in good standing at present, it will need to be replaced / renewed.

**Market Dynamics**

INR has reported that its market study revealed that the non-sodium borate (mainly boric acid) market has sufficient supply over the next four years but demand should exceed supply by 2023. However, when assuming an 85 percent utilisation of nameplate capacity, supply is forecast to tighten during 2020, with prices stabilising.

At present, Turkey and Rio Tinto are the very significant suppliers in the boron market, and dominate supply and have significant impact on price settlements. Within their reserves and development pipeline, they can maintain this position.

Potential new entrants to the market over the next few years could include Rhyolite Ridge, Jadar, and Fort Cady, with the first two operations targeting production of lithium carbonate in addition to boric acid, and the latter aiming to produce hydrochloric acid and SOP by-products.

US-based boric acid end users have relied on Boron and imports from Turkey for many years. Boron is entering the latter stage of its mine life, with the ore body getting deeper (Figure 23), requiring larger cut-backs, and waste stripping likely getting more expensive with quartz monzonite in parts of the cutback (Figure 24). In addition, the pit has been subject to a number of pit wall failures and slumps, which while RIO will be seeking to prevent further incidences, they remain an attendant risk.

The market will ultimately be shaped by how Turkey and in particular RIO will handle a new entrant. Should RIO commit to remaining longer term in the boron market, and seek exposure to the lithium
market, it will continue to develop the Jadar asset. The asset will be underground, developed in an untested mining jurisdiction, in a geography that makes it more competitive with Turkey’s customer base, while losing its competitive local advantage for US domiciled customers.

Rhyolite Ridge is amenable to open cut mining, a long life boron asset in a low sovereign risk jurisdiction, and importantly located in the same country as many of its existing customers, offering supply chain security. Like Jadar, it too offers exposure to lithium and additional leverage the battery thematic, and it is conceivable that Rhyolite Ridge would make a more seamless asset transition than Jadar for RIO, if it chooses to maintain boron as part of its Energy and Minerals Division. On the same basis, if ABR secures all the necessary permitting and financing, it too could offer RIO a similar US-based continuity of boric acid production. Alternatively, either of these assets could be viewed as a pathway to securing upstream supply by an end user or other third party seeking an opportunity to disrupt the borate market.

Pricing

Boron products are priced according to boric oxide content (t B₂O₃). Boric acid sells at a range of prices between US$650/t and US$900/t depending on contract volumes. According to INR, the average price is US$700/t. Since 2011 boric acid prices have been range-bound between US$700/t and US$900/t, and are forecast to be US$700/t to 2023 (Chart 11). INR assumes a forward price of US$700/t in its PFS published in October 2018, while ABR used US$800/t in its DFS, published in December 2018.

Lithium Themes

Overview

Lithium is a soft, silvery white metal which is highly reactive, and like boron, does not occur in nature in its elemental state, typically occurring as compounds. It has the highest electrochemical potential of all metals, and the highest specific heat capacity among solids. Combined with its low atomic mass and density, these attributes make lithium an ideal component for use in rechargeable batteries in conjunction with renewable energy storage, and as a power source for EVs, consumer electronics and power tools. Other uses include as frits for ceramics, an additive to glass, and in greases and colourants. Demand in 2018 has been estimated at ~270ktpa lithium carbonate equivalent (LCE) tonnes, worth about US$3.5bn in sales, equivalent in size to the borate market. In contrast to borates, the lithium market is expanding rapidly at >20% CAGR, driven by increasing demand for rechargeable batteries. This demand is anticipated to outpace new supply additions from the early to mid-2020s.

Occurrences

Economic concentrations of lithium typically occur within brine deposits, formed in similar environments and under similar conditions to sedimentary boron deposits, and within pegmatites, late stage igneous intrusives in which lithium has been concentrated in magmatic fluids to crystallise spodumene and other lithium-rich minerals.

Most known brine lithium deposits occur in Chile, Argentina, and Bolivia. Examples include Salar de
Atacama (SQM, Albermarle) in Chile and Olaroz (Orocobre) in Argentina. Albermarle’s Silver Peak operation, 25km due east of Rhyolite Ridge, was the first brine lithium operation to enter production in 1966. Pegmatite-hosted lithium deposits occur in Australia, USA, Canada, China, as well as Russia, Brazil, India, and central and southern Africa. Examples include Greenbushes (Talison) and the Pilgangoora-Wogina deposits (Mineral Resources, Pilbara Minerals, Altura Mining) in Western Australia, as well as Kings Mountain region in North Carolina (Piedmont) and Whabouchi in Quebec (Nemaska). Other known lithium deposit types include lithium clay deposits such as Thacker Pass in Nevada (Lithium Americas) and Sonora in Mexico (Bacanora Minerals), and unique sedimentary lithium-boron deposits such as Jadar and Rhyolite Ridge.

**Products & Uses**

At brine operations, lithium is concentrated via solar evaporation over a 12-18 month period, before being processed to form lithium carbonate (Li$_2$CO$_3$), lithium hydroxide (LiOH), or lithium chloride (LiCl). Pegmatites are mined conventionally, with spodumene-bearing ore either shipped to end users directly or processed using dense media separation and flotation techniques to create a six percent spodumene concentrate, which is subsequently converted to lithium hydroxide or lithium carbonate at a downstream processing facility.

Lithium carbonate is used in rechargeable lithium ion batteries, frits for ceramics and adhesives, powders for continuous casting, industrial air purification conditioning, aluminium smelting, and in the pharmaceutical industry. Lithium hydroxide is used in lubricating greases, rechargeable lithium ion batteries, and in colourants. Other lithium products include lithium bromide (LiBr), used in industrial absorption refrigeration systems, and butyllithium, used as a polymerisation initiator in the rubber and plastics markets, and to synthesise organic compounds in the pharmaceutical industry.

Since 2000, rechargeable batteries have overtaken ceramics as the largest end use of lithium, growing from 12% to 46% in 2017 (Chart 12).

**Chart 12. Forecast consumption of lithium by first use 2000-2017 (‘000t LCE)**

Source: Roskill 2018

**Demand – Driven by Electric Vehicles (EVs)**

The key factor driving demand is the transition to electro-mobility, as EVs increase market share against internal combustion engine powered vehicles. Pilbara Minerals stated in its recently release Scoping Study for Pilgangoora Stage 3 that market consultant Roskill forecasts demand for lithium raw materials to grow at 28% per annum between 2018 and 2028, largely driven by the automotive sector. It is estimated that by 2030, around 66% of the world’s automotive sales or 56.1 million passenger cars will have a battery as part of their powertrain. Albermarle estimates 2018 lithium demand was 270kt LCE, which it has forecast to grow to 1,000kt by 2025 at an overall CAGR of 21% (Chart 13). Of this growth, 610kt LCE demand will come from EVs, and a further 100kt from other sources.

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3 Source: Pilbara Minerals, March 2019 Pilgangoora Stage 3 Scoping Study.
electric powered vehicles such as buses, as EV market penetration rates rise from 2% in 2018 to 15% in 2025. An increase in the battery size and lithium intensity in those vehicles will lead to further demand for more lithium in the cathode. In its March 2019 corporate presentation SQM published a similar demand outlook, with slightly more conservative EV penetration rates (12%) and lower battery intensities, resulting in growth at 16-20% CAGR⁴.

**Chart 13. Lithium Demand – Forecast to Grow by 21% CAGR from 2021-2025**

**Government Initiatives & Automotive Industry Response**

The increase in demand for EVs is being driven by an effort to reduce pollution and anthropogenic contribution to climate change. Governments are announcing ambitious targets to achieve 100% EV sales, with Norway and the Netherlands seeking to achieve this by 2025, and Germany and China by 2030 (Figure 25). In the USA, a bill has been introduced to Congress to extend the tax credits available for EV manufacturers under the Driving America Forward Act.

**Figure 25. Government Policy Initiative and Automotive Company Responses**

Auto manufacturers are responding by signalling an increasing number of EVs will be added to their range, with the latest being an announcement by Volkswagen at the 2019 Shanghai Auto Show that it plans to introduce 70 EV models by 2028, with EV production totalling 22 million units, of which 11.6 million will be made in China.

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⁴ Source: SQM, March 2019 Corporate Presentation.
Reuters estimates global auto manufacturers will spend at least US$300 billion developing and procuring batteries and EVs, with more than 45% directed at China (Figure 26). Auto manufacturers have been signing supply agreements with lithium converters to secure battery raw materials. Chinese lithium producer Ganfeng Lithium signed an agreement with BMW in September 2018, and recently signed an MOU with Volkswagen to supply lithium for battery cell production. Some have even started to move further up the supply chain, as evidenced initially by Toyota Tsusho’s lithium carbonate offtake with Orocobre, Great Wall’s spodumene concentrate offtake with Pilbara Minerals, and Tesla’s future lithium hydroxide offtake with integrated developer Kidman Resources (potentially Wesfarmers) under its JV with SQM.

**Figure 26. EV Investment Flows by Country of Origin of Automaker**

![Figure 26. EV Investment Flows by Country of Origin of Automaker](source)

Reflected in the increase in number and size of battery factories

The increased number of EVs requires rechargeable batteries to power them. Benchmark Minerals closely monitors the development of battery factories. From a total capacity of 286 GWh in 2018, it forecasts an increase to 921 GWh in 2023, increasing to 1,549.5 GWh in 2028. This rate of battery factory expansion will require an additional 407kt LCE over the next five years, and a further 401kt LCE over the following five years, representing greater than a fivefold increase over the next decade (Figure 27).
Emergence of lithium hydroxide

To date lithium carbonate has been the dominant source of lithium in lithium ion batteries, due to the predominant use of lithium hydroxide in the grease industry. However, battery configurations are changing, driven in part by the motivation to achieve greater range in EVs. Government policies are also behind this push, with China removing subsidies from EVs with driving ranges below 250km altogether (previously 150km minimum) as of June 2019. Greater ranges can be achieved by increased lithium intensity within the cathode. Lithium hydroxide offers better energy intensity than lithium carbonate, and is used in nickel metal hydride batteries. Benchmark Minerals has examined this trend, and forecasts that lithium hydroxide will increase from ~10% to 30% of cathode lithium requirements, with lithium carbonate falling from ~60% to ~30% by 2025 (Chart 14).

Chart 14. Cathode lithium requirements

The increasing demand for lithium hydroxide is viewed as beneficial to spodumene producers, as lithium hydroxide can be processed in a single step from spodumene. Brine producers have sought exposure to spodumene producers for this reason, partnering in downstream lithium hydroxide plants with a view to forming integrated concentrator-converters (eg SQM-Kidman Resources at Earl Grey, and Albermarle increasing its spodumene/hydroxide capacity by taking a 50% stake in Mineral Resources’ Wogina asset and entering a JV for a planned downstream conversion plant). While...
lithium hydroxide is forecast to rise in demand at a greater rate than lithium carbonate with respect to battery requirements, it should be considered that lithium carbonate producers are facing challenges meeting battery specifications (e.g., Orocobre, as detailed in its March 2019 quarterly report). In addition, some existing spodumene converters such as General Lithium are building processing plants capable of producing lithium hydroxide or lithium carbonate, indicating that they are not shutting the door on future lithium carbonate demand\(^5\).

**Lithium Supply**

Market expectations in 2018 were for significant new additions to supply through spodumene producers ramping up in Western Australia, and new brine production in South America, with spodumene concentrates and lithium carbonate targeting battery grade specifications.

Western Australian spodumene producers continue to ramp up, although there have been challenges hitting target recoveries and specifications. Similarly, brine producers are having difficulty meeting battery specifications, and some of the forecast new brine supply has been delayed (e.g., SQM's expansion to 70,000tpa LCE).

New supply also came from Chinese domestic brine operations in the Qinghai region. Benchmark Minerals estimates this totalled 5-10kt LCE, and that these operations will look to increase supply, although their high magnesium ratios will likely require further refinement of this product.

With increasing volumes of spodumene concentrates entering the market, and existing low-cost brine producers seeking to expand production, the supply-demand balance will be driven by whether sufficient conversion capacity is available to produce battery chemicals. If operations hit their forecast production rates and deliver battery grade material, Roskill forecasts the market to be in oversupply until 2023/2024, when it swigs to deficit on increasing demand.

**Chart 15. Lithium Supply & Demand**

![Chart 15. Lithium Supply & Demand](image)

Source: Roskill 2018 (published in Piedmont Lithium’s Scoping Study for the Piedmont Lithium Project, 3rd Sep 2018)

**Lithium Pricing**

Lithium pricing is difficult to assess, given many existing supply contracts are long term and confidential. Lithium carbonate and lithium hydroxide are classified as either higher purity ‘battery grade’ or ‘technical grade’. Spodumene concentrates are priced according to spodumene content (SC 6.0 or six percent spodumene being the benchmark for lithium hydroxide converters), with penalties incurred for material that is below specification (e.g., either lower in spodumene content, or higher levels of impurities such as iron). Organisations such as Benchmark Minerals and Fastmarkets IB track these prices, which are quoted either as Chinese domestic prices, or delivered to Asia (CIF/CFR Asia) or priced on a FOB basis at the port of origin.

In 2018, increased production of Chinese lithium brine material as well as an influx of material not suitable to end users hit the market\(^6\). In contrast, Albermarle has indicated under its contracts that it will receive pricing in 2021 and 2025 at sales prices above those received in 2018. We have adopted a long-term price of US$12,647/t in our modelling. This sits below long-term lithium carbonate prices.

\(^5\) Source: Reuters, April 2019: China's General Lithium to launch 60,000 T spodumene converter by end-2020.

recently published in Pilbara Minerals’ Scoping Study for Pilgangoora Stage 3.

**Chart 16. Lithium carbonate price forecasts – US$13,000-US$15,000/t from mid 2020s**

![Chart: Lithium carbonate price forecasts](image)

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