# Ravensthorpe Nickel Operations

## Western Australia

## NI 43-101 Technical Report, March 28, 2022

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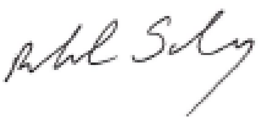

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# Item 1 SUMMARY

This report is a National Instrument 43-101 (NI 43-101) Technical Report, with an effective date of December 31, 2021, describing the current status of the Ravensthorpe Nickel Operation (RNO or the operation) in Western Australia. RNO is operated by FQM Australia Nickel Pty Ltd (FQMAN). FQMAN is owned by FQM Australia holdings Pty Ltd (FQMA) which is in turn owned 70% by First Quantum Minerals Ltd Pty (FQM) who is the issuer of this report. The remaining 30% of FQMAN is owned by POSCO Holdings Inc. POSCO Holdings Inc. is South Korea's largest steel producer as well as a leading integrated producer of cathode and anode materials for the electric vehicle battery sector. POSCO Holdings Inc. is expanding its secondary battery material business for which Ravensthorpe will provide a portion of the feed.

FQM previously filed a Technical Report for the operations in 2013 (RNO, 2012). RNO consists of 5 discrete nickel laterite deposits (Halleys, Hale-Bopp, Shoemaker-Levy, Shoemaker-Levy North and Nindilbillup) and associated mining and processing infrastructure. Mining first started in 2010 with the ore (limonite and saprolite) being mined using low cost, simple open cut mining. Processing is undertaken using a combination of high pressure acid leach ("HPAL") and atmospheric leach ("AL") methods to produce a mixed hydroxide product ("MHP").

RNO is producing nickel and cobalt from three open pit mines sited on the Halleys, Hale-Bopp and Shoemaker-Levy deposits. Mining at Shoemaker-Levy has only recently started in 2021. Nindilbillup and Shoemaker-Levy North are at an early stage of development.

The global focus on Environmental, Social and Governance (ESG), together with strong demands for EV batteries, has placed 100% of RNO's MHP Ni sales to the EV battery market. With high market growth projections, MHP contracts have become highly payable. In addition RNO has a strong focus on further reducing already low $CO_2$ emissions. Key contributions include RNO's processing operations been powered from waste heat generated from acid production and the recent construction of a 9km overland ore conveying system which eliminates emmissions from truck haulage.

This Technical Report describes recently completed updated Mineral Resources and Mineral Reserves estimates for all 5 deposits along with recent development work being undertaken to bring the Shoemaker-Levy open pit mine into full production. Shoemaker-Levy's Measured and Indicated Mineral Resources accounts for 81% of the total Mineral Resource, with reserves accounting for 88% of the total Mineral Reserves. Shoemaker-Levy ore is capable of delivering a higher grade feed for leaching with higher Limonite nickel grades and higher beneficiated Saprolite nickel grades when compared to Hale-Bopp (Table 15-1 and Table 16-2). RNO currently has a remaining life of mine (LOM) of around 19 years.

## 1.1 Property description and location

RNO is 550 kilometres south east of the city of Perth and located in the shire of Ravensthorpe, Western Australia. The main regional service centre for RNO is the port city of Esperance which is located about 155 km to the east of the operations area. The nearest town is Ravensthorpe which is about 30 km to the west of the Shoemaker-Levy deposit.

## 1.2 Operations background

Since the previous NI43-101 Technical Report (RNO, 2012), operations have largely depleted the Mineral Resources and Mineral Reserves of the Halleys and to a lesser extent the Hale-Bopp deposits. RNO was placed on care and maintenance in October 2017 due to low nickel prices but during this time continued with its statutory environmental monitoring and reporting obligations including the permitting process for the Shoemaker-Levy deposit. RNO recommenced nickel and cobalt production in February 2020 from the Halleys and Hale-Bopp mines with Shoemaker-Levy starting in June 2021. Close spaced RC grade control drilling commenced shortly after February 2020 with most drilling taking place at Shoemaker-Levy and to a lesser extent the Halleys and Hale-Bopp areas.

## 1.3 Mineral tenure

RNO has secured the nickel laterite mineralisation, plant, processing facilities and associated infrastructure via 38 granted titles (26 mining leases, 10 miscellaneous Licenses, one general purpose license and one exploration license). These tenements cover the Halleys, Hale-Bopp, Shoemaker-Levy and Shoemaker-Levy North areas and immediate surroundings.

RNO does not own any of the tenements covering the Nindilbillup deposit and immediate surroundings. However, RNO does hold nickel laterite exploration and mining rights over two tenements (M 74/85) and M 74/82) which cover about 80 % of the Nindilbillup deposit.

## 1.4 Production status

In the period February 2020 to December 31st, 2021, RNO mined 14.95 million tonnes of ore from the Halleys, Hale-Bopp and Shoemaker-Levy deposits at an average head grade of 0.63% Ni. During 2021, RNO was mining on average 650 thousand tonnes of ore per month with at least 6 months over 800 thousand tonnes of ore per month. To date a strip ratio of 1.3 has been achieved which is slightly higher than the planned ratio of 1 due to initial waste stripping at Shoemaker-Levy. Due to the initial ramp-up period (2020-2021), only 127 thousand tonnes of MHP has been produced with a metal content of around 23% nickel and 0.9% cobalt.

## 1.5 Geology setting and mineralisation

The RNO nickel laterite deposits have developed over Archean Ultramafic rocks on the eastern margin of the Ravensthorpe Greenstone Belt. The host rocks (Bandalup Ultramafics) are comprised of a serpentinised (greenschist facies metamorphism) komatiite complex with rare interflow sedimentary units; the primary rock was dunitic in composition. The Bandalup sequence is in turn bound by:

- Metabasalt and metadolerite members of the Maydon basalt.
- Gneissic granitoids of monzogranodiorite to granodiorite composition.

Excluding the Nindilbillup deposit, the mineralisation has a strong north-northwest orientation along a total strike length of about 17 kilometres. The Nindilbillup deposit strikes east-west for a strike length of about 6 km. The 5 deposits display strong similarities in regolith geology, geochemistry, texture and mineralogy as a consequence of the consistency of the underlying ultramafic sequence from which they developed. Nickel and cobalt, within the serpentinised komatiites, were concentrated by weathering and oxidation processes in the lateritic regolith.

The weathering/leaching process has resulted in horizontally defined deposits with four typical layers from top to bottom being overburden, limonite, saprolite, developed over altered/weathered saprolitic rock (saprock) grading to bedrock. The overburden is essentially barren while the Ni and Co mineralisation is hosted largely in the limonite and upper portions of the saprolite. The style of mineralisation at RNO is amenable to beneficiation. Beneficiation removes components of waste rock and non-recoverable material, reducing tonnages and increasing nickel grade of the final product prior to processing in the RNO plant.

The mineralised sequences have been intruded in places by dolerites and talc zones associated with faulting. The dykes are sometimes mineralised due to nickel leaching from the surrounding ultramafic based laterite.

## 1.6 Mineral Resource estimates

The 5 deposits were re-estimated in the period 2020 to 2021. The Mineral Resource estimate updates were completed by Mr Richard Sulway of FQM, with the assistance of RNO geological staff. The Mineral Resources element grades were estimated using ordinary and multiple indicator kriging into detailed geology model volumes of the respective nickel laterite domains. Unfolding was employed to optimise estimates of the undulating and relatively narrow nickel laterite domains. Post processing of parent block estimates has used localised uniform conditioning for the wider drill grid areas in order to better reflect grade and tonnages at the scale of mining. The accuracy of sample density values was improved with more comprehensive sampling using geophysical methods and in-pit bulk samples. Dry bulk density values were assigned to the models based on core based values (caliper method) or in selected areas of the Shoemaker-Levy deposits, downhole geophysics.

All deposit estimates have been completed using the same estimation method. The standardised estimation methodology has been translated into the routine grade control systems in order to support delivery to the mine plan.

The resulting estimates were classified as Measured, Indicated and Inferred Mineral Resources in accordance with the guidelines of the Standards on Mineral Resources and Reserves of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines, CIM November 2019 and the CIM Definition Standards). The classification was guided by confidences in the geology, estimation methods and the resulting grade estimates in addition to the degree of geological continuity, the drillhole grid spacing and quality of sample analysis.

The models were depleted for mining (where relevant) and reported using a 0.3% nickel cut-off grade (Table 1-1). Measured and Indicated Mineral Resources have increased by 15% from added drilling and increased confidence in the resulting grade estimates and applied density values. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability as per the current reserve criteria.

**Table 1-1 RNO Mineral Resource statement as of 31st December 2021 (0.3% Ni cut-off)**

| Deposit | Classification | Tonnes (Mt) | Ni (%) | Co (%) | Fe (%) | Al (%) | Mg (%) | Ca (%) |
|---|---|---|---|---|---|---|---|---|
| Halleys | Measured | 2.44 | 0.61 | 0.03 | 11.8 | 1.7 | 5.6 | 1.6 |
| | Indicated | 2.59 | 0.56 | 0.03 | 13.5 | 2.8 | 6.3 | 1.0 |
| | **Total Measured & Indicated** | **5.03** | **0.58** | **0.03** | **12.6** | **2.3** | **6.0** | **1.3** |
| | Inferred | 0.25 | 0.61 | 0.03 | 10.6 | 1.3 | 9.7 | 1.8 |
| Hale-Bopp | Measured | 21.65 | 0.55 | 0.03 | 11.8 | 1.5 | 5.5 | 0.5 |
| | Indicated | 15.39 | 0.55 | 0.03 | 11.5 | 1.7 | 8.0 | 0.8 |
| | **Total Measured & Indicated** | **37.04** | **0.55** | **0.03** | **11.7** | **1.6** | **6.6** | **0.6** |
| | Inferred | 1.23 | 0.47 | 0.02 | 9.5 | 1.7 | 10.7 | 1.5 |
| Shoemaker-Levy | Measured | 80.55 | 0.58 | 0.03 | 12.7 | 1.2 | 3.5 | 1.9 |
| | Indicated | 102.19 | 0.55 | 0.03 | 12.5 | 1.6 | 4.1 | 1.5 |
| | **Total Measured & Indicated** | **182.74** | **0.56** | **0.03** | **12.6** | **1.5** | **3.9** | **1.7** |
| | Inferred | 9.59 | 0.47 | 0.02 | 10.8 | 1.3 | 6.9 | 2.7 |
| Nindilbillup | Inferred | 26.72 | 0.53 | 0.03 | 12.9 | 2.4 | 5.8 | 0.4 |
| Shoemaker-Levy North | Inferred | 30.47 | 0.52 | 0.02 | 11.2 | 2.7 | 3.3 | 0.8 |
| | **Total Measured** | **104.64** | **0.57** | **0.03** | **12.5** | **1.3** | **4.0** | **1.6** |
| | **Total Indicated** | **120.17** | **0.55** | **0.03** | **12.4** | **1.7** | **4.7** | **1.4** |
| Total Resources | **Total Measured & Indicated** | **224.81** | **0.56** | **0.03** | **12.4** | **1.5** | **4.3** | **1.5** |
| | **Total Inferred** | **68.26** | **0.52** | **0.02** | **11.8** | **2.4** | **5.0** | **0.9** |

Notes:

- Mineral Resources are reported inclusive of Mineral Reserves.
- Small discrepancies may occur in the figures due to the effects of rounding.
- The tabled Mineral Resources reflect 100% of the in-situ grades and tonnes. FQM's attributable share would be 70% of these totals.
- Fe, Al, Mg and Ca estimates do not constitute part of the Mineral Resource. They are included as additional information relevant to beneficiation and leaching performance.

The total stockpiled mined ore at RNO is listed in Table 1-2, the material is mostly saprolite. The buffer ponds contains 0.08 Mt of Measured Resources at 1.0% Ni.

**Table 1-2 Total RNO Stockpiles**

| Description | Classification | Tonnes (Mt) | Ni (%) | Co (%) | Fe (%) | Al (%) | Mg (%) | Ca (%) |
|---|---|---|---|---|---|---|---|---|
| **Stockpiles** | **Measured** | **17.68** | **0.58** | **0.02** | **11.2** | **1.3** | **9.4** | **1.3** |

## 1.7 Mineral Reserve estimates

The detailed mine planning for this Technical Report, including conventional optimisation processes, open pit designs and Life of Mine (LOM) production scheduling was completed by FQM staff under the supervision of the Qualified Person, Anthony Cameron of Cameron Mining Consultants Ltd.

RNO uses conventional open-cut mining which follows the standard drill, blast, load, and haul cycle. The shallow flat tabular mineralisation, allows for around 10% of material mined to be free dig (no blasting) with low overall strip ratios.

Pit optimisations, including sensitivity analysis, were used to establish design pit shells. The optimisations used variable nickel and cobalt recoveries as per the respective limonite and saprolite material types. In addition, pit slope design criteria and mining/processing operating costs derived from extrapolated and actual production indicators were used. Following optimisation, pit designs were guided from the selected shells and detailed LOM scheduling was completed in order to demonstrate an achievable and viable mine plan.

Future Mineral Reserves and mining will be focused at Shoemaker-Levy over several phases starting in the south and progressively moving to the north. Mining commenced at Shoemaker-Levy in 2021 and ore is crushed at Shoemaker-Levy prior to being conveyed 9km overland to the existing processing facilities in order to minimise costs. The average Ni grade mined is around 0.6% Ni, which is upgraded via beneficiation to almost double the mined grades and significantly reduced tonnages. Tabled Mineral Reserves include consideration of a cash flow model that incorporates updated operating and metal costs as well as capital and sustaining expenditure.

The tabled Mineral Reserves (Table 1-3) are based upon an average economic cutoff grade of 0.3% Ni which accounts for a longer-term nickel and cobalt price of US$8/lb and US$30/lb respectively. Mg and Ca estimates do not constitute part of the Mineral Resource or Mineral Reserve. They are included as additional information relevant to beneficiation and leaching performance.

**Table 1-3 RNO Mineral Reserve statement as of 31st December 2021**

| Type/Classification | Tonnes (Mt) | Ni (%) | Co (%) | Ca (%) | Mg (%) |
|---|---|---|---|---|---|
| **Limonite Ore** | | | | | |
| Proven Reserve | 67.2 | 0.62 | 0.03 | 0.6 | 2.1 |
| Probable Reserve | 62.9 | 0.60 | 0.03 | 0.5 | 2.0 |
| **Total Limonite Reserve** | **121.3** | **0.60** | **0.03** | **0.6** | **2.1** |
| **Saprolite Ore** | | | | | |
| Proven Reserve | 24.2 | 0.44 | 0.03 | 4.4 | 7.5 |
| Probable Reserve | 23.7 | 0.46 | 0.03 | 3.5 | 8.2 |
| **Total Saprolite Reserve** | **48.0** | **0.45** | **0.03** | **3.9** | **7.9** |
| **Total Ore in Pits** | | | | | |
| Proven Reserve | 91.4 | 0.57 | 0.03 | 1.6 | 3.6 |
| Probable Reserve | 86.6 | 0.56 | 0.03 | 1.4 | 3.7 |
| **Total In Pit Reserve** | **178.0** | **0.56** | **0.03** | **1.5** | **3.6** |
| **Stockpile** | | | | | |
| Proven Reserve | 17.7 | 0.58 | 0.03 | 1.5 | 9.4 |
| Probable Reserve | | | | | |
| **Total Stockpile** | **17.7** | **0.58** | **0.03** | **1.5** | **9.4** |
| Total Proven Reserve | 109.1 | 0.57 | 0.03 | 1.6 | 4.5 |
| Total Probable Reserve | 86.6 | 0.56 | 0.03 | 1.4 | 3.7 |
| **Total Reserve including Stockpile** | **195.7** | **0.57** | **0.03** | **1.5** | **4.1** |

Notes:

- Tonnages are in millions of metric tonnes.
- Royalty is composed of a 3.4% royalty on Revenue for Nickel plus a 3.05% royalty on Revenue for Cobalt).
- Figures reported are rounded to 2 significant figures to reflect accuracy which may result in small tabulation errors.
- Mineral Reserves are classified as Proven or Probable Mineral Reservesin accordance with CIM Definitions and Standards.
- The Buffer Ponds contain 0.08 Mt at 1% Ni and are beneficiated product used as temporary storage to assist the processing team manage fluctuations and disruptions in Leach feed from the Beneficiation Plants.
- Mg and Ca estimates do not constitute part of the Mineral Reserve. They are included as additional information relevant to beneficiation and leaching performance.

## 1.8 Processing

The details of RNO's metallurgical sampling, processing, recovery methods and results, as contained in this Technical Report, have been completed under supervision and by the Qualified Person, Mr Robert Stone of FQM.

Mined limonite and saprolite material is crushed and beneficiated in two dedicated streams. Beneficiated limonite material is treated via HPAL and beneficiated saprolite is treated via pre-leaching using concentrated sulphuric acid followed by AL of the combined HPAL and pre-leach products.

Typically beneficiation rejects 60 to 70% of the feed mass, and recovers 60 – 65% of the feed nickel into a beneficiated products stream approximating to a doubling of the ROM grade in one third of the volume. Nickel recovery through the two leach circuits approximates to 90% for Limonite and 70% for Saprolite.

Power for the process plant and mining operations is generated largely via steam turbines driven by steam generated from the sulphur burning acid plant. Backup diesel generators are also available when required. RNO's average power cost is around US$0.11 to US$0.15 kw/h which with acid plant power supply, translates into a US$22 to US$30 million savings per annum for the operation (as opposed to relying entirely on diesel generators).

The final MHP quality is planned to contain around 23% contained Ni metal and about 1% contained cobalt metal.

Since the previous Technical Report (RNO, 2012), RNO has embarked upon several key upgrades to the respective processing entities. The upgrades have ensured more consistent performance, reduced costs, improved efficiencies and assured overall recoveries. These upgrades include:

- Improvements in water management to reduce consumption and reduce long term storage requirements;
- Improvements in the beneficiation plant to increase recovery through cyclone optimisation;
- Upgrade of beneficiation dewatering circuit to reduce moisture content of waste products;
- Addition of a new crushing, sizing and 9km overland conveying system for the Shoemaker-Levy mine;
- Optimising of flocculant addition to thickeners to reduce consumption; and
- Addition of a second limestone ball milling circuit to improve availability and quality of the limestone product.

A comprehensive programme of diamond drilling was completed to cover the initial five years of mining at Shoemaker-Levy. The resulting diamond core samples were tested for beneficiation performance per nickel laterite domain. Results for limonite beneficiation were similar to historical performance, however, saprolite beneficiation results are noted for having marked product upgrade improvements.

Water is supplied to the plant via a pipeline from the sea, the pipeline extends approximately 46 km south of the operations to Masons Bay. A desalination and demineralisation plant provides desalinated feed water for the acid plant. Reject saline water from the desalination plant "hypersaline" is used for general processing. A bore field is used to provide potable water.

The tailings are stored in Tailings storage facilities which are of the downstream construction type, with walls raised as required.

The RNO processing operations operate with a zero discharge water balance. Water surplus to requirements is directed to evaporation ponds.

## 1.9 Environmental approvals and status

Ministerial Statement 633 was issued by the Western Australian Government in September 2003 under Part V of the Environmental Protection Act 1986 (EPA Act), to allow for the construction and operation of RNO in accordance with broad environmental outcome requirements. Since it was first issued, MS 633 has been updated numerous times to include infrastructure not previously allowed for or for changes to the approved RNO footprint.

RNO is also approved for operation under subsidiary legislation such as the Mining Act 1978 or Part IV of the EP Act. These approvals allow for operations to be managed in accordance with specific environmental compliance requirements.

Infrastructure approved for operation includes the RNO processing plant and associated infrastructure including the overland conveyor from Shoemaker-Levy, Mason Bay seawater pipeline, the tailings storage facility (TSF), evaporation ponds, Halleys, Hale-Bopp and Shoemaker-Levy stage 1 (95% of the current Mineral Reserves) mine pits and waste dumps and Tamarine quarry.

Additional approvals and licences required by subsidiary legislation are regularly reviewed and updated as required to allow for alterations or upgrades to existing operational infrastructure within the approved project footprint provided in MS633.

The stage 2 expansion required for additional infrastructure associated with the south east of the Shoemaker-Levy mine, and the remaining 5% of current Mineral Reserves, is being assessed by the Western Australian EPA. Subsidiary approval applications are yet to be prepared. Approval is currently expected in Q4 2022 or Q1 2023.

Subsidiary approvals documentation for a further sequence of lifts to the TSF is currently being prepared. These will allow for further ~5 years of tailings deposition beyond which an updated LOM tailings deposition strategy will be required.

## 1.10 Conclusions and recommendations

### 1.10.1 Mineral Resource estimate

The updated RNO models for the 5 deposit areas were compiled to incorporate recent drilling and to standardise the methods and model conventions across all the deposits. The operation has a long history of detailed exploration and mining dating back to the late 1990’s and as such the geology is well understood. Mineral Resource development drilling, sampling, logging and assaying practices are well defined and documented in detailed standard operating procedure documents.

Drilling will be ongoing largely for the purposes of grade control at the Shoemaker-Levy deposits however a proportion of the drilling will be used to expand the Mineral Resource base where possible and provide samples for ongoing metallurgical test work. The Shoemaker-Levy deposit makes up the bulk of the Mineral Resource base and will remain the main focus for Mineral resource development, extensions and mining for the years ahead.

### 1.10.2 Mineral Reserve estimate

RNO is an established conventional open cut nickel laterite mine that has been in operation for several years.

Mine planning and evaluations undertaken using the latest resource models confirm that the continuation of mining and processing at RNO is both viable and economic. 80 percent of the remaining Mineral Reserves are in Shoemaker-Levy where mining commenced in 2021. A further 10% is already stockpiled.

The Mineral Reserve estimate has a relatively high sensitivity to revenue which is controlled by metal prices and payability. It is noted however that at current long term forecast metal prices, the mineral reserve is relatively insenstive to changes in revenue and costs.

Given the mine has been operational for a number of years, technical risk in relation to the Mineral Reserves estimate is deemed to be low.

### 1.10.3 Processing

The processing facility at RNO has demonstrated a capability to upgrade (higher grade and lower mass) the ROM ores through a beneficiation process and to treat the resultant product efficiently through its two leach circuits to produce a Mixed Hydroxide Precipitate containing Nickel and Cobalt values.

Optimisation and further enhancement of the process is an ongoing function of normal operations. This will include continuing with development of techniques to utilise beneficiation rejects, in part or whole, for the construction of the tailings dam walls. Economic and technical review for direct site/external production of nickel sulphate will also continue as an opportunity for future product value.

# Item 2 INTRODUCTION

## 2.1 Purpose of this Technical Report

This Technical Report on the Ravensthorpe Nickel Operations (RNO or the operation) has been prepared by Qualified Persons (QPs) David Gray, Richard Sulway and Robert Stone of First Quantum Minerals Ltd (FQM, the issuer) and Anthony Cameron of Cameron Mining Consultants Ltd.

The purpose of this Technical Report is to document updated Mineral Resource and Mineral Reserve estimates for the operation, and to provide a commentary on the status of the operations and proposed life of mine (LOM). LOM operations descriptions are largely focussed on the Shoemaker-Levy deposit.

## 2.2 Terms of reference

The Technical Report covers the Halleys, Hale-Bopp, Shoemaker-Levy, Shoemaker-Levy North and Nindilbillup deposits and has been written to comply with the reporting requirements of the Canadian National Instrument 43-101: 'Standards of Disclosure for Mineral Projects' of the Canadian Securities Administrators (the Instrument) which in turn complies with the Standards on Mineral Resources and Reserves of the Canadian Institute of Mining, Metallurgy and Petroleum (the CIM Guidelines, 2019).

The effective date for the Mineral Resource and Mineral Reserve estimates is 31st December 2021.

## 2.3 Principal sources of information

This Technical Report was prepared by the issuer using data largely supplied by RNO staff and contractors. The content of this report was based on site derived drilling and mining data, internal unpublished studies, and third party consultants retained by RNO. Examples of the site derived data include:

- Logging and assay data from 20 plus years of drilling;
- Aerial magnetics surveys;
- Marketing and economic study results;
- Actual production performance;
- Mine reconciliation and metallurgical test work; and
- Previous Technical Reports.

A list of specialist consultants who provided information for the study is listed in Table 2-1.

**Table 2-1 Consulting Firms Who Provided Information for the Report**

| Consulting Firm | Area of Expertise |
|---|---|
| Golder Associates | Tailings Dams |
| Hetherington Exploration & Mining Title Services Pty Ltd | Mining tenements |

## 2.4 Qualified Persons and site inspections

The Mineral Resource estimates were prepared by Mr Richard Sulway and Mr David Gray (both Qualified Persons). Mr Sulway of FQM, the issuer, meets the requirements of a QP according to his Certificate of

Qualified Persons attached in Item 28. Similarly, Mr Gray of FQM, the issuer, meets the requirements of a QP according to his Certificate of Qualified Persons attached in Item 28.

Metallurgical testing, mineral processing and process recovery aspects of this report were prepared under the supervision of Mr Robert Stone (a Qualified Person). Mr Stone of FQM, the issuer, meets the requirements of a QP according to his Certificate of Qualified Persons attached in Item 28.

Mineral Reserve estimates were prepared under the direction of Mr Anthony Cameron (a Qualified Person) and with assistance of FQM staff. Mr Cameron of Cameron Mining Consultants Ltd, meets the requirements of a QP according to his Certificate of Qualified Persons attached in Item 28.

The Qualified Persons (QPs) have visited the site, as follows:

- David Gray has visited the RNO operations many times since 2015, with his most recent visit in December 2021. During Mr Gray's visits, he has investigated RC drilling, logging and sampling activities, grade control methods and has visited both mining, conveying, crushing, reclaiming and beneficiation operations on several occasions.
- Richard Sulway has visited the operations on many occasions each year since 2017, with his most recent visit in December 2021. During Mr Sulway's visits, he has investigated RC drilling practices, QAQC data, grade control methods, geology wireframe modelling and has carried out independent data verifications of logging, sampling, laboratory standards, QAQC, geology modelling, grade control practices and reconciliation data.
- Robert Stone has visited operations on many occasions each year since FQM's acquisition of RNO in 2010. Mr Stone's most recent visit was during the week of 9 February 2022. Mr Stone has visited all accessible areas of the site operations including crushing, belts, reclaimer, beneficiation , leach, hydrometallurgical plant, acid and power plants, and tailings storage and evaporation facilities.
- Anthony Cameron has visited site on many occasions each year since FQM's acquisition in 2010. Mr Cameron's most recent visit was in November 2021. Mr Cameron visited the operating mine areas as well as the crushing facilties.

The following table identifies which items of the Report have been the responsibilities of each QP.

| Name | Position | Ni43-101 Responsibility |
|---|---|---|
| **David Gray**<br>BSc Hons (Geology), FAIG | Group Mine and Resource Geologist<br>FQM (Australia) Pty Ltd | Supporting Author and Qualified Person<br>Items 1, 2, 3, 4, 5, 6, 12, 13, 14, 22, 23, 25, 26, 27. |
| **Richard Sulway**<br>MAppSc (Geological data processing), BAppSc Hons (Applied Geology) | Consulting Mine geologist<br>FQM (Australia) Pty Ltd | Author and lead Qualified Person<br>Items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 23, 24, 25, 26, 27 |
| **Robert Stone**<br>BSc Hons (CEng), ACSM | Group Consulting project metallurgist<br>FQM (Australia) Pty Ltd | Author and Qualified Person<br>Items 1, 2, 3, 6, 13, 17, 18, 20, 21, 22, 25, 26, 27 |
| **Anthony Cameron**<br>BEng (Mining), Grad Dip Bus, MComm Law | Consulting Mining Engineer<br>Cameron Mining Consultants Ltd | Author and Qualified Person<br>Items 1, 2, 3, 6, 15, 16, 18, 19, 20, 21, 22, 25, 26, 27 |

# Item 3 RELIANCE ON OTHER EXPERTS

The authors of this Technical Report do not disclaim any responsibility for the content contained herein.

# Item 4 PROPERTY DESCRIPTION, LOCATION AND TENURE

## 4.1 Operations description

RNO hosts 5 nickel laterite deposits at varying stages of development. The operations consists of a series of open cut mines and a centralised plant (hydrometallurgical process) that recovers nickel and cobalt to produce a mixed nickel cobalt hydroxide intermediate product.

The current status of the individual deposits is listed Table 4-1. The 5 deposits extend along a strike length of about 17 km (see Figure 7-1).

**Table 4-1 RNO Nickel Laterite Deposits**

| Deposit | Status |
|---|---|
| Halleys | First of the deposits to be extensively drilling and mined. It is now largely mined out. |
| Hale-Bopp | Extensively mined but still hosts considerable remaining Measured and Indicated Mineral Resources and Mineral Reserves. |
| Shoemaker-Levy | After the 2003 DFS was completed no further work was undertaken until 2017 when drilling was restarted. Mining started in 2021. |
| Nindilbillup | Early stage development project. |
| Shoemaker-Levy North | Early stage development project. |

## 4.2 Operations location

The operation is located about 550 km by sealed road from Perth or 155 km from Esperance (Figure 4-1) in Western Australia. The approximate midpoint (easting and northing) of the Shoemaker-Levy deposit in Australian Map Grid (AMG) coordinates is 252130 mE and 6281560 mN.

**Figure 4-1 Ravensthorpe Nickel Operation Location Map**


## 4.3 Mineral Tenure

RNO holds 38 approved tenements covering Mineral Resources, exploration areas, mining areas, processing and infrastructure facilities in the Ravensthorpe area. The mining titles covering most of the Nindilbillup deposit (M74/85-I and M74/82-I) are held by AML (Ravensthorpe) Pty Ltd, FQM Australia Nickel Pty Ltd

(FQMA) holds full rights to explore and mine nickel laterites on these titles. In terms of the 38 titles currently owned by FQMA (Table 4-2), the total area covered is about 15,000 ha which incurs an annual expenditure commitment of $1,352,500 AUD. An image of the tenement boundaries superimposed onto Landsat imagery is shown in Figure 4-2.

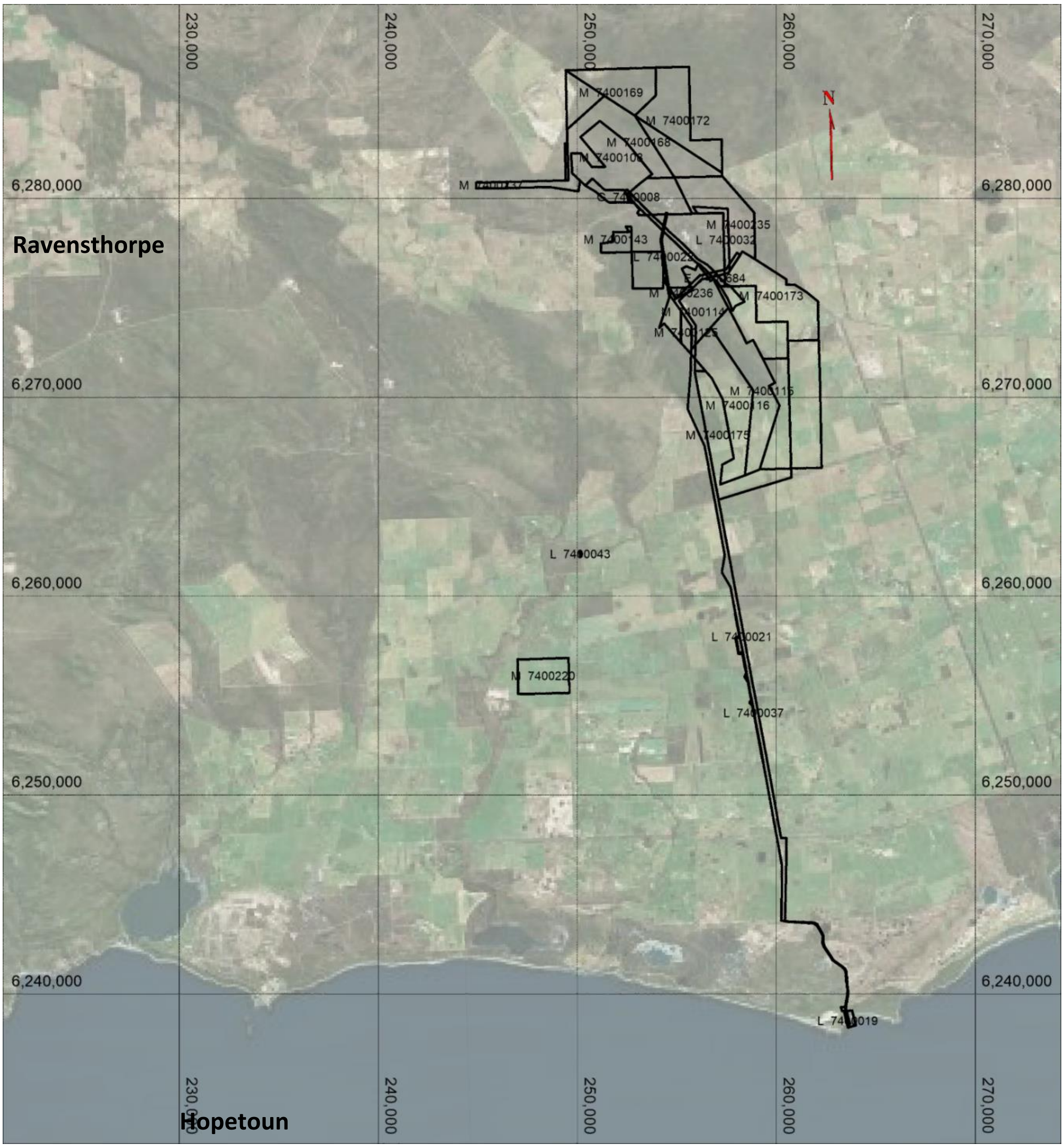
**Table 4-2 RNO Tenements as of 31st December 2021**

| Tenement number | Current Holder | Area (Ha) | Grant date | Expiry date | Expenditure commitment |
|---|---|---|---|---|---|
| E 74/684 | FQM AUSTRALIA NICKEL PTY LTD | 600* | 07/05/2021 | 06/05/2026 | $15,000 |
| G 74/8 | FQM AUSTRALIA NICKEL PTY LTD | 6.76 | 25/03/2010 | 24/03/2031 | $0 |
| L 74/19 | FQM AUSTRALIA NICKEL PTY LTD | 4.52 | 07/08/2001 | 06/08/2022 | $0 |
| L 74/20 | FQM AUSTRALIA NICKEL PTY LTD | 3.96 | 07/08/2001 | 06/08/2022 | $0 |
| L 74/21 | FQM AUSTRALIA NICKEL PTY LTD | 889.97 | 21/01/2000 | 20/01/2042 | $0 |
| L 74/22 | FQM AUSTRALIA NICKEL PTY LTD | 34.37 | 07/08/2001 | 06/08/2022 | $0 |
| L 74/32 | FQM AUSTRALIA NICKEL PTY LTD | 118.69 | 21/02/2011 | 20/02/2032 | $0 |
| L 74/33 | FQM AUSTRALIA NICKEL PTY LTD | 32.00 | 17/02/2005 | 16/02/2026 | $0 |
| L 74/36 | FQM AUSTRALIA NICKEL PTY LTD | 9.35 | 07/10/2005 | 06/10/2026 | $0 |
| L 74/37 | FQM AUSTRALIA NICKEL PTY LTD | 16.90 | 07/10/2005 | 06/10/2026 | $0 |
| L 74/43 | FQM AUSTRALIA NICKEL PTY LTD | 1.00 | 14/11/2006 | 13/11/2027 | $0 |
| L 74/54 | FQM AUSTRALIA NICKEL PTY LTD | 209.44 | 26/07/2019 | 25/07/2040 | $0 |
| M 74/108 | FQM AUSTRALIA NICKEL PTY LTD | 804.65 | 19/06/2001 | 18/06/2022 | $80,500 |
| M 74/114 | FQM AUSTRALIA NICKEL PTY LTD | 630.85 | 07/05/1998 | 06/05/2040 | $63,100 |
| M 74/115 | FQM AUSTRALIA NICKEL PTY LTD | 952.50 | 07/05/1998 | 06/05/2040 | $95,300 |
| M 74/116 | FQM AUSTRALIA NICKEL PTY LTD | 972.50 | 07/05/1998 | 06/05/2040 | $97,300 |
| M 74/123 | FQM AUSTRALIA NICKEL PTY LTD | 55.97 | 07/08/2003 | 06/08/2024 | $10,000 |
| M 74/124 | FQM AUSTRALIA NICKEL PTY LTD | 4.54 | 07/05/2010 | 06/05/2031 | $5,000 |
| M 74/125 | FQM AUSTRALIA NICKEL PTY LTD | 80.93 | 07/05/2010 | 06/05/2031 | $10,000 |
| M 74/142 | FQM AUSTRALIA NICKEL PTY LTD | 108.25 | 31/08/2005 | 30/08/2026 | $10,900 |
| M 74/143 | FQM AUSTRALIA NICKEL PTY LTD | 129.85 | 28/10/2002 | 27/10/2023 | $13,000 |
| M 74/144 | FQM AUSTRALIA NICKEL PTY LTD | 632.10 | 28/10/2002 | 27/10/2023 | $63,300 |
| M 74/145 | FQM AUSTRALIA NICKEL PTY LTD | 541.60 | 28/10/2002 | 27/10/2023 | $54,200 |
| M 74/167 | FQM AUSTRALIA NICKEL PTY LTD | 441.05 | 25/03/2010 | 24/03/2031 | $44,200 |
| M 74/168 | FQM AUSTRALIA NICKEL PTY LTD | 954.70 | 25/03/2010 | 24/03/2031 | $95,500 |
| M 74/169 | FQM AUSTRALIA NICKEL PTY LTD | 617.15 | 27/06/2007 | 26/06/2028 | $61,800 |
| M 74/170 | FQM AUSTRALIA NICKEL PTY LTD | 286.80 | 25/03/2010 | 24/03/2031 | $28,700 |
| M 74/171 | FQM AUSTRALIA NICKEL PTY LTD | 416.90 | 25/03/2010 | 24/03/2031 | $41,700 |
| M 74/172 | FQM AUSTRALIA NICKEL PTY LTD | 900.95 | 27/06/2007 | 26/06/2028 | $90,100 |
| M 74/173 | FQM AUSTRALIA NICKEL PTY LTD | 998.65 | 07/01/2004 | 06/01/2025 | $99,900 |
| M 74/174 | FQM AUSTRALIA NICKEL PTY LTD | 995.45 | 07/01/2004 | 06/01/2025 | $99,600 |
| M 74/175 | FQM AUSTRALIA NICKEL PTY LTD | 814.80 | 07/01/2004 | 06/01/2025 | $81,500 |
| M 74/187 | FQM AUSTRALIA NICKEL PTY LTD | 284.95 | 25/03/2010 | 24/03/2031 | $28,500 |
| M 74/203 | FQM AUSTRALIA NICKEL PTY LTD | 25.51 | 25/03/2010 | 24/03/2031 | $10,000 |
| M 74/220 | FQM AUSTRALIA NICKEL PTY LTD | 450.40 | 29/03/2006 | 28/03/2027 | $45,100 |
| M 74/235 | FQM AUSTRALIA NICKEL PTY LTD | 882.90 | 25/03/2010 | 24/03/2031 | $88,300 |
| M 74/236 | FQM AUSTRALIA NICKEL PTY LTD | 37.98 | 25/03/2010 | 24/03/2031 | $10,000 |
| M 74/237 | FQM AUSTRALIA NICKEL PTY LTD | 47.80 | 25/03/2010 | 24/03/2031 | $10,000 |

Notes:

- * Exploration Tenements are issued as Blocks; E 74/684 was granted for two blocks. The listed area is approximate as nearby Mining Leases will exclude parts of the Blocks.
- "E" prefix tenements are Exploration Licenses, "G" prefix tenements are General Purpose Leases, "L" prefix tenements are Miscellaneous Licenses and "M" prefix tenements are Mining Leases.

**Figure 4-2 RNO Tenement Map as of December 31st 2021 superimposed on Landsat satellite imagery MGA 94 Zone 51 grid)**




The isolated M 74/220 mining lease in the middle of the above image (Figure 4-2) covers the Tamarine limestone quarry.

In addition, FQMA has nickel laterite rights to the following 5 tenements (Table 4-3), but does not currently hold the tenements themselves.

**Table 4-3 Other RNO tenements**

| AML (Ravensthorpe) - Laterite Nickel Rights | Status | Holder |
|---|---|---|
| M74/106 | Live | Aml (Ravensthorpe) Pty Ltd |
| M74/82 | Live | Aml (Ravensthorpe) Pty Ltd |
| M74/84 | Live | Aml (Ravensthorpe) Pty Ltd |
| M74/85 | Live | Aml (Ravensthorpe) Pty Ltd |
| E74/379 | Live | Galaxy Lithium Australia Limited |

## 4.4 Royalties, rights, payments and agreements

Royalties payable by the RNO include:

- A State Government of Western Australia mineral royalty of 2.5% of sales less certain allowable deductions is paid on a quarterly basis for Nickel and Cobalt;
- A Native Title Royalty of between AUD $750,000 and $1,500,000 per year dependent on Nickel price and production rate and is paid annually; and
- Third Party Royalties on sales of 0.93% for Nickel and 0.55% for Cobalt are paid within 74 days of delivery of product.

## 4.5 Environmental liabilities

Environmental liabilities associated with the RNO site are generally those that would be expected from a mining operation consisting of open pit mines, waste dumps, processing plant and associated infrastructure, tailings storage facilities, evaporation ponds and exploration drilling sites.

A key long term closure risk for the project is a requirement for the backfilling of Halleys and Hale-Bopp pits with beneficiation rejects to a topography similar to that of the original Bandalup Hill. Other key risks include management of closure of Halleys waste rock dump (saline drainage) and closure of the evaporation ponds.

The current closure liability for RNO is estimated at US$185 million.

## 4.6 Permits

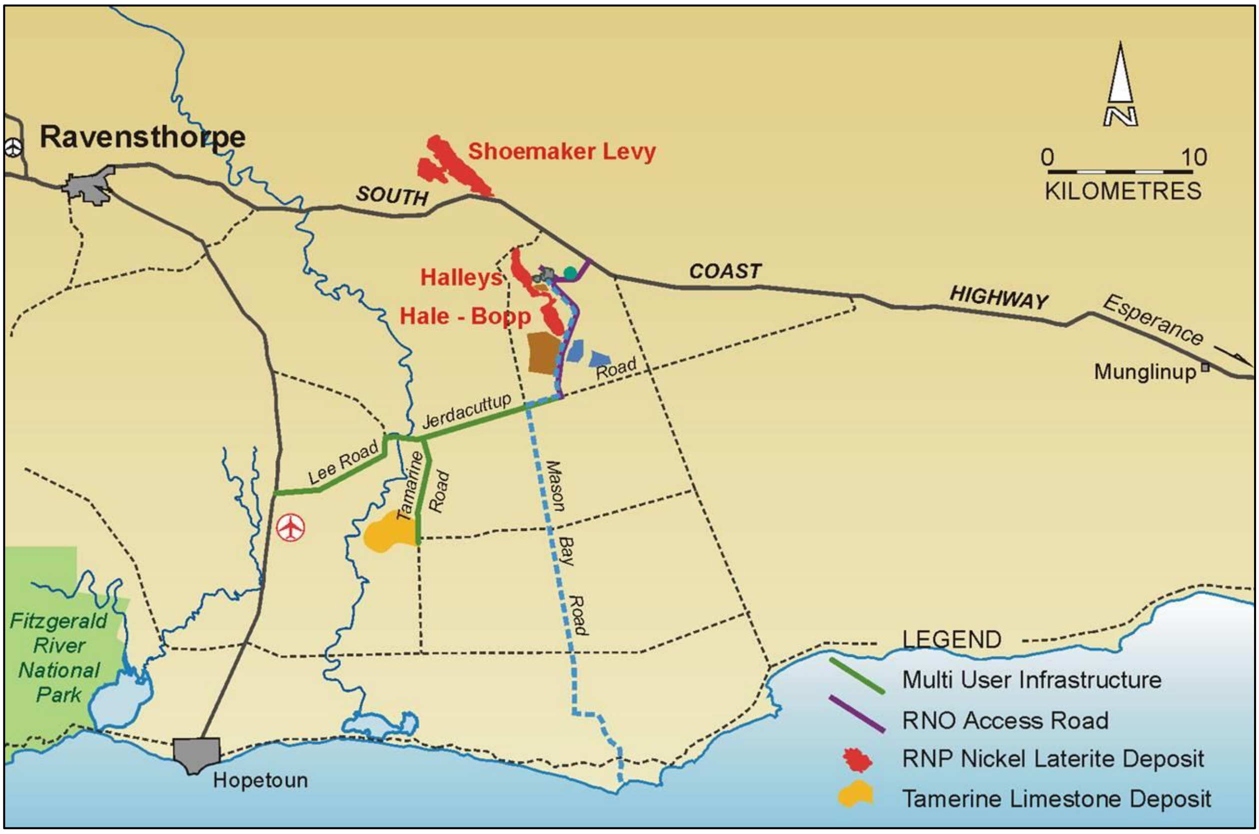
RNO has operated to date and continues to operate under required environmental approvals, licences and permits. For further details see Item 20 of this Technical Report.

# Item 5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

## 5.1 Accessibility

RNO is accessible via both the South Coast Highway and the Jerdacuttup road as shown in Figure 5-1. The northern access road gate (via the South Coast highway) is about 35 km to the east of the town of Ravensthorpe and 155 km west of Esperance.

**Figure 5-1 Location of the Ravensthorpe Nickel Operation and surrounding infrastructure**




Air access is via a sealed runway (Ravensthorpe Airport) approximately 15 km from the RNO processing plant and associated mine offices. The Airport was built to support the local mines and is capable of handling small to medium sized jet aircraft.

## 5.2 Climate

Ravensthorpe has a semi-arid climate whereby the summers are warm to hot and the winters cool. It is often windy. Over the course of the year, the temperature typically varies from 7°C to 30°C. Rainfall is moderate (about 430 mm a year) and largely falls during the winter months. The wettest months are May to July.

## 5.3 Physiography

The RNO laterite deposits consist of low-lying ridges which rise up to 80 m above the surrounding plane. The topography of slopes (<5°) gently away from the ridge crests until merging with the surrounding granitic sand plains.

## 5.4 Vegetation

The vegetation of the RNO area including much of the Shoemaker-Levy area is characterised by Mallee-Heath dominated sandy plains with the most dominant Mallee species being Eucalyptus Pleurocarpa. An example of the vegetation at Shoemaker-Levy is shown in Figure 5-2.

**Figure 5-2 East-west drilling section line at Shoemaker-Levy in 2019**

The laterite dominated ridges e.g. Hale-Bopp are thickly vegetated with Proteaceae dominated shrublands.

A number of threatened species have been identified in the Halleys and Hale-Bopp deposit areas including Beyeria Cockertonii, Eucalyptus Purpurata and Kunzea Similis as part of flora and fauna surveys completed as part of the 2003 feasibility study. Exclusions zones were enabled as part of the mining approvals process in 2003 to protect these species.

## 5.5 Local resources

The operation is located in the Shire of Ravensthorpe, which is largely supported by farming (sheep, wheat and other cereal crops). The nearest town, Ravensthorpe has a population of approximately 1,560 people (2021 Census).

Hopetoun is located approximately 45 km from site, on the coast, and is where most of the residential workforce is accommodated.

## 5.6 Infrastructure

FQM inherited all fixed plant and infrastructure at RNO built by the previous owners when it purchased the operation in 2010. The RNO plant includes:

- Crushing and beneficiation facilities (includes dedicated separate limonite and saprolite crushing and stacking facilities);
- Mine workshops and administration buildings;
- HPAL and AL processing circuits;

- Acid production plant, desalination and demineralisation plants
- Steam driven power generators (via three 178.5MW steam turbines) and backup diesel power generators (three 1.9 MW and five 2.0MW generators);
- Security fencing and gates, sealed roads and gatehouses;
- Water bores, storage ponds, and a pipeline linking the plane to the coast to supply sea water;
- Limestone quarry located about 10km from the plant; and
- Tailings storage facility and evaporation ponds.

## 5.7 Mine personnel

Mine staff are employed from both nearby population centres such as Esperance and Albany or from Perth. Staff are employed either on a residential basis or on a FIFO (fly-in fly-out) or DIDO (drive-in, drive-out) basis.

## 5.8 Accommodation

Personnel are housed in company owned houses and flats in Hopetoun (45km south of the operation site) or a dedicated accommodation village located about 2km east of the RNO processing plant.

## 5.9 Power

All power is provided from site, no external power sources are used.

## 5.10 Water

All water is sourced from either a bore field (potable water) or sea water (via a pipeline) for processing. Both sources are treated prior to use.

## 5.11 Processing plant and tailings storage facilities

Plant and tailings storage facilities are established on site.

## 5.12 Sufficiency of Surface rights

The existing nickel mineral rights sufficiently cover the extents of the deposit mineralisation and planned life of mining operations and processing facilities. FQMA has full rights to mine on the detailed mining tenements (Item 4.3). There are currently no approvals in place for mining operations across the Shoemaker-Levy North and Nindilbillup deposits.

# Item 6 HISTORY

## 6.1 Prior exploration and mining

Exploration in the vicinity of the RNO deposits occurred in three distinct periods, prior to 1995, 1996 to 2009 and after 2009. Only limited work was done prior to 1995.

### 6.1.1 1960 to 1995

The first known exploration in the area occurred in the early 1960s when Pickands Mather International Limited (PMI) conducted stream sediment sample over the Ravensthorpe Greenstone Belt. Anomalous Ni and Cu values led to further soil sampling and Reverse Circulation ("RC") drilling which identified the presence of nickel sulphide and nickel laterite mineralisation.

Western Mining Corporation Limited (WMC) farmed into PMI's Ravensthorpe properties in 1975 and undertook RC and diamond drilling targeting nickel sulphide mineralisation. WMC also undertook surface mapping and regional aeromagnetics surveys.

Limited exploration work was undertaken in the period 1985 to 1995 and was mostly limited to assessing work undertaken by WMC and PMI.

### 6.1.2 1996 to 2009

In 1997 Greenstone Resources NL (Greenstone) drilled the Nindilbillup deposit using a grid of 102 rotary air blast ("RAB") and 13 Aircore ("AC") holes.

In November 1998 Anaconda Nickel (Anaconda) undertook a first pass RC programme at the Shoemaker-Levy North deposit involving 42 holes drilled on a 400 mN by 200 mE grid totalling 1,304 m (Comet, 1999).

In October 1996 Comet Resources Limited (Comet) entered into an option agreement with a prospecting syndicate (Messrs Ellis, Lipple and Wadley) that held the RNO tenements over the Halleys, Hale-Bopp and Shoemaker-Levy deposits at that time. Drilling started in 1997 and continued through to 2003 (BHP, 2003).

In May 2000 Comet and QNI Pty Ltd (BHP's Nickel Division) completed a joint venture agreement resulting in the formation of Ravensthorpe Nickel Operations Pty Ltd. In June 2001 BHP merged with Billiton and became BHP Billiton. The same year Comet sold its interest to BHP Billiton giving them 100% ownership of the operation.

In 2002 RNO acquired the Anaconda Shoemaker-Levy North tenements and secured exclusive nickel laterite rights over the Nindilbillup deposit. In 2002 RNO drilled 42 RC holes (1267 m) over the Shoemaker-Levy North deposit in a programme designed to complement the existing Anaconda RC Drilling. In the same year RNO also drilled the Nindilbillup deposit (Comet, 1999) involving 57 RC holes for 1452 m. The programme was designed to twin the older Greenstone drilling.

In 2002 RNO started its definitive feasibility study. The RNO started trial mining at Halley's in August 2002 stockpiling some 111,000 tonnes of laterite ore. The BHP Billiton Board gave final approval for the operation in 2004. By 2007 the construction work was completed and the operation produced its first nickel product in October 2007. Operations were suspended indefinitely in 2009 pending a review of operations due to a combination of low nickel prices and processing difficulties.

### 6.1.3 2010 to 2021

RNO was purchased by FQM in February 2010 as a decommissioned operation. RNO restarted mining and processing in late 2011 after an extensive refit of the processing plant and associated infrastructure costing about $550 million US. Processing continued until August 2017 when FQM placed the operation on care and maintenance due to low nickel prices.

In April 2019 RC drilling was restarted at the Shoemaker-Levy targeting a south-east portion of the deposit.

In July 2019 FQM announced its intention to restart the operation in the first quarter of 2020. Mining restarted in February 2020 at Halleys and Hale-Bopp, the processing plant was restarted in April 2020.

In mid-2020, earthworks was started at Shoemaker-Levy in order to:

- Support the completion of a conveyor linking the RNO Plant and the Shoemaker-Levy deposit.
- Support the completion of mine infrastructure.

Mining and stockpiling of ore from Shoemaker-Levy started in mid-2021.

## 6.2 Previous Mineral Resource and Mineral Reserve estimates

The most recent Mineral Resource and Mineral Reserve estimates were prepared by RNO in accordance with the CIM Definition Standards on Mineral Resources and Mineral Reserves in 2012. The Mineral Resources were published in the RNO NI43-101 Technical report on the 31st of December 2012 (RNO, 2012).

The 2012 Mineral Resource and Mineral Reserve estimates are now superseded (refer Item 14 and 15).

There are no historic Mineral Resources or Mineral Reserves to report in this section.

## 6.3 Production from the property

Since restarting the operation, in the period February 2020 to December 31st, 2021, RNO mined 14.95 million tonnes of ore from the Halleys, Hale-Bopp and Shoemaker-Levy deposits at an average head grade of 0.63% Ni. During 2021, RNO was mining on average 650 thousand tonnes of ore per month with at least 6 months over 800 thousand tonnes of ore per month. To date a strip ratio of 1.3 has been achieved which is slightly higher than the planned long term ratio of 1 due to initial waste pre-stripping at Shoemaker-Levy.

Over this period (2020-2021), 127 thousand tonnes of MHP has been produced with a metal content of around 23% nickel and 0.9% cobalt. The restart was undertaken with ore principally sourced from the Hale-Bopp deposit. As a result, planned beneficiation upgrades were lower and impacted this production. Following the move to Shoemaker-Levy in late 2021, upgrade performance in the beneficiation plant was restored to planned expectations with consequential improvement in production levels. Recovery achieved during 2020 and 2021 equated to circa 79.4% for Nickel and 82.2% for Cobalt.

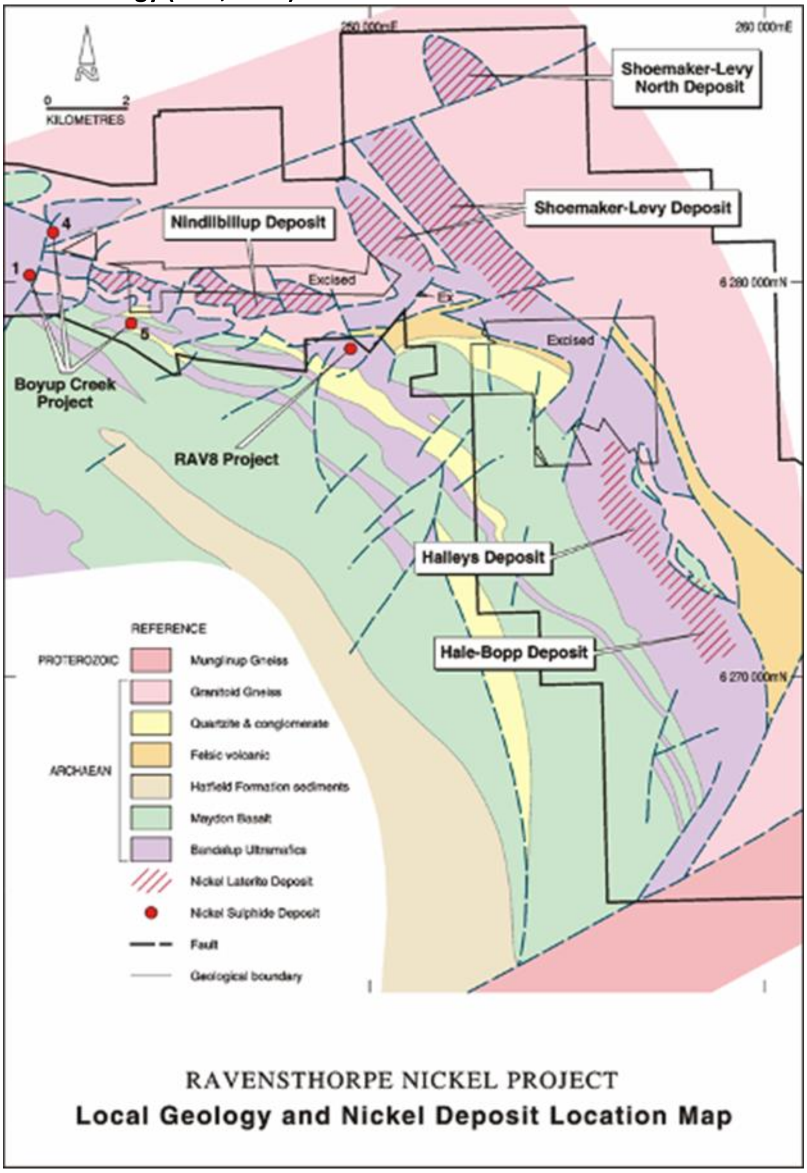
# Item 7 GEOLOGICAL SETTING AND MINERALISATION

## 7.1 Regional geology

RNO is located in the south-east corner of the Archaean Yilgarn craton. The Yilgarn Craton is composed of Archean granitoid gneisses that are interbedded with extensive belts of metamorphosed sedimentary and volcanic rocks.

The RNO deposits sit on the eastern margin of the Ravensthorpe greenstone belt with the nickel laterite deposits forming over a sequence of north-west-trending ultramafic rocks (Bandalup Ultramafics). Figure 7-1 shows the location of 5 RNO deposits and the immediate geology of the area.

**Figure 7-1 RNO Local Geology (BHP, 2003)**




To the south of the Hale-Bopp deposit the mineralised sequenced becomes increasingly thin until truncated by the north-east trending Jerdacuttup fault. North of Halleys the laterite becomes rapidly stripped down to bedrock. At this point the ultramafic sequence bifurcates trending to the west as two split ultramafic units separated by metasediments and to the north-west.

In the western area the Nindilbillup deposit is hosted by the northern ultramafic limb while the southern ultramafic limb is host to several nickel sulphide deposits. The sulphide mineralisation lies on tenements not held by RNO.

The north-west split is host to the Shoemaker-Levy and Shoemaker-Levy North deposits. The Shoemaker-Levy and Shoemaker-Levy North deposits are the results of the dextral north-east trending fault offsetting the northern tip of an originally contiguous zone of ultramafic strata by approximately 2.5 km. The mineralisation in the northern tip of the Shoemaker-Levy North deposit (based on current drilling) becomes increasingly discontinuous and starts to pinch out against the granite.

## 7.2 Local Geology

The Bandalup Ultramafics dominate the RNO area with a strike length of approximately 45 km and are typically between 500 m to 3000 m wide. The host rocks are comprised of a serpentinised (greenschist facies metamorphism) komatiite complex with rare interflow sedimentary units; the primary ultramafic rock was dunitic in composition. The serpentinite typically exhibits pseudomorphs of mesocumulate to adcumulate olivine textures and secondary magnetite. The sequence has been altered in areas with overprinting carbonate rich rocks, mostly in the saprolite. The serpentinite sequence dips at about 50 degrees to the west. The Bandalup sequence is in turn bound by:

- Metabasalt and metadolerite members of the Maydon basalt; and
- Gneissic granitoids of monzogranodiorite to granodiorite composition.

The Shoemaker-Levy and Hale-Bopp Archean strata have been intruded by a series of stacked typically north-east trending sub-vertical Proterozoic dolerite dykes. The dykes are often associated with faulting. Late stage cross cutting dykes are evident at some of the other deposits but not to the same extent.

The Hale-Bopp and to a lesser extent Shoemaker-Levy deposits are also cut in places by narrow discrete talc dominated shear zones typically associated with faulting.

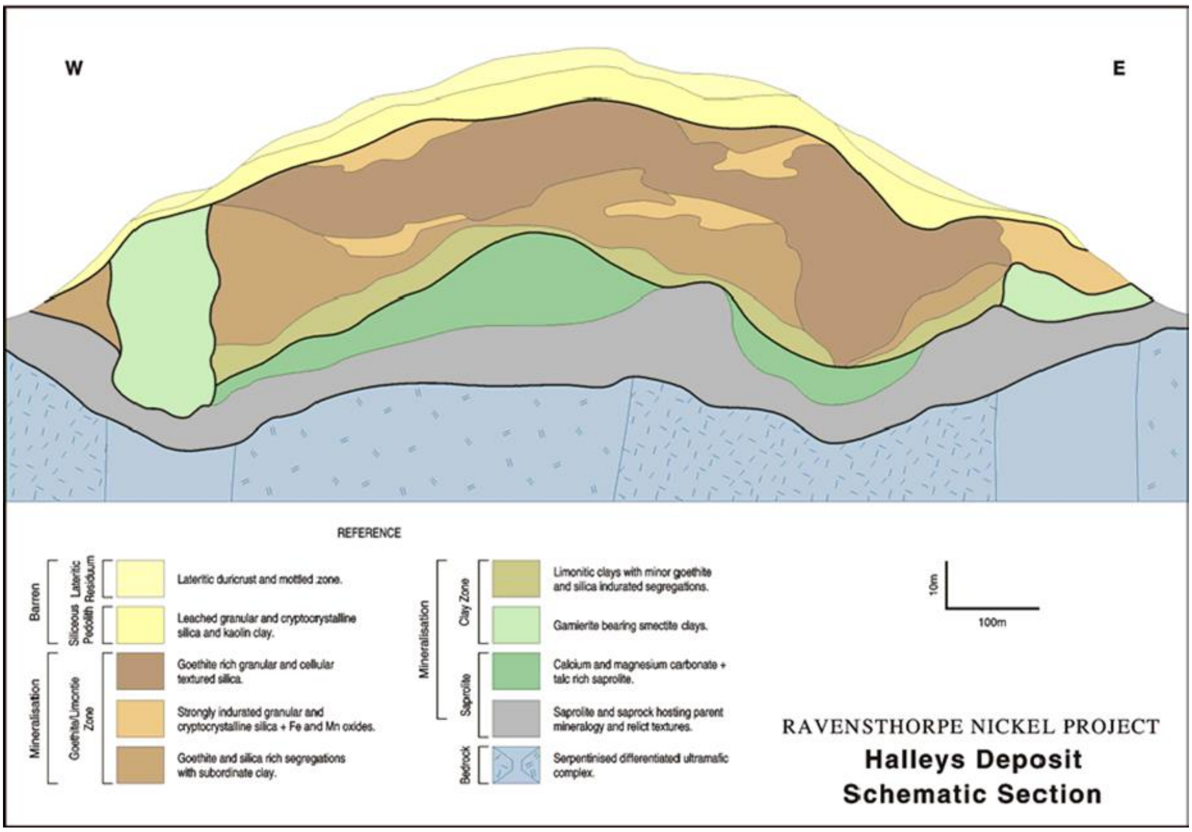
## 7.3 Ravensthorpe Nickel Laterite Mineralisation

The RNO Nickel laterite deposits are residual products formed by the pervasive weathering of Bandalup serpentinite rocks during the Cretaceous period (wet humid climate). The weathering/leaching process has resulted in horizontally defined deposits with four typical layers being overburden, limonite and saprolite developed over altered/weathered saprolitic rock (saprock) grading to bedrock. The degree of layer development and the extent of any transition zones are dependent on the local conditions and may be influenced by geochemical characteristics of the protolith. At RNO the laterisation process stopped as the climate started to become increasingly arid in the Tertiary period after which the laterite became eroded and covered in transported sediments. This is why the overburden layer is largely barren in terms of Ni content.

The weathering results in a volume reduction of the rock mass as Mg, Si and other soluble components are removed (primary minerals are replaced by more stable secondary phases). The limonite layer is composed predominantly of iron oxides that are the residual product of the laterisation of ultramafic/serpentinite rocks. Nickel is usually leached from olivine or its metamorphosed derivative, serpentine and is concentrated in the form of nickel silicates and or in iron and manganese oxides. Some Ni is hosted in green smectite clays however this style of mineralisation makes up only a few percent of the total number of drilled metres at RNO.

The background concentration of Ni in the RNO serpentinite typically ranges from about 0.1 to 0.4 %. The Mg content of unweathered serpentinite is typically in excess of about 16%. The low level of aluminium-bearing minerals (particularly pyroxene) in the primary dunite has resulted in a laterite that is generally low in aluminium at depth. Shear zones, dykes and the surface caprock layer however all contain relative higher levels of Al. A schematic profile through the RNO Halleys Ni laterite deposit is shown in Figure 7-2.

**Figure 7-2 Schematic Section, Halleys Laterite Profile (BHP, 2003)**




## 7.4 Nickel and cobalt mineralisation

The majority of the nickel mineralisation at RNO is hosted in the Limonite and the upper portions of the saprolite layer. Nickel and cobalt react differently to the laterisation process and as such are often not coincident. During the weathering process Ni will tend to migrate down the profile while cobalt will often tend to precipitate out due to changes to the oxidation state (redox boundary's) with depth often in association with accumulations of manganese in minerals like asbolane.

During the weathering process the cumulate texture of the original olivine minerals is well preserved. The presence of this cumulate texture in the Bandalup ultramafics and its partial preservation in the regolith is very important to the beneficiation success of the deposits at RNO. As serpentine has broken down in the weathering process, silica released has precipitated pseudomorphing the cumulate olivine boundaries provided thus preserving the cumulate texture. This silica lattice is generally low in nickel, while the fine minerals within the relict olivine crystal boundaries (mostly Fe oxides) contain the bulk of the nickel mineralisation. The physical difference between fine, nickel-bearing minerals and coarse, hard nickel-poor silica rich minerals means the ore can be upgraded by a process of washing and screening known as beneficiation (see Item 17).

# Item 8 DEPOSIT TYPE

The RNO deposits are characteristic of nickel laterite deposits formed in tropical conditions (high rainfall and warm temperatures) of weathered and serpentinised olivine rich ultramafic rocks over long periods of time (greater than 1 million years - Golichtly, 1981). The high rain fall and warm temperatures increase the kinetics of the weathering process. The primary Ni content of these rocks is typically between 0.2 and 0.4%.

Nickel is usually leached from the olivine (easily weathered and the main source of nickel and cobalt) or its metamorphosed derivative, serpentine and is typically concentrated in the form of nickel silicates and in iron and manganese oxides (Edwards and Atkinson, 1986).

About 85% of the world's nickel laterite deposits are located in accretionary terrains, developed in the weathered mantle of obducted Miocene and Pliocene ophiolite sequences (Brand et al, 1998). The remaining 15% of known nickel laterite resources are located in stable cratonic platforms developed over komatiitic ultramafic rocks.

## 8.1 Laterite chemistry

The weathering processes result in the breakdown of primary minerals and the release of some of their chemical components into the groundwater. Some elements are transported out of the local environment while others are concentrated by the weathering process as described below:

- Soluble elements such as Ca, Si and Mg are leached from the local system (At RNO Ca has been deposited back over the mineralisation).
- Some elements, notably Ni, Co, Mn, Zn and Y (yttrium) are secondarily enriched.
- Some elements are residually concentrated (Fe, Cr, Al, Ti, Zr and Cu).
- The result of this weathering process is:
- New minerals are formed which are stable in an oxidizing environment.
- The production of a stratified profile containing a number of distinct horizons of different chemistry and mineralogy overlying the parent (basement) rocks.

## 8.2 Laterite Profile

The laterite profile from the top down consists of 5 broad zones:

- Either colluvium or ferricrete (iron cap) at the top (at RNO this layer has been largely eroded away);
- A limonite or ferruginous layer comprised primarily of goethite and a few residual mineral/rock fragments;
- A transitional zone of limonite and or smectite;
- Basal boulder saprolite transitional to weathered bedrock; and
- Fresh bedrock, typically serpentinite.

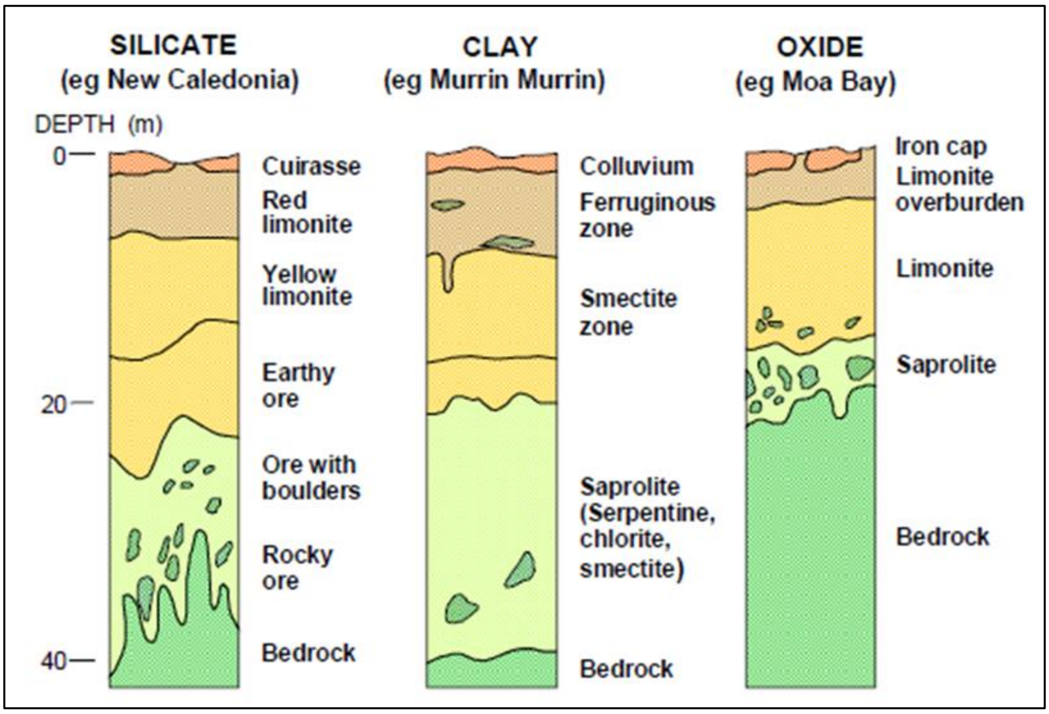
## 8.3 Laterite Classification

The following classification is taken from a 1998 paper by Brand, Butt and Elias and is based on the mineralogy of the main nickel host.

- Silicate nickel deposits, dominated by hydrated magnesium-nickel silicates (e.g. garnierite), generally occurring deep within the saprolite. New Caledonia is an example of this style of mineralization. This style of deposit is only formed in hot humid climates. Typically contain grades of between 2 and 3.0 % Ni. Some Silicate deposits such as New Caledonia can contain Ni grades which exceed 15%.

- Clay nickel deposits (dry laterites) dominated by smectitic clays (e.g. nontronite) commonly occurring in the upper saprolite or limonite zone. These deposits form in relatively less severe weathering conditions. Si is not leached and instead combines with Fe and Al to form clays. Examples of this style of deposit include Murrin Murrin and Bulong in Australia. Typically contain grades of between 1 % and 1.5 % Ni.
- Oxide deposits, dominated by iron oxy-hydroxides (e.g. goethite). Examples include Moa Bay in Cuba, Çaldağ in Turkey and RNO. This style of deposit can be formed under dry or humid conditions. Oxide deposits generally contain Ni grades of up to 1.6% Ni and are the most common of the three types.
- RNO is a type of Oxide deposit is formed over dunite which consists mostly of goethite with minor clay and abundant free silica in the form of veins and masses. The relatively limited presence of Al (limited pyroxene minerals in the primary host) means that there is much less clay development compared to other oxide deposits.

**Figure 8-1 Schematic comparison of the three main laterite profile types (Brand et al 1998)**



# Item 9 EXPLORATION

Other than drilling (discussed in Item 10 of this report) exploration in the RNO district on behalf of the current owners (FQML) has consisted of ground and airborne geophysical surveys conducted by Perth based contractors. The main surveys initiated by RNO since 2010 are summarised below.

## 9.1 2010 Ravensthorpe airborne EM survey

SkyTEM Surveys ApS flew an airborne time-domain electromagnetic ("EM") survey in 2010 over the three main deposit areas (Halleys, Hale-Bopp, and Shoemaker-Levy). The survey was intended to map the base of electrically conductive weathered regolith over resistive fresh basement rock, and thus the ultimate base of the laterite resource. Success was mixed, in that the transition from weathered to fresh rock is often gradual enough such that there is no clear boundary in the EM results. The conclusion was EM data did not have the spatial resolution to be used at a local scale.

## 9.2 2010 – 2012 Halleys and Shoemaker-Levy gravity surveys

In July 2010 Haines Surveys Pty Ltd ("Haines") undertook a ground-based gravity survey comprising 3004 stations over the northern half of the Halleys deposit area. In May 2012 Haines undertook a ground-based gravity survey comprising 7234 stations over the northern end of the Shoemaker-Levy deposit. Both surveys were collected at high resolution using a Scintrex CG5 gravimeter at a station spacing of 20 m on a square grid. The surveys were run to help delineate the deeper and shallower limonite/saprolite contacts by exploiting the significant density contrast between these regolith zones.

## 9.3 2015 Hale-Bopp magnetics survey

In May 2015 Resource Potentials Pty Ltd undertook a ground-based magnetics survey of the complete Hale-Bopp deposit area, using a Geonics G859 magnetometer with continuous integrated GPS measurements. This was the first survey of its kind at Hale-Bopp, and was used to identify structures that might influence weathering depth and associated regolith variations.

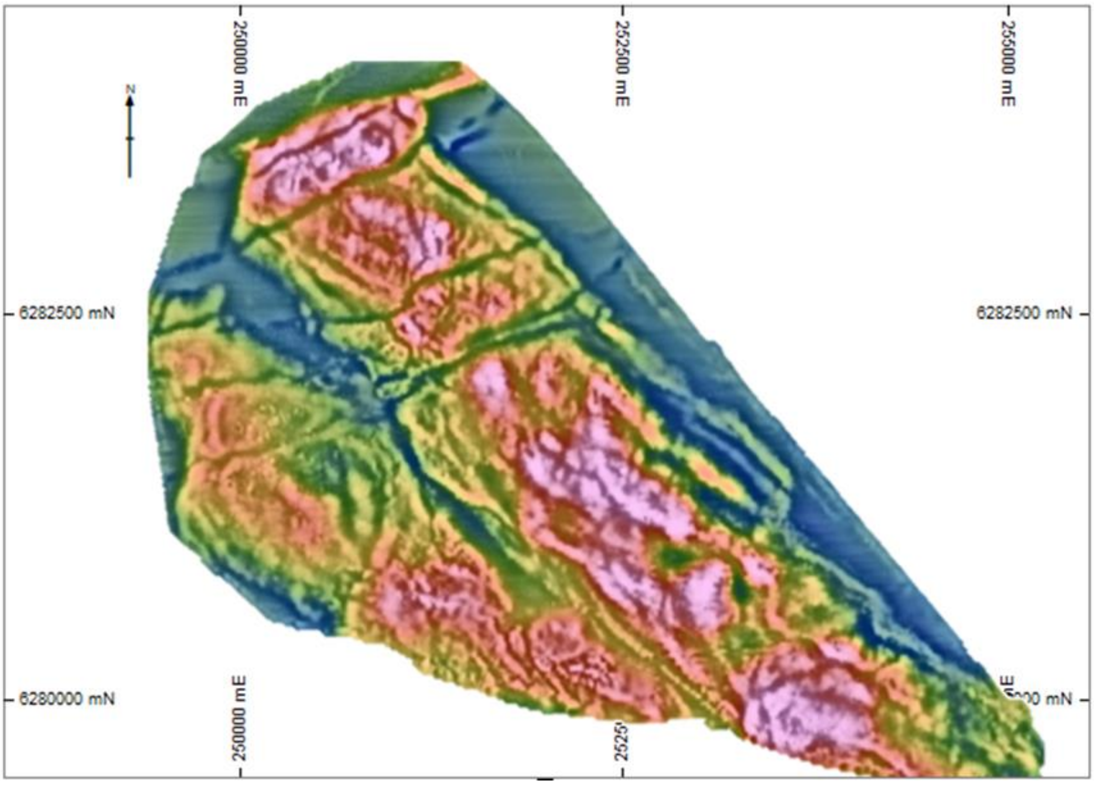
## 9.4 2019 Shoemaker-Levy magnetics survey

In November 2019 Ultramag Geophysics completed a high resolution UAV (unmanned aerial vehicle) magnetics survey of the entire Shoemaker-Levy deposit area, using a Geonics DroneMag™ magnetometer slung below a DJI Matrice 600 drone. This survey is a much higher-resolution replacement for an earlier fixed-wing survey flown for Comet in 1987 by Kevron Geophysics Pty. Ltd. The drone-based survey was flown at 25 m line spacing and 15 m sensor terrain clearance, providing maximum detail for the interpretation of structures, mafic dikes, and the extents of the ultramafic host rock via its fresh rock signal at depth. Mapping the ultramafic magnetic signature in plan view translates to mapping the likely potential extents of the laterite resource. An image showing the survey data is illustrated in Figure 9-1.

## 9.5 2019 Shoemaker-Levy Passive Seismic Survey

Throughout 2019 to 2021, selected drill lines in the southern portion of the Shoemaker-Levy deposit were tested using a ground-based passive seismic survey by FQM staff based in Perth. Three-component geophone measurements were processed as single stations using the horizontal to vertical spectral ratio (HVSR method), and compiled into sections along the drill lines. These surveys were conducted to determine the seismic shear velocity contrasts in the regolith, as well as to test the effectiveness of the HVSR method for defining the upper saprock contact. Through comparison with drillhole logs, the results appear to map this contact, but the accuracy away from drillholes is insufficient for use at the scale of mining.

**Figure 9-1 2019 Shoemaker-Levy Magnetics Survey**




## 9.6 2019 – 2021 Shoemaker-Levy ground penetrating radar surveys

Throughout 2019 to 2021, selected drill lines in the southern portion of the Shoemaker-Levy deposit were surveyed using ground penetrating radar (GPR) by FQM staff based in Perth, as part of a sponsored research and development effort to produce a new magnetic dipole GPR that could penetrate deeper below the surface. Results show that penetration is on the order of 10 – 15 m, sufficient to map the depth of caprock, but not sufficient to reach the limonite/saprolite boundary that was the ultimate objective of the trials.

## 9.7 2019 – 2021 Shoemaker downhole petrophysics surveys

As part of the results collected from the downhole geophysics campaigns at Shoemaker-Levy from 2019 onwards, susceptibility and inductive conductivity data was also collected along with the density data. Magnetic susceptibility is generally very low in the weathered regolith and did not prove useful except insofar as confirming the magnetic signature of mafic dikes as mapped by surface and airborne magnetics. Inductive conductivity results demonstrate that there is no mappable conductivity difference between limonite and saprolite, while at the same time highlighting discrete and continuous conductive zones within limonite. The significance of these zones is not currently understood.

## 9.8 Significant results

Apart from these surveys and drilling (described in Item 10), there has been no other exploration work completed on the property. Results from this work has had limited use apart from the 2019 magnetic surveys, which assisted in defining nickel laterite deposit limits and mafic dyke intrusions. The 2019-2021 downhole petrophysics data provided useful detail in support of density estimates.

# Item 10 DRILLING

Five types of drilling have been used to define and estimate the RNO nickel laterite deposits namely:

- RC drill holes for resource definition and grade control;
- Diamond core holes (DDH - PQ diameter, triple tube) principally for bulk density measurement, beneficiation test work and geotechnical studies;
- Large scale Calweld bucket rig holes (CALWELD) for collection of bulk samples for metallurgical test work;
- Minor AC drilling at the Halleys and Nindilbillup Deposit; and
- Minor Rotary Air Blast (RAB) drilling at the Nindilbillup deposit.

Of the various drilling methods used, approximately 99% of the drilled metres has been completed using RC drilling. All drilling has been completed using vertical holes which is common practice with nickel laterite deposits due to the sub-horizontal nature of most of the mineralisation. The summary drilling statistics for the five RNO deposits in terms of metres drilled is listed in Table 10-1.

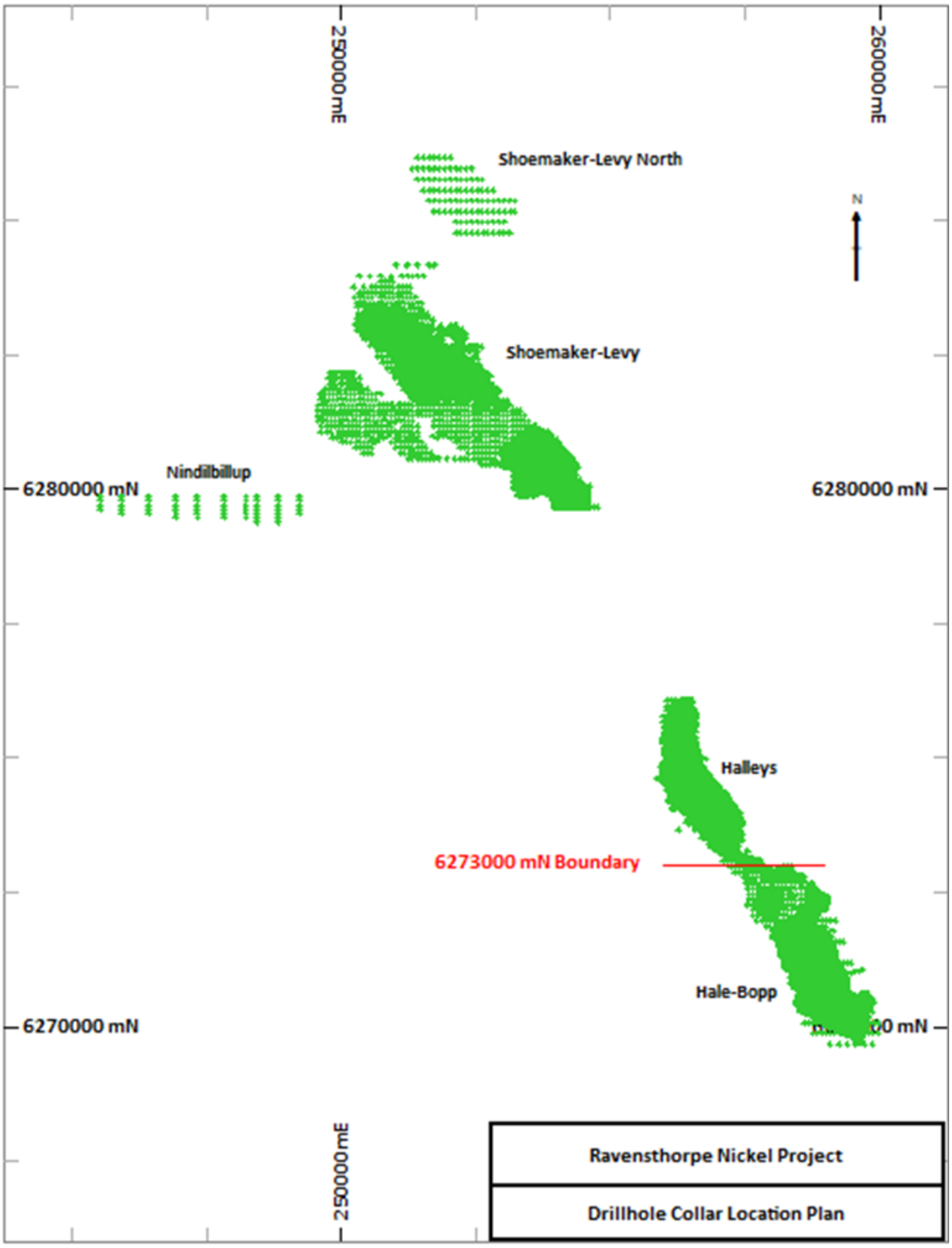
**Table 10-1 Ravensthorpe Drilling Statistics as of 31st December 2021**

| Deposit | Drilling Method | Number of holes | Metres Drilled (m) | Average Hole Depth (m) |
|---|---|---|---|---|
| Halleys | RC | 10,471 | 314,214 | 30 |
| | DDH | 4 | 210 | 53 |
| | CALWELD | 49 | 1,341 | 27 |
| | AC | 7 | 358 | 51 |
| Hale-Bopp | RC | 7,814 | 222,101 | 28 |
| | DDH | 59 | 1,518 | 26 |
| | CALWELD | 19 | 421 | 22 |
| Shoemaker-Levy | RC | 7,774 | 274,392 | 35 |
| | DDH | 60 | 2,082 | 35 |
| | CALWELD | 30 | 749 | 25 |
| Nindilbillup | RAB | 102 | 2,237 | 22 |
| | RC | 57 | 1,452 | 25 |
| | AC | 13 | 306 | 24 |
| Shoemaker-Levy North | RC | 100 | 3,261 | 33 |

Collar locations were surveyed by qualified surveyors using differential global positioning system survey equipment. The data is considered, accurate to within 15 cm in both horizontal and vertical directions. No downhole surveys were collected given that all holes were drilled vertically to shallow depths, (98% of the RC drilling has been completed to depths of less than 60 m).

A plan view of the drillhole collars is shown in Table 10-1.

**Figure 10-1 Collar Location Map (RC, DDH, CALWELD, RAB, AC) for Drilling up to December 2021**




## 10.1 RC drilling (1996 to 2021)

RC drilling has been conducted extensively at RNO largely from 1996 to the present day, all RC drilling was undertaken using face sampling hammer. RC drilling is undertaken in a staged approach starting with a large 80 mE by 100 mN grid for the initial Mineral Resource definition stage (define the limits of the mineralisation) down to 10 mE by 12.5 mN grid for grade control drilling purposes prior to mining. The drilling grids are summarised in Table 10-2. After the completion of each campaign of successive infill drilling, as the grids get smaller it gets easier to plan the required drillhole depths which in turn optimises the number of metres drilled.

**Table 10-2 RC Drilling Grids**

| Grid Dimensions | Primary Purpose |
|---|---|
| 80 mE by 100 mN | Mineral Resource Definition |
| 40 mE by 50 mN | Mineral Resource Definition/Mine Planning |
| 20 mE by 25 mN | Mine Planning/Grade Control |
| 10 mE by 12.5 mN | Grade Control |

The variations in the thickness and orientation of the mineralised horizons can be significant as is typical of these deposits, however the risk to mining and processing is largely mitigated by detailed grade control drilling (10 mE by 12.5 mN).

RC sampling was largely based on a 2 m interval while logging was undertaken using a 1 m interval. Sample lengths of less than 2 m were limited to the base of a few RC holes. RC drilling conducted in the late 1990s and early 2000s involved collecting the full coarse RC sample and riffle splitting the RC chips to produce a 2 to 3 kg sample that was subsequently stored in a numbered calico bag. The sampling method was subsequently changed to use a cone splitter to produce the 2 m composite directly from the Drilling rig into the Calico bag.

Particular attention is paid to minimising sample contamination. The cone splitter and cyclone are pulled apart and cleaned using a steel scrapper and compressed air when required, often at the end of every hole.

Drilling was conducted to keep the samples as dry as possible. While drilling (sampling) injecting water was avoided where possible, water was used when clearing the holes between each sample to condition the drillhole walls and reduce the amount of unconsolidated material collapsing into the hole. While ground water is intercepted in some of the drilling, the vast majority of the samples were dry.

RC sample recovery is variable which is not surprising given the relatively soft nature of the material being drilled. Analysis of grades from twinned 22 RC with DDH holes at Hale-Bopp and Shoemaker-Levy by Golder Associates Pty Ltd – now Golder Associates (Golder, 2001) in 2001 showed while some localised differences did exist there was no evidence of significant smearing or bias in the primary elements namely Ni, Co, Fe, Al, Mg and Ca. There was no correlation between RC sample weights and twinning precision.

## 10.2 Diamond drilling

### 10.2.1 1996 to 2003

Core drilling completed during this period was undertaken at all three of the main RNO deposits (Halleys, Hale-Bopp and Shoemaker-Levy) as part of the Feasibility Study which was completed in mid-2003 by BHP (See Item 6). The holes were collared in scattered locations across the full strike lengths of the deposits twinning selected RC drillholes. The core holes were drilled mainly to provide twinned grade and bulk density data.

Diamond drilling was completed typically using PQ triple tube coring; core recovery was good typically exceeding 90%. Core was logged (geologically and geotechnically), assessed for dry bulk density and then sampled based on a nominal 1 m interval. Diamond drilling samples were also sent to Ultratrace for analysis after completing the density assessment (BHP, 2003). The core samples were mostly bagged as 1m composites prior to dispatch to Ultratrace, a few 2 m composited from the Halleys deposit were also produced early in the drilling campaigns.

### 10.2.2 2015 and 2021

Two short campaigns of diamond drilling were undertaken at Hale-Bopp 2015 and Shoemaker-Levy 2021 primarily for the purposes of providing samples for metallurgical test work. Not all core was sampled and composites were collected for analysis using a nominal 3m Interval targeting the mineralised sections of core. The samples were logged and as part of the metallurgical test work multi-element chemistry analysis was undertaken. The purpose for both campaigns was to improve the understanding of how the mineralisation preforms when it is processed by the beneficiation plant. The drilling was sited to target areas planned for mining in the short to medium term.

There is no core recovery data for the 2015 drilling, in the case of the 2021 drilling the average recovery for the processed samples typically exceeded 90%.

## 10.3 Calweld Drilling (1997, 2000, 2002)

A Calweld drill rig was used to collect 98 bulk samples primarily for metallurgical test work by means of drilling wide diameter holes (0.9 m) with a toothed bucket assembly or coring barrel. The drilling was conducted by BHP on the Halleys, Hale-Bopp and Shoemaker-Levy deposits, the data collected was used as part of the 2003 Feasibility study.

The rig was able to penetrate most rock types although some drillholes were abandoned on encountering highly competent siliceous material. Samples were collected every 0.5 m and stored in bulka bags via a steel hopper. Scooping was used to collect a 2 m composite from each sample for multi-element analysis. These samples were composited over a 1m interval.

## 10.4 AC Drilling

Limited AC drilling was conducted at Halleys by RNO (1996 and 1998) and at Nindilbillup by Greenstone in 1997, it was not used at any other of the RNO deposits. There is no known documentation describing this work. It is likely that given parts of the mining sequence can be relatively hard, this aspect would have made this method unsuitable for ongoing use at RNO.

## 10.5 RAB Drilling

RAB was used at Nindilbillup by Greenstone as part of the initial testing of the deposit. This drilling method was not used at any other of the RNO deposits. There is no known documentation describing this work, based on the collars table hole numbering it appears Greenstone switched from AC to RAB drilling after initially drilling 13 AC holes.

# Item 11 SAMPLE PREPARATION, ANALYSES AND SECURITY

## 11.1 Geological Logging

RNO has a well established set of geology codes and logging procedures developed in the late 1990s which continue to be used to this day. The lithology coding aims to differentiate the major weathering zones of the ultramafic regolith as well as identifying the occurrence of secondary mafic and felsic rock types and structures (typically talc and chlorite shears). The presence of significant key mineralogical occurrences such as the presence of talc and or smectite which can impact on processing is also allowed for in the codes. A summary of the codes is presented in Figure 11-1.

**Figure 11-1 RNO Lithology Logging Codes**

| | | |
|---|---|---|
| SURFICIAL | QUD | Undifferentiated, unconsolidated surficial cover |
| | QCC | Calcrete |
| LATERITE | TPC | CAPROCK- Pisolitic duricrust |
| | TCG | CAPROCK- Nodular-fragmental-massive duricrust/mottled zone |
| | TSC | CAPROCK- Siliceous duricrust & leached silica + kaolin clay |
| | TSH | CAPROCK- Leached, cellular/honeycomb textured silica |
| | TLI | LIMONITE - Goethite – silica rich, w-m indurated, cellular laterite |
| | TSI | LIMONITE - Silica dominated, goethitic, s. indurated laterite |
| | TLC | LIMONITE - Goethite – silica segregations in sandy clay |
| | TCL | CLAY - Goethitic, w-m plastic clay |
| | TSM | CLAY - Smectite clay, m-s plastic ± garnierite |
| | TCS | CLAY – Saprolite, w-m plastic clay |
| | TAU | SAPROLITE – Clay (major) ± Fe ± Si altered saprolite |
| | TCB | SAPROLITE - Ca ± Mg carbonate rich saprolite |
| | TMS | SAPROLITE - Magnesite rich saprolite |
| | TSP | SAPROLITE – Serpentine rick sparolite |
| | TAM | MAFIC - Weathered clay & saprolite |
| | TFV | FELSIC - Weathered clay & saprolite |
| | TPG | PEGMATITE - Weathered clay & saprolite |
| | TFS | SEDIMENT - Weathered clay & saprolite |
| | TSZ | SHEAR ZONE – Talc rich |
| BEDROCK | AUM | ULTRAMAFIC - Undifferentiated ultramafic |
| | AUS | ULTRAMAFIC – Serpentinite |
| | AUD | ULTRAMAFIC – Dunite |
| | ABM | MAFIC – Basalt |
| | ADM | MAFIC – Dolerite |
| | AGB | MAFIC – Gabbro |
| | AFV | FELSIC - Undifferentiated felsic |
| | AFM | FELSIC - Felsic schist |
| | AGV | FELSIC - Granitoid |
| | APG | FELSIC – Pegmatite |
| | AFS | SEDIMENT - Undifferentiated sediment |
| | AGS | SEDIMENT - Graphitic shale/schist |
| | ASC | SEDIMENT – Chert |
| | ASZ | SHEAR ZONE – Chlorite rich |

**NS No Sample Return**
If no sample is returned record lithology code as NS

| QUANTIFIER | |
|---|---|
| AB | Asbestiform minerals |
| AT | Actinolite |
| BI | Biotite |
| CB | Calcium carbonate |
| CH | Chlorite |
| CR | Chromite |
| DO | Dolomite |
| GA | Garnierite |
| GO | Goethite/limonite |
| HE | Hematite |
| KA | Kaolinite |
| KF | K-feldspar |
| MI | Mica |
| MN | Manganese oxide |
| MS | Magnesite |
| MT | Magnetite |
| OL | Olivine |
| PL | Plagioclase |
| PY | Pyrite |
| QV | Quartz vein |
| SE | Sericite |
| SI | Silicified |
| SP | Serpentine |
| SU | Sulphide |
| TL | Talc |
| TR | Tremolite |

| FABRIC | |
|---|---|
| BD | Banded |
| BX | Brecciated |
| FO | Foliated |
| SH | Sheared |
| MA | Massive |
| HC | Honeycomb |

| COLOUR | |
|---|---|
| BK | Black |
| BL | Blue |
| BLGN | Blue green |
| BLGY | Blue grey |
| BR | Brown |
| BRBK | Brown black |
| BRGN | Brown green |
| BRPU | Brown purple |
| BU | Buff |
| DKBR | Dark brown |
| FA | Fawn |
| GN | Green |
| GNGY | Green grey |
| GY | Grey |
| GYMA | Grey mauve |
| GYRD | Grey red |
| KH | Khaki |
| LTBR | Light brown |
| LTGN | Light green |
| LTGY | Light grey |
| MA | Mauve |
| NS | No sample |
| OL | Olive |
| OLGN | Olive green |
| OLGY | Olive grey |
| PI | Pink |
| RD | Red |
| RDBR | Red brown |
| TA | Tan |
| WH | White |
| YLBR | Yellow brown |

Initially logging was recoded into computer based Microsoft Excel spreadsheets. At some stage after 2010 the procedure was changed to make use of ruggardised laptops running logging specific software (LogChief – geological logging and data management software).

All drilling types were logged using the same codes and a nominal 1 m interval to support direct comparisons between different twinned drillhole results. The following section briefly describes the logging procedure for RC samples (99% of all the metres drilled).

The various RNO drilling databases are managed using database management software (DataShed).

### 11.1.1 RC Logging Procedure

The coarse rejects from the RC drilling are typically placed in piles (one pile per metre) in rows of 10 working from left to right (like reading a book). A cleared area near the cyclone is selected for this purpose.

Each spoil piles is later logged by an RNO geologist as follows:

- A hand full of chips is placed in a kitchen sieve and washed in water.

- The sieved sample if logged for lithology, colour, the presence of carbonates, magnetism and the plasticity of the sample. In the initial broad spaced drilling campaigns chip trays are used to preserve a small sample from each interval.
- The information is typed directly into the logging software. The pre-set calico bag sample numbers are also assigned to the database during this step.

An example of a logging laptop and associated equipment is shown in Figure 11-2.

**Figure 11-2 Ruggedised Laptop, Sieves and Logging Chip Trays for One Drillhole (2019)**

## 11.2 Density Measurement

Density data used in compiling the final models was been derived from two sources namely core measurements and downhole geophysics measurements (Shoemaker-Levy only). The methods are described in the following sections; all final density values represent dry bulk density values.

It was not possible to run direct comparisons between the two methods as the old pre 2003 hole collars have long since collapsed. Global comparisons based on the model domains have shown the results to be very similar.

### 11.2.1 Core Drilling

BHP as part of the 2003 feasibility study collected density information from all the core drilling across the three main deposits. After trialing different core based density determination methods it was concluded the most suitable approach was the Caliper method. The Qualified Person agrees with this decision.

The caliper method works by:

- Selecting core intervals (triple tube PQ Core) analysis and cleaning the core of mud and or debris, a nominal 1 m sample interval; was used for this study.
- Caliper measurements are collected for every 10 cm for each interval to be measured.
- The core is dried and weighed.

The final dry density is then calculated using the formula listed in Figure 11-3:

**Figure 11-3 Dry Bulk Density Caliper Method Formula**

$$V = \pi \times \left(\frac{corediameter}{2}\right)^2 \times corelength$$

$$\rho_d = \frac{M_s}{V}$$

(V=volume of sample, $M_s$=dry mass of sample, $\rho_d$ = dry bulk density)

A total of 1,327 samples were measured this way. Almost all the data came from laterite intercepts with very little information for the various intrusives. A breakdown of the measurements is given in Table 11-1.

**Table 11-1 BHP Core Based (Caliper Method) Density Data by deposit**

| | Deposit | | |
|---|---|---|---|
| | Halleys | Hale-Bopp | Shoemaker-Levy |
| Measurements | 576 | 282 | 469 |

### 11.2.2 Limonite density check - pitting

In July 2020 a pitting based density programme was run in the Hale-Bopp pit targeting the limonite material (RNO, 2020a, RNO, 2020b). Limonite was selected as:

- It is the main mineralisation host.
- Obtaining density data from limonite strata using conventional diamond coring methods can be problematic given the material is relatively soft and prone to core loss. In other words the risk is the core based mean density result may under call the true mean density value.

A series of 300 mm by 300 mm by 200 mm pits (approximately 20 to 25 kg) were excavated and the material dried and weighed (dry mass). The pits were excavated using a combination of electric breaker drills and hand tools. An example pit is shown in Figure 11-4.

**Figure 11-4 Density Sampling Pit (Hale-Bopp Mine) – (300 mm by 300 mm by 200 mm)**

The excavated material was collected in buckets and the pits were then backfilled with sand of a known density to determine the volume. The samples were dried in an oven overnight prior to determining the dry mass. This mass was used in conjunction with the corresponding sand volume to calculate a dry density for each pit.

A total of 33 Hale-Bopp limonite pit density samples yielded a mean dry bulk density of 1.47 t/m. This result is similar to the corresponding core based Hale-Bopp limonite density value of 1.44 t/m albeit slightly higher.

### 11.2.3 Downhole Geophysics

Perth based geophysical contractors, Wireline Services Group ("WSG") were employed to undertake downhole geophysical logging campaigns as part of the 2019, 2020, and 2021 drilling programmes at Shoemaker-Levy. Drillholes were logged based on a nominal 80 mE by 100 mN spacing in order to achieve a broad coverage of the drilled areas. An image of the 4 wheel drive mounted unit taken in 2019 is shown in Figure 11-5.

**Figure 11-5 2019 Downhole Geophysics Logging**


A 3 m long probe containing a source and several detectors is lowered to about 1 m above the base of the drillhole and then slowly raised to the surface. As the probe is winched to the surface density data from the surrounding strata is collected and conveyed by cable to a computer stored in the car. The density component of the downhole probe works by using a radioactive source (caesium 137) located at the bottom of the probe to emit gamma rays into the surrounding strata while separate detector(s) located at the top of the probe measures the number of gamma rays that are scattered back. The amount of back scattered gamma radiation measured by the probe is inversely proportional to the bulk density of the surrounding strata. Software is used to convert the detector signals into a corresponding in-situ wet bulk density values. Readings are typically collected every 10 cm down the drillhole. The radioactive source was selected to suite the relatively low densities of the rocks at RNO (the common alternative source used for downhole logging is Cobalt 60).

The downhole "wet" density data was composited to 2 m and corrected for in-situ moisture to yield a dry density using the conversion formula (Lipton and Horton, 2014) : Dry bulk density = in-situ bulk density * (1-moisture content (fraction)).

The moisture content of the corresponding RC samples from the geophysically logged holes is calculated using "in-situ" wet sample weights collected in the field with the corresponding dry sample weight returned by the laboratory (See section 11.5). Wet sample weights are collected for every 5$^{th}$ hole by weighing each sample as soon as possible after a hole is drilled. Samples affected by significant ground water or injected water are not weighed. Logged holes were selected based on the availability of moisture data. In cases where none was available mean moisture values derived from data coded with the resource model geology domains was used.

A calibration hole is selected and run multiple times during each campaign as a check on instrument drift. No issues have been identified in any of the campaigns.

## 11.3 Sample dispatch from site

The complete numbered calico sample bags were grouped in lots to 5 to 10 samples and placed in labelled heavy duty green plastic bags at the drilling site. Quality control samples (standards, blanks and duplicates) are also inserted into the sample stream at this stage.

The plastic bags are subsequently taken to the RNO warehouse and placed into plastic pallet boxes for dispatch to Perth. The supply of the pallet boxes and road transport to Perth is coordinated by RNO warehouse staff in consultation with the site geologists. No sample crushing or pulverising is undertaken at site. Sample dispatch documentation is used to record the samples numbers in each pallet box and track their progress in terms of transport and delivery to the Perth laboratory.

## 11.4 Laboratory

During the life of the operation all sample preparation and analysis has been undertaken by independent commercial third party laboratories based in Perth, Western Australia.

Since the late 1990s all sample analysis was undertaken by the UltraTrace Laboratory in Canning Vale, Perth. The laboratory has undergone several changes of ownership being purchased by Amdel Limited in 2007 who in turn were purchased by Bureau Veritas Minerals Pty Ltd (BV) in 2008. BV located at 58 Sorbonne Cresant, Canning Vale, Perth.

BV continued to be used for the analytical work up until early 2020. Briefly the ALS Perth Balcatta Laboratory was used for sample analysis from April to May 2020 before the all sample processing was moved to SGS Australia Pty Ltd (SGS). The SGS laboratory is located at 28 Reid Road Perth Airport WA 6105. The decision to change laboratories from BV to SGS in 2020 was due to slow sample turnaround times.

At various times in the early 2000's the Genalysis Pty Ltd and Analabs Pty Ltd laboratories in Perth were used to preform check assaying to validate the work of the primary laboratory.

The BV/UltraTrace and SGS laboratories are all registered with the National Association of Testing Authorities (NATA) and accredited to ISO 17025.

## 11.5 Sample Preparation

The bagged sample delivered from site are placed in racks which in turn are placed in drying ovens for about 12 hours at 105°. The samples are weighed both before and after the drying process and the weights are included in the returned laboratory analytical results.

The dry samples (2-5 kg each) are then crushed (Jaw Crusher) and pulverised (LM5 Ring Mill) to produce a pulverised sample (90% passing 75 µm). The laboratory monitors the pulverising stage by routinely checking a subset of samples by sieving analysis. About 100g is scooped into a labelled kraft envelope for analysis. The coarse reject is initially stored on site in Perth and later disposed of after few months.

## 11.6 Laboratory analytical methods

### 11.6.1 1996 to 2010

Samples were then subject to 4 acid digest with an inductively coupled plasma optical emission spectroscopy (ICPOES). The main suite of elements analysed using ICPOES consisted of 11 elements (Ni, Co, Mg, Fe, Al, As, Cu, Zn, Cr, Mn and Ca). Carbonate content was analysed using a 0.5 g charge and the total carbon (TC) method (based on a Leuco style furnace). The carbonate content is expressed as $CaCO_3$ using the C content and the stoichiometric factor of 8.33.

### 11.6.2 2010 to 2021

RNO switched to X-ray fluorescence spectroscopy (XRF) analysis from ICPOES towards the end of 2010. XRF has the advantage is it does not require sample dissolution (non-destructive method) which avoids issues with the incomplete dissolution of samples or the loss of silica during open vessel digestion. XRF is the preferred industry standard for the analysis of nickel laterite samples. There are no Si assay results for the pre 2010 drilling because of Si limitation associated with the ICPOES method.

A glass fused disc is prepared from the pulverised sample using lithium borate flux and 5% NaNO3. The disk is then subject to XRF analysis for Ni, Co, Fe, Si, Al, Ca, Mg, Mn, Zn, Cu, Cr, As and Cl. In addition to standard 13 element laterite suite, the samples were also analysed for total carbon using the same Leuco method used previously. The carbonate content is expressed as CaCO3 using the C content and the stoichiometric factor of 8.33. The As and Cl data is not used in the modelling.

SGS and BV used the same analytical methods. The only difference is the SGS carbonate content is calculated using a factor of 8.2364 not 8.33. Given the conversion is an approximation of the carbonate content the difference is not considered material by RNO.

## 11.7 Quality Control

Quality Control (QC) data (standards, blanks, coarse reject field duplicates and umpire sample analysis samples) has been collected routinely since each major phase of drilling was completed since the late 1990s. The data collected in the years 1996 to 2002 was subject to several independent reviews by Golder in 2001 and 2002. Since then, internal RNO company reports analysing the QC data have been compiled at various stages (RNO, 2017; RNO, 2019a; RNO 2019b; RNO, 2022a and RNO, 2022b).

Several other data reviews were conducted into the data quality between 1996 and 2003 but unfortunately the reports are no longer available.

Based on Database queries, the submission rates for RNO standards, blanks and duplicates up to the 31st of December 2021 during the life of the operation was 1 in 50, 1 in 100 and 1 in 20 respectively. Submission rates have varied and more recently the submission rate for standards, blanks and duplicates since 2019 to the present day has been 1:25.

### 11.7.1 Certified Reference Materials (CRMs)

Prior to 1999 internal Laboratory (UltraTrace) standards were analysed by RNO. These QC results were supplied by UltraTrace in the sample certificates as per common industry practice. In other words there were no independent RNO standards.

In 1999 two standards (RBS3 and RBS8) were prepared on behalf of RNO from one tonne of Halleys nickel laterite bulk drillhole samples. The material was prepared by Gannet Industries by crushing to a nominal –5 mm and homogenised in a drum mixer. The homogenised bulk sample was riffle split into one kilogram standards. The recommended value for each standard was derived by Geostats Pty Ltd (Geostats) following assaying by seven different laboratories. These two standards are in effect "coarse crush" standards, not the conventional pulverised sample style standard. The returned values will show more variation in the returned values than would be expected from a pulp style standard sample.

In 2007 six certified standards (HYS-06-01, HYS-06-0, HYS-06-03, HYS-06-04, HYS-06-05 and HYS-06-016) were prepared and purchased from Ore Research & Exploration Pty Ltd ("ORE") Victoria facility in 2007. Each standard was prepared by ORE using 6 batches of 50 kg samples of material collected and supplied by RNO staff from the bulk holes drilled for the definitive feasibility Study. ORE used 10 commercial laboratories located in both Australia and overseas in the certification process to establish the certified values and confidence limits.

The supplied standards were prepared using the following steps:

- Drying to constant mass at 105° C;
- Crushing and screening;
- Milling to 100% minus 3 microns;
- Homogenisation;
- Packaging into 10g or 20g lots in laminated foil pouches.

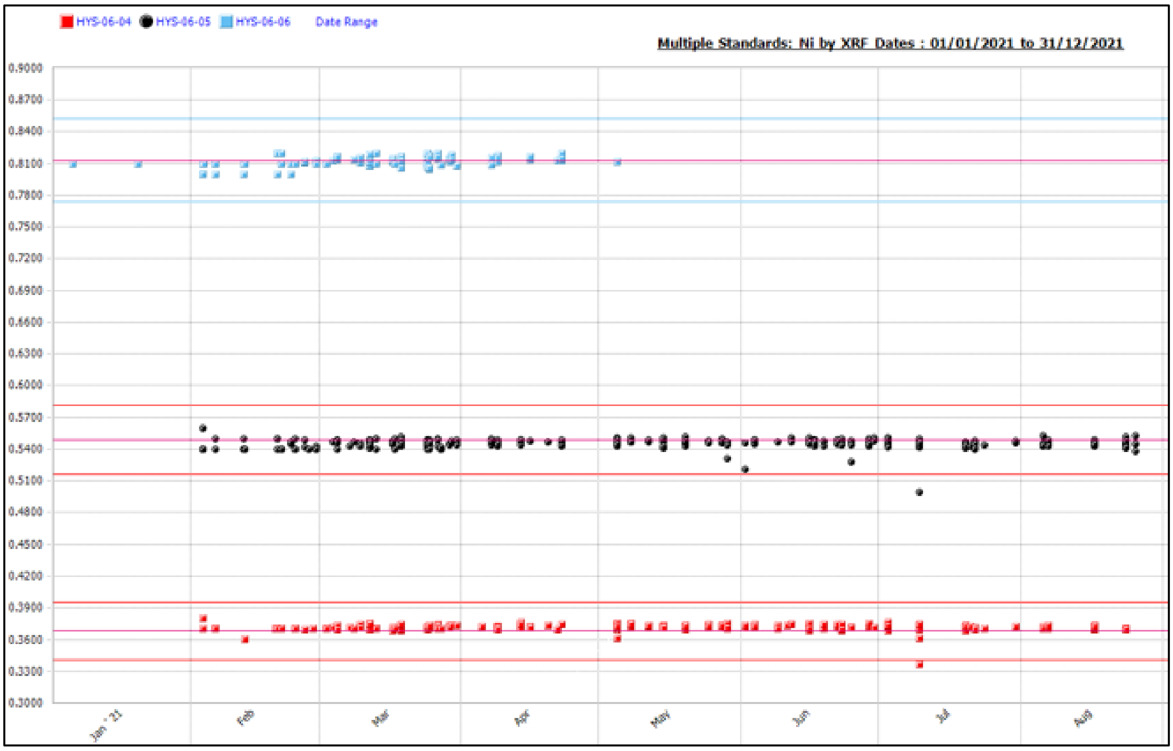
The 2007 series standards continued to be used up until late 2021 when the supply of most of the standards was exhausted. At this point 3 commercial Laterite standard samples purchased from Geostats in Perth started to be used namely GBM919-4, GBM310-5 AND GBM914-11.

Analysis of the standard results for the period 2010 to 2019 for the key elements (Ni, Co, Fe, Si, Al and Mg) yielded acceptable levels of accuracy and indicated that there were no material biases. The Golders 2001 and 2002 reports indicated satisfactory results were achieved for the UltraTrace and 1999 RNO standards.

Analysis of the standard results for the period 2020 to 2021 for the key elements (Ni, Co, Fe, Si, Al, Mg and Ca) yielded acceptable levels of accuracy and indicated that there were no material biases. Ni standard results in 2021 for HYS-06-04, 05 and 06 are shown in Figure 11-6.

The results from the SGS laboratory while acceptable are of a lower quality compared to the previous laboratory (BV). The BV data generally has better precision and accuracy, this concern has been communicated to site and SGS.

**Figure 11-6 Ni results for standards HYS-06-04, 05 and 06 in the 2021 drill programme**

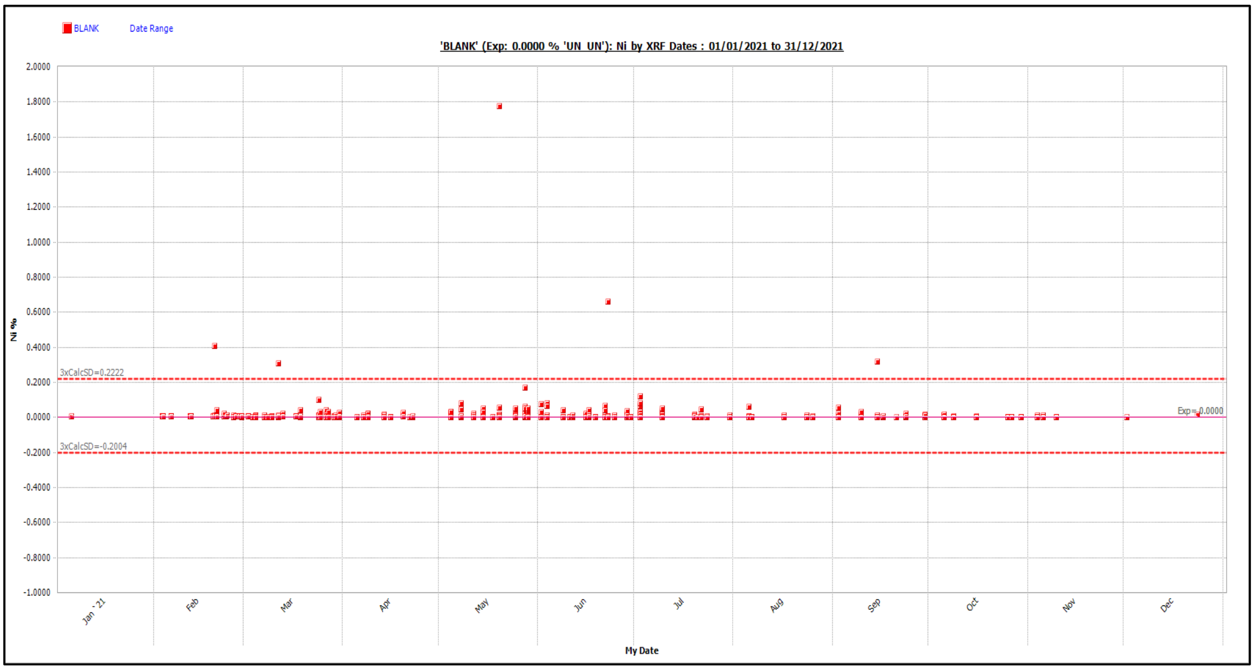



## 11.7.2 Blank samples

The routine submission of "blank" material into the RNO sample stream started around 2012, prior to 2012 only the Laboratory internal blanks data was available for analysis by RNO. The uncertified blank material consisted of crushed and screened limestone sourced from the nearby marun quarry. This is the same quarry which is used to supply the RNO plant with limestone. There are no known listed values for this material however, the RNO, 2017 report analysed the data from 2010 to 2014 and documented the results, as such approximate baseline concentrations are known. Given the nature of the blank material being used aside this "blank" will have trace levels of Ni and Co present but varying low percentages of the other elements being analysed. In particular relatively high concentrations of Ca, Mg and to a lesser extent Si should be expected making it of limited use in assessing for contamination for these elements.

Analysing the Limestone standard results for Ni, Co, Fe Si and Al indicated there were no significant contamination issues. Blank results from the 2021 drilling for Ni are shown in Figure 11-7.

Figure 11-7 Ni results for blank material in the 2021 drilling programmes




### 11.7.3 RC Duplicate samples

Field duplicate samples have been submitted since the first detailed drilling since the late 1990s. The samples were prepared by either re-splitting the coarse reject from rifle split samples or directly via cone splitters once they became available. The riffle split duplicates are not true field duplicates as they were collected as a secondary step by re-splitting coarse rejects but are still a valuable check.

Golders analysis pre 2002 duplicate (riffle split) indicated that generally good levels of precision were achieved for the key laterite elements (Ni, Co, Fe, Al, Ca, and Mg).

Analysis of the post 2010 duplicates (cone splitter) derived duplicate results indicated that generally average to good levels of precision were achieved for the key laterite elements (Ni, Co, Fe, Si, Al, and Mg). Analysis of duplicate Ca results was started in 2020, the levels of precision observed in the Ca data was moderate to poor.

### 11.7.4 Umpire samples (Inter-Laboratory Pulp Check Samples)

Several campaigns of check assaying were undertaken in 2001 and 2002 which involved selecting subsets of returned assays pulps from UltraTrace and resubmitting them to Analabs or Genalysis (Golder, 2001, 2002). The precision of the Ni Co, Fe, Al and Mg data was good. The precision of the Ca results was moderate but acceptable while the repeat of the Cr results was poor. The cause of the poor Cr results is not discussed by Golder.

## 11.8 Quality Assurance

The methodology used to collect drilling and logging data is described in detail in the BHP 2003 Feasibility report along with reference to multiple third party reviews. Detailed procedure documents whose origins probably dates back to BHP's involvement in the operation have been developed for all the tasks associated with drilling logging sampling and assaying. These standard operating procedure ("SOP") style documents are regularly updated by site. The Qualified Person reviewed and helped update these documents in 2019 when drilling was restarted at RNO.

## 11.9 Comments on sample preparation, security and analytical procedures

It is the opinion of Richard Sulway, who is a Qualified Person, that:

- The geological logging, sample security, collection, preparation and multi-element analysis undertaken at RNO is appropriate to the style of mineralisation and in line with industry standards.
- The collected dry density data is based on standard industry methods and is appropriate for the deposit type.

The quality control data collected over the life of the operation has not identified any major flaws. The sample values are believed to be representative of the prevailing mineralisation and are suitable for estimation purposes. RNO has a well-documented series of procedure documents governing site logging, sampling and sample processing procedures which are routinely updated.

# Item 12 DATA VERIFICATION

The RNO site has been visited by Richard Sulway and David Gray (Qualified Persons for the Mineral Resource estimate) on numerous occasions since 2017, the most recent visit having ocurred in December 2021. Mr Sulway and Mr Gray have made many visits to the operating mines, the plant and laboratory, and development areas being drilled. These site visits have been undertaken for a range of tasks including supervising RC and downhole geophysics logging and sampling programmes, updating SOP documentation, training site mine geology personnel and interviewing other RNO staff as part of internal technical studies.

The following verifications were undertaken:

- Collar coordinates from the Shoemaker-Levy drilling data were validated against the pre-mining topographic surface (see section 14.1.2). No discrepancies were noted.
- Field inspection of collaring and drilling activities were completed on a regular basis to verify the position and quality of drilling and sample handling practices. No issues were identified.
- The Database data was checked for:
  - Duplicate, overlapping or negative sample intervals
  - Duplicate or missing collar values
  - Negative grades (laboratory codes for missing or incomplete samples)
- Analytical methods and QAQC results were assessed and verified as suitable to assure assay accuracy and precision, with sufficient controls on contamination;
- The current analytical laboratory (SGS Perth) was visited in March 2021. Overall, laboratory practices were good, with secure sample handling and acceptable preparation and analysis.
- Logging and sampling procedures were verified against actual samples and found to reflect documented standards. Inconsistent chip logging practices were noted during 2020 RC drilling. These practices have since been rectified with staff training.
- Geology model interpretations were based upon integrated 3D data sets which served to verify the relative position of modelled geology surfaces.
- Bulk in-pit density test work was completed and verified historic diamond core density values for Limonite at Hale-Bopp.
- During 2021, 16 PQ diamond core holes were completed at Shoemaker-Levy in order to verify beneficiation performance metrics.

It is the opinion of the QP Richard Sulway that the drilling data used to compile the Mineral Resource estimates described in this report is of sufficient quality to adequately represent the in-situ mineralisation and so provides the basis for the conclusions and recommendations reached in this report.

# Item 13 MINERAL PROCESSING AND METALLURGICAL TESTING

## 13.1 Nature of test work

The RNO processing plant upgrades, extracts and purifies ore feed to produce a nickel and cobalt MHP. The steps to achieve this include crushing, wet scrubbing and classification (beneficiation) followed by HPAL and AL solvent extraction, partial acid neutralisation with CaCO3 from quarried limestone, counter current decantation, precipitation of impurities with further limestone and lime, and final hydroxide precipitation. The process is described in greater detail in Item 17.

Extraction of nickel from RNO's nickel laterite material is enhanced by its amenability to beneficiation. Beneficiation physically separates waste/gangue minerals from nickel-bearing minerals prior to leaching. Beneficiation of mined nickel mineralised tonnes increases product grades and decreases the mass. The regoliths different physical and chemical properties do affect beneficiation performance but the characteristic rock properties enable predictable beneficiation performance for different material types.

Metallurgical characteristics of the nickel laterite mineralisation have been extensively tested. Beneficiation and process test work has been completed at both bench and pilot plant scales, as well as confirmation from full scale plant operation. The Mineral Resource estimates use grade interpolation techniques of the mineralisation domains that are aligned with metallurgical material types and so, provides for more accurate predictions of beneficiated mass recoveries and ore grades of the product for leaching. The product grades and mass recoveries are used during conversion of Mineral Resources to Mineral Reserves. Particularly, beneficiation influences the rate of mining for meeting processing throughput requirements and for producing a viable metal product.

## 13.2 Beneficiation

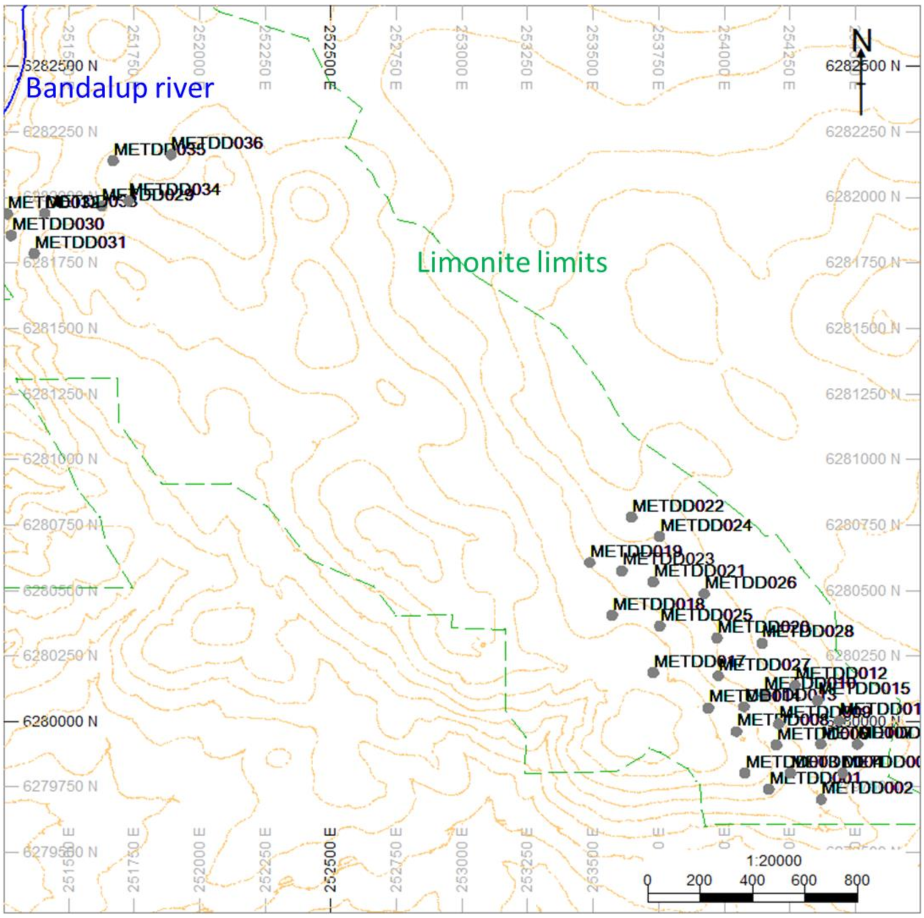
The RNO beneficiation process physically separates (scrubbing, screening and classification) the higher grade fine fraction of mineralisation (product) from coarser lower grade material (reject). Nickel is predominantly associated with very fine-grained iron hydroxide minerals in the limonite zone and the very fine-grained weathered nickel-magnesium silicates in the saprolite zone. Beneficiation may be affected by:

- Late stage silicification common in the near surface horizon;
- Fine kaolinite in upper limonite that beneficiates but has no mineralisation;
- Porcelaneous limonite which is rejected;
- Smectite clays which can inhibit beneficiation; and
- Lower saprock with strong bedrock textures that limit competency contrast between ore and gangue minerals.

### 13.2.1 Beneficiation test work and results

At Shoemaker-Levy, 36 diamond core holes were drilled to a PQ (83mm) core diameter in 2021. Holes were collared at surface and drilled through caprock, limonite, upper saprolite and lower saprolite and were terminated in the bedrock or fresh rock. These holes cover the initial 5 years of Shoemaker-Levy mining with further drilling and test work planned to progressively cover the remaining areas over time. Holes were drilled around 150m apart in order to provide reasonable coverage for accurate predictions of beneficiation variables (mass recovery and product upgrades) for mine planning.

**Figure 13-1 Plan view of the Diamond drilled holes used for beneficiation analysis at Shoemaker-Levy**




Drilled core was logged according to current RNO logging standards so as to correctly identify regolith geology. Three metre samples, that honour the regolith contacts, were marked up and submitted to the onsite laboratory where beneficiation analysis was completed per sample. A total of 303 samples were tested. The analysis method is summarised as follows:

- The full 3m length of core was weighed and crushed to a nominal 25mm crush size in a laboratory jaw crusher.
- The full sample was placed into a scrubber in batches of equal mass and water for around 4 minutes.
- The mixed slurry was passed through screens of 2mm and then 212µm. The collected sample was weighed, dried and analysed using XRF.
- Material passing 212µm was further agitated. 20% of this sample was wet sieved through 150µm, 106µm, 75µm, 53µm and 38µm screens. Samples were weighed, dried and analysed with XRF. Similarly, sample passing 38µm was decanted, weighed, dried and analysed with XRF.
- Remaining dried samples were marked and stored.

Analytical results were used to calculate the mass recovered at each size fraction as well as the corresponding product upgrades and recoveries. Nickel, cobalt, magnesium, iron, silica, aluminium, calcium were each analysed for and reported. Sample results were grouped into the key regolith domains of caprock, limonite, upper saprolite and lower saprolite. The results for limonite and upper saprolite have identified that the 150 µm to 106µm size fractions yield optimal results for the limonite and saprolite feeds. At 150µm, limonite material had an average mass recovery of 30% and a nickel upgrade of 2 times (i.e. the head grade doubles). Similarly, at 106µm, saprolite had an average mass recovery of 25% and a nickel upgrade of 2.25 times.

The data produced from the laboratory testwork program has been benchmarked against plant treatment of the Shoemaker-Levy ores, with a high degree of agreement in the outcomes. This provides confidence the laboratory testwork procedures effectively mimic the performance of the beneficiation plant.

The beneficiated products are leached through Pressure Leach (Limonite) and Pre Leach (Saprolite).

The laboratory leach testwork on both products equates well to plant results although individual Saprolite results tend to be more variable due to the less aggressive Pre Leach and the influence of the combined Atmospheric leach.

## 13.3 Factors affecting economic extraction

The limonite and saprolite ores contain varying concentrations of magnesium and or carbonate bearing minerals. The mining of the orebodies take this into account to ensure a balanced feed to the process plant. These two items influence both the temperature control and acid consumption through the leaching process which in turn can impact nickel recovery. The concentrations of these minerals in the plant feed is managed within a set of tolerance (operational envelope) to ensure consistency in the circuit operations.

# Item 14 MINERAL RESOURCE ESTIMATES

The Mineral Resource Estimates for the 5 deposits (Halleys, Hale-Bopp, Shoemaker-Levy, Nindilbillup and Shoemaker-Levy North) have been re-estimated in the period 2020 to 2021. The estimates were compiled by Richard Sulway (Consultant-Mine Geology), who is a contractor retained by RNO and the Qualified Person for the Mineral Resources component of this report. Mr David Gray of FQM (a Qualified Person) has acted as a supporting author. The current classified Measured and Indicated Mineral Resources are hosted by the Halleys, Hale-Bopp, and Shoemaker-Levy deposits. The Shoemaker-Levy deposit hosts approximately 80% of the Measured and Indicated Mineral Resources at RNO as of 31st December 2021 as the Halleys Deposit is almost mined out and the Hale-Bopp deposit has been extensively mined.

The 12 estimated grade fields are listed in Table 14-1. The the same suite of fields have been estimated in each of the previous models since the late 1990s with the exception of Si, which has been added to theis estimate.

**Table 14-1 Estimated grade attribute fields**

| Drilling/Model Field names (%) | Element/Compound (%) |
|---|---|
| NIPCT | Ni |
| COPCT | Co |
| FEPCT | Fe |
| ALPCT | Al |
| MGPCT | Mg |
| SIPCT | Si |
| CAPCT | Ca |
| CACO3PCT | $CaCO_3$ (calculated from the C content) |
| CRPCT | Cr |
| MNPCT | Mn |
| CUPCT | Cu |
| ZNPCT | Zn |

## 14.1 Data

The estimates cover the three mining areas (Halleys, Hale-Bopp and Shoemaker-Levy deposits) along with the early stage development studies, Nindilbillup and Shoemaker-Levy North.

### 14.1.1 Drilling Databases

Database exports for each of the 5 deposits were exported from the RNO database and saved as comma separated values ("CSV") text files. The csv tables consisted of collars, assays surveys and geology data in a relational database format. Additional csv exports also supplied included the Shoemaker-Levy downhole geophysics data and the BHP core based density data.

In terms of each estimate the CSV tables were imported into StudioRM ("Datamine") software and desurveyed (the sample tables were merged and the local grid coordinates were added to each sample interval). The drillhole collar coordinates are all based on the MGA 94 Zone 51 grid. The historic (pre 2003) BHP drilling was originally surveyed using the AMG 84 datum and was later converted to the MGA 94 grid system.

Along with visual checks of the drilling data validation routines were run as part of the Datamine desurvey process to identify any discrepancies such as duplicate or missing records, and no significant issues were identified.

### 14.1.2 Topographic Surveys

The Halleys, Hale-Bopp and Shoemaker-Levy topographic surfaces were originally surveyed by Kevron Pty Ltd on behalf of BHP in 1998. Up until mid-2017 when the mine was put on care and maintenance, depletion mining surfaces were routinely compiled by the mine surveyors by manually surveying the toes, crests and bench floors (spot heights) of the open pits. Since mining restarted in early 2020, the surface surveys have been derived using a drone (Wingtra WingtraOne) survey instrument to produce raster format 3D topography surfaces.

The original surveys for the Halleys, Hale-Bopp, and Shoemaker-Levy were supplied as Surpac format string files. The depletion surfaces for mining up to the 31st of December 2021 were supplied as DTM surfaces in Vulcan format.

There are no topographic surveys for the Shoemaker-Levy North or Nindilbillup deposits. As such, for these deposits surface topography wireframes (DTM surfaces) were generated from the surveyed drillhole collar elevations. These surveys were extrapolated 1000 m to support the Mineral Resource Modelling work. No mining has occurred at Nindilbillup or Shoemaker-Levy North.

All surfaces were converted to Datamine format for modelling purposes.

## 14.2 Geological Interpretation and horizon modelling approach

Since 2020, the geological interpretations have been revised for all 5 deposits and new Mineral Resource models compiled. The key reasons for undertaking the work was to:

- Incorporate drilling results from data collected since 2012, particularly in the Hale-Bopp and at Shoemaker-Levy deposit areas.
- Standardise the modelling methodology. The Nindilbillup and Shoemaker-Levy North deposits had not been modelled (estimated). The previous reported grades were based on a statistics analysis of the drillhole grades.
- The Halleys, Hale-Bopp and Shoemaker-Levy deposits were previously modelled on numerous occasions using methods from the 2003 feasibility study. The older methods while reasonable do not reflect the improved understanding of the RNO geology developed over the last 20 years.

### 14.2.1 Domain modelling methodology

The RNO deposit domains were interpreted based on the following observations:

- Understanding changes in chemistry as a function of depth and weathering is critical to delimiting mineralised zones. Four distinct regolith layers (weathered ultramafic) were delimited as a function of geological logging and assay data. A Ni and Mg depleted surface layer (Caprock), an underlying limonite and clay zone, an upper saprolite zone and finally a basement of lower saprolite grading to saprock.
- There are no distinctive spatial or statistical Ni trends such as inflexions in log probability plots which may be used to distinguish mineralised and unmineralised strata. While a distinct 0.22% threshold exists in the Ni distribution the two statistical populations overlap to such an extent that this threshold is of limited use in the modelling process. The 0.22% Ni threshold is largely driven by the change in Ni content from semi fresh serpentinite grading into lateritised (Ni enriched) strata. Ni in fresh serpentinite will largely not be recoverable.

- Changes in Mg concentration from the surface to basement strata (Mg content increases with depth) shows several distinct statistical breaks. These correlate which the observed logging changes as a function of depth. Both the logging and changes to Mg chemistry were used as a guide to model the ultramafic regolith profile. Changes in the Ni and Fe content as a function of depth were also used to guide the interpretation but to a lesser extent.
- Where intrusives (granites, dolerites, basalts and talc shears) were modelled they were set to stope out the mineralisation (i.e. intrusives take precedence). In terms of domains for estimation purposes, there is usually too little drilling information to model the weathering profile in these non-ultramafics. Instead they are treated as single domains regardless of weathering state. The only exception to this rule is the Caprock in most cases overprints any intrusives.
- The dolerite dykes typically cross-cut the laterite striking north-east (040° to 070°). The basalts occur along the outer edges of the deposits, parallel the deposit strike and often adjacent to granite bodies. Dolerites are sometimes mineralised while basalts are typically barren. Mineralised dolerites are the product of nickel leaching into the intrusive contacts from the surrounding ultramafic.
- The laterite and underlying ultramafic are typically wedged between granitoid bodies.
- A geo referenced tiff format image of the 2019 Shoemaker-Levy magnetics survey was used to aid interpreting the extents of the dolerites, basalts and granites along the outer limit of the drilled areas at Shoemaker-Levy. The resolution of the 2015 Hale-Bopp magnetics survey was found to be too coarse for effectively delimiting the intrusives.
- Smectite material is too patchy to support dedicated domains and as such it was modelled as part of the limonite.

## 14.3 RNO model domains

### 14.3.1 Geology domains descriptions

The grade thresholds and logging criteria/codes (See section Figure 11-1) used to domain the ultramafic based laterite profile and the secondary intrusives and talc shears are listed in Table 14-2.

**Table 14-2 Laterite Domain Criteria**

| Short Description | Logging and Grade Criteria |
|---|---|
| Non host rocks | Logged as granite (AFV, AGV, APG), dolerites and basalts (ABM, ADM) or talc shears (TSZ). The granites and basalts contain only trace amounts of Ni and are very low in Mg. |
| Caprock | Surface unconsolidated pale coloured sediments and silicified caprock depleted in Ni. Typically logged as QUD", "TPC", "TSC and "TSH" and to a lesser extent "CAP" and "TCG". Mg<0.5%, Fe<5%, Ni<0.20%, Al% >2% Scattered pods of material located just above the limonite contact are also mineralised. Occasionally, relatively thin (<4m) basalt flows are found at the base of the sediments (Shoemaker-Levy). |
| Limonite | Limonite logged as TLI, TSI, TLC and LIM. Typically Fe>7%, Mg<7%. The average Fe and Mg grades are about 14% and 2% respectively. Limonite is typically brown in colour |

| | |
|---|---|
| Upper Saprolite | Logged as Saprolite (TAU, TSP, TCB and TMS). The Mg content typically ranges between >=5% and < 11% and is about 7.5% on average. This is a statistically mixed domain marking the transition from limonite to saprock material. It is typically grey in colour. |
| Lower Saprolite | Saprolite grading into bedrock in some areas. Logged as both Saprolite (e.g. TCB, TMS) and bedrock (AUM, AUS). The Mg content is typically >=11% with the average Mg content being about 16%. The presence of mixed statistical domains is evident to the same extent as the Upper Saprolite domain. As the rocks become less weathered they often change from grey to green in colour. |

### 14.3.2 Domain Wireframes

The laterite regolith contacts were defined using DTM surfaces based on the criteria listed in Table 14-2. The surfaces were defined using manually digitised strings (sectional interpretations) aligned east-west along each of the drilling lines. A single perimeter was used with each set of strings (caprock, limonite, upper saprolite and lower saprolite) to define the outer limit of each DTM surface. The outer limit of the laterite mineralisation was clipped to 50 m beyond the last mineralised extent (about half the 80 mE by 100 mN resource definition drilling grid). The only exception to this convention are instances where the mineralisation is cut by barren basalt dykes and or granites.

The DTM surfaces were checked and adjusted where required to ensure the wireframes did not cross.

The dolerite and basalt dykes, granites and talc shears were all modelled using 3D wireframe solids. These wireframes were checked to ensure there were no cross overs or holes in the solids.

### 14.3.3 Geology domain fields

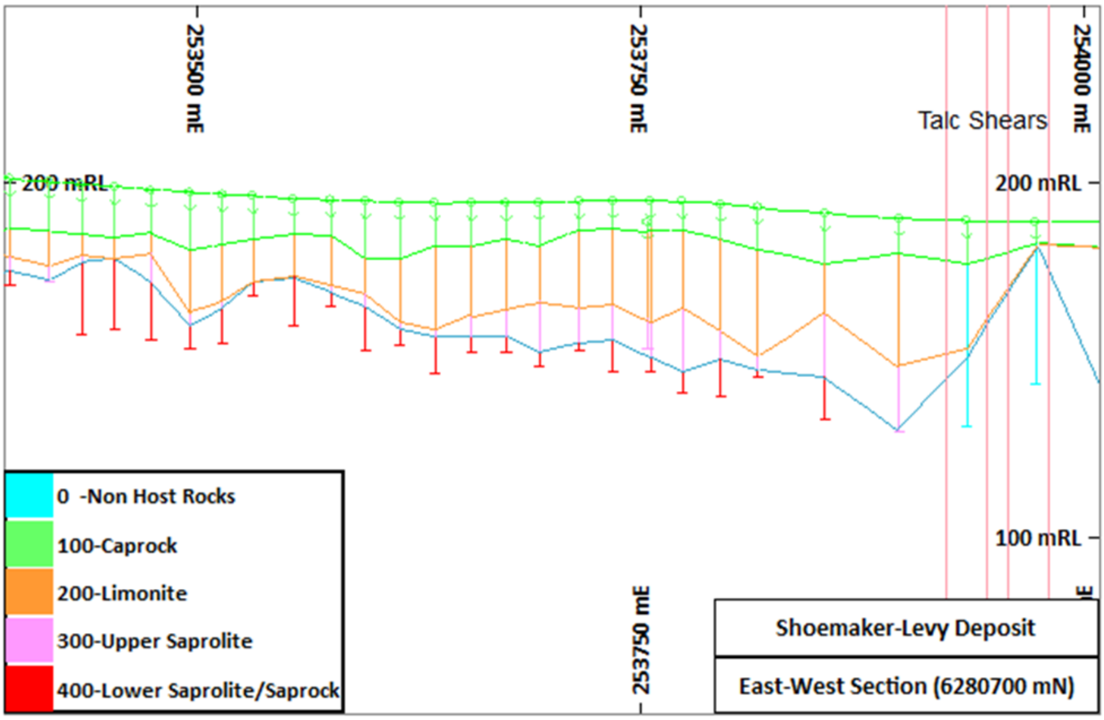
Two fields RGDOMAIN and RKCOMAIN were assigned to all five block models and the corresponding drillhole files in order to identify the different rock types for model modelling and grade estimation purposes. Once the models and drilling were coded they could be estimated and reported with no further need to reference the associated wireframes. The geology domain integer values are listed in Table 14-3.

**Table 14-3 Model geology domain fields**

| Description | RKDOMAIN (field value) | RGDOMAIN (field value) |
|---|---|---|
| Undifferentiated strata on the edge of the deposits | 0 | 0 |
| Caprock | 100 | 100 |
| Limonite | 100 | 200 |
| Upper Saprolite | 100 | 300 |
| Lower Saprolite | 100 | 400 |
| Dolerite | 10 | 0 and 100 |
| Basalt | 20 | 0 and 100 |
| Granite | 40 | 0 and 100 |
| Talc Shear | 50 | 0 and 100 |

An east-west section through the Shoemaker-Levy Drilling showing slices through the laterite and talc shear wireframes is shown in Figure 14-1. The drilling is colour coded on the RGDOMAIN field.

**Figure 14-1 Shoemaker-Levy east-west geology section (Wireframe Slices)**




### 14.3.4 Dolerite dyke DYKENUM field

While the granites and basalts are barren in terms of Ni, some of the dolerite dykes are mineralised and some were estimated. A field called DYKENUM was added to the dolerite dyke wireframe files and each individual solid (dyke) was allocated a unique number for later use in the estimation process.

### 14.3.5 Base of mineralisation (BASEMENT field)

Typically drilling is terminated approximately 6 m into the lower saprolite. While semi fresh serpentinite is sometimes found in the base of the drilling, this is rarely the case. To limit the extrapolation of the mineralisation at depth a base of drilling DTM surface was compiled for each of the deposits with the surfaces being extrapolated 500m in the XY plane for modelling purposes.

The base of drilling surfaces from each of the 5 deposits was lowered 6 m and used to code each model with a field called BASEMENT as described in Table 14-4. The BASEMENT=1 blocks are considered to be unmineralised from a planning and reporting point of view.

**Table 14-4 BASEMENT field values**

| BASEMENT (field name) | Description |
|---|---|
| 0 | Above the lowered BOH surface |
| 1 | Below the lowered BOH surface. |

The laterite (RGDOMAIN=400) blocks in this region (BASEMENT=1) were allocated mean grades for all 12 grade fields. The mean values used were compiled by taking the corresponding deposit composite drilling RGDOMAIN=400 drillhole sample data and filtering it to remove samples with Ni values >=0.3% Ni. 0.3% Ni is the reporting cut-off.

This change ensures the laterite mineralisation estimates (potential reported Mineral Resources) are not smeared well below the base of drilling i.e. there is a 6m vertical limit. The BASEMENT field is also used as part of the Mineral Resource classification process (see section 14.12).

### 14.3.6 Model Conservation Area domains (CONSERVE field)

There are a number of flora conservation areas at the Halleys and Hale-Bopp deposits where drilling and mining is not allowed (see section 5.4). These areas were flagged in the Halleys and Hale-Bopp model using a field called CONSERVE as listed in Table 14-5. None of the other three RNO deposits is impacted by conservation areas.

**Table 14-5 CONSERVE field values**

| CONSERVE (field name) | Description |
|---|---|
| 0 | No restrictions on Drilling and Mining |
| 1 | Conservation Area |

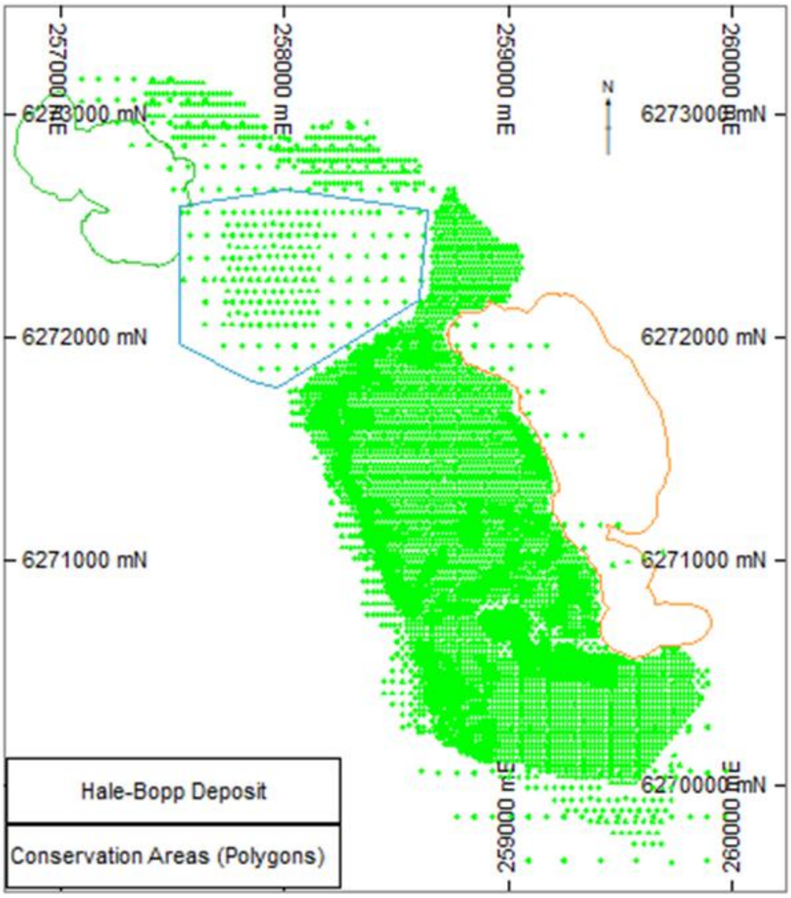
**Halleys**

A single conservation area at the far northern end of the Halleys deposits exists (Northern Conservation Area). The impact on the Mineral Resource is minor.

**Hale-Bopp**

There are three flora conservation areas at Hale-Bopp deposit where drilling and mining is not allowed. A plan view of the Hale-Bopp drillhole collars and perimeters defining the three conservation areas is shown in Figure 14-2. Note the drillhole collars located inside the conservation areas shown in Figure 14-2 were drilled prior to 2002 (prior to the mining approvals process).

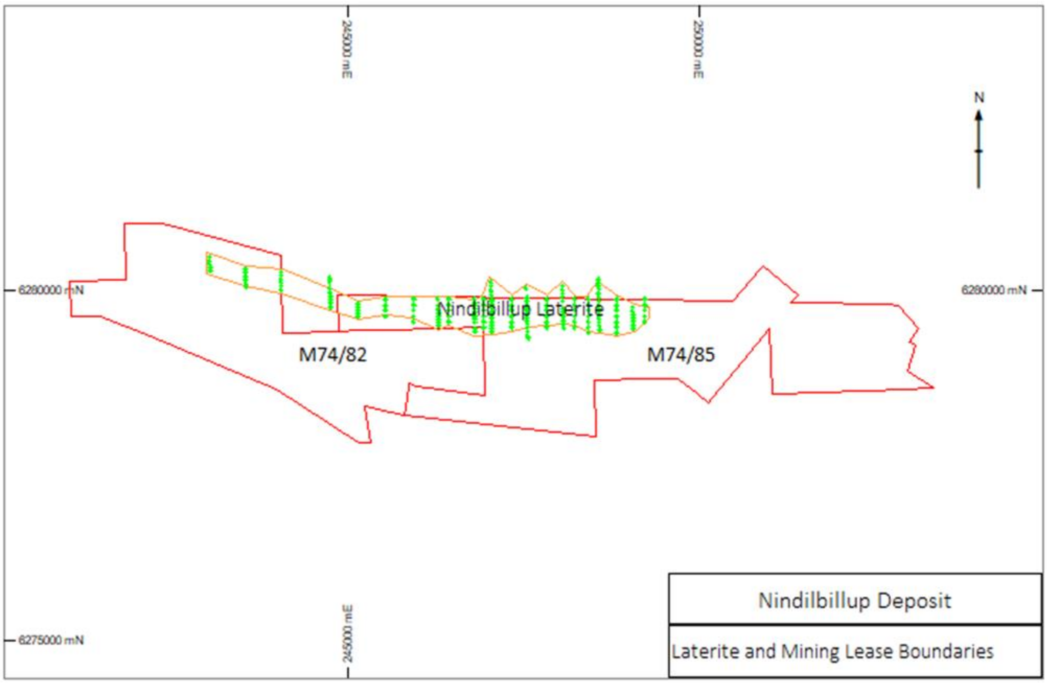
**Figure 14-2 Hale-Bopp Conservation areas and drillhole collars**



### 14.3.7 Nickel Rights - Nindilbillup

None of the tenements covering the Nindilbillup deposit are currently held by RNO. However, RNO does retain the laterite nickel rights to leases M74/85-I and M74/82-I. Only the portion of the deposit covered by these two tenements is considered part of the Mineral Resource (reported publically). A plan view showing the model regolith extent and the two lease boundaries is shown in Figure 14-3. Approximately 20% of the mineralisation lies outside the two lease boundaries.

**Figure 14-3 Nindilbillup drillhole collars, laterite outline and the M74/82 and M74/85 lease boundaries**




A field called NIRIGHT was added to the Nindilbillup model and set to 1 for blocks which lie inside the two tenements. For all other blocks this field was set to zero.

## 14.4 Sample compositing

Almost all the drilling is assayed using a 2 m sample interval. The only exceptions are seen in a few of the early RC holes and the diamond core samples. All drilling was coded with the RGDOMAIN and RKDOMAIN field values prior to undertaking drillhole compositing as these were used to control the process. Downhole compositing was run within the coded horizon fields to ensure that no composite intervals crossed any lithological boundaries. To allow for uneven sample lengths within each of the horizons, the Datamine composite process was run using the variable sample length method. This adjusts the sample intervals, where necessary, to ensure that all samples are included in the composite file (i.e. no residuals) while keeping the sample interval as close to the desired sample interval (2m) as possible.

The downhole geophysics logging data was collected using a 0.1 m sample interval. This was composted to 2 m for variogram and estimation modelling purposes to be consistent with the composited assay data. This is needed as the moisture correction data is sourced from the assays tables (wet and dry sample weights).

## 14.5 Estimation domains

An assessment of grade and density data from each of the RGDOMAIN/RKDOMAIN field (domain) combinations for the 5 deposits identified the following aspects which needed to be allowed for in the estimation process namely:

- Dolerite dykes are sometimes mineralised. These dykes are atypical in their chemistry when compared to normal ultramafic regolith. The strike and dip of dykes (northeast and vertical) is also different to the sub horizontal undulating regolith that hosts the bulk of the Ni mineralisation. After analysing the sampling information available for the dolerites dykes, it was decided to estimate individual dykes (unique DYKENUM value) with 45 or more samples. Individual dykes with fewer than 45 samples were each allocated mean grades based on the corresponding sampling information.
- The basalt and granite domains host almost no nickel mineralisation and are effectively barren. These domains will be allocated mean domain grade values rather than estimated grades. While the talc zones (Hale-Bopp and Shoemaker-Levy only) are sometimes mineralised, this material is too problematic to process and as such is also allocated mean grades.
- Grades will be estimated using a combination of ordinary kriging (OK) and Multiple Indicator Kriging (MIK) in the case of strongly skewed distributions (avoid excessive top-cutting). The grade resolution of some of the 80 mE by 100 mN drilled areas will be increased through the use of Localised Uniform Conditioning (“LUC”).
- Some top cutting will be required for the grade/domain combinations to be estimated using OK to prevent overestimation and smearing of the relatively high values (when compared to the majority of the results) into the surrounding blocks. Top cutting involved resetting the grades which exceed a top cut value to the top-cut value on a domain by domain basis.
- An assessment of the coefficient of variation (CV – ratio of standard deviation to the mean) for each domain/grade combination along with the presence or absence of distinct bi modal populations was used to select the corresponding estimation method to use. Most grade domain/grade combinations were estimated using OK. The distribution of Ca and CaCo3 in caprock, limonite and sometimes saprolite domains in Halleys, Hale-Bopp and Shoemaker-Levy drilling data is strongly skewed (CV>2). Similarly distribution of Al in the Saprolite for Hale-Bopp and Halleys is also strongly skewed. Estimation of these grade/domain combinations using ordinary kriging (OK) would require excessive top cutting (>5% of the data) in some cases. Multiple Indicator Kriging (MIK) was used as an alternative estimation method to OK for most of these estimates.
- As an example, the summary domained laterite statistics for the Shoemaker-Levy drilling (Ni, Co, Fe, Al, Mg, Si and Ca grades) are shown in Table 14-6. Most of domain/grade combinations are not strongly skewed or dominated by multiple populations with CV values being less than 1.5. While the CV for Mg and Al for some of the domains in Table 14-6 is high the number of high “outliers” Al and Mg values is relatively small and so can be managed using top-cutting. Ca in the Caprock and Limonite domains was estimated using MIK for this estimate.
- Some of the grade distributions in Nindilbillup and Shoemaker-Levy North are strongly skewed but there is only limited drilling data available and so MIK was not used as part of any of these for these estimates.

**Table 14-6 Summary domained laterite drillhole statistics (Ni, Co, Fe, Al, Mg, Si, Ca) – Shoemaker-Levy**

| Laterite Domain | Element | Number of samples | Minimum (%) | Maximum (%) | Mean (%) | Variance | Coefficient of Variation (CV) |
|---|---|---|---|---|---|---|---|
| Caprock | Ni | 34605 | 0 | 2.6 | 0.07 | 0.01 | 1.24 |
| | Co | 34609 | 0.001 | 0.148 | 0.004 | 0 | 1.34 |
| | Fe | 34609 | 0.01 | 44.32 | 3.77 | 16.76 | 1.09 |
| | Al | 34609 | 0.01 | 22.7 | 3.92 | 5.59 | 0.6 |
| | Mg | 34609 | 0.01 | 22.13 | 0.66 | 2.68 | 2.48 |
| | Si | 24938 | 0.01 | 46 | 37.88 | 25.11 | 0.13 |
| | Ca | 34609 | 0.01 | 27.2 | 0.21 | 0.56 | 3.57 |
| Limonite | Ni | 44549 | 0 | 8 | 0.69 | 0.15 | 0.56 |
| | Co | 44549 | 0.001 | 0.915 | 0.032 | 0.001 | 1.01 |
| | Fe | 44549 | 0.01 | 59.92 | 14.21 | 59.2 | 0.54 |
| | Al | 44549 | 0.01 | 18 | 1.26 | 3.06 | 1.39 |
| | Mg | 44549 | 0.01 | 28.58 | 2.27 | 7.9 | 1.24 |
| | Si | 32353 | 0.02 | 47 | 29.96 | 50.74 | 0.24 |
| | Ca | 44549 | 0.01 | 21.46 | 0.86 | 4.76 | 2.54 |
| Upper Saprolite | Ni | 22857 | 0 | 3.9 | 0.38 | 0.04 | 0.5 |
| | Co | 22857 | 0.001 | 0.242 | 0.013 | 0 | 0.67 |
| | Fe | 22857 | 0.01 | 50.74 | 6.53 | 10.28 | 0.49 |
| | Al | 22857 | 0.01 | 16 | 0.42 | 1.19 | 2.6 |
| | Mg | 22857 | 0.01 | 28.5 | 7.25 | 17.15 | 0.57 |
| | Si | 19279 | 0.01 | 48.89 | 24.07 | 85.06 | 0.38 |
| | Ca | 22857 | 0.01 | 20.37 | 5.61 | 20.18 | 0.8 |
| Lower Saprolite | Ni | 27950 | 0 | 2.59 | 0.31 | 0.02 | 0.44 |
| | Co | 27950 | 0.001 | 0.098 | 0.009 | 0 | 0.53 |
| | Fe | 27950 | 0.01 | 35.34 | 4.9 | 4.21 | 0.42 |
| | Al | 27949 | 0.01 | 12.41 | 0.21 | 0.29 | 2.56 |
| | Mg | 27950 | 0.01 | 29.5 | 16.16 | 14.52 | 0.24 |
| | Si | 21545 | 0.01 | 47 | 16.06 | 18.49 | 0.27 |
| | Ca | 27950 | 0.01 | 22.04 | 3.46 | 9.4 | 0.89 |

- The undulating nature of the nickel laterite mineralisation (as is typical with this type of deposit) means the estimate will be improved through the use of unfolding. The Datamine Unfold process was used to transform the sample (drillhole file) coordinates into a flat (not undulating) unfolded state. This allows search/variogram analysis and grade estimation to be carried out using the "flattened" coordinates, which are then converted back to the folded (local) coordinate system prior to writing out the block grades. The unfolding process results in more samples (and more correctly aligned samples) being available for variogram modelling and grade estimation than would have been the case if standard resource estimation methods based on the local mine grid were used.
- The dyke estimates were compiled using variograms and search ellipses defined in Cartesian space (mine grid) i.e. were not unfolded.
- There is sufficient geophysics density data to estimate density (OK) into parts of the Shoemaker-Levy deposit. Elsewhere global means (dry bulk density) based on the BHP core measurements were assigned to the Shoemaker-Levy block model.

## 14.6 Top cuts

Top-cutting is only material to grade estimates compiled using OK; for the MIK estimates the uncut values were used. The top-cuts applied to the datasets used to estimate the 5 deposits for the key laterite elements are listed in Table 14-7.

No top-cuts were applied to domains where no estimates were undertaken and just mean domain values assigned (due to domains with limited data and or being largely barren in terms of Ni).

**Table 14-7 Top-cuts (Ni, Co, Fe, Al, Mg, Si, Ca and $CaCO_3$)**

| Deposit | RGDOMAIN (field value) | RKDOMAIN (field value) | DYKENUM (field value) | Description | Grade field (%) | Top-cut (%) | Number of data points | Number of data points cut | Cut CV |
|---|---|---|---|---|---|---|---|---|---|
| Shoemaker-Levy | 100 | 0 | 0 | Caprock | MGPCT | 5.0 | 34609 | 764 | 1.6 |
| | 300 | 0 | 0 | Upper Saprolite | ALPCT | 2.0 | 22857 | 1202 | 1.8 |
| | 400 | 0 | 0 | Lower Saprolite | ALPCT | 2.0 | 27949 | 417 | 1.9 |
| | 0 | 10 | 4 | Dolerite Dyke | CAPCT | 0.8 | 496 | 27 | 1.8 |
| | 0 | 10 | 9 | Dolerite Dyke | CACO3PCT | 10.0 | 699 | 15 | 1.5 |
| Halleys | 0 | 10 | 1 | Dolerite Dyke | CACO3PCT | 10.0 | 444 | 20 | 1.5 |
| | 0 | 10 | 2 | Dolerite Dyke | CACO3PCT | 10.0 | 65 | 6 | 1.6 |
| | 0 | 10 | 4 | Dolerite Dyke | NIPCT * | 1.5 | 795 | 169 | 0.5 |
| | 0 | 10 | 4 | Dolerite Dyke | CAPCT | 3.0 | 795 | 70 | 1.5 |
| Hale-Bopp | 300 | 0 | 0 | Upper Saprolite | ALPCT | 7 | 14936 | 370 | 1.5 |
| | 0 | 10 | 20 | Dolerite Dyke | ALPCT | 3 | 84 | 4 | 1.6 |
| | 0 | 10 | 21 | Dolerite Dyke | ALPCT | 4.65 | 98 | 4 | 1.5 |
| | 0 | 10 | 21 | Dolerite Dyke | CAPCT | 1.0 | 98 | 9 | 2.7 |
| | 0 | 10 | 21 | Dolerite Dyke | CACO3PCT | 10.0 | 98 | 9 | 1.7 |
| | 0 | 10 | 22 | Dolerite Dyke | CACO3PCT | 10.0 | 172 | 5 | 1.6 |
| Nindilbillup | 100 | 0 | 0 | Caprock | COPCT | 0.1 | 368 | 2 | 1.7 |
| | 100 | 0 | 0 | Caprock | MGPCT | 8.0 | 368 | 6 | 1.6 |

| Deposit | RGDOMAIN (field value) | RKDOMAIN (field value) | DYKENUM (field value) | Description | Grade field (%) | Top-cut (%) | Number of data points | Number of data points cut | Cut CV |
|---|---|---|---|---|---|---|---|---|---|
| | 100 | 0 | 0 | Caprock | CAPCT | 1.25 | 123 | 9 | 1.6 |
| | 200 | 0 | 0 | Limonite | CAPCT | 1.0 | 178 | 18 | 1.6 |
| | 300 | 0 | 0 | Upper Saprolite | CACO3PCT | 45.0 | 78 | 2 | 1.5 |
| Shoemaker -Levy North | 100 | 0 | 0 | Caprock | MGPCT | 6.0 | 592 | 24 | 1.6 |
| | 100 | 0 | 0 | Caprock | CAPCT | 1.0 | 592 | 44 | 1.8 |
| | 200 | 0 | 0 | Limonite | CACO3PCT | 30.0 | 187 | 8 | 1.6 |
| | 200 | 0 | 0 | Limonite | CAPCT | 1.0 | 465 | 37 | 1.7 |
| | 300 | 0 | 0 | Upper Saprolite | CACO3PCT | 20.0 | 41 | 5 | 1.7 |
| | 400 | 0 | 0 | Lower Saprolite | ALPCT | 5.0 | 360 | 32 | 1.5 |

* Atypically high nickel grades in a dyke which were probably due to scattered occurrences of garnierite or another high grade nickel silicate (bimodal distribution). The dyke is largely mined out.

## 14.7 Variography

Variograms were generated to assess the grade continuity of 12 elements and geophysics based density data (Shoemaker-Levy deposit) as inputs to the kriging algorithm used to interpolate grades (OK and MIK). Snowden Supervisor software was used to generate and model the variograms and export them for use in Datamine.

The variograms were compiled using the following approach:

- Variograms for the 12 elements in the laterite domains (Caprock, Limonite, Upper Saprolite, Lower Saprolite) were compiled using drilling data transformed using the Unfold process. Both conventional and where required indicator variograms were compiled.
- Variograms for the dyke estimates were compiled using variograms based on mine coordinates. There was insufficient data to model variograms for most of the individual dykes. Where required models compiled for the larger dykes were later used to estimate the smaller dykes.
- All grades were modelled using mostly two or three structure spherical variograms. All variograms were standardised (variance rescaled to be between 0 and 1).
- Variograms compiled for OK were based on normal score variograms. This method produces a clearer image of the ranges of continuity in skewed data sets. The nugget and spatial variance components were subsequently back transformed (discrete gaussian polynomials technique) to produce traditional variograms for estimation purposes.
- Variograms compiled for the MIK estimates were based largely on two structure indicator variograms. On average about 8 to 10 thresholds were compiled for each grade/domain combination. For estimation purposes threshold values of 95%, 97.5% and 99% were estimated using the corresponding 90% variogram model for each domain.
- All variogram models used to estimate Nindilbillup and Shoemaker-Levy North were copies of the models used to estimate the Shoemaker-Levy deposit in late 2021. This decision was taken as there is insufficient drilling in terms of sample numbers to justify modelling variograms using

the deposit drilling data. The axis rotation factors were adjusted to align the Shoemaker-Levy variogram models with the key strike directions of the Nindilbillup and Shoemaker-Levy North deposits.

- Nugget values were based on downhole variograms.

The Ni variograms from Halleys, Hale-Bopp and Shoemaker-Levy deposits are listed in Table 14-8. The nugget values are low and the ranges in the XY plane relatively large (>200) while the vertically the ranges are short. These features are all typical of Ni laterite deposits.

**Table 14-8 Halleys, Hale-Bopp and Shoemaker-Levy Ni variograms (unfolded coordinates)**

| Deposit | RGDOMAIN (field value) | Description | Orientation | Nugget | Sill 1 | Range 1 (m) | Sill 2 | Range 2 (m) | Sill 3 | Range 2 (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| Halleys | 100 | Caprock | 0°→ 170° | 0.12 | 0.52 | 33 | 0.14 | 115 | 0.22 | 486 |
| | | | 0°→ 260° | | | 29 | | 91 | | 301 |
| | | | 90°→ 000° | | | 9 | | 12 | | 26 |
| | 200 | Limonite | 0°→ 170° | 0.11 | 0.52 | 26 | 0.19 | 122 | 0.18 | 396 |
| | | | 0°→ 260° | | | 31 | | 114 | | 193 |
| | | | 90°→ 000° | | | 10 | | 18 | | 25 |
| | 300 | Upper Saprolite | 0°→ 170° | 0.11 | 0.52 | 26 | 0.19 | 101 | 0.18 | 427 |
| | | | 0°→ 260° | | | 43 | | 95 | | 170 |
| | | | 90°→ 000° | | | 13 | | 14 | | 21 |
| | 400 | Lower Saprolite | 0°→ 170° | 0.11 | 0.52 | 49 | 0.19 | 149 | 0.18 | 811 |
| | | | 0°→ 260° | | | 29 | | 212 | | 275 |
| | | | 90°→ 000° | | | 20 | | 34 | | 41 |
| Hale-Bopp | 100 | Caprock | 0°→ 270° | 0.12 | 0.32 | 19 | 0.29 | 62 | 0.27 | 175 |
| | | | 0°→ 180° | | | 21 | | 87 | | 187 |
| | | | 90°→ 000° | | | 8 | | 9 | | 10 |
| | 200 | Limonite | 0°→ 270° | 0.12 | 0.33 | 16 | 0.29 | 52 | 0.26 | 196 |
| | | | 0°→ 180° | | | 16 | | 51 | | 242 |
| | | | 90°→ 000° | | | 6 | | 11 | | 17 |
| | 300 | Upper Saprolite | 0°→ 270° | 0.11 | 0.33 | 38 | 0.29 | 61 | 0.27 | 253 |
| | | | 0°→ 180° | | | 29 | | 67 | | 279 |
| | | | 90°→ 000° | | | 12 | | 17 | | 20 |
| | 400 | Lower Saprolite | 0°→ 270° | 0.11 | 0.43 | 45 | 0.20 | 144 | 0.27 | 333 |
| | | | 0°→ 180° | | | 71 | | 210 | | 1132 |
| | | | 90°→ 000° | | | 22 | | 28 | | 30 |
| Shoemaker-Levy | 100 | Caprock | 0°→ 270° | 0.13 | 0.47 | 94 | 0.18 | 250 | 0.22 | 413 |
| | | | 0°→ 180° | | | 149 | | 263 | | 403 |
| | | | 90°→ 000° | | | 8 | | 9 | | 12 |
| | 200 | Limonite | 0°→ 270° | 0.12 | 0.34 | 15 | 0.28 | 44 | 0.25 | 252 |
| | | | 0°→ 180° | | | 27 | | 40 | | 243 |
| | | | 90°→ 000° | | | 10 | | 15 | | 18 |
| | 300 | Upper Saprolite | 0°→ 270° | 0.13 | 0.45 | 37 | 0.26 | 234 | 0.15 | 347 |
| | | | 0°→ 180° | | | 63 | | 301 | | 322 |
| | | | 90°→ 000° | | | 18 | | 19 | | 20 |
| | 400 | Lower Saprolite | 0°→ 270° | 0.13 | 0.36 | 39 | 0.28 | 192 | 0.23 | 480 |
| | | | 0°→ 180° | | | 49 | | 139 | | 299 |
| | | | 90°→ 000° | | | 14 | | 18 | | 20 |

## 14.8 In-situ Density

The DENSITY field values assigned to the 5 block models represent dry bulk values. Core based density data collected in the early 2000s exists (see section 11.2) for Halleys, Hale-Bopp and Shoemaker-Levy. Downhole based geophysics data has been collected from Shoemaker-Levy on a campaign basis since 2019. There has been no density data collected for the Nindilbillup or Shoemaker-Levy North deposits.

### 14.8.1 Core based density statistics

The summary core based density data for Halleys, Hale-Bopp, and Shoemaker-Levy for the caprock, limonite, upper saprolite and lower saprolite domains is presented in Table 14-9 coded on the key geology domains. Anomalous low (<1) or high values were bottom and top cut prior to compiling these statistics. Very little of this data related to the various secondary intrusives and as such this non laterite core based data was not used in any of the estimates.

**Table 14-9 Capped Caliper based bulk density data and assigned model values**

| Deposit | RGDOMAIN (field value) | Description | Number of samples | Minimum ($t/m^3$) | Maximum ($t/m^3$) | Mean ($t/m^3$) | Variance | Model value ($t/m^3$) |
|---|---|---|---|---|---|---|---|---|
| Halleys | 100 | Caprock | 28 | 1.14 | 2.20 | 1.63 | 0.07 | 1.63 |
| | 200 | Limonite | 367 | 1.0 | 2.43 | 1.44 | 0.10 | 1.44 |
| | 300 | Upper Saprolite | 82 | 1.0 | 2.16 | 1.51 | 0.06 | 1.51 |
| | 400 | Lower Saprolite | 99 | 1.0 | 2.17 | 1.67 | 0.05 | 1.67 |
| Hale-Bopp | 100 | Caprock | 44 | 1.14 | 2.0 | 1.68 | 0.06 | 1.68 |
| | 200 | Limonite | 127 | 1.0 | 2.15 | 1.40 | 0.05 | 1.44 * |
| | 300 | Upper Saprolite | 56 | 1.0 | 1.97 | 1.42 | 0.05 | 1.51 * |
| | 400 | Lower Saprolite | 63 | 1.17 | 2.10 | 1.64 | 0.07 | 1.64 |
| Shoemaker-Levy | 100 | Caprock | 106 | 1.10 | 2.20 | 1.78 | 0.07 | 1.78 |
| | 200 | Limonite | 250 | 1.10 | 2.00 | 1.40 | 0.05 | 1.40 |
| | 300 | Upper Saprolite | 46 | 1.10 | 2.14 | 1.60 | 0.06 | 1.60 |
| | 400 | Lower Saprolite | 88 | 1.10 | 2.41 | 1.75 | 0.09 | 1.75 |

Aside from volumes with estimated density values in the Shoemaker-Levy model, fixed density values as listed in Table 14-9 were assigned to the model laterite domains based on the average cut core values. The two cases where this was not the case (flagged with asterisks) was due to the following:

- Hale-Bopp limonite density core value is too low when compared to the results from the 2020 pitting work (1.47 t/m3 - see section 11.2). As such a value of 1.44 based on the adjacent Halleys deposit density data was used.
- The core based Hale-Bopp mean upper saprolite value is considered atypical (1.42 i.e. too low). As an alternative the corresponding value from the Halleys core data was used.

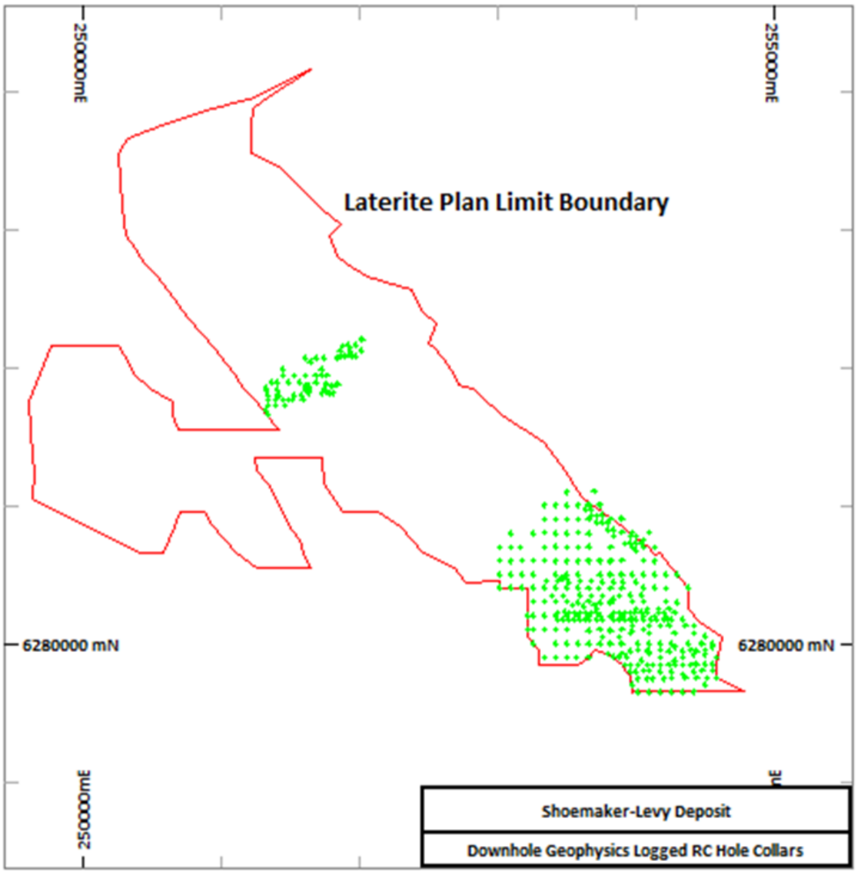
### *14.8.2* Nindilbillup and Shoemaker-Levy North laterite density values

The laterite domains (RGDOMAIN=100,200, 300 and 400) in the Nindilbillup and Shoemaker-Levy North deposits were allocated the mean density values from the corresponding domained core data from the Shoemaker-Levy deposit. Shoemaker-Levy is the closest of the three main deposits to these two areas.

### 14.8.3 Downhole geophysics based density data

A plan view of the collar locations of RC drilling at Shoemaker-Levy which have been logged for downhole density is shown in Figure 14-4. In the two areas of the Shoemaker-Levy deposit subject to downhole geophysical logging were estimated (ok -laterite domains only) for dry bulk density (40 m by 50 m by 4 m parent cell outlines). Two perimeters were digitised around the two cluster of logged holes (see Figure 14-4) to constrain the density estimates to blocks directly in and around the logged holes. Areas in these two areas which could not be estimated were allocated the corresponding mean domain geophysics based density. Mean core values were used for the remaining laterite blocks located outside the two perimeters.

**Figure 14-4 Shoemaker-Levy RC drilling with downhole density data**




The summary downhole geophysics density data after applying bottom and top cuts are listed in Table 14-10.

**Table 14-10 Shoemaker-Levy downhole geophysics density data**

| RGDOMAIN (field value) | RKDOMAIN (field value) | Description | Number of samples | Minimum ($t/m^3$) | Maximum ($t/m^3$) | Mean ($t/m^3$) | Variance |
|---|---|---|---|---|---|---|---|
| 100 | 0 | Caprock | 1195 | 1.1 | 2.20 | 1.78 | 0.06 |
| 200 | 0 | Limonite | 1773 | 1.1 | 2.00 | 1.51 | 0.04 |
| 300 | 0 | Upper Saprolite | 1247 | 1.1 | 2.20 | 1.65 | 0.06 |
| 400 | 0 | Lower Saprolite | 1274 | 1.1 | 2.70 | 1.88 | 0.09 |
| 0 | 10 | Dolerite | 74 | 1.11 | 2.23 | 1.75 | 0.08 |
| 0 | 20 | Basalt | 111 | 1.33 | 3.02 | 2.14 | 0.18 |
| 0 | 40 | Granite | 12 | 1.54 | 2.42 | 1.95 | 0.05 |
| 0 | 50 | Talc Shear | 104 | 1.36 | 2.69 | 2.01 | 0.13 |

The mean limonite Shoemaker-Levy density value is higher than the corresponding core based values collected at Halleys, Hale-Bopp and Shoemaker-Levy. This observation is consistent with the pitting test work undertaken at Hale-Bopp in 2020 in that the core based density values in the Limonite zone are probably biased slightly low, most likely due to core loss. Ongoing downhole geophysical logging and pit based density measurements at Shoemaker-Levy will be needed to confirm this observation.

The mean density values for dolerites, basalts, granites and talc shears based on the downhole geophysics data. The values (intrusives only) used in the Halleys, Hale-Bopp, Nindilbillup and Shoemaker-Levy North deposits differ slightly from those listed in Table 14-10 due to changes in the summary statistics following each new campaign of downhole logging. The differences are not considered material.

## 14.9 Block model parameters

### 14.9.1 Volume model extents and block dimensions

Conventional sub-celled block models were built for all 5 deposits with all block values being expressed in contained quantities i.e. not in proportions. The parent cell (maximum) block size and minimum cell sizes used in the 5 models are summarised in Table 14-11. The X and Y block parent size components are based on being about half the corresponding drillhole spacing. The 4 m height in the Z direction is based on a combination of the nominal sample interval being 2 m and the typical bench height used at the three mining areas being 3 m.

**Table 14-11 RNO block model extents and block sizes**

| | | Deposit | | | | |
|---|---|---|---|---|---|---|
| | | Halleys | Hale-Bopp | Shoemaker-Levy | Nindilbillup | Shoemaker-Levy North |
| Model Origin (MGA 94 Zone 51 grid) | Easting | 255800 | 256650 | 252000 | 242300 | 251000 |
| | Northing | 6272800 | 6269500 | 6281000 | 6278800 | 6284500 |
| | Elevation | 65 | 65 | 140 | 100 | 150 |
| Maximum (MGA 94 Zone 51 grid) | Easting | 257800 | 260200 | 255000 | 253400 | 253400 |
| | Northing | 6276300 | 6273250 | 6282500 | 6286500 | 6286500 |
| | Elevation | 212 | 212 | 240 | 240 | 240 |
| Parent Cell Size (m) | Easting | 40 | 40 | 40 | 100 | 50 |
| | Northing | 50 | 50 | 50 | 50 | 100 |
| | Elevation | 4 | 4 | 4 | 4 | 4 |
| Minimum Cell Size (m) | Easting | 5 | 5 | 5 | 12.5 | 6.25 |
| | Northing | 6.25 | 6.25 | 6.25 | 6.25 | 12.5 |
| | Elevation | 2 | 2 | 2 | 2 | 2 |

### 14.9.2 Halleys, Hale-Bopp and Shoemaker-Levy (SMUDRSCL field)

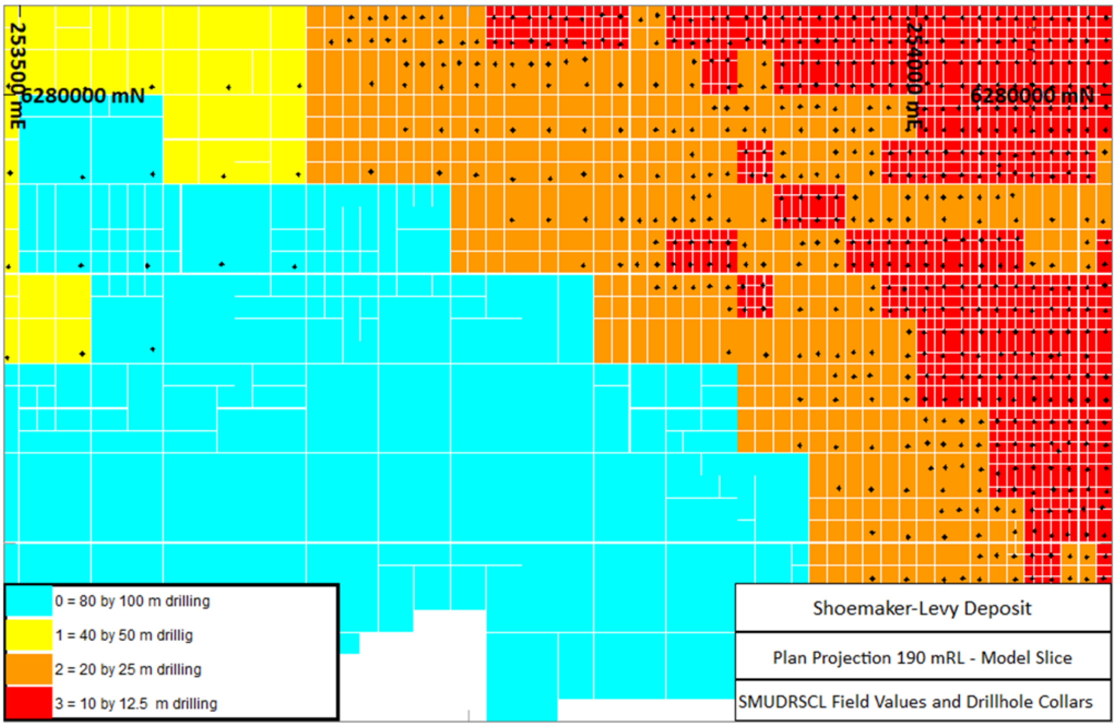
As discussed in section 10.1 the three main deposits currently being mined have been drilled out to 4 different drillhole spacings ranging from 80 m E by 100 mN (initial Mineral Resource definition) to 10 mE by 12.5 mN (grade control). Drilling is done in a staged process of infilling the pre-existing drilling to optimise the number of metres drilled (not drill to unwanted depths). Prior to running the grade estimates each model was classified based on drilling density. A field called SMUDRSCL was added to each model (Halleys, Hale-Bopp and Shoemaker-Levy) and a nearest-neighbour estimation routine was used to classify the model based on drilling density. The SMUDRSCL field values and corresponding drilling grids and estimate block sizes are listed in Table 14-12. The objective is blocks should be estimated into block sizes based on about half the of the immediate drillhole spacing surrounding them.

**Table 14-12 SMUDRSCL drilling density field settings**

| SMUDRSCL (field value) | Nominal Drillhole Spacing | Estimation Parent Cell Size | | |
|---|---|---|---|---|
| | | Easting | Northing | Elevation |
| 0 | 80 mE by 100 mN | 40 m | 50 m | 4 m |
| 1 | 40 mE by 50 mN | 20 m | 25 m | 4 m |
| 2 | 20 mE by 25 mN | 10 m | 12.5 m | 4 m |
| 3 | 10 mE by 12.5 mN | 5 m | 6.25 m | 4 m |

A plan view of a slice through the southern part of the Shoemaker-Levy model showing the drillhole collars and model blocks coloured on the SMUDRSCL values is shown in Figure 14-5.

**Figure 14-5 Shoemaker-Levy SMUDRSCL field values**




Dolerite grade and laterite density estimates were all estimated only using the primary parent cells size (SMUDRSCL=0). The data for these estimates was too broad spaced and or irregular to consider different drilling grids/block sizes.

### 14.9.3 Nindilbillup and Shoemaker-Levy North

In the case of the Nindilbillup and Shoemaker-Levy North deposits the drilling is all largely based on a fixed nominal grid size across each deposit. Both of these deposits were estimated (all domains) using the primary parent cell size.

## 14.10 Grade Estimation

### 14.10.1 Search Parameters

For each deposit, the same search ellipse ranges and axis rotations were used within each domain for all 12 grade estimates in order to maintain the ratios of the various constituents (metal balance) as consistently as possible. The search ellipse parameters were derived from the variogram modelling (mostly Ni) from each deposit and are summarised in Table 14-13. Only a single rotation was applied around the Z axis for all search ellipses, this rotation number matched the number used in the corresponding variogram models.

**Table 14-13 Search ellipse axis lengths and rotations for OK and MIK estimates using unfolding**

| Deposit | RGDOMAIN (field value) | RKDOMAIN (field value) | DYKENUM (field value) | Datamine Rotation (Z Axis °) | Axis lengths (m) | | |
|---|---|---|---|---|---|---|---|
| | | | | | X | Y | Z |
| Halleys | 100 | 0 | 0 | 80 | 200 | 200 | 10 |
| | 200 | 0 | 0 | 80 | 100 | 100 | 10 |
| | 300 | 0 | 0 | 80 | 100 | 100 | 10 |
| | 400 | 0 | 0 | 80 | 100 | 100 | 5 |
| | 0 | 10 | 11 | 110 | 100 | 20 | 25 |
| | 0 | 10 | 12 | 120 | 60 | 40 | 25 |
| | 0 | 10 | 13 | -140 | 20 | 50 | 15 |
| Hale-Bopp | 100 | 0 | 0 | 0 | 50 | 50 | 10 |
| | 200 | 0 | 0 | 0 | 50 | 50 | 10 |
| | 300 | 0 | 0 | 0 | 50 | 50 | 10 |
| | 400 | 0 | 0 | 0 | 50 | 50 | 5 |
| | 0 | 10 | All | 40 | 100 | 20 | 60 |
| Shoemaker-Levy | 100 | 0 | 0 | 0 | 100 | 100 | 10 |
| | 200 | 0 | 0 | 0 | 75 | 75 | 10 |
| | 300 | 0 | 0 | 0 | 125 | 125 | 10 |
| | 400 | 0 | 0 | 0 | 150 | 150 | 5 |
| | 0 | 10 | All | -110 | 100 | 20 | 50 |
| Nindilbillup | 100 | 0 | N/A | 0 | 200 | 200 | 10 |
| | 200 | 0 | N/A | 0 | 100 | 100 | 10 |
| | 300 | 0 | N/A | 0 | 150 | 150 | 10 |
| | 400 | 0 | N/A | 0 | 200 | 200 | 5 |
| Shoemaker-Levy North | 100 | 0 | N/A | 150 | 200 | 200 | 10 |
| | 200 | 0 | N/A | 150 | 100 | 100 | 10 |
| | 300 | 0 | N/A | 150 | 150 | 150 | 10 |
| | 400 | 0 | N/A | 150 | 200 | 200 | 5 |

There were no dolerite estimates for the Nindilbillup and Shoemaker-Levy North deposits due to limited data at the Nindilbillup and the absence of dolerite dykes at Shoemaker-Levy North.

To allow for isolated gaps in the drilling, a dynamic search volume approach was used with two search passes run for each estimate. The process worked by for each block estimate by:

- Checking to see if based on the available data (meets minimal sample number requirements) and the search ellipse dimensions listed Table 14-14. Where possible, a grade was estimated.
- If there were insufficient samples to estimate an estimate based on the primary ellipse the search ellipse was expanded (all three axis) by a factor and the estimation process attempted a second time.
- If after two passes it was not possible to estimate a grade the affected blocks were left set to null values. At the end of the process any blocks set to null values were reset to the corresponding mean drillhole domain values.

There are no absent grade fields in any of the 5 block models. The sample selection criteria and search ellipse expansion factors are listed in Table 14-14.

**Table 14-14 Search ellipse sample selection criteria**

| | Laterite (RGDOMAIN) | | Dolerite (RKDOMAIN) |
|---|---|---|---|
| **Estimation setting** | **100, 200, 300** | **400** | **10** |
| Unfolded/mine grid drillhole composites | Yes | Yes | No |
| Boundary conditions | Hard | Hard | Hard |
| Minimum number of samples – volume 1 | 6 | 8 | 6 |
| Maximum number of samples – volume 1 | 18 | 8 | 18 |
| Search volume 2 factor | 1.5 | X1 or X1.5 | X2 or X3 |
| Minimum number of samples – volume 2 | 6 | 4 | 3 |
| Maximum number of samples – volume 2 | 18 | 18 | 18 |

The selection of samples for both the unfolded and conventional estimates was clipped (using the Datamine MAXKEY parameter) so that a maximum of four composites per drillhole was used when estimating each block grade. This constraint was applied to stop individual block estimates being based on only two or three drillholes and so better reflect the changes in whole rock chemistry as a function of depth (reduce smearing in the Z direction).

### 14.10.2 Estimation methods

The OK and MIK estimates were undertaken using Datamine software. The MIK estimates were post processed using the GSLIB POSTIK software while the LUC change of support was based on OK estimates and undertaken using Snowden Optiro's LUC software. Estimates were combined to produce single block model for each of the 5 deposits in Datamine format. Blocks which could not be estimated or were based on limited drilling data and usually not mineralised e.g. granites were assigned mean values.

### 14.10.3 LUC

LUC is a modified uniform conditioning (non-linear) technique for modelling the grades of relatively small blocks for circumstances where the drilling is broadly spaced for accurate estimation using linear techniques such as ordinary kriging. LUC is not a substitute for close spaced drilling but adds granularity to estimates across wide spaced drilled areas. LUC provides a more realistic indication of tonnes and grade above a cut-off at the scale of mining.

The application of OK, MIK and assignment of mean grades in the 5 RNO models is summarised in Table 14-15.

**Table 14-15 Estimation methods - OK, MIK or Not Estimated (Assigned global mean values)**

| Shoemaker-Levy North (slresmod140122.dm) | | | | | |
|---|---|---|---|---|---|
| RGDOMAIN | RKDOMAIN | DYKENUM* | OK Estimates** | MIK Estimates | Not Estimated (Mean) ** |
| 100 | 0 | 0 | Ni, Co, Fe, Al, Mg, Si, Cr, Mn, Zn, Cu | Ca, $CaCO_3$ | N/A |
| 200 | 0 | 0 | Ni, Co, Fe, Al, Mg, Si, Cr, Mn, Zn, Cu | Ca, $CaCO_3$ | N/A |
| 300 | 0 | 0 | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 400 | 0 | 0 | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 0 | 10 | 4, 5, 6, 7, 9, 12, 14,17, 20 | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 0 | 10 | 1, 3, 8, 15, 18, 19, 21 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 20 | 0 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 40 | 0 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 50 | 0 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| Halleys (hyresmod140122.dm) | | | | | |
| RGDOMAIN | RKDOMAIN | DYKENUM | OK Estimates | MIK Estimates | Not Estimated (Mean Value) |
| 100 | 0 | 0 | Ni, Co, Fe, Al, Mg, Si, $CaCO_3$, Cr, Mn, Zn, Cu | Ca | N/A |
| 200 | 0 | 0 | Ni, Co, Fe, Al, Mg, Si, Ca, Cr, Mn, Zn, Cu | $CaCO_3$ | N/A |
| 300 | 0 | 0 | Ni, Co, Fe, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | Al | N/A |
| 400 | 0 | 0 | Ni, Co, Fe, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | Al | N/A |
| 0 | 10 | 1,2, 4, 5, 6, | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 0 | 10 | 3, 7, | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 20 | 0 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 40 | 0 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |

| Hale-Bopp (hbresmod101221.dm) | | | | | |
|---|---|---|---|---|---|
| **RGDOMAIN** | **RKDOMAIN** | **DYKENUM** | **OK Estimates** | **MIK Estimates** | **Not Estimated (Mean Value)** |
| 100 | 0 | 0 | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | Ca | N/A |
| 200 | 0 | 0 | Ni, Co, Fe, Al, Mg, Si, Cr, Mn, Zn, Cu | Ca, $CaCO_3$ | N/A |
| 300 | 0 | 0 | Ni, Co, Fe, Al, Mg, Si, $CaCO_3$, Cr, Mn, Zn, Cu | Ca | N/A |
| 400 | 0 | 0 | Ni, Co, Fe, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | Al | N/A |
| 0 | 10 | 3, 4, 5, 6, 9, 10,13,14,17, 18, 20, 21,22 | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 0 | 10 | 1, 2, 7, 8, 11, 12, 15, 16, 19, 23 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 20 | 0 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 40 | 0 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 50 | 0 | N/A | N/A | Ni, Co, Fe, Al, Mg, Si, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| **Nindilbillup (nubresmod170521.dm)** | | | | | |
| **RGDOMAIN** | **RKDOMAIN** | **DYKENUM** | **OK Estimates** | **MIK Estimates** | **Not Estimated (Mean Value)** |
| 100 | 0 | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 200 | 0 | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 300 | 0 | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 400 | 0 | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 0 | 10 | N/A | N/A | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 40 | N/A | N/A | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| **Shoemaker-Levy North (slnorthresmod060521.dm)** | | | | | |
| **RGDOMAIN** | **RKDOMAIN** | **DYKENUM** | **OK Estimates** | **MIK Estimates** | **Not Estimated (Mean Value)** |
| 100 | 0 | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 200 | 0 | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 300 | 0 | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 400 | 0 | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu | N/A | N/A |
| 0 | 20 | N/A | N/A | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |
| 0 | 40 | N/A | N/A | N/A | Ni, Co, Fe, Al, Mg, Ca, $CaCO_3$, Cr, Mn, Zn, Cu |

* There is no DYKENUM field in the Nindilbillup and Shoemaker-Levy North Estimates.

** There are no Si estimates in the Nindilbillup and Shoemaker-Levy North Estimates (no corresponding grade data).

### 14.10.4 Caprock, Limonite, Upper and Lower Saprolite

The Caprock, Limonite, Upper and Lower Saprolite domains were estimated (OK and MIK) using a staged process which incorporated the SMUDRSCL field, unfolding and where required top-cut drilling data. Each domain was estimated 4 times, once for each SMUDRSCL value using the following steps:

- Blocks were extracted based on the selected SMUDRSCL field value and the model parent cell prototype was adjusted to match the corresponding listed parent block values in Table 14-12. No changes were required for the SMUDRSCL=0 iteration. All estimates were based on the current parent cell dimension (no estimation of sub-cells).
- The 12 elements were estimated into the subset block model.
- The model prototype was reset back (when required) to the primary model prototype (SMUDRSCL=0)
- Steps 1 to 3 were repeated for all 4 parent cell combinations and the subset models were then combined back together.

All grade estimates were compiled in unfolded space with the values reassigned to the corresponding mine grid based volume model. Any blocks which could not be estimated were allocated mean values taken from the corresponding mean domain drillhole grade value.

LUC was used to improve the grade resolution in the areas estimated using 80 m by 100 m spaced drilling (SMUDRSCL=0) in the Halleys, Hale-Bopp and Shoemaker-Levy block models. LUC was only applied to the NIPCT, FEPCT, MGPCT and ALPCT grade fields in the limonite and upper saprolite domains (RGDOMAIN=200 and 300). This step was done to add grade granularity in the broadly drilled areas to aid with internal mine planning studies.

### 14.10.5 Dolerites Dykes

The dykes (>45 samples) were estimated using OK. The dykes which were estimated were each treated as a separate entity from a domain point of view. In other words only samples within each dyke wireframe were used to estimate the corresponding dyke blocks values.

### 14.10.6 Basalts, granites and talc shears

Blocks in these domain were allocated domain base grade means for all 5 deposits.

## 14.11 Block model validation

The grade and density estimates (including blocks assigned mean values) were validated using the following steps:

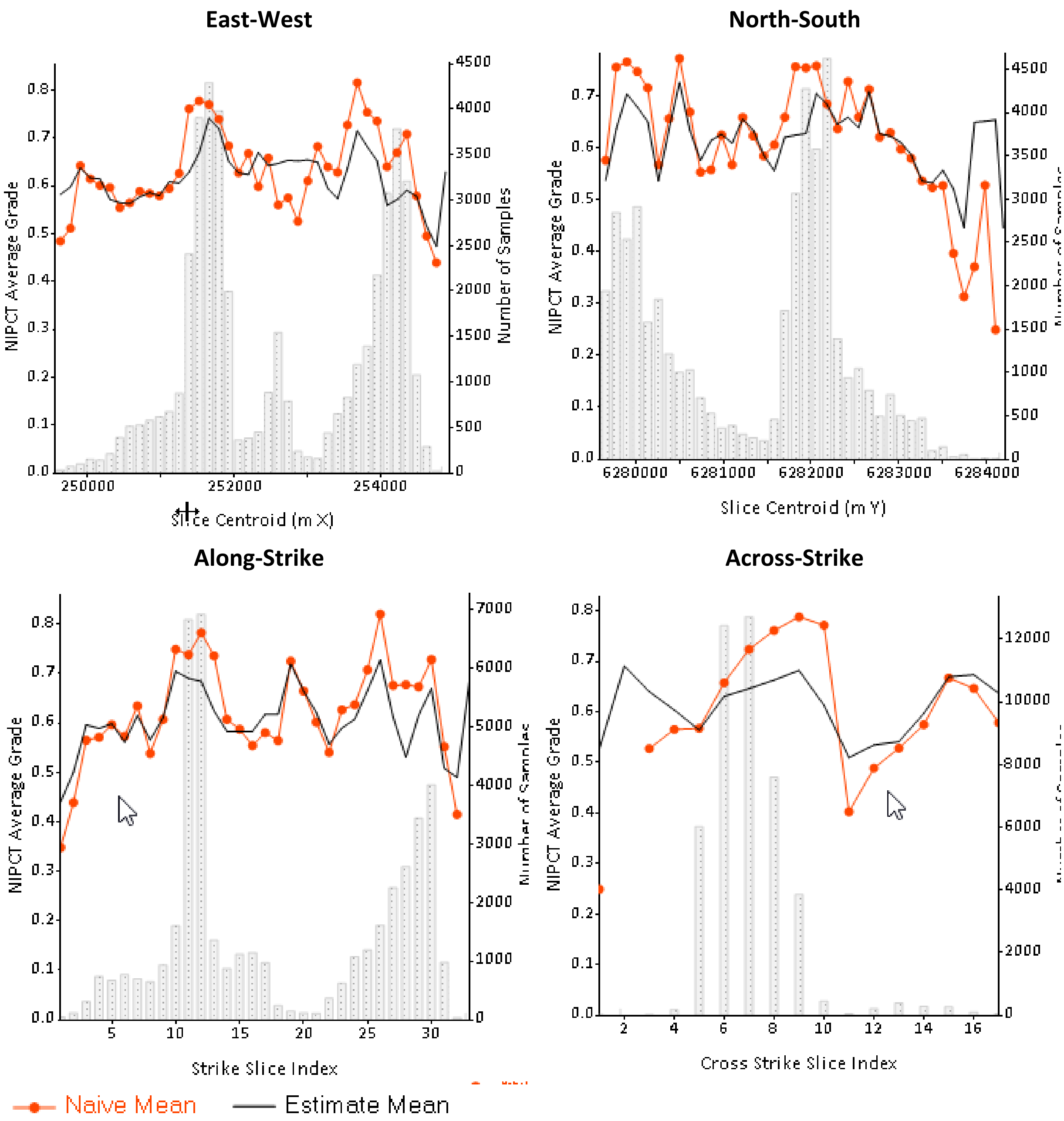
- Visual comparison of the drilling grade density values and the corresponding block model fields was undertaken on a section by section basis;
- Generation of grade trend plots for the comparing the block models and the corresponding drillhole grades used to estimate them. Plots were produced for the east-west, north-south, across strike and along strike grade trend plots for all the grade and density estimates in the four laterite domains (RGDOMAIN=100, 200, 300 and 400). As an example, Ni plots from the Limonite zone (RGDOMAIN=200) for the Shoemaker-Levy estimate are shown in Figure 14-6; and

- Generation of univariate statistics (declustered and naive) from the drilling on a domain by domain basis and comparing this data with the corresponding model grades.

Assessment of the results yielded the following observations:

- Visually the drilling and model grades compare well in the areas subject to close spaced drilling;
- The use of Unfold has improved the modelling of the key grade trends in the weathering profile; and
- Statistical comparison of the models key laterite grade estimates (Ni, Co, Fe, Si, Al, Ca, and Mg) with declustered input drilling data yielded results that were mostly less than 10%. The differences in the Ni grades were typically less than 3%.

**Figure 14-6 Shoemaker-Levy Limonite Ni grade trend plot.**



## 14.12 Resource classification

The resulting estimates were classified as Measured, Indicated and Inferred Mineral Resources in accordance with the guidelines of the Standards on Mineral Resources and Reserves of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines, CIM November 2019 and the CIM Definition Standards). The classification was guided by confidences in the geology, estimation methods and the resulting grade estimates in addition to the degree of geological continuity, the drillhole grid spacing and quality of sample analysis. Each of the 5 block models was classified using the following deposit and domain criteria:

- A 0.3 % Ni reporting cut-off was used for reporting purposes as per past estimates.
- The outer limit of the laterite mineralisation is defined using a perimeter which is extrapolated 50 m beyond the last limonite or upper saprolite mineralised (Ni>0.3%) intercept.
- Caprock mineralisation (relatively minor component) was all classified as Inferred.
- Limonite and upper saprolite mineralisation delimited by 40 mE by 50 mN drilling or closer was classified as Measured.
- Limonite and upper saprolite mineralisation delimited by 80 mE by 100 mN drilling was classified as Indicated.
- Limonite and upper saprolite mineralisation delimited by drilling a drilling spacing larger than 80 mE by 100 mN drilling was classified as Inferred.
- The lower saprolite domain strata consists mostly of high (>=16%) Mg material which is lightly weathered mafic/ultramafic basement and or semi competent serpentinite, and in some cases saprolite which was subject to extensive magnesite metasomatism. The Ni content of this material is typically low (about 80% of the drillhole samples have Ni grades less than 0.4% Ni). In addition, the Ni metal in the more competent (less weathered) strata will remain largely bound within the silicates and as such is mostly not recoverable. Only the lower saprolite blocks with an Mg content of 14% or less was classified in order to exclude a significant proportion of the lightly weathered serpentinite that has Ni grades of between 0.3 % and 0.4 % Ni. The 14% threshold was chosen as it delimited semi contiguous zones of mineralisation and was less than the 16% or more Mg content seen in the serpentinite rich samples. The lower saprolite was classified either Indicated or Inferred or unclassified.
- Basalts and granites are essentially barren and were flagged as unclassified.
- Dolerites were initially classified as Indicated regardless of drill spacing as they are difficult to define given that both the drilling and intrusives are sub-vertical in their orientation. Portions of dykes extrapolated beyond the laterite 50 m extrapolation perimeter are flagged as unclassified unless they have been tested using detailed drilling. Dolerite dykes defined by less than 45 samples were downgraded to Inferred.
- Talc shears were all flagged as unclassified as the tenor is typically low (< about 0.4%) and this material currently viewed as too problematic to process, even when blended.
- A base of drilling (BOH) surface (bohtr.dm/bohpt.dm) was compiled from the toe of each hole and projected downwards 6 m. All mineralisation below the 6 m projection level regardless of the rock type was flagged as unclassified. Mineralisation within the 6 m window below the drilling (excluding dykes) with Mg % <14 was all classified as Inferred.
- A small lease not owned by RNO (M 74/107) cuts the edge of south-west corner of the Shoemaker-Levy deposit. The affected tonnes has been excluded from the Mineral Resource. The impact on the global Mineral Resource is negligible being less than 0.5 Mt.

The classification was recorded in the block models using a field called RESCAT, which is described in Table 14-16.

**Table 14-16 Mineral Resource classification model field (RESCAT) values**

| RESCAT | Description |
|---|---|
| 1 | Measured |
| 2 | Indicated |
| 3 | Inferred |
| 4 | Not classified |

## 14.13 Mineral Resource reporting

The December 2021 Mineral Resource estimate statement is presented in Table 14-17 using a 0.3% Ni cut-off. The mined Mineral Resources (stockpiles and buffer ponds) are described in item 14.13.1.

**Table 14-17 RNO December 31st 2021 Mineral Resource statement using a 0.3% Ni cut-off grade**

| Deposit | Classification | Tonnes (Mt) | Ni (%) | Co (%) | Fe (%) | Al (%) | Mg (%) | Ca (%) |
|---|---|---|---|---|---|---|---|---|
| Halleys | Measured | 2.44 | 0.61 | 0.03 | 11.8 | 1.7 | 5.6 | 1.6 |
| | Indicated | 2.59 | 0.56 | 0.03 | 13.5 | 2.8 | 6.3 | 1.0 |
| | **Total Measured & Indicated** | **5.03** | **0.58** | **0.03** | **12.6** | **2.3** | **6.0** | **1.3** |
| | Inferred | 0.25 | 0.61 | 0.03 | 10.6 | 1.3 | 9.7 | 1.8 |
| Hale-Bopp | Measured | 21.65 | 0.55 | 0.03 | 11.8 | 1.5 | 5.5 | 0.5 |
| | Indicated | 15.39 | 0.55 | 0.03 | 11.5 | 1.7 | 8.0 | 0.8 |
| | **Total Measured & Indicated** | **37.04** | **0.55** | **0.03** | **11.7** | **1.6** | **6.6** | **0.6** |
| | Inferred | 1.23 | 0.47 | 0.02 | 9.5 | 1.7 | 10.7 | 1.5 |
| Shoemaker-Levy | Measured | 80.55 | 0.58 | 0.03 | 12.7 | 1.2 | 3.5 | 1.9 |
| | Indicated | 102.19 | 0.55 | 0.03 | 12.5 | 1.6 | 4.1 | 1.5 |
| | **Total Measured & Indicated** | **182.74** | **0.56** | **0.03** | **12.6** | **1.5** | **3.9** | **1.7** |
| | Inferred | 9.59 | 0.47 | 0.02 | 10.8 | 1.3 | 6.9 | 2.7 |
| Nindilbillup | Inferred | 26.72 | 0.53 | 0.03 | 12.9 | 2.4 | 5.8 | 0.4 |
| Shoemaker-Levy North | Inferred | 30.47 | 0.52 | 0.02 | 11.2 | 2.7 | 3.3 | 0.8 |
| | **Total Measured** | **104.64** | **0.57** | **0.03** | **12.5** | **1.3** | **4.0** | **1.6** |
| | **Total Indicated** | **120.17** | **0.55** | **0.03** | **12.4** | **1.7** | **4.7** | **1.4** |
| Total Resources | **Total Measured + Indicated** | **224.81** | **0.56** | **0.03** | **12.4** | **1.5** | **4.3** | **1.5** |
| | **Total Inferred** | **68.26** | **0.52** | **0.02** | **11.8** | **2.4** | **5.0** | **0.9** |

Notes:

- Mineral Resources are reported inclusive of Mineral Reserves.
- Mineral Resources that are not Mineral Reserves do not have a demonstrated economic outcome.
- Small discrepancies may occur in the figures due to the effects of rounding, the impact is not material.

- Fe, Al, Mg and Ca estimates do not constitute part of the Mineral Resource or Mineral Reserve. They are included as additional information relevant to beneficiation and leaching performance.

### 14.13.1 Stockpiles and buffer ponds

The total stockpiled mined ore at RNO is listed in Table 14-18, the material is mostly saprolite.

**Table 14-18 Total RNO Stockpiles**

| Description | Classification | Tonnes (Mt) | Ni (%) | Co (%) | Fe (%) | Al (%) | Mg (%) | Ca (%) |
|---|---|---|---|---|---|---|---|---|
| **Stockpiles** | **Measured** | **17.68** | **0.58** | **0.02** | **11.2** | **1.3** | **9.4** | **1.3** |

The buffer ponds contains 0.08 Mt of Measured Resources at about 1.0% Ni

## 14.14 Comparison with previous Mineral Resource estimate

The results from the previously reported block models (2012 Technical Report) subsequently depleted for mining as of 31st December 2021 are listed in Table 14-19.

**Table 14-19 RNO December 2012 models depleted to 31st December 2021 using 0.3% Ni cut-off grade**

| Deposit | Classification | Tonnes (Mt) | Ni (%) | Co (%) | Fe (%) | Al (%) | Mg (%) | Ca (%) |
|---|---|---|---|---|---|---|---|---|
| Halleys | Measured | 3.62 | 0.57 | 0.02 | 8.13 | 1.3 | 11.7 | 2.4 |
| | Indicated | 3.36 | 0.57 | 0.02 | 11.7 | 1.7 | 8.9 | 0.6 |
| | **Total Measured & Indicated** | **6.98** | **0.57** | **0.02** | **9.8** | **1.50** | **10.3** | **1.5** |
| | Inferred | 2.32 | 0.36 | 0.01 | 6.9 | 0.5 | 15.91 | 1.1 |
| Hale-Bopp | Indicated | 13.76 | 0.57 | 0.02 | 9.8 | 1.5 | 9.8 | 1.0 |
| | **Total Measured & Indicated** | **13.76** | **0.57** | **0.02** | **9.8** | **1.5** | **9.8** | **1.0** |
| | Inferred | 30.41 | 0.55 | 0.03 | 9.5 | 1.5 | 11.1 | 0.4 |
| Shoemaker-Levy | Measured | 62.29 | 0.61 | 0.03 | 13.9 | 1.9 | 4.6 | 1.2 |
| | Indicated | 112.60 | 0.57 | 0.03 | 11.3 | 1.4 | 5.3 | 1.6 |
| | **Total Measured & Indicated** | **174.89** | **0.59** | **0.03** | **12.2** | **1.6** | **5.1** | **1.4** |
| | Inferred | 15.04 | 0.44 | 0.02 | 7.8 | 1.5 | 11.3 | 1.7 |
| Nindilbillup | Inferred | 25.3 | 0.53 | 0.02 | 11.7 | 2.2 | 7.6 | 0.4 |
| Shoemaker-Levy North | Inferred | 31.4 | 0.55 | 0.02 | 11.3 | 2.2 | 4.7 | 0.8 |
| | **Total Measured** | **65.91** | **0.61** | **0.03** | **13.5** | **1.8** | **5.0** | **1.3** |
| | **Total Indicated** | **129.72** | **0.57** | **0.03** | **11.1** | **1.4** | **5.9** | **1.5** |
| | **Total Measured & Indicated** | **195.63** | **0.58** | **0.03** | **11.9** | **1.6** | **5.6** | **1.4** |
| Total | **Total Inferred** | **104.47** | **0.52** | **0.02** | **10.3** | **1.8** | **8.5** | **0.7** |

There are differences between the two sets of results which are discussed in the following sections:

### 14.14.1 Halleys

The updated model is reporting about 28% less indicated Measured and Indicated Mineral Resources and a 2% increase in the corresponding nickel grade due to the Halleys deposit been almost mined out and hence the remaining reported tonnage is relatively small.

### 14.14.2 Hale-Bopp

Extensive drilling completed since 2012 has upgraded a significant proportion of the Indicated and Inferred Mineral Resources reported in 2012 to Measured and Indicated in 2021. In terms of the Measured plus Indicated Mineral Resource tonnage there has been an increase of about 270% and a corresponding 4% decrease in the nickel grade.

### 14.14.3 Shoemaker-Levy

Infill drilling conducted since 2017 has resulted in a 4% increase in the Measured and Indicated Mineral Resource tonnage and a corresponding 5% decrease in the nickel grade.

### 14.14.4 Nindilbillup and Shoemaker-Levy North

The previously reported Mineral Resources for Nindilbillup and Shoemaker-Levy North are based on estimates derived from wireframed volumes compiled using a 0.3% Ni threshold (Limonite and Saprolite domains) and density values from the nearby Shoemaker-Levy deposit. The reported Mineral Resource grades are based on mean grades derived from drillhole samples which were included inside each wireframe volume. In other words, the previous estimates were not based on conventional block model estimates.

In mid-2021 both models were estimated using the same procedure used to model the three main deposits (Halleys, Hale-Bopp and Shoemaker-Levy). The reported tonnes and grades are similar to the historic values. However, the differences in the methods used to compile the previous and current estimates make it impractical to compare the results in any detail.

These Nindilbillup and Shoemaker-Levy North deposits require additional RC drilling to upgrade the Mineral Resource classification. This upgrade in classification will also require new core drilling to provide samples for other key areas such as bulk density, QC analysis and metallurgical test work.

# Item 15 MINERAL RESERVE ESTIMATE

## 15.1 Introduction

This section of the report summarises the main considerations in relation to preparation of the RNO Mineral Reserves update and provides references to the sections of the study where more detailed discussions of particular aspects are covered. Detailed technical information provided in this section relates specifically to this Mineral Reserve update and is based on the Mineral Resource models and estimates as reported in Item 14.

The Mineral Reserves update was compiled with reference to NI 43-101 by the Qualified Person responsible for the reporting of open pit Mineral Reserves, Mr. Tony Cameron, who is a Fellow of The Australasian Institute of Mining and Metallurgy (AusIMM), and a contractor for FQM. Mr. Cameron has sufficient experience, which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he has undertaken to be a Qualified Person, as defined by NI 43-101.

## 15.2 Mineral Reserve Statement

Mineral Resources are reported inclusive of Mineral Reserves, (that is, Mineral Reserves are not additional to Mineral Resources). Mineral Reserves are subdivided into Proven Mineral Reserves and Probable Mineral Reserves categories to reflect the confidence in the underlying Mineral Resource data and modifying factors applied during mine planning. A Proven Mineral Reserve can only be derived from a Measured Mineral Resource while a Probable Mineral Reserve is typically derived from an Indicated Mineral Resource but can also be made up of a Measured Mineral Resource should the Qualified Person have reason to downgrade the confidence of the estimation.

The Mineral Reserves for RNO has been updated as at 31st December 2021 and summarised in Table 15-1 and Table 15-2 below and shows there remains a total of 196 Mt of Open Cut Mineral Reserves at 0.576% Ni were estimated at an average cut-off grade equivalent to 0.3% Ni. Mg and Ca estimates do not constitute part of the Mineral Reserve. They are included as additional information relevant to beneficiation and leaching performance.

**Table 15-1 RNO Mineral Reserve statement as of 31st December 2021**

| Type/Classification | Tonnes (Mt) | Ni (%) | Co (%) | Ca (%) | Mg (%) |
|---|---|---|---|---|---|
| Limonite Ore | | | | | |
| Proven Reserve | 67.2 | 0.62 | 0.03 | 0.6 | 2.1 |
| Probable Reserve | 62.9 | 0.60 | 0.03 | 0.5 | 2.0 |
| **Total Limonite Reserve** | **121.3** | **0.60** | **0.03** | **0.6** | **2.1** |
| Saprolite Ore | | | | | |
| Proven Reserve | 24.2 | 0.44 | 0.03 | 4.4 | 7.5 |
| Probable Reserve | 23.7 | 0.46 | 0.03 | 3.5 | 8.2 |
| **Total Saprolite Reserve** | **48.0** | **0.45** | **0.03** | **3.9** | **7.9** |
| Total Ore in Pits | | | | | |
| Proven Reserve | 91.4 | 0.57 | 0.03 | 1.6 | 3.6 |
| Probable Reserve | 86.6 | 0.56 | 0.03 | 1.4 | 3.7 |
| **Total In Pit Reserve** | **178.0** | **0.56** | **0.03** | **1.5** | **3.6** |
| Stockpile | | | | | |
| Proven Reserve | 17.7 | 0.58 | 0.03 | 1.5 | 9.4 |
| Probable Reserve | | | | | |
| **Total Stockpile** | **17.7** | **0.58** | **0.03** | **1.5** | **9.4** |

| | | | | | |
|---|---|---|---|---|---|
| Proven Reserve | 109.1 | 0.57 | 0.03 | 1.6 | 4.5 |
| Probable Reserve | 86.6 | 0.56 | 0.03 | 1.4 | 3.7 |
| **Total Reserve including Stockpile** | **195.7** | **0.57** | **0.03** | **1.5** | **4.1** |
| **Type/Classification** | **Tonnes (Mt)** | **Ni (%)** | | | |
| Buffer Ponds - Proven | 0.08 | 1.00 | | | |

Notes:

- The Mineral Reserves update was compiled with reference to NI 43-101 by the Qualified Person responsible for the reporting of open pit Mineral Reserves, Mr. Tony Cameron, who is a Fellow of The Australasian Institute of Mining and Metallurgy (AusIMM), and a contractor for FQM. Mr. Cameron has sufficient experience, which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he has undertaken to be a Qualified Person, as defined under CIM.
- Tonnages are metric tonnes
- Royalty is composed of a 3.4% royalty on Revenue for Nickel plus a 3.03% royalty on Revenue for Cobalt)
- Figures reported are rounded to 2 significant figures to reflect accuracy which may result in small tabulation errors.
- Mg and Ca estimates do not constitute part of the Mineral Reserve. They are included as additional information relevant to beneficiation and leaching performance.
- Mineral Reserves are reported in accordance with the requirements of Canadian National Instrument 43-101 of the Canadian Securities Administrators ("NI 43-101").
  The Buffer Ponds contain beneficiated product and are used as temporary storage to assist the processing team manage fluctuations and disruptions in Leach feed from the Beneficiation Plants.

Table 15-2 below shows the Mineral Reserves in each pit as at December 31st 2021. As can be seen, 157 Mt, which is 80% of the remaining Mineral Reserve, is in Shoemaker-Levy where mining commenced in 2021. Mg and Ca estimates do not constitute part of the Mineral Reserve. They are included as additional information relevant to beneficiation and leaching performance.

**Table 15-2 RNO Mineral Reserves by Pit as of 31st December 2021**

| Deposit | Classification | Tonnes (Mt) | Ni (%) | Co (%) | Ca (%) | Mg (%) |
|---|---|---|---|---|---|---|
| Halleys | Proven Limonite | 0.7 | 0.54 | 0.03 | 0.3 | 2.3 |
| | Probable Limonite | 0.6 | 0.58 | 0.03 | 0.3 | 1.7 |
| | **Total Limonite** | **1.3** | **0.56** | **0.03** | **0.3** | **2.0** |
| | Proven Saprolite | 0.5 | 0.69 | 0.03 | 2.1 | 4.3 |
| | Probable Saprolite | 0.7 | 0.73 | 0.03 | 0.7 | 2.6 |
| | **Total Saprolite** | **1.2** | **0.71** | **0.03** | **1.3** | **3.3** |
| | Proven Ore | 1.2 | 0.61 | 0.03 | 1.1 | 3.1 |
| | Probable Ore | 1.3 | 0.66 | 0.03 | 0.5 | 2.2 |
| | **Total Halleys** | **2.5** | **0.63** | **0.03** | **0.8** | **2.7** |
| Hale-Bopp | Proven Limonite | 9.9 | 0.54 | 0.03 | 0.1 | 2.9 |
| | Probable Limonite | 1.9 | 0.65 | 0.03 | 0.2 | 3.0 |
| | **Total Limonite** | **11.7** | **0.56** | **0.03** | **0.1** | **2.9** |
| | Proven Saprolite | 4.6 | 0.54 | 0.03 | 0.5 | 9.2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Probable Saprolite | 1.8 | 0.65 | 0.03 | 0.8 | 10.8 |
| | **Total Saprolite** | **6.4** | **0.56** | **0.03** | **0.6** | **9.6** |
| | Proven Ore | 14.4 | 0.54 | 0.03 | 0.2 | 4.9 |
| | Probable Ore | 3.7 | 0.61 | 0.03 | 0.5 | 6.8 |
| | **Total Hale-Bopp** | **18.1** | **0.56** | **0.03** | **0.3** | **5.3** |
| Shoemaker-Levy | Proven Limonite | 56.6 | 0.63 | 0.03 | 0.7 | 2.0 |
| | Probable Limonite | 60.4 | 0.60 | 0.03 | 0.6 | 1.9 |
| | **Total Limonite** | **117.0** | **0.61** | **0.03** | **0.6** | **2.0** |
| | Proven Saprolite | 19.1 | 0.42 | 0.01 | 5.3 | 7.2 |
| | Probable Saprolite | 21.3 | 0.44 | 0.02 | 3.8 | 8.2 |
| | **Total Saprolite** | 38.0 | **0.43** | **0.02** | **4.6** | **7.7** |
| | Proven Ore | 75.7 | 0.58 | 0.03 | 1.9 | 3.3 |
| | Probable Ore | 81.7 | 0.55 | 0.03 | 1.4 | 3.6 |
| | **Total Shoemaker-Levy** | 157.4 | **0.56** | **0.03** | **1.6** | **3.4** |
| Combined Pits | Proven Limonite | 67.2 | 0.62 | 0.03 | 0.6 | 2.1 |
| | Probable Limonite | 62.9 | 0.60 | 0.03 | 0.5 | 2.0 |
| | **Total Limonite** | **130.0** | **0.61** | **0.03** | **0.6** | **2.1** |
| | Proven Saprolite | 24.2 | 0.44 | 0.02 | 4.4 | 7.5 |
| | Probable Saprolite | 23.7 | 0.46 | 0.02 | 3.5 | 8.2 |
| | **Total Saprolite** | **48.0** | **0.45** | **0.02** | **3.9** | **7.9** |
| | Proven Ore | 91.4 | 0.57 | 0.03 | 1.6 | 3.6 |
| | Probable Ore | 86.6 | 0.54 | 0.03 | 1.4 | 3.7 |
| | **Total Combined Pits** | **178.0** | **0.56** | **0.03** | **1.5** | **3.6** |
| Stockpiles | Proven Ore | 17.7 | 0.58 | 0.03 | 1.5 | 9.4 |
| | Probable Ore | - | - | - | - | - |
| | **Total Stockpiles** | **17.7** | **0.58** | **0.03** | **1.5** | **9.4** |
| Mineral Reserve including Stockpiles | Proven Ore | 109.1 | 0.57 | 0.03 | 1.6 | 4.5 |
| | Probable Ore | 86.6 | 0.56 | 0.03 | 1.4 | 3.7 |
| | **Total Mineral Reserve** | **195.7** | **0.57** | **0.03** | **1.5** | **4.1** |

## 15.3 Mineral Reserve Cut-off Grade

A ROM marginal break-even cut-off grade calculation based on the latest cost estimation, metallurgical recoveries determined the economic marginal cut-off of to be 0.40% BNi for Limonite and 0.50% BNi for Saprolite. These cut-offs were applied for the estimation of Mineral Reserves.

It is noted that after taking mass recoveries into account, the calculated marginal cut-offs equate to an average in-situ Nickel cut-off of 0.3% Ni.

## 15.4 Mineral Reserve Dilution and Ore Loss

Historically, mining loss and dilution at RNO have been approximated by applying a 3% global loss and 5% global dilution. These numbers reflect the fact that the contacts are highly visible and the Limonite/Saprolite boundary incurs no ore loss.

Minesite reconciliation data for Halleys confirmed the actual loss and dilution percentages matched reasonably well with predicted loss and dilution, however loss and dilution at Hale-Bopp was higher than predicted. For the optimisation of the remainder of Hale-Bopp, mining loss has been increased to 10% due to the presence of talc and Halley's other deleterious materials in the mineralised zones. Given mineralisation at Shoemaker-Levy is similar to Halleys, the original 3% global loss and 5% global dilution has been applied to Shoemaker-Levy for this optimisation.

## 15.5 Mineral Reserve Pit Determination and Modifying Factors

The conversion of the Mineral Resource estimate to a Mineral Reserve estimate followed a conventional approach commencing with determination of the economic pit limits using the Whittle 4X pit limit optimisation software ("Whittle 4X Optimiser"). The word 'optimisation' is used as the pit shell generated defines economic mining limits for each mining area using the given input parameters. Whittle was not used to "optimise" the overall RNO project development as practical elements such as mine sequence, blending strategy, and power management were excluded.

The approach used to identify the final economic pit limits for RNO was:

- Identify any physical constraints to mining, for example, tenement boundaries, infrastructure, protected zones (flora, rivers, roads and road easements);
- Define mining and processing costs as well as selling prices and costs;
- Define the mining loss and dilution;
- Define processing recoveries for Limonite and Saprolite (includes beneficiation recoveries as well as leach recoveries);
- Define the pit slope design parameters for each mining area and material type;
- Import all above parameters, including geological model into the pit limit optimisation software;
- Run pit limit optimisation software to produce a series of nested pit shells at increasing product selling prices;
- Analyse results and select a preferred pit shell for each mining area for guidance in the pit designing process.

The selected ultimate pit outlines (shells) were used to create practical and detailed open pit designs accounting for the siting of in-pit ramps, berms, pumps, and haul roads. These pit designs then provided the bench by bench ore and waste mining inventories for the detailed production schedule that demonstrates viable open pit mining and provides the physical basis for cash flow modelling (refer Item 16).

### 15.5.1 Mining Lease & Physical Mining Constraints

Physical constraints are typically surface features which limit the allowable extent of mining. Examples include critical infrastructure, mining titles, property ownership and environmentally sensitive areas.

The following constraints to the pit limits were applied:

- Halleys - Backfilled areas excluded.
- Hale-Bopp – Kunzea zone excluded plus limits placed to prevent the pit from encroaching on the tailings dam and southern access road.
- Shoemaker-Levy – Bandalup creek plus South Coast highway easement excluded.

FQM is not aware of any additional physical constraints to the pit limits and current mining operations at RNO.

### 15.5.2 Geological Block Models and Topography

As discussed in Item 14 of this report, the resource block models for Halleys, Hale-Bopp, and Shoemaker-Levy were prepared by FQM in Datamine format. All blocks in the three models were 40 m x 50 m x 4 m height with no sub-blocking.

The three models were imported into Surpac. Surveyed mining surfaces as at 31st December 2021 were then applied to the models to deplete mined material and to identify backfilled areas, which were coded into the models. The three block models were subsequently manipulated in Surpac to add attributes required for optimisation and exported to Whittle 4X model format.

### 15.5.3 Geotechnical Parameters

Pit optimisation input included overall slope design angles as follows:

- Halleys – 45 degrees.
- Hale-Bopp – 35 degrees.
- Shoemaker-Levy – 35 degrees above Limonite/Saprolite boundary and 45 degrees below.

The geotechnical engineering basis for these design angles is outlined in Item 16.

### 15.5.4 Metal prices and Payabilities

The optimisation inputs for long term metal prices based on consensus forecasts available at the time of undertaking the optimisation were as follows:

- Nickel = $8.00/lb ($17,637/t)
- Cobalt = $30.00/lb ($66,139/t)

Payabilities, representing metal costs, were applied based on current contracts as follows:-

- Nickel = 87 %
- Cobalt = 45 %

It is noted that Nickel payability can be up to 92% based on prevailing metal price, however a more conservative view has been taken for the longer term.

### 15.5.5 Metal recoveries

As discussed in Item 14, beneficiation plant recoveries and upgrades were added as attributes in the Geology models before export to Whittle.

Leach recovery inputs were the same as those listed in Item 13, namely:

- Limonite (PAL) = 90.3 %
- Saprolite (AL) = 68.4 %

### 15.5.6 Operating costs

The unit operating costs used in the pit optimisation process were derived based on the RNO 2022 2027 Budget/5 year Plan and adjusted using long term forecast estimates for major items such as Sulphur, parts, and labour.

**Mining Costs**

Variable mining costs comprising drill, blast, load and haul costs, on a bench by bench basis, were based on the current mining contract. Costs for areas scheduled to be mined beyond the term of the current contract were estimated using haul profiles and preliminary mine designs used to develop the LOM schedule. Given the RNO pits are relatively shallow, no incremental depth adjustments were considered necessary.

The resulting weighted average variable mining costs was $5.50/t for ore and waste including an allowance for rehandle of ore. Further details of these mining costs are outlined in Item 21.

No allowance was required for mining equipment or sustaining capital costs as the assumption was made that Contractor mining would continue for the life of the mine.

**Processing Costs**

RNO is process constrained, hence the process operating costs were input as the sum of the fixed and variable costs. These costs vary by process route but are the same for each deposit (details are outlined in Item 21):

- Sulphur Cost ($/tonne) = $145
- Processing PAL ($/tonne leach feed) = $33.34
- Processing AL ($/tonne leach feed) = $42.83
- Fixed cost (equivalent G&A cost in variable terms) = $4.73/t leach feed
- Averaged total processing cost = $58.08/t leach feed.

### 15.5.7 Net return

Net return is calculated using the formula "net return = recovery * (revenue – metal costs)" and needs to be expressed in units of metal grade. Since the metal grades in the geology models for Ni and Co are measured in % terms, the appropriate unit is $/10kg. In other words, the $/lb costs must be multiplied by 2,204.62 and divided by 100.

### 15.5.8 Marginal cut-off grades

No mining or processing cut-off grades were applied within the Whittle pit optimiser. Selection of material for processing was made by Whittle based on the value of the contained metal and associated production costs.

Whittle optimisation software uses the following simplified formula to calculate the marginal cut-off grade.

Marginal COG = (PROCOST x MINDIL)/(NR)

- where PROCOST is the sum of the processing cost plus the ore mining cost differential, and
- MINDIL is the mining dilution factor

### 15.5.9 Optimisation Results and Shell Selection

Figure 15-1 to Figure 15-3 show the graphical results of pit optimisation. Key criteria used in selecting the final pit shell included:

- Maximise cash flow;
- Maximise resource recovery;
- Balance between maximising ore and minimising incremental strip ratio; and
- Practical pit size and shape.

The 100% revenue factor pit shell was selected as the overall preferred result for each of the mining areas.

**Figure 15-1 Halleys Pit Optimisation Results**

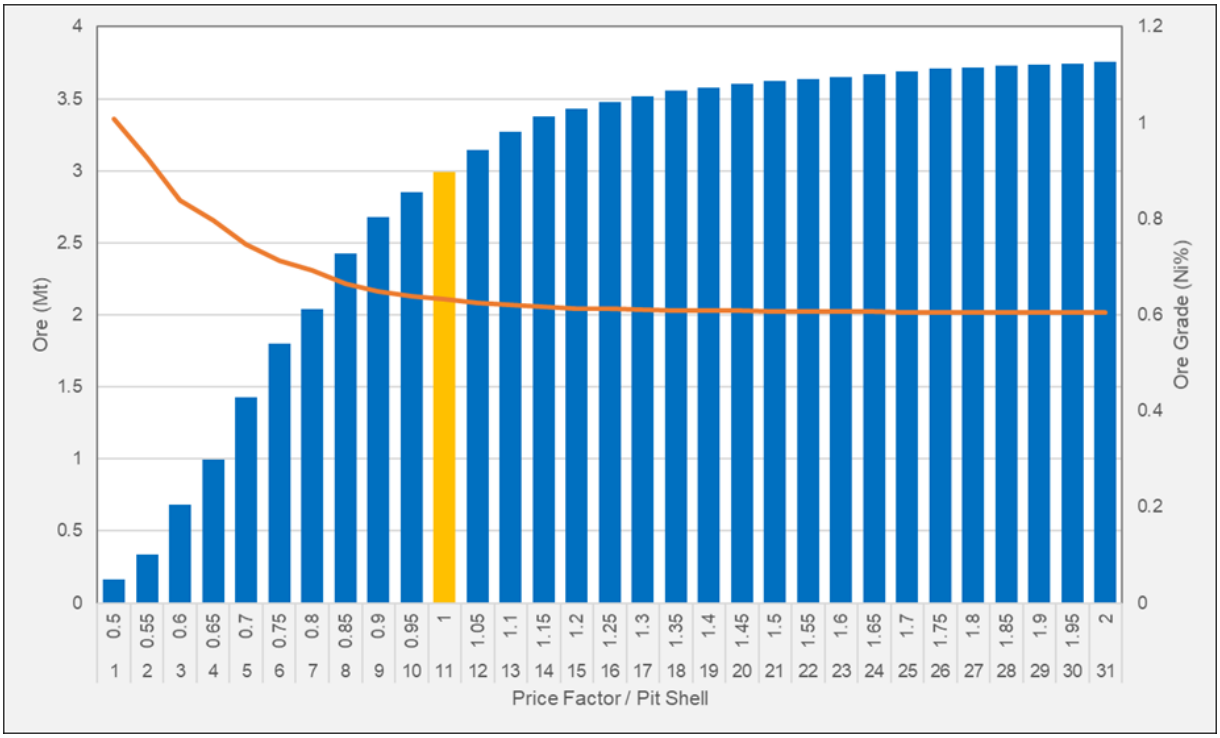



**Figure 15-2 Hale-Bopp Pit Optimisation Results**

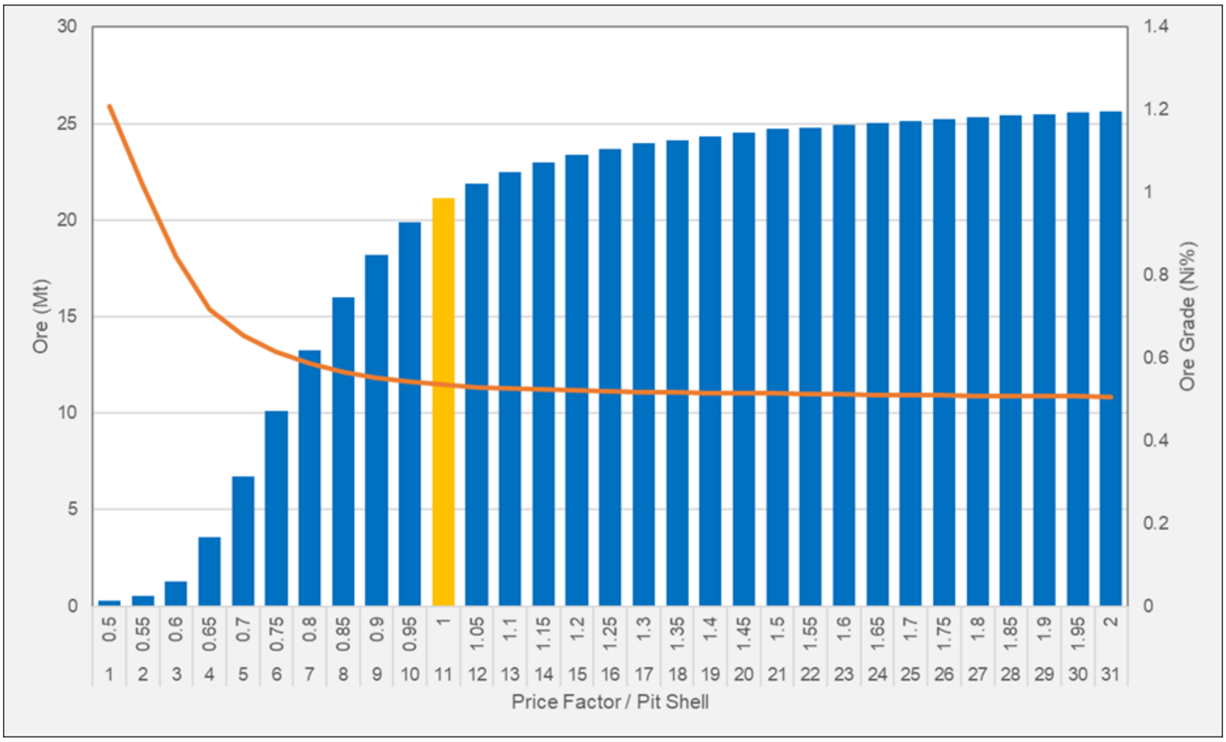
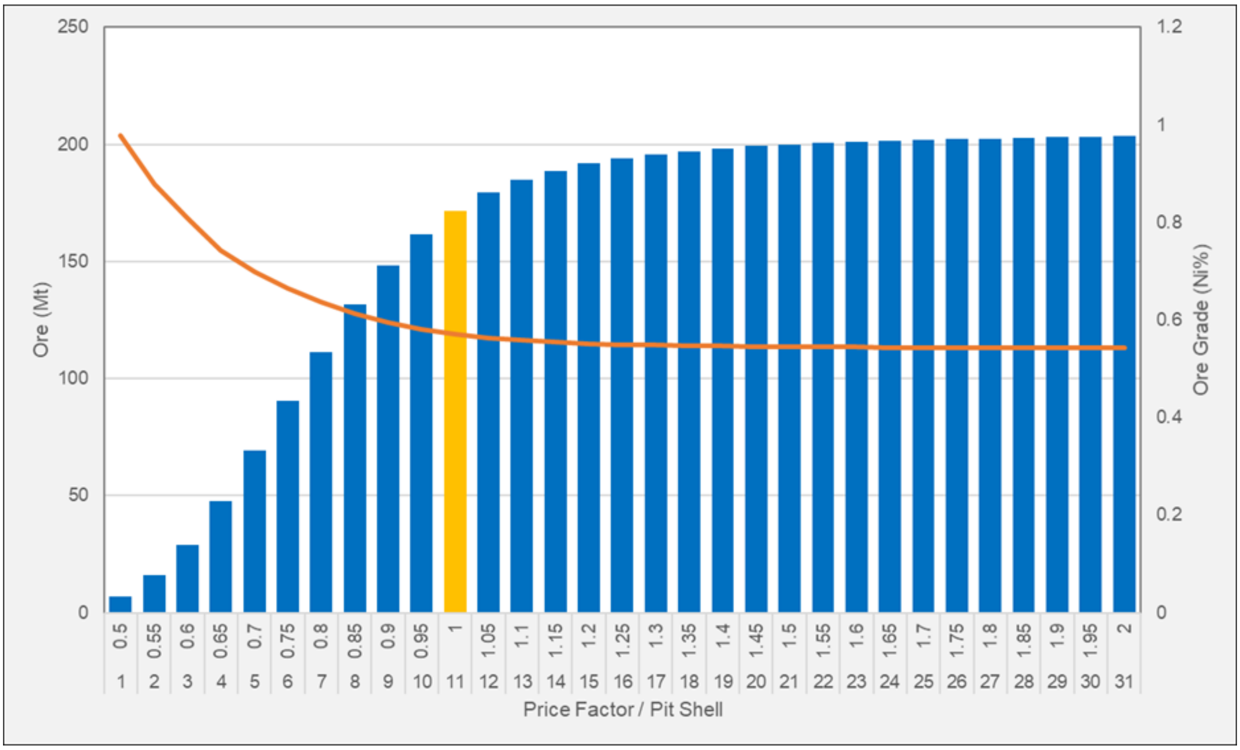


**Figure 15-3 Shoemaker-Levy Pit Optimisation Results**




The total inventory of the combined shells is 192.6 Mt at 0.57% Ni as shown in Table 15-3.

**Table 15-3 RNO Selected Optimal pit shell inventories**

| Pit | Waste (Mt) | Ore (Mt) | Strip Ratio | Ni (%) |
|---|---|---|---|---|
| Halleys | 3.6 | 3.0 | 1.20 | 0.63 |
| Hale-Bopp | 18.0 | 21.1 | 0.85 | 0.54 |
| Shoemaker-Levy | 176.5 | 171.7 | 1.03 | 0.57 |
| **Total Inventory** | **198.6** | **195.9** | **1.01** | **0.57** |

## 15.6 Design and planning parameters

The following design parameters relate to the design of the three ultimate pits:-

- Benches (interval between berms) are mined to a height of 6 m in 2 x 3 m flitches in ore and waste
- Truck ramp and road width including bund = 30 m
- Maximum haul ramp gradient = 1 : 10 (approximately 6°)
- Halleys (all slopes and material): Batter angle 55°, Berm width = 5 m
- Hale-Bopp (all slopes and material): Batter angle 45°, Berm width = 5 m
- Shoemaker-Levy (all slopes above Limonite/Saprolite contact) Batter angle 65°, Berm width = 5.7 m
- Shoemaker-Levy (all slopes below Limonite/Saprolite contact) Batter angle 70°, Berm width = 3.5 m

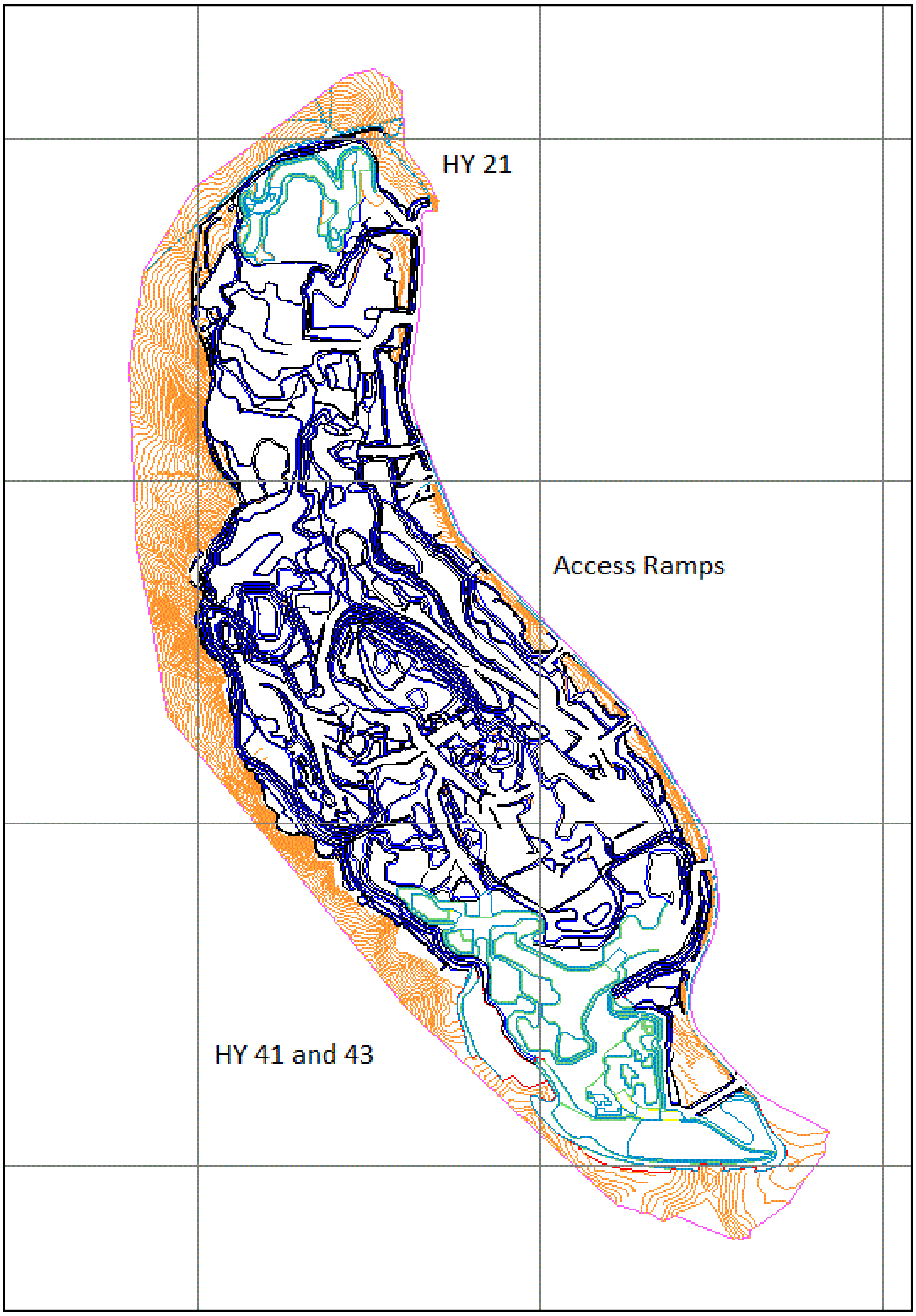
## 15.7 Pit designs

As noted in item 15.5 above, the ultimate pit designs for each mining area are based on the selected ultimate pit shells. These designs were developed in accordance with the design and planning parameters listed in item 15.6.

Note that only material with a Resource classification of measured or indicated can be considered when designing an ultimate pit for determining a Reserve.

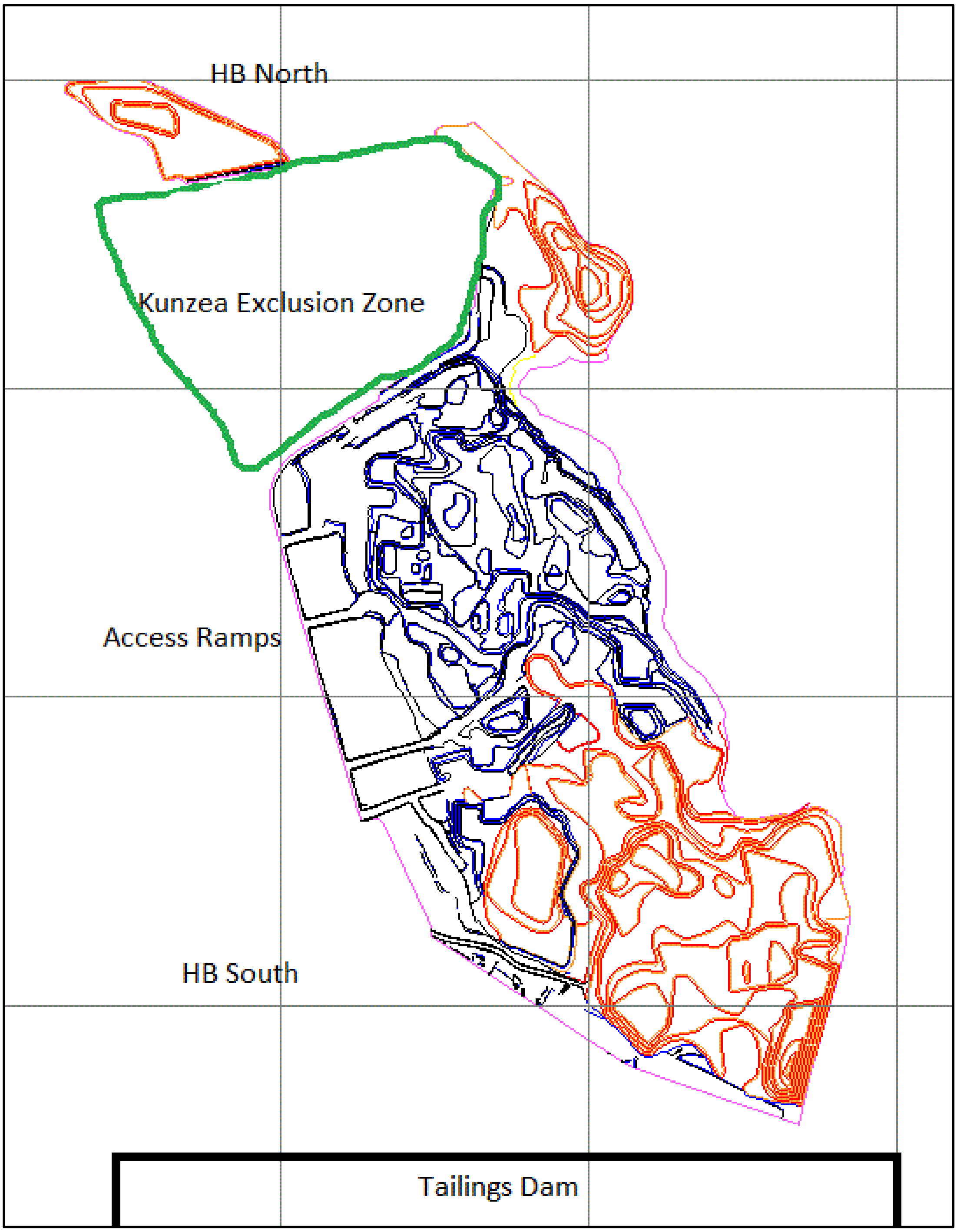
Figure 15-4 to Figure 15-6 show the ultimate pit designs produced from respective pit shell outlines. The Halleys and Hale-Bopp designs have been merged with as-mined surfaces because they are both close to completion. The Shoemaker-Levy pit design has been cut with the surface topography as only starter pits within the final pit limits have been commenced there. Ramp access to Shoemaker-Levy changes over time. There are no final ramps in the design as all ramps are internal and will be mined out or created from backfill material as the mining and waste backfill faces advance.

**Figure 15-4 Halleys Ultimate Pit Design**



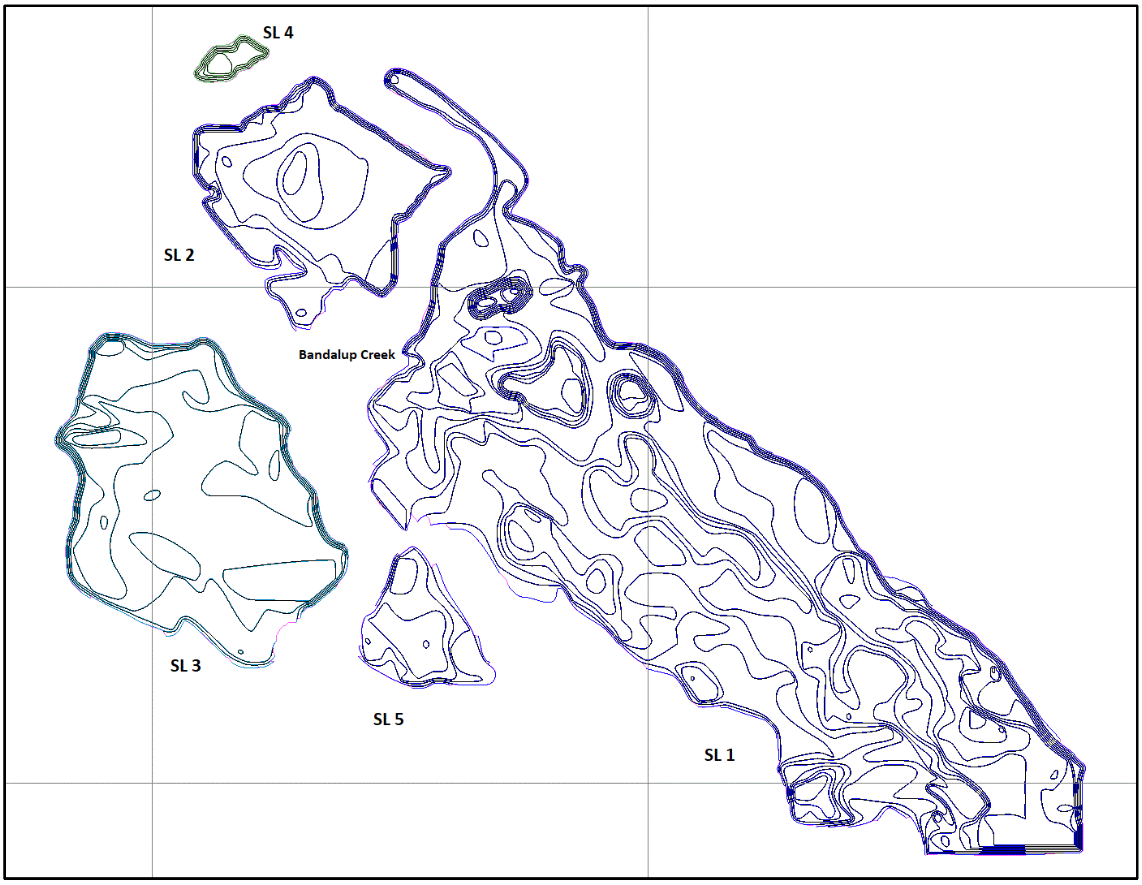
The remaining portions in HY 21, HY 41, and HY 43 in Halleys pit contain 2.5 Mt of ore at a strip ratio of 1.07 to 1. Pit access is already established and backfill has commenced in the mined out portions of the pit (HY 11, 13, 14, 31, and 33).

**Figure 15-5 Hale-Bopp Ultimate Pit Design**




Hale-Bopp is now defined as Hale-Bopp south (which extends to the tailings dam) and Hale-Bopp north (which heads towards Halleys whilst staying out of the Kunzea exclusion zone). The remaining portions in Hale-Bopp north and south contain 18.1 Mt of ore at a strip ratio of 1.04 to 1. Pit access is already established.

Figure 15-6 Shoemaker-Levy Ultimate Pit Design




Mining commcenced in Shoemaker-Levy in 2021 hence the bulk of the deposit is still available for mining and processing. The designed pit contains 157.4 Mt of ore at a strip ratio of 1.06 to 1.

## 15.8 Design efficiency

Table 15-4 provides a validation comparison between the ultimate pit designs and the shells upon which those designs were based.

**Table 15-4 RNO Validation between pit shell and design**

| Pit | Waste (Mt) | Ore (Mt) | Strip Ratio | Ni (%) |
|---|---|---|---|---|
| Halleys | 3.6 | 3.0 | 1.20 | 0.63 |
| Halleys | 2.7 | 2.5 | 1.07 | 0.63 |
| HY Variance | -0.9 | -0.5 | -0.13 | 0.00 |
| **HY Variance %** | **-24.7%** | **-15.3%** | **-11%** | **0%** |
| Hale-Bopp | 18.0 | 21.1 | 0.85 | 0.54 |
| Hale-Bopp | 18.9 | 18.1 | 1.04 | 0.56 |
| HB Variance | 0.8 | 3.0 | 0.19 | 0.02 |
| **HB Variance %** | **4.6%** | **-14.4%** | **22.2%** | **3.8%** |
| Shoemaker-Levy | 176.5 | 171.7 | 1.03 | 0.57 |
| Shoemaker-Levy | 166.7 | 157.4 | 1.06 | 0.56 |
| SL Variance | -9.7 | -14.4 | 0.03 | -0.01 |
| **SL Variance %** | **-5.5%** | **-8.4%** | **3.1%** | **-1.1%** |
| RNO Combined | 198.1 | 195.9 | 1.01 | 0.57 |

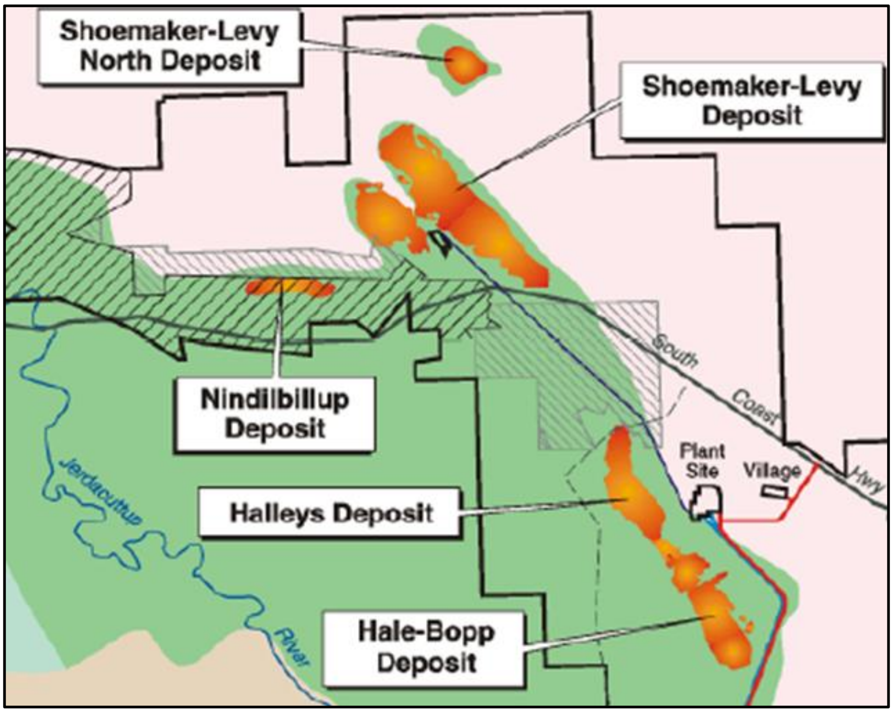
| | | | | |
|---|---|---|---|---|
| RNO Combined | 188.3 | 178.0 | 1.06 | 0.56 |
| Combined Variance | -9.8 | -17.9 | 0.05 | -0.01 |
| **Combined Variance %** | **-4.9%** | **-9.1%** | **4.6%** | **-0.6%** |

Overall and for each pit there is a reasonable validation between pit designs and the selected ultimate shells.

## 15.9 Mine site layout

Figure 15-12 shows how the RNO pits relate to each other. Additionally, this figure shows the location of the process plant site and Shoemaker-Levy ore conveying route.

**Figure 15-7 RNO Mine Layout**




## 15.10 Mineral Reserve estimate comparisons

Reflecting the updates to the Mineral Resource model and the comparisons made between the depleted 2012 and December 2021 Mineral Resource estimates (Item 14.14 and Table 14-19), there are commensurate differences between the respective Mineral Reserve estimates for each pit.

The 2012 Technical Report (FQM) contained a Mineral Reserve estimate of 230 million tonnes at a grade of 0.63% Ni. These Mineral Reserves were estimated using a 0.3% Ni cutoff grade based on a US$7.50/lb Nickel price. Since 2012 the reported Mineral Reserve has been depleted annually by mining and processing at RNO and as at December 31, 2021, the depleted Mineral Reserve stood at 192.9 million tonnes at a grade of 0.59% Ni.

A comparison between the depleted 2012 Mineral Reserve estimate and the 2021 Mineral Reserve estimate as at December 31, 2021 is provided in Table 15-5 below.

**Table 15-5 RNO Mineral Reserve Comparison by Pit as at 31 December 2021**

| | | 2021 New | | 2021 Depletion | | Variance % | |
|---|---|---|---|---|---|---|---|
| **Deposit** | **Classification** | **Tonnes (Mt)** | **Ni (%)** | **Tonnes (Mt)** | **Ni (%)** | **Quantity** | **Grade** |
| Halleys | Proven Limonite | 0.7 | 0.54 | 0.3 | 0.63 | 164% | -14% |
| | Probable Limonite | 0.6 | 0.58 | 0.3 | 0.65 | 78% | -10% |
| | **Total Limonite** | **1.3** | **0.56** | **0.6** | **0.64** | **115%** | **-13%** |
| | Proven Saprolite | 0.5 | 0.69 | 2.9 | 0.53 | -82% | 30% |
| | Probable Saprolite | 0.7 | 0.73 | 1.1 | 0.55 | -36% | 33% |
| | **Total Saprolite** | **1.2** | **0.71** | **4.0** | **0.54** | **-69%** | **33%** |
| | Proven Ore | 1.2 | 0.61 | 3.2 | 0.54 | -61% | 12% |
| | Probable Ore | 1.3 | 0.66 | 1.4 | 0.57 | -8% | 15% |
| | **Total Halleys** | **2.5** | **0.63** | **4.6** | **0.55** | **-45%** | **15%** |
| Hale-Bopp | Proven Limonite | 9.9 | 0.54 | 0 | 0 | | |
| | Probable Limonite | 1.9 | 0.65 | 3.8 | 0.55 | -51% | 18% |
| | **Total Limonite** | **11.7** | **0.56** | **3.8** | **0.55** | **207%** | **1%** |
| | Proven Saprolite | 4.6 | 0.54 | 0 | 0 | | |
| | Probable Saprolite | 1.8 | 0.65 | 6.5 | 0.51 | -72% | 10% |
| | **Total Saprolite** | **6.4** | **0.56** | **6.5** | **0.51** | **-2%** | **7%** |
| | Proven Ore | 14.4 | 0.54 | 0 | 0 | | |
| | Probable Ore | 3.7 | 0.61 | 10.3 | 0.53 | -65% | 15% |
| | **Total Hale-Bopp** | **18.1** | **0.56** | **10.3** | **0.53** | **76%** | **6%** |
| Shoemaker-Levy | Proven Limonite | 56.6 | 0.63 | 44.2 | 0.64 | 28% | -2% |
| | Probable Limonite | 60.4 | 0.60 | 74.1 | 0.59 | -18% | 0% |
| | **Total Limonite** | **117.0** | **0.61** | **118.9** | **0.61** | **-2%** | **0%** |
| | Proven Saprolite | 19.1 | 0.42 | 16.3 | 0.54 | 17% | -23% |
| | Probable Saprolite | 21.3 | 0.44 | 25.8 | 0.54 | -17% | -18% |
| | **Total Saprolite** | **38.0** | **0.43** | **42.2** | **0.54** | **-4%** | **-20%** |
| | Proven Ore | 75.7 | 0.58 | 60.5 | 0.61 | 25% | -6% |
| | Probable Ore | 81.7 | 0.55 | 99.8 | 0.58 | -18% | -4% |
| | **Total Shoemaker-Levy** | **157.4** | **0.56** | **160.4** | **0.59** | **-2%** | **-5%** |
| Combined Pits | Proven Limonite | 67.2 | 0.62 | 44.5 | 0.64 | 51% | -4% |
| | Probable Limonite | 62.9 | 0.60 | 78.2 | 0.59 | -20% | 1% |
| | **Total Limonite** | **130.0** | **0.61** | **122.7** | **0.61** | **6%** | **-1%** |
| | Proven Saprolite | 24.2 | 0.44 | 19.2 | 0.54 | 26% | -17% |
| | Probable Saprolite | 23.7 | 0.46 | 33.3 | 0.53 | -29% | -14% |
| | **Total Saprolite** | **48.0** | **0.45** | **52.5** | **0.53** | **-9%** | **-16%** |
| | Proven Ore | 91.4 | 0.57 | 63.7 | 0.61 | 43% | -7% |
| | Probable Ore | 86.6 | 0.54 | 111.5 | 0.57 | -22% | -3% |
| | **Total Combined Pits** | **178.0** | **0.56** | **175.2** | **0.59** | **2%** | **-4%** |
| Stockpiles | Proven Ore | 17.7 | 0.58 | 17.7 | 0.58 | 0% | 0% |
| | Probable Ore | - | - | - | - | - | - |
| | **Total Stockpiles** | **17.7** | **0.58** | **17.7** | **0.58** | **0%** | **0%** |
| Mineral Reserve including Stockpiles | Proven Ore | 109.1 | 0.57 | 81.4 | 0.60 | 34% | -5% |
| | Probable Ore | 86.6 | 0.56 | 111.5 | 0.57 | **-22%** | -3% |
| | **Total Mineral Reserve** | **195.7** | **0.57** | **192.9** | **0.58** | **1%** | **-4%** |

Overall, there has been a small increase in tonnes of 1% and a decrease in grade of 4%. A summary of the reasons behind the differences for each mining area is as follows:

- Halleys – Resource Model updates to include grade control drilling results plus adjustments reflecting completion and closure of mined out sections (HY 11,13,14,31, and 33) since 2012.
- Hale-Bopp – Resource Model updates to include grade control drilling results as well as upgrade of Inferred Resource in the southern half of the deposit to Measured and Indicated categories. Depletion adjustments for mining and processing of Hale-Bopp ore from 2015 onwards were also applied.
- Shoemaker-Levy – Model updates to include grade control drilling results as well as application of new metallurgical sampling, testing, and estimation regime (as described in Item 14 of this report). Quarantine of Bandalup creek zone resulted in approximately 10 Mt of Mineral Resource being excluded from the estimate for now.

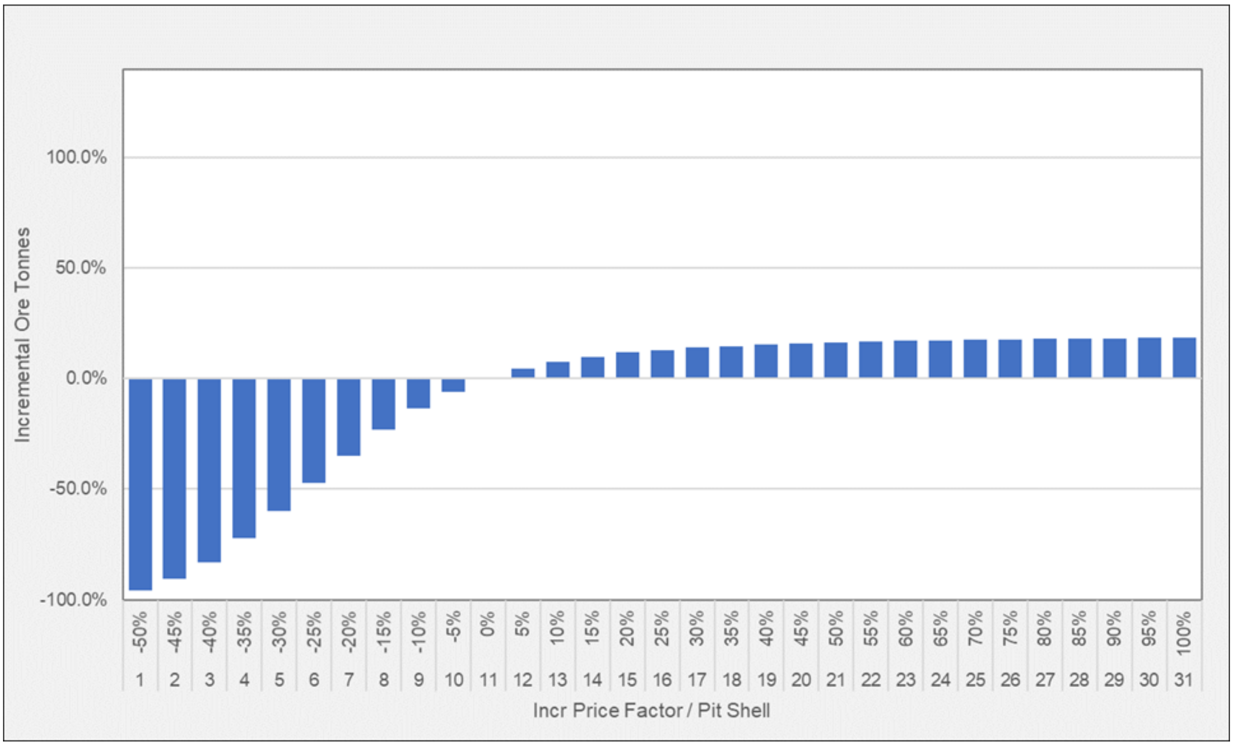
## 15.11 Mineral Reserve Sensitivity

The sensitivity of the RNO Mineral Reserve has been reviewed at a high level using the Whittle optimisation software. As in any mining operation, the results of the senstivity analysis represent forward looking information that is subject to a number of known and unknown risks, uncertainties and other factors that may cause actual results to differ materially from those presented here. Areas of uncertainty that may materially impact the RNO Mineral Reserve estimation include:

- Commodity price and exchange rate assumptions,
- Capital and operating cost estimates, and
- Nickel recovery.

A high level sensitivity analysis of the deposit to a range of metal prices is presented graphically in Figure 15-8.

**Figure 15-8 RNO Mineral Reserve Sensitivity**



This review shows that above a nickel price of about 16,500 US$/t ($7.50/lb), the Mineral Reserves of the RNO deposits are only moderately sensitive to variations in price, or conversely costs. Below that price, the RNO Mineral Reserve is more sensitive. This has been factored into mine scheduling designs and sequences in order to reduce risk.

# Item 16 MINING METHODS

## 16.1 Mining overview

All planned mining activities take place in the three mining areas with the bulk of the remaining mining scheduled in Shoemaker-Levy. Each pit has been split into smaller stages as per the designs in Item 15.2 of this report. The current mining activities in the Shoemaker-Levy and Halleys deposits are conducted in the form of a conventional Drill/Blast and Load/Haul operation.

FQM has contracted Mining and Civil Australia (MACA), a mining contracting company based in Western Australia, to undertake ore and waste mining at RNO under a five year, bcm rate based contract which includes drill and blast activities and management of the explosives supply. The contract has an option for extension however, FQM is also undertaking operational reviews that consider alternative mining methods and owner mining.

Mining and crushing operations at RNO recommenced under FQM ownership at Halley's in May 2011 with average daily production targets of 10 Kt per day of saprolite and 17 Kt per day of limonite being delivered to the crushers. Limonite delivery capacity has since been increased up to 20 Kt per day.

In 2017 mining operations moved to Hale-Bopp and in 2021 mining commenced in Shoemaker-Levy with ore now being transferred back to the process facility via a 12 km long conveyor that crosses the South Coast highway.

The current state of development at each mining area is:

- Halley's: Mostly saprolite left in HY 21, HY 41, and HY 43. All other pits have been completed and are available for backfill.
- Hale-Bopp: Mining has been completed in some of the upper sections of the pit (HB201). The remainder of the pit will be mined and backfilled towards the end of the LOM schedule.
- Shoemaker-Levy: SL01 pit is currently 40 metres deep and the SL11 pit is approximately 20 metres deep, both with Limonite Ore exposed.

The monthly requirement for material movement is 1.5 to 1.6 million tonnes per month which is within the capability of the current mining fleet.

As mining at Shoemaker-Levy is still in the early phase of opening up the starter pits, all waste from mining activities is being stored in external waste dumps. Backfill of waste material into the mined-out areas of Shoemaker-Levy is scheduled to commence in Q3 2022.

Rejects from the Beneficiation Plants are being hauled to the mined-out sections of the Halley's pit area and deposited in accordance with FQM's commitment to return the Halley's pit area to a similar landform to its original state.

## 16.2 Grade control

Conventional open pit grade control practices have been put into place, incorporating RC drilling and sampling on a suitably designed drilling pattern to cover multiple bench horizons. Multi element sample assaying is being carried out on each sample. A grade control process has been standardised and implemented as the basis for designing dig blocks. The procedure ensures up to date estimate results are used together with the defined standards for material types as well as the bench and flitch specifications as aligned to the Mineral Reserve process.

## 16.3 Drilling and blasting

Some near-surface overburden and limonite material can be mined as free-dig however most bench development requires blasting in order to achieve excavator productivity targets. Production drilling and blasting is carried out on 6 metre benches using a small range of drilling/charging patterns and relatively low powder factors.

Controlled blasting is undertaken on interim and final walls to prevent blast damage and to maintain wall control.

## 16.4 Pit and Dump Design

The pit design parameters including berm widths, batter angles, berm spacing and haul road gradients and widths are detailed in Item 15.

For ease of rehabilitation, the external waste dumps were designed to have an overall outer slope gradient of 1:4.5. Ex-pit dumps were used at both Halleys and Hale-Bopp prior to backfill operations commencing. FQM has also designed three small ex-pit dumps for Shoemaker-Levy using 10m benches and 10m berms. Ex-pit deposition of waste material at Shoemaker-Levy will cease in Q3 2022 when in-pit backfill commences.

The geotechnical parameters are discussed in Items 15.4.3 and 16.5. The mine design parameters are shown in Table 16-1.

**Table 16-1 RNO Mine Design Parameters**

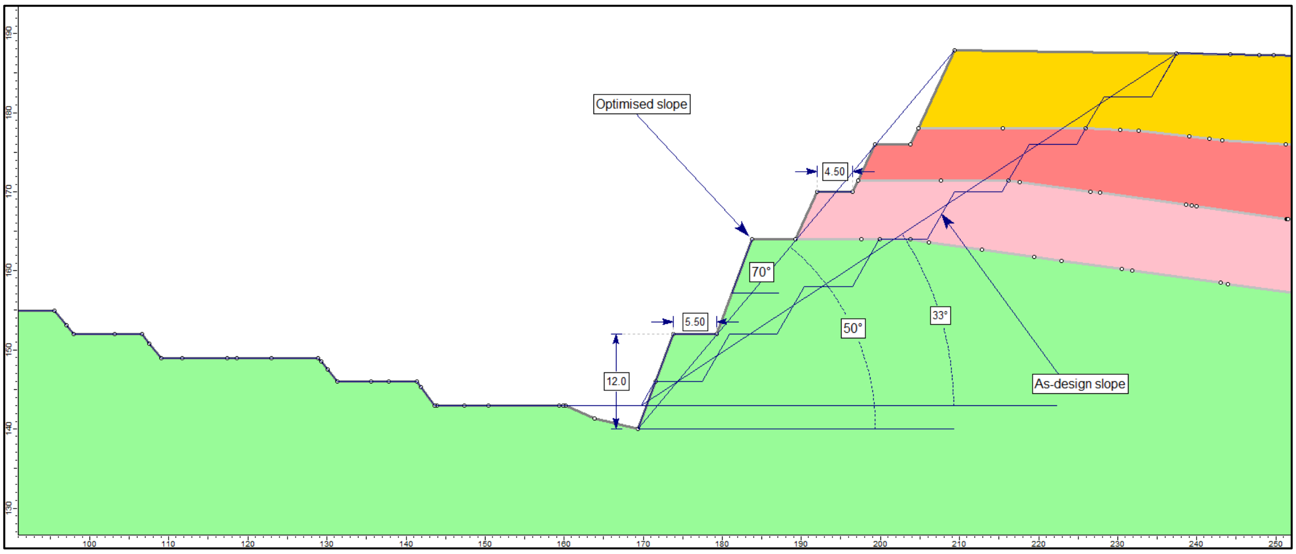
| Pit | Area/Zone | Item | Measurement |
|---|---|---|---|
| Halleys | All | Batter Height | 6 m |
| | | Batter Angle | 55 degrees |
| | | Berm Width | 5 m |
| Hale-Bopp | All | Batter Height | 6 m |
| | | Batter Angle | 45 degrees |
| | | Berm Width | 5 m |
| Shoemaker-Levy | Above Limonite/Saprolite Contact | Batter Height | 6 m |
| | | Batter Angle | 65 degrees |
| | | Berm Width | 5.7 m |
| | Below Limonite/Saprolite Contact | Batter Height | 6 m |
| | | Batter Angle | 70 degrees |
| | | Berm Width | 3.5 m |
| All Pits | | Ramp Width | 30 m |
| | | Ramp Gradient | 1 in 10 |
| External Waste Dumps | All | Bench Height | 10 m |
| | | Batter Angle | 15 degrees |
| | | Berm Width | 10 m |

## 16.5 Mine geotechnical engineering

The 2012 Technical Report (FQM, December 2012) provided a summary of the then current open pit slope design parameters adopted from the previous owners (BHP). Since 2012 minor adjustments were made to the design parameters based on operational reviews undertaken between 2012 and 2017.

In 2021 FQM commissioned an independent geotechnical review by Mining One Consultants (M1, April 2021). This review was focussed on developing geotechnical recommendations for Shoemaker-Levy and involved the drilling of geotechnical holes for testing and assessing wall rock properties. The M1 review resulted in some changes to earlier specifications, notably the berm width and face angle which were also split into separate design parameters for each rock type in the pit walls. Previously the design parameters applied to Shoemaker-Levy were 60° batters with a 5-metre-wide berm every 6 metres for all pit walls. The new design parameters based on the M1 recommendations increased overall slope angles, particularly in the Saprolite zone. Figure 16-1 shows the overall slope angle being steepened from 33° to 50°.

**Figure 16-1 Shoemaker-Levy Recommended Pit Slopes**




Mining One recommended that FQM should drill more geotechnical drillholes in the northern sections of Shoemaker-Levy to confirm the assumptions that the northern portion of the deposit has similar material characteristics and a similar geotechnical environment as the southern portion.

A second recommendation related to FQM developing trial slopes in Stage 1 of Shoemaker-Levy to test whether good design achievement can be demonstrated and assess whether it is possible for further pit slope optimisation across the Shoemaker-Levy deposit

The updated slope design parameters for Shoemaker-Levy, and the unchanged parameters for Halleys and Hale-Bopp are listed in Table 16-1.

## 16.6 Pit water management

With respect to groundwater, the proposed pit floors are all above the water table, hence there has been no need to, and there are no plans to, pump water from the open pits.

In Halleys, a number of isolated pockets of water (perched water tables) were intersected and dealt with by allowing the water to evaporate. To date no perched water tables have been intersected at Hale-Bopp or Shoemaker-Levy however, if they happen to be intersected in the future, management of these events will follow the same procedures developed for Halleys.

The main water management issue at RNO is the annual winter wet season events where haul ramps and roads get slippery (potential safety issue) and occasionally surface water runoff needs to be diverted. Given FQM has been operating the mine since 2012, tried and tested procedures are in place for management of water from rainfall events.

## 16.7 Mining and processing schedules

With the completion of the detailed ultimate pit designs, detailed life-of-mine (LOM) production scheduling was completed using MineSched software. Scheduling assumptions included:

- minimum mining block size (x, y, z) for all pits = 50 m x 50 m x 3 m ;
- mining flitch height = 3 m for monthly and quarterly periods; 6 m for annual periods;
- maximum vertical advance rate = 54 m/year;
- terrace mining with horizontal lag distance of 100 m to 200 m.

Consistent with FQM group budgeting and forecasting practices, the schedule level of detail is monthly for 2022 and 2023, quarterly for 2023 to 2026, and annually thereafter.

## 16.8 LOM schedule

Features of the LOM mining and production schedule as displayed in Table 16-2 are as follows:

- Mining at Shoemaker-Levy commenced in 2021. From January 2022, the Project life is 19 years to 2040.
- The total material to be mined from all pits from January 2022 onwards, amounts to 366 Mt (209 Mbcm), of which 130 Mt is Limonite and 48 Mt is Saprolite, and 188 Mt is Waste.
- The starting stockpile balance as at the end of 2021 is 17.7 Mt at a grade of 0.58% Ni.
- The Leach feed throughput rates are 270 tph for HPAL and 150 tph for AL.
- The average annual nickel metal production in the first five years is 30.0 ktpa. Thereafter, the annual average is 28 ktpa.
- The annual average Cobalt production is approximately 1,000 tonnes.
- The overall life of mine strip ratio (tonnes) is 1.06 to 1.

Figure 16-2 to 16-9 depict the LOM schedule graphical results and end of period surfaces.

**Table 16-2 RNO LOM Schedule Commencing January 2022**

| Year | Unit | Total | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mining** | | | | | | | | | | | | | | | | | | | | | |
| Limonite Tonnes Mined | kt | **130,036** | 5,348 | 6,442 | 6,928 | 6,651 | 6,141 | 7,030 | 6,646 | 6,476 | 7,836 | 8,108 | 6,792 | 7,653 | 7,791 | 7,210 | 7,382 | 6,894 | 6,469 | 7,126 | 5,112 |
| Grade Ni | % | **0.61** | 0.75 | 0.59 | 0.60 | 0.57 | 0.61 | 0.62 | 0.58 | 0.62 | 0.73 | 0.68 | 0.59 | 0.59 | 0.57 | 0.56 | 0.61 | 0.60 | 0.56 | 0.59 | 0.59 |
| Grade Co | % | **0.03** | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 |
| Saprolite Tonnes Mined | kt | **47,965** | 2,591 | 2,960 | 2,557 | 2,588 | 3,724 | 3,387 | 2,639 | 2,743 | 2,991 | 2,573 | 1,981 | 2,476 | 1,962 | 2,027 | 2,326 | 1,966 | 2,116 | 2,635 | 1,722 |
| Grade Ni | % | **0.45** | 0.48 | 0.42 | 0.43 | 0.43 | 0.46 | 0.38 | 0.38 | 0.41 | 0.44 | 0.43 | 0.49 | 0.46 | 0.45 | 0.53 | 0.46 | 0.50 | 0.45 | 0.49 | 0.48 |
| Grade Co | % | **0.02** | 0.04 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 |
| Waste tonnes Mined | kt | **173,777** | 10,183 | 14,352 | 9,279 | 16,576 | 9,865 | 8,101 | 8,287 | 8,511 | 7,037 | 7,576 | 7,871 | 7,545 | 10,001 | 10,065 | 10,860 | 10,345 | 9,137 | 6,563 | 1,624 |
| **Total Tonnes Mined** | **kt** | **351,778** | **18,123** | **23,754** | **18,764** | **25,815** | **19,730** | **18,519** | **17,572** | **17,731** | **17,865** | **18,257** | **16,644** | **17,674** | **19,754** | **19,301** | **20,568** | **19,205** | **17,722** | **16,324** | **8,458** |
| Strip Ratio | t:t | **0.98** | 1.28 | 1.53 | 0.98 | 1.79 | 1.00 | 0.78 | 0.89 | 0.92 | 0.65 | 0.71 | 0.90 | 0.74 | 1.03 | 1.09 | 1.12 | 1.17 | 1.06 | 0.67 | 0.24 |
| **Processing** | | | | | | | | | | | | | | | | | | | | | |
| PAL Feed Tonnes | kt | **39,373** | 1,729 | 2,105 | 2,075 | 2,075 | 2,112 | 2,105 | 2,075 | 2,075 | 2,112 | 2,105 | 2,075 | 2,075 | 2,112 | 2,105 | 2,075 | 2,075 | 2,112 | 2,105 | 2,075 |
| PAL Grade Ni | % | **1.14** | 1.52 | 1.18 | 1.26 | 1.15 | 1.22 | 1.19 | 1.18 | 1.16 | 1.18 | 1.15 | 1.12 | 1.10 | 1.06 | 1.05 | 1.04 | 1.03 | 1.02 | 1.00 | 1.04 |
| PAL Grade Co | % | **0.04** | 0.051 | 0.039 | 0.042 | 0.038 | 0.041 | 0.040 | 0.039 | 0.039 | 0.039 | 0.038 | 0.037 | 0.036 | 0.035 | 0.035 | 0.035 | 0.034 | 0.034 | 0.033 | 0.034 |
| PAL (Ni & Co) Recovery | % | **90.3%** | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% | 90.3% |
| Ni Produced | t | **403,636** | 23,714 | 22,377 | 23,636 | 21,475 | 23,222 | 22,594 | 22,147 | 21,749 | 22,574 | 21,807 | 20,975 | 20,504 | 20,149 | 19,997 | 19,447 | 19,282 | 19,516 | 19,077 | 19,394 |
| Co Produced | t | **13,441** | 790 | 745 | 787 | 715 | 773 | 752 | 738 | 724 | 752 | 726 | 698 | 683 | 671 | 666 | 648 | 642 | 650 | 635 | 646 |
| | | | | | | | | | | | | | | | | | | | | | |
| AL Feed Tonnes | kt | **24,413** | 1,202 | 1,288 | 1,294 | 1,288 | 1,288 | 1,288 | 1,294 | 1,288 | 1,288 | 1,288 | 1,294 | 1,288 | 1,288 | 1,288 | 1,294 | 1,288 | 1,288 | 1,288 | 1,294 |
| AL Grade Ni | % | **0.81** | 0.91 | 0.89 | 0.91 | 0.91 | 0.94 | 0.72 | 0.71 | 0.75 | 0.74 | 0.76 | 0.79 | 0.83 | 0.81 | 0.80 | 0.81 | 0.80 | 0.81 | 0.79 | 0.78 |
| AL Grade Co | % | **0.03** | 0.030 | 0.030 | 0.030 | 0.030 | 0.031 | 0.024 | 0.024 | 0.025 | 0.025 | 0.025 | 0.026 | 0.028 | 0.027 | 0.026 | 0.027 | 0.027 | 0.027 | 0.026 | 0.026 |
| AL (Ni&Co) Recovery | % | **68.0%** | 66.5% | 66.5% | 66.5% | 66.5% | 67.5% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% | 68.4% |
| Ni Produced | t | **134,806** | 7,248 | 7,628 | 7,873 | 7,811 | 8,156 | 6,302 | 6,324 | 6,563 | 6,503 | 6,678 | 6,966 | 7,333 | 7,113 | 7,009 | 7,208 | 7,078 | 7,110 | 6,954 | 6,948 |
| Co Produced | t | **4,489** | 241 | 254 | 262 | 260 | 272 | 210 | 211 | 219 | 217 | 222 | 232 | 244 | 237 | 233 | 240 | 236 | 237 | 232 | 231 |
| | | | | | | | | | | | | | | | | | | | | | |
| **Total Ni Produced** | t | **538,442** | **30,962** | **30,005** | **31,509** | **29,287** | **31,378** | **28,896** | **28,472** | **28,311** | **29,077** | **28,485** | **27,941** | **27,836** | **27,262** | **27,006** | **26,654** | **26,360** | **26,626** | **26,031** | **26,342** |
| **Total Co Produced** | t | **17,930** | **1,031** | **999** | **1,049** | **975** | **1,045** | **962** | **948** | **943** | **968** | **949** | **930** | **927** | **908** | **899** | **888** | **878** | **887** | **867** | **877** |

**Figure 16-2 RNO LOM Schedule by Material and Source**

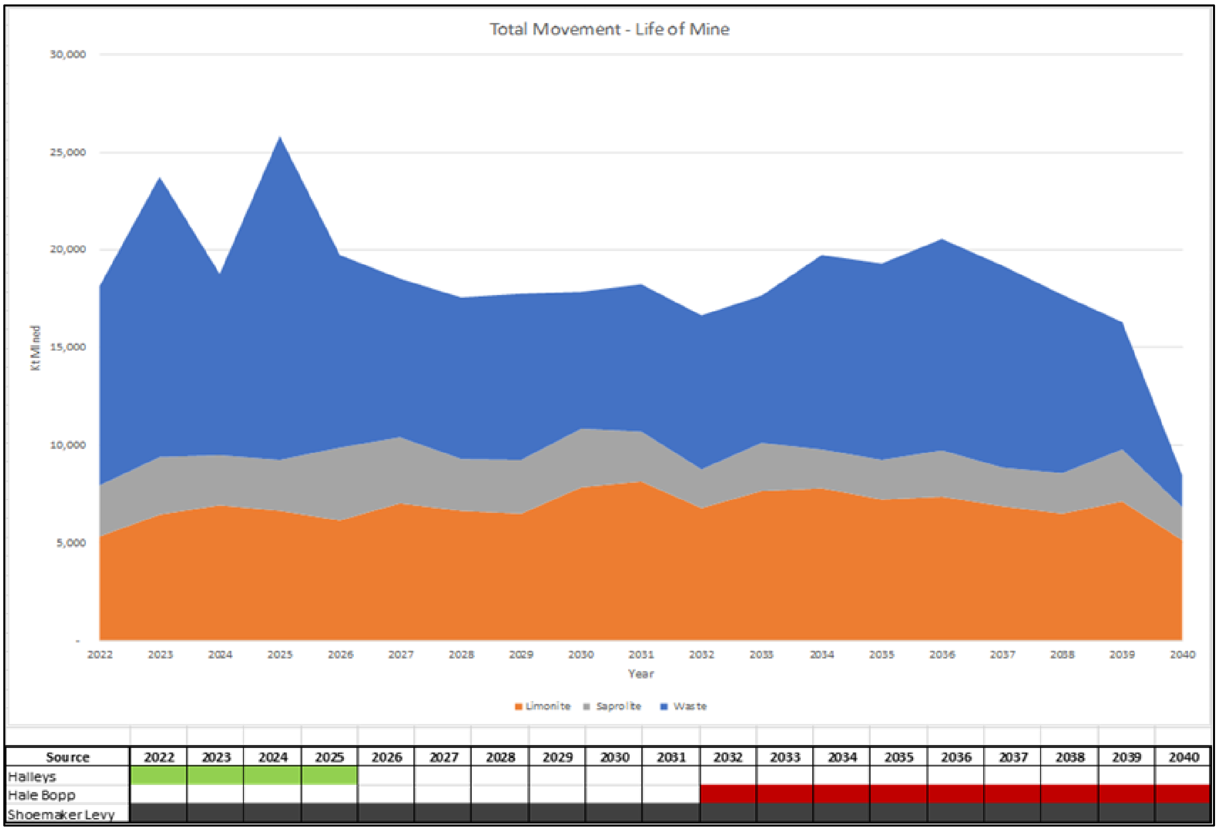
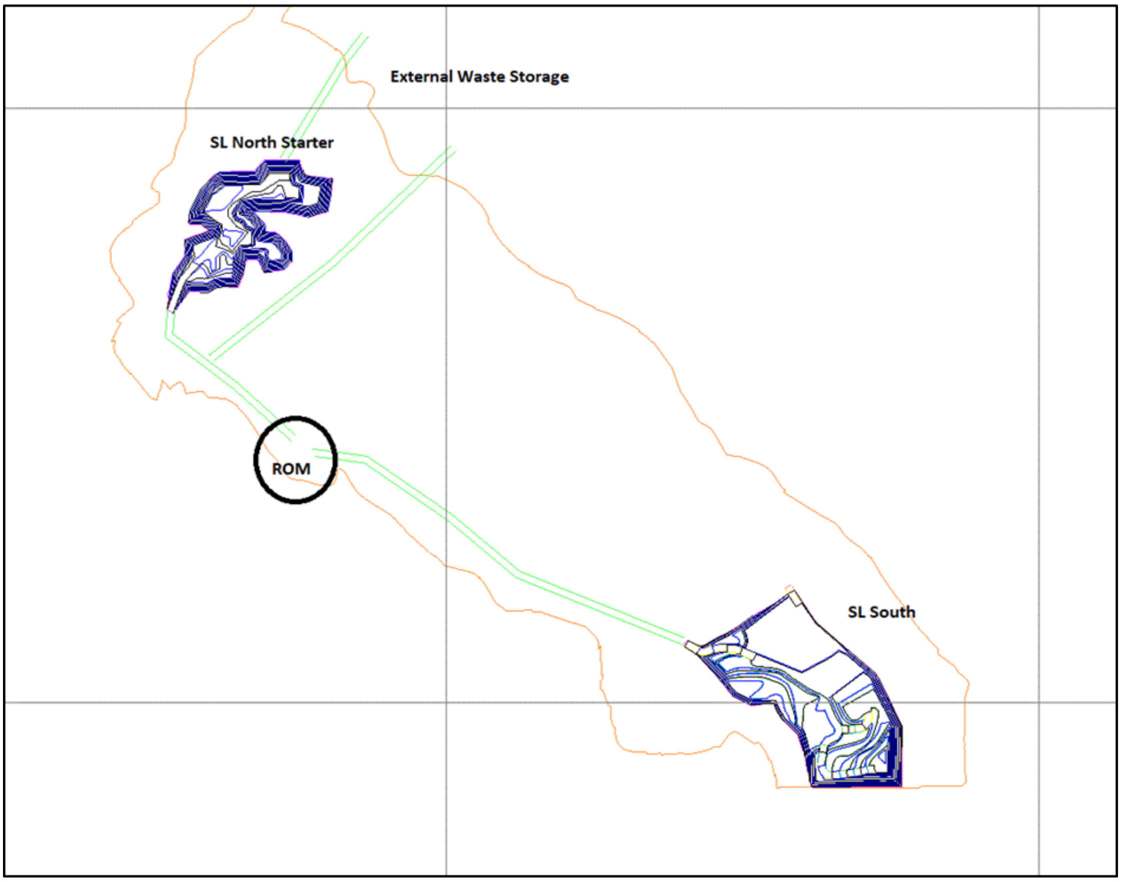
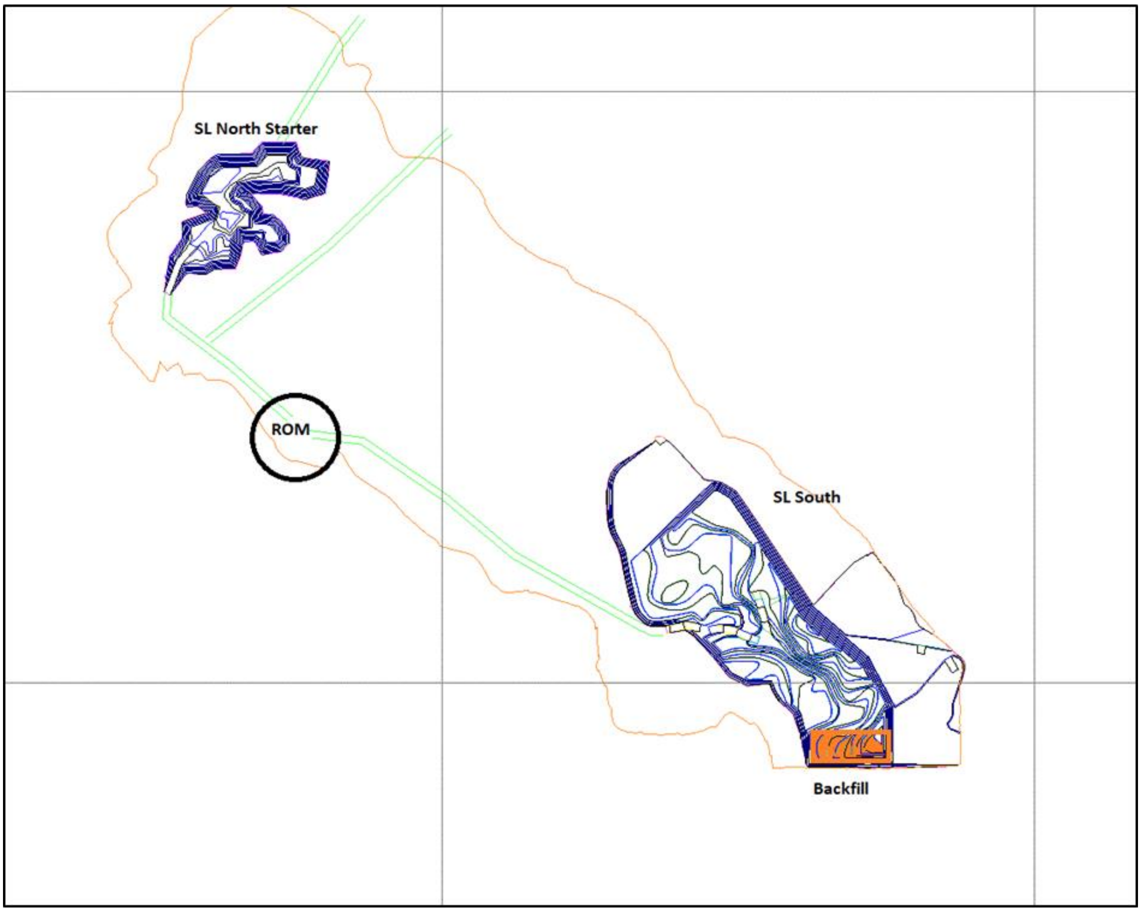



**Figure 16-3 Shoemaker-Levy at the end of 2022**



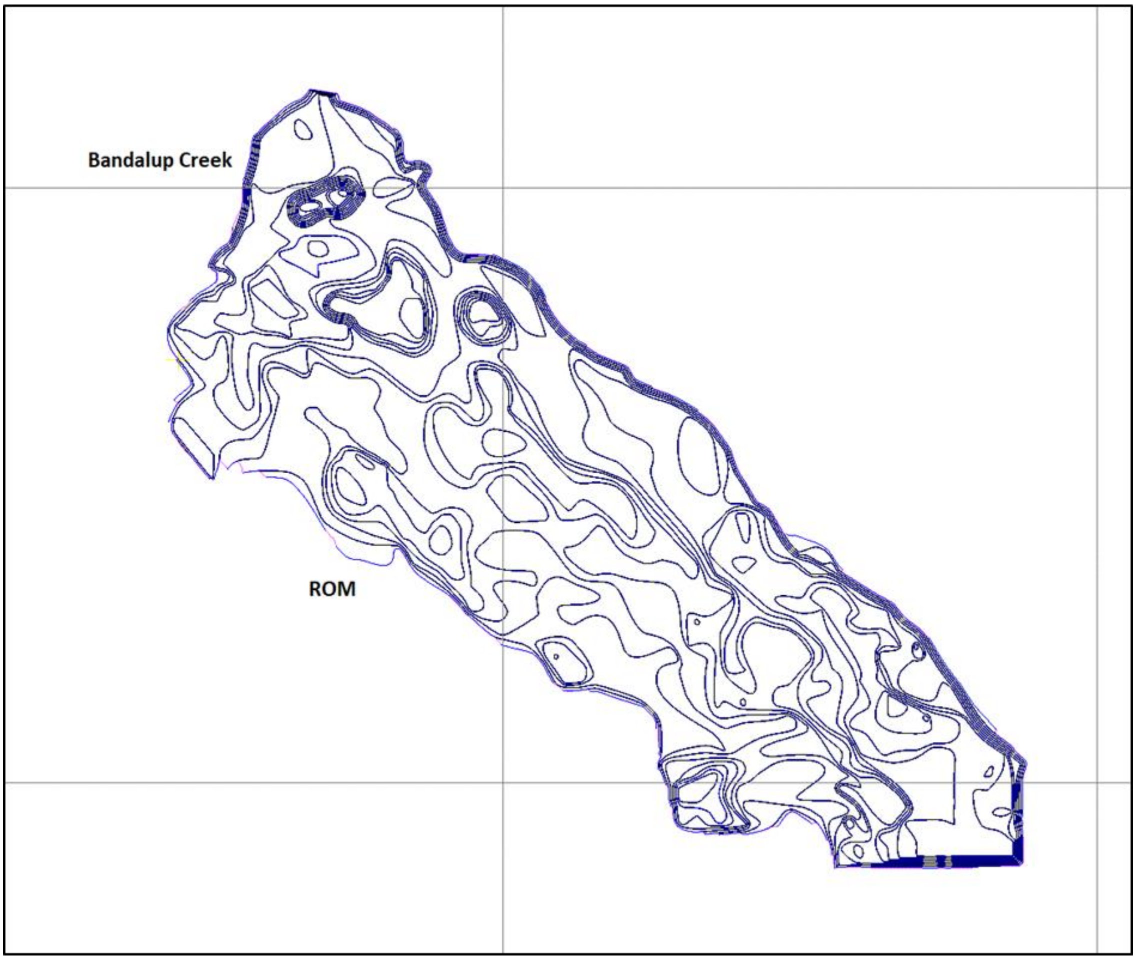
The two starter pits that were commenced in 2021 have been expanded. All ramps and road are within the ultimate pit outline. Waste material will be taken to the external dump areas until Q3 2022 when backfill of the southern pit is scheduled to commence.

**Figure 16-4 Shoemaker-Levy at the end of 2023**



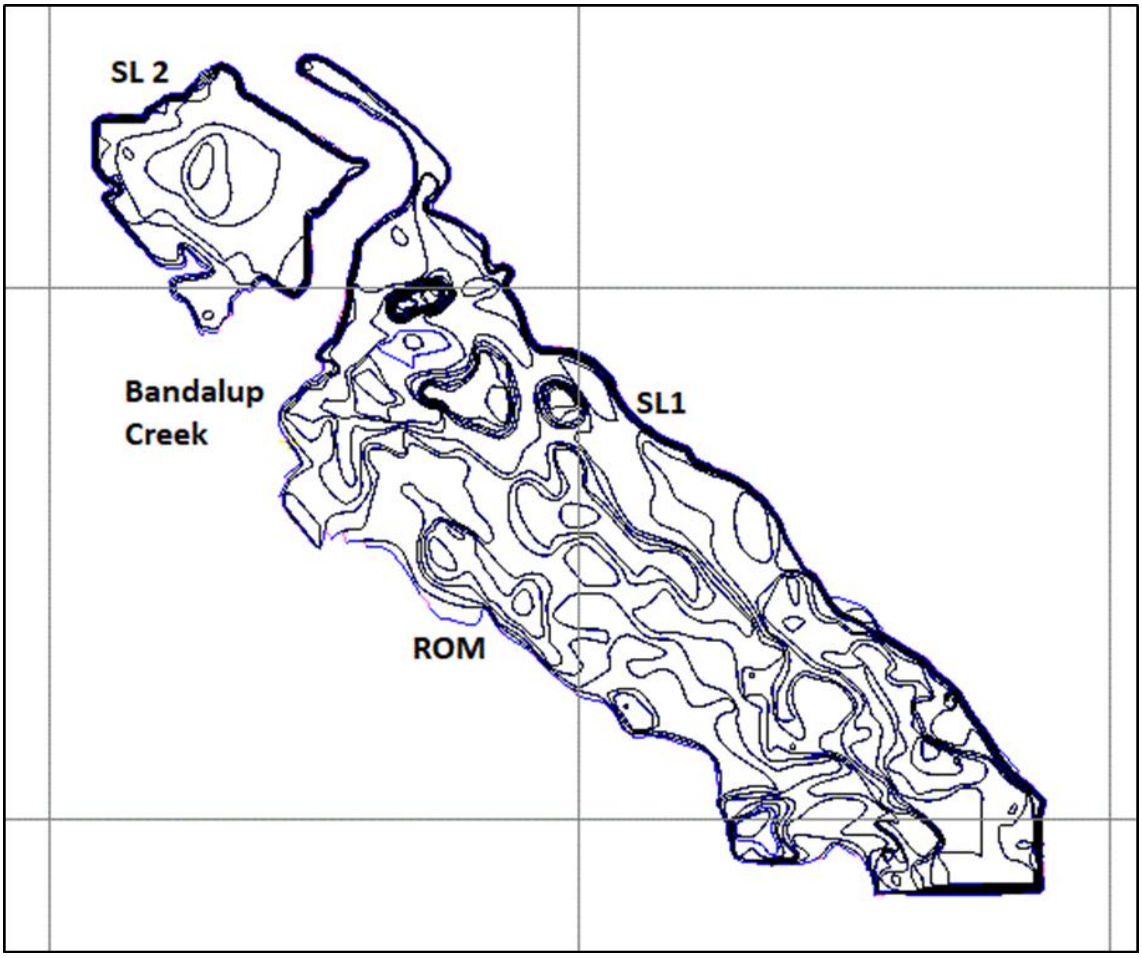

Mining in 2023 will focus on expanding the southern pit. The north starter pit is available as a source of blending ore if required. Backfill of the mined out portion moves from south to north (following the mine face advance).

**Figure 16-5 Shoemaker-Levy at the end of 2030**



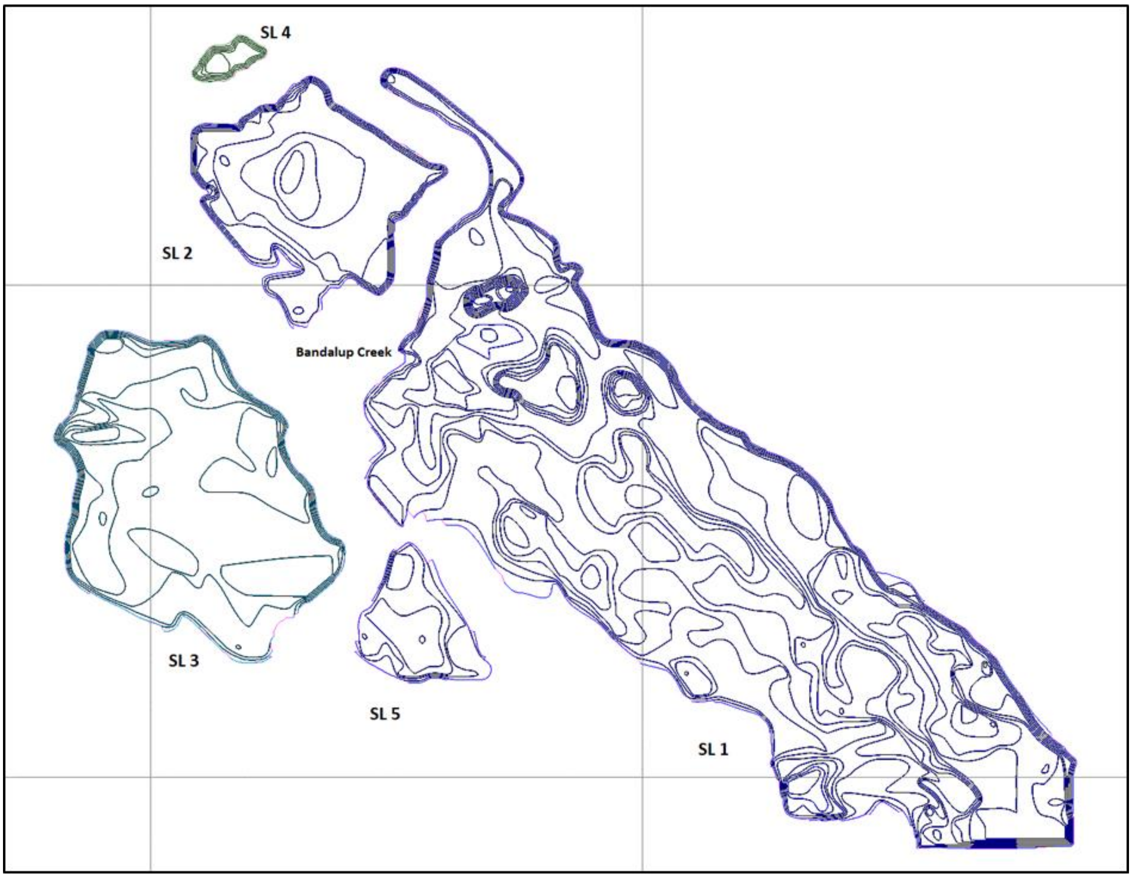

SL 1, which covers the bulk of the deposit between the South Coast Highway and Bandalup Creek has almost been completed. Approximately 40% of the pit will have been backfilled with the focus being on filling the southern sections near the highway as well as advancing the fill areas to keep the waste haul as short as possible.

**Figure 16-6 Shoemaker-Levy at the end of 2035**




Mining extends to the sections of Shoemaker-Levy that are north of Bandalup Creek. Access will be via a bridge that will be located after discussions with stakeholders. Initial waste material from SL 2 will be placed in SL 1 until sufficient space is available in SL 2 for backfill.

**Figure 16-7 Shoemaker-Levy at the end of 2040**




At the end of 2040, all 5 Shoemaker-Levy pits will have been completed.

## 16.9 Waste and Rejects dumping schedule

FQM is committed to put most of the mined waste rock back into mined out sections of the pits. In Halleys, waste backfill commenced in 2014. Co-disposal of Beneficiation Plant Reject material with the waste backfill also commenced in 2014. All future waste mined at Hale-Bopp can be backfilled into completed sections of Hale-Bopp and at Shoemaker-Levy, backfill is scheduled to commence in SL01 in Q1 2023.

Where out of pit waste storage is required, the external waste storage facility footprints have been designed to minimise clearing, disturbance of rare Flora, and water runoff control requirements. This has been done by applying exclusion zones and designing within water catchment boundaries.

The general waste and rejects placement strategy is as follows:

Halleys Pit:

- Any waste material mined during the cleaning out of remaining ore from H21, 41 and 43 can be placed directly into mined out sections of the pit.
- Rejects from the Beneficiation Plants will continue to be used to fill the pits back to original surface level (Halleys is predicted to be filled to final landform by the end of 2028).

Hale-Bopp Pit:

- Waste material scheduled to be mined during the LOM schedule can be placed directly into mined out sections of the pit.
- Rejects from the Beneficiation Plants will be used to fill the pits back to final landform from 2029.

Shoemaker-Levy Pit:

- Initial waste material mined will be stored in two external storage facilities until space is available in the pits for backfilling to commence.
- From Q1 2023 onwards all waste material mined at Shoemaker-Levy will be backfilled into the mined-out sections of the pit.

## 16.10 Mining equipment

Table 16-3 lists the current mining fleet and support equipment at RNO.

**Table 16-3 RNO Mining Equipment (December 2021)**

| Quantity | Equipment | Make and Model |
|---|---|---|
| 3 | Excavators | Liebherr 9200 |
| 2 | Excavators | Komatsu PC1250 |
| 2 | Drill Rigs | SmartROC T45 |
| 11 | 150t Haul Truck | Komatsu HDT1500 |
| 2 | 140t Haul Truck | Caterpillar 785C |
| 8 | 91t Haul Truck | Caterpillar 777D |
| 3 | Wheel Loaders | Caterpillar 993K |
| 1 | Wheel Loaders | Caterpillar 992K |
| 2 | Tracked Dozers | Caterpillar D10 |
| 2 | Graders | Caterpillar 16M and 16H |

Ancilliary fleet includes water carts, explosives trucks, lighting plants, as well as fuel, lube and service trucks.

The maximum capacity of the mining fleet is 3 Mt per month which is sufficient to meet LOM schedule movement requirements. The capacity of the mining fleet is will be adjusted to match the LOM schedule requirements by FQM controlling the number of shifts worked per day.

# Item 17 RECOVERY METHODS

## 17.1 Mining, Crushing and Ore Stockpiling

Limonite and Saprolite ores are identified in grade control and are mined separately for processing in separate beneficiation plants. Dedicated stockpiles are located ahead of the limonite and saprolite beneficiation plants.

Each of the two run-of-mine (ROM ore) ore streams (limonite and saprolite) has a typical particle size of sub 1000mm. This material is further crushed to a nominal sub 100mm product for delivery to the respective reclaim stockpiles. Crushing is effected via a jaw crusher and duplicate mineral sizers. Ore is recovered from the stockpiles via rotary bucket wheel reclaimers, which feeds the beneficiation plant feed bin and feed conveying system. The reclaimers are in effect blending tools allowing the stockpiled material to be sent for processing by taking cuts from the full 360° circumference around the rill tower.

Three crushing plants are installed, with two at the Halleys/Hale-Bopp mine area and one at the Shoemaker-Levy area. The two at the Halleys/Hale-Bopp area are each dedicated to one ore type while the crushing plant at Shoemaker-Levy is sized to support campaign crushing of limonite and saprolite, and transfer to the main process plant via a single 10km overland conveyor linking the Shoemaker-Levy mine to the RNO plant. Ore from Shoemaker-Levy deposit is fed onto the appropriate blending stockpiles via a feed distributor. The limonite reclaimer is shown in Figure 17-1.

**Figure 17-1 Limonite reclaimer**

Stockpile capacity is approximately 3 days. In parallel, and to support maintenance activities in the crushing plants, an emergency feed stockpile of a nominal 7 days capacity of crushed material is retained in the process plant for both Limonite and Saprolite which can be fed into the beneficiation plant via emergency feeders utilising a front end loader.

## 17.2 Mineral processing methods

Processing at RNO can be viewed as involving the following four general stages:

1. Initially the ore is beneficiated (increase the nickel grade and reduce the mass) via a scrubber and a series of screens and cyclones. The nickel and cobalt values are enriched in the fines fractions of both the limonite and Saprolite ores.
2. The beneficiated product is then processed to extract the contained nickel and cobalt into solution via two hydrometallurgical processing methods, HPAL and AL.

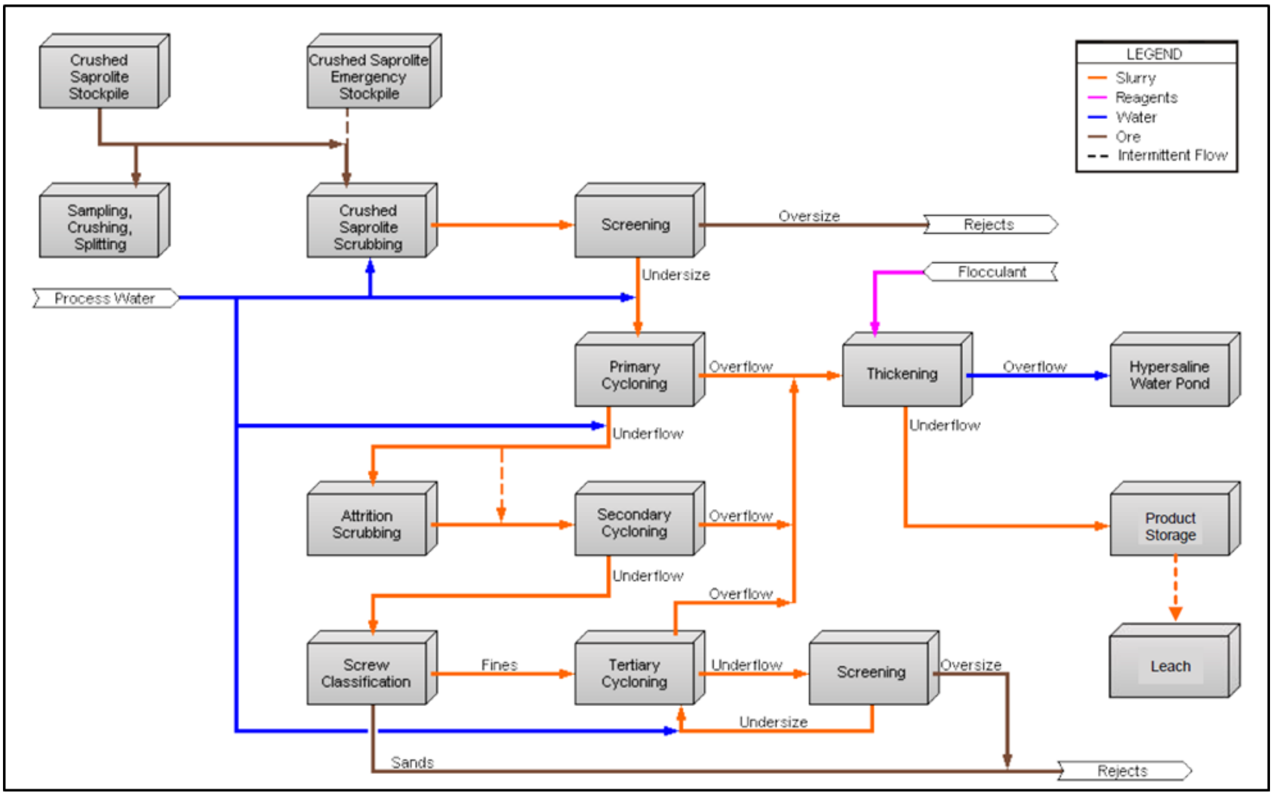
3. Precipitation and removal of impurities such as iron, aluminium, and chromium from solution.
4. Precipitation of nickel and cobalt into a MHP.

### 17.2.1 Beneficiation

This beneficiation process is designed to reject the principally siliceous barren coarse fractions. Typical mass rejections of 60-70% are achieved at a nominal nickel recovery of 60-65%. The increases in nickel grade in the final beneficiated product is ideally about 200%.

Crushed ore fed to each beneficiation circuit is recovered from its respective reclaimer. Both feeds direct the crushed ore to a drum scrubber where loose ore agglomerates are broken up and dispersed, and any loosely attached mineralisation is scrubbed from the siliceous gangue. The scrubber product is treated through a combination of screening and hydraulic classification (cyclones, screw classifiers) to recover the nickel and cobalt values which are now concentrated in, typically, the -100µ fraction. The +100µ material is discarded to a reject stream which is mechanically transported to a dump. A flowsheet illustrating the beneficiation process is given in Figure 17-2

**Figure 17-2 Simplified RNO Process flowsheet**




Surplus product from the beneficiation plants is stored in a pair of buffer ponds where the solids are allowed to settle and the supernatant water recycled. The ponds have an inherent capacity of approximately two weeks of operating requirements. The material stored in the ponds is used to enable maintenance of the beneficiation plants and provide buffer supply to support product blending and continuous operation of the two leach circuits. Reclamation from the two ponds is by dedicated floating dredges. Material reclaimed from the buffer ponds is rethickened prior to progressing to the leach circuits to control the leach feed densities.

### 17.2.2 Hydrometallurgical processing

Typically limonite beneficiated products are treated through HPAL circuit and saprolite beneficiated products are treated through a pre-leach circuit and subsequent AL circuit, after being thickened.

**HPAL circuit (limonite)**

Thickened beneficiated limonite ore slurry is processed in two parallel HPAL trains (autoclaves) to leach the nickel and cobalt values from the ore concentrate.

Each HPAL train consists of a continuous six-compartment, titanium lined, horizontal autoclave, operating at a temperature of 250°C and 4,500 kPa (Figure 17-3). Slurry is preheated to a temperature of approximately 190°C principally through three stages of counter current heating using heat contained in the autoclave pressure let down system before it is pumped into the autoclave using high pressure diaphragm pumps. Sulphuric acid is injected separately directly into the autoclave into the first two compartments.

**Figure 17-3 One of two autoclaves at RNO**

Steam injection is used for temperature control as required; this supplements the autogenous heating of the slurry resulting from the direct sulphuric acid injection into the first two compartments.

**Pre-Leach**

The thickened Saprolite slurry from the saprolite beneficiation circuit is mixed with sulphuric acid and leached under atmospheric pressure conditions at approximately 95°C. This “pre-leach” stage is undertaken in order to dissolve the bulk of the contained nickel and cobalt into solution. The leached slurry from the pre-leach stage (which contains a significant residual of acid, iron and other impurities in solution) is pumped to the AL circuit.

**AL**

Output streams from the HPAL and pre-leach stages are combined and allowed to further react in a series three of brick lined reactors maintained at a nominal temperature of 95 to 100°C with direct injected steam as required. As acid levels decrease below 30 grams/litre $H_2SO_4$, iron commences to precipitate in the form of sodium jarosite ($NaFe_3(SO_4)_2(OH)_6$), this process releases sulphuric acid which is used to continue the nickel and cobalt leaching process.

The slurry from the AL stage is then sent to the induced jarosite precipitation stage to start the process of removing impurities.

## 17.3 Impurity removal

### 17.3.1 Induced jarosite precipitation

The function of the induced jarosite precipitation stage is to precipitate excess ferric iron from solution under hot, mildly acidic conditions. Some precipitation of other impurities, such as aluminium and chromium, also occurs at this stage.

AL effluent is partially neutralised with recycled alkaline secondary neutralisation precipitation residue slurry (see below). The residual acid is then further reduced and controlled to approximately 5 – 10 g/l $H_2SO_4$ using ground limestone slurry. Temperature is maintained at >95°C to favour improved precipitate formation and solids settling characteristics.

The slurry then progresses to the primary neutralisation stage.

### 17.3.2 Primary neutralisation

In the primary neutralisation process, further limestone slurry is added in stages to increase the pH to 2.0 – 2.5, which precipitates the bulk of the remaining ferric iron, along with portions of the aluminium, chromium and other impurities. After a residence time of 1.5 hours, the slurry is pumped to the Counter-current Decant Washing ("CCD") circuit.

### 17.3.3 Counter-current Decant Washing

The CCD circuit separates the leach liquor from barren residues in a series of 6 x 42m thickeners with counter-current flow of solids and liquor. Wash liquor consists of manganese removal overflow (see below), which is added to the final thickener. Concentrated acid is added to CCD tank 6 as required to maintain the pH as the manganese removal solution is highly alkaline and if left uncontrolled would result in the unwanted precipitation of nickel and cobalt in the CCD circuit and consequential loss.

The CCD tank 6 underflow reports to the tailings neutralisation and disposal system, while CCD tank 1 overflow proceeds to the secondary neutralisation stage. The tailings are neutralised with, principally, manganese removal thickener underflow, with lime as a backup. The tails are pumped via a two stage pump system to the tailings storage facility. Two tailings pipelines are available for tailings transfer to the tailings dam.

High molecular weight, low charge anionic flocculant is added to each thickener to assist in settling and densification of the underflow.

### 17.3.4 Secondary Neutralisation

The secondary neutralisation stage removes the last of the iron and aluminium from the CCD tank 1 overflow before proceeding to the mixed hydroxide precipitation stage. This is achieved by oxidation with air and precipitation using limestone of the ferrous iron as ferric hydroxide, and by hydrolysis of the aluminium ion.

## 17.4 Mixed hydroxide precipitation

The mixed hydroxide precipitation stage recovers the bulk of the nickel and cobalt from solution as a MHP using magnesium oxide (MgO) powder as the precipitant in a train of three reactors. The precipitate product is then thickened. The thickener overflow, still containing approximately 5% of the incoming nickel and cobalt, is treated in the scavenger precipitation stage. This incomplete precipitation is necessary for impurity control, principally manganese.

MHP thickener underflow is forwarded to a horizontal belt filter where the solids are washed with clean water to remove soluble impurities, principally the saline leach solutions. The solids are repulped and filtered through a pressure filter with a clean water wash for final saline water removal. The pressure filter product is loaded into nominally 1.1t bulk bags and containerised for export as the final product. The bagging facility consists of three bagging stations plus the available option to bulk fill containers if required.

### 17.4.1 Scavenger precipitation

The scavenger precipitation stage recovers the remaining nickel and cobalt from the MNP thickener overflow solution, while still leaving manganese in solution for removal in the manganese removal stage. This is achieved by staged slaked lime addition through a train of three reactors with the resultant product thickened in a thickener to separate the solids and liquor.

Thickener overflow progresses to manganese removal while thickener underflow is recycle to the secondary neutralisation circuit for the recovery of the contained nickel and cobalt metal.

### 17.4.2 Manganese Removal

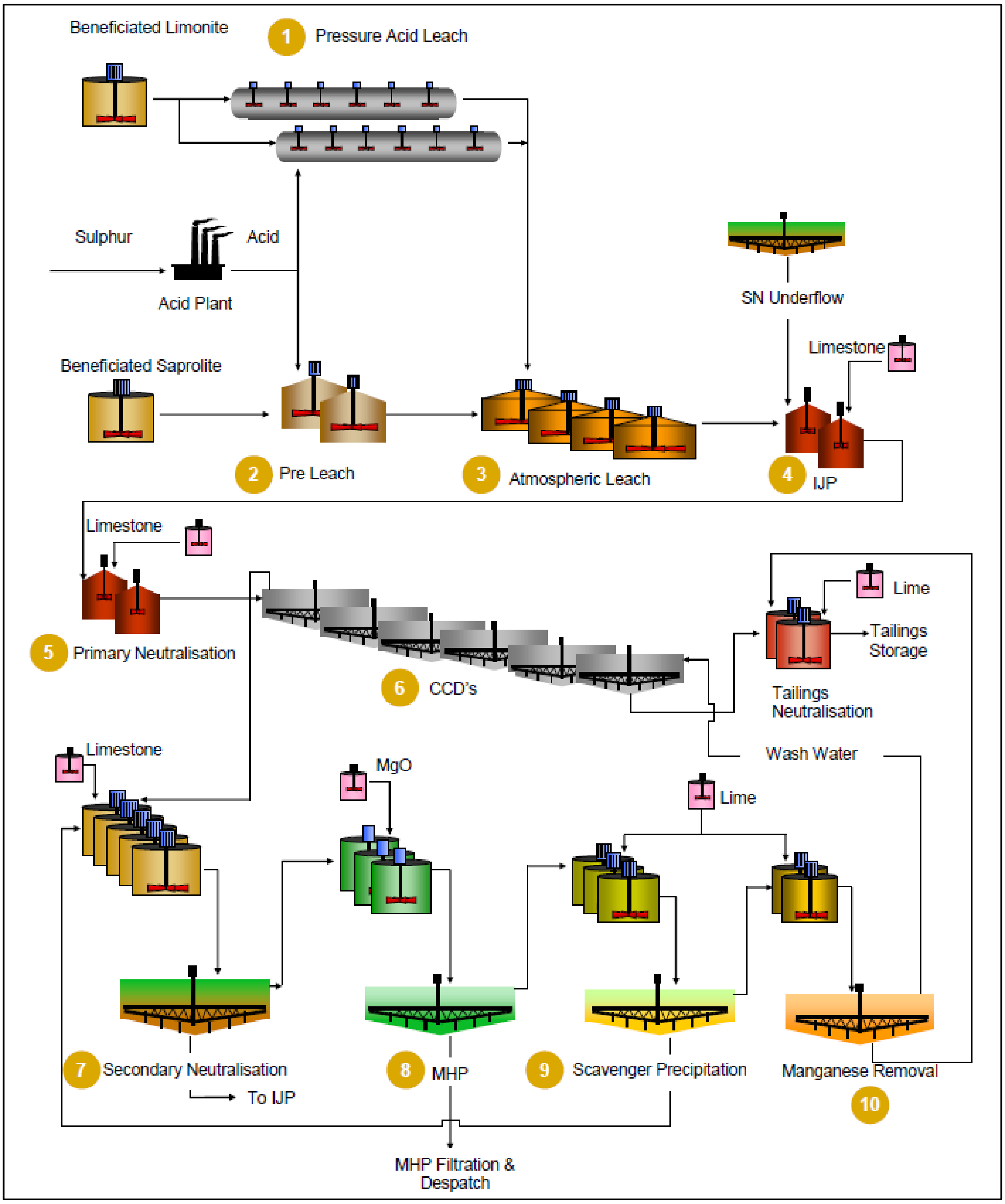
The manganese removal step precipitates the bulk of the manganese in solution. Precipitation occurs due to a combination of increased pH and mild aeration using slaked lime slurry and air in each of two tanks. The resultant product is thickened to separate the solids and liquor.

Thickener overflow is returned to CCD tank 6 as CCD wash liquor, whilst the thickener underflow is disposed of via tailings tanks to residue storage.

## 17.5 Processing summary

The full post beneficiation process is described in Figure 17-4.

Figure 17-4 Hydrometallurgical Process Flowsheet




## 17.6 Reagents and utilities requirements

### 17.6.1 Sulphur

Sulphur is used in the sulphuric acid plant for the production of sulphuric acid. At full production, sulphur consumption is 1,500 tonnes per day (tpd), producing approximately 4,400 tpd of concentrated sulphuric acid.

Sulphur is imported on bulk ships, offloaded, and stored in a shed at Esperance, this shed has a capacity of 100,000 tonnes and was constructed for the operation. Sulphur is transported to the mine (plant) site by road train and immediately melted upon arrival. Sulphuric acid is then stored ahead of the acid plant in two liquid sulphur storage tanks. Molten sulphur storage is approximately 6 days.

The concentrated sulphuric acid produced is stored in two acid storage tanks prior to distribution to the process plant. Acid storage is approximately 6 days.

### 17.6.2 Flocculant

Flocculant is used for settling in the thickeners, and for each of the process areas it is made up from powder and stored in specialised flocculant mixing plants for distribution.

### 17.6.3 Limestone

Limestone is mined from a local source (Tamarine quarry) and delivered to the Ravensthorpe operating site, where it is crushed and ground to produce a slurry for pH control in the process plant. The limestone plant consists of a two stage crushing circuit comprising a jaw and a cone crusher to produce the product required to feed into ball milling. Surplus crushed product is stockpiled for direct feed to ball milling as required. Two dedicated ball mills grind the limestone to produce the product specification required for use as a neutralising medium in the Induced jarosite precipitation, primary neutralisation and secondary neutralisation circuits.

### 17.6.4 Magnesia

Magnesia, delivered as a bulk powder from a third party supplier in Eastern Australia and stored in silos on site. It is used for precipitation in the MHP stage to produce the final product. The emptied containers are reused for bagged MHP product, and returned to the Port for reloading back onto ships.

### 17.6.5 Lime

Hydrated lime, delivered as a bulk powder in containers from a third party supplier and stored in silos on site. The bulk lime is slaked in a dedicated lime slaking mill prior to use for pH control in the precipitation and neutralisation areas.

Lime is freely available and sourced from various local suppliers.

## 17.7 Water

RNO takes all of its process water requirements from a seawater inlet on the coast, approximately 46km from the mine site (see section 18.4.3).

## 17.8 Power and Steam

RNO generates its own power from the steam produced in the acid plant from the burning of raw sulphur (see section 18.4.2). Diesel generators and package boilers support the available power and steam generation as required, and combined can replace the full acid plant output of both.

## 17.9 Plant design characteristics

The RNO plant has been designed and constructed according to best principles for handling the aggressive process fluids. This typically means that all pipelines and vessels are lined with appropriate materials, such as rubber, polymer or ceramic as required with wetted equipment items (agitators for example) fabricated from corrosion resistant materials such as Titanium. In the HPAL circuit where the temperatures and pressures are much higher than elsewhere the materials of construction make extensive use of high specification Titanium piping, fittings and linings.

# Item 18 OPERATIONS INFRASTRUCTURE

## 18.1 Roads and site access

The South Coast Highway is used to transport bulk goods between of Esperance and site. Access to the nearby towns of Ravensthorpe and Hopetoun is via sealed roads

## 18.2 Port facilities

RNO has agreements in place with the Esperance Port authority and has sheds at the Port used for storing sulphur and concentrate.

## 18.3 Plant buildings

The process plant is equipped with all necessary buildings to support efficient operations. These include Beneficiation, Leach, Utilities and Light vehicle workshops, Material Stores, Metallurgical and Assay Laboratory, Central Control Room.

## 18.4 Mine services

### 18.4.1 Waste dumps, tailings dams and pipelines

The tailings from the plant are pumped down one of two pipelines to the tailings storage facility (“TSF”). One is of HDPE construction, is buried, and is used as a standby, with the prime tailings line being of HDPE lined steel construction and running overland on sleepers to the TSF.

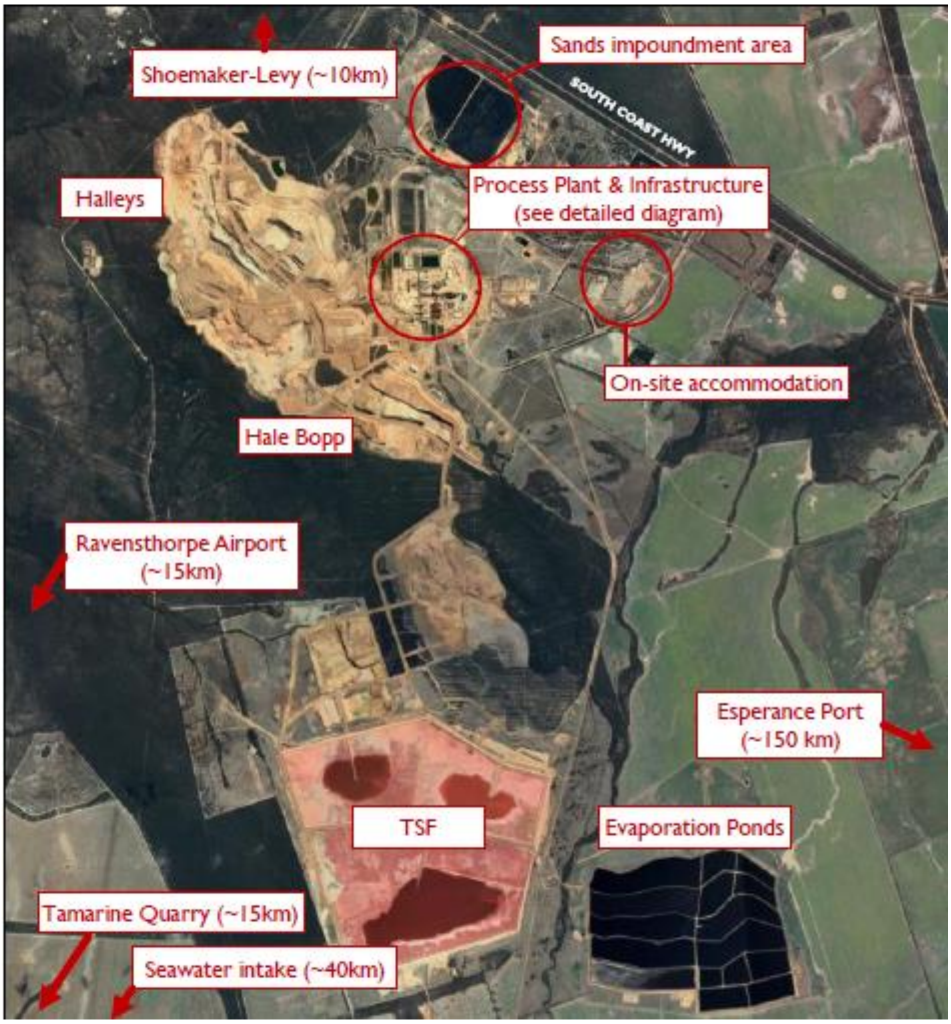
The TSF is located approximately 5km from the plant site and currently comprises two sections, TSF 1East/West and TSF 2. Both are used for storage of tailings as required. The facilities are of the downstream construction type utilising a combination of waste rock and clays for construction. The facilities are raised as required by operations and to maintain the required freeboard. LOM will require the future construction of a TSF 3 to the East of the current facilities.

The facility is of the conventional peripheral spigot discharge type dam with a central decant for solution recovery from its three main sections. The solution recovered is either returned to the plant for use or directed to the nearby evaporation ponds for storage and evaporation.

The plant site has no water storage dams, but does have run off dams which collect run off from the plant and mine areas. The collected solutions are returned to the plant for reuse.

An aerial photograph of the RNO Halleys/Hale-Bopp mine areas and surrounding infrastructure including the TSF is shown in Figure 18-1.

**Figure 18-1 RNO Site Layout**




### 18.4.2 Power supply

RNO generates its own power from the steam produced in the acid plant from the burning of raw sulphur. The plant power requirement can be provided entirely from the acid plant steam generated or from a combination of steam and diesel generators depending upon process requirements. In addition steam is used for various process heating requirements, principally in the HPAL circuit. Full steam backup (i.e. for acid plant maintenance) is available from 3 package boilers and/or diesel generators if required.

Dedicated power lines link the RNO power facilities to both the Shoemaker-Levy mine area to the north and the sea water pumping facilities to the south (see section 18.4.3).

RNO is currently a very low $CO_2$ emissions operation. The recently completed 9.5 km overland ore conveyor from the Shoemaker-Levy open pit to the processing facility further contributes to RNO maintaining its low $CO_2$ emissons status with much reduced truck haulage. The operations processing power requirements are primarily met through waste heat from acid production. The resulting low $CO_2$ emissions per tonne of Ni produced, place RNO in the lowest $CO_2$ emissions quartile of Ni producers. Power generated in this way contributes less than 1% of RNO's $CO_2$ emissions. Occasional use of diesel generation is in place to supplement power during intermittent periods where lower acid consuming ore results in lower acid production and a consequent decrease in power production from the waste heat.

However, early operational data from the Shoemaker-Levy deposit indicates that Shoemaker-Levy ore will have a lower average acid consumption per tonne of ore than the historical ore supply from the Halley's and

Hale-Hopp deposits. The lower acid requirements of Shoemaker-Levy ore means that less waste heat will be available from acid production to generate power. As such, supplemental power will be required. While RNO has the capacity to generate supplemental power from existing diesel generating capacity, a study to generate the majority of this supplemental power requirement from renewables such as wind or solar has been initiated. This study is at an early stage, and resulting project scope and permitting requirements are yet to be established. Once the requirements are defined from real operating data, renewable options, such as wind or solar energy, will be assessed. Given RNO already has acid waste heat and diesel generator energy solutions, it is unlikely that additional power generation will be required from fossil fuel power. Opportunities do exist with how renewables will interact with the swings in power demands/producers and so optimise the balance of power generation and consumption. The objective is to maintain RNO as a very low $CO_2$ emissions operation.

### 18.4.3 Water supply and discharge

Sea water is pumped from the coast (Mason Bay) through a single buried HDPE/FRP pipeline (46km) to the plant site where it discharges into a storage pond for use. The pipeline is equipped with three pump booster stations along its length and a settlement pond at the coast for removal of detritus. The incoming water is chlorinated at the inlet to control plant growth in the pipeline.

Desalinated water is produced from sea water sourced from the storage pond by two multiple effect desalination plants. The desalination plant product represents about 30 % of the input water flow. The desalinated water is further processed via a demineralisation plant for use in the acid plant. The rejected saline water is used in the RNO process plant for processing purposes and is ultimately disposed of in the tailings dam and or evaporation pond.

Potable water is produced from a bore field located south of the tailings dam via reverse osmosis potable water plant.

Process water for Shoemaker-Levy is provided from the main process plant via a pipeline. Potable water is provided via a package potable water plant.

RNO process operations are zero discharge. Water management within the process plant is a continual process of improvement to reduce consumption and improve recycling. Surplus effluents from the process plant are stored in evaporation ponds. These ponds receive, principally, surplus supernatant decant water from the tailings storage facilities. These waters are allowed to evaporate naturally to promote precipitation of the contained impurities (principally magnesium sulphate).

## 18.5 Accommodation

RNO has both housing in Hopetoun (161 houses) for residential staff (Figure 18-2) and an 528 room accommodation village 2 km east of the RNO plant for FIFO and DIDO staff (Figure 18-3).

**Figure 18-2 Hopetoun company housing.**

**Figure 18-3 Village/camp facilities at the RNO mine site.**

## 18.6 Shoemaker-Levy Infrastructure

Aside from extensive plant refurbishment after the purchase from BHP, the only significant infrastructure built since 2010 is at the Shoemaker-Levy Mine. In 2021 dedicated facilities were constructed for the mine including offices, ROM pads, crushers, heavy equipment workshops and laydown areas.

In the mining area new mobile fleet maintenance, refuelling, water storage facilities, ROM stockpiles as well as mine offices were built at Shoemaker-Levy some 10km away from the existing RNO facilities. A new crusher facility which replicates the proven design of the two existing crusher facilities was constructed and includes a ROM bin, apron feeder, vibrating grizzly, jaw crusher, sizers, conveyors and transfers to existing RNO plant conveyors (Figure 18-4).

Shoemaker-Levy will crush and convey both Saprolite and Limonite in a batch process to feed the two existing crushed ore stockpiles at RNO and has a design capacity of 2,600 tph.

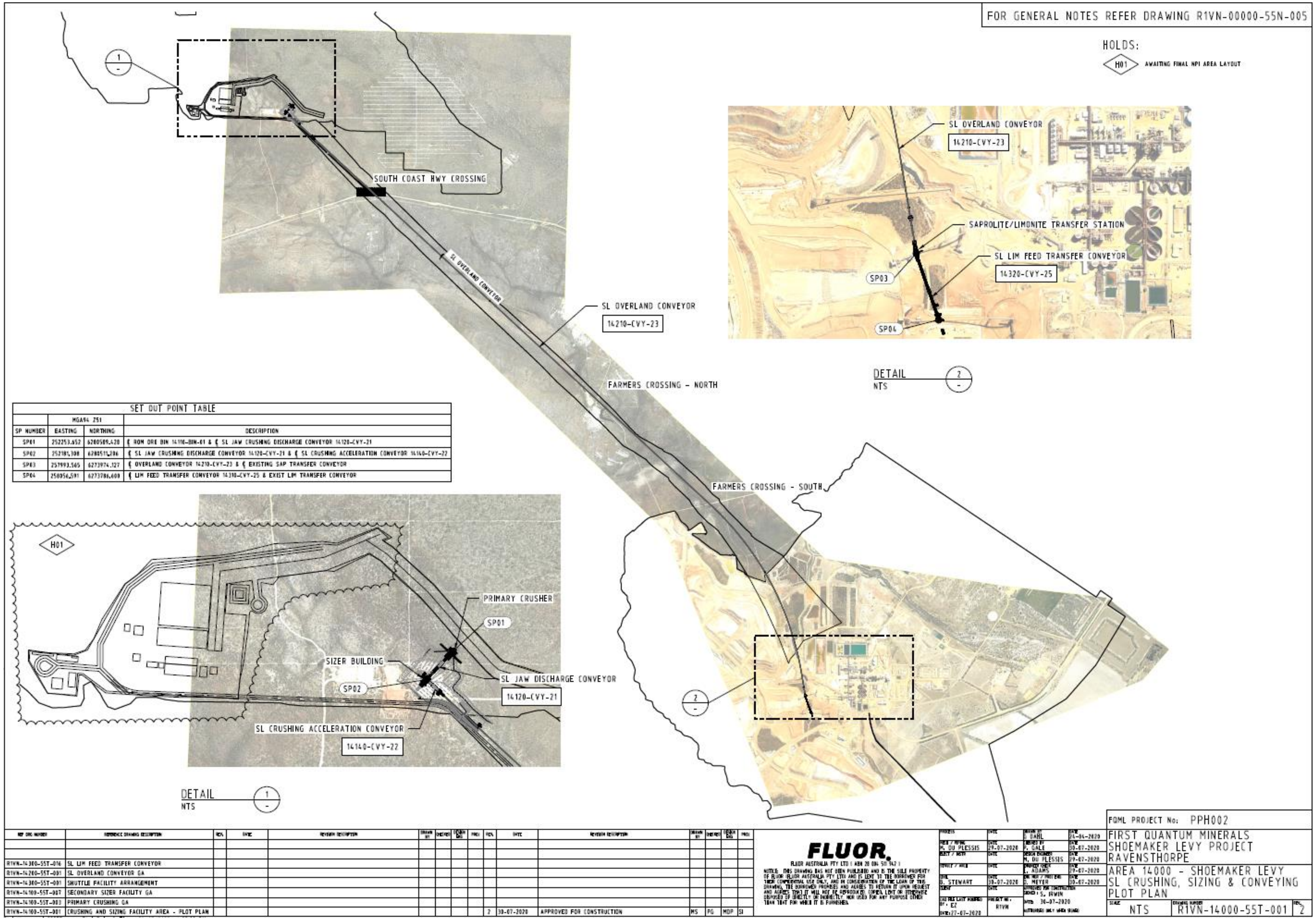
Crushed ore is transported to the RNO plant via a conveyor belt which was also constructed during 2021. An overpass was built to allow the conveyor to pass over the South Coast Highway (Figure 18-5).

The conveyor systems includes a 9km curved overland conveyor and overpass of the Southwest highway (Figure 18-4 and Figure 18-6). In addition to the processing facilities, a 33kV overhead line connects Shoemaker-Levy infrastructure to RNO and an overland pipeline provides raw water to Shoemaker-Levy from RNO.

**Figure 18-4 A view of the Shoemaker-Levy crushing and conveying infrastructure.**

**Figure 18-5 Shoemaker-Levy overpass August 2021 (looking east along the South Coast Highway)**

**Figure 18-6 Key Shoemaker-Levy infrastructure plan, including overland conveyor**



# Item 19 MARKET STUDIES AND CONTRACTS

## 19.1 Market Analysis

### 19.1.1 Nickel Market

The market demand for nickel is strong with compelling medium to long term prospects. The largest market sector demand for nickel is in the manufacture of stainless steel which accounts for approximately 67% of primary nickel demand. The fastest growing sector for nickel demand is in the manufacture of batteries, which are used widely, but most importantly in the production of Electric Vehicles. Looking forward to 2030, projections of the compound average growth rate for Ni required in the battery sector is around 16%. Significant amounts of nickel are also used in the production of non-ferrous alloys, and in the plating, and alloy steel industries.

### 19.1.2 MHP Markets

FQM has been selling MHP to major global nickel refineries for more than 10 years, and over this time it has marketed more than 200,000 tonnes of nickel contained in MHP to more than 20 customers located in various regions, including East Asia, South Asia, South America and Australasia.

The market demand, and the preferred route for MHP to final product has changed over this time:

- In the period 2011 through to 2016, the majority of MHP was sold to refineries where the nickel was converted to metal, mainly the form of cathode, which was then marketed mainly to producers of stainless steel.
- More recently, just about all RNO MHP has been converted into battery chemicals. MHP is a preferred feedstock by refineries as it dissolves readily, and can be efficiently converted into battery grade nickel sulphate. The nickel to cobalt ratio of RNO MHP is also interesting to refineries, as the cobalt units can also be routed into battery chemicals.

### 19.1.3 Product Valuations

The market price for MHP has improved significantly over the period that FQM has been marketing MHP. This is due to:

- MHP becoming more widely known within the market. To some refiners, MHP comprises the core of their feed blends.
- The aggregate capacity within the global refining pool that can theoretically treat MHP has increased considerably and the number of refineries interested in treating MHP is considerably higher. As an indication, the current interest in MHP exceeds RNO's production capacity by at least 3 times.

The number of operations producing a nickel intermediate product, that could be comparable to RNO MHP, has more than doubled over this period. In recent years, many customers for nickel intermediate feedstocks have become increasingly discerning of the ESG credentials and impact in the production of that intermediate (especially with consideration to the carbon dioxide intensity during production and logistics, and the situation of tailings deposition management). The relative ESG criteria of RNO and correspondingly the MHP is good, in comparison to many other producers of MHP, and this could allow RNO to realise improved value in the marketing of its MHP.

### 19.1.4 Typical MHP Specification (key components):

MP specifications have 23% Ni, 0.8% Co with around 50% moisture.

## 19.2 MHP Sales Contracts

As part of the POSCO equity in RNO, POSCO has a long term off-take agreement, beginning in 2024, for 7,500 tonnes per annum of Ravensthorpe's produced nickel in MHP. Pricing is based upon a weighted average of sales from the remaining 70% to other customers. The balance of Ravensthorpe's production is marketed by First Quantum.

The sales and marketing of MHP is performed by FQM. Where possible, the MHP is marketed directly to the operation or refinery that will be treating the MHP; through doing this, a higher level of cooperation and communication is established between RNO and the plant consuming the MHP.

### 19.2.1 Contracts under negotiation

Sales contracts are normally in place by the start of the calendar year. Through the calendar year, some trial contracts may be entered into, for the purpose of introducing the MHP to a new potential customer, or into a different flowsheet.

### 19.2.2 Contracts in place

In any calendar year, RNO MHP is typically marketed to between 5 and 8 customers (interest is typically received from more than double this number of customers).

**Terms**

Duration:

Due to the volatility of the nickel price, and also the variation in the payables for nickel intermediates like MHP, the industry practice has generally been to contract for a single calendar year at a time. However, there are signs that this may be changing as end consumers (EV OEMs) begin to look up the supply chain, especially in consideration of supply chain sustainability, and mining companies look down the supply chain, especially those operating at the higher levels of the various sustainability metrics, where there may be a possibility to market metal to a similarly minded OEM.

Nickel and Cobalt Payables:

Over the past decade, the payables for both nickel and cobalt contained in MHP have increased significantly with the development of the EV industry, and related demand for these metals in batteries for this sector.

- In the period 2011 through 2016, the payable for nickel within the market was typically in the region of 74% to 77%
- Over the last 2 years, the payable for nickel within the market has risen to around 90%, and in recent time, even above 90%.

**Logistics**

- Due to the 'Dangerous Goods' classification of MHP, the material is packed in plastic lined bags, with each bag weighing approximately 1 tonne. For Marine Freight, the bags of MHP are packed in 20' GP containers.
- Transporting MHP in containers has 2 further advantages:
  - It allows for the delivery to customers of smallish parcels, at competitive freight rates.

  - The quality of the MHP is maintained
- FQM controls the shipping and logistics of the MHP, and sales terms are typically cost, insurance and freight to the Port of Destination.

## 19.3 Material Contracts

The following contracts, as relevant to the operations, are in place at RNO:

- Contract Mining (MACA Ltd)
- RC Grade Control Drilling (Orlando Drilling Pty Ltd)
- Sulphur Road Freight (Mattben Pty Ltd T/A Freight Lines Group)
- MgO & MHP Road Freight (MLG Ltd)
- Village Management and Operations Cleaning (Compass Group Remote Hospitality Services Pty Ltd)
- Limestone Quarry Mangement (D Palmer Corporation Pty Ltd)
- Supply of Quicklime (Cockburn Cement Ltd)
- Supply of Diesel (Viva Energy Australia Pty Ltd)
- Supply of MgO (QMAG Pty Ltd)

Contracts are sourced through competitive tendering and reflect industry norms.

# Item 20 ENVIRONMENTAL STUDIES, PERMITTING, LAND, SOCIAL AND COMMUNITY IMPACT

## 20.1 Environmental setting

RNO operates under FQM's global standards with respect to environment with its own Environmental Management System (EMS). The EMS is aligned with ISO14001:2015 standards and is subject to external compliance audits. Closure planning and implementation is managed through regular three yearly reviews of closure costs, commitments and requirements. Rehabilitation trials have been successfully undertaken on the Halley's waste dump outer batter. Responsible management of the TSF is a key focus for FQM. RNO's TSF has been designed in line with international standards by TSF specialists Golder Associates which ensures the TSF is constructed and operated in a safe and environmentally responsible manner. The TSF is audited annually by independent experts.

## 20.2 Status of environmental approvals

Mining and mineral processing activites at RNO are approved under various legislative instruments issued by the Western Australian and Australian Governments. The key primary approval is Ministerial Statement 633 (MS633) which sets an overarching regulatory framework for environmental management at the project, including a requirement for implementation of the EMS. Numerous subsidiary approvals have also been issued to ensure project operations are undertaken in an environmentally responsible manner. Since it was first issued in September 2003, MS633 has been updated numerous times to include infrastructure not previous allowed for or for changes to the approved RNO footprint. Additional approvals required by subsidiary legislation are regularly sought to allow for alterations or upgrades to existing operational infrastructure within the approved project footprint provided in MS633. Approvals documentation for a further sequence of lifts to the TSF is currently being prepared.

The stage 2 expansion required for additional infrastructure associated with the south east of the Shoemaker-Levy mine is currently being assessed by the Western Australian EPA. Subsidiary approval applications are yet to be prepared. Approval is currently expected in late 2022 or early 2023. Stage 1 covers the original approved development envelope and includes 95% of the Shoemaker-Levy Mineral Reserve. Stage 2 is an extension application seeking approval to expand the footprint in the south east of Shoemaker-Levy mine for waste and topsoil coverage as well as the remaining 5% of the Shoemaker-Levy Mineral Reserves. An additional stage involves negotiating with waters, rivers and the native title holders for crossing the Bandalup Creek. Mineral Reserves have been excluded from this Bandalup Creek zone.

Table 20-1 provides a summary of the current environmental approvals status of RNO.

**Table 20-1 Summary of environmental approvals status of RNO**

<table>
<tr><th>RNO Infrastructure</th><th>Approvals Status</th><th>Legislation</th><th>Instrument</th><th>Type</th></tr>
<tr><td rowspan="2">Processing plant<br><br>Mason Bay seawater pipeline<br><br>Tailings storage facility (TSF)</td><td rowspan="2">Approved for operation</td><td>State Environmental Protection Act 1986 Part IV</td><td>Ministerial Statement 633</td><td rowspan="2">Primary</td></tr>
<tr><td>Commonwealth EPBC Act 1999</td><td>EPBC 2001/172</td></tr>
</table>

| RNO Infrastructure | Approvals Status | Legislation | Instrument | Type |
|---|---|---|---|---|
| Halleys mine pits<br>Hale-Bopp mine pits<br>Shoemaker–Levy conveyor and stage 1 mine pits<br>Tamarine limestone quarry | | State *Environmental Protection Act 1986* Part V | Operating Licence<br>L8008/2004/3 (RNO)<br>L8660/2021/2 (Tamarine) | Subsidiary |
| | | State *Mining Act 1978* | Mining Proposals (numerous)<br>Mine Closure Plan (2021) | Subsidiary |
| Shoemaker–Levy stage 2 mine pits | Under assessment | State *Environmental Protection Act 1986* Part IV | Ministerial Statement TBA | Primary |
| | | Commonwealth *EPBC Act 1999* | EPBC statement TBA | |
| | Development | State *Mining Act 1978* | Mining Proposal<br>Mine Closure Plan | Subsidiary |
| Shoemaker-Levy North | TBA | TBA | TBA | TBA |
| Nindilbillup | TBA | TBA | TBA | TBA |

## 20.3 Environmental management

The EMS currently in place at RNO is focussed on meeting the relevant commitments to environmental governance that are included in the company's Environmental Policy.

The EMS includes:

- Environmental aspects and impacts register;
- Environmental legal obligation register;
- Management plans and procedures focussed on key environmental risk areas;
- Monitoring and inspection of key environmental risk areas to ensure compliance;
- Internal reporting to capture non-compliance and ensure resolution and continuous improvement; and

- Stakeholder (internal and external) consultation to raise awareness of requirements and to gain feedback.

There are numerous environmental report submissions required by the various RNO environmental approvals and licences and these provide a benchmark assessment of the level of environmental compliance achieved by the site. In some cases reports are required to be accompanied by a signed declaration by an authorised company representative confirming the stated level of compliance.

## 20.4 Waste and tailings disposal

Mining and processing wastes are the key area of concern for RNO with regard to environmental management. Significant mining and processing waste streams include waste overburden material produced during mining operations, beneficiation rejects, tailings residue and supernatant liquor decanted from the tailings storage facility. Waste water (sewage) produced from the accommodation camp and the administration and operations office facilities along with contaminated storm water runoff produced from the processing plant footprint are also significant waste streams that require management. Table 20-2 summarises environmental management and controls in place for each key waste stream.

**Table 20-2 Environmental management summary for key waste streams at RNO**

<table>
<tr><th>Waste Type</th><th>Waste Source</th><th>Management Infrastructure</th><th>Control Mechanism(s)</th></tr>
<tr><td>Mining waste</td><td>Mining operations</td><td>Waste rock landforms (dumps) adjacent to open pits</td><td>Construction standards agreed with mining regulator.</td></tr>
<tr><td>Beneficiation rejects</td><td>Processing plant</td><td>Halleys and Hale-Bopp open pits</td><td>Reconstruction of Bandalup Hill landform to close to original contour as agreed with Western Australian Government.</td></tr>
<tr><td>Tailings residue</td><td>Processing plant</td><td>Tailings storage facility (TSF) located 4kms south of processing plant.</td><td rowspan="3">Construction completed to required standards. Operation in accordance with required operating manuals and RNO operating licence. Regular inspections/maintenance and where required, independent expert audits. Water monitoring. Annual reporting to environmental regulators.</td></tr>
<tr><td>Supernatant liquor</td><td>TSF</td><td>Evaporation ponds located 800 m east of the TSF.</td></tr>
<tr><td>Waste water (sewage)</td><td>Accommodation camp, administration and operations facilities</td><td>Aerobic waste water treatment plants.</td></tr>
</table>

| Waste Type | Waste Source | Management Infrastructure | Control Mechanism(s) |
|---|---|---|---|
| Contaminated storm water runoff | Processing plant and mine services area footprints | Internal drainage systems and recycling of collected water. | |

## 20.5 Community engagement

Stakeholder engagement and community consultation and participation in the planning, development, construction and operation phases of RNO have been extensive.

The Wagyl Kaip and Southern Noongar group (WKSN) are the native title claimants over the current RNO operational area. The Ravensthorpe Operations Agreement (ROA) between RNO and WKSN governs the way the parties work together to uphold and protect Native Title and Aboriginal Heritage. Annual payments are required by the ROA and are directed to a trust fund structure set up under this instrument with the purpose of advancing economic/business development opportunities for the WKSN people. The ROA also requires annual funding to support the advancement of health, education, wellbeing and employment opportunities of the WKSN people. This includes establishment and operation of the Relationship Committee (RC) which includes representatives from both RNO and WKSN. The RC meets quarterly to discuss issues and determine how best to allocate available funding. Annual funding payments also provide for engagement of a Noongar Development Officer whose role it is to support the operation of the RC. In addition, and in accordance with the ROA, for any proposed significant changes to the approved RNO mine footprint, RNO must seek input from WKSN (and other relevant parties) in the form of Aboriginal Heritage surveys. Survey outcomes can influence planning and operational aspects of RNO. RNO are now advanced in re-establishing positive working relationships with the WKSN native title claimants in accordance with the ROA, following a period of minimal contact during Care and Maintenance.

The Government approvals process involved significant community engagement and subsequent regulatory approvals require ongoing engagement. RNO's key ongoing stakeholder engagement activites are summarised in Table 20-3.

**Table 20-3 RNO key ongoing stakeholder engagement activity summary**

| Key Stakeholder | Key Interest in RNO | Engagement Method |
|---|---|---|
| Environmental regulatory agencies (EPA, DMIRS, DWER, DAWE) | Oversight for implementation of responsible environmental management. Regulation and compliance with environmental approvals and licences. | Compliance reporting in accordance with approvals/licence conditions. Consultation regarding changes or updates to approvals. Compliance audits and inspections. |
| Jerdacuttup and RNO Working Group (JRWG) | Fence line neighbours. | Quarterly (or as agreed) meetings and site visits. |

| Key Stakeholder | Key Interest in RNO | Engagement Method |
|---|---|---|
| Wagyl-Kaip/Southern Noongar (WKSN) native title claimants | Registered native title claimants over the project area. | Compliance with Ravensthorpe Operations Agreement (ROA) and relevant ILUA's. Quarterly Relationship Committee meetings. Heritage surveys as required. |
| Esperance Nyungars | Recognised aboriginal heritage interest in the project area. | Compliance with ILUA as required. Heritage surveys as required. |
| Shire of Ravensthorpe and Shire of Esperance | Rate collector, business and employment, local and regional infrastructure, community support. | Ongoing regular communications. |
| Local and regional community | Business and employment, local and regional infrastructure, community support. | Regular community meetings as required, newsletters. Attendance at community and business functions and industry conferences. |

## 20.6 Mine closure

In compliance with the 2020 *Statutory Guidelines for Mine Closure Plans*, RNO prepared and submitted an updated Mine Closure Plan (MCP) to mining regulator DMIRS in February 2021. The revised MCP was approved by DMIRS in November 2021.

Key updates to the revised MCP included closure assessments of the Shoemaker-Levy mine site and associated ore conveyor as well as the TSF 2 stage 3 lift. An extensive update to the technical information required to support closure was also included.

Given a proposed mine life of 20 years, the current version of the MCP is a relatively high level document and does not identify and cost specific closure activities in detail. A high level closure cost for each closure domain (e.g. open pits, waste landforms, TSF etc.) has been estimated using industry accepted methods.

The current version of the MCP aims to meet the following key objectives:

- Identification of all known closure obligations and commitments;
- Presentation and analysis of baseline and closure data that will inform the closure process including identification of knowledge gaps and a description of the ongoing work program required to fill these;
- Establishment of agreed final land use objectives;
- Identification of closure risks and appropriate controls for these. All risks to be as low as reasonably practicable (ALARP);
- Presentation of site specific closure outcomes and completion criteria. Closure outcomes must be realistic and achievable and consistent with agreed post mining land uses. Completion criteria must be specific, measurable, achievable, relevant and time bound and should demonstrate achievement of the closure outcome;
- Present closure designs and a work program and allow for contingencies;
- Present a closure monitoring and maintenance framework including a description of monitoring methodology; and

- Confirm financial provisioning is available for closure and that methods used to determine closure cost estimates meet industry standards.

For the purposes of this report, the most pertinent information to provide is the draft final land use objectives for RNO, which are presented in Table 20-4.

**Table 20-4 RNO final land use objectives for closure**

| Closure Domain | Post mining land use |
|---|---|
| Open pits | Access to the open pits will be restricted with abandonment bunds constructed in accordance with relevant guidelines.<br><br>**Backfilled open pits**<br>Backfilled open pit areas will be reprofiled and revegetated to improve visual amenity and support ecological linkage corridors.<br><br>**Open pit voids**<br>Open pit voids will be restricted access areas. The visual impact of the pit voids in the final landform from publicly accessible locations and nearby provate residences will be minimised as much as practicable. Pit walls will be reprofiled and revegetated. Pit floors will also be rehabilitated. |
| Landforms and TSFs | Constructed landforms will be stable, non-polluting and support self-sustaining local provenance native vegetation which provides habitat for local native fauna. Access to these areas will be restricted temporarily (nominally 10 years) by fencing while vegetation establishes. |
| Ore processing and handling infrastructure, non-processing infrastructure, roads and hardstand | All other mining areas will be made safe, stable and non-polluting and support self-sustaining local provenance native vegetation and provide habitat for native fauna. |
| Rehabilitation offsets | Remnant farmland will support self sustaining local provenance native vegetation which will provide a habitat for local native fauna. |

The MCP is required to be updated every three years to reflect current project status and is then re-submitted to DMIRS for approval. The next revision is due for submission in February 2024.

# Item 21 CAPITAL AND OPERATING COSTS

Costs are presented in United States dollars (US$)

## 21.1 Capital Costs Estimates

The LOM capital cost estimate for RNO is based on the 5 Year planning with longer term projections based on extrapolation of current practices. As noted in other Items of this report, FQMA has been operating and expanding the mine and process plant since 2011 and all infrastructure is in place.

The total estimated capital cost for the cost components of this Item is $185 million (M), which primarily consists of sustaining capital for the process plant and tailings dam.

**Table 21-1 RNO Mine Capital Cost Summary**

| COST ITEM | US$ Million |
|---|---|
| Land & Buildings | 2.7 |
| Mineral Properties | 37.7 |
| Motor vehicles | 7.6 |
| Processing Plant, Equipment & Tailings dam | 137.0 |
| **Total Capital Costs** | **185.0** |

### 21.1.1 Capital Costs – Mining

Given all mining areas have been developed and mining is undertaken for FQMA at RNO by a mining contractor, no mining capital costs have been allowed for.

### 21.1.2 Capital Costs – Processing

Repairs and upgrades of existing processing infrastructure were carried out in 2020/21 as part of the expansion of Shoemaker-Levy and restart of operations. No further capital projects have been identified or allowed for at this point in time.

### 21.1.3 Mine closure provisions

Table 21-2 lists the closure cost provisions comprising the estimated costs that would be incurred at the end of the Project life. These costs provide for rehabilitation of the entire Project site.

**Table 21-2 RNO Mine Closure Costs**

| COST ITEM | US$ Million |
|---|---|
| Domain 1 – open pit | 20.8 |
| Domain 2 – Waste rock landforms | 9.6 |
| Domain 3 – Tailings Storage Facility | 39.9 |
| Domain 4 – Ore processing and handling | 30.0 |
| Domain 5 – Non-process infrastructure | 70.3 |
| Domain 6 – Roads and Hardstand | 4.7 |
| **Total Mine Closure Liability** | **175.3** |

## 21.2 Operating Costs Estimates

Life-Of-Mine (LOM) operating costs were calculated based on actual site costs and the 5 Year Plan. The summary of average LOM operating costs is listed in Table 21-3. These costs are shown in $/tonne leached, $/tonne of nickel recovered and $/lb of nickel recovered.

Over the remaining life of mine, the average annual mining cost is $65 M and processing cost is $205 M. A further $20 M per year is allocated to Administration costs.

**Table 21-3 RNO Operating Costs**

| COST ITEM | LOM Average Annual Cost US$ Million | US$ / t Leached | US$ / t Ni | US$ / lb Ni |
|---|---|---|---|---|
| Mine Drill & Blast + Load & Haul | 45 | 14.15 | 1,666.67 | 0.76 |
| Mining Re-handle, Rehabilitation + Overheads | 20 | 6.29 | 740.74 | 0.34 |
| Variable Processing | 165 | 51.89 | 6,111.11 | 2.77 |
| Fixed Processing | 40 | 12.58 | 1,481.48 | 0.67 |
| Administration Costs | 20 | 6.29 | 740.74 | 0.34 |
| Selling Costs | 20 | 6.29 | 740.74 | 0.34 |
| Royalties and Selling Costs | 20 | 6.29 | 740.74 | 0.34 |
| **Total Operating Cost** | **330** | **103.77** | **12,222.22** | **5.56** |

The long term C1 costs will be in the range of US$5.00/lb to US$5.75/lb with the LOM average being US$5.21/lb. The primary driver for the long term variations in operating costs will be the cost of reagents, in particular, sulphur which has been assumed to be $175/tonne for the first five years reducing to the long term forecast price of $145/tonne for the remainder of the LOM.

### 21.2.1 Mining costs

Mining costs for this Technical Report were developed using the current mining contract and year 2023 of the RNO 2022 Budget/ 5 Year Plan and were checked against actual costs incurred in 2020/21. Costs for areas scheduled to be mined beyond the term of the current mining contract were estimated using haul profiles and preliminary staged mine designs used to develop the LOM schedule.

The mining costs (Table 21-4) took account of the plan to maintain short waste hauls for input backfilling.

**Table 21-4 RNO LOM Mining Costs**

| COST ITEM | LOM Average Annual Cost US$ Million | US$ / bcm |
|---|---|---|
| Drill & Blast | 14 | 1.16 |
| Load & Haul | 31 | 2.66 |
| Rejects Rehandle | 5 | 0.80 |
| ROM / SP Rehandle | 4 | 0.64 |
| Landform / Rehabilitation | 7 | 0.60 |
| FQM Overheads Mining Dept | 4 | 0.14 |
| **Total Mining Costs** | **65** | |

Ore rehandling includes allowances for mining from longer term ore stockpiles located near the process plan. The unit cost of $0.64/bcm ore reclaimed equates to approximately $1/tonne ore and was developed from 2020/2021 actual costs.

### 21.2.2 Processing and G&A costs

Operating costs for Processing and G&A costs were derived from historical actual costs and year 2023 of the RNO 2022 Budget/ 5 Year Plan. The estimates are shown in unit cost terms for the purposes of the original mine optimisation/planning and for subsequent cashflow modelling to support the Mineral Reserve update.

LOM process operating and G&A cost estimates reflect updated estimates of:

- consumption rates for crushing, conveying, beneficiation, and leaching consumables and reagents;

- sulphur and diesel consumption rates;
- unit costs for crushing, conveying, beneficiation, and leaching consumables as well as sulphur, diesel, and maintenance parts;
- plant and administration personnel numbers;
- annual assay costs;
- an allowance for tailings operation costs for such as piping and spiggotting.

**Table 21-5 RNO LOM Variable Processing Costs**

| COST ITEM | LOM Average Annual Cost US$ Million | US$ / t Leached |
|---|---|---|
| Reagents (Including Sulphur[1]) | 107 | 33.65 |
| MHP Transport Costs | 11 | 3.46 |
| Processing + Engineering Labour Costs | 25 | 7.86 |
| Maintenance Costs | 20 | 6.29 |
| Other Processing Costs | 2 | 0.63 |
| Total Processing Cost | 165 | 51.89 |

Notes: [1] Sulphur Cost = $145/tonne FOB.

The addition of Fixed Processing costs (US$40 Million average per year) made up of contractors and maintenance costs, brings the total LOM average processing cost to US$205 million per year. This does not include selling costs.

### 21.2.3 Metal costs

Royalties are applied at three levels to production and sales from RNO:

1. A State Government Royalty on revenue of 2.5% for Nickel, Cobalt and Limestone;
2. A Native Title Royalty of between AUD $750,000 and $1,500,000 per year dependent on Nickel price and production rate;
3. Third Party Royalties on sales of 0.93% for Nickel and 0.55% for Cobalt.

In addition to royalties, metal costs for nickel and cobalt in concentrate comprise:

- concentrate transport charges (ocean freight);
- concentrate refining charges;
- payable rates for each metal recovered into concentrate.

Table 21-6 lists the metal costs adopted for the pit optimisation described in Item 15.

**Table 21-6 LOM Metal and Selling Costs**

| ITEM | | US$ / lb |
|---|---|---|
| Royalty on Nickel Revenue | 3.4% | 0.30 |
| Smelter Charges (Payability) | 87% | 1.10 |
| **Total Metal Costs Nickel** | | 1.40 |
| Royalty on Cobalt Revenue | 3.05% | 0.91 |
| Smelter Charges (Payability) | 45% | 16.50 |
| **Total Metal Costs Cobalt** | | 17.41 |

# Item 22 ECONOMIC ANALYSIS

RNO has been operational for a number of years and, in accordance with Form 43-101 F1, FQMA has opted not to present a detailed Economic Analysis as this technical update does not include a material expansion of current production.

FQMA did however develop a cashflow model using the optimisation parameters and costs as outlined in Item 21 which confirms that RNO will have positive cash flow until the end of mine life, hence supporting the Mineral Reserve declaration.

# Item 23 ADJACENT PROPERTIES

There are no adjacent properties or relevant information pertaining to adjacent properties that are material to this Technical Report.

# Item 24 OTHER RELEVANT DATA AND INFORMATION

There is no other relevant information or explanation required to make this Technical Report understandable and not misleading.

# Item 25 INTERPRETATIONS AND CONCLUSIONS

## 25.1 Mineral Resource modelling and estimation

Systematic RC based drilling programs have been undertaken based on RNO SOPs at the Halleys, Hale-Bopp and Shoemaker-Levy deposits since at least the late 1990s with all samples sent to commercial laboratories in Perth. Detailed density information was collected as part of core drilling in the early 2000s and later utilising downhole geophysics methods (2017, 2019 to 2021). During this time Mineral Resource estimates have been compiled at various stages in accordance with standard industry practices and the process has been refined over time based on knowledge gained from mining the deposits. Aside from a period when the mine was on care and maintenance (August 2017 to January 2020) the operation has been in commercial production since 2011.

The future of the operation will be based largely around the Shoemaker-Levy deposit which hosts the bulk (81%) of the remaining Measured and Indicated Mineral Resources. The potential to increase the Shoemaker-Levy Mineral Resource base does exist:

- Minor increases in Mineral Resources will be possible in some areas where the drilling has been stopped in Limonite. Infill deeper drilling should increase the defined mineralisation extents.
- Better definition of the Limonite density across the full strike length of the deposit. The historic core based density of 1.4 $t/m^3$ appears to be conservative based on mining at the other deposits and recent downhole geophysical logging at Shoemaker-Levy.

The risk to the operations from unforeseen issues relating to the geological interpretations or the data used to compile the Mineral Resource estimates is low. The risk of variations in thickness and orientation of mineralised horizons (typical of Nickel laterite deposits) to mining and processing are largely mitigated by the detailed grade control drilling (10 mE by 12.5 mN).

## 25.2 Mine planning and Mineral Reserve estimation

RNO is an established conventional open cut nickel laterite mine that has been in operation for several years.

Mine planning and evaluations undertaken using the latest resource models confirm that RNO is both viable and economic. The bulk of the remaining Mineral Reserves are in Shoemaker-Levy where mining commenced in 2021. The Mineral Reserve estimate has a relatively high sensitivity to revenue which is controlled by metal prices and payability. It is noted however that at current long term forecast metal prices, the mineral reserve is relatively insenstive to changes in revenue and costs.

Given the mine has been operational for a number of years, technical risk in relation to the Mineral Reserves estimate is deemed to be low.

### 25.2.1 Water management

Based on current designs, no mine dewatering is required for mining within the established or planned mining pits. Mine water management is limited to surface stormwater control to prevent mine generated stormwater from affecting operational areas or from leaving the site footprint. Captured stormwater is reused where possible for dust suppression or mine services activities.

The water requirements for mining operations are largely limited to that required for dust control, resource drilling and for mine services. Water resources are adequately provided for through supply from the Mason Bay seawater pipeline or the bore field (potable water).

Water management presents a relatively low risk for mining operations.

### 25.2.2 Waste handling

The lack of accessible mine waste management options at the Shoemaker-Levy mine is a risk for mining operations going forward and ultimately, if not resolved may impact on ore feed to the processing plant. Access to approved areas that allow for expansion of waste rock landforms is a key requirement for Shoemaker-Levy and this in turn is dependent on the stage 2 Ministerial approval that is currently being assessed.

### 25.2.3 Mining licence, environmental and social

The Shoemaker-Levy stage 2 Ministerial approval that is currently under assessment by the Western Australian Government presents a risk for planned mining operations at Shoemaker-Levy. Currently, approval is expected in the last quarter of 2022 or the first quarter of 2023. If there are delays in getting approval the mine plan could be severely impacted resulting in impacts to plant ore feed.

Available options for expediting the approvals process should be assessed and actioned. Approval requirements also present a risk for further expansion of the Shoemaker-Levy mine.

## 25.3 Processing

The Shoemaker-Levy testwork program undertaken for the first five years of operations has demonstrated that the ore can be upgraded to an accpetable level to feed the main process plant. Current operational performance data is confirming the results of this testwork.

# Item 26 RECOMMENDATIONS

## 26.1 Mineral Resource estimation recommendations

- Ongoing campaigns of RC drilling for resource definition and core drilling to provide metallurgical test work samples are recommend as part of the grade control process.
- The understanding of bulk density at Shoemaker-Levy needs to continue to be evaluated using a combination of downhole geophysics and in pit testing. The core based density data is acceptable but the alternative methods (downhole geophysics and pitting) will provide more accurate results and in the case of downhole geophysics, more detailed results.
- Saprolite/saprock material, from Shoemaker-Levy, which has elevated Mg (> 8%), reasonable beneficiation and recoverable Ni, is currently under investigation as a supplementary source of heat for the saprolite leaching reaction. Test work results of lower saprolite/saprock material sourced from diamond drilled core at Shoemaker-Levy have demonstrated positive beneficiation with adequately reactive Mg. Further testing is required in order to ensure that this material will not dilute current Saprolite feed Ni grades.
- Detailed drill grid studies have been completed using close spaced drill data at Halleys, Hale-Bopp and Shoemaker-Levy. In order to limit misclassification between caprock waste, high recovery limonite and lower recovery Saprolite, drill grid spacings are optimals at a grid of 10 m by 12.5 m. Returns on the cost of drilling at these grids are in excess of 10 times.
- Maintain levels of supervision and database verification regarding consistent geological logging
- The quality of the analytical work (accuracy and precision and sample analysis) by the current laboratory (SGS Australia Pty Ltd) is acceptable but needs to be monitored due to slightly lower standards when compared to the previous laboratory (Bureau Veritas Minerals Pty Ltd).

## 26.2 Mineral Reserve estimation recommendations

- As Resource definition is ongoing, regular updates of the economic pit limits (pit optimisation), pit designs (interim and final), and life of mine schedules should be undertaken.
- Given the relatively long life of the mine, assessment of mining methods including alternative mining equipment (continuous miners) and Contractor mining versus Owner mining should continue. Studies are underway to evaluate the benefits of using continuous mining methods as opposed to the existing conventional blasting, load and haul mining methods. Continuous miners offer reduced drilling and blasting costs and can improve fragmentation of nickel laterite materials.
- Approximately 10 Mt of Mineral Resources associated with Bandalup creek were excluded from the Shoemaker-Levy Reserve estimate at this point in time. Ongoing review, negotiations, planning, and approvals will determine how much of this material can be included in future Mineral Reserve estimates.
- The imbalance of the Limonite/Saprolite ratio in the ground versus plant capacity means that some potentially economic limonite feed is being left unprocessed at the end of mine life. It is recommended that mining and processing options be reviewed to assess the economic viability of stockpiling and processing the additional material at the end of the mine life.

## 26.3 Mineral Processing recommendations

- The Shoemaker-Levy laboratory testwork program should be continued as previously assessed areas are depleted to confirm ongoing amenability and/or provide an adequate time frame for process plant revisions to accommodate variations in ore performance.

- Within the process plant, optimisation of the beneficiation process to maximise upgrade and recovery should continue as a part of routine operations. This may include revisions to screening, cycloning and dewatering parameters.
- Development of improved solution recovery through the CCD circuit through enhancements in thickener technology and automation is recommended.
- Water balance is critical to the operation and ongoing optimisation of consumption rates and reduction in usage is key. This may include improvements in such areas as recycling of solutions and/or forced evaporation of excess volumes to reduce long term storage requirements.

# Item 27 REFERENCES

BHP, 2003. Ravensthorpe Nickel Operations Pty Ltd (A.B.N. 75092506584). As Manager of Ravensthorpe Nickel Project Joint Venture. Mineral Resource Report Halleys, Hale-Bopp and Shoemaker-Levey Deposits (RNP-REP-537).

Brand, N.W., Butt, C.R.M., (1998), Classification and features of nickel laterites, in Short Course – Exploration Geochemistry, CRCLEME. WASM Kalgoorlie.

CIM, 2019. CIM Definition Standards for Mineral Resources and Mineral Reserves.

Comet, 1999. Ravensthorpe Nickel Project, Nickel Deposits of the Ravensthorpe Region. D.B. Sampson, Comet Resources NL.

Edwards, R., Atkinson, K., 1986. Ore Deposit Geology, (Chapman and Hall publishing).

Golder, 2001 Report on Review of Sampling and Assaying Quality Control Data – Hale-Bopp and Shoemaker-Levy Nickel Laterite Deposits, Golder Associates Pty Ltd, April 2001.

Golder, 2002 Report on Review of Sampling and Assaying Quality Control Data, Ravensthorpe Nickel Project, Nickel Laterite deposits, Golder Associates Pty Ltd, April 2002.

Golichtly, J.P. (1981), Nickeliferous Laterite Deposits, in Economic Geology 75th Anniversary Volume, pp710 to 735.

JORC (2012). The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, The JORC Code 2012 Edition, the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Mineral Council of Australia (JORC).

Lipton, I.T. and Horton, J.A., 2014. Measurement of bulk density for resource estimation – methods, guidelines and quality control. Mineral Resource and Ore Reserve Estimation – The AusIMM Guide to Good Practice. 2nd edition, Monograph 30.

RNO, 2012. Ravensthorpe Nickel Operations, Halleys, Hale-Bopp and Shoemaker-Levy Deposits, Western Australia. Technical Report Prepared for First Quantum Minerals Ltd by F. J. Hughes & Associates in accordance with National Instrument NI43-101 OF THE Canadian Securities Administrators. Effective as of December 31st 2012.

RNO, 2017. QAQCR report produced 10/04/17, Data range 31/07/2010 to 31/01/2014. (QAQCR Summary Report produced 10042017).

RNO, 2019a. Shoemaker-Levy Deposit, March to August 2017 RC Drilling Programme, Quality Control Sample Analysis Report.

RNO, 2019b. Shoemaker-Levy Deposit, April to July 2019 RC Drilling Programme, Drilling Downhole Geophysics and QAQC Report.

RNO, 2020a. Ravensthorpe Nickel Operations, Hale-Bopp Deposit, Pit Density Project, 13th October 2020.

RNO, 2020b. Ravensthorpe Nickel Operations, Procedure, In-situ Pitting and Sand Replacement Density Determination.

RNO, 2022a. FQM AUSTRALIA NICKEL PTY LTD, QAQCR Summary Report produced 25/01/22. Date Rang Used: 01/01/2020 to 31/12/2020.

RNO, 2022b. FQM AUSTRALIA NICKEL PTY LTD, QAQCR Summary Report produced 25/01/22. Date Rang Used: 01/01/2021 to 31/12/2021.

# Item 28 CERTIFICATES

*David Gray*
*First Quantum Minerals Ltd*
*24 Outram St, West Perth, Western Australia, 6005*
*Tel +61 8 9346 0100; david.gray@fqml.com*

I, David Gray, do hereby certify that:

1. I am the Group Mine and Resource Geologist employed by First Quantum Minerals Ltd.
2. This certificate applies to the technical report entitled “Ravensthorpe Nickel Operations, Western Australia, NI 43-101 Technical Report”, dated effective 28th March 2022.
3. I am a professional geologist having graduated with a Bachelor of Science degree with Honours (1988) in Geology from Rhodes University in Grahamstown, South Africa.
4. I am a Member of the Australasian Institute of Geoscientists (FAIG. # 7323)
5. I have worked as a geologist for a total of thirty three years since my graduation from university. I have over 20 years’ experience in production geology, over 5 years of exploration management of precious, base metal and copper deposits. During the last 15 years I have consulted to and held senior technical mineral resource positions in copper mining companies operating in Central Africa and worldwide.
6. I have read the definition of “qualified person” as set out in National Instrument 43-101 – Standards of Disclosure for Mineral Projects (“NI 43-101”) and certify that, by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a “qualified person” for the purposes of NI 43-101.
7. I most recently personally inspected the Ravensthorpe Nickel Operations described in the Technical Report in December 2021.
8. I am responsible for the preparation of those portions of the Technical Report relating to geology, data collection, data analysis and verification and Mineral Resource estimation (namely Items 1, 2, 3, 4, 5, 6, 12, 13, 14, 22, 23, 25, 26 and 27).
9. I am not independent (as defined by Section 1.5 of NI 43-101) of First Quantum Minerals Ltd.
10. I have had prior involvement with the property that is the subject of the Technical Report. The nature of my prior involvement has been in drilling, sampling, logging and QAQC as well as optimisation of estimation methods, development of geology and mineralisation models and beneficiation testwork, analysis and prediction of beneficiation variables.
11. I have read NI 43-101 and Form 43-101F1 and the Technical Report has been prepared in compliance with that instrument and form.
12. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required for it to be disclosed and to make the Technical Report not misleading.

Signed and dated this 28th day of March, 2022 at West Perth, Western Australia, Australia.

**David Gray**

*Richard Sulway*
*Independent Contractor – Mine Geology*
*First Quantum Minerals Ltd*
*24 Outram St, West Perth, Western Australia, 6005*
*Tel +61 8 9346 0100; richard.sulway@fqml.com*

I, Richard Sulway, do hereby certify that:

1. I am an Independent Contractor (Consultant – Mine Geology) retained by First Quantum Minerals Ltd since 2015.
2. This certificate applies to the technical report entitled "Ravensthorpe Nickel Operations, Western Australia, NI 43-101 Technical Report", dated effective 28th March 2022.
3. I am a professional geologist having graduated with a Bachelor of Applied Science degree with Honours (1989) in Applied Geology from the University of Technology Sydney. I have a Masters Degree (Geological Data Processing) from the University of New South Wales, Sydney (1995). I am a Member of the Australasian Institute of Mining and Metallurgy with Chartered Professional status, MAusIMM(CP).
4. I have worked as a geologist for a total of thirty one years since my graduation from university. During this period I have gained over 17 years' experience in Mineral Resource estimation both as a contractor (7 years) and as an employee for a Perth based mining consulting firm (10 years). During my career, I have compiled Resource estimates for 5 Ni laterite deposits located both in Australia and overseas.
5. I have read the definition of "qualified person" as set out in National Instrument 43-101 – Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that, by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a "qualified person" for the purposes of NI 43-101.
6. I have visited the Ravensthorpe operation numerous times since 2017, most recently in early December 2021.
7. I am responsible for the preparation of those portions of the Technical Report relating to reliance on other experts, drilling, sample preparation, analyses and security, data verification and Mineral Resource estimates (namely Items 3, 10, 11, 12 and 14).
8. I am not independent (as defined by Section 1.5 of NI 43-101) of First Quantum Minerals Ltd given my long association with the company (7 years).
9. I have had prior involvement with the property that is the subject of the Technical Report. The nature of my prior involvement was the planning of the 2019 RC drilling work at Shoemaker-Levy, the implementation of grade control procedures in 2020 and the compilation of internal Resource estimates for the Halleys, Hale-Bopp and Shoemaker-Levy deposits.
10. I have read NI 43-101 disclosure document and Form 43-101F1. The Technical Report has been prepared in compliance with that instrument and form.
11. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required for it to be disclosed and to make the Technical Report not misleading.

Signed and dated this 28th day of March 2022 at West Perth, Western Australia, Australia.

**Richard Sulway**

*Anthony R Cameron*
*Independent Contractor – Mine Engineering*
*24 Outram St, West Perth, Western Australia, 6005*
*Tel +61 8 9346 0100; tony.cameron@fqml.com*

I, Anthony Cameron, do hereby certify that:

1. I am an Independent Contractor (Consultant – Mine Engineering) retained by First Quantum Minerals Ltd since 2019.
2. This certificate applies to the technical report entitled "Ravensthorpe Nickel Operations, Western Australia, NI 43-101 Technical Report", dated effective 28th March 2022 (the "Technical Report").
3. I am a professional mining engineer having graduated with an undergraduate degree of Bachelor of Engineering (Mining) from the University of Queensland in 1988. In addition, I have obtained a First Class Mine Manager's Certificate (No. 509) in Western Australia, a Graduate Diploma in Business from Curtin University (Western Australia) in 2000, and a Masters of Commercial Law from Melbourne University in 2004.
4. I am a Fellow of the Australasian Institute of Mining and Metallurgy.
5. I have worked as a mining engineer for a period in excess of thirty years since my graduation from university. Over the last twenty years I have worked as a consulting mining engineer on mine planning and evaluations for base metals operations and development projects worldwide.
6. I have read the definition of "qualified person" as set out in National Instrument 43-101 – Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that, by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a "qualified person" for the purposes of NI 43-101.
7. I have visited the Ravensthorpe operation numerous times since 2011 with my most recent visits being in April and November 2021.
8. I am responsible for the preparation of those portions of the Technical Report relating to Mineral Reserve estimation and Mining, namely Items 15 and 16, respectively. I am also responsible for the preparation of items 1, 2, 3, 6, 18, 19, 20, 21, 22, 25, 26, 27.
9. I am not independent (as defined by Section 1.5 of NI 43-101) of First Quantum Minerals Ltd given my long association with the company (18 years).
10. I have had prior involvement with the property that is the subject of the Technical Report. The nature of my prior involvement was the planning of the restart in 2012 and preparation of the 2012 Technical Report. I have also prepared annual reserve updates and assisted with preparation of compilation of internal schedules and reports.
11. I have read NI 43-101 and Form 43-101F1 and the Technical Report has been prepared in compliance with that instrument and form.
12. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required for it to be disclosed and to make the Technical Report not misleading.

Signed and dated this 28th day of March 2022 at West Perth, Western Australia, Australia.

**Anthony Cameron**

*Robert R C Stone*
*First Quantum Minerals Ltd*
*24 Outram St, West Perth, Western Australia, 6005*
*Tel +61 8 9346 0100; rob.stone@fqml.com*

I, Robert Stone, do hereby certify that:

1. I am Consulting Project Metallurgist employed by First Quantum Minerals Ltd.
2. This certificate applies to the technical report entitled “Ravensthorpe Nickel Operations, Western Australia, NI43-101 Technical Report”, dated 28th March 2022 (the “Technical Report”).
3. I am a professional process engineer having graduated with an undergraduate degree of Bachelor of Science Honours from the Camborne School of Mines in 1984.
4. I am a Member of the Institute of Materials, Minerals and Mining (UK). I have been a Chartered Engineer through the Institute of Materials, Minerals and Mining since 1991.
5. I have worked as process engineer and metallurgist for a period in excess of thirty years since my graduation from university. For the last twenty three years I have been in the employ of First Quantum Minerals Ltd in both technical and managerial roles. Of these, seven years were as a manager of process plants producing copper in concentrate, copper as electrowon cathode, gold concentrate and cobalt metal by RLE. The remaining eight years were in a technical role as Consulting Process Metallurgist responsible for development of First Quantum Minerals Ltd projects worldwide including copper/cobalt in Central Africa, the redevelopment of Ravensthorpe Nickel Operations following acquisition from BHP in Australia, and copper/molybdenum/gold in Panama.
6. I have read the definition of “qualified person” as set out in National Instrument 43-101 – Standards of Disclosure for Mineral Projects (“NI 43-101”) and certify that, by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a “qualified person” for the purposes of NI 43-101.
7. I most recently personally inspected the RNO property described in the Technical Rep ort in February 2022.
8. I am responsible for the preparation of those portions of the Technical Report relating to mineral processing/metallurgical testing and recovery methods, namely Items 14 and 17, respectively.
9. I am not independent (as defined by Section 1.5 of NI 43-101) of First Quantum Minerals Ltd.
10. I have had prior involvement with the property that is the subject of the Technical Report. The nature of my prior involvement has been in project planning, the preparation of engineering studies, recommissioning and redevelopment of the RNO Process Plant, and operational support, commencing in 2009
11. I have read NI 43-101 and Form 43-101F1 and the Technical Report has been prepared in compliance with that instrument and form.
12. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required for it to be disclosed and to make the Technical Report not misleading.

Signed and dated this 28th day of March, 2022, at West Perth, Western Australia, Australia.

**Robert Stone**