Maiden Ore Reserve at Beharra Underpins Outstanding Pre-Feasibility Study Result, Confirming a Compelling Low Capex & Strong Free Cashflow Project

ASX RELEASE

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ASX: PEC

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PFS Highlights

- ***Highly successful Pre-Feasibility Study (PFS) confirms Beharra as a compelling long life silica sand project set to become an essential low impurity supplier of high-quality silica sand products to the rapidly growing APAC glass and foundry sand markets.***
- ***Compelling financial metrics demonstrate the robustness of the project which also affords expansion potential and the potential ability to respond to increases in market demand.***

Beharra Project Economics	Unit	Base Case
Total Silica Sand Produced	Mt	48
Annual Production	Mt	1.5
In-situ Probable Ore Reserve (@ 98.6% SiO_2)	Mt	64
Ore Reserve Life	Years	32
JORC Mineral Resource Estimate (@ 98.6% SiO_2)	Mt	139
Total Life of Mine Revenue	A$M	4,983
Start-up Capital	A$M	39
Total Life of Mine Capital Expenditure	A$M	77
Total Life of Mine EBITDA	A$M	1,714
Total Life of Mine Free Cashflow	A$M	1,131
Post-tax Discounted Cashflow (NPV_{10}) - ungeared	A$M	231
Post-tax Internal Rate of Return (IRR) - ungeared	%	55%
Post-tax Discounted Cashflow (NPV_{10}) - 40% geared	A$M	236
Post-tax Internal Rate of Return (IRR) - 40% geared	%	77%
Payback Period	Years	2
Year 1 FOB Costs	A$/t	43.07

- ***Nameplate production capacity of 1.5 mtpa, produced from a Run of Mine (ROM) production of 2 Mtpa.***
- ***Simple mining and processing confirmed, with off-the-shelf processing technologies applied and optimal plant configuration sized to allow maximum flexibility and optimal capital cost.***
- ***Lowest known impurity profile of end product streams in the Mid-West region, ideal for the burgeoning APAC markets.***

Summary of Final Products	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	LOI	Mass Yield
Beharra Special AFS #46	99.6%	280 ppm	1825 ppm	375 ppm	0.14%	68%
Beharra Premium AFS #44	99.6%	276 ppm	1789 ppm	369 ppm	0.14%	#46 & #27 combined
Beharra Special AFS #27	99.7%	235 ppm	1405 ppm	300 ppm	0.13%	6%

- ***Considerable project upside potential through further optimisation of metallurgical circuit.***
- ***Scope to reduce operating and capital costs at Feasibility Study (or other subsequent) stage which would materially improve financial and return metrics for Beharra.***
- ***The Board of Perpetual consider the rigour and detail undertaken in this Beharra PFS to be considerable and the Company is currently reviewing potential for an accelerated development path (subject to regulatory and approval processes).***
- ***Base case planning assumes a subsequent project study and/or a decision to fund in 2021 with first production in late 2022.***

Perpetual Resources Limited (**ASX: PEC**, "PEC" or "the Company") is pleased to announce the release of its Beharra PFS on its 100% owned Beharra Project located south east of Geraldton, Western Australia.

Perpetual's Executive Chairman, Mr Julian Babarczy, provided the following commentary, *"The finalisation and announcement of the PFS results demonstrate that the Beharra silica sand project can produce the highest known quality silica sand product in the Mid-West Region of Western Australia. After the conclusion of extensive studies across all areas of project focus, the announced outcomes of the Beharra PFS are simply outstanding, and suggest a compelling project, across both financial and operating metrics. In our view, Beharra represents the stand-out project in the Mid-West region of Western Australia, which looks set to become a dominant supply source for high quality silica sand to the APAC region. In the Perpetual Board's view, Beharra now sits atop all other projects in the region and we are excited to continue our rapid development as we move towards a subsequent project study and/or a decision to fund later in calendar year 2021".*

The PFS results, which are the culmination of over seven months of extensive independent study, confirm that the Beharra Project will deliver exceptionally strong margins over the initial 32-year mine life. Potential also exists to expand production in future years, with Beharra set to become an essential supplier to regional APAC silica sand markets.

A list of the standout features of the Beharra project are summarised below;

- Exceptionally strong return metrics, with low capital requirements, strong margins and high resultant free cash flows, which offer a compelling financial case.
- Investment returns anticipated to be of significant interest to both debt and equity investors in the region, once a decision to fund is reached in late 2021.
- Standout metallurgical testing results confirms Beharra as the pre-eminent Mid-West silica sand project (based on publicly available data on known projects), with attainment of the lowest impurity profile of any known project in the region.
- No fatal flaws identified throughout any of the studies undertaken, with significant scope for operational and financial optimisation once Feasibility or other studies are commenced.
- Strong initial engagement with local and regional stakeholders suggests good community interest in development of the Beharra project.
- Initial inbound and outbound enquiries from potential off takers and silica sand trading groups, as well as data compiled from independent price forecasters and other industry contacts, demonstrates strong support of Beharra's ability to achieve robust sales prices in the growing APAC silica sand markets.
- Simple, low cost flow sheet confirmed, with no requirement for the use of harmful chemicals and a very low subsequent environmental impact.
- Beharra Project can be readily up-scaled based on a modular plant configuration, that will assist in achieving the lowest possible capital intensity and substantial project flexibility.
- Overall, the key objectives of confirming a flexible and low capital project that also delivers compelling financial return metrics and delivers a highly attractive end product to the fast-growing APAC markets, has been achieved.
- Significant scope for optimisation at Feasibility Study (or subsequent development path) level exists, with potential for metallurgical improvements, capital and operating cost reductions, as well as operational simplification programs which will further enhance the already compelling metrics of the Beharra project.

Ore Reserve Highlights

- ***Total Probable Ore Reserves of 64.1 Mt @ 98.6% SiO_2***
- ***Probable Ore Reserve underpins an initial 32-year mine life at Beharra.***
- ***Probable Ore Reserve estimated to produce a Saleable Product of 47.6 Mt @ 99.6% SiO_2***
- ***Probable Ore Reserve positions Beharra as the pre-eminent silica sand project in the Mid West region of Western Australia (based on known projects).***
- ***Concurrent delivery of an outstanding Pre-Feasibility (PFS) demonstrates Beharra as a high quality, long life, low capital and high margin mining project.***

Perpetual is also pleased to announce the details of its maiden Probable Ore Reserve at its Beharra Silica Sand Project (Beharra), located approximately 300 km north of Perth and 96km south of Geraldton.

Perpetual recently released an updated Mineral Resource Estimate (MRE) for Beharra, reporting Indicated Mineral Resources of 139 Mt @ 98.6% SiO_2 (see ASX Announcement dated 9th March 2021, titled "Upgraded Mineral Resource Estimate - Beharra"). The MRE was prepared by Snowden Mining Consultants (Snowden), who has also prepared this Probable Ore Reserve estimate. The Ore Reserve is reported in accordance with Clause 49 of the JORC Code (2012), for the reporting of Industrial Minerals and Ore Reserves. The Ore Reserve estimate is provided in Table 1.

Table 1. Beharra Probable Ore Reserve March 2021

Sand	Tonnes (Mt)	SiO_2 (%)	Al_2O_3 (ppm)	TiO_2 (ppm)	Fe_2O_3 (ppm)	LOI (%)
In-situ	64.1	98.6	4,240	3,460	1,950	0.235
Saleable Product	47.6	99.6	1,789	369	276	0.100

***Note 1**: Million tonnes are rounded to one decimal place.*
Grades are rounded to 3 significant figures.
***Note 2:** No cut off is applied to the silica sand product.*
***Note 3:** The In-situ and Saleable Product are not additive, and the Saleable Product is a portion of the In-situ sand tonnage.*

***PEC's** Managing Director, Mr Robert Benussi provided the following commentary "the Ore Reserve estimate is based on saleable products that have been produced as part of the very successful and comprehensive metallurgical test work program, which was announced on 29th January 2021. This test work and the resultant Ore Reserve estimate clearly demonstrates that the Beharra end product is suitable for sale into the Asia Pacific glass and foundry sand industries, with the product readily positioned in a higher end segment of the market. The test work and Ore Reserve estimate show Beharra can comfortably service the 200 to 300ppm range of the APAC market (in relation to iron oxide, or Fe_2O_3), which is the key impurity of focus of end users. Further, the Ore Reserve estimate underpins a very long life mine plan of 32 years and enabled the release today of a compelling PFS study on Beharra which shows a low capital, high margin mining project that is, in our view, the pre-eminent silica sand project in the Mid-West region of Western Australia".*

There was no silica sand cut-off grade applied to the previously announced Indicated Mineral Resources for Beharra and the MRE is reported inclusive of the Ore Reserves. However, the Ore Reserve inventory includes only material with an Fe_2O_3 content averaging 2,000 ppm, which is considered optimal for plant feed considerations. The conversion from Mineral Resources to Ore Reserves was 46%, although, in addition to the Saleable Product Ore Reserve, an additional portion of the Indicated Mineral Resources was also identified (shown in Table 2 below). The additional portion of potentially economic material was identified using the same Modifying Factors as the Beharra insitu Ore Reserve and is reported as Indicated Mineral Resources. This is not a salable product and is higher in iron oxide (Fe_2O_3).

Table 2. Beharra additional portion of Indicated Mineral Resources March 2021

Sand	Tonnes (Mt)	SiO_2 (%)	Al_2O_3 (ppm)	TiO_2 (ppm)	Fe_2O_3 (ppm)	LOI %
Insitu	59.9	98.6	3900	3500	2640	0.270

Note 1: All of the additional portion tonnes are Indicated Mineral Resources (insitu) and reported exclusive of the Indicated Mineral Resources used to identify insitu Ore Reserves and inclusive of existing Indicated Mineral Resources.

Note 2: Cautionary Statement - For the additional portion tonnes, there is no certainty that the Indicated Mineral Resources will result in Ore Reserves.

The additional portion tonnes will be reassessed with a view to classifying the insitu tonnage as an Ore Reserve pending further metallurgical evaluation, however this is subject to future test work performance.

Mining Modifying Factors applied to the Ore Reserve estimate included pit optimisation to produce an economic mining shell followed by detailed pit design which was used to convert the Mineral Resources to an Ore Reserve. Mine equipment requirements and pricing were determined by contractors utilising load and haul mining and a mine production schedule that was developed by Snowden. Minor dilution was included due to boundary losses and offset corridors. Geotechnical analysis recommended pit slope design angles of 30°.

Calculation and determination of the Ore Reserves were based on producing Beharra Premium silica sand product #44, which has a SiO_2 grade of >99.5% and Fe_2O_3 content of <280ppm. Mass yield into this product as per the test work was calculated at 74.4%. Refer to Table 3 below.

Table 3. Beharra Silica Sand Products

Testwork Classification	Product Classification	Mass by ROM	Assays				
			%	ppm	ppm	ppm	%
			SiO_2	Al_2O_3	Fe_2O_3	TiO_2	LOI
		%	97.9	9,900	680	910	0.26
UCC Underflow (calc.)	**Beharra Premium #44**	74.4	99.6	1,789	276	369	0.14
Screen O/S	**Beharra Premium #27**	6.3	99.7	1,405	235	300	0.13
Screen U/S	**Beharra Premium #46**	68.0	99.6	1,825	280	375	0.14

The mineral processing flowsheet and plant design incorporated industry standard activities, including industry standard processes of screening and desliming, gravity, magnetic and physical separation, and commonly seen equipment used in the mineral sands industry. Supply of a packaged plant and turnkey solutions were sought for the processing facility including capital cost estimates. Summary capital costs is presented in Table 4. Accuracy of capital costs is +/-25%.

Table 4. Capital Cost Estimate

Capex A$	**Cost ($ '000)**
Process Plant incl water distribution	19,287
Services & Onsite Infrastructure	3,537
Offsite Infrastructure	9,272
Indirects, PCM and site office costs	2,338
Total development capital	**34,434**
Owners' costs	1,343
Owner's contingency (10%)	3,443
Total pre-production capital	**39,220**

Operating costs were derived from contractor budget pricing, market quotations, and bottom-up estimates based on a 32-year LOM. Refer to Table 5 below.

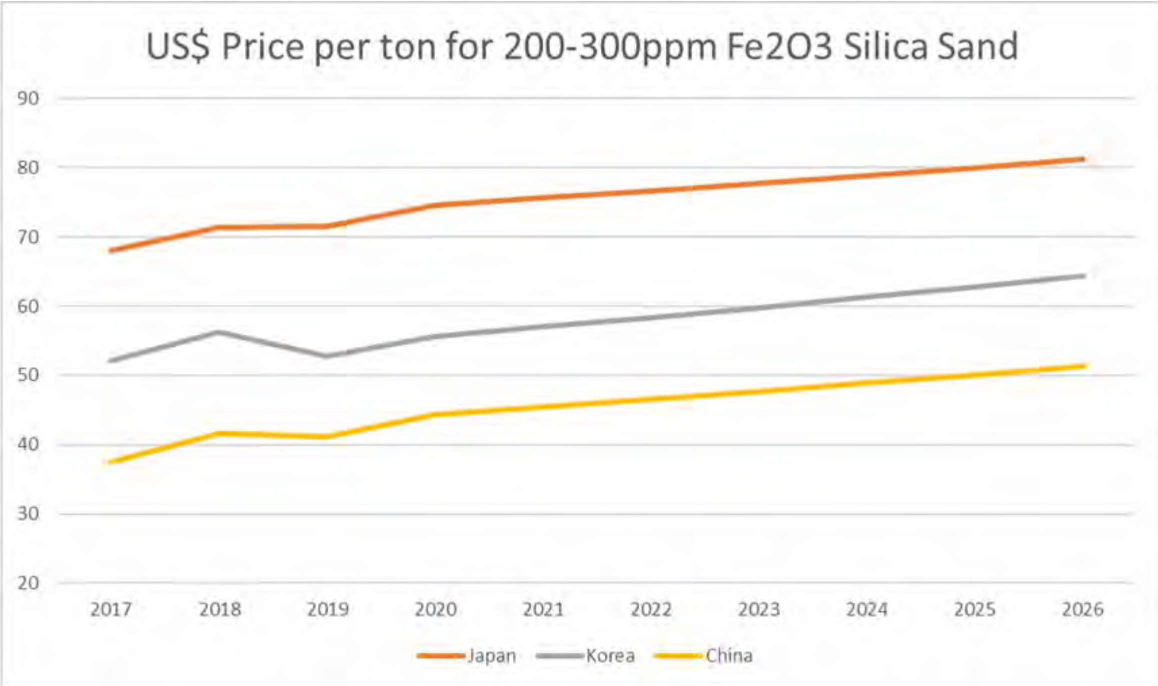
Table 5. Operating Cost Estimate

Opex A$	**Cost p.a. ($'000.)**	**A$/t Ore**	**A$/t Product Con.**
Mining (ROM+OB)	10.6	5.18	6.97
Processing	5.0	2.46	3.31
Reject Haulage	0.6	0.29	0.36
Admin	2.4	1.18	1.58
Transport + Port/ Ship loading	39.4	19.40	26.09
Rehab	1.8	0.43	0.58
Contingency	2.8	1.40	1.88
Royalty	3.5	1.71	2.30
Total Opex	66.1	32.05	43.07

Market assessment was provided by IMARC to provide an independent market review of Asia Pacific (APAC) region (in addition to discussions with sales and marketing consultants and industry contacts), specifically targeting selected countries and specific product grades. Consumption in the APAC region in 2020 amounted to a value of US$5,133.7 million and is forecast to grow by 7.1% per annum by 2026 to reach a value of US$7,638.1 million, equivalent to a demand of 174.3 million tons of silica sand.

Pricing ranges from country to country and is determined mostly by impurity levels (with a focus on Fe_2O_3), once a base level of SiO_2 has been achieved (typically >99.5% SiO_2). Please refer to Figure 1 below.

Figure 1. Regional APAC silica sand pricing for 200-300ppm Fe_2O_3



source: IMARC Group (Asia Pacific Silica Sand Market)

Adopted pricing by Perpetual for the Ore Reserve estimate was set in year one at US$50/mt FOB at a constant exchange rate of 0.75A$:1.00US$, resulting in an A$ sales price in year one of $67/dry tonne.

This announcement has been approved for release by the Board of Perpetual.

-ENDS-

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Cautionary Statement

The Pre-Feasibility Study (PFS) discussed herein has been undertaken to study a range of options to further develop the technical and economic feasibility of the Beharra Silica Sands Project (the Project). The production target incorporates the Probable Ore that sits within the proposed mining area. The is also an additional portion of the Indicated Mineral Resource within the area that is identified for further metallurgical test work.

There is a moderate level of geological confidence associated with Indicated Mineral Resources however there is no certainty that further exploration work will result in the determination of a Measured Mineral Resource or that the production target itself will be realised. For the additional portion of the Indicated Mineral Resource, there is no certainty that the Indicated Mineral Resources will result in Ore Reserves.

The Ore Reserve and Mineral Resource Estimate underpinning the PFS have been prepared by Competent Persons in accordance with the requirements of the JORC Code. Competent Persons' Statements are included in this document.

Investors should note that there is no certainty that Perpetual Resources Limited (Perpetual) will be able to raise funding required to commercialise the project when needed. It is also possible that such funding may only be available on terms that may be dilutive to or otherwise affect the value of Perpetuals' existing shares. It is also possible that Perpetual could pursue other 'value realisation' strategies to provide alternative funding options.

Given the uncertainties involved, investors should not make any investment decisions based solely on the results of the Project PFS.

Forward-looking statements

Certain statements contained in this document may be 'forward-looking' and may include, amongst other things, statements regarding production targets, economic analysis, resource trends, pricing, recovery costs, and capital expenditure. These 'forward–looking' statements are necessarily based upon a number of estimates and assumptions that, while considered reasonable by Perpetual, are inherently subject to significant technical, business, economic, competitive, political and social uncertainties and contingencies and involve known and unknown risks and uncertainties that could cause actual events or results to differ materially from estimated or anticipated events or results reflected in such forward-looking statements.

Forward-looking statements are often, but not always, identified by the use of words such as 'believe', 'expect', 'anticipate', 'indicate', 'target', 'plan', 'intends', 'budget', 'estimate', 'may', 'will', 'schedule' and others of similar nature.

Perpetual does not undertake any obligation to update forward-looking statements even if circumstances or management's estimates or opinions should change. Investors should not place undue reliance on forward-looking statements as they are not a guarantee of future performance.

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COMPETENT PERSONS STATEMENTS

The information in this report that relates to the March 2020 Exploration information for the Beharra Project is based on information compiled and fairly represented by Mr Colin Ross Hastings, who is a Member of the Australasian Institute of Mining and Metallurgy and consultant to Perpetual Resources Limited. Mr Hastings is also a shareholder of Perpetual Resources Limited. Mr Hastings has sufficient experience relevant to the style of mineralisation and type of deposit under consideration, and to the activity which he has undertaken, to qualify as a Competent Person as defined in the 2012 Edition of the Joint Ore Reserves Committee (JORC) "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Hastings consents to the inclusion in this report of the matters based on this information in the form and context in which it appears.

The information in this report that relates to the Exploration information for the Beharra Project from September 2020 onwards is based on information compiled and fairly represented by Mr John Doepel, who is a Member of the Australasian Institute of Mining and Metallurgy and consultant to Perpetual Resources Limited. Mr Doepel has sufficient experience relevant to the style of mineralisation and type of deposit under consideration, and to the activity which he has undertaken, to qualify as a Competent Person as defined in the 2012 Edition of the Joint Ore Reserves Committee (JORC) "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Doepel consents to the inclusion in this report of the matters based on this information in the form and context in which it appears.

The information in this report that relates to Mineral Resources is based on information compiled by Elizabeth Haren, a Competent Person who is a Member and Chartered Professional of the Australasian Institute of Mining and Metallurgy and a Member of the Australian Institute of Geoscientists. Elizabeth Haren is employed as an associate Principal Geologist by Snowden Mining Consultants Pty Ltd, who was engaged by Perpetual Resources Limited. Elizabeth Haren has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Elizabeth Haren consents to the inclusion in the report of the matters based on her information in the form and context in which it appears.

The information in this report that relates to Mineral Resources is based on information compiled by Dr Andrew Scogings, a Competent Person who is a Member of the Australasian Institute of Mining and Metallurgy, a Member of the Australian Institute of Geoscientists and is a Registered Professional Geologist in Industrial Minerals. Andrew Scogings is employed as an associate Executive Consultant Geologist by Snowden Mining Consultants Pty Ltd. Dr Scogings has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Dr Scogings consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

The information in this report that relates to the Beharra Ore Reserve is based on information reviewed or work undertaken by Mr Frank Blanchfield (FAusIMM). Mr Blanchfield is an employee of Snowden and has relied on Perpetual for marketing, environmental, permitting, and financial modelling and any costs not relating to mining and metallurgy. The mine design and mining costs and economic viability of the project were assessed and completed by Snowden under his direction. Mr Blanchfield has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the preparation of mining studies to qualify as a Competent Person as defined by the JORC Code 2012. Mr Blanchfield consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

The scientific and technical information in this report that relates to process metallurgy is based on information reviewed and work completed by Arno Kruger (MAusIMM), who is a metallurgical consultant and employee of IHC Robbins. The metallurgical factors including process flowsheet design and costs and assumptions for the bulk aircore sample that relate to Mineral Resources have been reviewed and accepted by Mr Kruger. Mr Kruger has sufficient experience that is relevant to the type of processing under consideration and to the activity being undertaken to qualify as a Competent Person as defined by the JORC Code 2012. Mr Kruger consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

JORC CODE (2012) TABLE 1 REPORTING
(SECTIONS 1, 2, 3, and 4)

Section 1: Sampling Techniques and data

Criteria	JORC Code explanation	Commentary
Sampling techniques	Nature and quality of sampling (e.g. cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as downhole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling. Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used. Aspects of the determination of mineralisation that are Material to the Public Report. In cases where 'industry standard' work has been done this would be relatively simple (e.g. 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases, more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (e.g. submarine nodules) may warrant disclosure of detailed information.	Aircore drilling and sampling referred to in this report occurred in two separate programs: March 2020 and September 2020. March 2020: Aircore samples were collected via a cyclone, the entire sample for each 1 m drill interval was collected and placed in a calico sample bag. No splitting on the rig was undertaken. The sample was labelled with the drillhole number and sample interval, and a waterproof tag nominating a sample number was placed in the bag and then sealed with a tie. September 2020: Aircore samples were collected via a cyclone, the entire sample for each 1 m drill interval was collected and placed in a calico sample bag, labelled with the drillhole number and sample interval, and weighed by a spring balance. A 1 kg split was taken by spear and placed in a smaller calico bag, labelled with a sample number. Aircore samples were collected from each metre drilled or part metre if the hole was not ended on a full metre. For the September program, separate samples were taken for 0–0.5 m and for 0.5–1 m. Only the latter had a 1 kg split taken from it. Representative samples of each interval drilled were placed in a chip tray for reference. Auger drilling and sampling referred to in this report and reported previously were obtained from hand auguring to a maximum depth of 2 m. Three auger samples were collected from each hole being surface to 0.5 m, 0.5–1.0 m, and 1.0–2.0 m. The top metre of the hole was split into two samples to allow a separate sample of the top 0.5 m that contains organic matter associated with native ground cover. If sand mining operations were to be carried out, this top 0.5 m would be stockpiled for future rehabilitation, so at this time treating it separately is appropriate. The shallow auger program was carried out to obtain representative sand samples to a maximum depth of 2 m for the reasons as described in the Company release of 12 February 2019.

Criteria	JORC Code explanation	Commentary
Drilling techniques	Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (e.g. core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).	March 2020: A total of 32 aircore drillholes were completed to an average depth of 12.3 m, with the deepest hole ending at 17 m. September 2020 aircore drilling was undertaken using a track mounted KL170 hydraulic top drive rig coupled to a 250 psi compressor. An 84 mm vacuum bit was fitted to a 76 mm outside diameter twin tube rod string. The internal diameter was 51 mm. All holes were drilled vertically. March 2020: A total of 40 aircore drillholes were completed for an average depth of 12.7 m, with the deepest hole ending at 20 m. March 2020 aircore drilling was undertaken using a track mounted Hitachi hydraulic top drive rig coupled to a 130 cfm/100 psi compressor. A 76 mm aircore bit was fitted to 70 mm twin tube rod string. All holes were drilled vertically. Auger drilling consisted of a manually hand operated 75 mm diameter sand auger (Dormer Sand Auger) with PVC casing utilised to reduce contamination potential as the auger is withdrawn from the hole. The auger was driven about 300 mm then retracted and the sample was placed in a UV resistant plastic bag and this continued until the sample interval was completed. The sample was labelled with the drillhole number and sample interval, then placed in a second plastic bag and sealed and removed from site for logging and sample preparation.
Drill sample recovery	Method of recording and assessing core and chip sample recoveries and results assessed. Measures taken to maximise sample recovery and ensure representative nature of the samples. Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	March 2020: Aircore – each sample bag was weighed to determine the actual sample recovery, which resulted in an average sample weight of approximately 7.5 kg/m of sample. September 2020: Aircore – each sample bag was weighed to determine the actual sample recovery, which resulted in an average sample weight of approximately 4 kg/m of sample. March 2020: Aircore sampling was typically terminated on reaching the water table, which occurred around 10–12 m below surface level. September 2020: Aircore sampling was typically terminated 2 m below the water table. Hole depths ranged from 9 m to 17 m. The cyclones were cleaned regularly to ensure maximum and representative recovery. For auger sampling, each sample bag was weighed to determine the actual sample recovery, which resulted in an average sample weight of 7.5 kg/m of sample. The type of sand auger used provided a clean sample with less possibility of contamination compared to a flight auger.

Criteria	JORC Code explanation	Commentary
Logging	Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies. Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography. The total length and percentage of the relevant intersections logged.	The samples have been sufficiently logged including estimates of grain size, sorting and texture, and colour. Particular attention has been taken to ensure a more scientific and less subjective approach to colour has been adopted because colour (white to grey shades, and pale yellow shades) is one of the targeting features. Chip tray samples for each hole were photographed.
Subsampling techniques and sample preparation	If core, whether cut or sawn and whether quarter, half or all core taken. If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry. For all sample types, the nature, quality and appropriateness of the sample preparation technique. Quality control procedures adopted for all subsampling stages to maximise representivity of samples. Measures taken to ensure that the sampling is representative of the in-situ material collected, including for instance results for field duplicate/second-half sampling. Whether sample sizes are appropriate to the grain size of the material being sampled.	Aircore samples were transported to Welshpool in Perth and locked in a secure storage shed. March 2020: Further check logging was undertaken, and representative subsamples were taken for duplicate analysis. Subsampling was carried out by spearing the samples selected and collecting approximately 400 g of sample. The duplicates have been utilised at the rate of 1:20. September 2020: Duplicate 1 kg subsamples were taken in a ratio of 1:18 at site. Blanks were generated from a publicly available washed sand product and taken by spearing a 20-bulk sample: March 2020 approx.400 g samples; September 2020 approx. 1 kg samples. The blanks have been utilised at the rate of 1:20 in March and 1:18 in September. March 2020: The prepared subsamples (duplicates and blanks) plus all the bulk drill samples were submitted to Nagrom Metallurgical Analytical Laboratories located in Kelmscott in Western Perth for drying, further splitting, and pulverisation in a zircon bowl. A subsample of 100 g with a P90 -75 µm particle size was utilised for analysis. September 2020: The 1 kg subsamples, including duplicates and blanks, were submitted to Intertek Genalysis analytical laboratory located in Maddington in Western Perth for drying, splitting to 100 g for pulverisation to a P90 -75 µm particle size in a zircon bowl. Auger samples were submitted to Intertek Laboratory in Maddington for drying, splitting, pulverisation in a zircon bowl. A subsample of 200 g with a 75 µm particle size is utilised for analysis. Allowance was made for duplication by drilling a twin auger hole located within 1 m of each other. Three twin holes were drilled representing 8% duplicate sample. The sample preparation methods are considered industry standard for silica sands. Records were kept describing whether the samples were submitted wet or dry.

Criteria	JORC Code explanation	Commentary
		The laboratory sample size taken is appropriate for the sand being targeted.
Quality of assay data and laboratory tests	The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total. For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc. Nature of quality control procedures adopted (e.g. standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established.	March 2020: All the aircore samples prepared by Nagrom were analysed at the same facility. The assay method for multi-element analysis consisted of prepared samples fused in a lithium borate flux with lithium nitrate additive then analysed by XRF (test method XRF001). LOI was also carried out on each sample out at 1,000°C (test method TGA002). Auger samples were submitted to the Intertek Laboratory in Maddington, Perth, Western Australia. The assay method for multi-element analysis consisted of four-acid digest including hydrofluoric, nitric, perchloric and hydrochloric acids in Teflon beakers with inductively coupled plasma (ICP)-optical (atomic) emission spectrometry finish. Silica is reported by difference. March 2020: Inter-laboratory checking was carried out by submitting 28 prepared representative pulps (umpire samples) to the Intertek Laboratory located in Maddington. The samples were analysed by two methods, XRF (test method FB1/XRF20) and ICP-optical (atomic) emission spectrometry (test method 4ABSi/OE901). Samples for ICP analysis consisted of a four-acid digest including hydrofluoric, nitric, perchloric and hydrochloric acids in Teflon beakers. Silica is reported by difference. March 2020: The same 28 samples analysed by Intertek were also analysed by ICP at Nagrom' s laboratory. For analysis of Al_2O_3 and SiO_2 the samples were fused with sodium peroxide and digested in dilute hydrochloric acid and then analysed by ICP (test method ICP005). All other elements were determined by ICP after dissolution in an acid mixture (test method ICP003). March 2020: Final analyses of the aircore samples were carried out at Intertek's laboratory using four-acid digest followed by ICP determination. The samples used consisted of pulps that were prepared by Nagrom. September 2020: Intertek's analysis method for silica sands analysis consisted of four-acid digestion followed by silica sands 17-element ICP/OE analysis plus LOI at 1,000°C with SiO_2 reported by difference. September 2020: Inter-laboratory umpire analysis was carried out by submitting 20 pulps, and 20 non-pulverised portions of the same samples, from Intertek Genalysis to the Bureau Veritas laboratory located in Canning Vale, Perth. The samples were analysed by mixed acid digest (MA100) followed by 17 elements by ICP-OES (MA101) and LOI (TG001). Silica was reported by difference.

Criteria	JORC Code explanation	Commentary
		The extensive analysis by different laboratories and different methods are industry standard procedures and methods producing high level of confidence on the results produced. The ICP method is considered industry standard for reporting sand grades. No geophysical tools were utilised for the process.
Verification of sampling and assaying	The verification of significant intersections by either independent or alternative company personnel. The use of twinned holes. Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols. Discuss any adjustment to assay data.	March 2020: There were no twin aircore holes. Twin holes were completed for three out of the 38 auger holes. September 2020: One of the September aircore holes was twinned; two of the March 2020 aircore holes were twinned. All drilling and sampling procedures were monitored on site by an independent geologist on a hole-by-hole basis. All primary information was initially captured in a written log on site by a geologist, data entered, imported then validated and stored in a geological database. March 2020: Additional check logging was carried by an independent geologist in Perth prior to samples being submitted to Nagrom for analysis. No adjustments to assay data have been performed. External review of umpire samples reported by Intertek and Bureau Veritas was carried out.
Location of data points	Accuracy and quality of surveys used to locate drillholes (collar and downhole surveys), trenches, mine workings and other locations used in Mineral Resource estimation. Specification of the grid system used. Quality and adequacy of topographic control.	The position of the aircore hole locations was determined by a Trimble R6 RTK global positioning system (GPS) in RTK mode. The survey was carried out by Heyhoe Surveys from Geraldton. Accuracy of 0.05 m relative to SSM Dongara 49. The position of the auger hole locations was determined by a GPS model Garmin GPS Map 64s with an accuracy of 5 m. The CRS used was GDA94/MGA Zone 50 (ex SSM DON49). The topography at the project site currently under exploration is flat to gentle undulating terrain. Site survey (Heyhoe Surveys) have produced a ± 50 cm DTM across the entire project area.
Data spacing and distribution	Data spacing for reporting of Exploration Results. Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. Whether sample compositing has been applied.	The aircore drillholes were spaced on an approx. 350–600 m (east west) x 480 m along strike (north-south) grid. The auger drillholes were spaced on an approx. 400 m (east-west) x 800 m (north-south) grid. The adopted spacing at this time is sufficient based on the geological continuity of the sand formation being tested, and sufficient to be applied in Mineral Resource estimation. No sample compositing of holes has been applied.

Criteria	JORC Code explanation	Commentary
Orientation of data in relation to geological structure	Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type. If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	The orientation utilised for the aircore drilling campaign represents the entire strike length of the aeolian dune within the initial prospective target area and as such is not expected to introduce any particular bias.
Sample security	The measures taken to ensure sample security.	All samples have been bagged and removed from site and are under the care of the contract senior geologist and field sampling supervisor. March 2020: Aircore samples initially stored a secure facility in Welshpool where sample reconciliation was undertaken before delivery to Nagrom Laboratory. March 2020: Aircore samples were delivered to Nagrom in Kelmscott. The laboratory carried out a sample reconciliation which was audited against the sample submission sheet. September 2020: Aircore samples and returned samples and pulps from Intertek Genalysis are in the Welshpool facility along with chip trays from both the March and September drill programs. Auger samples were delivered to Intertek Maddington. The laboratory provided a sample reconciliation report which was audited against the sample submission sheet.
Audits or reviews	The results of any audits or reviews of sampling techniques and data.	Guidance was provided by an independent consultant, Andrew Scogings, on sampling lengths and hole spacings who carried out a site visit to inspect the drilling and sampling operations.

Section 2: Reporting of Exploration Results

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings. The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	Miscellaneous licence L70/219 comprises an effective land area of 10.36 km^2 and was granted on 18 November 2020 for a period of 21 years. The holder is Perpetual Resources Limited. A 1% vendor royalty applies minerals sold from the Licence. The licence area exploration is covered by Crown Land. No impediments on a licence to operate at time of reporting.
Exploration done by other parties	Acknowledgment and appraisal of exploration by other parties.	Past exploration by others targeting heavy mineral sands. Refer to ASX release dated 6 February 2019, historical exploration.

Criteria	JORC Code explanation	Commentary
Geology	Deposit type, geological setting and style of mineralisation.	Unconsolidated Quaternary coastal sediments, part of the Perth Basin. Aeolian quartz sand dunes overlying Pleistocene limestones and paleo-coastline.
Drill hole information	A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drillholes: • easting and northing of the drillhole collar • elevation or RL (Reduced Level – elevation above sea level in metres) of the drillhole collar • dip and azimuth of the hole • downhole length and interception depth • hole length. If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.	Exploration Results are not being reported here; however, drillhole information can be found in ASX release dated 1 April 2020 and 7 December 2020.
Data aggregation methods	In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (e.g. cutting of high grades) and cut-off grades are usually Material and should be stated. Where aggregate intercepts incorporate short lengths of high-grade results and longer lengths of low-grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail. The assumptions used for any reporting of metal equivalent values should be clearly stated.	Exploration Results are not being reported.
Relationship between mineralisation widths and intercept lengths	These relationships are particularly important in the reporting of Exploration Results. If the geometry of the mineralisation with respect to the drillhole angle is known, its nature should be reported. If it is not known and only the downhole lengths are reported, there should be a clear statement to this effect (e.g. 'downhole length, true width not known').	Exploration Results are not being reported.
Diagrams	Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drillhole collar locations and appropriate sectional views.	Refer to figures incorporated in the body of the report.

Criteria	JORC Code explanation	Commentary
Balanced reporting	Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	Exploration Results are not being reported.
Other substantive exploration data	Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.	Groundwater was intersected in all holes that exceeded 10 m depth. Water table generally occurred between 10 m and 12 m. Average in situ density (dry) determined to be 1.64 t/m^3 from six sites. Density locations were hand excavated to 0.4 m deep. The Instrument used was an Instrotek model Explorer. Tests were performed by Western Geotechnical & Laboratory Services. For the March 2020 program particle size distribution analysis was carried out on eight representative samples. Tests were undertaken by Western Geotechnical & Laboratory Services. Previous metallurgical testwork was undertaken by Nagrom to establish possible process methods to provide a beneficiated product. Refer to ASX releases of 30 January 2020 and 24 February 2020. Petrological examination by Paul Ashley undertaken and reported on 18 February 2020. An approximate two tonnes bulk sample from the March aircore drilling was process tested by IHCR with results received in December 2020. In-situ PSD was determined for 12 aircore holes from the March 2020 program south of the Mount Adams Road and for six holes from the September 2020 program to the north. The March 2020 samples were tested using a dry sieving method by Diamantina Laboratories, Malaga and the September 2020 samples were tested by Nagrom, Kelmscott using a wet screening method. In-situ particle size is predominantly within the range of 0.15 mm to 0.6 mm. About 70% of the sand grains are between 0.125 mm and 0.6 mm. Calculated AFS numbers for the March 2020 samples are predominantly in the range 40–50. The sands appear to become finer grained with depth. This is illustrated by P50 which decreases from about 400 µm to 300 µm for the March 2020 samples. The September 2020 aircore results are generally finer than the March 2020 aircore samples. It

Criteria	JORC Code explanation	Commentary
		appears that there is a general trend of decreasing grain size going north. The apparently finer size of the September 2020 samples may be due to the wet screening method used, compared with dry screening for the March 2020 samples. Wet screening is likely to be more efficient than dry screening. Snowden is of the opinion that the PSD results from both programs need verification, by umpire testing of September 2020 Nagrom samples at Diamantina. Twins 20B019 and 20B032 should be included for testing at both Robbins and Nagrom. Infill holes should also be tested for PSD.
Further work	The nature and scale of planned further work (e.g. tests for lateral extensions or depth extensions or large-scale step-out drilling). Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	The Company will carry out further metallurgical testwork.

Section 3: Estimation and Reporting of Mineral Resources

Criteria	JORC Code explanation	Commentary
Database integrity	Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes. Data validation procedures used.	Selected checks by Snowden of drillhole data against original assay certificates were completed with no errors identified. Statistical checks completed to ensure all assays fall within acceptable limits. Checks on overlapping or duplicate intervals completed. Checks were completed on all samples which fell below analytical detection limits to ensure samples were assigned half detection limit grades in estimation.
Site visits	Comment on any site visits undertaken by the Competent Person and the outcome of those visits. If no site visits have been undertaken indicate why this is the case.	The Competent Person, Andrew Scogings, visited the site during the aircore drilling program in March 2020.
Geological interpretation	Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit. Nature of the data used and of any assumptions made. The effect, if any, of alternative interpretations on Mineral Resource estimation. The use of geology in guiding and controlling Mineral Resource estimation.	Snowden believes the local geology is well understood as a result of work undertaken by Perpetual and other companies working in the region. Surfaces of the sand layers were interpreted based on a combination of geochemistry and the geological logging. Each layer was treated as a hard boundary for resource modelling.

Criteria	JORC Code explanation	Commentary
	The factors affecting continuity both of grade and geology.	Alternative interpretations of the mineralisation are unlikely to significantly change the overall volume of the layers in terms of the reported classified material.
Dimensions	The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.	The deposit has an extent of approx. 7.1 km north-south x 1.9 km east-west in the south and 1.2 km east-west in the north. The deposit is restricted by tenement boundaries and the Yardanogo Nature Reserve in the west. The deposit is open outside of these limits.
Estimation and modelling techniques	The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used. The availability of check estimates, previous estimates and/or mine production records and whether the MRE takes appropriate account of such data. The assumptions made regarding recovery of by-products. Estimation of deleterious elements or other non-grade variables of economic significance (e.g. sulphur for acid mine drainage characterisation). In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed. Any assumptions behind modelling of selective mining units. Any assumptions about correlation between variables. Description of how the geological interpretation was used to control the resource estimates. Discussion of basis for using or not using grade cutting or capping. The process of validation, the checking process used, the comparison of model data to drillhole data, and use of reconciliation data if available.	Ordinary kriging estimation using a parent cell size of 200 mE x 240 mN x 2 mRL to estimate for SiO_2, Al_2O_3, TiO_2, Fe_2O_3 and LOI. Sample selection honoured geological domains which were developed considering the vertical chemical and geological trends of the profile. Five layers were modelled: Yellow, White Upper, White Lower, Light Grey Pod, Grey Pod and Grey. Statistical analysis by domain was completed. Top cuts were applied to some elements in some layers where appropriate to control sporadic extreme values during estimation; however, no top cut was applied for SiO_2. Variography was completed for all elements. Due to the low number of samples for individual layers, data was combined for variogram modelling. Correlations were largely maintained by using similar estimation parameters. Validation of block estimates included visual and statistical checks, both global and local. Checks were completed against original and de-clustered drillhole samples. The validations show that while smoothed, the block estimates reproduce the trends observed in the drillhole data.
Moisture	Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.	All tonnages have been estimated as dry tonnages.

Criteria	JORC Code explanation	Commentary
Cut-off parameters	The basis of the adopted cut-off grade(s) or quality parameters applied.	No cut-off parameters have been applied as the yellow and white sand being reported appears to be readily amenable to beneficiation to a suitable product specification through relatively simple metallurgical processes as demonstrated by initial reported metallurgical testing results.
Mining factors or assumptions	Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.	It is assumed that the deposit will be mined using conventional open cut mining methods. No assumptions regarding minimum mining widths and dilution have been made. No mining has occurred.
Metallurgical factors or assumptions	The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.	Eight composites were made of three sand types from the 2020 aircore drill program and tested for particle size distribution at Western Geotechnical in Welshpool during April 2020. The samples were described as light grey-white sand, grey clayey sand and yellow sand. The in-situ PSD is fairly consistent irrespective of the type of sand, with approximately 85% of the sand between 0.15 mm and 0.6 mm. A composite sample weighing 178.6 kg from nine shallow auger holes drilled in 2019 was submitted to Nagrom of Kelmscott, WA for process test work which was reported in February 2020. The process flowsheet included screening at 1 mm, washing, attritioning, spiral separation, medium intensity magnetic separation, acid leaching and calcination. Gravcon Consultancy PL was commissioned by Perpetual in June 2020 to review the Nagrom results and the following notes are derived from the Gravcon report. The percentage of SiO_2 in the samples increased during the test process while Fe_2O_3, TiO_2, Al_2O_3 and LOI decreased relative to the head grade. Attritioning and washing the material removed fines and silt, which increased the SiO_2 content. The spirals test produced samples where the largest fraction of SiO_2 was in the light and middlings fractions.

<table>
<tr><th>Criteria</th><th>JORC Code explanation</th><th>Commentary</th></tr>
<tr><td></td><td></td><td>Magnetic separation indicated that the largest fraction of SiO_2 was in the middlings and non-magnetic fractions. Acid leach tests showed that hydrochloric acid reduced Al_2O_3 and Fe_2O_3. Repeat leaching had minimal impact and the use of sulphuric acid alone or combined with hydrochloric acid had minimal impact. Calcination tests indicated limited improvement to product quality.

Examples of SiO_2 and Fe_2O_3 results for each process stage are summarised as:
<table>
<tr><th>Process stage</th><th>SiO_2% (XRF)</th><th>Fe_2O_3% (XRF)</th></tr>
<tr><td>Feed -1 mm</td><td>99.037</td><td>0.127</td></tr>
<tr><td>Deslimed +75 micron</td><td>99.297</td><td>0.111</td></tr>
<tr><td>Spiral lights + middlings</td><td>99.594</td><td>0.045</td></tr>
<tr><td>MIMS non-magnetics</td><td>99.647</td><td>0.030</td></tr>
<tr><td>HCl leach</td><td>99.746</td><td>0.009</td></tr>
</table>
The particle size distribution (aircore samples) and process testwork (auger composite sample) indicate that the Beharra deposit may be suitable for the production of silica sand for markets such as glass, ceramics and foundry. However, it is noted that the composite auger sample was from shallow holes less than 2 m depth, that the composite may not be truly representative of the Beharra deposit and that further metallurgical testwork on, for example, aircore drill samples is recommended to verify the auger sample results and to provide samples for potential customers in the target markets.</td></tr>
<tr><td>Environmental factors or assumptions</td><td>Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.</td><td>It is assumed that no environmental factors exist that could prohibit any potential mining development at the deposit.</td></tr>
</table>

Criteria	JORC Code explanation	Commentary
Bulk density	Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples. The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vughs, porosity, etc), moisture and differences between rock and alteration zones within the deposit. Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.	Six in-situ bulk density measurements were completed by Western Geotechnical & Laboratory Services using a nuclear densometer and reported on 16 April 2020. The sites were sampled in accordance with AS 1289.1.2.1-6.5.1 and tested in accordance with AS 1289.2.1.1. and AS 1289.5.8.1. The results from the seven measurements are corrected based on the measured moisture factor. The dry density ranged from 1.57 t/m^3 to 1.68 t/m^3 with an average dry in situ density result of 1.64 t/m^3 which was applied to the estimate. The Competent Person is of the opinion that the bulk density determined using recovered sample weight, and nominal aircore or vacuum hole diameter, supported the results from the nuclear densometer method (1.64 t/m^3) and the loose and tapped methods (1.66 t/m^3). Based on all data, an average density of 1.64 t/m^3 as determined by the nuclear densometer has been assumed for the Project.
Classification	The basis for the classification of the Mineral Resources into varying confidence categories. Whether appropriate account has been taken of all relevant factors (i.e. relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data). Whether the result appropriately reflects the Competent Person's view of the deposit.	The Mineral Resource was classified based on data quality, sample spacing, grade continuity, geological continuity of the domains and metallurgical/process test results into Inferred material. The grey sands are considered uneconomic at this stage and have been excluded. The reported Mineral Resource does not include any material within the Yardanogo Nature Reserve which occupies a strip approximately 300 m wide on the western side of the tenement and excludes a buffer of 50 m south and north of Mount Adams Road. The Mineral Resource classification appropriately reflects the view of the Competent Person.
Audits or reviews	The results of any audits or reviews of MREs.	Snowden is not aware of any independent reviews of the MRE. Snowden's internal review process ensures all work meets quality standards.
Discussion of relative accuracy/ confidence	Where appropriate a statement of the relative accuracy and confidence level in the MRE using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate.	The Mineral Resource has been validated both globally and locally against the input sample data. Estimates are considered to be accurate to a level which supports mine planning – Indicated. There is no operating mine at the Project, and as such, no production data is available.

Criteria	JORC Code explanation	Commentary
	The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	

Section 4: Estimation and Reporting of Ore Reserves

Item	JORC Code explanation	Comments
Mineral Resource for conversion to Mineral Reserves	Description of the MRE used as a basis for the conversion to an Ore Reserve. Clear statement as to whether the Mineral Resources are reported additional to, or inclusive of, the Ore Reserves.	Mineral Resources for the Beharra deposit were reported in February 2021 from a Datamine model "beharra_20210210.dm". No cut-off grade is applied for the silica sand Mineral Resources and is commensurate with other deposits. Mineral Resources are reported inclusive of the Ore Reserves.
Site visits	Comment on any site visits undertaken by the Competent Person and the outcome of those visits. If no site visits have been undertaken indicate why this is the case.	Site visits were completed by the following Competent Persons: **Competent Persons** / **Items** / **Date of site visit** Frank Blanchfield / Mining / Dec 2020 Arno Kruger / Metallurgy / Feb 2021
Study status	The type and level of study undertaken to enable Mineral Resources to be converted to Ore Reserves. The Code requires that a study to at least PFS level has been undertaken to convert Mineral Resources to Ore Reserves. Such studies will have been carried out and will have determined a mine plan that is technically achievable and economically viable, and that material Modifying Factors have been considered.	The Beharra Silica Project has been under technical investigation as a PFS completed in March 2021.
Cut-off parameters	The basis of the cut-off grade(s) or quality parameters applied.	The ore inventory was required to have a Fe_2O_3 average below 2000 ppm for plant feed consideration.
Mining factors and assumptions	The method and assumptions used as reported in the PFS or Feasibility Study to convert the Mineral Resource to an Ore Reserve (i.e. either by application of appropriate factors by optimisation or by preliminary or detailed design). The choice, nature and appropriateness of the selected	Snowden completed a mining prefeasibility study for the Beharra Project in 2021. The study reflects the latest understanding of the Project. An evaluation using pit optimisation to produce an economic mining shell followed by detailed pit design was used to convert the Mineral Resource to an Ore Reserve. A mine layout was developed for mining of staged designs mine layout development. Mine equipment requirements were determined by contractors, who provided pricing using the

<table>
<tr><th>Item</th><th>JORC Code explanation</th><th>Comments</th></tr>
<tr><td></td><td>mining method(s) and other mining parameters including associated design issues such as pre-strip, access, etc.

The assumptions made regarding geotechnical parameters (e.g. pit slopes, stope sizes, etc), grade control and pre-production drilling.

The major assumptions made and Mineral Resource model used for pit and stope optimisation (if appropriate).

The mining dilution factors used.

The mining recovery factors used.

Any minimum mining widths used.

The manner in which Inferred Mineral Resources are utilised in mining studies and the sensitivity of the outcome to their inclusion.

The infrastructure requirements of the selected mining methods</td><td>Snowden mine production schedule as a basis. Selective mining using an open pit load and haul mining cycle is used for mining activities.

Geotechnical

Snowden completed a geotechnical analysis to recommended pit slope design parameters for Beharra for 80 m deep pit as summarised as:
<table>
<tr><th>Batter angle (°)</th><th>Berm width at base of batter (m)</th><th>Batter height (m)</th><th>Inter-ramp slope angle (crest to crest, °)</th><th>Overall slope angle (crest to toe, °)</th></tr>
<tr><td>30</td><td>NA</td><td>10</td><td>NA</td><td>30</td></tr>
</table>
Grade control

The drill density for Indicated Resources is sufficient to define the flat ore basement. As the mining floor limit is elevated by 0.5 m and the grade control in the basement will be visual. There is a 0.5 m roof ore loss and this will be sufficient to maximise or guarantee the quality of the ore.

Dilution

Dilution was essentially zero, however there were ore losses from boundary losses (neighbouring nature reserve, Mount Adams Road and 10 m lease offset corridor that were about 5% of the available resources and floor and roof loses and internal waste that was about 8% of the available resources.

Schedule

Snowden identified a LOM schedule of 33 years suitable for Ore Reserve assessment.

No in-pit Inferred Resources were used to quantify Ore Reserves.</td></tr>
<tr><td>Metallurgical factors and assumptions</td><td>The metallurgical process proposed and the appropriateness of that process to the style of factors or mineralisation.

Whether the metallurgical process is well-tested technology or novel in nature.

The nature, amount and representativeness of metallurgical test work undertaken, the nature of the metallurgical domaining applied and the corresponding metallurgical recovery factors applied.

Any assumptions or allowances made for deleterious elements.

The existence of any bulk sample or pilot scale test work and the degree to which such samples are considered</td><td>Metallurgical testwork

To date, metallurgical testing has been carried out in two phases. The first phase of mineralogical examination, PSD of aircore samples and process testing of hand auger samples was reported on previously by Haren and Scogings (2020).

The initial Phase 1 process testwork program was conducted on the composite auger drill samples and indicated that the Beharra deposit was suitable for producing silica sand for markets such as glass, ceramics and foundry.

The second phase of metallurgical test work commenced in Q3 2020 with Perpetual supplying approximately two tonnes of sand samples from the March 2020 aircore drill program to IHCR of Brisbane, a specialist mineral sands laboratory, for bulk process testwork. This programme was conducted using full size or genuinely scalable equipment and the results are demonstrated in IHCR report 1959-PM-REP-0000-8002.</td></tr>
</table>

<table>
<tr><th>Item</th><th>JORC Code explanation</th><th>Comments</th></tr>
<tr>
<td></td>
<td>representative of the orebody as a whole.

For minerals that are defined by a specification, has the ore reserve estimation been based on the appropriate mineralogy to meet the specifications</td>
<td>The resultant products derived from the IHCR 2.0T bulk metallurgical test program were of high quality as demonstrated in the table below.
<table>
<tr><th rowspan="3">Testwork Classification</th><th rowspan="3">Product Classification</th><th rowspan="2">Mass by ROM</th><th colspan="5">Assay</th></tr>
<tr><th>%</th><th>ppm</th><th>ppm</th><th>ppm</th><th>%</th></tr>
<tr><th></th><th>SiO2</th><th>Al2O3</th><th>Fe2O3</th><th>TiO2</th><th>LOI</th></tr>
<tr><td></td><td></td><td>%</td><td>97.9</td><td>9990</td><td>680</td><td>910</td><td>0.26</td></tr>
<tr><td>UCC Underflow (calc)</td><td>Beharra Premium #44</td><td>74.4</td><td>99.6</td><td>1789</td><td>276</td><td>369</td><td>0.14</td></tr>
<tr><td>Screen O/S</td><td>Beharra Premium #27</td><td>6.3</td><td>99.7</td><td>1405</td><td>235</td><td>300</td><td>0.13</td></tr>
<tr><td>Screen U/S</td><td>Beharra Premium #46</td><td>68</td><td>99.6</td><td>1825</td><td>280</td><td>375</td><td>0.14</td></tr>
</table>
Calculation and determination of Ore Reserves is based on producing Beharra Premium silica sand product #44, which will have a SiO_2 of >99.5% and a Fe_2O_3 of <280 ppm. Mass yield into this product as per test work is calculated at 74.4%. (Ref: 1959-PM-REP-0000-8001 Rev 2).

Mineral Processing

The mineral processing flowsheet and plant required for the upgrading of the mined material at Beharra is commonly seen and used both in the quarrying and aggregates and mineral sands industry. The separation techniques employed are commonplace and include screening and desliming, gravity, magnetic and physical separation.

Given the relatively small throughput requirement and simplicity, traditional package plant suppliers were approached for an all-inclusive turnkey solution, based on the provided sound engineering documentation and the proposed flowsheet provided by Perpetual.</td>
</tr>
<tr>
<td>Environmental</td>
<td>The status of studies of potential environmental impacts of the mining and processing operation. Details of waste rock characterisation and the consideration of potential sites, status of design options considered and, where applicable, the status of approvals for process residue storage and waste drum s should be reported.</td>
<td>Environment

Considerable baseline environmental studies, commissioned by Tiwest (now Tronox) for its Dongara titanium minerals project, immediately adjacent to the Beharra Project have been procured from Tronox via a data share arrangement.

This data significantly contributes to the environmental impact assessment process to support approvals for Beharra and covers factors including groundwater and groundwater-dependent ecosystems, surface water, flora, vegetation, weeds and dieback, terrestrial and subterranean fauna, soil profiles and acid sulphate soils and indigenous heritage.

In addition, studies conducted to date by Perpetual to complement the extensive Tronox dataset and cover the following areas: flora and vegetation, terrestrial fauna, groundwater and groundwater-dependent ecosystems and heritage.

Mine rehabilitation

A comprehensive study was undertaken to determine the most suitable progressive rehabilitation method for the Beharra Project based on the existing environment. Consultation and benchmarking with other extractive sand miners in the local area as well as expert rehabilitation practitioners was undertaken to assist in developing the method.</td>
</tr>
</table>

Item	JORC Code explanation	Comments
Infrastructure	The existence of appropriate infrastructure: availability of land for plant development, power, water, transportation (particularly for bulk commodities), labour, accommodation; or the ease with which the infrastructure can be provided or accessed.	The Project site is easily accessed via the sealed Brand Highway and unsealed Adams Road. There will be a requirement for some road and intersection upgrade works to support the volume of haul trucks required to transport the final product to Geraldton. An on-site power station and water supply infrastructure will need to be constructed. Labour will be sourced from the nearby towns of Dongara and Geraldton, removing the requirement for onsite accommodation.
Costs	The derivation of, or assumptions made, regarding projected capital costs in the study. The methodology used to estimate operating costs. Allowances made for the content of deleterious elements. The derivation of assumptions made of metal or commodity price(s), for the principal minerals and co-products. The source of exchange rates used in the study. Derivation of transportation charges. The basis for forecasting or source of treatment and refining charges, penalties for failure to meet specification, etc. The allowances made or royalties payable, both government and private.	The capital cost estimate prepared by Perpetual includes direct plant and supporting infrastructure, indirect costs and is to an accuracy level of ±25% with a contingency of 10% included. Budget pricing was received from a process plant supply and install contractor (inclusive of engineering, process and materials handling equipment, E, I & C, process water circuit, and associated structure and piping). Budget pricing was also received for civil works, concrete, fuel storage, power station, administration, amenities and workshop infrastructure. The operating cost estimate was developed as a bottom-up estimate over the 32-year LOM to obtain average operating costs. All significant and measurable items are itemised, with smaller items estimated based on other silica sand operations and the experience/expertise of project consultants. Mining costs were derived from tenders fielded to appropriately qualified contract mining companies using pit models provided by Snowden. A contract mining model has been adopted and the raw mining cost provided by the selected tenderer, has been included in the operating cost estimate. This rate has then been brought forward into the mining model. Rehabilitation costs have been provided by Tetris (Trajectory) based on a $/ha breakdown. Specific consumption rates for reagents and consumables were estimated through a combination of equipment operating data, bench-scale testwork and modelling software. Current market pricing was obtained for all major consumables and reagents based on supplier budget pricing as of December 2020. A small general allowance was made for minor miscellaneous consumables based on historical data from similar operations. Power station supply and install is included as a $kw/hr, BOOM operational cost – supplying power and sized according to the drawn loads on the equipment list.

Item	JORC Code explanation	Comments
		Maintenance costs were estimated based on projected capital estimates for the plant using industry benchmarked factors. Remuneration rates typically expected in this area for discipline personnel were used to establish operating costs, with labour rates being sourced from three contributors: AMMA, Gravcon, and Allied PD. Perpetual has elected to use a flat A$:US$ exchange rate of 75c across the forecast period, which is considered a reasonable estimation of a likely long run average level. Perpetual acknowledges that wide exchange rate fluctuations are possible and could positively or negatively affect the profitability and economic viability of the Beharra Project at any single point in time. This risk will be managed by the management team and Board of Directors who may utilise an exchange rate hedging strategy should it be considered appropriate at the time. **Annual operating costs – average years 1-5 at full production** An average summary of annual operating costs forecast for the first five years of full production are set out below:

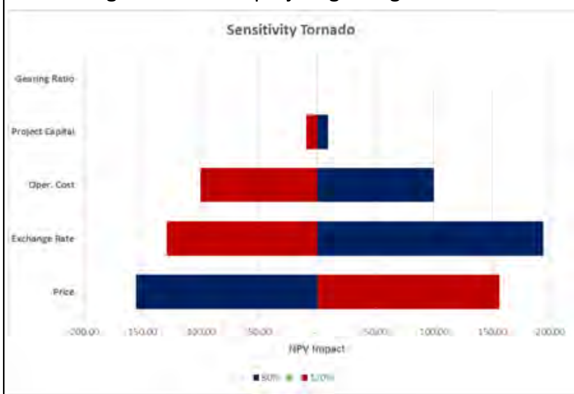
OPEX (A$)	Cost per annum ($'000)	A$/t ore	A$/t product concentrate
Mining (ROM+OB)	10.6	5.18	6.97
Processing	5.0	2.46	3.31
Reject haulage	0.6	0.29	0.36
Administration	2.4	1.18	1.58
Transport + Port/ ship loading	39.4	19.40	26.09
Rehabilitation	1.8	0.43	0.58
Contingency	2.8	1.40	1.88
Royalty	3.5	1.71	2.30
Total OPEX	**66.1**	**32.05**	**43.07**

Pre-production capital costs

A summary of the pre-production capital estimate is set out below:

CAPEX (A$)	Cost ($'000)
Process plant (incl. water distribution)	19,287
Services and onsite infrastructure	3,537
Offsite infrastructure	9,272
Indirect, PCM and site office costs	2,338
Total development capital	34,434
Owners' costs	1,343

Item	JORC Code explanation	Comments
		Owner's contingency (10%) — 3,443 Total pre-production capital — 39,220
Revenue factors	The derivation of, or assumptions made regarding revenue factors including head grade, metal or commodity price(s) exchange rates, transportation and treatment charges, penalties, net smelter returns, etc. The derivation of assumptions made of metal or commodity price(s), for the principal metals, minerals and co-products.	The grade of the process feed and iron content is supported by the information in the MRE and driven by the mining and production schedule. Processing recoveries were estimated based on a metallurgical test program completed during the PFS, using scalable processing equipment. Perpetual engaged IMARC, to prepare an independent market assessment of the APAC region, specifically targeting selected countries and product grades. Beharra metallurgical testwork to date has confirmed that Beharra end-product to be suitable for sale into the 200–300 ppm Fe_2O_3 markets in the APAC region. In 2019, silica sand with 200–300 ppm Fe_2O_3 recorded a price of between US$41.10 in China and US$71.60 per metric ton in Japan. Sell prices, in US$, have been forecast out to 2026 by IMARC. Based on the above and advice provided by industry experts, Perpetual is confident that a sell price of US$50 per metric ton and above is achievable.
Market assessment	The demand, supply and stock situation for the particular commodity, consumption trends assessment and factors likely to affect supply and demand into the future. A customer and competitor analysis along with the identification of likely market windows for the product. Price and volume forecasts and the basis for these forecasts. For industrial minerals the customer specification, testing and acceptance requirements prior to a supply contract.	The APAC market assessment revealed the APAC region to be amongst the largest consumers of silica sand in the world based on increasing utilisation in the glass and foundry industries, reaching a value of US$5,133.7 million in 2020. The forecast market value is expected to reach US$7,638.1 million by 2026, exhibiting a CAGR of 7.1% during this period. The forecast market consumption volume is expected to reach 174.25 million metric tons by 2026, exhibiting a CAGR of 4.8% during the 2021–2026 period. In 2020, the glass industry represented the largest end use sector for silica sand accounting for 37.6% of the total APAC market volume, with foundry sand accounting for 27.1%. Perpetual's marketing strategy therefore is focussed on targeting the APAC glass sand industry in the higher end market based on products, initially in the 200–300 ppm range in relation to iron, where prices range from US$41.10/t in China to US$71.60/t in Japan. Pricing for silica sand products in the APAC region vary by a number of factors, mostly dictated by country of purchase and impurity levels. In China, silica sand prices for higher purity grades sell for between US$45/t and US$115/t, in Korea this price range is US$55/t to US$130/t, and in Japan the range is US75/t to US$190/t. Perpetual has conservatively chosen a price of US$50/t FOB Geraldton which provides significant scope for pricing upside as marketing channels are developed.

Item	JORC Code explanation	Comments
		Perpetual has sent a number of samples to potential customers in the APAC region, and has signed one Memorandum of Understanding for offtake for up to 250,000 tons per annum with a Chinese end user called Yaoguo Solar Science & Technology Co. Ltd (Yaoguo). Yaoguo has already tested samples of Beharra silica sand and have provided a positive response, with further samples being sent to develop deeper discussions. Strong indications have been provided by Yaoguo that Beharra silica sand is suitable for the Asian market.
Economic	The inputs to the economic analysis to produce the NPV in the study, the source and confidence of these economic inputs including estimated inflation, discount rate, etc. NPV ranges and sensitivity to variations in the significant assumptions and inputs.	Financial modelling was completed by Perpetual, Snowden is reliant on the commodity price projections advised by Perpetual. Snowden is not an expert in the forecasting of commodity prices, and other than to draw attention to the sensitivity of the project to these projections, is not able to comment on the risk that these projections will change over time. However the commodity price estimate is based on the 2019 price outlook provided by IMARC and also the professional opinion of Stratum Resources, which is a specialist industrial mineral consultancy that provides advice and trading in the silica sand markets regionally. The key financial metrics for just the reserve portion of the project are the IRR 54.6% and NPV 230.9 million @ %10 discount rate. A real, pre-tax discount rate of 10.0% was applied based on Perpetual's calculated weighted average cost of capital and also a comparison to other similar projects. A long-term AUD: USD FX rate averaging 0.75:1 over the LOM was applied, reflecting an approximation of the average exchange rate over the last 40 years. A sensitivity analysis on the NPV is provided below, which looks to analyse the economic impact of key variables for the Beharra Pproject, including: • Revenue per tonne • Changes in operating costs • Changes in capital costs • Exchange rate fluctuations • Changes in levels of project gearing. 

Item	JORC Code explanation	Comments
Social	The status of agreements with key stakeholders and matters leading to social licence to operate.	Perpetual has undertaken an assessment of its key stakeholders that have a (statutory) interest in the Project, including local government authorities, government agencies, and other interested parties, i.e. Shires, traditional owners etc). Perpetual will maintain a program of engagement throughout the life of the project. Consultation will be aimed at developing relationships that are mutually beneficial to both parties. Stakeholders will be engaged early in the planning process, primarily in the interests of achieving a collaborative approach to raise any concerns and provide Perpetual with the means to respond to feedback and to ensure that local knowledge is considered in the design and management of the project. A stakeholder register and records of engagement are maintained.
Classification	The basis for the classification of the Ore Reserves into varying confidence categories. Whether the result appropriately reflects the Competent Person's view of the deposit. The proportion of Probable Ore Reserves that have been derived from Measured Mineral Resources (if any).	The Beharra Ore Reserves are classified using the guidelines of the JORC Code (2012). In-pit Indicated Mineral Resources were used as the basis for Probable Ore Reserve.
Other	The status of agreements with key stakeholders and matters leading to social licence to operate. To the extent relevant, the impact of the following on the project and/or on the estimation and classification of the Ore Reserves: • Any identified material naturally occurring risks. • The status of material legal agreements and marketing arrangements. • The status of governmental agreements and approvals critical to the viability of the project, such as mineral tenement status, and government and statutory approvals. There must be reasonable grounds to expect that all necessary government approvals will be received within the timeframes anticipated in the PFS or feasibility study. Highlight and discuss the materiality of any unresolved matter that is dependent on a	Perpetual recognises there is a potential human health exposure risk to RCS at Beharra. RCS could be produced as an airborne dust when silica sand is disturbed through mineral extraction, stockpiling, transportation and handling and is dry enough to generate dust particles. These particles can be small enough to lodge deep in the lungs and cause illness or disease such as bronchitis, silicosis and lung cancer. A WES exists for crystalline silica and represents the concentration of an airborne hazardous chemical within a worker's breathing zone that should not cause adverse health effects or undue harm. The current WES for RCS is 0.1 mg/m³ over an eight-hour working day in Western Australia, with the WES likely to be lowered to 0.05 mg/m³ by the end of 2020 to meet national standards. RCS exposure and safety requirements are governed by the following Western Australian Legislation: • Occupational Safety and Health Act 1984 • Occupational Safety and Health Regulations 1995 • Mines Safety and Inspection Act 1994 • Mines Safety and Inspection Regulations 1995. Prior to the commencement of any extraction activities at the Project, a HRA will be undertaken to define key sources and the pathways of RCS. With this information, defined dust management procedures to reduce the risk of exposure to personnel above the WES will be developed using the hierarchy of controls – substitution, isolation, engineering, administrative, PPE.

Item	JORC Code explanation	Comments
	third party on which extraction of the reserve is contingent.	Additionally, the HRA will be a key input to the preparation of a HHMP in accordance with the DMIRS Guideline 'Preparation of health and hygiene management plan – guide' (2018) and approved by DMIRS prior to operations commencing at the Project. The HHMP will define as a minimum the sources, pathways management and monitoring of RCS. The HHMP will be reviewed annually to ensure it meets current standards and capture any changes to operational circumstances or procedural controls. This will enable Perpetual to maintain continual compliance with its legislative health and safety obligations. Currently, final product samples of Beharra Premium have been provided from the resultant bulk metallurgical test program to a variety of potential off takers. Perpetual has not entered into any binding agreements or arrangements with marketing agencies or consultants at this time.
Audits or reviews	The results of any audits or reviews of Ore Reserve estimates.	There have not been no external audits ore reviews of the 2021 PFS. The MRE, pit optimisation, design and schedule as developed for the Beharra PFS were reviewed internally by Snowden.
Relative accuracy/ confidence	Where appropriate a statement of the relative accuracy and confidence level in the Ore Reserve estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the reserve within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors which could affect the relative accuracy and confidence of the estimate. The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. Accuracy and confidence discussions should extend to specific discussions of any applied Modifying Factors that may have a material impact on Ore Reserve viability, or for which there are remaining areas of	The capital cost estimates in this study relating to mining, processing and cost performance are underpinned by a pre-feasibility level study. The capital cost estimate has an assessed accuracy of ±25% and complies with the AusIMM Class 4 PFS criteria.

Item	JORC Code explanation	Comments
	uncertainty at the current study stage. It is recognised that this may not be possible or appropriate in all circumstances. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	

BEHARRA SILICA PROJECT

PRE-FEASIBILITY STUDY

MARCH 2021

Document No.	Rev	Reason for Issue	Date	Author	Review	Approved
5221-PM-REP-0000-8010	A	Draft for CP review	03/03/21	MRO	Squad	RBE
5221-PM-REP-0000-8010	B	Final Issue	14/03/21	MRO	JBA	RBE

CAUTIONARY STATEMENT

The Pre-Feasibility Study (PFS) discussed herein has been undertaken to study a range of options to further develop the technical and economic feasibility of the Beharra Silica Sands Project (the Project). The production target incorporates the Probable Ore Reserve that sits within the proposed mining area. There is also an additional portion of the Indicated Mineral Resource within the area that is identified for further metallurgical test work.

There is a moderate level of geological confidence associated with Indicated Mineral Resources however there is no certainty that further exploration work will result in the determination of a Measured Mineral Resource or that the production target itself will be realised. For the additional portion of the Indicated Mineral Resource, there is no certainty that the Indicated Mineral Resources will result in Ore Reserves.

The Ore Reserve and Mineral Resource Estimate underpinning the PFS have been prepared by Competent Persons in accordance with the requirements of the JORC Code. Competent Persons' Statements are included in this document.

Investors should note that there is no certainty that Perpetual Resources Limited (Perpetual) will be able to raise funding required to commercialise the project when needed. It is also possible that such funding may only be available on terms that may be dilutive to or otherwise affect the value of Perpetuals' existing shares. It is also possible that Perpetual could pursue other 'value realisation' strategies to provide alternative funding options.

Given the uncertainties involved, investors should not make any investment decisions based solely on the results of the Project PFS.

FORWARD-LOOKING STATEMENTS

Certain statements contained in this document may be 'forward-looking' and may include, amongst other things, statements regarding production targets, economic analysis, resource trends, pricing, recovery costs, and capital expenditure. These 'forward–looking' statements are necessarily based upon a number of estimates and assumptions that, while considered reasonable by Perpetual, are inherently subject to significant technical, business, economic, competitive, political and social uncertainties and contingencies and involve known and unknown risks and uncertainties that could cause actual events or results to differ materially from estimated or anticipated events or results reflected in such forward-looking statements.

Forward-looking statements are often, but not always, identified by the use of words such as 'believe', 'expect', 'anticipate', 'indicate', 'target', 'plan', 'intends', 'budget', 'estimate', 'may', 'will', 'schedule' and others of similar nature.

Perpetual does not undertake any obligation to update forward-looking statements even if circumstances or management's estimates or opinions should change. Investors should not place undue reliance on forward-looking statements as they are not a guarantee of future performance.

DISCLAIMER

No representation or warranty, express or implied, is made by Perpetual that the material contained in this document will be achieved or proved correct. Except for statutory liability and the ASX Listing Rules which cannot be excluded, Perpetual and each of its directors, officers, employees, advisors and agents expressly disclaims any responsibility for the accuracy, correctness, reliability or completeness of the material contained in this document and excludes all liability whatsoever (including in negligence) for any loss or damage which may be suffered by any person through use or reliance on any information contained in or omitted from this document.

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EXECUTIVE SUMMARY

INTRODUCTION

Perpetual Resources ("Perpetual" or "the Company") is a progressive resource company actively pursuing opportunities in the silica sand market. The Company's flagship asset, the Beharra Silica Project ("the Project") is located 300 km north of Perth and is 96 km south of the port town of Geraldton in Western Australia.

Access to the Project from Geraldton and Perth is via the sealed Brand Highway, then via Mount Adams Road providing access to the centre of the Beharra project site. The seamless alignment of this infrastructure solution is considered a key sustainable advantage of the Beharra Project, which will utilise sealed roads the entire way from site through to an open-access deep water bulk commodities port.

Early positive results at Beharra have recently accelerated the Company's efforts to develop the potential Project with a view to first production in Q4 2022.

This Pre-Feasibility Study (PFS) examines the requirement for the Project to generate a >99.5%+ SiO_2 purity silica sand product at a production rate of nominally 1.51 Mtpa.

Some key features of the Beharra Project are:

- A high quality SiO_2, low Fe_2O_3 silica product
- Readily extracted, uncomplicated free-flowing material
- Simple metallurgical process flowsheet
- Proximal to high quality road and port infrastructure
- Environmental issues are well understood, data is shared by peer projects and manageable
- Use of proven mine rehabilitation methods leads to a lower risk profile
- Mineral sands history in the area equals skilled labour market available from Dongara, Geraldton areas
- Located in a geopolitically stable jurisdiction
- Demand for silica sand in the Asia Pacific (APAC) region continues to grow with strong buy price pressures.

The Company has been pragmatic and conservative in the project development process which has resulted in a largely de-risked project profile. Perpetual is pleased to present the PFS to investors and stakeholders alike, with positive financial results apparent and significant upside to be realised.

Further, the Company also considers that the level of detail and analysis in this PFS positions Perpetual well to consider a more rapid start-up or project advancement scenario.

GEOLOGY AND RESOURCE

Silica sand mineralisation at Beharra occurs within the coastal regions of the Perth Basin, and the targeted silica sand deposits are the aeolian quartz sand dunes that overlie the Pleistocene limestones and paleo-coastline.

The Mineral Resource was classified as Indicated based on data quality, sample spacing, grade continuity, geological continuity of the domains and metallurgical/process test results.

No cut-off grade has been used for the reported Mineral Resource as the layers considered potentially economic are amenable to beneficiation to a suitable product specification through relatively simple processes.

The Beharra Indicated Mineral Resource as of February 2021, with potential recovery fraction is reported below.

Table 1.1: Beharra Indicated Mineral Resource (February 2021)

Sand	Tonnes (Mt)	SiO_2 (%)	Al_2O_3 (%)	TiO_2 (%)	Fe_2O_3 (%)	LOI %	>75 µm	
							Tonnes (Mt)	% Tonnes
Yellow	13.2	98.2	0.50	0.23	0.23	0.51	11.7	88.8
White	125.8	98.6	0.41	0.36	0.23	0.21	115.9	92.1
Total	**139.0**	**98.6**	**0.42**	**0.35**	**0.23**	**0.24**	**127.6**	**91.8**

Reserve and Mining

Snowden Mining Industry Consultants Pty Ltd (Snowden) was engaged by Perpetual to undertake a PFS on the Beharra Silica Project. The objective of this study was to develop an Ore Reserve, and the works were conducted in two phases.

During the first phase of work, Snowden used the Beharra Inferred Mineral Resources to identify a mineral inventory, thus enabling planning for other study disciplines and to support mining operations budget quotations from mining contractors. Given the free-digging nature of the orebody, conventional truck and shovel methodologies were selected as the base case for mining operations.

During the second phase of works, mining costs derived from the quotations were used to support Ore Reserves using the updated Indicated Mineral Resources. All other aspects of the PFS, including the development of non-mining related operating costs and capital costs, were provided by Perpetual and its consultants for use as Modifying Factors in the estimation of Ore Reserves.

The Mineral Resource within the mining area has been classified as Indicated and the Ore Reserve classified as Probable.

The Ore Reserve estimate is provided as tabled below. The Ore Reserve is reported in accordance with Clause 49 of the JORC Code (2012) for the reporting of industrial minerals and Ore Reserves. The saleable silica product is reported rather than the "as-mined" product. Details of the completed mine planning process are available in the PFS document titled "Beharra Silica Project Pre-Feasibility Study".

Table 1.2: Beharra Probable Ore Reserve (March 2021)

Sand	Tonnes (Mt)	SiO_2 (%)	Al_2O_3 (ppm)	TiO_2 (ppm)	Fe_2O_3 (ppm)	LOI (%)
In situ	64.1	98.6	4240	3460	1950	0.235
Saleable product	47.6	99.6	1789	369	276	0.100

An additional portion tonnage is also identified as provided in the table below. The portion is higher in iron and is reported without a saleable product.

Table 1.3: Beharra additional portion of Indicated Mineral Resources (March 2021)

Sand	Tonnes (Mt)	SiO_2 (%)	Al_2O_3 (ppm)	TiO_2 (ppm)	Fe_2O_3 (ppm)	LOI (%)
In situ	59.9	98.6	3900	3500	2640	0.270

Further details are provided in the Beharra Competent Persons Assessment JORC Code (2012), Table 1, Section 4.

Metallurgy

To date, metallurgical testing has been carried out in two phases. The first phase of mineralogical examination, particle size distribution (PSD) of aircore samples and process testing of hand auger samples was reported on previously by Haren and Scogings (2020).

The initial Phase 1 process testwork program was conducted on the composite auger drill samples and indicated that the Beharra deposit was suitable for producing silica sand for markets such as glass, ceramics and foundry.

The second phase of metallurgical testwork commenced in Q3 2020 with Perpetual supplying approximately 2 tonnes of sand samples from the March 2020 aircore drill program to IHC Robbins (IHCR) of Brisbane, a specialist mineral sands laboratory, for bulk process testwork. This program was conducted using full size or genuinely scalable equipment and the results are demonstrated in IHCR report 1959-PM-REP-0000-8002.

The resultant products derived from the IHCR 2.0 tonne bulk metallurgical test program were of high quality, as demonstrated in the table below.

Table 1.4: Resultant products derived from the IHCR 2.0 tonne bulk metallurgical test program

Testwork classification	Product classification	Mass by ROM	Assay				
			SiO_2 (%)	Al_2O_3 (ppm)	Fe_2O_3 (ppm)	TiO_2 (ppm)	LOI (%)
		%	**97.9**	**9990**	**680**	**910**	**0.26**
UCC Underflow (calc.)	Beharra Premium #44	74.4	99.6	1789	276	369	0.14
Screen O/S	Beharra Premium #27	6.3	99.7	1405	235	300	0.13
Screen U/S	Beharra Premium #46	68	99.6	1825	280	375	0.14

Source: Extract IHC Robbins report 1959-PM-REP-0000-8002.

Mineral Processing

The mineral processing flowsheet and plant required for the upgrading of the mined material at Beharra is commonly seen and used both in the quarrying and aggregates and mineral sands industry. The separation techniques employed are commonplace and include screening and desliming, gravity, magnetic and physical separation. The process flowsheet chosen as the basis for the study is the result of extensive testwork, with the initial focus on achieving a lowest impurity prolife, particularly Fe_2O_3. The process flowsheet is therefore based on freely available equipment, readily customised to suite the Beharra orebody.

Given the relatively small throughput requirement and simplicity, traditional package plant suppliers were approached for an all-inclusive turnkey solution, based on sound engineering documentation and the proposed flowsheet provided by Perpetual.

Market Analysis

The primary end use market suitable for Beharra product is the APAC glass industry, with a secondary focus on the APAC foundry industry. The glass goods industry is growing in APAC, especially in countries such as China, Japan, South Korea, India, and many other South-East Asian countries such as Vietnam, Thailand, Indonesia, etc. (as cited in IMARC Report SR090221K2).

Demand

APAC is amongst the largest consumers of silica sand based on its increasing utilisation in the glass and foundry industries as well as many other high growth applications. The current and forecast rising demand (Source: IMARC Report SR090221K2 – 6.1.2 and 6.2.2) for silica sand in the APAC region is being driven by many factors, including the following:

- The rapid development of solar infrastructures is catalysing the installation of glass-based photovoltaic (PV) modules
- Increase in specialty glass demand due to the growing consumer electronics sector in the region
- Increasing demand for foundry sand in the automobile industry
- Manufacturing of PV panels and silicon-metal composite materials
- The expanding construction industry
- Rapid urbanisation propelling the demand for high-grade construction materials in both residential and commercial sectors
- The growing infrastructural investments in various countries, such as China, India, Japan, South Korea, Vietnam, etc.

The APAC silica sand market reached a value of US$5,133.7 million in 2020 and looking forward is expected to reach a value of US$7,638.1 million by 2026 (Source: IMARC Report SR090221K2 – 5.7.2).

Market

The Beharra products fall in the 200–300 ppm range in relation to Fe_2O_3 (which is considered the key impurity of focus for buyers and end users). Based on the below and advice provided by industry experts, Perpetual is confident that a sell price of US$50/metric tonne FOB (free on board) Geraldton and above is achievable (Source: IMARC Report SR090221K2 – Price Trends figures 24, 37, 42, Industry Contacts, Perpetual Sales & Marketing Consultants).

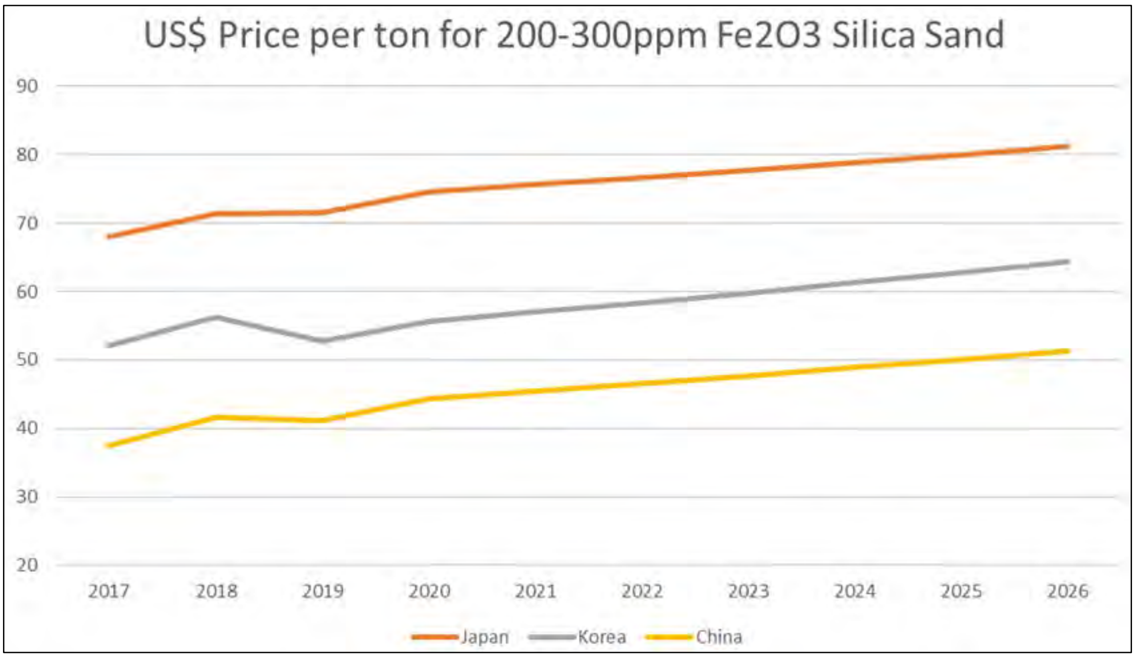


Figure 1 **Price per tonne for 200–300 ppm Fe_2O_3 silica sand (2017 to 2026)**

Source: IMARC Report SR090221K2

Based on ongoing testwork, potential exists for Perpetual to achieve a Beharra product that is <200 ppm Fe_2O_3, which, if achieved, may lead to a material increase in the revenue per tonne from the Project (Source: IMARC Report SR090221K2 – Price Trends figures 24, 37, 42, Industry Contacts, Perpetual Sales & Marketing Consultants). None of this potential revenue per ton upside has been modelled in this PFS but will be actively analysed and pursued in subsequent efforts.

Health and Safety

The Project will be delivered in accordance with highest health and safety standards and the Project execution is seen as low risk due to simple mining and operational requirements.

Environment

Considerable baseline environmental studies, commissioned by Tiwest (now Tronox) for its Dongara titanium minerals project, immediately adjacent to the Beharra Project, have been procured from Tronox via a data share arrangement.

This data significantly contributes to the Environmental Impact Assessment (EIA) process to support approvals for Beharra.

In addition, studies conducted to date by Perpetual to complement the extensive Tronox dataset and cover the following areas: flora and vegetation; terrestrial fauna; groundwater and groundwater dependent ecosystems; and heritage.

These past and ongoing efforts are considerable and are anticipated to enable Perpetual to achieve successful environmental approval in time. Perpetual will always adhere to a collaborative engagement process with the required state and federal departments as managing the environmental impact is acknowledged as a key element of a successful project.

Mine Rehabilitation

A comprehensive study was undertaken to determine the most suitable progressive rehabilitation method for the Beharra Project based on the existing environment. Consultation and benchmarking with other extractive sand miners in the local area as well as expert rehabilitation practitioners was undertaken to assist in developing the method. The chosen method of rehabilitation is seen as practical and effective while remaining economically viable.

Risk Assessment

The preliminary risk assessment was performed, and the Project was benchmarked against existing operations and detailed investigation of all aspects was undertaken. No fatal flaws have been highlighted and initial government and community engagement has been positive.

There were no risks categorised as fatal flaws and a risk management plan and risk register will be developed and maintained as part of the Definitive Feasibility Study (DFS) and further works. Project risks can be found in Section 8.

Capital and Operating Estimates

The capital estimate was compiled by Perpetual using pricing sought from suitably qualified vendors. Requests for quotation were circulated to the market via a competitive bid process for major items and recent historical pricing included where appropriate for minor plant and equipment. Perpetual considers that an exhaustive list of the capital items has been included in the capital estimates for the Beharra Project, as detailed in the table below.

The estimated capital requirement for the Project, inclusive of all direct, indirect, on-site and off-site infrastructure costs, is A$39.22 million. In addition, sustaining capital covering both operational and plant moves has been allowed for at A$1.2 million per annum.

Table 1.5: Capital cost estimate

Capital	Cost (A$'000)
Process plant (including water distribution	19,287
Services and on-site infrastructure	3,537
Off-site infrastructure	9,272
Indirects, procurement construction management, and site office costs	2,338
Total development capital	**34,434**
Owner's costs	1,343
Owner's contingency (10%)	3,443
TOTAL PRE-PRODUCTION CAPITAL	**39,220**

The operating cost estimate includes all site-related operating costs associated with mining and processing ore to produce a >99.5% + silica sand product including transport on an FOB ship basis. A base estimate mining rate of nominally 2.0 Mtpa was established and on this basis the nett cost per tonne of product on an FOB basis is calculated to be A$43.07/t and A$66.1 million for the first five years at full production.

Table 1.6: Operating cost estimate

Capital	Cost per annum (A$'000)	$A/t ore	A$/t production
Mining ROM + OB	10.6	5.18	6.97
Processing	5	2.46	3.31
Reject haulage	0.6	0.29	0.36
Administration	2.4	1.18	1.58
Transport + Port	39.4	19.4	26.09
Rehabilitation	1.8	0.43	0.58
Contingency	2.8	1.4	1.88
Royalty	3.5	1.71	2.3
TOTAL OPEX	**66.1**	**32.05**	**43.07**

The capital and operating costs are in line with similar types of industrial minerals projects.

Financial Analysis

The financial analysis completed by Perpetual has been performed using discounted cash flow (DCF) analysis. All amounts are in Australian dollars (A$) and are nominal. Variability of input assumptions for capital, operating and sales price has been assessed using sensitivity analysis.

The key assessment criterion is the internal rate of return (IRR) on a nominal, after tax basis. Net present value (NPV) (@ 10%, nominal after tax), payback periods and capital funding requirements have also been assessed.

Beharra Project Economics	Unit	Base Case
Total Silica Sand Produced	Mt	48
Annual Production	Mt	1.5
In-situ Probable Ore Reserve (@ 98.6% SiO_2)	Mt	64
Ore Reserve Life	Years	32
JORC Mineral Resource Estimate (@ 98.6% SiO_2)	Mt	139
Total Life of Mine Revenue	A$M	4,983
Start-up Capital	A$M	39
Total Life of Mine Capital Expenditure	A$M	77
Total Life of Mine EBITDA	A$M	1,714
Total Life of Mine Free Cashflow	A$M	1,131
Post-tax Discounted Cashflow (NPV_{10}) - ungeared	A$M	231
Post-tax Internal Rate of Return (IRR) - ungeared	%	55%
Post-tax Discounted Cashflow (NPV_{10}) - 40% geared	A$M	236
Post-tax Internal Rate of Return (IRR) - 40% geared	%	77%
Payback Period	Years	2
Year 1 FOB Costs	A$/t	43.07

Figure 2 **Key assessment criterion**

Summary

The Beharra PFS results confirm a highly cash positive mineral resource project. This outcome has been realised even when applying a conservative approach to all aspects of the study scope and costings.

Moving forward, reduction of capital and operating costs will be a key focus of future study efforts with potential for revenue increase by way of achieving higher final product yield, sourcing of additional higher priced markets, improvements in the impurity profile of Beharra end-product which may lead to increased revenue per tonne of product sold, and investigations of expansion cases will be thoroughly explored.

Perpetual is engaged in a variety of regulatory and development works for the Beharra Project. The overall timeline for development, permitting and approval activities is targeting commencement of construction in Q2 2022 with commencement of mining and processing operations in Q4 2022. The schedule is contingent upon regulatory and funding approvals as demonstrated in the schedule below.

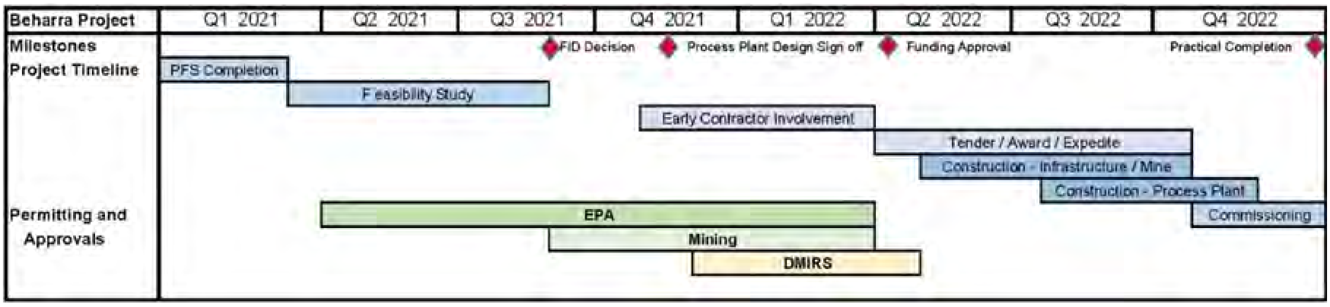


Figure 3 **Beharra Project timeline and permitting and approvals**

Opportunities and further works that have presented themselves during the study process are inclusive of but not limited to the following:

- Selective processing of the white sand horizons which have potential to produce a lower impurity end-product which has potential to achieve a higher revenue per ton of product sales price
- Campaign mining and processing scenarios that may have the potential to reduce operating costs
- Dry mining and slurrification option (hydro-transport of run of mine (ROM)) which will potentially reduce operating cost
- Potential truncation and simplifying of the metallurgical flowsheet to lower capital and operating costs whilst achieving a 200–300 ppm Fe_2O_3 product
- Freight alternatives such as road + rail or rail which have potential to reduce operating costs

- Direct port access as part of Mid-West Ports expansion project which could lead to increased sales tonnage and a reduction in unit costs
- Reduction of initial capital such as off-site infrastructure costs – for example, road intersection and upgrades (conversion to opex or shared costs with other operators)
- Investigations of expansion cases in terms of increased plant throughput.

1. INTRODUCTION

1.1 SCOPE OF STUDY

1.1.1 Report objectives and scope

This PFS addresses the greenfield development potential of Perpetual's Beharra Silica Project. The Beharra Project is fully owned by Perpetual.

The PFS examines the requirement for the project to generate a >99.5%+ SiO_2 purity silica sand product at a production rate of nominally 1.51 Mtpa. The purpose of the study is to develop capital costs and operating costs to a level of ±25% accuracy, based on JORC 2012 compliant Mineral Resource and Ore Reserve estimates.

Scope of study includes:

- Geology and Resources
- Mining, material handling and Reserves
- Metallurgy and process plant
- Infrastructure
- Product handling and ship loading
- Permitting, community and environment
- Industrial relations
- Capital and operating costs
- Financial assessment
- Risk management
- Implementation schedule and plan.

The study includes recommendations and proposals for works going forward to further define operating parameters, capital estimation and resultant financial performance. These opportunities provide an avenue to add value to the Project by lowering operating costs and reducing operating complexity.

1.1.2 Methodology

In considering the requirements for the proposed Beharra Project, selected industry consultants and companies were engaged, including key professionals with significant experience in silica and mineral sands operations.

The core objectives adopted during the PFS are listed below:

- Act in a responsible and respectful manner when engaging with all stakeholders
- Maintain and comply with the JORC 2012 guidelines for project development
- Further develop and quantify the mineral resource and upgrade the Mineral Resource estimate (MRE)
- Carry out a representative bulk metallurgical program using composite samples derived from previous drill programs
- Ensure the metallurgical program employed full size or genuinely scalable separation equipment in order to ensure real world results and identify the most amenable and cost-effective processing path (i.e. a physical separation lab)
- Identify achievable silica product(s) specifications
- Expend sufficient engineering effort to meet the ±25% confidence factor for the capital expenditure (CAPEX) estimate
- Provide the Board of Perpetual with a comprehensive PFS document.

During this phase of study, much energy was directed towards further defining the mineral resource and conducting a representative bulk metallurgical test program to identify a sustainable final silica product quality.

In parallel, further drilling was carried out under the direction of Competent Persons for exploration and resource estimation with the view to upgrade the MRE and further confirm the consistency of the orebody.

In relation to the development of the process and conceptual plant design, traditionally in the mineral sands industry, plant designs are bespoke by nature and require a significant engineering effort to be expended during study phases to quantify the plant and equipment. This is required due to the often highly variable mineral assemblages and convoluted retreat processes to arrive at either concentrate or final products.

By contrast, silica beneficiation plants are diametrically opposed in many ways to the heavy mineral sands industry in so much that rather than processing large throughputs in order to extract a relatively low grade of heavy mineral concentrate, silica operations generally provide high product yields returning relatively low ratio of rejects to the mine pit.

Given these much lower processing rates, they are more closely related to the quarrying and aggregates industry; this creates additional opportunities to access an array of package plants routinely operating in this sector.

With this in mind, the adopted strategy in relation to this processing plant involved the development of solid base engineering documentation and then the production of a very prescriptive Scope of Work (SoW) – attached at Appendix 1 – that was fielded to appropriately qualified package plant providers.

This SoW included metallurgical data, process flow diagrams and basis of design documents including firm battery limits in relation to the scope of supply. The process design and engineering design documents are attached at Appendix 2 and Appendix 3, respectively.

In relation to mine infrastructure, generally a minimalistic approach was applied to the operation, and enquiries were fielded to a variety of vendors for pricing in relation to site amenities, roadways, power supply etc.

Fortuitously, there is a wealth of information available in many aspects relating to the Mid-West coast of Western Australia (WA) that has been investigated by either active or prospective major mineral sands operators. This provided a good platform for additional investigations by Perpetual's nominated consultants.

The study is to a PFS level for the capital and operating costs, based on a JORC 2012 compliant Ore Reserve.

The format of this report is:

- Executive Summary
- Introduction (Project overview) – Chapter 1
- Individual sections of the report – Chapters 2 to 14
- Supporting appendices.

1.1.3 Conventions

Table 1.1 Study conventions

Acronym	Description of convention
$/t	Australian dollars per tonne of product
$/ha	Australian dollars per hectare
$c/kwhr	Australian dollars and cents per kilowatt hour
$/litre	Australian dollars per litre
ADT	Articulated dump truck
AFS No.	American Foundry Society Number
aka	Also known as
APAC	Asia Pacific
ASX	Australian Stock Exchange
Al_2O_3	Aluminium oxide
Allied PD	Allied Project Developments
ARC	ARC Infrastructure
AUD	Australian dollar

Acronym	Description of convention
BCM	Bank cubic metre
BOOM	Build-own-operate-maintain
CAGR	Compound annual growth rate
CAPEX	Capital expenditure
CCIWA	Chamber of Commerce and Industry Western Australia
CCTV	Closed circuit television
CMS	Contractor Management System
Company	Perpetual Resources Limited
CP	Competent Person (as outlined under the JORC 2012 guidelines for project development)
DCF	Discounted cash flow
dt	Dry tonnes
DFS	Definitive Feasibility Study
DMIRS	Department of Mines, Industry Regulation and Safety
DMSU	Dry mining slurrification unit
DPLH	Department of Planning, Lands and Heritage
DSO	Direct shipped ore
DWER	Department of Water and Environmental Regulation
EBITDA	Earnings before interest, taxes, depreciation and amortisation
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
PCM	Procurement construction management
Fe	Iron
Fe_2O_3	Iron oxide
FEL	Front-end loader
FPP	Feed preparation process
FOB	Free on board
FTE	Full-time employee
GCP	Gravity concentration process
g/t	Grams per tonne
GL	Gigalitre
GPS	Global positioning system
Gravcon	Gravcon Consultants
GW	Giga watts
GWhpa	Giga watt hours per annum
ha	Hectares
HCl	Hydrogen chloride
HHMP	Health and Hygiene Management Plan
HRA	Health Risk Assessment
HR/IR	Human Resources/Industrial Relations
HSEC	Health, Safety, Environment and Community
ICP	Inductively coupled plasma
IHCR	IHC Robbins
ILUA	Indigenous Land Use Agreement
IRR	Internal rate of return
IPP	Independent power provider

Acronym	Description of convention
JORC	(Australian) Joint Ore Reserves Committee (Guidelines 2012)
kdt	Thousands of dry tonnes
kg/t	Kilograms per tonne
kl	Kilolitre(s)
km	Kilometre(s)
km^2	Square kilometres
LOD	Level of detection
LOI	Loss on ignition
LOM	Life of mine
LTI	Lost-time injury
M	Million(s)
m^3	Cubic metres
m^3/hr	Cubic metres an hour
Mdt	Million dry tonnes
MI	Mining Insights Pty Ltd
MG12	Spiral Separator
ML	Mining Lease
mm	Millimetres
Mm3	Million cubic metres
MRE	Mineral Resource estimate
MRWA	Main Roads Western Australia
Mt	Million tonnes
Mtpa	Million tonnes per annum
MUP	Magnetic Upgrade Process
MWPA	Mid-West Ports Authority
NPV	Net present value
OEM	Original equipment manufacturer
OPEX	Operational expenditure
O/S	Oversize
PEP	Project Execution Plan
Perpetual	Perpetual Resources Limited
PCS	Project Consultancy Services Pty Ltd
PFS	Prefeasibility study
PSD	Particle size distribution
PPE	Personal protective equipment
ppm	Parts per million
P50	50% product passing size
P80	80% product passing size
PV	Photovoltaic
QAQC	Quality assurance/quality control
RCS	Respirable crystalline silica
ROM	Run of mine
RSO	Radiation Safety Officer
SiO_2	Silicon dioxide
SG	Specific gravity

Acronym	Description of convention
SMP	Safety management plan
SoW	Scope of Work
t	Tonnes
t/m^3	Tonnes per cubic metre
tph	Tonnes per hour
TDS	Total dissolved solids
TiO_2	Titanium dioxide
UCC	Up-current classifier
µm	Micrometre (also called micron)
US$	United States dollar(s)
UTM	Universal Transverse Mercator
WA	Western Australia
WBS	Work breakdown structure
WHS	Workplace Health and Safety
WES	Workplace Exposure Standard
WHIMS	Wet high-intensity magnetic separation
XRF	X-ray fluorescence

1.2 SITE CONDITIONS

1.2.1 Location and site description

The Beharra Project is located in WA, approximately 100 km south of the port town of Geraldton. The Project location is shown in Figure 1.1.

Figure 1.1 Project location

The project area lies north and south of Mount Adams Road, is relatively flat to mildly undulating, and covered with low heath woodland. The total profile is sand and there are no seasonal watercourses. An example of the heath woodland is shown in Figure 1.2.

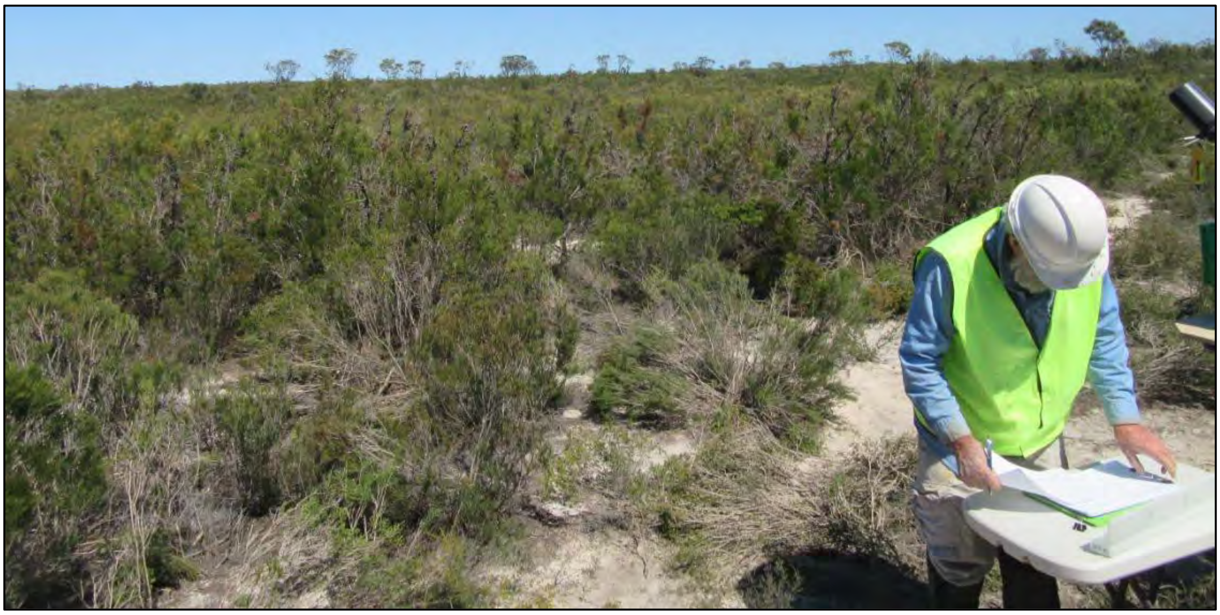


Figure 1.2 Representative site conditions and heath woodland

1.2.2 Access and transport

Access to the Project site from Geraldton (to the north) and Perth (to the south) is via the sealed Brand Highway, then the unsealed Mount Adams Road providing access to the centre of the tenure. The western end of Mount Adams Road links to the Perth-Geraldton railway via Carsons Road.

Separate studies have been conducted into road and rail transportation with transportation of final product by road being selected at this stage of the Project. Rail has not been discounted and is being considered as a future opportunity requiring further investigation as project development progresses. Pursuing a road transport scenario in early years affords Perpetual maximum operating and production flexibility.

1.2.3 Climatic conditions

The average monthly temperature recorded at Carnamah and the average monthly precipitation recorded at Green Grove are provided in Figure 1.3 and Figure 1.4, respectively. These provide an indication of the expected temperature and rainfall on the Beharra project site.

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	36.1	35.6	32.8	27.7	22.7	19.2	18.0	19.2	22.1	26.2	30.3	33.6	26.9
Lowest	33.2	31.9	28.8	23.8	19.9	16.5	15.6	16.6	18.6	22.1	26.0	29.9	25.3
5th %ile	33.6	33.1	30.3	24.9	20.6	17.1	16.5	17.5	19.9	23.4	27.3	31.3	25.7
10th %ile	34.0	33.4	30.6	25.5	21.0	17.5	16.8	17.8	20.4	23.8	27.8	31.7	26.0
Median	35.8	35.7	32.8	27.8	22.5	19.3	18.0	19.2	22.2	26.3	30.3	33.5	26.9
90th %ile	38.1	37.6	34.7	29.9	25.0	20.8	19.6	20.8	23.6	28.4	32.7	35.3	27.9
95th %ile	38.6	38.0	35.2	30.1	25.2	21.4	20.1	21.1	24.4	28.7	33.5	36.0	28.2
Highest	39.5	38.9	35.8	31.4	26.1	22.9	20.4	24.0	25.6	30.2	38.0	38.1	29.1

Figure 1.3 Average maximum and minimum temperatures

Source: http://www.bom.gov.au

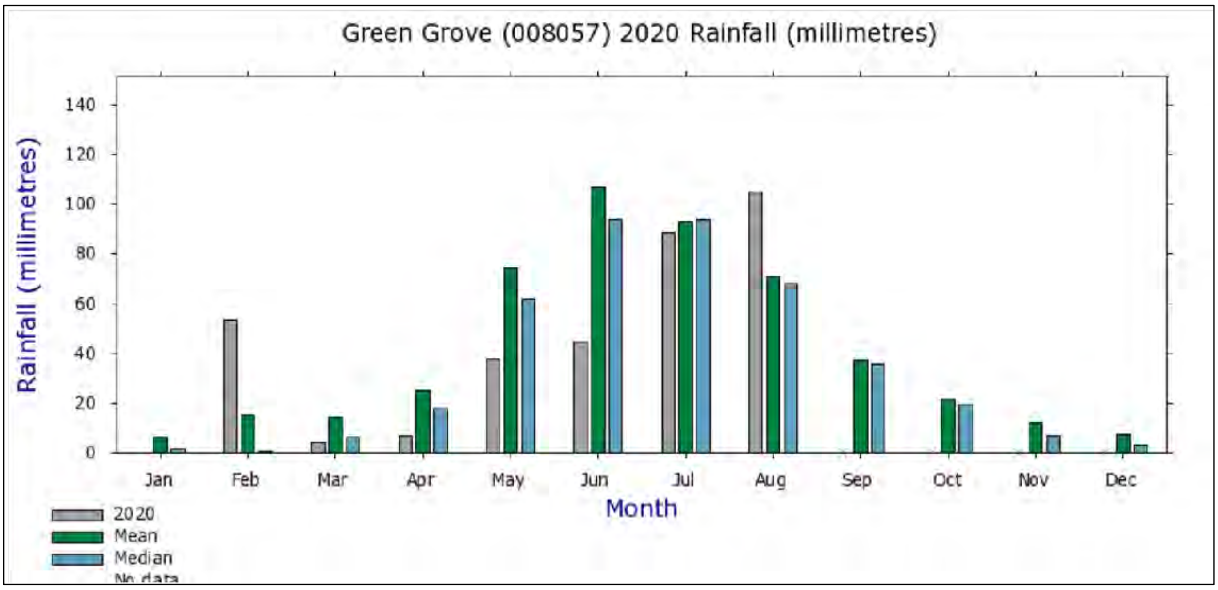


Figure 1.4 **Average monthly precipitation**

Source: http://www.bom.gov.au

1.2.4 Local infrastructure

The Project is located south of Geraldton, which hosts a regional airport, accommodation, and health care facilities. Given the size of the commercial and industrial centre, the city is well placed to support the operation, inclusive of goods, services, and labour supply.

The Port of Geraldton is fully established and operational. The port is multimodal and will provide a location from which final product can be barged.

1.2.5 Population and socioeconomics

The Mid-West region shown in Figure 1.5 covers nearly one-fifth of WA's land area, spanning around 478,000 km^2 from Green Head to Kalbarri and more than 800 km inland to Wiluna in the Gibson Desert. The region is divided into three subregions that demonstrate similarities in environment, land use, demography, and industry. These are the Batavia Coast, Murchison, and North Midlands sub-regions.

Figure 1.5 **Mid-West region, WA**

Source: DPIRD – WA – Mid West

The Mid West has a diverse economy built around mining, agriculture, tourism, and fishing. Mining is its most valuable sector, with a range of minerals and energy deposits available including gold, iron ore, copper, nickel, silver, mineral sands, natural gas, and silica sand. Demand for the region's resources has driven a rise in employment, triggering a number of new mining and construction projects and job growth in associated service sectors.

1.2.6 Geraldton

Geraldton, the region's capital, is currently in the midst of an economic expansion and has significant capacity for further growth. Land availability is good, housing prices are affordable and existing infrastructure is well-established.

Strong business and economic connections exist between Geraldton and the Pilbara. Cutting edge science and technology will complement mining activity in the region and bring a variety of economic, training and education opportunities for its residents.

Geraldton is located 418 km (4.5 hours) by road northwest of Perth and 64 km (45 minutes) north of Dongara. Geraldton's relationship to the Beharra project site by road is nominally 100 km (1 hour and 6 minutes). Figure 1.6 refers.

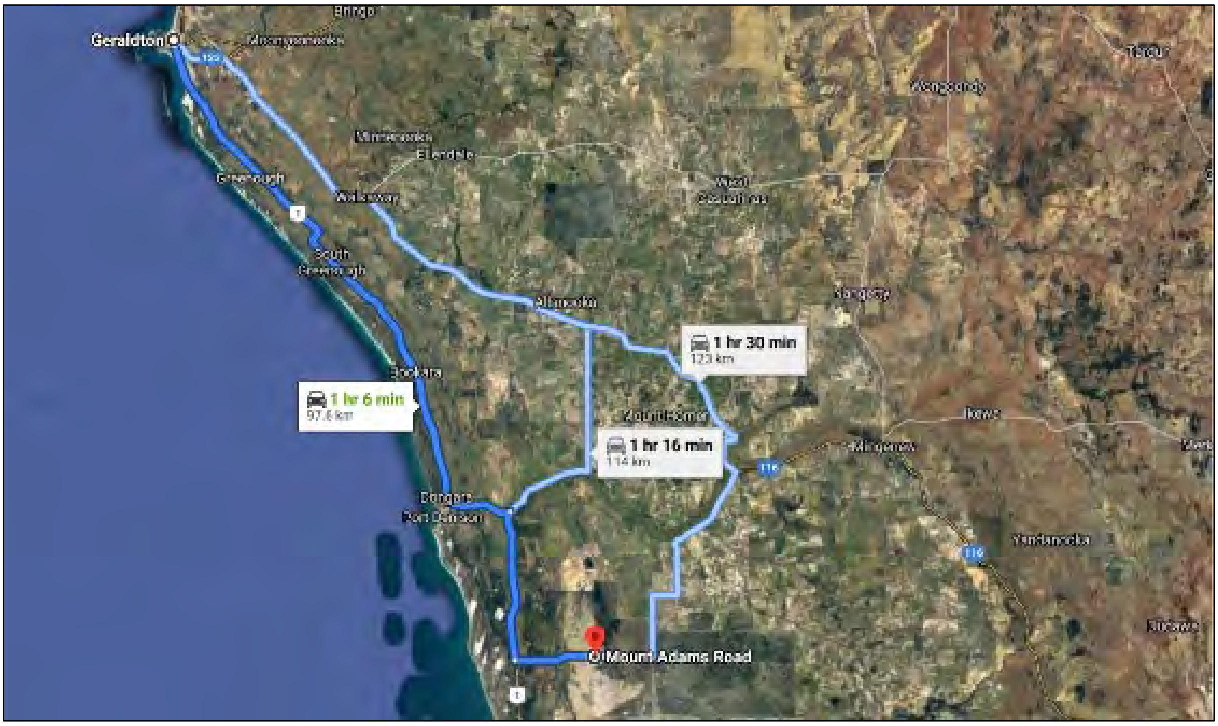


Figure 1.6 Geraldton to site

Source: Google Maps

1.2.7 Dongara – Port Denison

Dongara is located at the mouth of the Irwin River, nominally 350 km north-northwest of Perth accessed via the Brand Highway. Dongara is the seat of the Shire of Irwin which has a population of approximately 3,569, with 2,782 residing in the towns of Dongara and Port Denison. Dongara's relationship to the Beharra project site by road is nominally 33 km (23 minutes). Figure 1.7 refers.

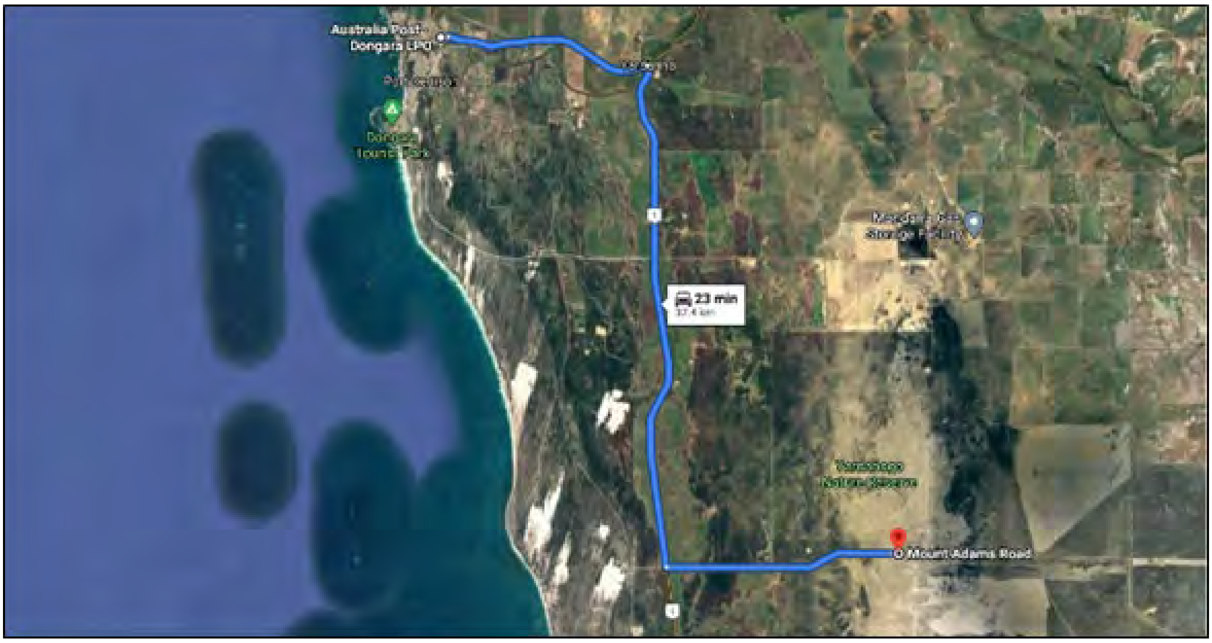


Figure 1.7 Dongara to site

Source: Google Maps

1.2.8 Land use, flora and fauna

The project area lies to the north and south of Mount Adams Road. Apart from this road, some minor tracks and small areas of disturbance from previous exploration activities, the vegetation and soils are undisturbed. The area is part of a much larger expanse of native vegetation that is connected to Yardanogo Nature Reserve in the west and forms a broad corridor of native vegetation between cleared agricultural land. Clearing to the east is particularly extensive, but there are large reserves to the west and southwest.

1.3 PERMITS AND AUTHORISATIONS

1.3.1 Government policy and regulations

Key legislation and associated permits relevant to the Beharra Project are defined in Table 1.2. Perpetual has commenced the preparation of State and Federal statutory permits to enable the continued development of the Beharra Project.

Table 1.2 Approvals and permitting

Primary health, safety and environmental approvals and permitting – Project-specific				
Legislation	**Permit**	**Department**	**Description**	**Estimated submission**
Environmental Protection and Biodiversity Conservation Act 1999	Part 7 Referral and EIA	Department of Agriculture, Water and the Environment	Assessment and approval of impacts to the Carnaby's Cockatoo	Q2 2021
Environmental Protection Act 1986	Part IV Referral and EIA	Environmental Protection Authority Department of Water and Environmental Regulation	Assessment and approval of impacts to terrestrial fauna, flora and vegetation factors	Q2 2021
	Part V Works Approval and Licence	Department of Water and Environmental Regulation	Prescribed activities licence to enable on site processing of ore	Q4 2021
Mining Act 1978	Mining Proposal	Department of Mines, Industry Regulation and Safety	Approval for the construction of mine infrastructure and undertaking mining activities	Q4 2021

Primary health, safety and environmental approvals and permitting – Project-specific				
Legislation	**Permit**	**Department**	**Description**	**Estimated submission**
	Mine Closure Plan	Department of Mines, Industry Regulation and Safety	Defines rehabilitation and closure prescriptions and accompanies the Mining Proposal	Q4 2021
Mines Safety and Inspection Act 1994	Project Management Plan	Department of Mines, Industry Regulation and Safety	Project safety plan approval	Q4 2021
Rights in Water and Irrigation Act 1914	26D Licence to Construct a Well	Department of Water and Environmental Regulation	Enables the construction of a water supply bore/s	Q4 2021
	5C Licence to Abstract Water	Department of Water and Environmental Regulation	Enables the abstraction and use of water from supply bore/s	Q4 2021

2. MARKET ANALYSIS

2.1 SILICA SANDS

Silica sand, also called industrial sand, is primarily composed of quartz and other materials, such as feldspars, carbonates, clay mineral, iron oxides, etc. Silica sand finds diverse applications in glassmaking, hydraulic fracturing, water filtration, industrial casting, sandblasting, etc. This can be accredited to its several benefits, such as high granularity, strength, durability, better resistance against heat and chemical reactions, etc.

Silica sand forms the major ingredient among natural raw materials required for glass making, and it is also used in foundry, ferro-silica alloy and cement industries besides being used in many other industries like ceramic, fertiliser, abrasives, chemical, coal washery, electrode, paint, rubber, textile, water filtration, construction, etc.

The primary end use market suitable to Beharra product is the glass industry, with a secondary focus on the foundry industry. The glass goods industry is growing in APAC (IMARC Report SR090221K2), especially in countries such as China, Japan, South Korea, India, and many other South-East Asian countries such as Vietnam, Thailand, Indonesia, etc. Major global players in the glass industry are shifting their production base to APAC countries. Rapid industrialisation, urbanisation and increasing adoption of smart and energy-efficient methods are driving glass production rates throughout the region. Furthermore, the use of specialty glass in electronic materials in developed countries, such as Japan, is projected to drive the market in the future.

A sample of silica sand from the Beharra project site is shown in Figure 2.1.

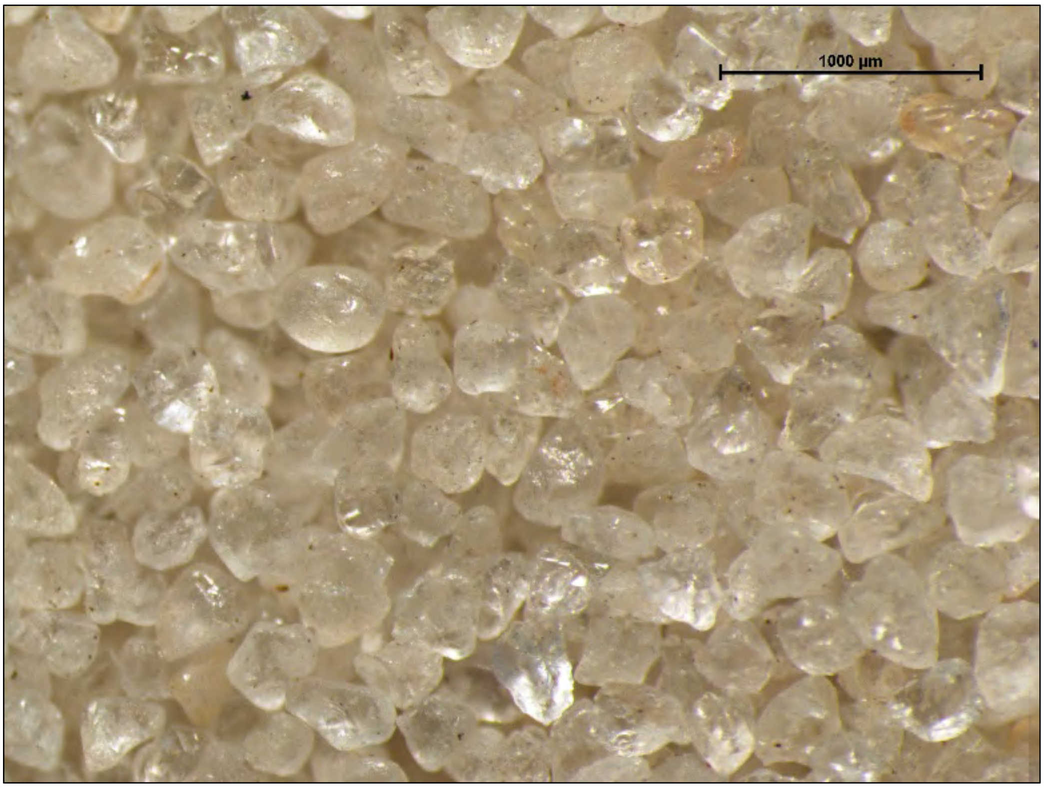


Figure 2.1 Silica sand microscopy– Beharra Project

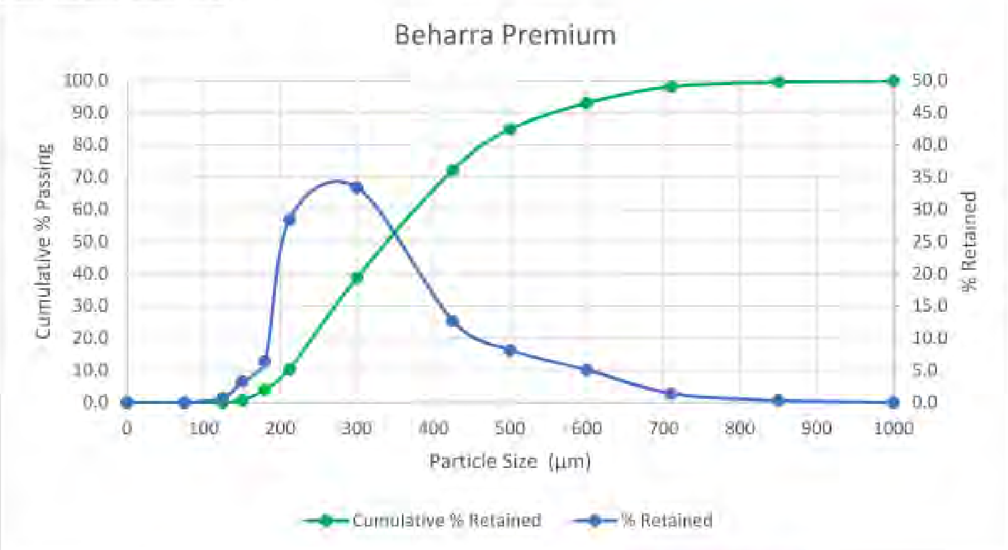
2.1.1 Product specifications

Three products have been produced as a result of the metallurgical test program conducted during the PFS: Beharra Premium#44, Beharra Special #27, and Beharra Special #46.

The yield to Beharra Premium #44 represents 74.4% of the bulk ROM feed sample, derived from Beharra Special #27 and Beharra Special #46 combined to form the single saleable glass sand product being used as the basis for the PFS.

Product specifications are provided in the technical data sheets located in Figure 2.2, Figure 2.3 and Figure 2.4, respectively.

Typical Grain Analysis



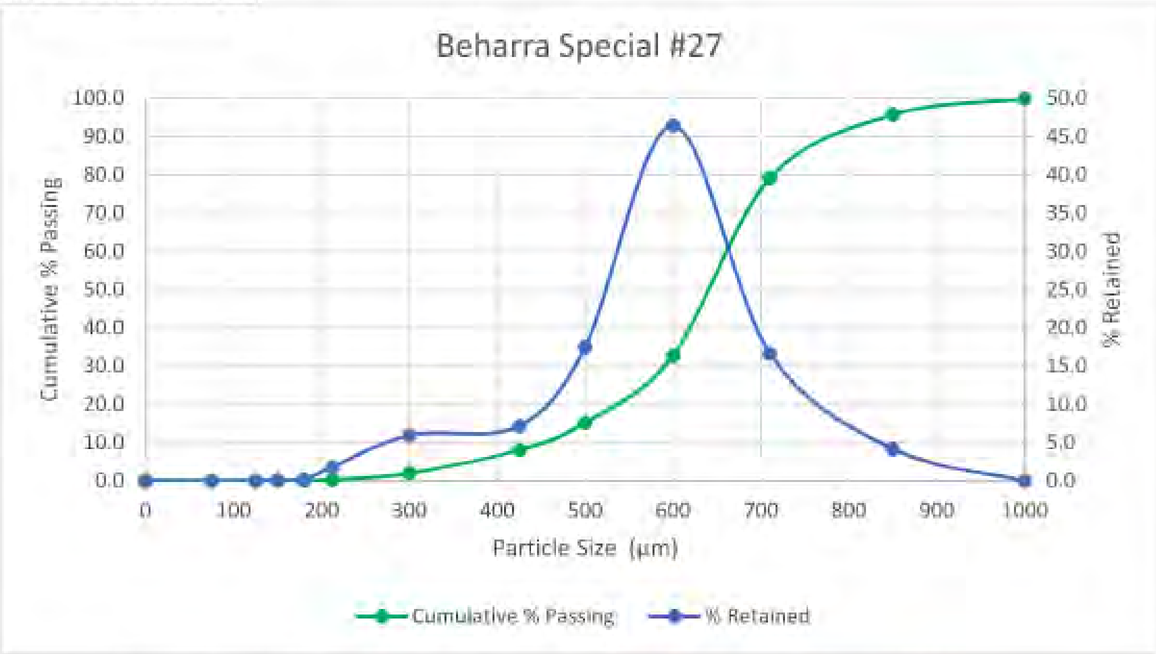
Typical Product Sizing		Beharra Premium		
ASTM Sieve	Micron(µm)	Retained %	Cum. Retained%	Cum. Passing %
No. 18	1000 µm	0.0	0.0	100.0
No. 20	850 µm	0.4	0.4	99.6
No. 25	710 µm	1.4	1.8	98.2
No. 30	600 µm	5.1	6.9	93.1
No. 35	500 µm	8.1	15.0	85.0
No. 40	425 µm	12.7	27.7	72.3
No. 50	300 µm	33.4	61.1	38.9
No. 70	212 µm	28.5	89.6	10.4
No. 80	180 µm	6.4	96.0	4.0
No. 100	150 µm	3.3	99.3	0.7
No. 120	125 µm	0.7	100.0	0.0
	Total	100.0	-	-
P_{50} (µm)		338		
P_{80} (µm)		469		
AFS No.		44		

Typical Chemical Composition	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O
	%	ppm	ppm	ppm	ppm	ppm	ppm
Beharra Premium	99.6	1,789	276	369	59	29	179

Typical Physical Properties	Density	Hardness	PH level	Moisture	LOI
Beharra Premium	2.65	7	7	<5%	0.1%

Figure 2.2 Beharra Premium technical data

Typical Grain Analysis



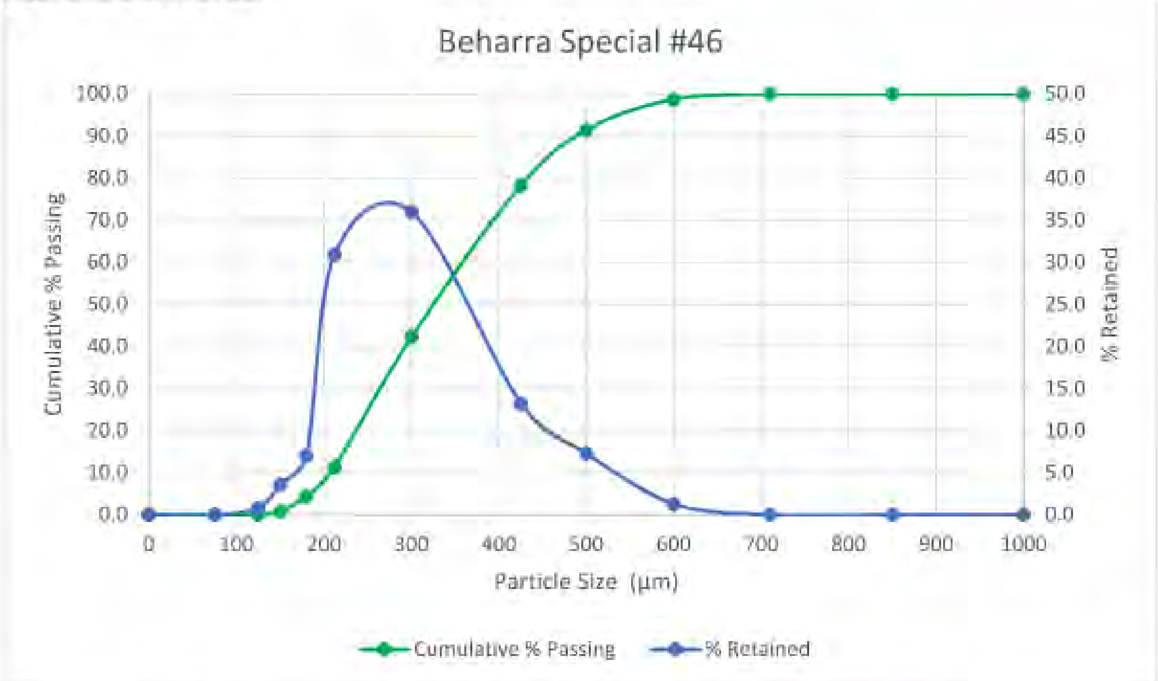
Typical Product Sizing		Beharra Special #27		
ASTM Sieve	Micron(µm)	Retained %	Cum. Retained%	Cum. Passing %
No. 18	1000 µm	0.0	0.0	100.0
No. 20	850 µm	4.2	4.2	95.8
No. 25	710 µm	16.6	20.8	79.2
No. 30	600 µm	46.5	67.3	32.7
No. 35	500 µm	17.5	84.8	15.2
No. 40	425 µm	7.2	91.9	8.1
No. 50	300 µm	6.0	97.9	2.1
No. 70	212 µm	1.8	99.7	0.3
No. 80	180 µm	0.2	99.9	0.1
No. 100	150 µm	0.1	100.0	0.0
	Total	100.0	-	-
P_{50} (µm)	639			
P_{80} (µm)		716		
AFS No.		27		

Typical Chemical Composition	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O
	%	ppm	ppm	ppm	ppm	ppm	ppm
Beharra Special #27	99.7	1,405	235	300	50	20	60

Typical Physical Properties	Density	Hardness	PH level	Moisture	LOI
Beharra Special #27	2.65	7	7	<5%	0.1%

Figure 2.3 Beharra Special # 27 technical data

Typical Grain Analysis



Typical Product Sizing		Beharra Special #46		
ASTM Sieve	Micron(µm)	Retained %	Cum. Retained%	Cum. Passing %
No. 25	710 µm	0.0	0.0	100.0
No. 30	600 µm	1.3	1.3	98.7
No. 35	500 µm	7.3	8.5	91.5
No. 40	425 µm	13.2	21.7	78.3
No. 50	300 µm	36.0	57.7	42.3
No. 70	212 µm	30.9	88.7	11.3
No. 80	180 µm	7.0	95.6	4.4
No. 100	150 µm	3.6	99.2	0.8
No. 120	125 µm	0.8	100.0	0.0
	Total	100.0	-	-
P_{50} (µm)		324		
P_{80} (µm)		434		
AFS No.		46		

Typical Chemical Composition	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O
	%	ppm	ppm	ppm	ppm	ppm	ppm
Beharra Special #46	99.6	1,825	280	375	60	30	190

Typical Physical Properties	Density	Hardness	PH level	Moisture	LOI
Beharra Special #46	2.65	7	7	<5%	0.1%

Figure 2.4 Beharra Special #46 technical data

It should be noted that Perpetual continues to analyse and test the Beharra orebody and anticipates additional potential product streams will be identified. Perpetual aims to maximise the potential revenue per tonne from Beharra through optimisation of product specifications produced.

2.1.2 Demand forecasts

Perpetual engaged IMARC to provide a report, attached at Appendix 4, on the APAC silica sand market, incorporating industry trends, share, size, growth, opportunities and forecasts out to 2026.

APAC is amongst the largest consumers of silica sand based on its increasing utilisation in the glass and foundry industries as well as many other high growth applications. The current and forecast rising demand for silica sand in the APAC region is being driven by many factors, including the following:

- The rapid development of solar infrastructures is catalysing the installation of glass-based PV modules
- Increase in specialty glass demand due to the growing consumer electronics sector in the region
- Increasing demand for foundry sand in the automobile industry
- Manufacturing of PV panels and silicon-metal composite materials
- The expanding construction industry
- Rapid urbanisation propelling the demand for high-grade construction materials in both residential and commercial sectors
- The growing infrastructural investments in various countries, such as China, India, Japan, South Korea, Vietnam, etc.

The APAC silica sand market reached a value of US$5,133.7 million in 2020.

Looking forward, the APAC silica sand market is expected to reach a value of US$7,638.1 million by 2026, exhibiting a compound annual growth rate (CAGR) of 7.1% during 2021–2026. Figure 2.5 refers.

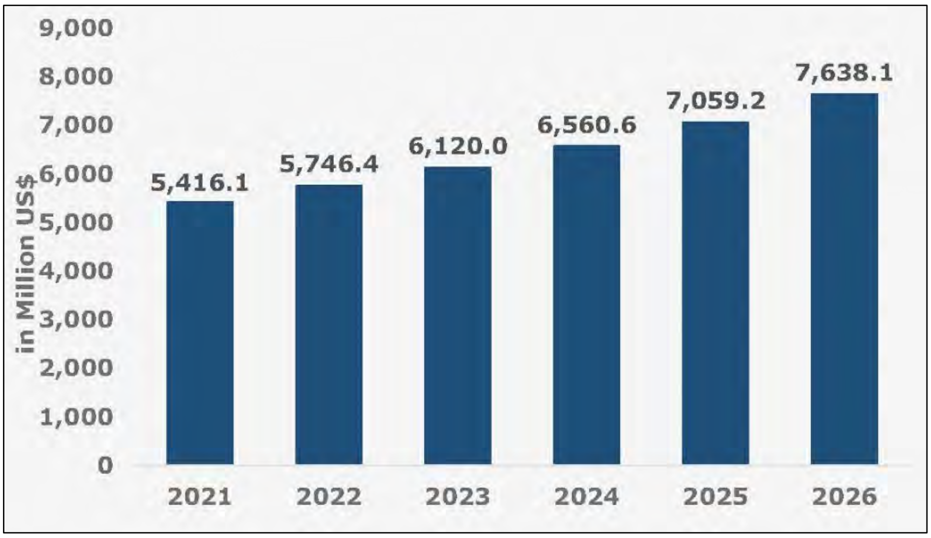


Figure 2.5 APAC silica sand market forecast consumption value (2021–2026)

Source: IMARC Group

Market growth is expected to reach a consumption volume 174.25 million metric tons by 2026, growing at a CAGR of 4.8% during 2021–2026. Figure 2.6 refers.

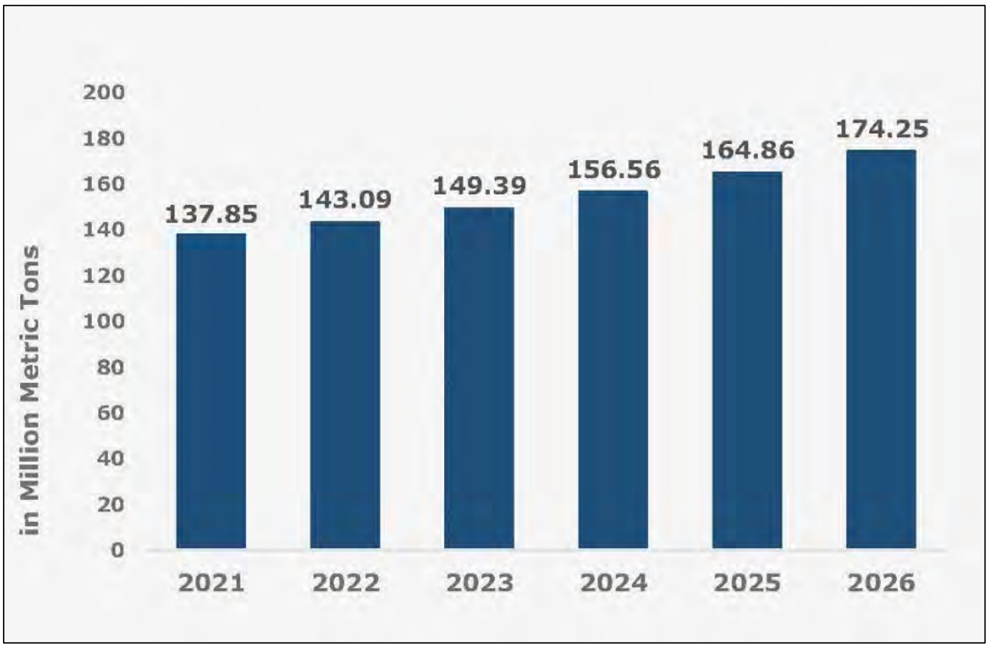


Figure 2.6 APAC silica sand market forecast consumption volume (2021–2026)
Source: IMARC Group

In 2020, the glass industry represented the largest end use sector for silica sand accounting for 37.6% of the total volume of the APAC silica sand market. See Figure 2.7 for end-use market breakup.

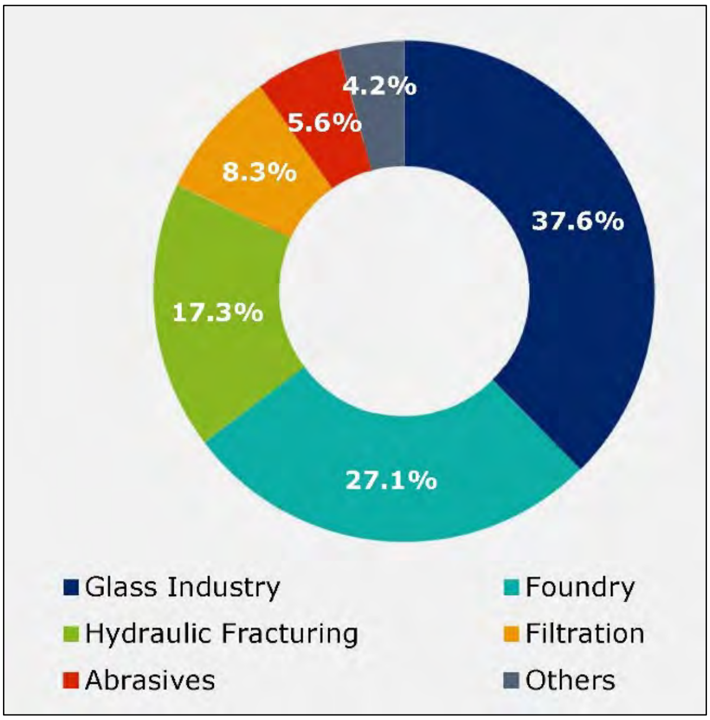


Figure 2.7 APAC silica sand market: breakup by end use
Source: IMARC Group

By 2026, the glass industry is expected to dominate the APAC silica sand market, accounting for 38.9% of the total market, with foundry sand applications the next largest, comprising 25.6% of the total market. Figure 2.8 refers.

Breakup by End Use	2021	2022	2023	2024	2025	2026	CAGR 2021-2026
Glass Industry	52.11	54.41	57.14	60.24	63.81	67.84	5.4%
Foundry	37.01	38.07	39.38	40.90	42.67	44.69	3.8%
Hydraulic Fracturing	24.01	25.11	26.42	27.91	29.61	31.54	5.6%
Filtration	11.52	12.05	12.68	13.39	14.21	15.14	5.6%
Abrasives	7.53	7.68	7.88	8.12	8.41	8.73	3.0%
Others	5.67	5.76	5.88	6.00	6.15	6.30	2.1%

Figure 2.8 APAC silica sand market forecast consumption value (2021–2026)

Source: IMARC Group

The growth for silica sand in glass making is attributed to increasing demand from the food and beverage sector, owing to rise in demand for transparency and hygienic packaging of products, as well as the rapid increase in architectural glass used in construction.

Emerging trends such as increasing usage of hybrid guide plate, solar control glazing for automotive and building glasses, lightweight glazing glass, and advanced nanotechnology in flat glass are also contributing towards the growth of the glass industry, consequently, boosting the demand for silica sand.

The forecast market in this segment is expected to reach a consumption volume of 67.84 million metric tons by 2026, exhibiting a CAGR of 5.4% during 2021–2026.

2.1.3 Supply forecasts

The supply market concentration ratio in 2019 for the APAC silica sand market is shown in Figure 2.9 and market share analysis in Figure 2.10.

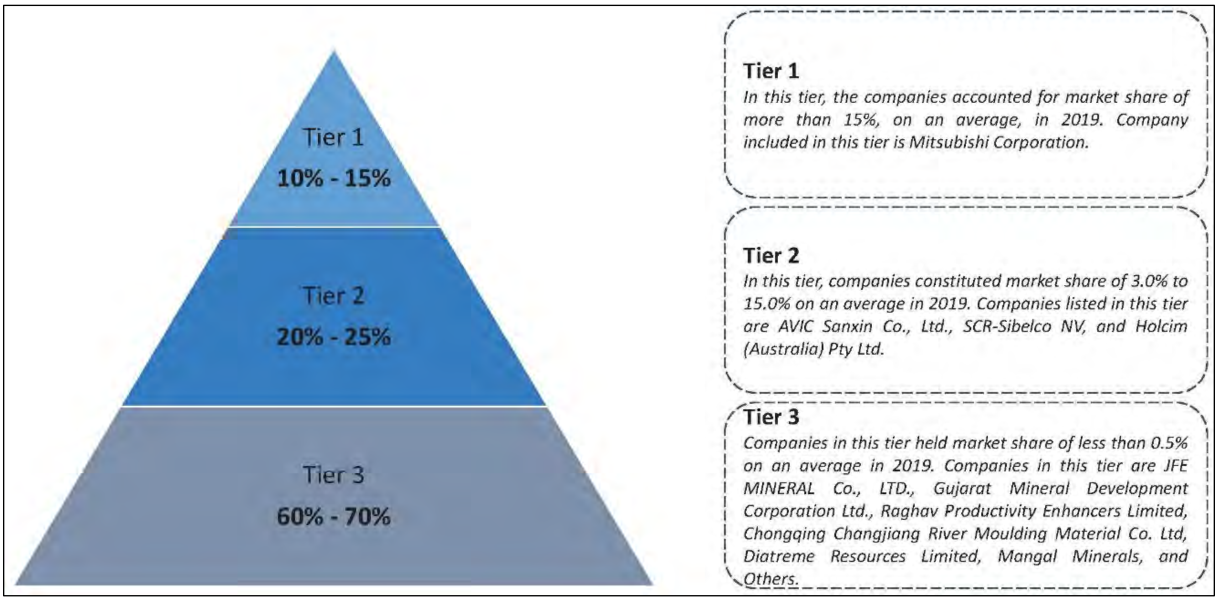


Figure 2.9 APAC silica sand market – supply market concentration ratio (2019)

Source: UMR Analysis

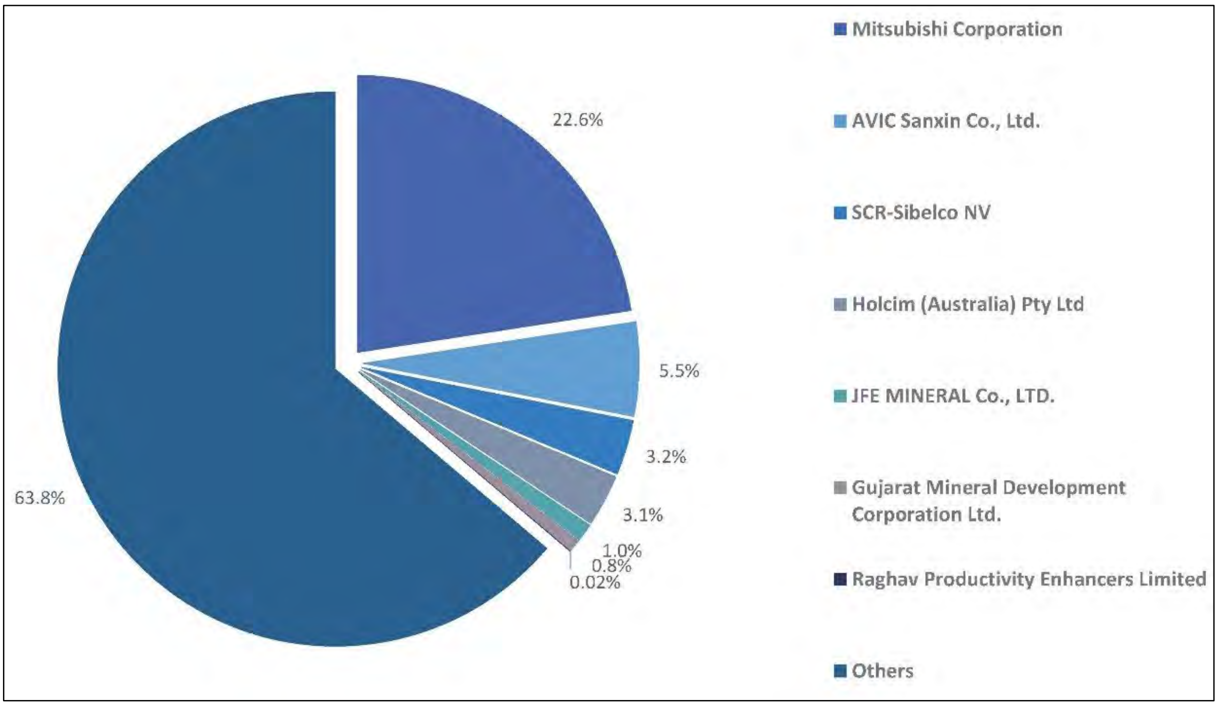


Figure 2.10 Market share analysis

Source: UMR Analysis

The Beharra Project will be competing within the larger Tier 3 supply market which consists of a multitude of companies, each having held a market share less than 0.5% on average.

2.1.4 Marketing strategy

Companies in the APAC silica sand market are expected to adopt the following strategies to compete in the market:

- New applications: The use of this sand in specialty glass used in the production of electronic components is projected to create opportunities for market players in the near future.
- Local suppliers: Sourcing local suppliers can reduce transportation costs and time taken for transportation. Choosing local supplier is projected to create opportunities for small local businesses to enter the market.
- Competitive prices: Currently, the APAC silica sand market is fragmented with many suppliers trying to sell their products. Selling the silica sand at competitive prices in the market can help suppliers to gain presence in the market, although this strategy is hampered by logistics costs and also the prevalence of suitable geological characteristics.
- Adoption of omni-channel concept: The adoption of online sales channels by companies is important, as many retailers are engaged in ordering products in bulk through online stores. Moreover, this strategy helps companies to withstand the uncertain crisis in the market such as COVID-19.

2.1.5 Target customers

The Beharra product can be supplied into the glass sand and foundry end use markets. Perpetual will be targeting potential customers in the APAC region within both these market areas.

2.1.6 Pricing assumptions

The price of silica sand varies according to the product grade and geographic region of end use. The main (but not only) determinant of silica sand product grade is the concentration of Fe_2O_3 in the final end-product, measured in parts per million (ppm).

The lower the ppm grade level, the higher the purity level of the silica sand.

In 2019, silica sand with 150–200 ppm recorded a price of between US$102.30 in China and US$184.50 per metric ton in Japan (refer Figure 2.11).

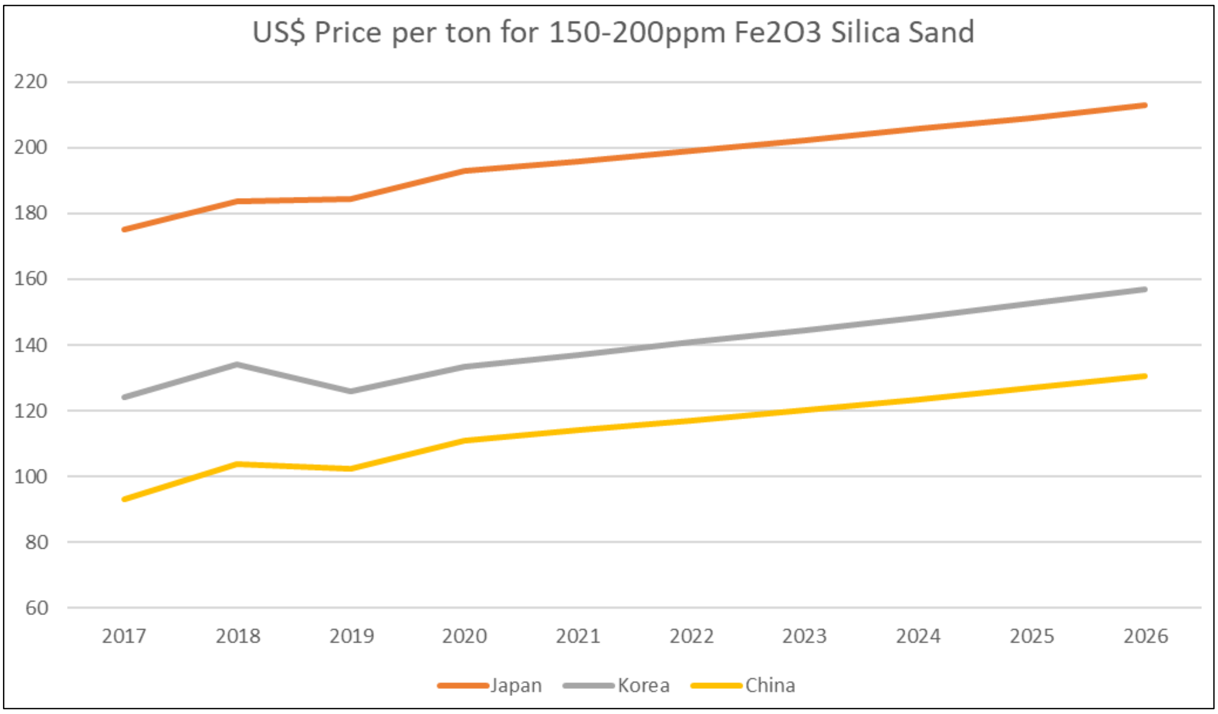


Figure 2.11 **Silica sand pricing in APAC region**
Source: IMARC

A very high purity silica sand of lowest ppm grade has become one of today's key strategic minerals with applications in high-tech industries including semiconductors, high temperature lamp tubing, telecommunications and optics, microelectronics and solar silicon applications. Due to its varied applicability, the demand for respective grade level has been increasing over the years, resulting in a consistent increase in its prices since 2017. Perpetual's metallurgical testing has not demonstrated an ability to service this market, although additional testing is underway to test Beharra silica sand for its suitability for this higher priced market.

Beharra metallurgical testwork to date has confirmed the Beharra end-product to be suitable for sale into the 200–300 ppm Fe_2O_3 markets in the APAC region. This market is a higher volume market which attracts lower pricing than the 150–200 ppm Fe_2O_3 markets, although still represents a compelling sales price and generates strong margins for the Beharra Project.

In 2019, silica sand with 200–300 ppm Fe_2O_3 recorded a price of between US$41.10 in China and US$71.60 per metric ton in Japan (refer Figure 2.12).

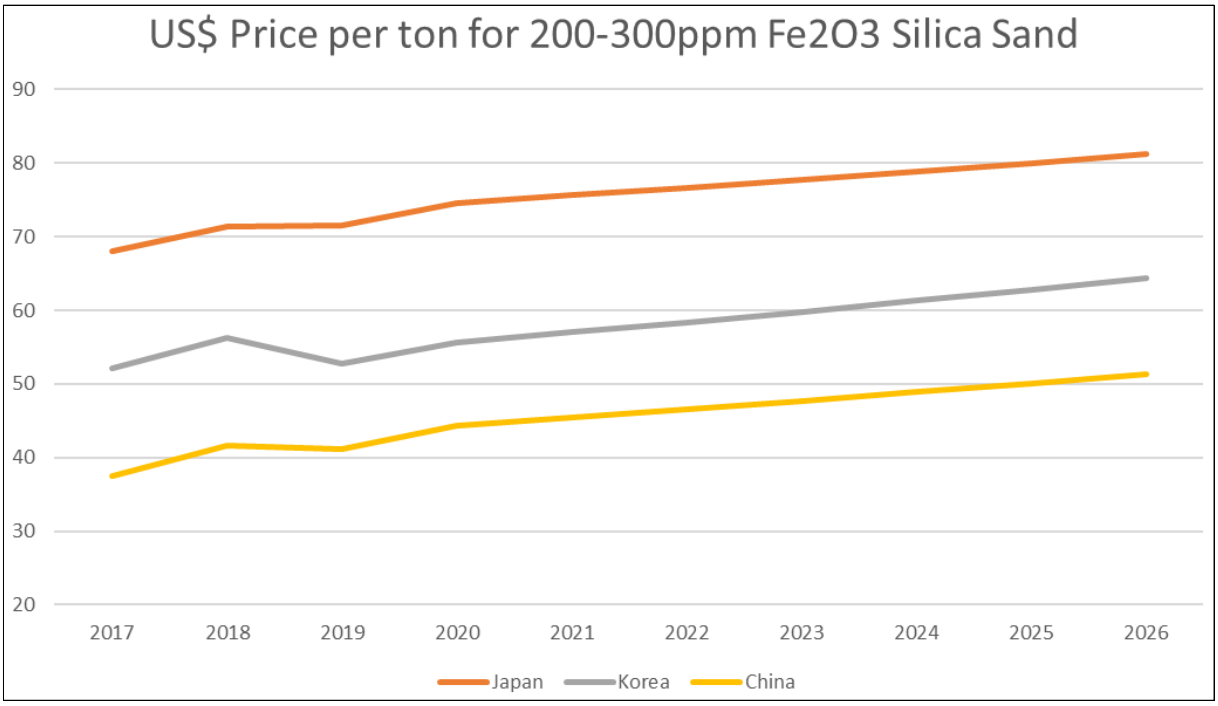


Figure 2.12 Silica sand pricing in APAC region

Source: IMARC

Perpetual has a strategy to optimise the potential revenue per ton from the Beharra Project and will continue to explore options for upgrading of product to achieve the premium prices enjoyed in the 150–200 ppm Fe_2O_3 silica sand markets.

As the Beharra products fall in the 200–300 ppm range in relation to Fe_2O_3, based on the above and advice provided by industry experts, Perpetual is confident that a sell price of US$50 per metric ton FOB Geraldton and above is achievable (Source: IMARC Report SR090221K2).

3. MINERAL SPECIFICS

3.1 GEOLOGY AND MINERAL RESOURCE

The MRE report (attached at Appendix 5) describes the Mineral Resource estimation completed by Snowden for Perpetual for the extent of the Beharra Project.

3.1.1 Geology and geological interpretation

Silica sand mineralisation at Beharra occurs within the coastal regions of the Perth Basin, and the targeted silica sand deposits are the aeolian quartz sand dunes that overlie the Pleistocene limestones and paleo-coastline.

3.1.2 Drilling, sampling and assaying

The Beharra deposit was initially explored in February 2019 using auger drilling across the southern extent of tenement E70/5221. A total of 38 holes to a maximum depth of 2 m were completed on a ~800 mE x ~400 mN grid, covering 7,215 m of strike and an average width of 1,700 m.

Following positive analytical results from the auger holes, 40 aircore drillholes for a total depth of 506.7 m were drilled between 18 and 23 March 2020. A sum of 509 samples were obtained, with one interval missing from the bottom of hole AC_20 below the water table; 502 of the assayed samples were 1 m in length, one was 1.5 m, five were 0.5 m, and one was 0.2 m in length. X-ray fluorescence (XRF) assays were obtained for 509 samples analysed by Nagrom and 485 assay results were obtained by inductively coupled plasma (ICP) techniques from Intertek Genalysis.

Following the maiden MRE in July 2020, a further 32 holes for a total depth of 394 m were drilled in September 2020. A sum of 394 samples were obtained, 362 of the assayed samples were 1 m in length with the remainder 0.5 m which represented the interval from 0.5 m to 1.0 m downhole. The first 0.5 m was not sampled to remove any effects of surface vegetation contamination. All assay results were obtained by ICP techniques from Intertek Genalysis.

The estimate described in this report only uses ICP assay results.

Samples were submitted to the Intertek Laboratory in Maddington, Perth, WA. The assay method for multi-element analysis consisted of four-acid digest including perchloric and hydrochloric acids in Teflon beakers with ICP-optical (atomic) emission spectrometry finish. Silica is reported by difference.

Internal laboratory quality assurance/quality control (QAQC), which includes duplicates, standards and blanks, was utilised. In addition, a high-purity silica standard has been utilised at the rate of 1:20.

No geophysical tools were utilised during drilling.

The Mineral Resources were estimated within horizons defining the white and yellow sands above the logged water table surface. Surfaces were based on the geological boundaries of logged sand types and chemical analysis results from the drill data.

3.1.3 Mineral Resource estimation

Grade estimation was completed using ordinary kriging with hard boundaries applied between identified layers. Top cuts were applied to the data where required.

Six in-situ bulk density measurements were completed by Western Geotechnical and Laboratory Services using a nuclear densometer and reported on 16 April 2020. The sites were sampled in accordance with AS 1289.1.2.1-6.5.1 and tested in accordance with AS 1289.2.1.1. and AS 1289.5.8.1. The results from the seven measurements are corrected based on the measured moisture factor. The dry density ranged from 1.57 t/m^3 to 1.68 t/m^3 with an average dry in-situ density result of 1.64 t/m^3 which was applied to the estimate.

The Mineral Resource was classified as Indicated based on data quality, sample spacing, grade continuity, geological continuity of the domains, and metallurgical/process test results. The grey sands are considered low grade at this stage, and as there is no metallurgical testwork, have therefore been excluded. The reported Mineral Resource does not include any material within the Yardanogo Nature Reserve which occupies a strip approximately 300 m wide on the western side of the tenement plus a 50 m buffer to the boundary and is limited to a buffer of 50 m north and south of Mount Adams Road. The surface humus layer is typically about

300 mm thick. The upper 500 mm (overburden) is likely to be reserved for rehabilitation purposes and was therefore excluded from the Mineral Resource.

No cut-off grade has been used for the reported Mineral Resource as the layers considered potentially economic are amenable to beneficiation to a suitable product specification through relatively simple processes, as demonstrated by initial metallurgical testing results of shallow auger samples.

The Beharra Indicated Mineral Resource is reported in Table 3.1.

Table 3.1 Beharra Indicated Mineral Resource (February 2021)

Sand	Volume (Mm^3)	Density	Tonnes (Mt)	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	LOI
Yellow	8.1	1.64	13.2	98.2	0.50	0.23	0.23	0.51
White	76.7	1.64	125.8	98.6	0.41	0.36	0.23	0.21
Total	**84.8**	**1.64**	**139.0**	**98.6**	**0.42**	**0.35**	**0.23**	**0.24**

3.1.4 Recommendations

Snowden makes the following recommendations to improve confidence in the geology model (geology, grade, and quality continuity), and verify product quality (metallurgy):

- The PSD results from both drilling programs should be verified by umpire testing of some of the September 2020 Nagrom samples at the laboratory used by Robbins (Diamantina Laboratories, Malaga)
- Twins 20B019 and 20B032 should be included for PSD testing at Nagrom and Diamantina, to compare with AC_16 and AC_38, respectively
- Additional (infill) samples from the March 2020 (if available) and September 2020 drilling programs should be tested for PSD to improve confidence in trends with depth and laterally across the deposit
- The Mineral Resource block model should be used, in conjunction with individual borehole data to identify domains for further metallurgical testwork
- Metallurgical variability tests should be carried out per geological domain to assess the effect (if any) of subtle geochemical and PSD changes across and vertically through the deposit on processing and product characteristics
- Petrographic and/or microprobe analyses to be completed to determine deportment of Fe_2O_3 and Al_2O_3 contaminants.

3.2 MINING

3.2.1 Introduction

Snowden was engaged by Perpetual to develop an Ore Reserve on the Beharra Silica Project. The complete Ore Reserve Statement is attached at Appendix 6.

The Snowden work was divided into two phases. The first phase used the Beharra Inferred Mineral Resources to identify a mineral inventory, thus enabling planning for other study disciplines and to support mining operations budget quotations from mining contractors. The second phase of the study saw the mining costs from the quotations used to support Ore Reserves using the updated Indicated Mineral Resources. All other aspects of the PFS, including the development of non-mining related operating costs and capital costs, were provided by Perpetual and relevant consultants, for use as Modifying Factors in the estimation of Ore Reserves.

3.2.2 Conventions

Unless otherwise specified, all costs and prices are in Australian dollars (A$).

The units of measure (volume, distance, etc) used in this report are metric.

Spatial data measurements are formatted as XYZ. Where X refers to the easting, Y to the northing and Z to the vertical distance above mean sea level.

The coordinate system used is based on the Universal Transverse Mercator (UTM) datum using Zone 50.

3.2.3 Tenure description

The Beharra tenement covers a total area of approximately 48.48 km^2. Details of the tenement are provided in Table 3.2 and shown in Figure 3.1 (with block model location outlined in the southern end) and apply to a depth of 30 m.

Table 3.2 Beharra tenement

Tenement	E70/5221
Status	Live
Application date	11/10/2018
Grant date	13/06/2019
Expiration date	12/06/2024
Term (years)	5
Area (ha) – ()BL)	4,848.69 ha – 19 BL
Expenditure commitments ($)	$20,000
Holder	Perpetual Resource Limited
Coordinates	Latitude 29.43603 S, longitude 115.11151E

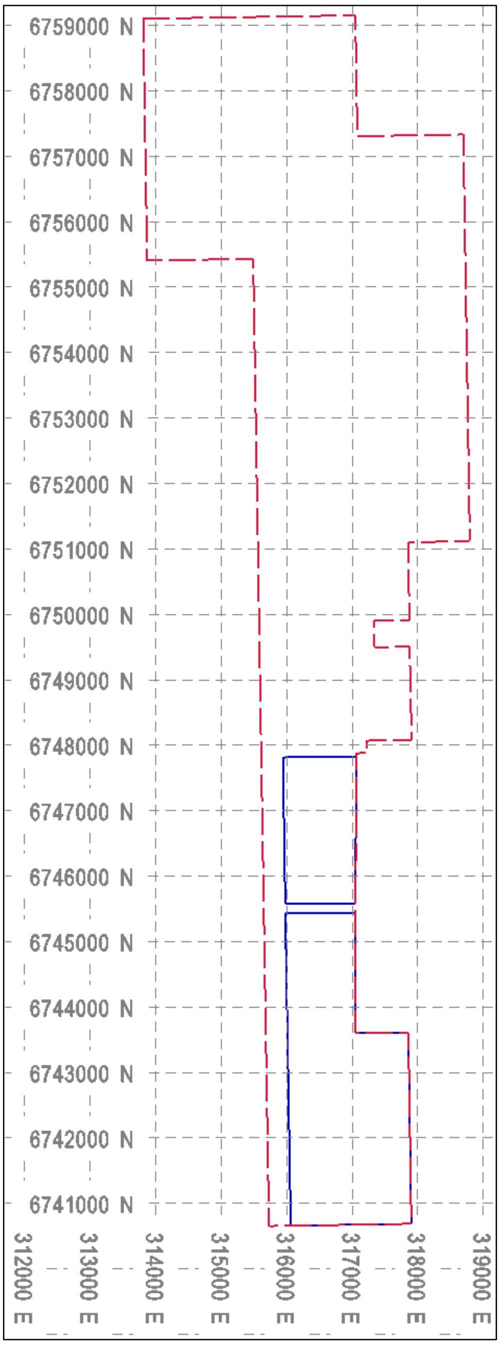


Figure 3.1 **Beharra tenement**

3.2.4 Historical production

Beharra is an undeveloped project and consequently has no historical production.

3.2.5 Mining method development

Resource description

For Mineral Resource estimation, five layers were modelled: Yellow, White Upper, White Lower, Light Grey Pod, Grey Pod, and Grey.

The resources were only developed to the water table and the model is unsaturated. The water table will be in the sand below and is typically 10–12 m below the surface. The top 500 mm were excluded from Mineral Resource, being yellow sand with the upper 300 mm containing humus. Yellow sand below 500 mm deep was eligible for processing. The resource profile is in Figure 3.2.

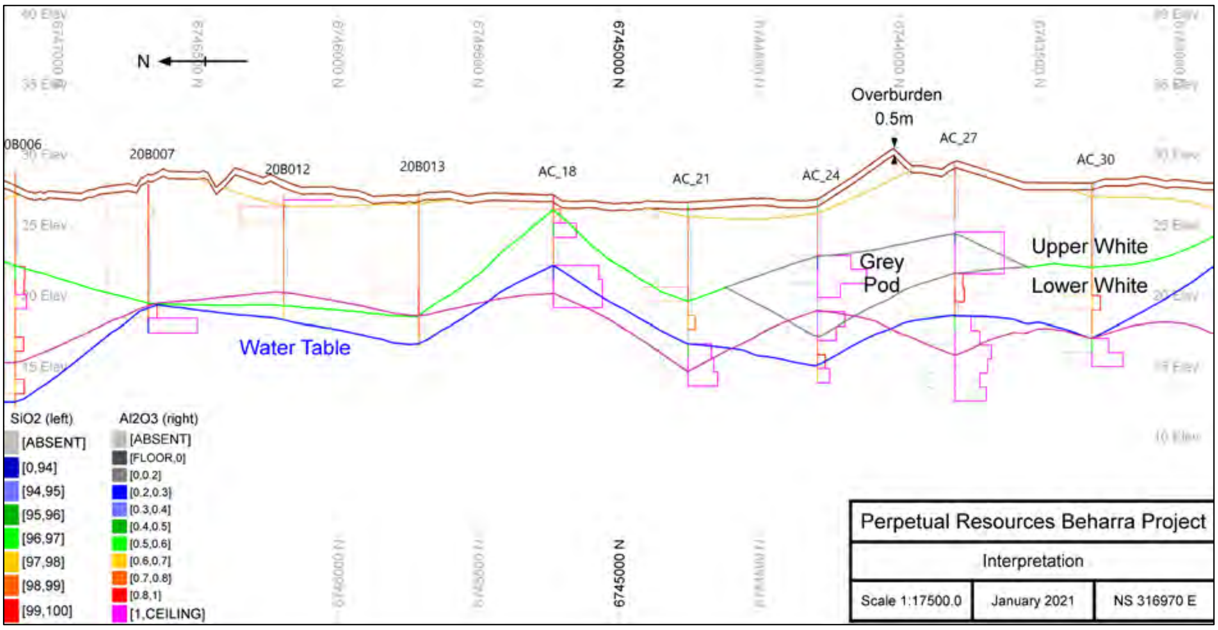


Figure 3.2 Beharra Resource profile

Source: Snowden, 2021

Grey Pod A was present in seven drillholes, average depth of 2.1 m, higher Al_2O_3, Fe_2O_3, LOI, K_2O, than Upper White. Grey Pod B pods were small within White layers, present in two drillholes, average depth of 5.0 m, lower SiO_2, high Al_2O_3, high LOI. The pod material was mined as waste and not processed. The pods are internal waste.

Geotechnical parameters

The resource report has defined aeolian quartz sands largely of medium grain size with an average fines content (-0.075 mm) of ~3.5% (~8% in "grey" sand). Even the "grey" sand is 93.5% quartz with negligible clay minerals and this material is not eligible for processing because the deleterious minerals. The deposit overlies limestones and paleo-coastline, so may locally be underlain by "clayey/peaty" lacustrine/swamp deposits.

Trafficability on the sand unlikely to be an issue, but roads would be needed over any lacustrine/swamp deposits that are affected by winter rainfall.

The diggability assessment is that aeolian sands are all free dig.

Snowden recommends that 30° walls will be sufficient for developing the pit limits during mining. If a seasonal water table variation is experienced the pit wall angle may need to be flattened or the mining scheduled to a time when the water drains during the dry season, however this is unlikely due to the water table being two metres below the resource.

Mining method

The proposed mining cycle is summarised in Figure 3.3.

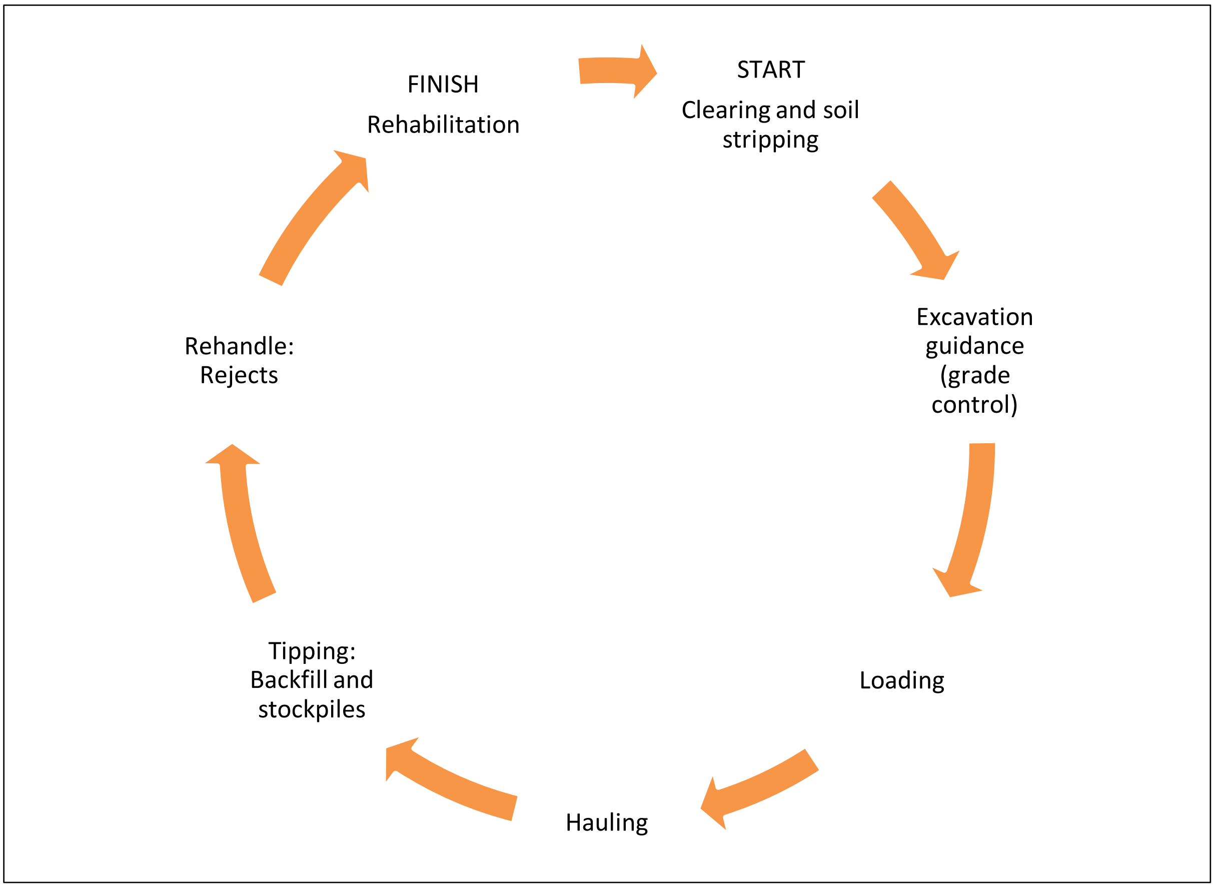


Figure 3.3 Mining cycle

3.2.6 Clearing and stripping

Mining areas will be cleared of vegetation using track dozers. Vegetation will be stockpiled for spreading on rehabilitated slopes.

Soil will be stripped from cleared areas (with exception of soil stockpile areas), to a nominal depth of 500 mm (potentially in two passes with the actual depth depending on location, soil characteristics and prevalence of tree roots and rootlets), using graders and track dozers forming windrows which will be reclaimed using front-end loaders (FELs) and hauled in rigid rear dump trucks.

3.2.7 Drilling

Production drilling will not be required for blasting due to the loose nature of the material.

Grade control drilling will not be required. The Indicated Resource drill density is sufficient to define the ore basement. As there will be an ore loss envelope around the grey sand, any grade control in the basement will be visual only.

3.2.8 Excavation guidance

In general, excavation guidance will involve the following steps:

- Ore/Waste elevation determination:
  - Dig plan creation.
- Ore control:
  - Mark out by surveyors
  - Ore spotting, if required.
- Reconciliation:
  - Comparison of mined and processed with resource block model.

3.2.9 Loading

All material will be mined, as far as practicable, to the profile (e.g. upper white) up to a maximum height of 6 m. Above this height, the profile would be split into benches. Material will be loaded using 50-tonne FELs. An example of this size and type of equipment is shown in Figure 3.4.

Figure 3.4 50-tonne operating weight FEL
Source: Caterpillar (AEHQ5618-01 (3-06))

There may be an opportunity to reduce mining costs by utilising an excavator instead of FELs although this would be at the expense of operational flexibility.

3.2.10 Hauling

Trafficability will be below average based on the material type. Given the low volume, articulated dump trucks (ADTs) will be used as they are generally able to handle soft and uneven ground conditions better than rigid body haul trucks. All material will be hauled using 55-tonne capacity ADTs. Figure 3.5 shows an example of this size and type of equipment. Occasionally, roads will be sheeted if they are semi-permanent, or if any clay areas are encountered.

Figure 3.5 ADT
Source: Volvo (20050609_A)

3.2.11 Tipping

Ore will be direct tipped into the feed hopper.

Any waste material will be backfilled into the pit.

Material rejected from the processing plant will be deposited into a hopper that is configured for direct loading of empty ore trucks on their return cycle from the crusher.

Waste and rejects from starting cells (i.e. initial pit area) will need to be stockpiled until pit floor space is available for backfilling.

There is an opportunity to slurry the rejects back into the pit; however, this would need to be evaluated as it may require the wall angles to be reduced because of potential erosion.

3.2.12 Rehabilitation

Pits will be backfilled with waste and rejects and progressively rehabilitated over the project life. Pit wall angles will be reduced to 8° using waste and rejects against the dug pit walls. Track dozers will be used to reprofile the paddock tips.

Growth media collected during mining operations will then be rehandled from stockpile to the rehabilitation face and spread to a depth of between 200 mm and 300 mm. Finally, timber mulch is evenly spread as soon as practicable to protect the soil surface from wind erosion. Based on the low batter angles on the outer pit walls, sandy soil profile and lack of local surface water drainage features that may contribute to water erosion, it is not expected that significant repair or maintenance earthworks will be required after rehabilitation of each cell.

3.2.13 Ancillary

All parts of the mining cycle will be supported with the use of ancillary equipment. They will be required to complete the following tasks:

- Clearing and stripping of topsoil
- Construction of haul roads and ramps (temporary and long term)
- Pit and stockpile floor maintenance
- Clean-up of spillage around pit and stockpile working areas and haul roads and ramp
- Paddock tip and pit wall reprofiling for rehabilitation
- Topsoil spreading, ripping, and seeding.

Table 3.3 lists the ancillary equipment that was selected to match the proposed load and haul units.

Table 3.3 Ancillary equipment

Type	Class
Track dozer	70 t operating weight
Grader	14 foot blade
Water truck	30 kL capacity
Service truck	50 kL capacity
Vibrating roller	16 t

3.2.14 Pit optimisation

Mining model

The Resource model was modified into a mining model suitable for mine planning purposes. The following steps were undertaken on the resource model to derive the mining model:

- Grey Pod B reassigned from “White” to “Grey” profile
- Model parent cell size reduced to allow better estimation of wall angles
- Identification of surface blocks and coding of the 0.5 m thick surface material as waste.

Identification of blocks available for mining using 30° walls (Figure 3.6) 30 m offset from lease (20 m plus 10 m for crest access):

- 60 m offset from Yardanogo Nature Reserve (50 m plus 10 m for crest access)
- 160 m wide corridor for Mount Adams Road
- Application of ore loss envelope around Grey floor and Grey Pod A
- 0.5 m above Grey floor
- 0.5 m below and 1 m above the Grey Pod in case of voids.

Figure 3.6 **Mineable area**

Table 3.4 shows a comparison between the resource and mining models. A total of 13,886 kdt is removed from the resource in converting it to the mining model:

- 5,685 kdt is due to the Grey envelope (floor and Pod B)

- 7,667 kdt is due to the offsets
- 534 kdt is due to both the offsets and Grey envelope.

Table 3.4 Resource and mining model comparison

	Resource model			Mining model		
	X	Y	Z	X	Y	Z
Origin	315,100	6,740,315	0	315,100	6,740,315	0
Extent	318,500	6,748,475	36	318,500	6,748,475	36
Parent cell size (m)	200	240	2	10	10	1
Minimum sub-cell size (m)	10	10	0.25	10	10	0.25
Volume (kbcm)	419,637			419,637		
Mass (kdt)	688,204			688,204		
Resource (kdt)	138,991			125,105		
Al_2O_3 (%)	0.419			0.409		
CaO (%)	0.0068			0.0069		
Cr_2O_3 (%)	0.00078			0.00077		
Fe_2O_3 (%)	0.228			0.228		
K_2O (%)	0.106			0.101		
MgO (%)	0.0134			0.0138		
MnO (%)	0.0053			0.0053		
Na_2O (%)	0.0109			0.0105		
SiO_2 (%)	98.58			98.60		
TiO_2 (%)	0.349			0.348		
V_2O_5 (%)	0.0011			0.0011		
LOI (%)	0.241			0.241		
Total assay (%)	99.97			99.97		

Parameters and Modifying Factors

Resource classification

Only Indicated Mineral Resources (no Measured or Inferred) are available in the Resource model for pit optimisation.

Starting surface

The initial surface for the optimisation was the original topography which was coded into the Resource model.

Boundaries

Exclusion areas were coded into the mining model.

Geotechnical constraints

A 30° overall wall angle was applied for the pit optimisation.

Dilution and mining recovery

Ore loss was favoured over dilution resulting in a mining recovery of 95.5%.

Process rate

A constant processing rate of 2,031 kdt/a was used in the optimisation.

Process recovery

A constant mass yield of 74.37% was used. This comprised 6.35% to product #27 and 68.02% to product #46 based on the metallurgical testwork.

Results

Figure 3.7 shows a summary of the physicals resulting from the pit optimisation. There are two significant mass increases:

- 0.75 to 0.8 revenue factor which indicates that a decrease in price (or mass yield) of more than 20% will render the Project uneconomic

- 1.2 to 1.3 which coincides with majority of the partial ore loss blocks around the grey profiles becoming economic.

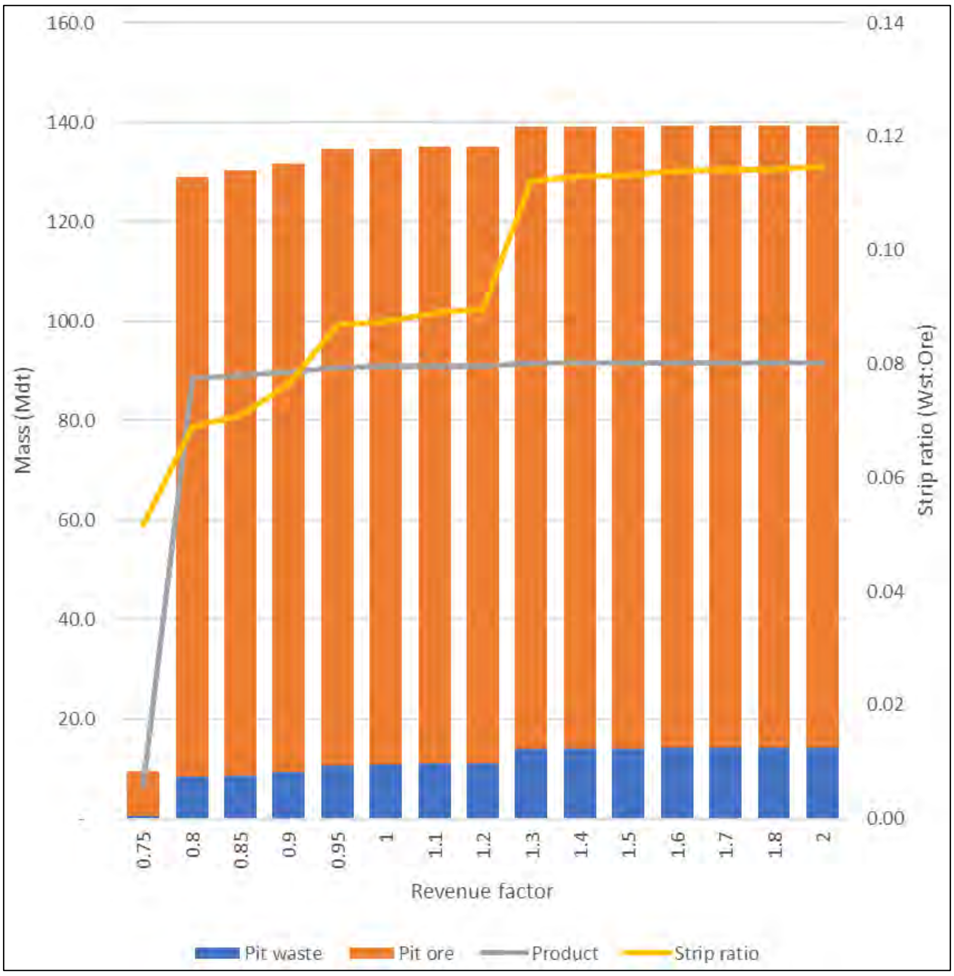


Figure 3.7 Pit optimisation results – physical

Figure 3.8 shows a summary of the financials resulting from the pit optimisation. Like the physicals, there are two corresponding decreases in unit cash flow at the same revenue factors.

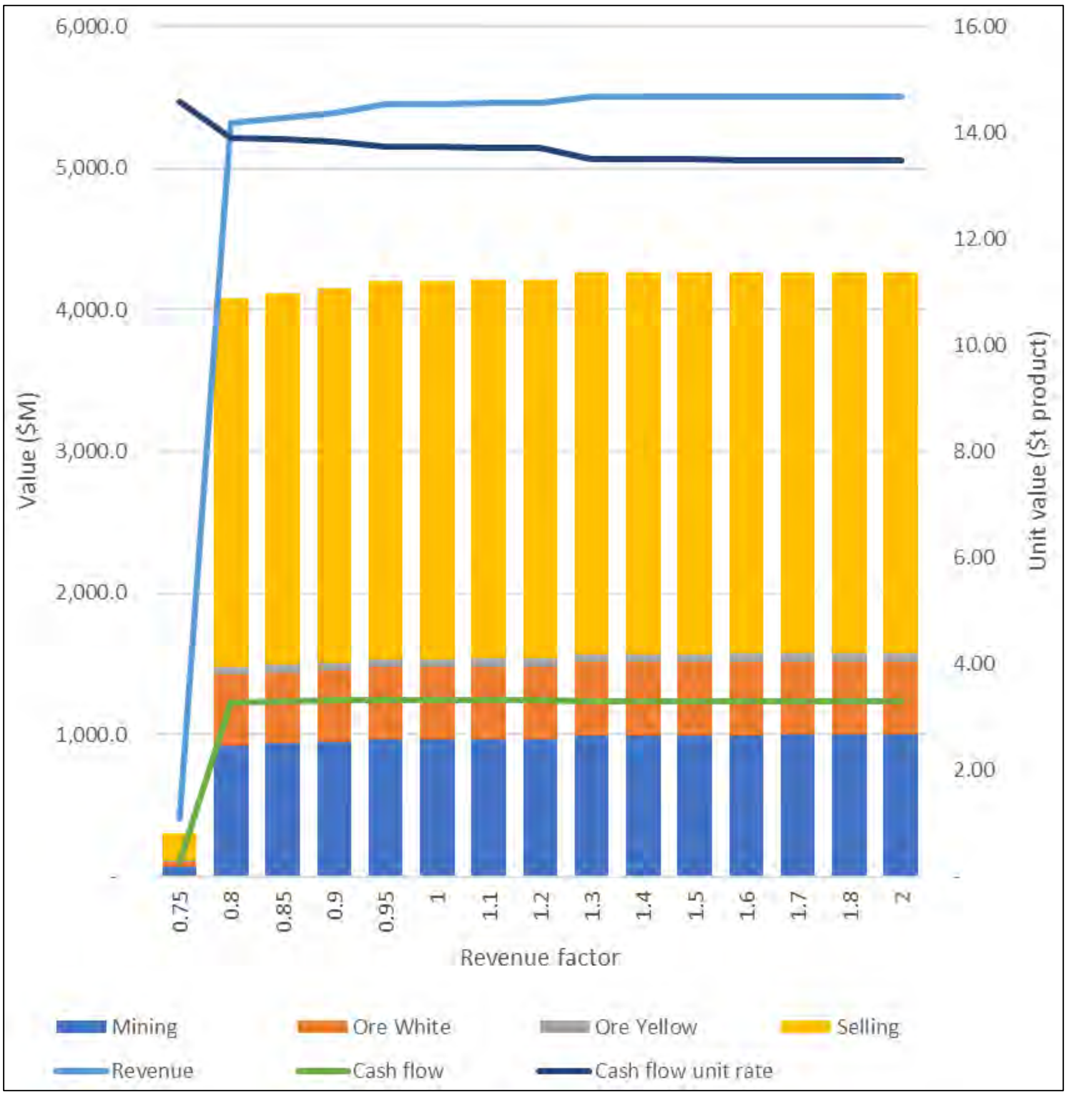


Figure 3.8 Pit optimisation results – financial

Table 3.5 summarises values of select pit shells from the pit optimisation.

Table 3.5 **Pit optimisation result summary**

General						
Pit shell	**1**	**2**	**4**	**6**	**9**	**15**
Revenue factor	0.75	0.80	0.90	1.00	1.30	2.00
Apparent price (US$/dt product)	33.75	36.00	40.50	45.00	58.50	90.00
Physicals						
Ore (Mdmt)	9.1	120.8	122.5	123.9	125.0	125.1
Waste (Mdmt)	0.5	8.3	9.4	10.8	14.0	14.4
Total (Mdmt)	**9.6**	**129.1**	**131.8**	**134.8**	**139.1**	**139.5**
Strip ratio (waste:ore)	0.05	0.07	0.08	0.09	0.11	0.11
Resource conversion (%)	6.6	86.9	88.1	89.2	90.0	90.0
White ore (Mdt)	8.0	108.2	109.9	111.3	112.4	112.5
White SiO_2 (%)	98.65	98.65	98.65	98.64	98.64	98.64
Yellow ore (Mdt)	1.1	12.5	12.6	12.6	12.6	12.6
Yellow SiO_2 (%)	98.26	98.23	98.23	98.23	98.23	98.23
Total product (Mdt)	**6.7**	**88.6**	**89.8**	**90.9**	**91.7**	**91.7**
Mass yield (%)	74.4	74.4	74.4	74.4	74.4	74.4
Economics						
Mining cost ($ M)	68.5	926.3	945.4	965.4	994.9	997.6
Mining cost ($/dmt)	7.12	7.17	7.17	7.16	7.15	7.15
Ore cost ($ M)	39.0	554.1	562.1	568.8	573.9	574.2
Ore cost ($/dt ore)	4.26	4.59	4.59	4.59	4.59	4.59
Selling cost ($ M)	197.1	2,602.9	2,639.7	2,670.6	2,694.4	2,695.9
Selling cost ($/dt product)	29.39	29.39	29.39	29.39	29.39	29.39
Total cost ($ M)	304.5	4,083.3	4,147.2	4,204.8	4,263.2	4,267.6
Total cost ($/dt product)	45.41	46.11	46.17	46.27	46.50	46.52
Revenue ($ M)	402.4	5,313.9	5,389.1	5,452.2	5,500.8	5,503.7
Revenue ($/dt product)	60	60	60	60	60	60
Undiscounted cash flow ($ M)	97.8	1,230.5	1,241.9	1,247.3	1,237.5	1,236.1
Undiscounted cash flow ($/dt product)	14.59	13.89	13.83	13.73	13.50	13.48

Figure 3.9 show the pit shells generated in the pit optimisation. After the rapid size increase from pit shell 1 to 2, the remaining pit shells are predominately adding incremental tonnes along the pit floor and around "Grey Pod B" (due to the block height these blocks typically contain both ore and waste).

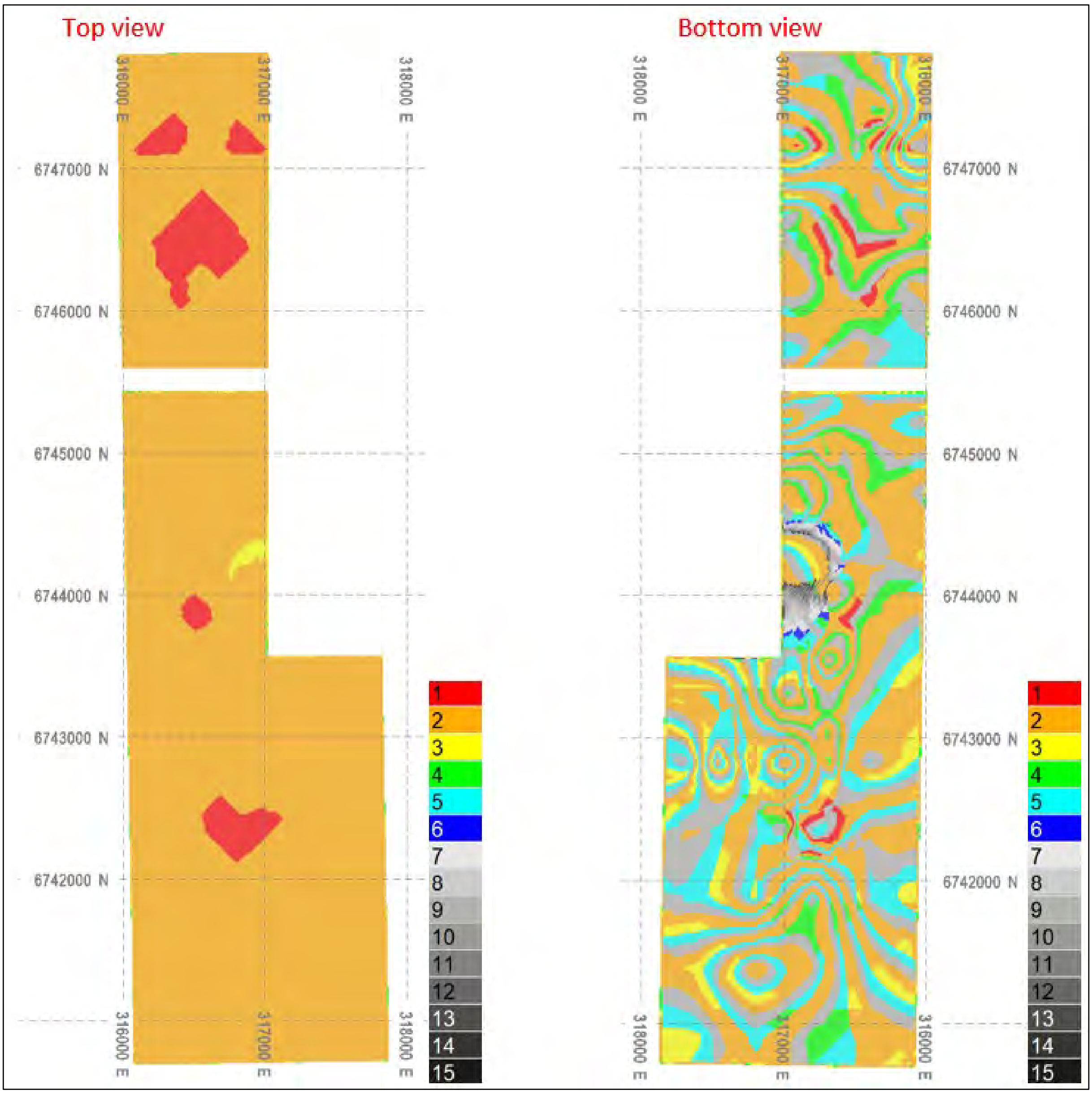


Figure 3.9 **Pit optimisation pit shells**

At the completion of the scheduling, another pit optimisation was run to check the impact of the cost and price changes. Despite a decrease in costs of about 7% and increase in price of about 11%, there was little physical change pit shell with marginally more ore and waste included around the grey profiles (floor and pod B). The revised revenue factor 1 pit shell was equivalent to the original revenue factor 1.3 pit shell (Table 3.5) containing 125 Mdt of ore (<1% change).

3.2.15 Mine design

Pit

The following parameters were used in the pit designs:

- 30° wall angle
- 1 m high bench flitches
- 20 m wide ramps at 1:10 gradient.

The ultimate pit design was split into panels aimed at balancing the number of plant movements and minimising haul distances. The panels were sequenced to access the marginally better grades first whilst minimising road development and maintaining a logical grouping sequence. Figure 3.10 shows the ultimate and panel pit designs. These panels will be further subdivided into cells for scheduling.

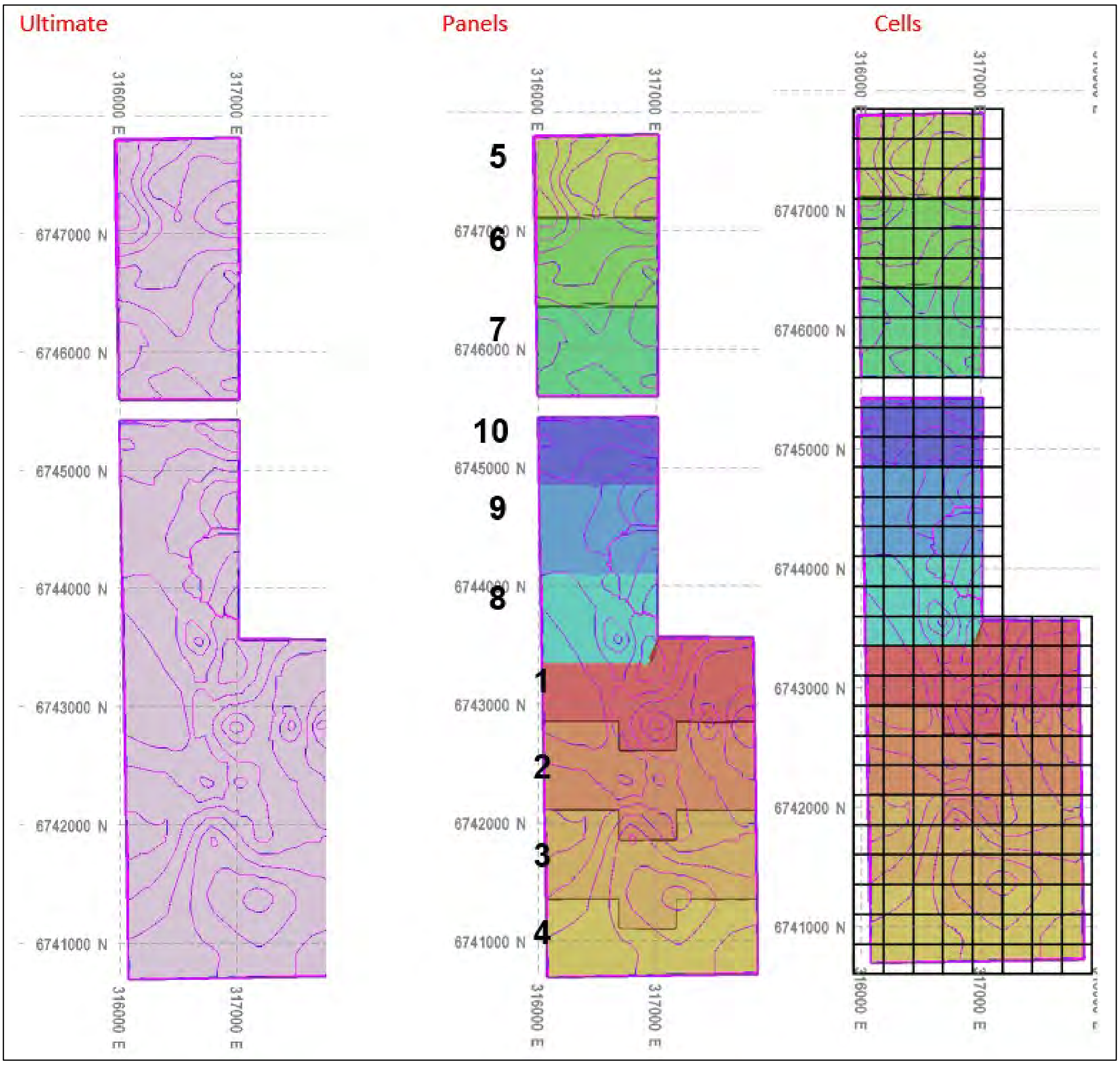


Figure 3.10 **Pit design**

Figure 3.11 shows the pit depths. The deepest sections, at around 15 m, are in the northwest corner of panels 5 and 6 whilst the shallowest sections, at around 3 m, are in the east of panels 8 and 9. Due to the 1 m minimum height used in the design it clips the water table, in practice mining would stop above the water table.

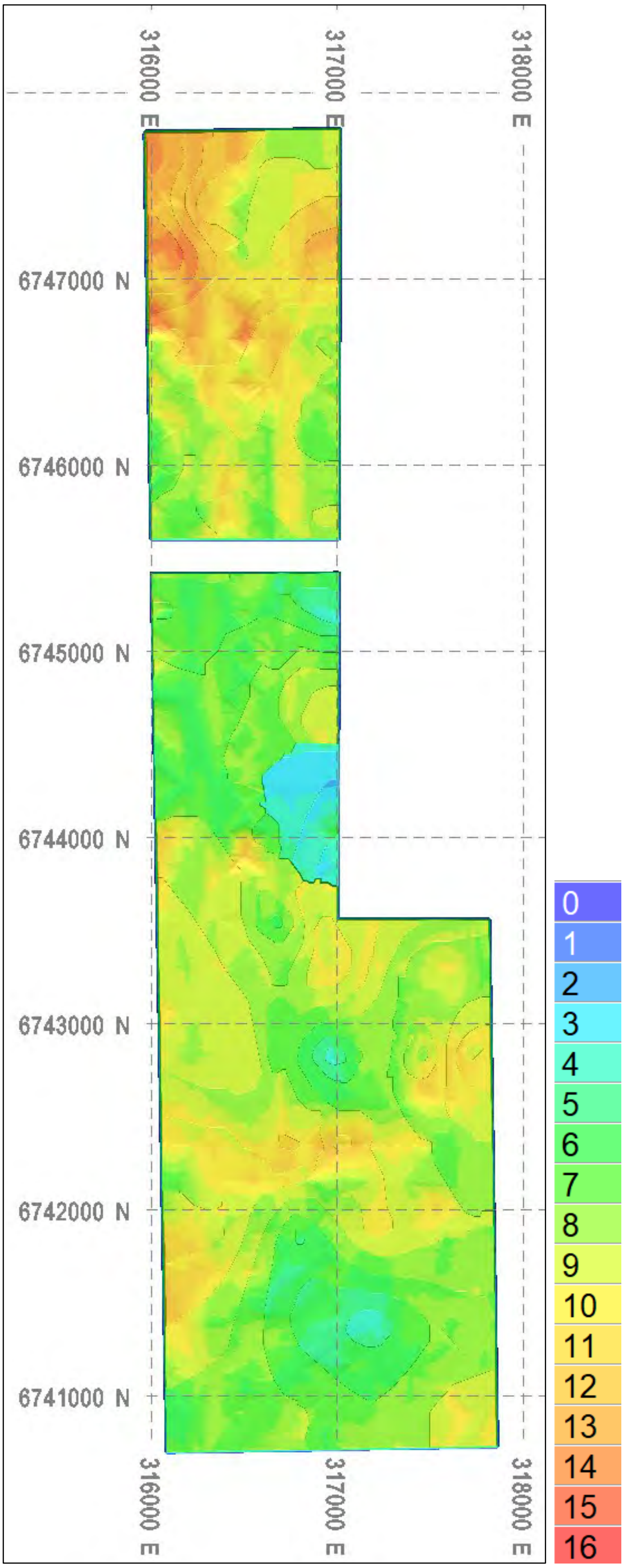


Figure 3.11 **Pit depth (m)**

Table 3.6 summarises the ultimate pit design by profile.

Table 3.6 Pit inventory by profile

DOMNAME	Overburden (topsoil)	Grey Pod A	Yellow	White Upper	White Lower	Grey Pod B	Grey Floor	Total
REPMINE	Overburden	White	Yellow	White	White	Grey	Grey	**-**
Total (Mdmt)	7.7	1.8	12.6	73.3	39.4	0.1	0.0	**134.8**
Waste (Mdmt)	7.7	-	-	0.7	2.4	0.1	0.0	**10.9**
Ore (Mdmt)	-	1.8	12.6	72.6	37.0	-	-	**123.9**
Al_2O_3 (%)	-	0.50	0.50	0.30	0.59	-	-	**0.41**
CaO (%)	-	0.005	0.013	0.006	0.007	-	-	**0.007**
Cr_2O_3 (%)	-	0.001	0.001	0.001	0.001	-	-	**0.001**
Fe_2O_3 (%)	-	0.26	0.23	0.22	0.25	-	-	**0.23**
K_2O (%)	-	0.09	0.08	0.06	0.18	-	-	**0.10**
MgO (%)	-	0.01	0.05	0.01	0.01	-	-	**0.01**
MnO (%)	-	0.005	0.003	0.005	0.006	-	-	**0.005**
Na_2O (%)	-	0.01	0.01	0.01	0.02	-	-	**0.01**
SiO_2 (%)	-	98.54	98.23	98.84	98.28	-	-	**98.60**
TiO_2 (%)	-	0.34	0.23	0.35	0.38	-	-	**0.35**
V_2O_5 (%)	-	0.001	0.001	0.001	0.001	-	-	**0.001**
LOI (%)	-	0.21	0.51	0.19	0.25	-	-	**0.24**
Total assay (%)	-	100.0	99.9	100.0	100.0	-	-	**100.0**
Mass yield (%)	-	74.37	74.37	74.37	74.37	-	-	**74.37**
Product (Mdt)	-	1.3	9.4	54.0	27.5	-	-	**92.2**

Table 3.7 summarises the ultimate pit design by panel. There are only minor grade differences between the panels; however, in general, the lower numbered panels have slightly higher alumina and slightly lower Fe_2O_3 grades.

Table 3.7 Pit inventory by panel

Panel	1	2	3	4	5	6	7	8	9	10	Total
Total volume (Mbcm)	10.3	12.8	11.1	8.4	8.3	8.7	7.0	6.3	5.2	4.3	82.2
Waste volume (Mbcm)	0.8	0.9	0.9	0.7	0.5	0.5	0.6	0.6	0.6	0.4	6.7
Ore volume (Mbcm)	9.5	11.9	10.1	7.6	7.8	8.1	6.4	5.6	4.6	3.9	75.6
Total mass (Mdmt)	16.9	20.9	18.2	13.7	13.6	14.2	11.4	10.3	8.5	7.1	134.8
Waste mass (Mdmt)	1.4	1.5	1.6	1.2	0.8	0.9	0.9	1.0	0.9	0.7	10.9
Strip ratio (wst:ore)	0.09	0.08	0.09	0.10	0.07	0.07	0.09	0.11	0.12	0.11	0.09
Ore mass (Mdmt)	15.5	19.4	16.6	12.5	12.8	13.3	10.5	9.2	7.6	6.4	123.9
Al_2O_3 (%)	0.41	0.44	0.44	0.41	0.50	0.40	0.36	0.34	0.32	0.36	0.41
CaO (%)	0.007	0.007	0.006	0.006	0.010	0.006	0.006	0.009	0.009	0.005	0.007
Cr_2O_3 (%)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Fe_2O_3 (%)	0.22	0.22	0.17	0.15	0.33	0.27	0.26	0.20	0.25	0.24	0.23
K_2O (%)	0.13	0.13	0.09	0.07	0.15	0.09	0.06	0.07	0.08	0.07	0.10
MgO (%)	0.01	0.01	0.01	0.00	0.03	0.02	0.01	0.01	0.06	0.01	0.01
MnO (%)	0.005	0.005	0.005	0.004	0.006	0.005	0.006	0.005	0.006	0.006	0.005
Na_2O (%)	0.01	0.01	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01
SiO_2 (%)	98.61	98.59	98.64	98.68	98.31	98.61	98.69	98.77	98.53	98.62	98.60
TiO_2 (%)	0.35	0.36	0.35	0.32	0.32	0.31	0.37	0.33	0.41	0.42	0.35
V_2O_5 (%)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LOI (%)	0.23	0.21	0.25	0.26	0.30	0.26	0.22	0.23	0.24	0.22	0.24
Total assay (%)	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	99.9	100.0	100.0
Mass yield (%)	74.37	74.37	74.37	74.37	74.37	74.37	74.37	74.37	74.37	74.37	74.37
Product (Mdt)	11.5	14.5	12.3	9.3	9.5	9.9	7.8	6.9	5.7	4.8	92.2
Rejects (Mdt)	4.0	5.0	4.3	3.2	3.3	3.4	2.7	2.4	2.0	1.6	31.8

Plant pads

To maximise the resource and accommodate panel sequences that advance away from the road corridor it will be necessary to construct plant and stockpile pads plus access road for some panels out of waste and rejects. The remaining panels will locate the plant and stockpile on unmined panels. Figure 3.12 shows these locations and backfilled pads.

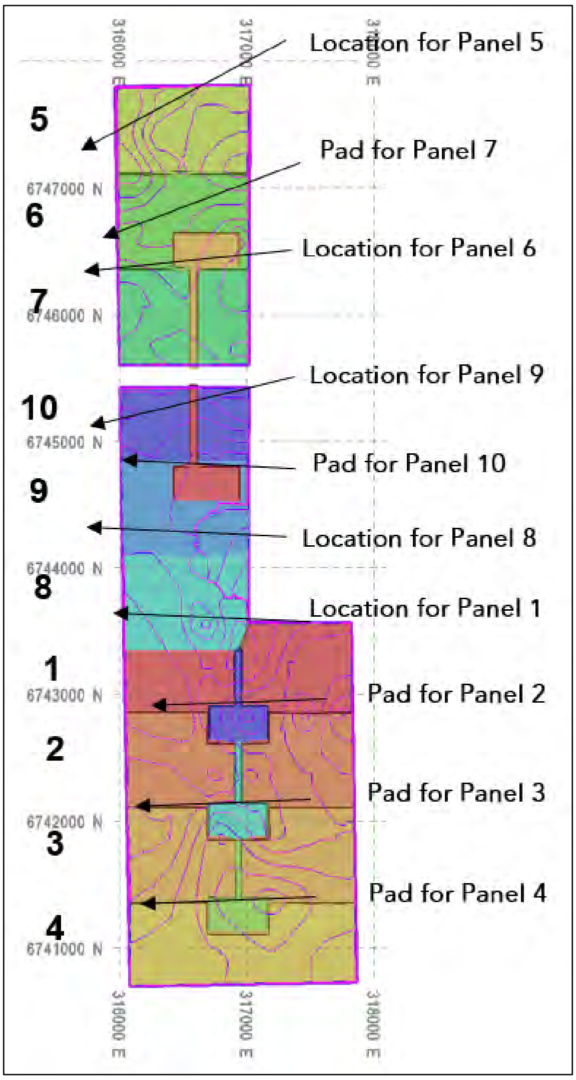


Figure 3.12 Plant pads

Table 3.8 summarises the backfill volumes required for constructing the plant pads.

Table 3.8 Plant pad volumes

Pad for panel	Volume (Mlcm)
2	1.0
3	1.0
4	0.6
7	1.7
10	1.6
Total	**5.9**

If insufficiently dry rejects are available, it will be necessary to modify the panel sequence such that they **a**ll retreat towards the road corridor and/or sterilise some of the inventory to allow the plant to sit on unmined areas.

Backfill

To ensure long term stability of the pit walls, it will be necessary to reduce the angle of the pit walls to 8°. To maximise the resource, the walls are mined to 30° so to reduce the slope angle it is necessary to backfill waste and rejects against the pit walls. Figure 3.13 shows the backfilled material around the pit edge with an example cross section in

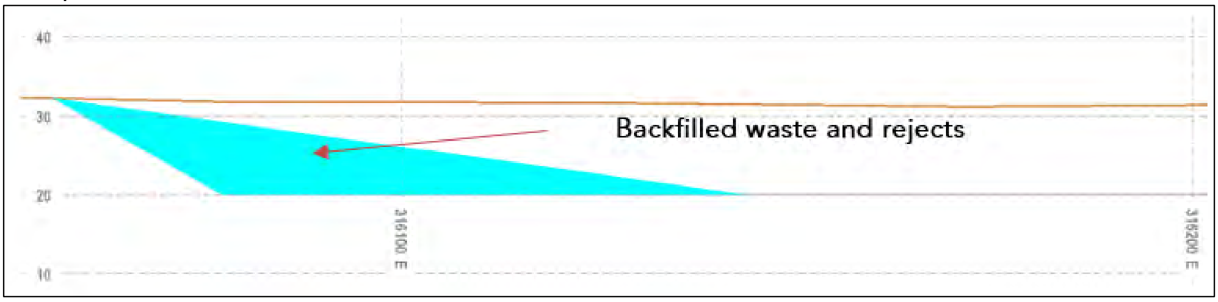


Figure 3.14.

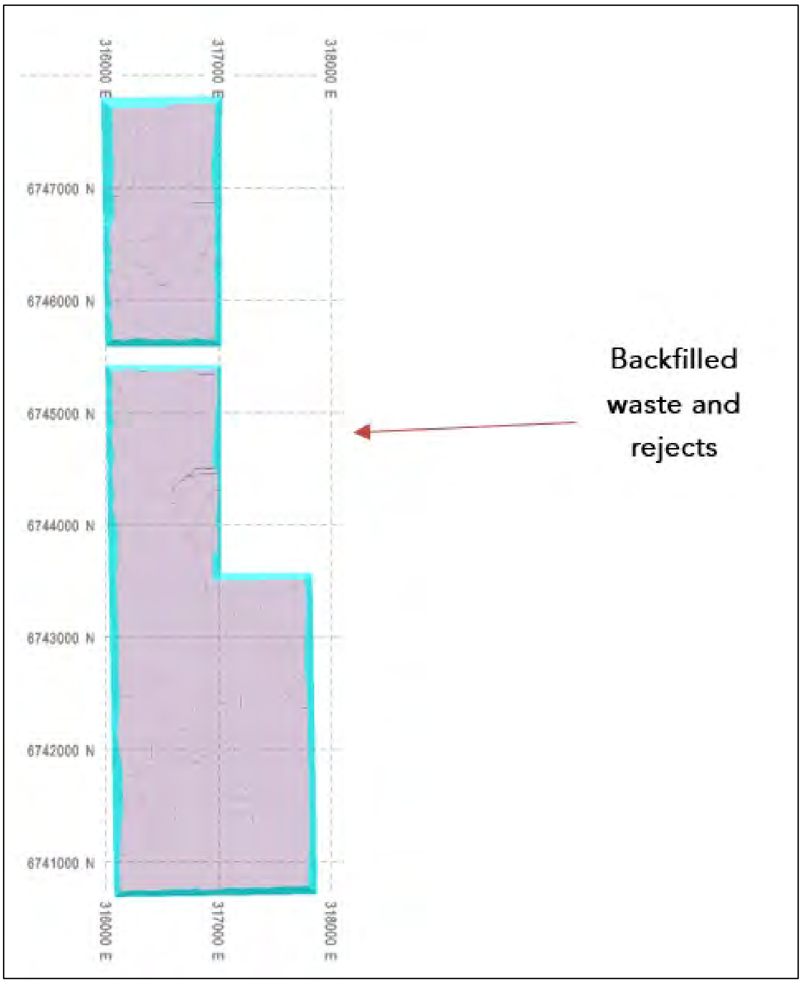


Figure 3.13 Pit wall backfill

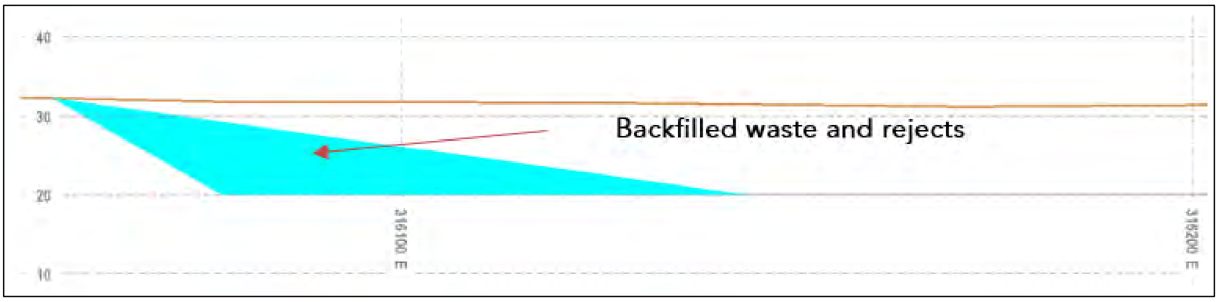


Figure 3.14 Pit wall backfill example section

Table 3.9 summarises the backfill volumes required to stabilise the pit walls.

Table 3.9 Wall backfill volumes

Panel	Volume (Mlcm)
1	0.5
2	0.4
3	0.4
4	0.6
5	0.9
6	0.5
7	0.5
8	0.3
9	0.2
10	0.3
Total	**4.6**

About half the waste and reject volume is required between the plant pads and pit wall backfill, the remainder will be rehandled to the pit floor prior to rehabilitation.

The waste and rejects from the first cell in each mining area (north and south of the road) will need to be stockpiled on the surface until sufficient pit floor is open.

3.2.16 Mine schedule

A mine schedule was completed for the first four panels and limited the Fe_2O_3 to an average of 2000 ppm life of mine (LOM). This was used for the Ore Reserve estimate. A second schedule was also provided that added additional tonnes with higher iron at 2640 ppm (panels 6 to 10). The additional portion of Indicated Mineral Resources will be re-assessed with a view to classifying the in-situ tonnage as an Ore Reserve pending further feasibility study metallurgical evaluation.

Material groups

Material was grouped by the following fields:

- Water table (above or below)
- DOMNAME (Overburden, Yellow, Upper White, Lower White, Grey Pod A, Grey Pod B, Grey Floor)
- REPNAME and REPMINE (Overburden, Yellow, White, Grey) with a change from yellow or white to grey indicating ore loss
- RESCAT (Indicated or Unclassified).

Time scale

The schedule was completed in quarterly increments over the life of the Project. All quarters were considered the same (i.e. all 91.25 days long).

Resolution

Based on the selected time scale, quantities were aggregated to a 4 m bench level by panel, cell, and material group.

Precedencies

All benches within a cell were dependent on the bench above being mined out. To ensure that panels were opened to allow sufficient time to build the plant pads, the fixed sequence in Figure 3.15 was followed.

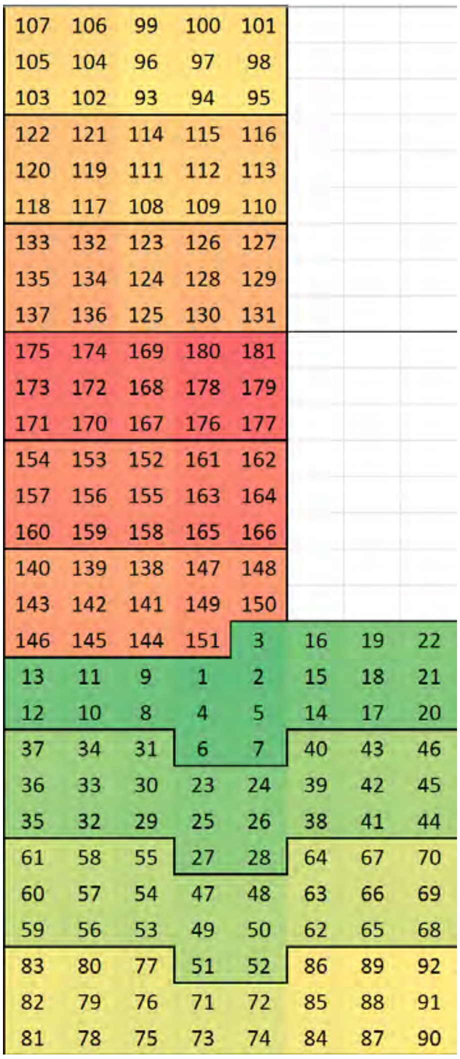


Figure 3.15 **Cell sequence**

Active mining areas

The number of active cells that can be mined in any period is one.

Bench turnover

Bench turnover was not restricted due to the shallow depths and relatively fixed mining rate.

Mining

The mining rate was not restricted.

Processing

Table 3.10 summarises the processing rate constraint.

Table 3.10 **Processing rate**

Quarter	Mass (Mdt/qtr)
1	-
2	140,680
3	140,680
4	348,075
5	487,305
6 onwards	507,750

Constraints were not applied to any grades.

Product

No constraint was applied to the product although by virtue of the fixed mass yield it was controlled by the processing rate.

3.2.17 Life of mine schedule

The LOM schedule includes the entire pit design inventory and is summarised annually.

Mining

Figure 3.16 summarises the total movement by panel. Apart from year 3 and 4 when there is rehandle of the previous year's rejects, there are slight movement variations caused by the waste mining.

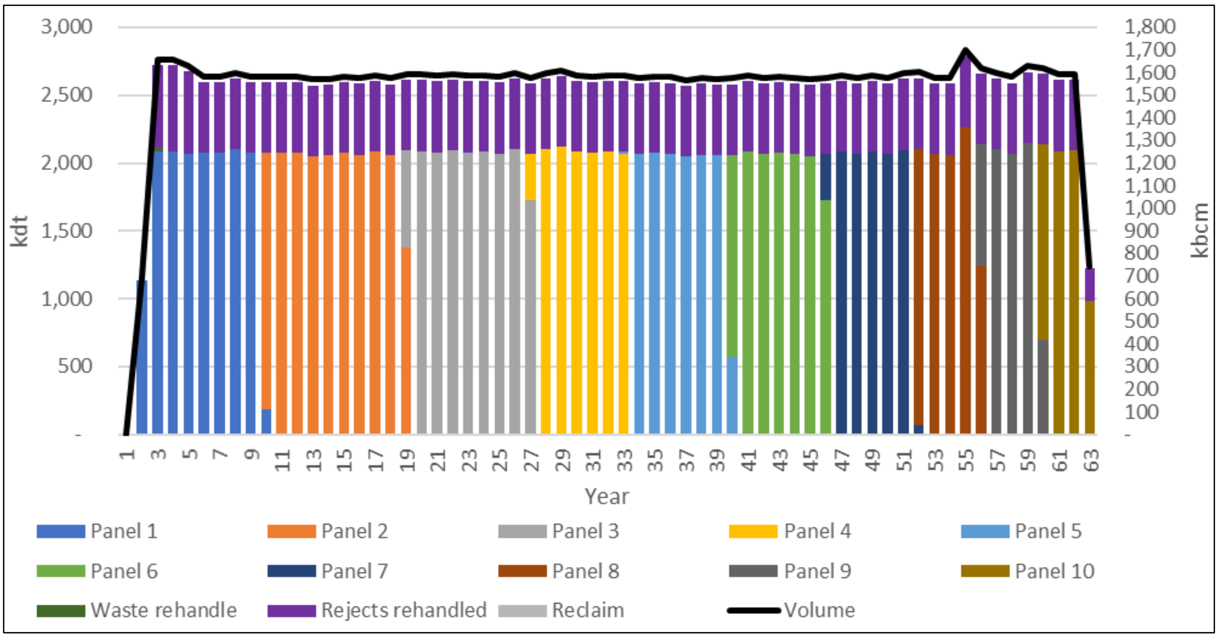


Figure 3.16 Total movement by panel

Figure 3.17 shows the ex-pit movement (i.e. no rehandle) by profile group.

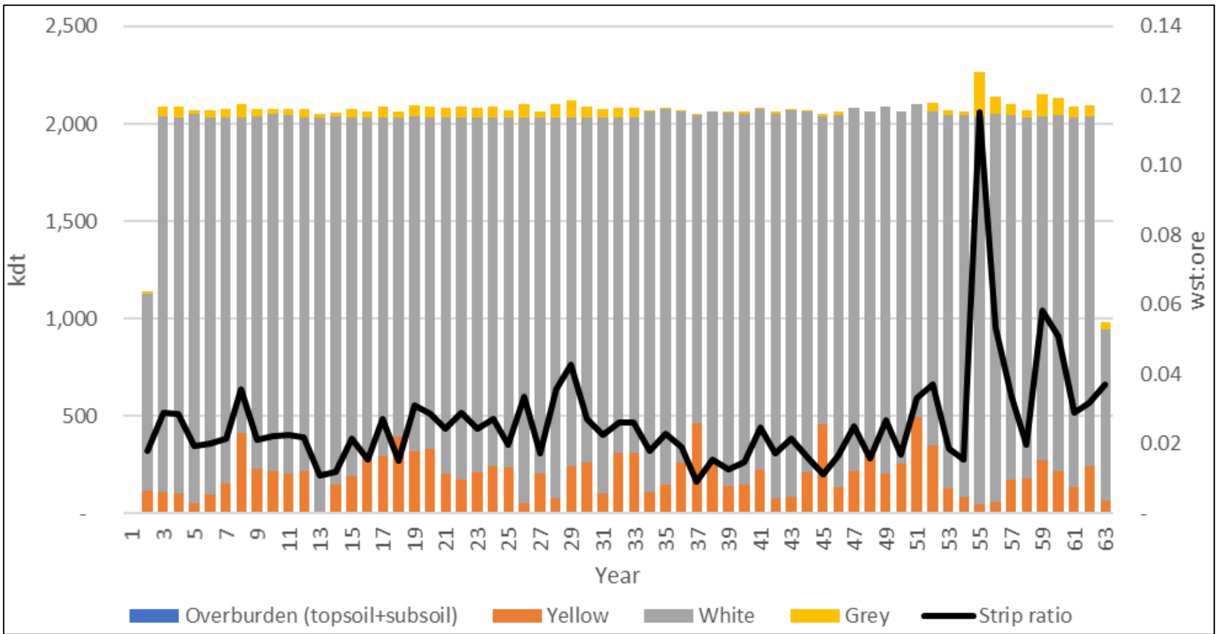


Figure 3.17 Ex-pit movement by profile group

Figure 3.18 shows the ex-pit ore and waste movement together with the haul distance estimate. The ore hauls are more variable in the first four panels due to their extra width. This variation could be reduced by mining from two or more cells at a time (i.e. one close to the plant and one far).

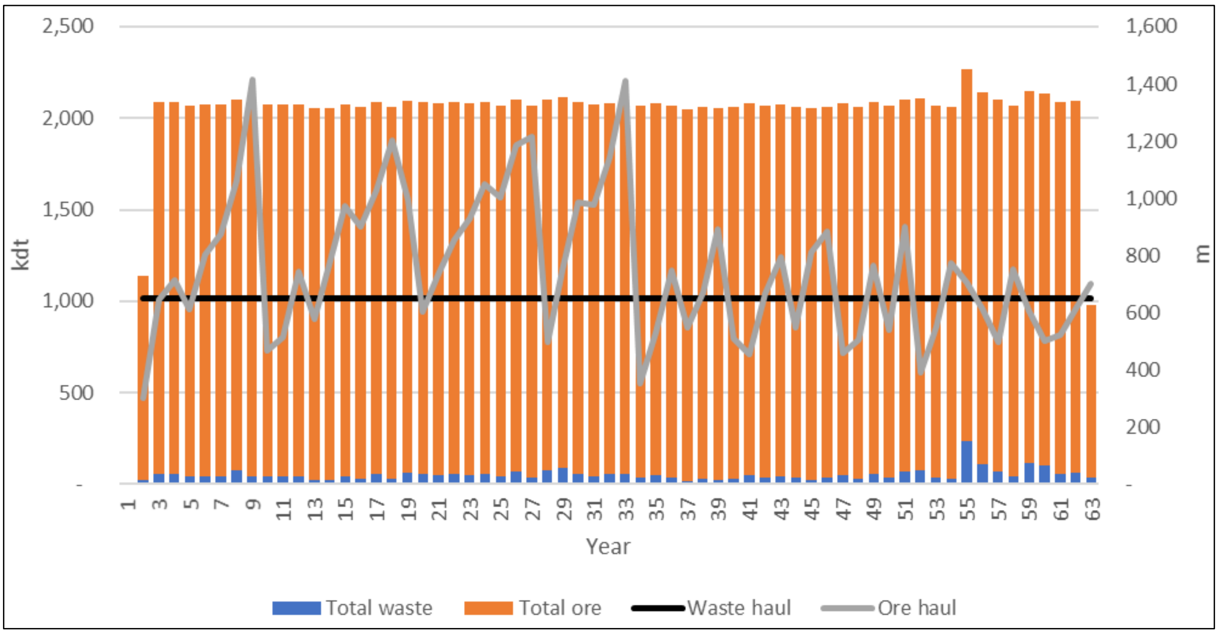


Figure 3.18 Ex-pit movement and haul distance

Processing

Figure 3.19 shows the ore feed by profile group. The plant is fully utilised until the final year of the schedule.

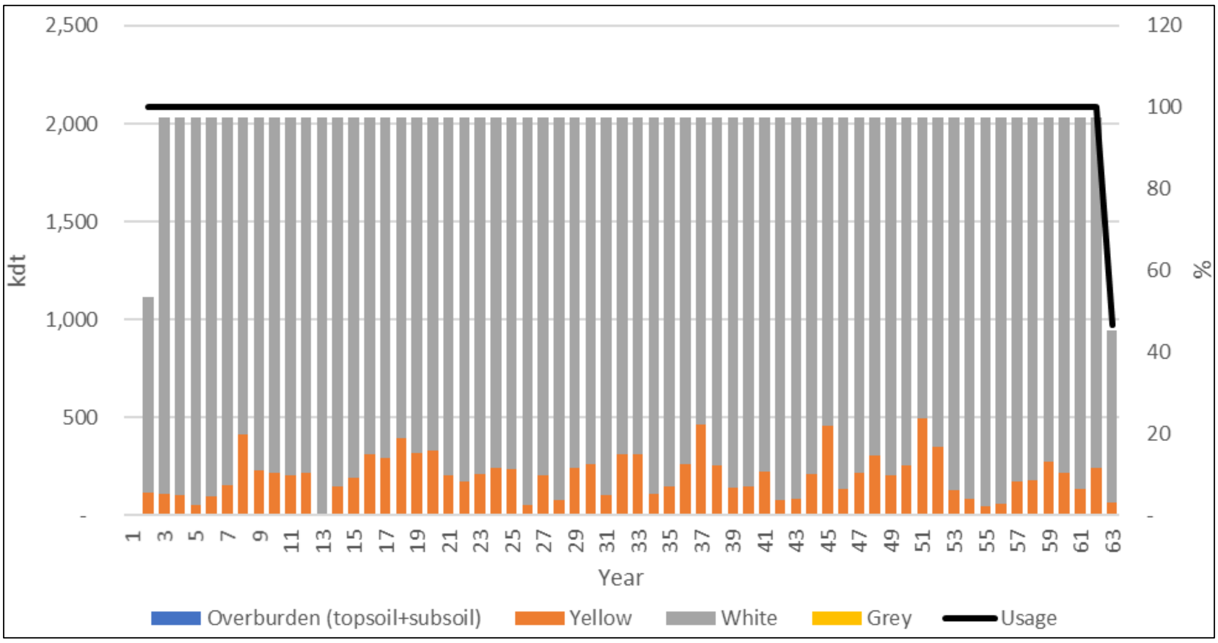


Figure 3.19 Ore feed by profile group

Figure 3.20 and Figure 3.21 show the ore feed grades. In general, the second half of the schedule is more variable than the first.

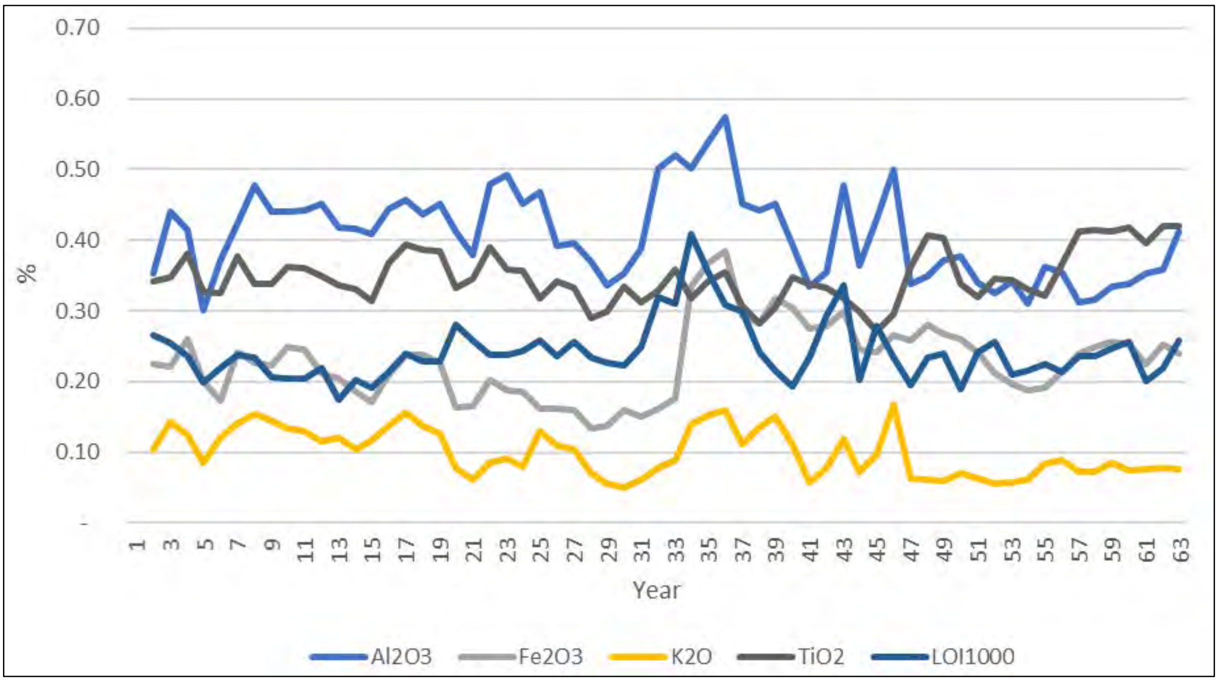


Figure 3.20 **Ore feed grades**

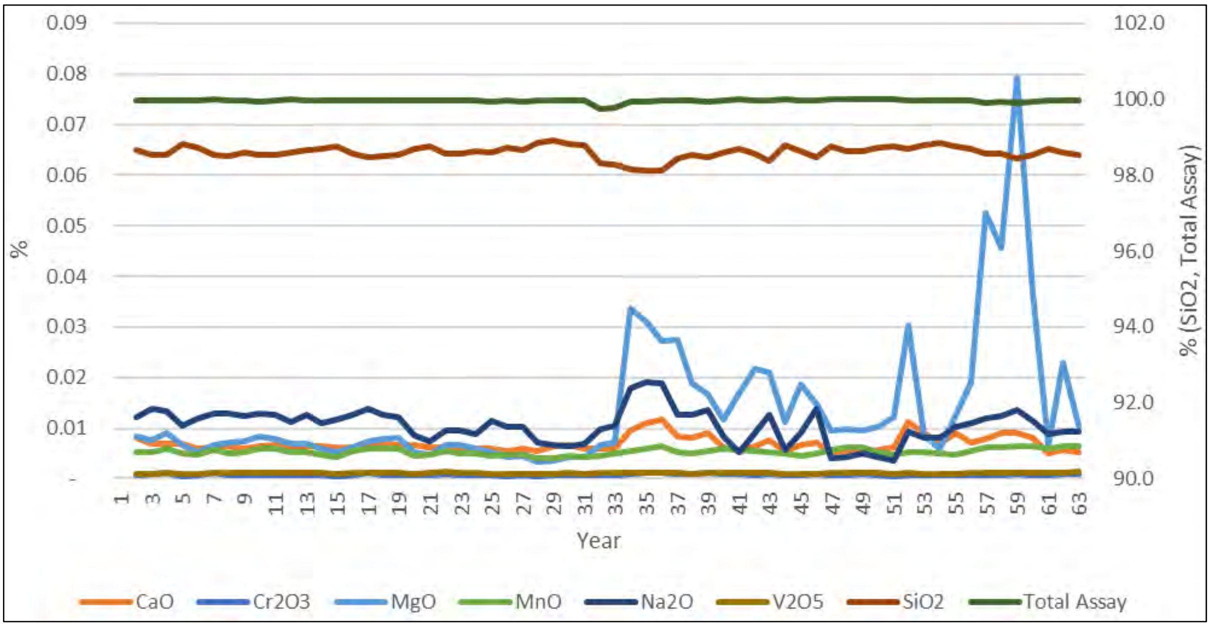


Figure 3.21 **Ore feed grades**

Figure 3.22 shows the plant product and rejects. Due to the constant mass yield, these are constant except for the first and final years of production.

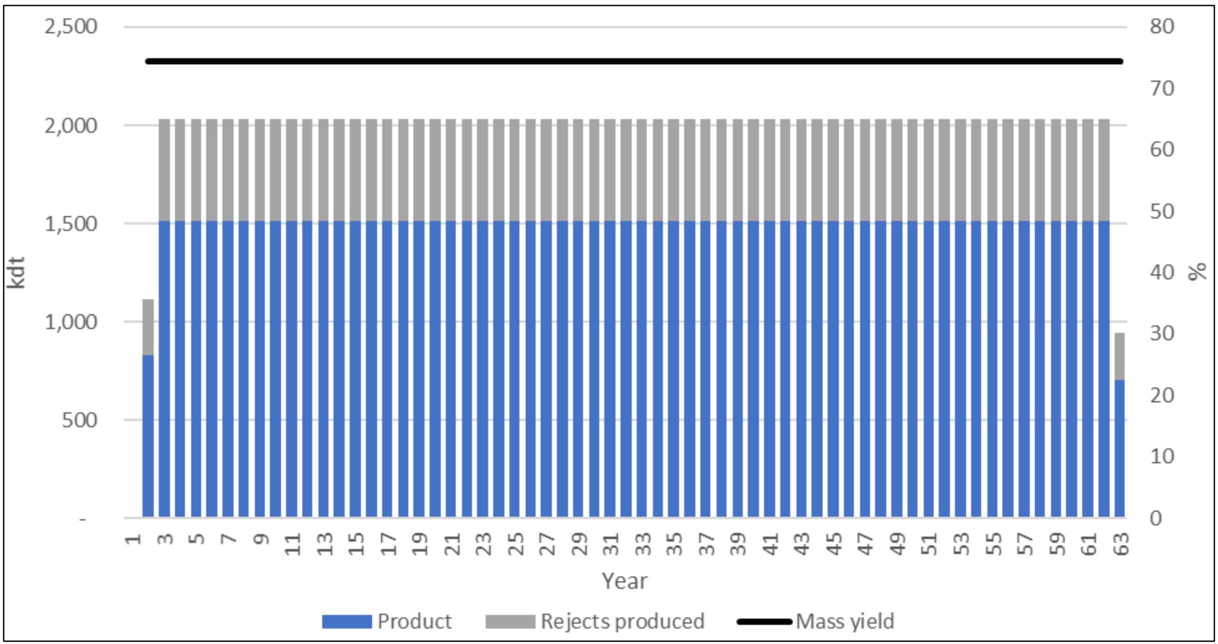


Figure 3.22 Plant product and rejects

Environmental

Figure 3.23 shows the estimated annual area cleared for topsoil stripping. Road construction distances are for access to the plant locations by road trains transporting the product.

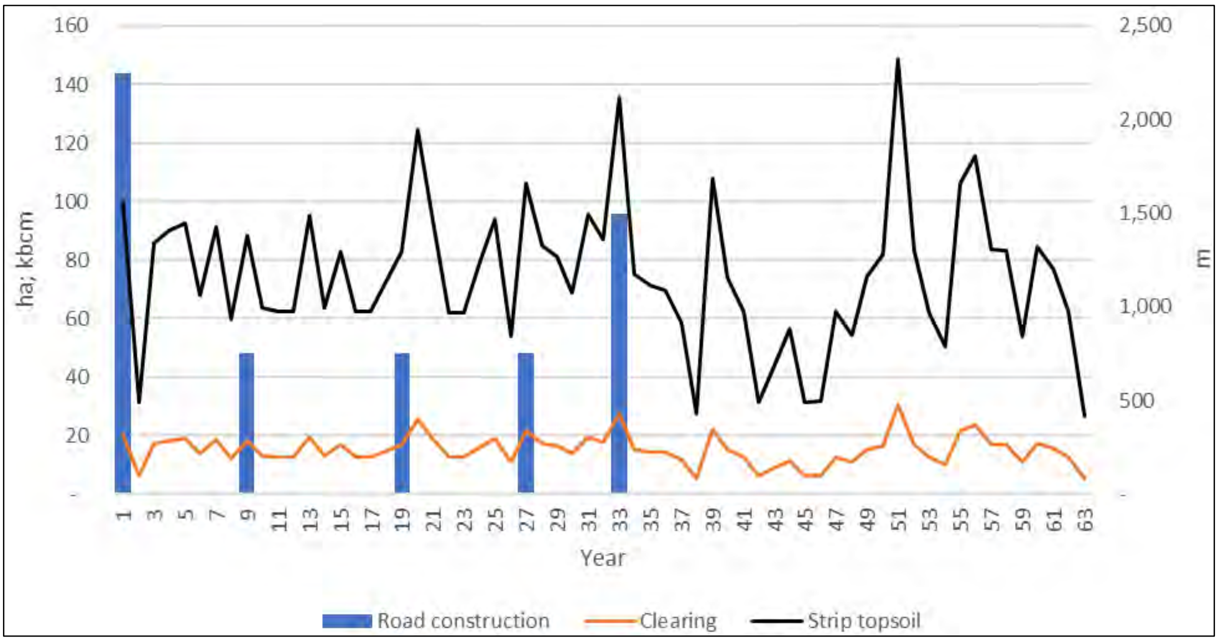


Figure 3.23 Disturbance

Figure 3.24 shows the estimated annual area rehabilitated and the topsoil spread over the rehabilitated area.

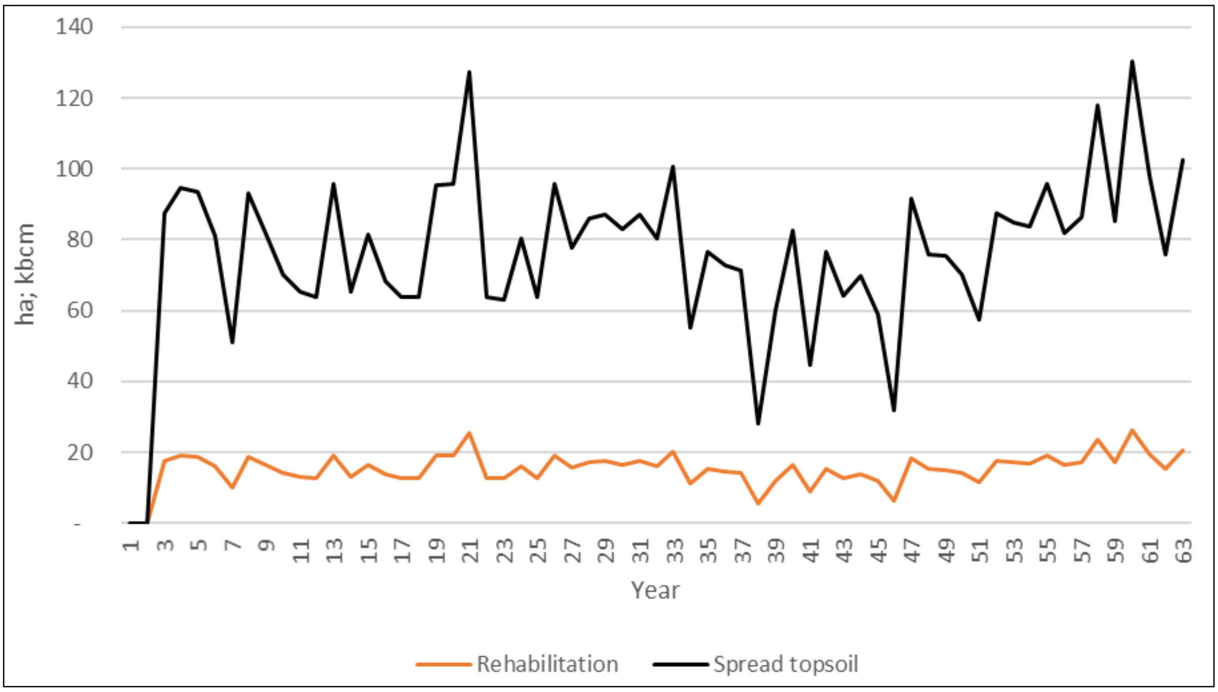


Figure 3.24 **Rehabilitation**

3.2.18 Reserve schedule

The Reserve schedule includes the pit design inventory for panels 1 to 4 and is shown quarterly.

Mining

Figure 3.25 summarises the total movement by panel. The mining ramp-up mirrors the processing plant ramp-up due to the very low strip ratio. Mining peaks in years 3 and 4 when there is rehandle of rejects and waste from the first cell. Movement varies due to the presence of small amounts of waste.

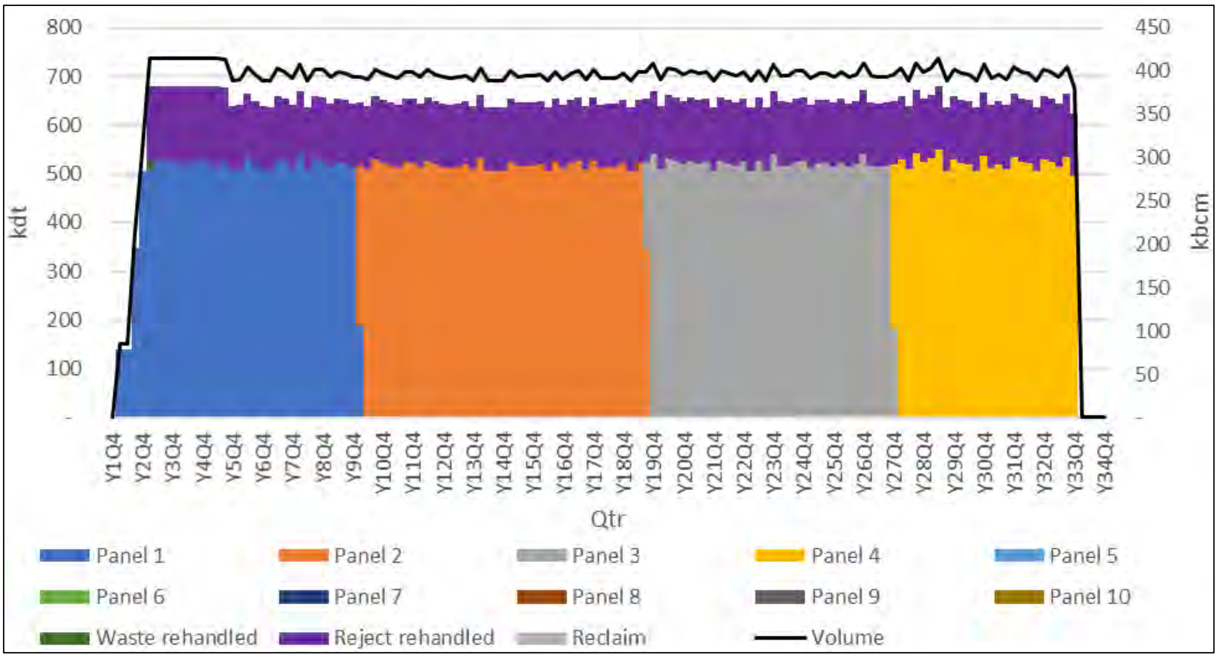


Figure 3.25 **Total movement by panel**

Figure 3.26 shows the ex-pit movement (i.e. no rehandle) by profile group. The movement of the yellow plus white profiles are consistent, with slight variations due to ore loss.

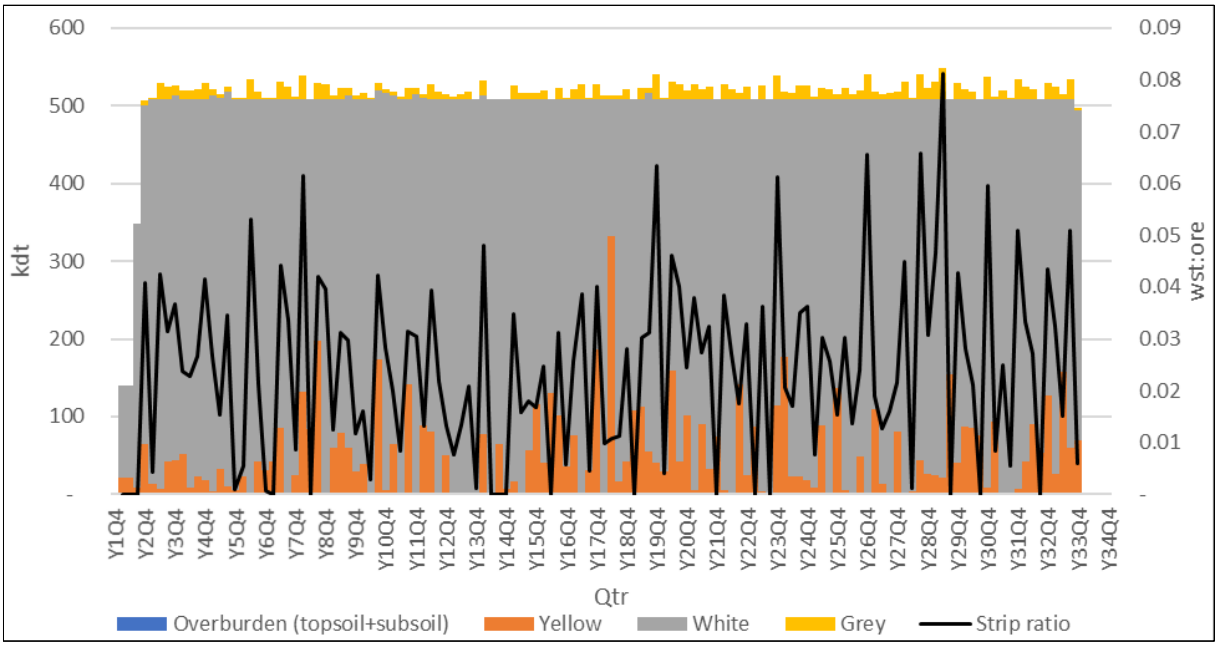


Figure 3.26 **Ex-pit movement by profile group**

Figure 3.27 shows the ex-pit ore and waste movement together with the haul distance estimate. The ore hauls trend from short to long as mining progresses through the panel. This variation could be reduced by mining from two or more cells at a time (i.e. one close to the plant and one far).

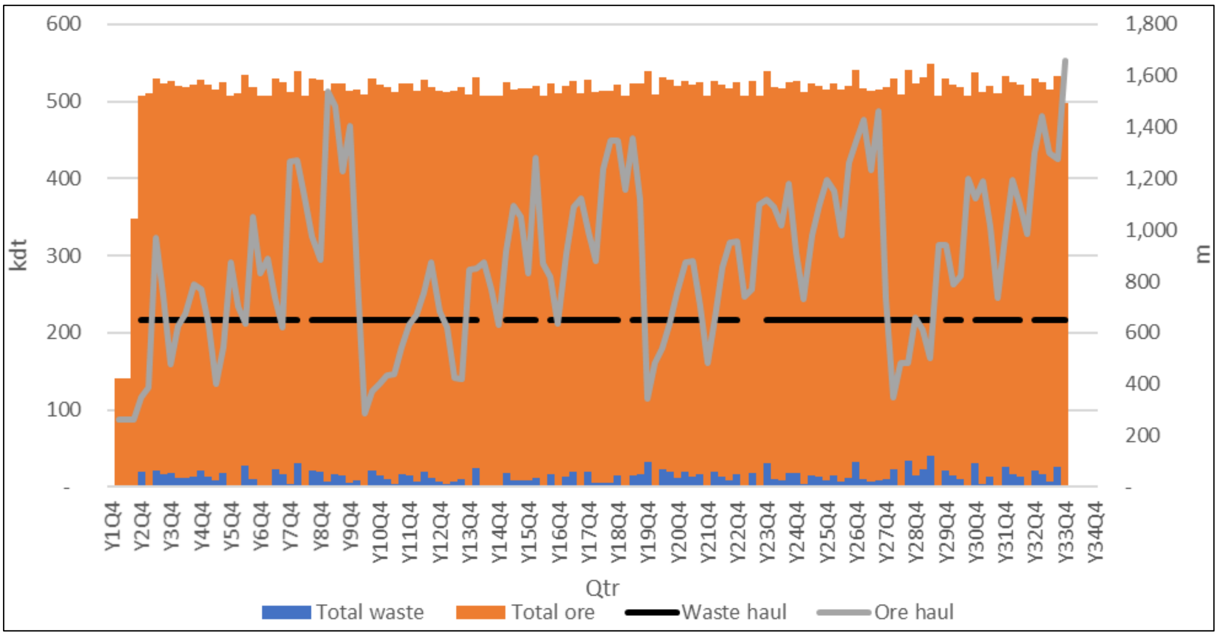


Figure 3.27 **Ex-pit movement and haul distance**

Processing

Figure 3.28 shows the ore feed by profile group. The plant ramp-up over four quarters is visible and is fully utilised until the last processing quarter.

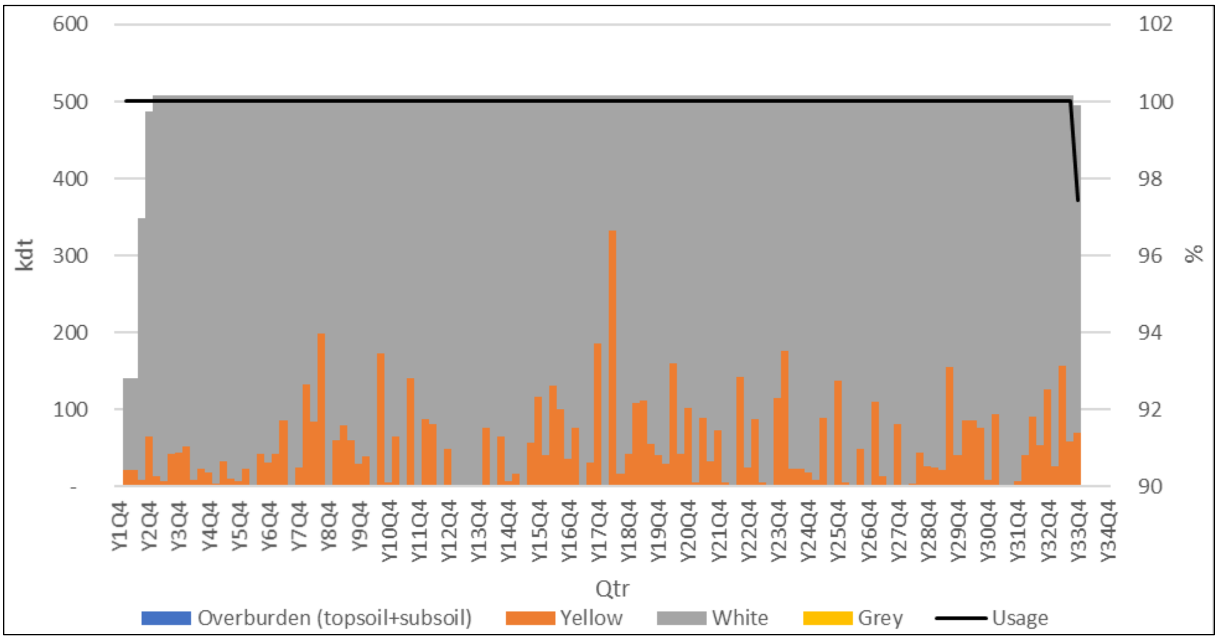


Figure 3.28 **Ore feed by profile group**

Figure 3.29 and Figure 3.30 show the ore feed grades. These vary between quarters with no clear trends.

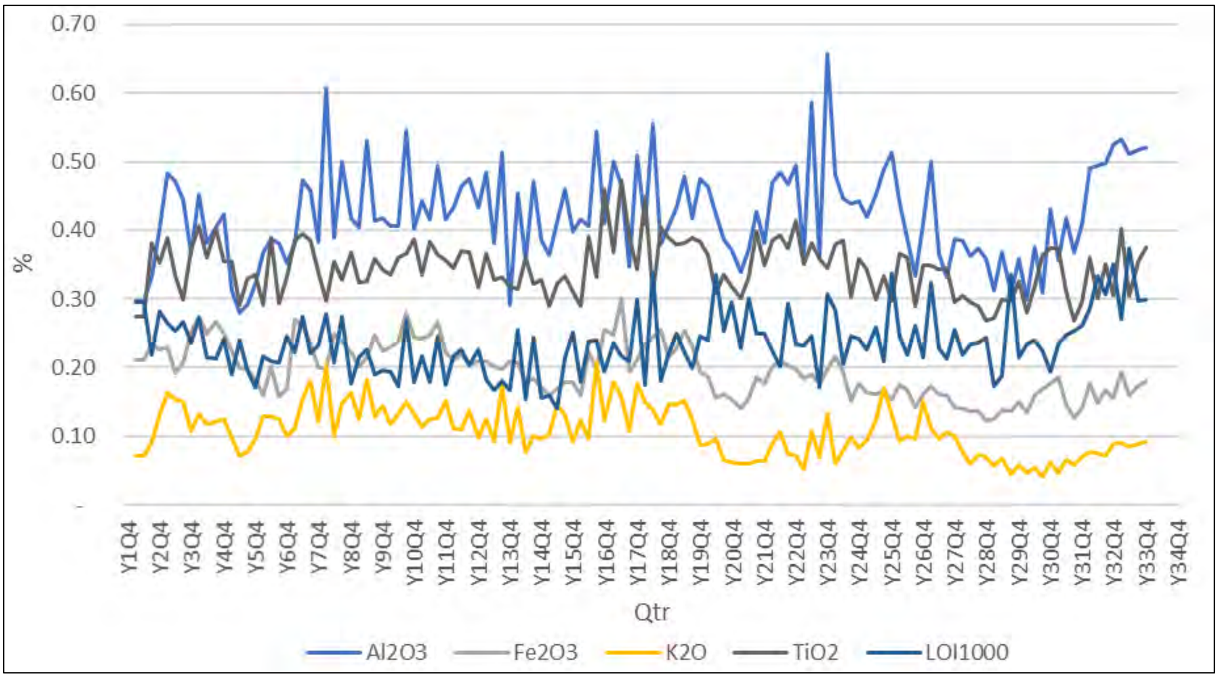


Figure 3.29 **Ore feed grades**

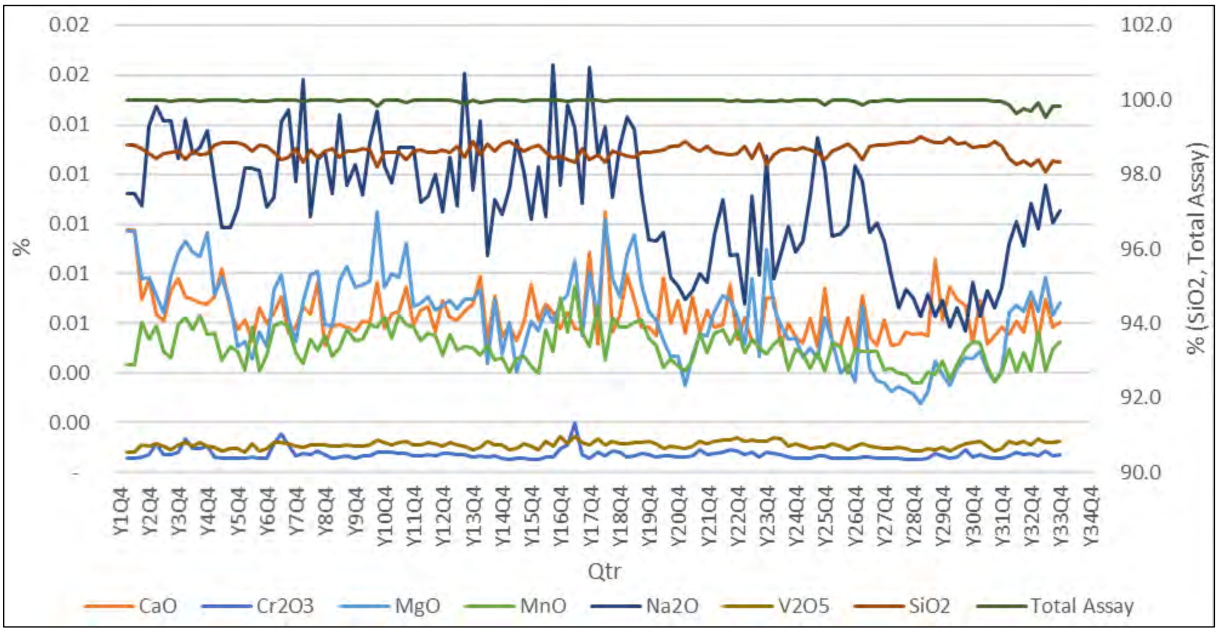


Figure 3.30 **Ore feed grades**

Figure 3.31 shows the plant product and rejects. Due to the constant mass yield these are constant except for the first and final years of production.

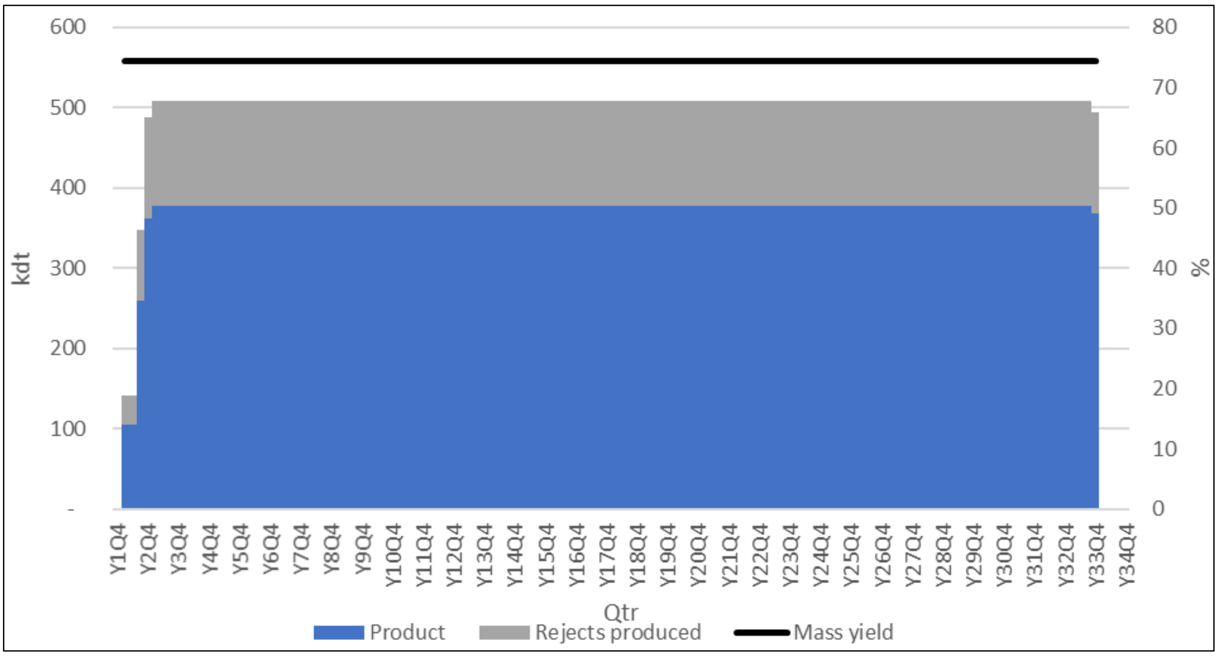


Figure 3.31 **Plant product and rejects**

Environmental

Figure 3.32 shows the estimated area cleared for topsoil stripping by quarters. Road construction distances are for access to the plant locations by road trains transporting the product.

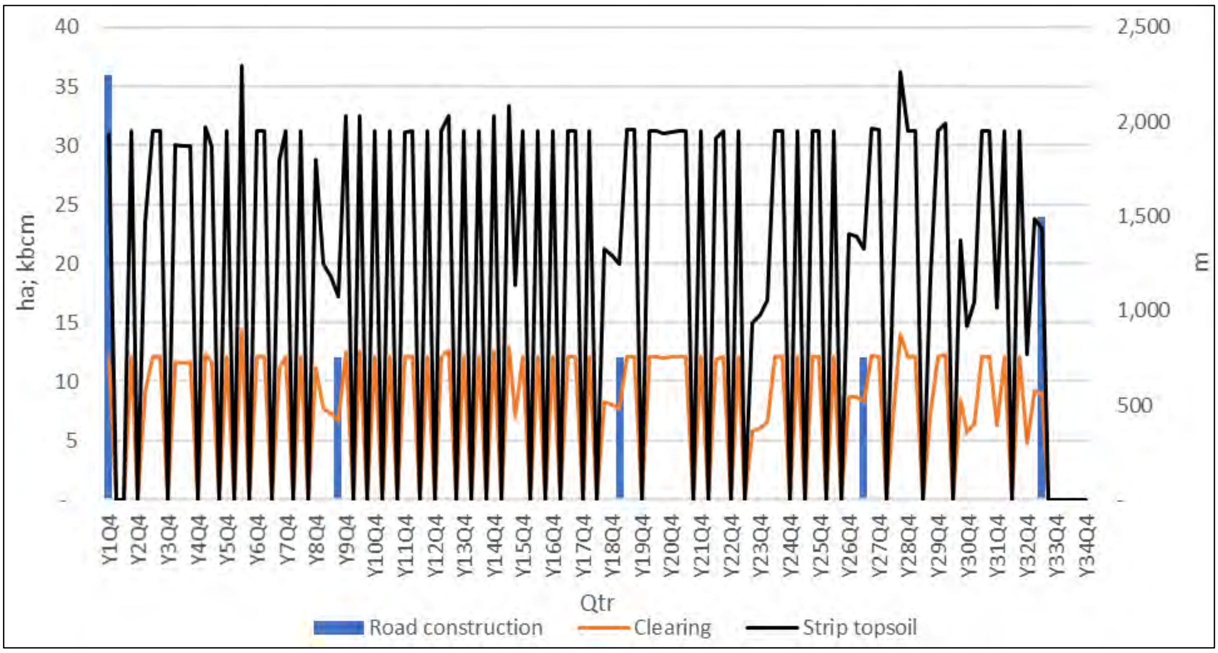


Figure 3.32 **Disturbance**

Figure 3.33 shows the estimated area rehabilitated and the topsoil spread over the rehabilitated area by quarters.

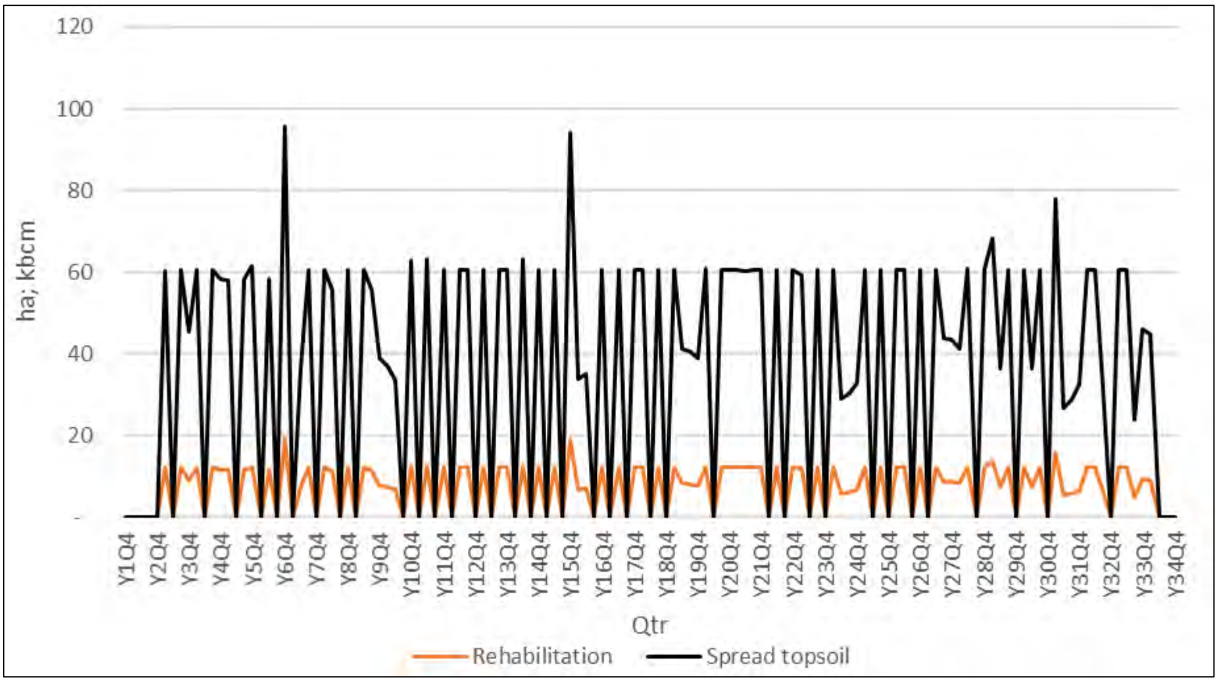


Figure 3.33 **Rehabilitation**

3.2.19 Mine requirements

Mining equipment and support

Table 3.11 summarises the average primary and ancillary equipment numbers required to mine the schedules.

Table 3.11 Equipment

Type	Units
FEL	2
ADT	3
Track dozer	1
Grader	1
Water truck	1
Service truck	1
Vibrating roller	1

Table 3.12 summarises the energy consumables required by the mining operation.

Table 3.12 Consumables

Type	Units
Fuel (ML/a)	1.2
Electricity (MW/a)	1.314

Table 3.13 summarises the mining full-time employees (FTEs) required.

Table 3.13 Personnel

Type	FTEs
Managers	1
Administration	2
Supervisors	6
Operators	31
Maintainers	21
Technical	4
Total	**65**

3.3 METALLURGY

3.3.1 Testwork regimes and programs

As part of the PFS, a bulk sample (+2 tonne) was generated from exploration drilling samples that conformed to the resource definition criteria being:

- White or yellow sand horizons only
- Above the water table
- Maximum depth 10 m
- >98% SiO_2.

A full list of the drill samples included in the bulk sample is provided in Appendix 7.

The drilling samples, see Figure 3.34, were composited and used to complete the PFS testwork, including:

- Ore characterisation
- Flowsheet development
- Preparation of marketing samples
- Slime settling characteristics
- Definition of the mass balance.

The testwork was completed at IHCR, a recognised mineral sand testing specialist, from October to December 2020 and reported in report 1959-PM-REP-0000-8001 Rev 2 “Pre-Feasibility Metallurgy Testwork” provided in Appendix 8.

Figure 3.34 Drilling samples identified for bulk sample composite

3.3.2 Ore characteristics

The resource definition compliant samples, such as:

- Intervals within the yellow and white definition only
- Intervals to a maximum of either the water table or 10 m below surface
- Greater than 98.2% SiO_2
- Representing four complete traverse drill lines of the deposit.

were recovered and blended to provide a homogeneous sample (see Table 3.14).

Table 3.14 Homogenous sample makeup

BHID	SAMPNUM	FROM	TO	BHID	SAMPNUM	FROM	TO	BHID	SAMPNUM	FROM	TO	BHID	SAMPNUM	FROM	TO
AC_16	B03601	0	1	AC_26	B01049	2	3	AC_38	B01209	3	4	AC_51	B01405	3	4
AC_16	B03602	1	2	AC_26	B01050	3	4	AC_38	B01210	4	5	AC_51	B01407	5	6
AC_16	B03603	2	3	AC_26	B01051	4	5	AC_38	B01211	5	6	AC_51	B01408	6	7
AC_16	B03604	3	4	AC_26	B01052	5	6	AC_38	B01212	6	7	AC_51	B01409	7	8
AC_16	B03605	4	5	AC_26	B01053	6	7	AC_38	B01213	7	8	AC_52	B01390	0	1
AC_16	B03606	5	6	AC_26	B01054	7	8	AC_38	B01214	8	9	AC_52	B01391	1	2
AC_16	B03607	6	7	AC_26	B01055	8	9	AC_39	B01218	0	1	AC_52	B01392	2	3
AC_16	B03608	7	8	AC_26	B01056	9	10	AC_39	B01219	1	2	AC_52	B01393	3	4
AC_16	B03609	8	9	AC_27	B01030	0	1	AC_39	B01220	2	3	AC_52	B01394	4	5
AC_17	B03621	0	1	AC_27	B01031	1	2	AC_39	B01221	3	4	AC_52	B01395	5	6
AC_17	B03622	1	2	AC_27	B01032	2	3	AC_39	B01222	4	5	AC_52	B01396	6	7
AC_17	B03623	2	3	AC_27	B01033	3	4	AC_39	B01223	5	6	AC_52	B01397	7	8
AC_17	B03624	3	4	AC_36	B01179	1	2	AC_39	B01224	6	7	AC_52	B01398	8	9
AC_17	B03625	4	5	AC_36	B01180	2	3	AC_39	B01226	8	9	AC_53	B01378	0	1
AC_17	B03626	5	6	AC_36	B01181	3	4	AC_39	B01227	9	10	AC_53	B01379	1	2
AC_18	B03641	0	1	AC_36	B01182	4	5	AC_40	B01231	0	1	AC_53	B01380	2	3
AC_18	B03642	1	2	AC_36	B01183	5	6	AC_40	B01232	1	2	AC_53	B01381	3	4
AC_18	B03643	2	3	AC_36	B01184	6	7	AC_40	B01233	2	3	AC_53	B01382	4	5
AC_18	B03644	3	4	AC_36	B01185	7	8	AC_40	B01234	3	4	AC_53	B01383	5	6
AC_18	B03645	4	5	AC_36	B01186	8	9	AC_40	B01235	4	5	AC_53	B01384	6	7
AC_25	B01059	0	1	AC_37	B01192	0	1	AC_40	B01236	5	6	AC_53	B01385	7	8
AC_25	B01060	1	2	AC_37	B01193	1	2	AC_50	B01414	0	1	AC_54	B01366	0	1
AC_25	B01061	2	3	AC_37	B01194	2	3	AC_50	B01415	1	2	AC_54	B01367	1	2
AC_25	B01062	3	4	AC_37	B01195	3	4	AC_50	B01416	2	3	AC_54	B01368	2	3
AC_25	B01063	4	5	AC_37	B01196	4	5	AC_50	B01417	3	4	AC_54	B01369	3	4
AC_25	B01064	5	6	AC_37	B01197	5	6	AC_50	B01418	4	5	AC_54	B01371	5	6
AC_25	B01065	6	7	AC_37	B01198	6	7	AC_50	B01419	5	6	AC_54	B01372	6	7
AC_25	B01066	7	8	AC_37	B01199	7	8	AC_50	B01420	6	7	AC_54	B01373	7	8
AC_25	B01067	8	9	AC_37	B01200	8	9	AC_50	B01421	7	8	AC_54	B01374	8	9
AC_25	B01068	9	10	AC_37	B01201	9	10	AC_51	B01402	0	1	AC_54	B01375	9	10
AC_26	B01047	0	1	AC_38	B01207	1	2	AC_51	B01403	1	2				
AC_26	B01048	1	2	AC_38	B01208	2	3	AC_51	B01404	2	3				

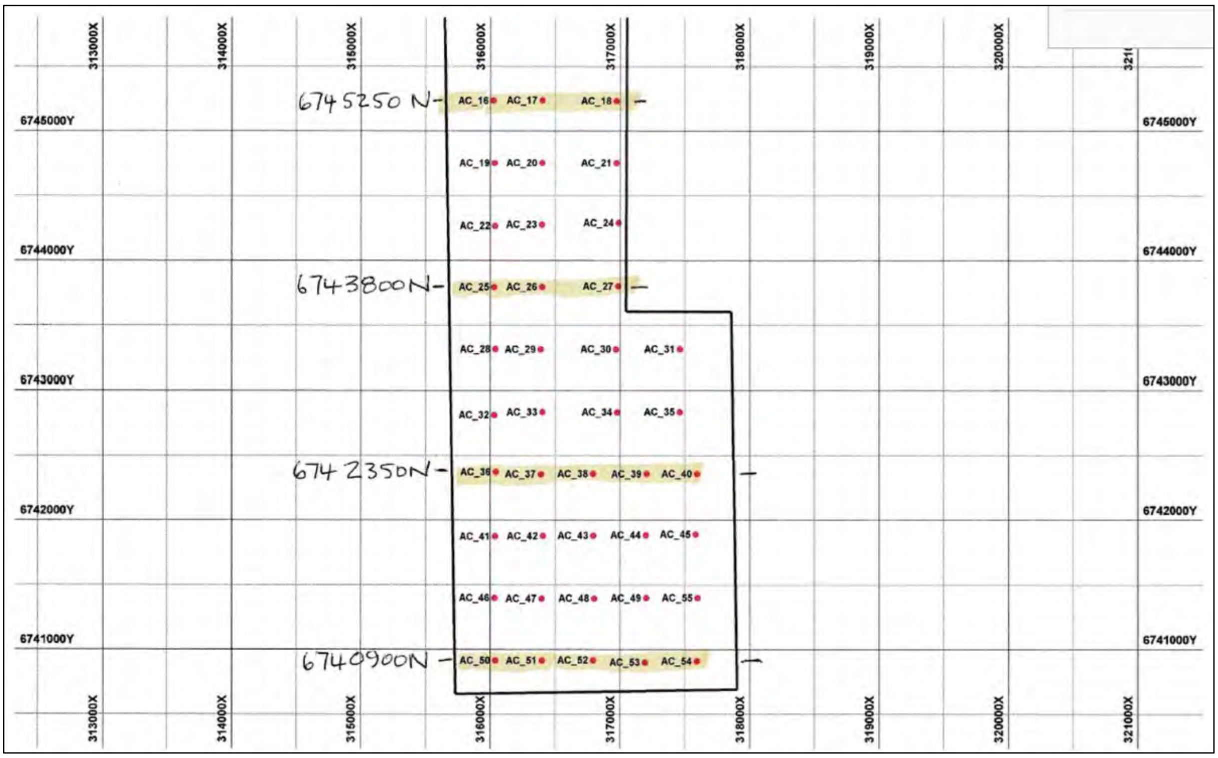


Figure 3.35 **Representative head sample makeup**

A representative 100 kg head sample was split to provide material for analysis and any requests for ROM/DSO material for marketing purposes. Refer Figure 3.35.

The head sample presented the ore characteristics as shown in Table 3.15 and Table 3.16.

Table 3.15 **Head assay (as ROM)**

SiO_2 (%)	Ag_2O (ppm)	Al_2O_3 (ppm)	As_2O_3 (ppm)	BaO (ppm)	CaO (ppm)	CdO (ppm)	CoO (ppm)	Cr_2O_3 (ppm)	CuO (ppm)	Fe_2O_3 (ppm)	K_2O (ppm)	Li_2O (ppm)	MgO (ppm)
99.1	BDL	2780	BDL	BDL	10	BDL	BDL	1	BDL	2053	511	BDL	6
MnO (ppm)	**MoO_3 (ppm)**	**Na_2O (ppm)**	**NiO (ppm)**	**P_2O_5 (ppm)**	**PbO (ppm)**	**SO_3 (ppm)**	**Sc_2O_3 (ppm)**	**SrO (ppm)**	**TiO_2 (ppm)**	**V_2O_5 (ppm)**	**Y_2O_3 (ppm)**	**ZnO (ppm)**	**ZrO_2 (ppm)**
59	BDL	10	BDL	3	BDL	33	BDL	BDL	3440	2	BDL	BDL	51

Table 3.16 **Head sample sizing**

Particle size distribution			
Size (µm)	**Retained (%)**	**Cumulative retained (%)**	**Passing (%)**
1000	0.7	0.7	99.3
850	0.9	1.6	98.4
710	2.1	3.8	96.2
600	4.5	8.2	91.8
425	16.9	25.1	74.9
300	26.9	52.0	48.0
250	15.8	67.8	32.2
180	17.4	85.2	14.8
125	9.1	94.3	5.7
75	3.1	97.5	2.5
0	2.5	100.0	0.0
Total	**100.0**	**-**	**-**
P50 (µm)	308		
P80 (µm)	472		

A split of the head sample was characterised by screening at 1 mm, 75 µm and the -1 mm +75 µm fraction being separated using heavy liquid at 2.65sg giving the results shown in Table 3.17.

Table 3.17 Head feed characterisation

1959 head feed characterisation	Mass (%)	Assay			
Fraction		SiO_2 (%)	Al_2O_3 (ppm)	Fe_2O_3 (ppm)	TiO_2 (ppm)
O/S (+1.0 mm)	0.7	98.7	8500	1600	1350
Fines (-75 µm)	2.5	94.0	9300	17000	26700
Sand (-1.0 mm, +75 µm)	96.8	99.2	2567	1667	2850
HM (+2.85sg)	0.6	13.4	100300	183000	427600
Floats (-2.85sg)	96.1	99.7	1900	300	350
Total feed	**100.0**	**99.1**	**2780**	**2053**	**3440**

3.3.3 Process selection and basis

The process flowsheet followed a route derived from earlier testwork completed on a smaller and non-representative sample completed by Nagrom.

3.3.4 Feed preparation

Phase 1 was a preliminary feed classification, including:

- Removal of +1 mm trash
- Desliming by cyclone.

The process flowsheet and mass flows are presented in Figure 3.36 below.

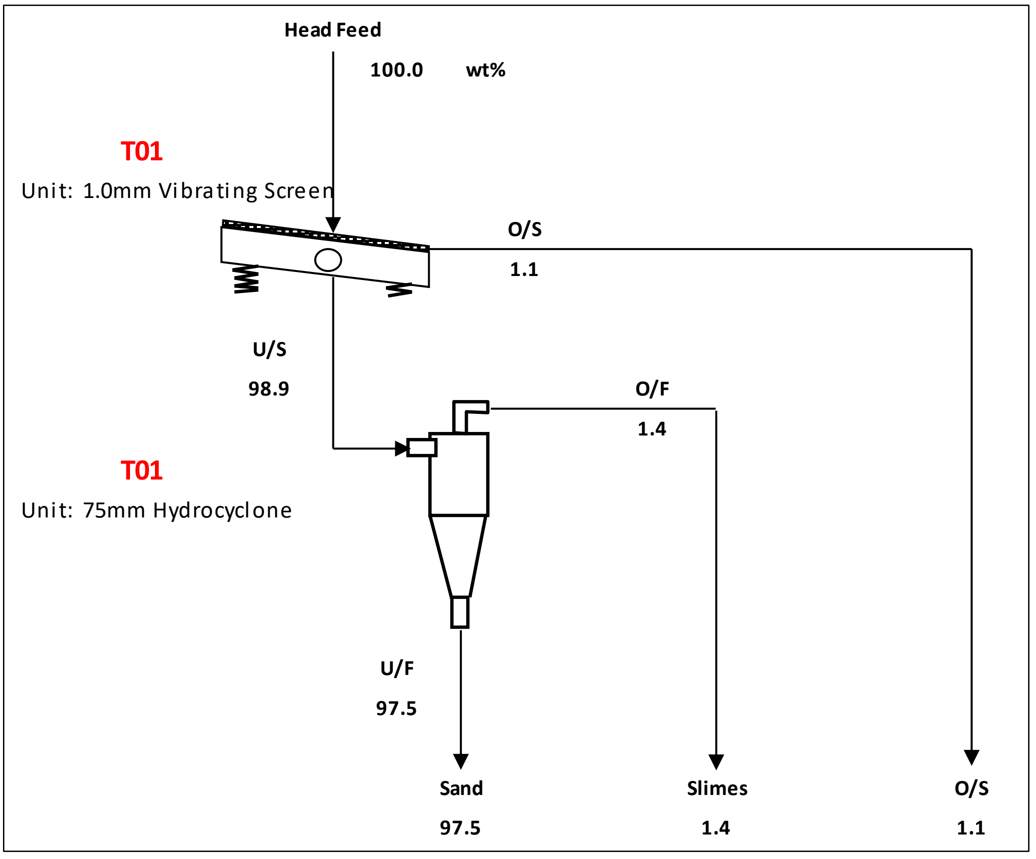


Figure 3.36 Feed preparation – process flowsheet and mass flow

The oversize contained the bulk of the organic matter and the very coarse silica sand. Subject to available marketing opportunities scope exists to separate the silica sand and organics by various processes to generate a potential filter sand product.

Table 3.18 below shows the assays and relevant recoveries of SiO_2 and contaminants. The data indicates the elevated rejection of contaminants in the cyclone overflow.

Table 3.18 Feed preparation process (FPP) assay and distribution summary

		Assay	Distribution

FPP summary (BVM ICP)	Dry mass (%)	SiO_2 (%)	Al_2O_3 (ppm)	Fe_2O_3 (ppm)	TiO_2 (ppm)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)
Screen O/S	1.1	98.7	8500	1600	1350	1.1	2.9	0.9	0.5
Cyclone O/F	1.4	94.0	9300	17000	26700	1.4	4.3	13.5	13.0
Cyclone U/F (Sand)	97.5	99.2	3000	1600	2650	97.6	92.9	85.6	86.6
Head feed	100.0	99.1	3150	1823	2985	100.0	100.0	100.0	100.0

The cyclone overflow was a mixture of silt +10 µm and clays -10 µm. This material was collected, and a flocculant supplier (BASF) was commissioned to conduct some preliminary flocculant selections and provided indicative consumption rates for use in the financial model. The results of this testwork are presented in BASF Report RM-006, which has been included with Appendix 8 metallurgical report and associated documents.

3.3.5 Wet gravity circuit

Phase 2 included a two-stage wet gravity circuit aiming to reject the heavy minerals which carry the bulk of the contaminant minerals (i.e. Fe_2O_3, TiO_2, Al_2O_3 et al.). The second stage of the spirals received the primary middling.

A series of sighter tests were conducted on the primary spiral feed material to assess two alternative spiral types with the better performing spiral MT MG 12 being selected. For expediency, the data was based on heavy mineral results. The process flowsheet, mass flows, and metallurgical results are presented in the Figure 3.37 and Table 3.19 below.

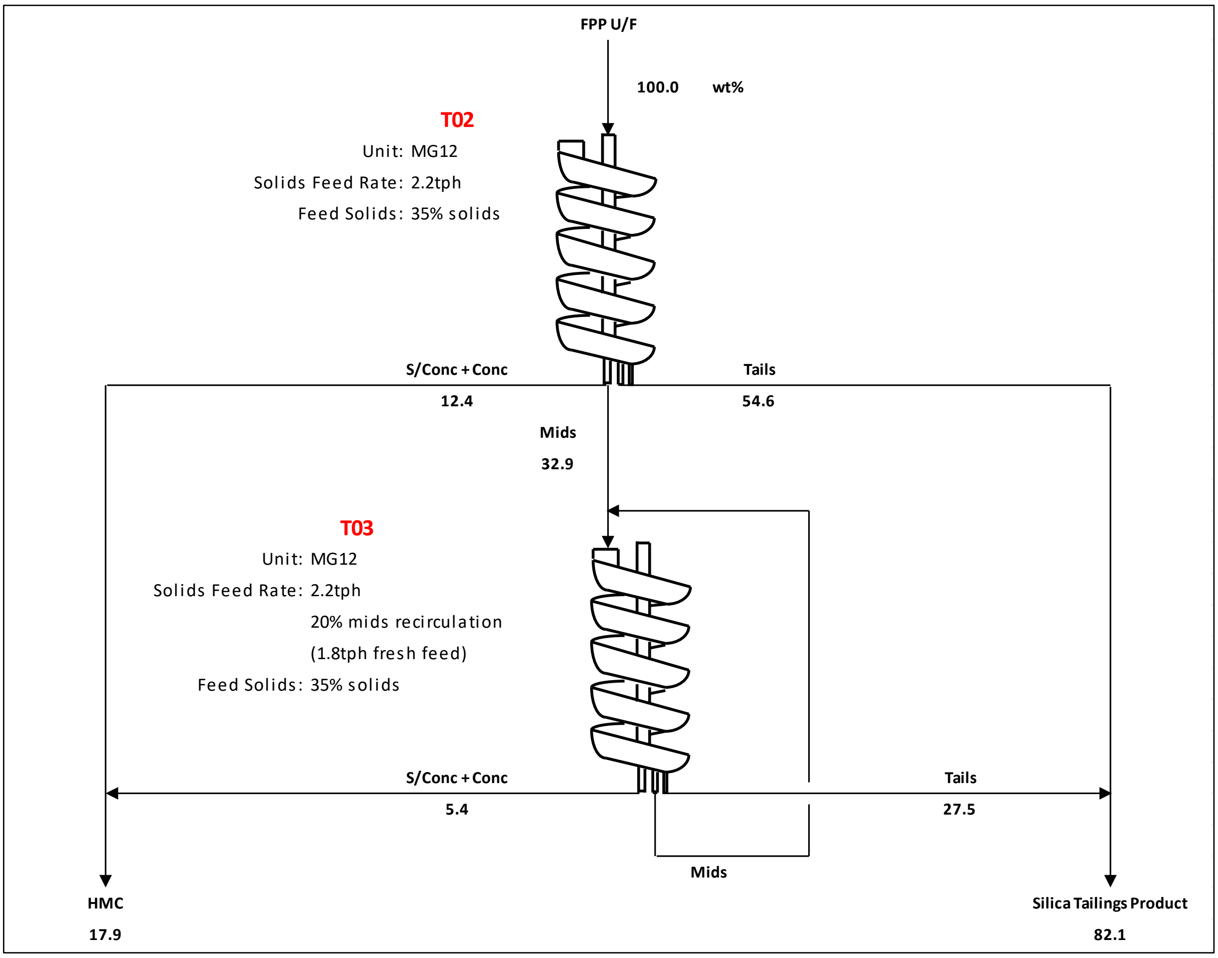


Figure 3.37 Wet gravity circuit – process flowsheet and mass flow

Table 3.19 **Gravity concentration process (GCP) assay and distribution summary**

GCP summary	Mass yield (%)	Assay (BVM ICP)							Distribution					
		HM (%)	Floats (%)	SiO_2 (%)	Al_2O_3 (ppm)	Fe_2O_3 (ppm)	TiO_2 (ppm)	LOI (%)	HM (%)	Floats (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)
HMC	17.9	3.9	96.1	97.3	3818	7382	13640	-	100.0	17.3	17.5	27.7	81.4	86.4
Tails product	82.1	0.0	100.0	99.6	2166	367	467	-	0.0	82.7	82.5	72.3	18.6	13.6
Feed	100.0	0.7	99.3	99.2	2461	1620	2819	-	100.0	100.0	100.0	100.0	100.0	100.0

3.3.6 Magnetic separation circuit

Phase 3 incorporated a magnetic separation stage to reject residual contaminant magnetic minerals carrying Fe_2O_3 and TiO_2.

A set of sighter tests were conducted to define the preferred operating parameters with regards to wash water addition. The two conditions assessed were the standard parameters used in mineral sands and an alternative using no non-magnetics wash water to minimise the risk of washing off magnetic minerals into the non-magnetics product. The results supported the nil non-magnetics wash water with a lower non-magnetics product grades for Fe_2O_3 and TiO_2 for negligible additional loss of mass into the magnetics product. This would also prove advantageous to operating costs.

The process flowsheet and mass flows are presented in Figure 3.38 and Table 3.20 below.

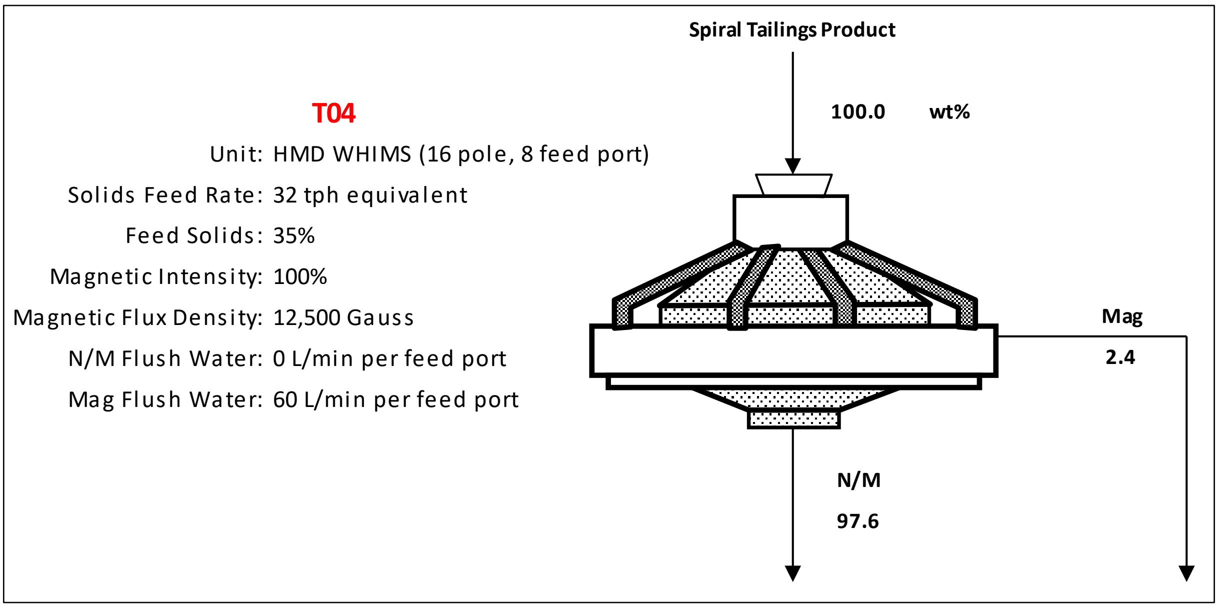


Figure 3.38 **Magnetic separation circuit – process flowsheet and mass flow**

Table 3.20 **Magnetic upgrade process (MUP) assay and distribution summary**

MUP summary	Mass yield (%)	Assay (BVM ICP)				Distribution			
		SiO_2 (%)	Al_2O_3 (ppm)	Fe_2O_3 (ppm)	TiO_2 (ppm)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)
Mag	2.4	99.2	3200	1700	2400	2.4	3.6	9.6	14.6
N/M	97.6	99.7	2167	400	350	97.6	96.4	90.4	85.4
Feed	100.0	99.7	2192	432	400	100.0	100.0	100.0	100.0

3.3.7 Attritioning circuit

Phase 4 investigated the potential for the improvement of the product quality due to surface staining. Eight splits of the wet high-intensity magnetic separation (WHIMS) non-magnetics were used to test the impacts of high density attritioning. The series of tests covered options re: residence times (i.e. three, six, and nine minutes), reagents (HCl) and Freevis9934 (a viscosity modifier) and reagent dosages (i.e. 15 kg/t and 32 kg/t of HCl or 15 kg/t and 32 kg/t of Freevis). Post attritioning each sample was screened at 75 µm to effect removal of slimes. A sample was screened only to provide a baseline.

All tested conditions provided negligible changes in contaminant levels and with consideration of capital and operating costs, this option was not followed.

3.3.8 Classification circuit

Phase 5 applied further classification steps to align the final product to industry standard parameters. The bulk non-magnetics product was subjected to a stage of up-current classification to affect a removal of fines with a target cut point of 150 µm. The underflow (aka coarse fraction) was then wet screened at 600 µm.

The process flowsheet, mass flows and metallurgical results are presented in Figure 3.39 and Table 3.21 below.

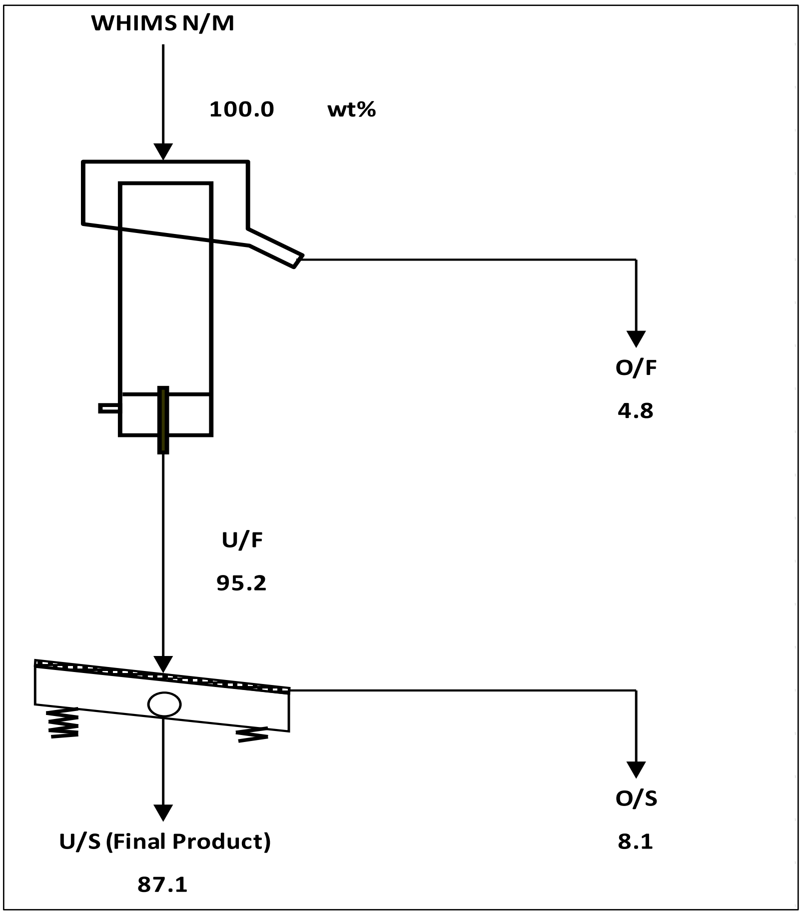


Figure 3.39 Classification circuit – process flowsheet and mass flow

Table 3.21 Classification assay and distribution summary

Classification summary	Mass by stage (%)	Assay					Distribution			
		SiO_2 (%)	Al_2O_3 (ppm)	Fe_2O_3 (ppm)	TiO_2 (ppm)	LOI (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)
UCC O/F	4.8	97.9	9990	680	910	0.26	4.7	22.0	11.1	11.1
UCC U/F (Calc.)	95.2	99.6	1789	276	369	0.14	95.3	78.0	88.9	88.9
Screen O/S	8.1	99.7	1405	235	300	0.13	8.1	5.2	6.4	6.2
Screen U/S	87.1	99.6	1825	280	375	0.14	87.2	72.8	82.5	82.8
Feed (Calc.)	100.0	99.5	2184	296	395	0.14	100.0	100.0	100.0	100.0
Feed (Assay)	-	99.5	2100	310	390	0.18	-	-	-	-

3.3.9 Product quality and recoveries

Following completion of the testwork, Perpetual prepared three preliminary products (see Table 3.22 below) with product data sheets, being:

- The up-current classifier (UCC) underflow fraction, which fraction which the assigned product name of Beharra Premium #44 which has a nominal AFS No. of 44
- The screen oversize fraction which the assigned product name of Beharra Special #27 which has a nominal AFS No. of 27
- The screen undersize fraction which the assigned product name of Beharra Special #46 which has a nominal AFS No. of 46

Table 3.22 Product classification data

Testwork classification	Product classification	Mass by ROM	Assay				
			SiO_2 (%)	Al_2O_3 (ppm)	Fe_2O_3 (ppm)	TiO_2 (ppm)	LOI (%)
		%	**97.9**	**9990**	**680**	**910**	**0.26**
UCC Underflow (calc.)	Beharra Premium #44	74.4	99.6	1789	276	369	0.14
Screen O/S	Beharra Premium #27	6.3	99.7	1405	235	300	0.13
Screen U/S	Beharra Premium #46	68	99.6	1825	280	375	0.14

Product size distributions for each of the above products are presented in Figure 3.40 below.

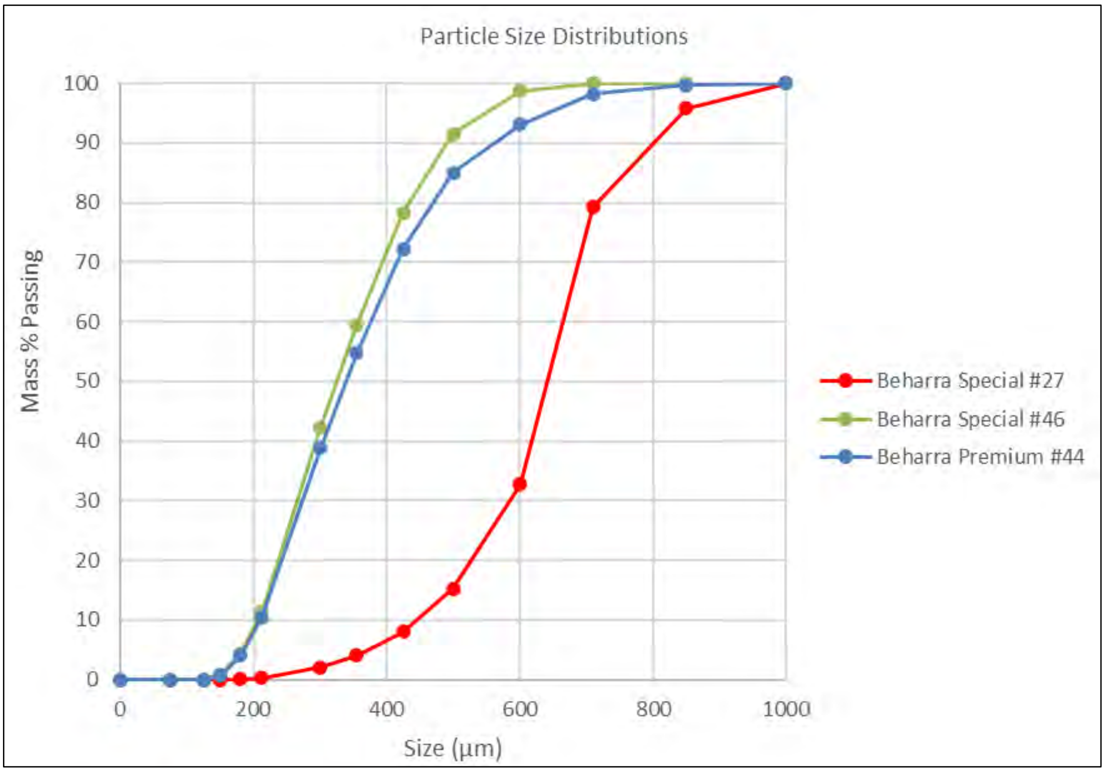


Figure 3.40 Product size distribution

The yield to Beharra Premium #44 represents 74.4% of the bulk ROM feed sample and for the PFS, only one product yield is sufficient for the Ore Reserves estimates, and only one suite of product grades (yielded chemistry grades) is used for estimation of Ore Reserves.

Assays of intermediate products that may also be of a marketable quality are presented in Table 3.23.

Table 3.23 Intermediate product assays

Process stream	Mass % vs ROM	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)	LOI (%)
Primary spiral tails	53.8	99.5	2240	340	460	0.11
Mid retreat tails	26.8	99.6	1860	280	370	0.08
Combined spiral tails	80.6	99.5	2114	320	430	0.10
WHIMS non-magnetics	78.1	99.5	2100	310	390	0.18

3.3.10 Process flow overview

The process flowsheet for the bulk sample and the relevant intermediate potential product qualities is detailed in Figure 3.41 below.

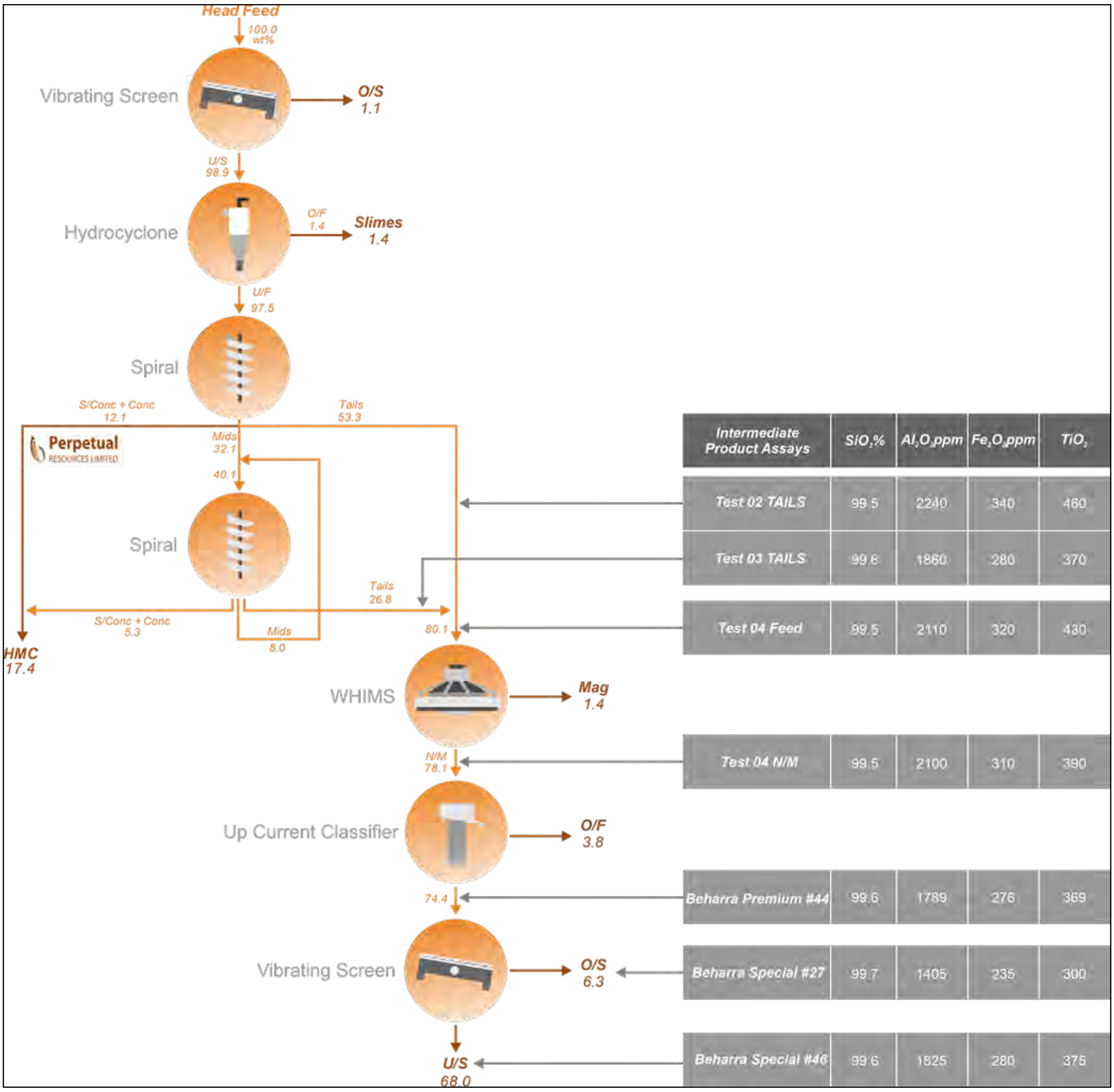


Figure 3.41 Process flowsheet

3.3.11 Process options

During the process of the flowsheet development, an abbreviated assay technique was used. This involved the assays being completed using an ICP analysis with a constrained level of precision and accuracy, i.e. a minimum level of detection (LOD) of 100 ppm and accuracy of ±50 ppm.

On completion of the test program, a more definitive ICP procedure was used with a minimum LOD of 10 ppm and accuracy of ±5 ppm. This procedure is used for certification of bulk shipping samples and are certified results.

The results derived from the definitive assay procedure for the preliminary products indicated considerable improvement in the combined spiral products Fe_2O_3 results (i.e. from 370 ppm to 320 ppm) but comparable results for the SiO_2, Al_2O_3 and TiO_2.

As a function of the initial results, a large mass rejection (i.e. 17.4% of the ROM) resulted from the wet gravity processing phase.

With the revised assays, future testwork will focus on the reduction in this mass rejection at this stage and would be expected to generate a higher mass yield to the final products with minimal, if any loss in product quality.

Further work is also planned to assess any potential product quality impacts from the processing of the yellow and white horizon sands separately.

3.4 MINERAL TREATMENT AND HANDLING

3.4.1 Process facility description

The preliminary planning for operations is for the transport of ore by truck to the fixed process facility.

ROM material will be stockpiled near the feed module for loading into the feed bin by FEL at a nominal rate of 250 tph.

The feed module consists of feed bin (30 m^3) sized to provide sufficient surge capacity (approximately five minutes) to allow continuous feed delivery during refuelling of the loader, operator shift change and any ancillary stockpiling activities required.

Feed is drawn from the bin by a feed belt onto a transfer conveyor fitted with a belt weigher. The belt weigher provides feed back to the belt feeder drive to maintain the required feed rate.

The feed discharges the belt and is slurried with water for presentation to a 1 mm screen for rejection of coarse material being both mineral and organics.

The oversize is conveyed to a separate stockpile for either return to the mine void or potential site use.

The slurried undersize is pumped via a hydro-cyclone to effect desliming and fines rejection with a cut point of approximately 75 µm.

Figure 3.42 Silica sand plant

Source: CDE

The cyclone overflow reports with other cyclone stage overflows to the thickener.

The cyclone underflow is collected in a sump and pumped to two stages of wet gravity spiral separators in a Primary (108 starts) and Mid Retreat (36 starts) configuration and associated pumping stages to reject elevated sg minerals from the free silica sands.

The spiral tails are combined with other sand reject streams and pumped to the rejects dewatering screens.

The spiral product streams are pumped to a distributor feeding four WHIMS units to reject magnetic contaminants from the non-magnetics free silica sands. The magnetic rejects are added to the spiral rejects.

The non-magnetic fraction is pumped via a distributor to two clusters of dewatering cyclones each mounted above two crossflow UCCs. The overflows report to the thickener and the underflows feed to the classifiers.

The classifiers are operated to reject fine minerals to effect both contaminant mineral rejection which predominate the fine fraction and to reject fine silica, which is typically a negative characteristic to silica sand marketing.

The classifier overflow reports to the thickener. Subject to marketing requirements the underflow is either pumped to the final product dewatering screens as the Beharra Premium #44 product and the dewatered product is conveyed to the nominated product stockpile.

Alternatively, the underflow is pumped to a classification screen to prepare a coarse and fine product. The screen aperture will be selected to meet defined marketing requirements. In the testwork, the screens used a 600 µm aperture and produced the Beharra Special #27 (coarse) and Beharra Special #46 (fine) products.

The screen oversize already being dewatered is conveyed to the nominated stockpile area. The screen undersize is pumped to the final product dewatering screens and conveyed to the relevant stockpile.

Dewatering screen supernatant reports to the thickener

Reject streams from the spirals and WHIMS mags are pumped to a cyclone cluster mounted above the rejects dewatering screen. The dewatered sand fraction is conveyed to the rejects bin mounted for direct dumping into the ore trucks for return to the mined-out void. Nominally, one or two trucks per hour will backload these rejects.

The various fines/slimes-bearing flows will report to the thickener with a suitable flocculant added to generate a clear overflow for reuse within the process water circuit.

The thickener underflow will be pumped to a plate press to further densify the fines/slimes. The solids discharge will be combined with the sand rejects into the rejects bin for return to the mine void. The supernatant will be recycled to the thickener feed.

Automatic samplers will be fitted to allow all potential product streams to be sampled, located as follows:

- Slurry samplers
- WHIMS feed
- UCC feed
- Screen feed
- Screen undersize
- Conveyor crosscut samplers
- Screen oversize.

For plant mass balancing, each of the following slurry streams will be fitted with mass low/density instrumentation:

- Spiral feed
- WHIMS feed
- UCC feed
- Screen feed
- Screen undersize.

A preliminary GA can be found at Appendix 13.

3.4.2 Process water supply

Operation of the plant will see a high level of reuse of the process water to minimise both the demand for additional make-up water and minimise the impact on the water table.

It is proposed to utilise a large process water storage tank to which the thickener overflow reports.

Water to make up for losses into both the final product and rejects will be sourced from a deep aquifer bore fitted with a suitable pump to bring to the surface and a booster pump to deliver the water to the process water tank to meet demand.

The process water will be reticulated to the plant in two services with one being a low-pressure supply for sump make up and high-volume dilution requirements and a second lower volume, high-pressure supply to meet demand for high and or constant pressure demands (i.e. WHIMS wash water, screen sprays etc.).

The makeup water requirement for the plant is nominally 29.5 m^3/hr.

3.4.3 Rejects and water disposal

The reject rate is relatively low (<60 tph) and rejects other than the primary screen oversize will be collected in the elevated rejects bin. The bin will be fitted with a dump valve that can be operated from the truck by the operator to effect the load out of rejects for return to the mine void. This equates to three trucks being assigned a back haul duty in every two-hour period.

The primary screen oversize will be stockpiled for possible use for the rehabilitation to utilise the elevated level of organics likely to be present and the coarseness of the sand to minimise windage of the surface during rehabilitation.

This solution ensures that rejects are dewatered directly by the dewatering screen at nominally 10% moisture, thus minimising water loss, and can be placed back on to the pit floor to meet the soil profile and the rehabilitation recommendations.

Water disposal will not be required as the site will be a nett user of water due to:

- Evaporation of retained water in the product stockpiles and replaced rejects
- Seepage of retained water in the product stockpiles and replaced rejects and from plant spillages/overflows following operational disturbances
- Water retained in product being transported off site.

Due to the substrate surrounding the plant site, there will be negligible stormwater occurrences. The minimal roofing of plant and equipment will have any flows directed via the thickener for supplementation of bore water demands.

3.4.4 Final product handling

Subject to the market requirement, multiple defined product stockpiles will be delineated using concrete bollards. The final product is dewatered using dewatering screens giving a moisture content of nominally 10%. The final product is then stacked using a radial stacker conveyor. This provides a stockpile pre transport of nominally 15,000 tonnes.

As the stacker conveyor travels radially the final product is further dewatered using an under-stockpile dewatering system. This system uses drain coil type pipework connected to a vacuum pump. The reclaimed water is then pumped back to the process water bin for reuse in the process.

This provides a final moisture content of around 5% remaining in the transported product.

Product loading will be by FEL into the truck. To prevent access to incorrect stockpiles for load out, suitable barriers will be put in place.

4. INFRASTRUCTURE AND SERVICES

4.1 INFRASTRUCTURE REQUIREMENTS

Due to the close proximity of the Beharra project site to Dongara and Geraldton, on-site infrastructure requirements during the construction phase will be minimal and supply services during mine and process plant operations readily available.

4.2 UTILITIES

4.2.1 Power supply

Process plant energy consumption will be nominally 12 GWhpa at peak production, achieved within the first three years of operation.

Perpetual engaged PCS to provide an evaluation of energy supply options for the Beharra Project. The PCS-issued Beharra Silica Project energy supply strategy report is attached at Appendix 12.

A range of power station configurations were evaluated and found that the thermal (diesel fuelled) power station design was optimal with the potential introduction of solar at a later date. This allows the Project to commence with a reliable thermal power solution and potentially augment the power station with solar PV should demand increase. Figure 4.1 shows a typical thermal power station located on site.

Figure 4.1 Typical thermal power station

Proposed power stations consist of multiple generators providing redundancy and maintenance opportunities minimising operational impact. The power station will be located within close proximity to the process plant, and be diesel fuelled via a self-bunded fuel storage tank. Taking into consideration a mine life in excess of 15 years, the power station will also be relocatable. Figure 4.2 depicts the internal layout of a thermal power station.

Figure 4.2 Thermal power station – internal layout

An opportunity remains to connect to the South West Interconnected System, but based on initial inquiries with Western Power, the cost to connect to and upgrade the existing distribution power lines to the Beharra project site are unlikely to be economic compared to the standalone option.

4.2.2 Water supply

Groundwater overview

Perpetual is currently investigating various options for the securing of a groundwater licence for the proposed Beharra operation. The Beharra deposit sits over the northern extents of the deep confined Yaragadee aquifer.

**The Yarragadee north aquifer is the largest regional aquifer in the northern Perth Basin, containing a great thickness of low-salinity groundwater* (Figure 4.3). *The Yarragadee aquifer extends south from the Greenough River to the Perth region, covering a total area about 17,600 km^2.*

The Yarragadee aquifer consists of a multi-layered sequence of sandstone beds with very fine to very coarse grained and granule-sized quartz sand that are often feldspathic with variable amounts of matrix clay, and interbedded siltstone, shale and claystone.

There are four sub-units within the Yarragadee Formation that have distinctive lithologies: units A and C are predominantly unconsolidated sandstone, while units B and D are predominantly siltstone, shale and claystone.

Groundwater recharge into the Yarragadee aquifer is mostly by direct rainfall infiltration over outcrop areas as well as downward leakage from overlying aquifers. Concentrated recharge from rivers and streams is also important in some areas.

Groundwater within the Yarragadee aquifer is generally fresh to marginally brackish (Figure 4.4) *but varies considerably both laterally and with depth. This variability is due to salt input from recharge, depth of groundwater flow and residence time.*

*Source: Department of Water – North Perth Basin, Geology, hydrogeology and groundwater resources

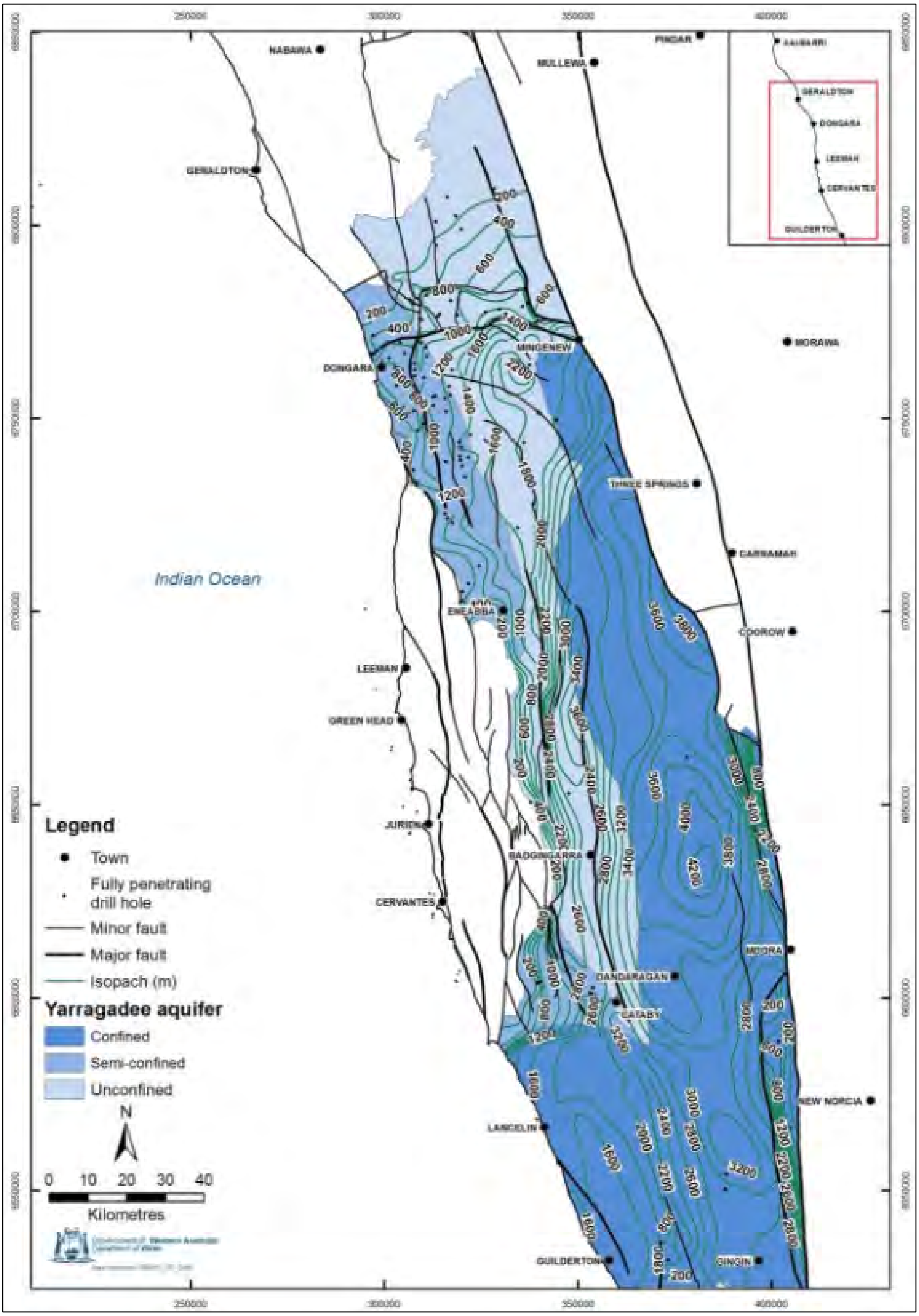


Figure 4.3 **Yarragadee aquifer – saturated aquifer thickness**

Source: Department of Water

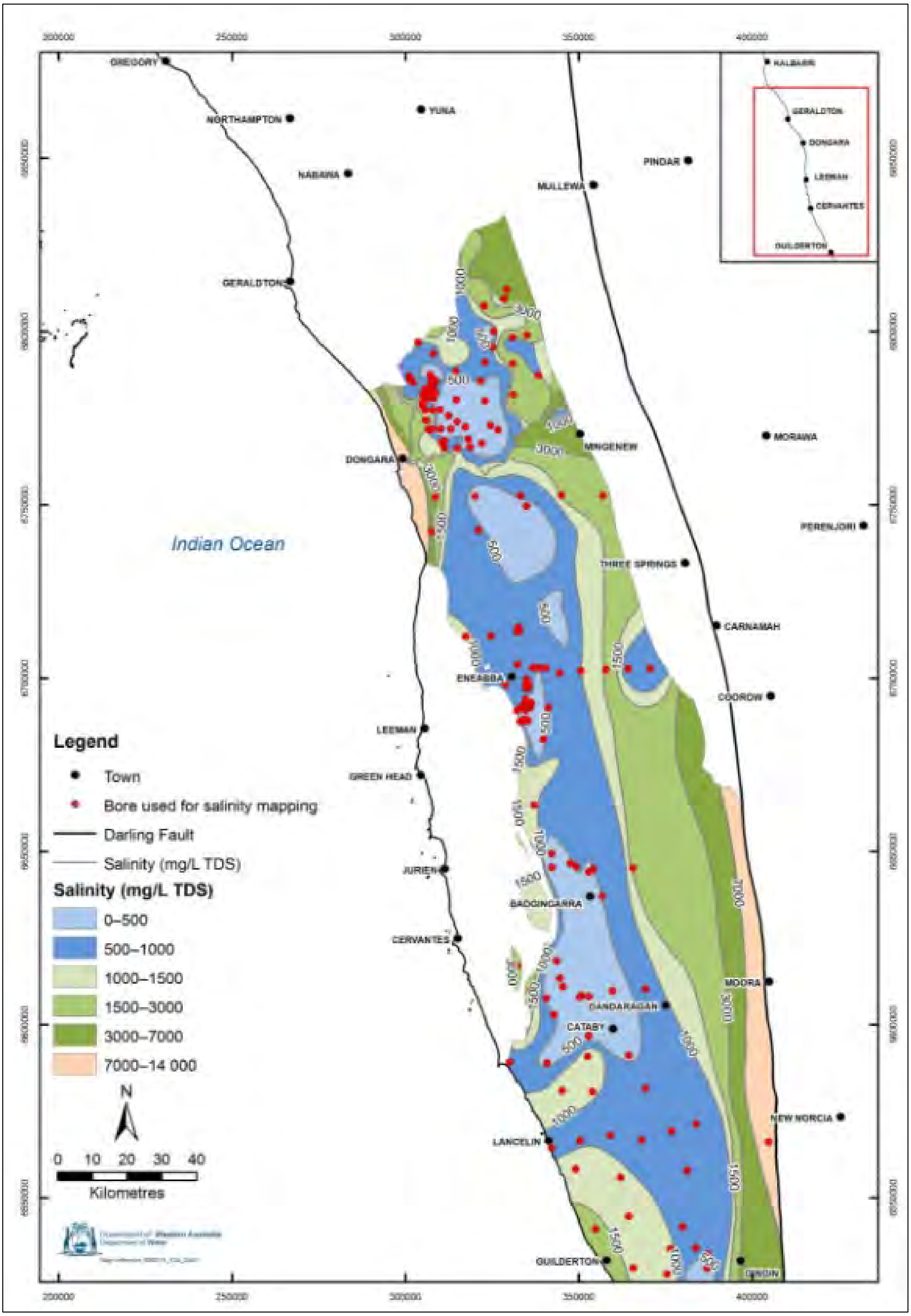


Figure 4.4 **Yarragadee aquifer – groundwater salinity**

Source: Department of Water

Perpetual RESOURCES LIMITED

Perpetual is currently investigating the practicalities of securing a groundwater licence from the Yarragadee aquifer within the Dongara and Twin Hills sub-areas, both of which are accessible to the Beharra Project (refer Figure 4.5).

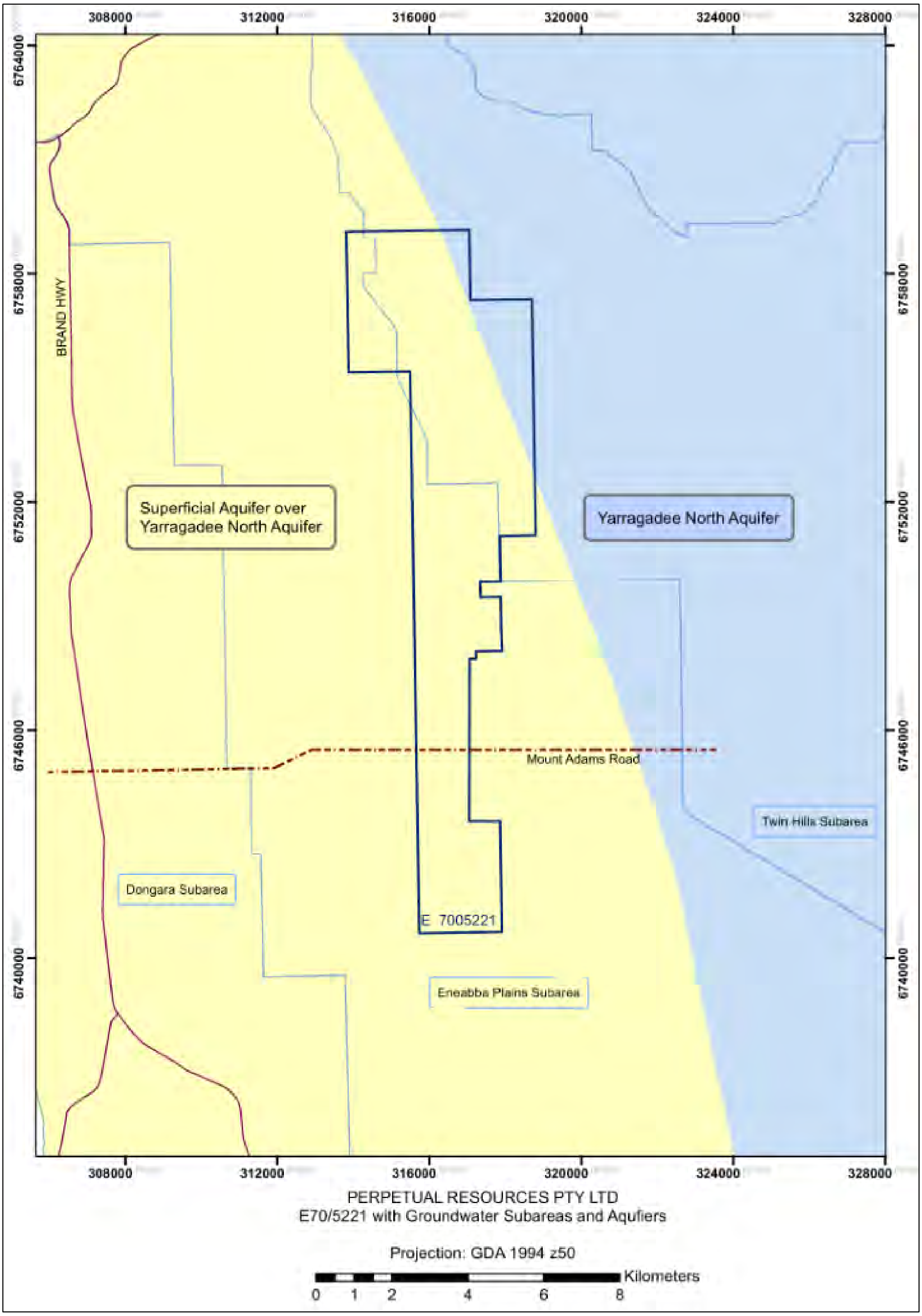


Figure 4.5 **Groundwater sub-areas (namely, Dongara, Eneabba Plains and Twin Hills)**

Source: Pennington Scott

Perpetual, together with our groundwater consultants, are in liaison with the Department of Water and Environmental Regulation (DWER) and will continue to work towards optimising the water supply during the DFS.

Water table – interface

Generally, the water table in the proposed mining pit is nominally +10 m below natural ground level. The water table is associated with grey sands which are not of significant commercial value due to the higher levels of contaminants they contain.

As part of the early mine pit optimisation study, the pit floor was raised by 0.5 m in the pit shell model to ensure a cleaner interface between the white and grey sands and to ensure the operation was operating above the water table at all times (refer Figure 4.6).

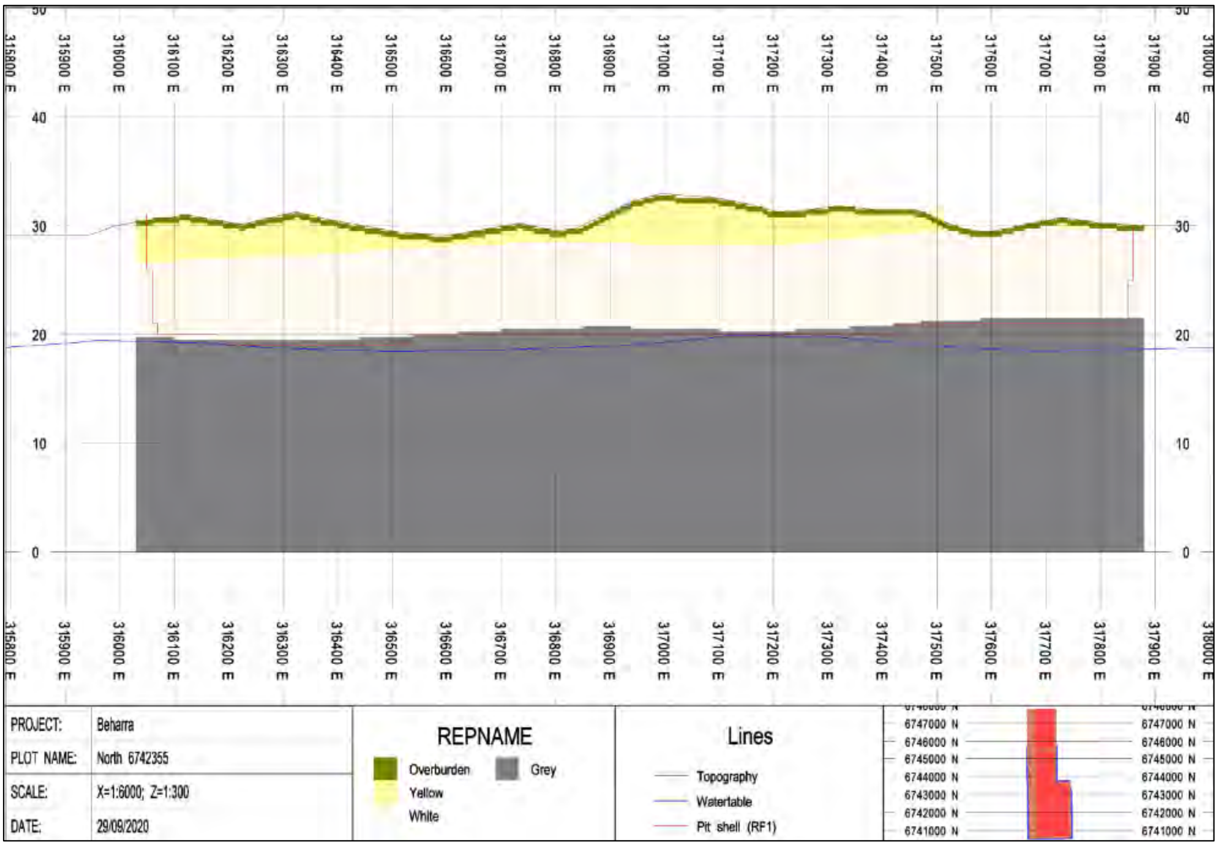


Figure 4.6 Typical pit section showing yellow, white, grey sands and water table

Source: Snowden (2021)

Process water requirement

As part of the process plant circuit development, the mass balance identified the make-up water requirement for the process plant and various other minor consumers of water for the operation. The make-up water requirement to satisfy the operation is between 0.5 GL and 0.7 GL.

As noted during the metallurgical bulk test program, the Beharra feedstock contains very low slimes (-75 um material) by mass at around 1.4% of the dry feed. One of the added advantages of this relatively clean material is the ability to recycle the plant process water with a high efficiency and minimal losses.

The abovementioned material profile, in conjunction with excellent settling rates achieved during the floc tests conducted by BASF further minimised the makeup water requirement. This is achieved by eliminating large settling and process water ponds which are prone to high levels of evaporative loss.

The ground water resources in the area are suitable for the process water application as the salinity and Total Dissolved Solids (TDS) is generally <1000 ppm.

Perpetual will further work to optimise the process water consumption during the next phase of project development.

4.2.3 Fuel supply

Fuel is available on a contract delivery basis from well-established distributors based out of Geraldton and tanker deliveries will be maintained to support process plant operations utilising on site storage. A self-bunded fuel tank located at the process plant area will provide a total storage capacity of 69 kL and is designed to accommodate a 10-day fuel supply, with 25% buffer, for the power station and light vehicle usage.

Fuel supply and storage for mining operations will be provided by the mining contractor.

4.3 BUILDINGS AND FACILITIES

4.3.1 Offices

Site administration offices are of containerised relocatable design. Offices and amenities also included in this group are first aid, ablutions, crib room and laboratory. Allowances for basic fit out have been made.

4.3.2 Workshops

Workshop and store facilities consist of a typical covered containerised dome shelter construction utilising 2 x 12 m shipping containers adjoined using a dome shelter and concrete slab. A double stacked site store and additional office facility is also included.

4.3.3 Mineral laboratory

The site mineral laboratory will consist of a 6 m relocatable containerised unit housing basic site quality assurance production monitoring equipment, such as vibratory sieve shaker, PSD screens, and sampling equipment. Production assays will be sent offsite for analysis and final product assays conducted at the wharf prior to shipment.

4.4 TRANSPORT INFRASTRUCTURE

4.4.1 Road

The investigations into the transport of the Beharra Project final product by road required an appraisal of the existing offsite infrastructure, existing road conditions and likely upgrades required for the hauling of final product.

Given that the most cost-effective and practical solution is utilising PBS approved 100T Super Triples as the road transport vehicle, these loads and transport frequencies were then applied to the road network and the following upgrades and options were identified.

Mount Adams Road

Currently, Mount Adams Road is rated at RAV 3.1 standard and can accommodate 55T doubles only. Hauling this size payload is undesirable from both cost and frequency perspectives.

Mount Adams Road will require upgrading to the RAV 7.3 standard in order to accommodate 100T Super Triple Road trains. The distance from the turnoff from the Brand Highway to site is nominally 9.0 km (refer Figure 4.7 and Figure 4.8).

Figure 4.7 Mount Adams Road – typical view east

While a full seal of this road has been allowed for in terms of capital, further engineering investigations will be required to determine whether a full seal of the road surface will be required, or whether sealing of the approach to the rise of the various elevations will be sufficient. This work is to be carried out during the DFS.

Figure 4.8 Mount Adams Road upgrade – route and elevation

Source: Google Earth Pro

The upgrade costs associated with these types of road upgrades are reasonably well understood and indicative costs are between A\$0.6 million/km and A\$0.8 million/km.

Given the size and frequency of the vehicle movements, consultation with a variety of existing stakeholders using Mount Adams Road currently and discussions with other project developers will be undertaken during the DFS.

Final apportioned costs will be determined once the various stakeholders have been further consulted and in principle agreements are in place.

Brand Highway–Mount Adams Road intersection

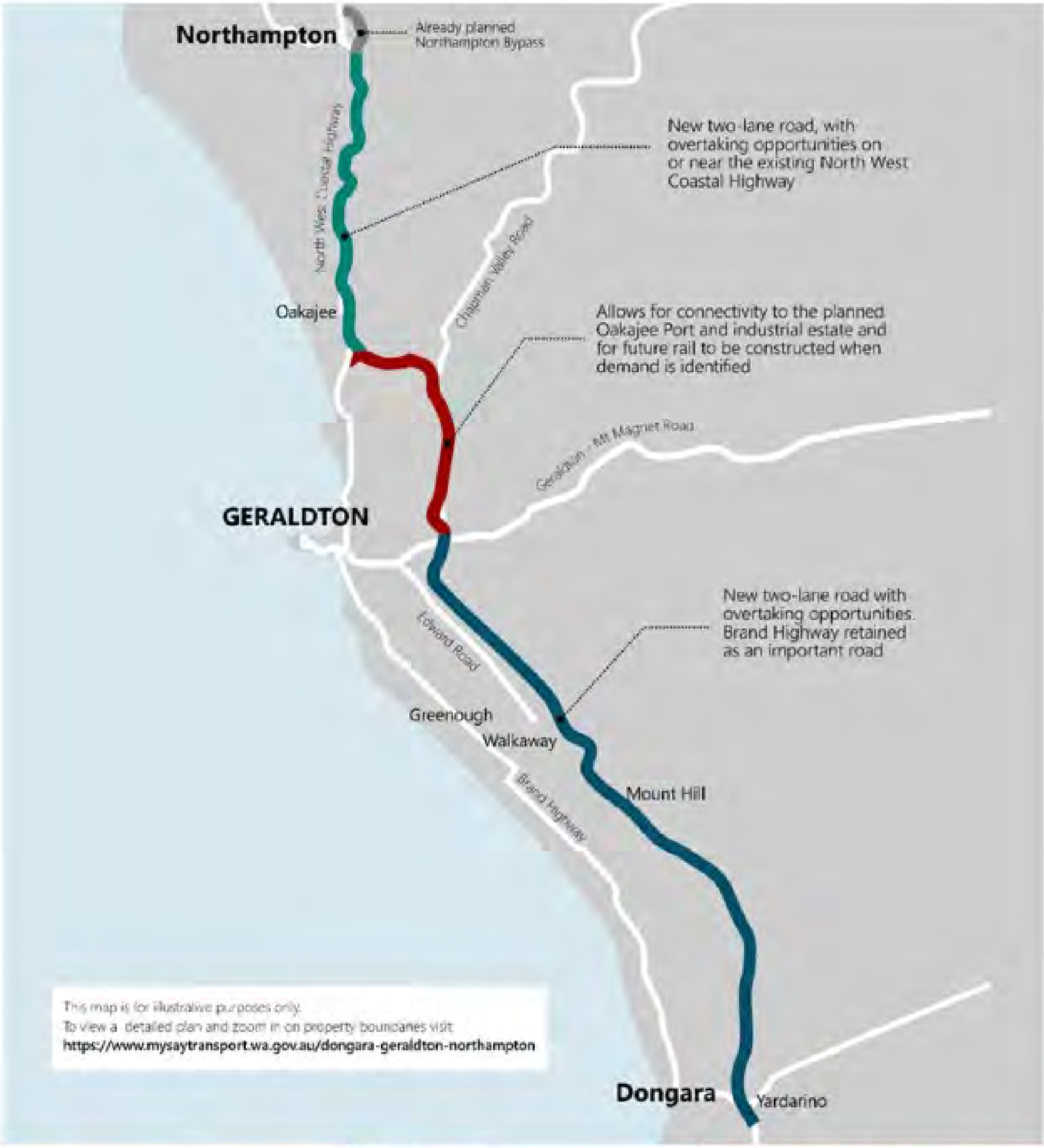
As part of the road upgrades required, the Brand Highway-Mount Adams Road intersection will need to be upgraded. This is based upon the selected transport configuration, in this case the Super Triple 100T units.

As trucks exit Mount Adams Road on to the Brand Highway and turn north to Geraldton, an acceleration lane will be needed to enable safe merging with other northbound road users. In addition, a turnoff lane will be required to enable safe exit from the traffic flow running south. Refer Figure 4.9.

Figure 4.9 Brand Highway–Mount Adams Road intersection
Source: Google Earth Pro

As a recent example, Image Resources are using the same 100T Triples for its Boonanarring mineral sands operation and was required to upgrade the intersection of Wannamal Road West and the Brand Highway running south to Bunbury. This upgrade was approximately a A$2.5 million exercise and it is likely that similar costs will be incurred for the Mount Adams Road upgrade.

Main Roads Western Australia (MRWA) is currently investigating an inland corridor that will bypass Dongara on the way to Geraldton (refer Figure 4.10 and Figure 4.11). The road will take a more direct route to Geraldton and could potentially eliminate about 20 km of road haul length from the freight route depicted in Section 5.2.7, thereby reducing freight costs in the future.



Dongara to Geraldton

A new inland corridor starting near the Brand Highway / Midlands Road intersection which links up with the current Arthur Road alignment to the south of Geraldton. Further investigations will focus on ways to minimise impacts on existing lifestyle and heritage properties, manage floodplain interactions and consider suitable local road connections.

Central link

The northern link and southern options are linked by proposed new road infrastructure within the already planned Oakajee Narngulu Infrastructure Corridor (ONIC). Further investigations will focus on the road alignment in isolation from planned future rail, without precluding the rail option. This allows flexibility in planning and has no additional impact on landowners within the ONIC.

Geraldton to Northampton

A new road is proposed within a wider corridor near the existing North West Coastal Highway. Minor sections of the existing highway would be retained as local service roads. This corridor avoids major impacts on large farming properties and has the potential to be staged. Further investigations will consider management of services and access to properties. This route allows for Northampton Bypass to be delivered as an independent stage.

Figure 4.10 Proposed Dongara to Geraldton inland corridor

Source: MRWA

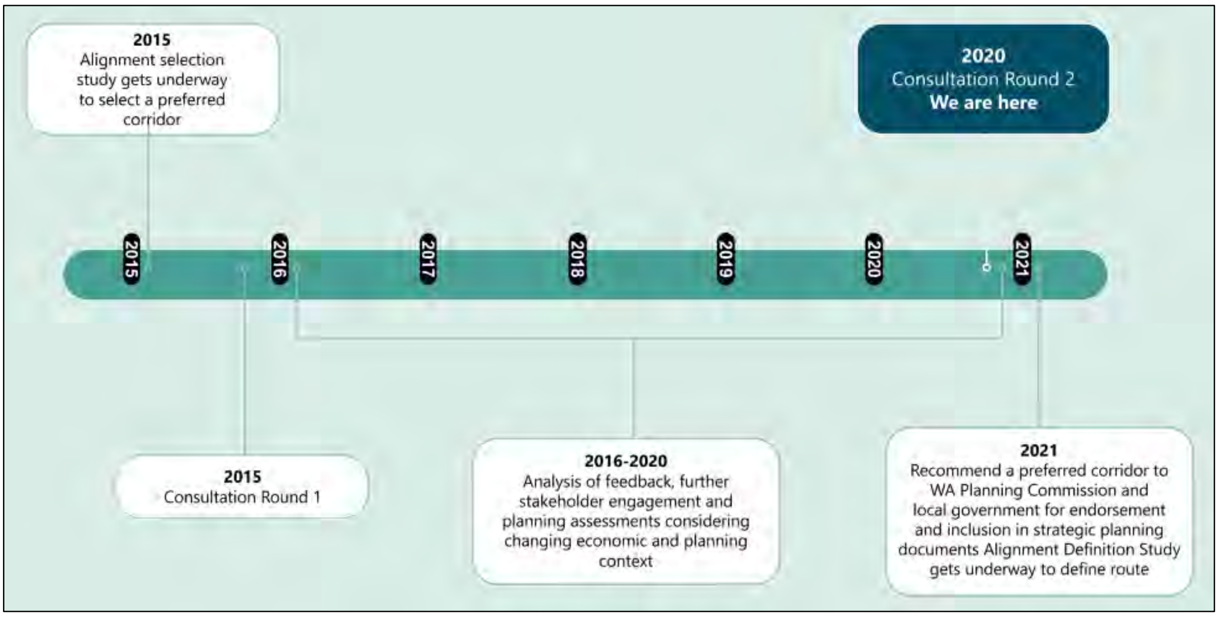


Figure 4.11 Dongara to Geraldton consultation timeline

Source: MRWA

4.4.2 Rail

As part of the freight and logistics study exercise, a road + rail solution was also investigated to ascertain whether any opportunities were available to rail the final product to Geraldton.

There is an existing rail line some 13.0 km to the west of the Beharra site. If a combined road and rail operation is adopted, the methodology would be generally as follows. The product would be loaded onto road units at the mine site, then transported some 13 km, via Mount Adams Road, crossing the Brand Highway, to the end of Carson Road where a new rail loading loop would be built (as shown in Figure 4.12).

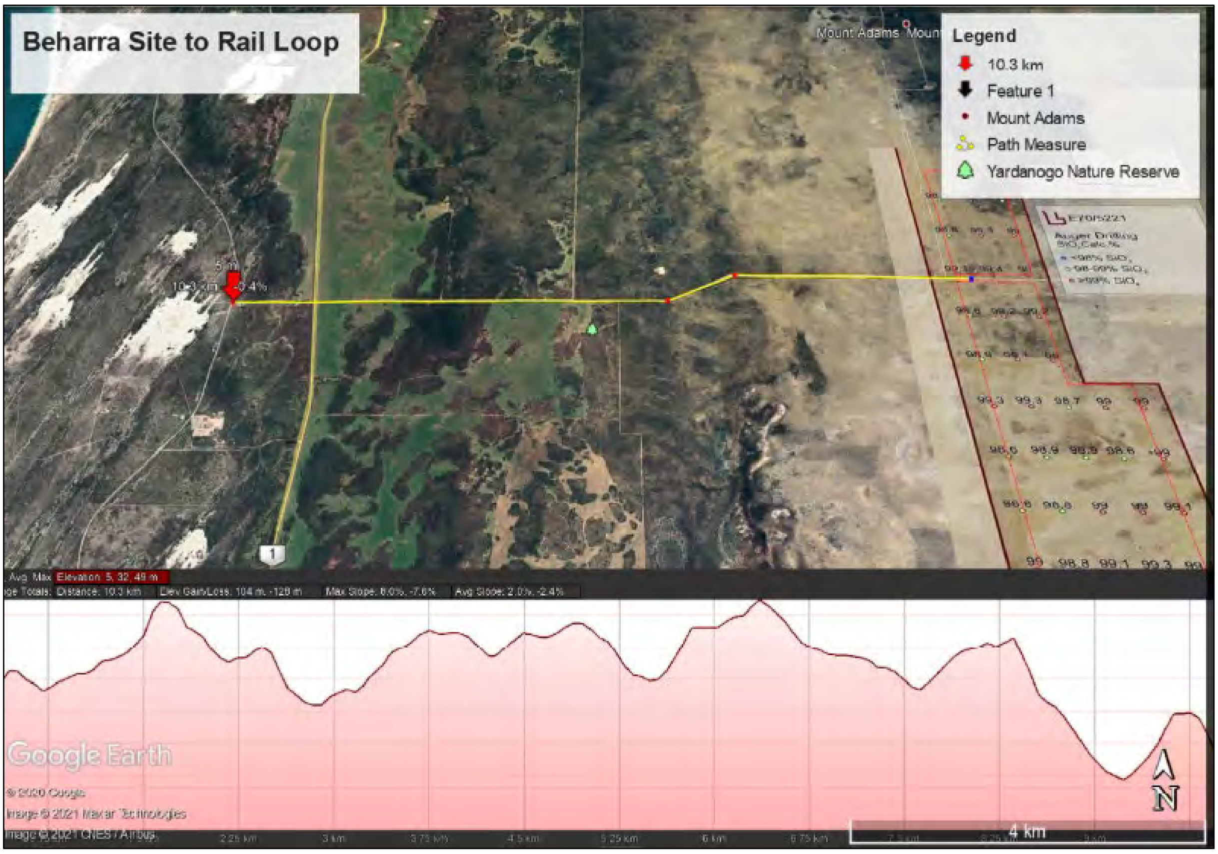


Figure 4.12 Site to rail head

Source: Google Earth Pro

At the proposed rail loop location, a hardstand, open-air storage and wagon loading facility would be set up. The product would be loaded onto wagons using a FEL and transported by rail to Geraldton Port where they will be unloaded using the rail bottom dump facility.

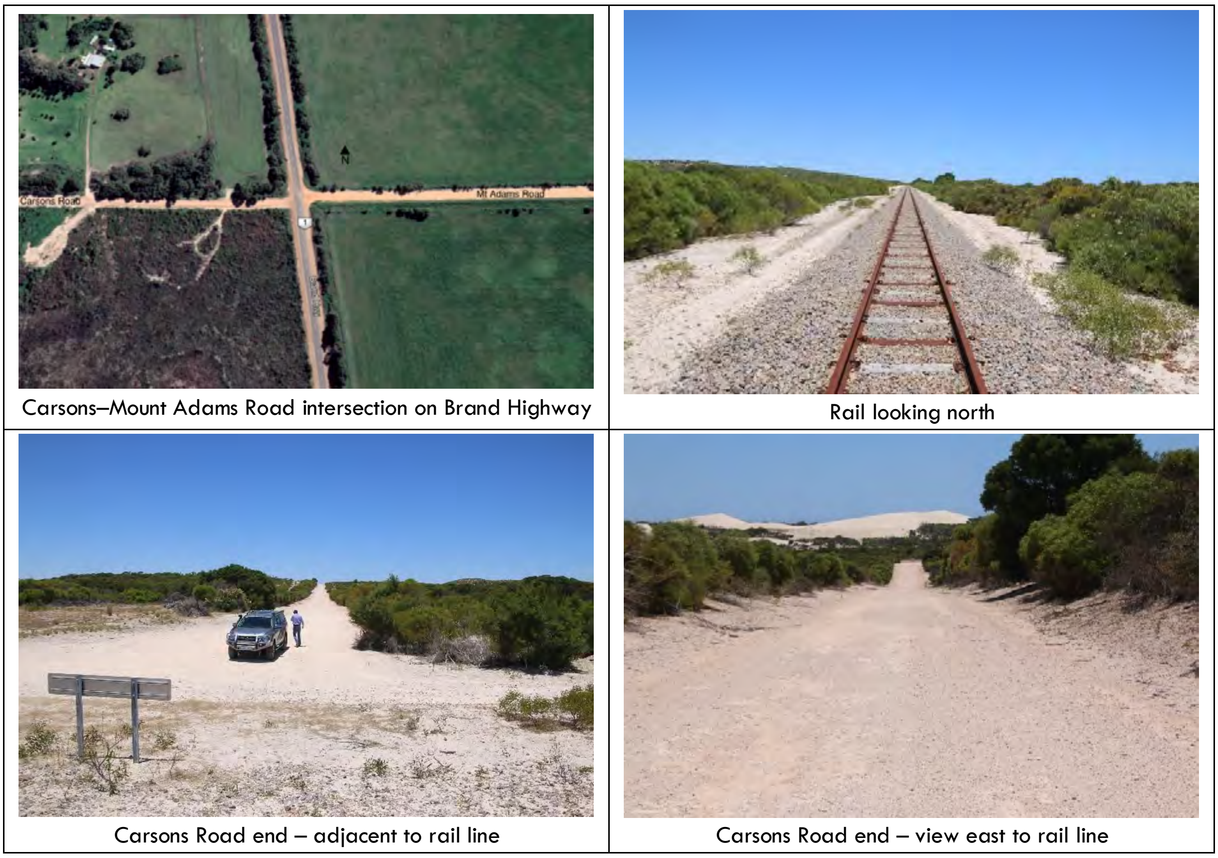
The product would then be stored in an undercover storage structure and when ready for despatch, loaded onto ships using the existing ship-loading system. A conveyor system may need to be set up to link the storage facility to the ship-loading system. The rail infrastructure is owned by ARC Infrastructure (ARC), a subsidiary of Brookfield Infrastructure Partners LP.

The rail segment between the proposed rail load loop and Dongara (some 24 km) is a piece of rail infrastructure which has not seen any commercial activity in the last 15 years or so; however, ARC mentioned the rail corridor has been regularly checked and maintained appropriately.

Prior to any reactivation of the line, a review and maintenance of the line would be undertaken, this is a relatively simple activity and routinely performed, as advised by ARC.

In terms of infrastructure, Carsons Road would require significant upgrade as it appears to be little more than basic hardstand in nature. To run the short haul truck operation, this would have to be upgraded to the correct standard dependant on the selection of transport vehicles.

Also of note, there is a slight misalignment at the Carsons–Brand–Mount Adams intersection in an east-west direction that may need to be rectified should the rail option be considered (refer Figure 4.13).



Carsons–Mount Adams Road intersection on Brand Highway

Rail looking north

Carsons Road end – adjacent to rail line

Carsons Road end – view east to rail line

Figure 4.13 Road and rail alignment

While a direct spur line from the Beharra site to the existing rail line has also been considered, this solution may prove difficult and costly due to the crossing of the Brand Highway.

Road and rail options will be further considered during the DFS.

4.4.3 Port of Geraldton

Overview

Given the Beharra site location, the Port of Geraldton (see Figure 4.14) is the only real option where bulk product can be exported. The Port is keen to facilitate trade, extremely active and is currently in discussions with a variety of proponents who are either expanding existing operations or seeking opportunities such as Perpetual for its developing projects.

Figure 4.14 Geraldton Port
Source: MWPA

The Port trade volume for 2019/20 was 14.95 Mt, slightly down on the previous year by 6% (0.96 Mt), primarily attributable to the reduced grain season and some impacts of COVID-19.

The Port handles a variety of bulk commodities as listed in Table 4.1 below.

Table 4.1 Bulk commodities – Geraldton Port

Product	Product detail	Loading berth/method
Ores	Iron ore	Bulk via Berth 7 and 5
	Manganese	Bulk via Berth 5
Heavy metals and concentrates	Lead sulphide concentrate (HMC)	Bulk via Berth 4 Containers via Berth 6
	Copper concentrate	Bulk via Berth 4 Containers via Berth 6
	Zinc concentrate	Bulk via Berth 4 Containers via Berth 6
	Nickel concentrate	Containers via Berth 6
	Mineral sands concentrate	Containers via Berth 6
Sands	Clean fill and construction sands	Bulk via Berth 5 and 4
	Mineral sands	Bulk via Berth 4
Other	Fertilisers	Discharge via Berth 6/Berth 2

Source: MWPA

Other opportunities – Port Master Plan

Mid-West Ports Authority (MWPA) has undertaken the development of a Port Master Plan for the Port of Geraldton. The plan (shown at Figure 4.15) provides a high-level analysis of potential trade growth and required infrastructure to accommodate this growth over a 30-year planning timeframe.

Figure 4.15 Geraldton Port Master Plan

Source: MWPA

It further considers the development required in the short to medium term (i.e. over the next 15 years) to maximise the throughput and efficiency of the existing Port, prior to considering longer term expansion options, at either Geraldton or the Oakajee Port. While the long-term expansion options are considered, additional investigations, consultation and design work would be required to enable a preferred option to be recommended.

Ultimately the best solution for Beharra operations would be to have a custom-built storage facility as part of the new port development project. This would deliver a high degree of independence, eliminate the need for offsite storage and reduce operating cost. This option is dependent upon the Port acting and executing the proposed plan.

Perpetual will remain engaged with MWPA and pursue this going forward.

4.5 Communications and Information Systems

There is currently no 4G or 5G signal coverage on the Beharra project site, with no planned expansion of existing networks in the near future, as depicted in Figure 4.16.

On-site communications will be conducted through use of satellite phones and two-way radios in lieu.

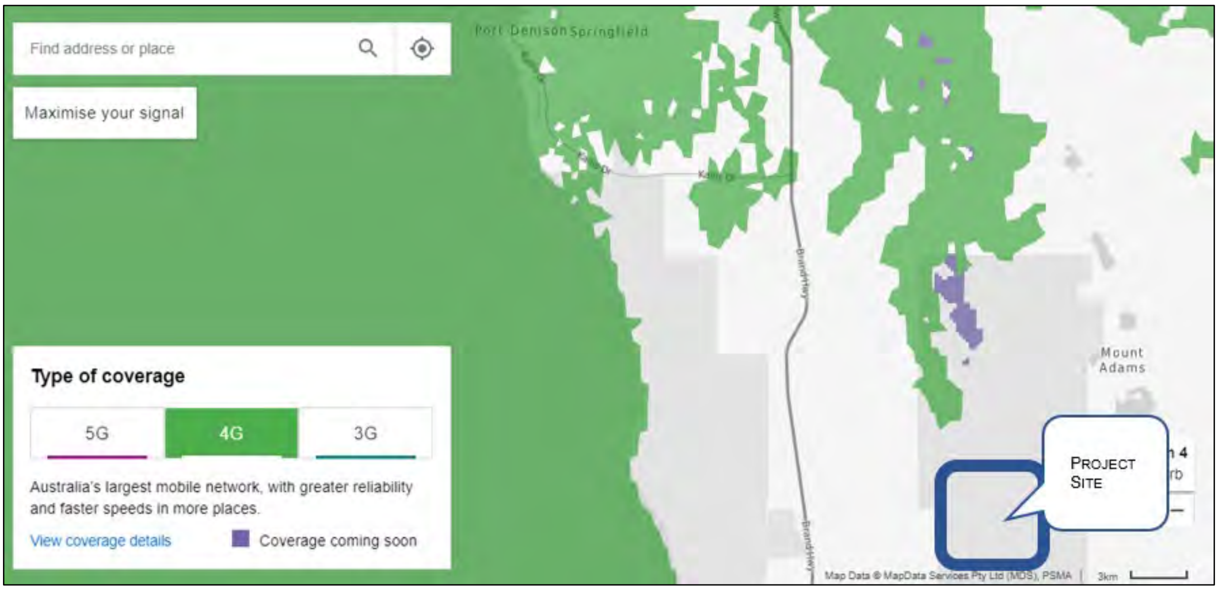


Figure 4.16 **Telstra 4G coverage – Beharra project site**

Source: Telstra

4.6 WASTE DISPOSAL

4.6.1 Surface water management

Product stockpile dewatering systems are incorporated into the process plant design to recover and pump reclaimed surface water back to primary process water tank.

Any surface water resulting from rain events will be dispersed through infiltration into the sands around the site.

4.6.2 Wastewater

Wastewater comprises water within the operational area, including process water, pit water, tailings water and hardstand runoff, that is not recoverable back into the process water circuit or is in excess of the capacity of the process water system.

Process plant design incorporated equipment that recirculates water back to the main process water tank thereby minimising wastewater. Accordingly, the volume of wastewater is considered to be negligible during mine operations.

Any wastewater water will be released principally through infiltration into the sands around the site.

4.6.3 Solid waste

A waste management plan will be developed describing the necessary procedures and infrastructure for solid waste management.

Disposal of solid waste on site will be restricted to that of inert material that will not impact groundwater quality. All other solid wastes will be stored in appropriately constructed facilities prior to offsite disposal in accordance with relevant legislation.

4.7 TEMPORARY FACILITIES

Due to the proximity of the townships of Dongara and Geraldton to the Beharra project site, there is no requirement for a camp or mess facilities during construction or operations.

A 20 kVA genset with portable fuel day tank will provide power during the construction phase and be retained as an emergency power back up post construction.

The 25 kl fire services tank will be installed early during construction to provide the water required for concrete works and onsite/access road dust suppression.

Site offices will be provided by the process plant installation contractor and mining contractor, with temporary fencing and ablutions provided by Perpetual.

4.8 OTHER

4.8.1 Security

A chain wire perimeter security fence will be installed around the administration and amenities area only. Sensor activated floodlights and localised closed circuit television (CCTV) will be installed around the administration, amenities and process plant areas.

4.8.2 Fire control

The site will be supplied with a fire water system incorporating a dedicated 25 kl water tank and associated electric primary supply pump and jacking pump and in the event of a power loss a diesel back-up pump.

Fire extinguishers will also be located within the administration, amenities and process plant areas for fire suppression, if required.

4.8.3 Emergency services

The nearest emergency services to the Beharra project site are at Dongara, which is a 23-minute drive. Facilities and services available are a medical centre, hospital, St Johns Ambulance and Fire and Rescue. Geraldton (a 1 hour and 6 minute drive from site) has additional emergency services capability.

5. OPERATIONS MANAGEMENT

5.1 OPERATIONS STRUCTURE

5.1.1 Operating philosophy

The Beharra Project will be operated from the commissioning phase into sustained operations under a formal Operations Plan and Health, Safety, Environment and Community (HSEC) management systems.

5.1.2 Management structure and organisation

The Operations management structure for the Beharra site will be similar to many of the smaller quarrying and aggregates businesses with overall responsibilities in an operational sense falling under the remit of the site senior executive and a small team covering the key roles such as Safety, Health, Environment, Quality, Production Management, and Maintenance. This structure will be further developed during the DFS.

5.1.3 Contract strategy and management

A variety of key contracts will be required for the operation. There has been some early identification of the range of contracts likely to be required for the Beharra operation and some of the major operational contracts are outlined below:

- Mining – Mining contract scope including grubbing and stripping, overburden removal, ore excavation, delivery to process plant feed hopper, product loadout and rejects return basis $/t delivered.
- Rehabilitation – Contract to include acquisition and storage of seed, place and stockpile mulched vegetation, topsoil stockpile and management, dump and spread surfaces in preparation for soil growth media placement, load, haul, dump and spread stockpile topsoil to rehabilitation face and spread of native seed. Basis $/ha.
- Freight and logistics – Haulage inclusive of transport of final product from the Beharra site to offsite storage facility, then short haul from storage facility to Port of Geraldton on a $/t basis.
- Power supply – Supply of power by Independent Power provider (IPP). IPP to supply power station and all fuelling maintenance etc., build-own-operate-maintain (BOOM) contract power supplied on a $c/kwhr basis.
- Fuel supply – Diesel fuel delivery and decanting service – basis $/litre delivered.

A formal Contractor Management System (CMS) will be developed and implemented that will ensure contractor capability and suitability prior to engagement, and ongoing monitoring during the period of engagement.

Further development of contract scopes and management systems will be identified in the Project Execution Plan (PEP) at DFS stage.

5.2 OPERATIONAL ASPECTS

5.2.1 Management and administration

PEC will utilise a small corporate management team with site focus to minimise overhead and operational costs. Corporate/marketing and major contract management activities will be based offsite with only operations staffing located at the Beharra site.

5.2.2 Mining

Currently, the mining activities will be performed under a contract mining scenario and invoiced on a $/BCM basis. Quantities will be assessed using conventional bulk site survey techniques and back checked using a weight-o-meter fitted to the processing plant feed hopper reading tonnes of material.

The mining contractor shall provide all plant equipment and labour necessary to ensure the continuous, safe, and reliable delivery of ore and return of waste to the mining pit. The contractor will operate under the site regulations and relevant legislative requirements.

The contractor shall operate autonomously in relation to all on and offsite costs included and attributed to the single $/BCM fee.

5.2.3 Processing

The process plant will be operated on a 24 hour/7 days per week basis.

The plant feed is loaded under the terms of the mining contractor at the nominal rate of 250 tph.

The plant is operated from a centrally located control room with a high level of automation/instrumentation, allowing operation by two operators per shift working three roster rotations. The operators are supported by a shift coordinator and two day-crew to provide cover for planned and unplanned crew absences during dayshift, five days per week.

Operational maintenance will be supported by five maintenance personnel working dayshift only, on a 4-on 3-off/3-on 4-off roster with a provisional eight-hour planned maintenance shutdown per month.

Technical support will be provided by a plant metallurgist on a five-day per week roster.

The plant will provide a high degree in flexibility to meet multiple product requirements and will allow sections of the plant to be bypassed directly to the final product classification screen or dewatering screens.

Final products will be loaded onto the road trains by the mining contractor.

Product stockpile management will be a one of the primary roles of the plant metallurgist and shift coordinator.

Preliminary site layout 5221-M-GA-0000-8098 Rev A, inclusive of process plant and major infrastructure, is included at Appendix 9.

5.2.4 Technical services

The final product samples will be automatically sampled and collected on a shift basis. These shift samples will be dried, and sub sampled for transport to an offsite laboratory for product quality assays.

Splits of these samples will also be routinely subjected to site screening tests to confirm settings on the upstream classifier and for blinding or holes on the final classification screen.

The Metallurgist will also be responsible for routine calibration of mass flow density gauges (including being the Radiation Safety Officer), belt weigher, and adjustment of metallurgical settings.

Technical services will also provide all other non-operational functions in support of operations and include the following key processes:

- Mine surveying for mining control, tailings survey, land acquisition, infill drilling and exploration
- Exploration and geological support
- Mine planning, long and short term
- Metallurgical control
- Mineral sampling, handling, and analysis
- Environmental management, inclusive of rehabilitation, topsoil replacement, product superintending for shipment of product.

5.2.5 Maintenance

Maintenance will provide all support for both operations and general project infrastructure, which will include the following:

- Fixed plant
- Light vehicles
- Buildings, power supply, diesel generators and general infrastructure.

Day-to-day operational maintenance on the fixed plant shall be addressed by the owner's maintenance team with use of external contractors to support major shutdowns.

Typically for this type of wet process plant, maintenance is largely preventative consisting of the replacement of pump liner wear parts and screening assemblies which can be readily planned to fall under a scheduled maintenance shutdown routine.

Allowance of an eight-hour planned maintenance shutdown per month has been included.

The diesel power station will be maintained under a BOOM contract and the maintenance built into the power price. Light vehicles will be serviced by a local dealership.

5.2.6 Procurement and supply

A Procurement Plan will be developed during the Beharra Project DFS, detailing the processes and procedures to be adopted during procurement activities.

Perpetual will attempt to procure off the shelf items locally or within Australia. In the case of an original equipment manufacturer (OEM) being an international company, the local agent for the OEM will be approached.

Where possible, similar types of equipment will be procured from the same vendor (i.e. pumps) in order to standardise the equipment and minimise spares holdings.

5.2.7 Transport and logistics

Overview

Qube provided a complete transport solution which was used as the basis for the Beharra Project.

With an output of 1.51 Mtpa considered, the final product transport component of the Project contributes significantly to the operating cost as expected. This will continue to be optimised going forward during the DFS.

In addition to the means of transport, port options and facilities have also been investigated. Perpetual has met with MWPA representatives and discussed possible export quantities, storage options, and berth availability at the Port of Geraldton.

Various road freight options have been put forward and considered from both a practicality and cost perspective. While rail is to be considered, initially the road solution is preferred as it provides flexibility during the initial stages of operations, the approvals and issues are well understood, and there are some unknowns regarding timing and rail access to be discussed later in this document.

A commentary on the base case that has been adopted in relation to the transport and logistics methodology at this juncture are outlined below.

Methodology

Operational breakdown:

- Loading final product at site
- Long haulage site to Narngulu offsite storage facility
- Offsite storage offload and reload activities at Narngulu
- Short haulage from Narngulu to Port/Berth
- Ship loading activities.

Final product will be loaded from the final product stockpile using a FEL and loaded into trucks bound for the Port of Geraldton.

Site loading in the current operational model is the responsibility of the mining contractor.

From the loading point the trucks will travel approximately 2.8 km on the internal haul road from which point they will turn left onto Mount Adams Road.

The trucks then travel nominally 9 km until they reach the Brand Highway intersection.

This intersection will need upgrading (discussed in infrastructure) to include both an acceleration lane and turning lane for the return trip. Turning right onto the Brand Highway, the trucks travel some 86 km to Narngulu to a 60,000-tonne capacity stockpiling shed of which various options are to be considered.

Once dumped, the trucks return back to the Beharra site to be reloaded (see Figure 5.1).

Figure 5.1 Road transport route – site to Narngulu
Source: Google Earth Pro

The transport configuration for the short-haul assignment from Narngulu to the port is different from the long-haul exercise as the dump point is either hopper (end tip) or drive over (belly dump) infrastructure.

The Narngulu shed is filled and when a vessel is ready to be loaded at the port, the short haul cycles begin to transport the product to the ship loading shed where either drive over or end tip options are available into the hopper, likely to be Berth 4.

Some overflow storage is available on the port site, but limited to around 12,000 tonnes, and with competing users on a lease arrangement.

Summary of costs

Costs at the wharf in relation to ship loading and wharfage have been captured and are identified in the summary of costs at Table 5.1.

Table 5.1 Summary of costs

Freight and logistics – preliminary cost schedule – Beharra (RAV 7.3)		
Item	**Road charges**	**Unit ($/t)**
1	Loading product at site	Incl.
2	Haul product – Beharra to Narngulu	Incl.
3	Stockpile management – Narngulu	Inc.
4	Haulage – Narngulu to Port of Geraldton (Berth 4)	Inc.
	Port charges	
5	Wharfage – MWP	Incl.
6	Ship loading – Berth 4	Incl.
	Subtotal	**$24.85**
-	*Moisture modifying factor 5% added	
	TOTAL	**$26.09**

*Moisture content added to dry tonnes.

Site to Narngulu – truck body configurations considered

There are three mainstream truck body options that are considered for use in meeting the required duty to transport the final product to the Narngulu offsite storage facility. These are demonstrated below.

RAV3.1 – Double configuration

Currently, access to site via Mount Adams Road is limited to a RAV3.1 network which allows the Double configuration (shown at Figure 5.2) to operate, achieving an estimated payload of 55 tonnes.

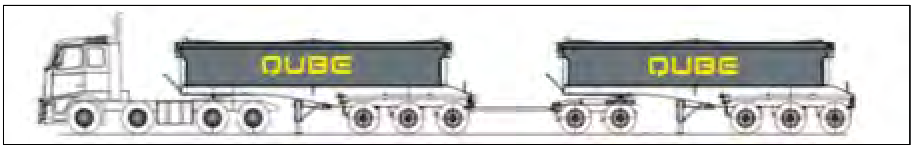


Figure 5.2 Double configuration

RAV4.3 – Pocket Road Train

If access roads and intersections were to be upgraded to a RAV4.3 network, it would allow a Pocket Roan Train configuration (shown at Figure 5.3) to operate, achieving an estimated payload of 65 tonnes.

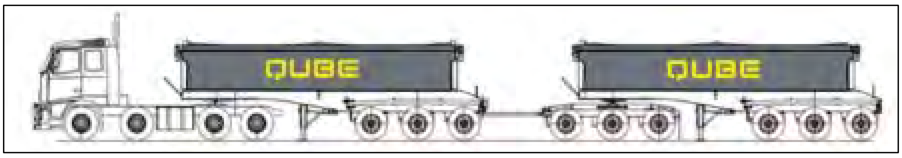


Figure 5.3 Pocket Road Train configuration

RAV7.3 – PBS Super Triple

If access roads and intersections were to upgraded to a RAV7.3 network, it would allow PBS Super Triples configuration (shown at Figure 5.4) to operate, achieving an estimated payload of 100 tonnes.

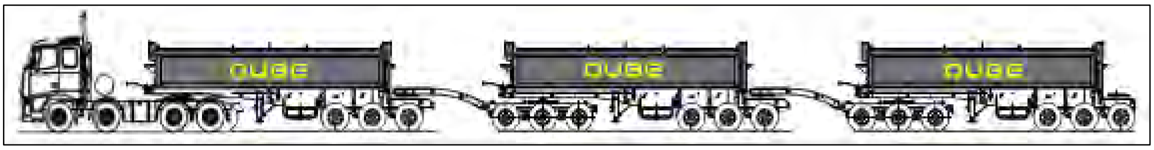


Figure 5.4 PBS Super Triple configuration

After considering the options available, the PBS Super Triple was selected for the duty in order to minimise truck movements and operating costs. Based upon transporting 1.517 Mtpa of product to Port, truck movements per day adopting this solution are reduced to nominally 42 per day as opposed to 64 per day with the Pocket Road Train and 76 using the Base Double 55t configuration.

Further works in relation to the permitting of this vehicle and engagement with various stakeholders such as Irwin Shire Council, City of Geraldton, and MRWA is underway and will be progressed further during the DFS.

Narngulu to Port – truck body configurations considered

The infrastructure at Berth 4 drives the selection of the vehicle configurations as only hopper (end tip) or drive over (belly dump), infrastructure is available as a direct input.

However, if on-port storage is available, then side tip bodies may be considered.

The Combination End Tipper and Combination Belly Dump are shown at Figure 5.5 and Figure 5.6, respectively.

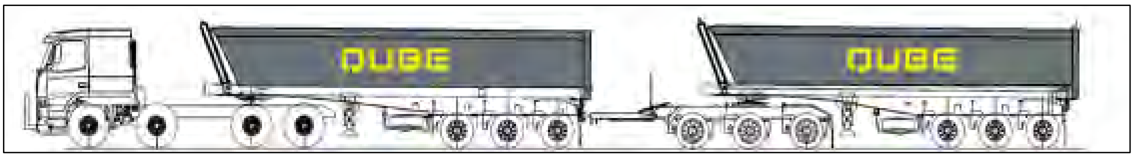


Figure 5.5 Combination End Tipper

Figure 5.6 **Combination Belly Dump**

Narngulu – offsite storage

After investigating the possibilities of a direct road to on-port storage solution for the Beharra product, it became clear that given the variety of commodities vying for storage and berth access at the Port, offsite storage is the more practical option with the current MWPA infrastructure in place.

The locality of Narngulu to Geraldton Port is demonstrated in Figure 5.7 below.

Figure 5.7 **Narngulu to Geraldton Port locality**
Source: Google Earth

Offsite bulk storage is currently being utilised at Narngulu from the port by a number of exporters, including Iluka Resources and GMA Garnet for bulk offsite sand storage.

Ship loading

The options in terms of berths available and suitable for the Beharra product are No's 4 and 5.

The Berth 5 ship-loader has a theoretical maximum speed of 5,000 tph; however, in reality, this is constrained by the load out rate from the storage sheds and time lost due to vessel de-ballasting, hatch changes, etc. With iron ore typically they see load rates of 3–3,500 tph, but silica sand is more typically 2,000 tph given its lower bulk density.

As an important consideration, the sharing of Berth 5 running iron ore, irrespective of thorough decontamination procedures, is undesirable given the Beharra low iron product specifications.

The Berth 4 ship-loader has a theoretical maximum speed of 1,800 tph; however, this is also constrained by the rate of delivery to bulk handling system and by time lost due to vessel de-ballasting, hatch changes, etc. With the Berth 4 mineral sands products, typically loading rates of 900–1,200 tph are achieved. Rates on silica would be lower again at around 740 tph.

From investigations and discussions thus far, both with Perpetual's consultants and MWPA, Berth 4 would be the most appropriate for the loading of the Beharra product. While Berth 4 tends to be used for smaller "parcel" shipments of 10–20,000 tonnes, this may well suit the initial shipment sizes.

6. HEALTH, SAFETY, ENVIRONMENT, AND COMMUNITY

6.1 POLICY AND PLANNING

6.1.1 Company policy and objectives

Perpetual will develop a HSEC policy designed to provide a controlled work environment that protects the health, safety and welfare of all employees and other persons at its work sites.

6.1.2 Statutory obligations and other commitments

Perpetual will meet its obligations to the current Australian and WA Workplace Health and Safety (WHS) Act, Regulations, Standards and Codes of Practice by developing and maintaining a HSEC Management System appropriate to the management of health, safety, and environment at all work sites.

6.1.3 HSEC management systems

The HSEC Management System will form the basis for management and control and development will be undertaken with consideration to:

- ISO 45001:2018 – Occupational health and safety management systems
- ISO 14001:2016 – Environmental management systems
- ISO 31000:2018 – Risk management
- Corporate Social Responsibility obligations.

6.1.4 Key performance indicators

HSEC key performance indicators will be developed post-DFS to ensure a quantifiable measure is used to evaluate how effectively Perpetual is achieving set business objectives.

6.2 HEALTH AND SAFETY

6.2.1 Risk assessment summary

The key health and safety risk identified for the Project is exposure to and working around silica. Considerations with respect to this risk are discussed below.

6.2.2 Silica-specific considerations

Perpetual recognises there is a potential human health exposure risk to respirable crystalline silica (RCS) at the Beharra Project. RCS could be produced as an airborne dust when silica sand is disturbed through mineral extraction, stockpiling, transportation, and handling and is dry enough to generate dust particles. These particles can be small enough to lodge deep in the lungs and cause illness or disease such as bronchitis, silicosis, and lung cancer.

A Workplace Exposure Standard (WES) exists for crystalline silica and represents the concentration of an airborne hazardous chemical within a worker's breathing zone that should not cause adverse health effects or undue harm. The current WES for RCS is 0.1 mg/m^3 over an eight-hour working day in WA, with the WES likely to be lowered to 0.05 mg/m^3 by the end of 2020 to meet national standards.

RCS exposure and safety requirements are governed by the following Western Australian Legislation:

- Occupational Safety and Health Act 1984
- Occupational Safety and Health Regulations 1996
- Mines Safety and Inspection Act 1994
- Mines Safety and Inspection Regulations 1995.

Prior to the commencement of any extraction activities at the Beharra site, a Health Risk Assessment (HRA) will be undertaken to define key sources and the pathways of RCS. With this information, defined dust management procedures to reduce the risk of exposure to personnel above the WES will be developed using the hierarchy of controls – substitution, isolation, engineering, administrative, personal protective equipment (PPE).

Additionally, the HRA will be a key input to the preparation of a Health and Hygiene Management Plan (HHMP) in accordance with the Department of Mines Industry Regulation and Safety (DMIRS) Guideline "Preparation of health and hygiene management plan – guide" (2018) and approved by DMIRS prior to operations commencing. The HHMP will define as a minimum the sources, pathways management and monitoring of RCS. The HHMP will be reviewed annually to ensure it meets current standards and capture any changes to operational circumstances or procedural controls. This will enable Perpetual to maintain continual compliance with its legislative health and safety obligations.

6.2.3 Management and monitoring plan

Perpetual is responsible and accountable for providing quality processes, practices, structures, equipment and verification of personnel competency and training, to ensure that Perpetual employees, employees of its subcontractors and all other personnel sharing the work areas with Perpetual are free from the risk of workplace injury or illness.

A Perpetual Safety Management Plan (SMP) will be developed as part of the HSEC management system to enable a uniform and effective standard of health and safety management to be applied to all Beharra Project activities. The SMP will been designed to comply with Australian Regulations, Codes of Practice, Perpetual Policies and Procedures and to ensure that all subcontractor systems are in alignment.

6.3 ENVIRONMENT

6.3.1 Environmental baseline studies

Considerable baseline environmental studies were commissioned by Tiwest (now Tronox) for its Dongara titanium minerals project, immediately adjacent to the east of the Beharra Project. Many of the baseline studies covered the Beharra project area and have been procured from Tronox via a data share arrangement. This data will significantly contribute to the environmental impact assessment process to support approvals for Beharra and covers factors such as:

- Groundwater and groundwater-dependent ecosystems
- Surface water
- Flora, vegetation, weeds, and dieback
- Terrestrial and subterranean fauna
- Soil profiles and acid sulphate soils
- Indigenous heritage.

Additional studies conducted to date by Perpetual to complement the extensive Tronox dataset cover the following factors:

- Flora and vegetation
- Terrestrial fauna
- Groundwater and groundwater-dependent ecosystems
- Heritage.

Further baseline studies will be conducted during the ongoing project development.

6.3.2 Aspects and impacts assessment summary

The key potential impacts associated with the Beharra Project are believed to be:

- Medium term direct impact to vegetation and groundwater dependent ecosystems (vegetation) from clearing nominally 550 ha. Duration assumes successful rehabilitation.
- Short term indirect impact to groundwater dependent ecosystems (vegetation) through groundwater drawdown during operations.
- Medium term direct loss of Carnaby Cockatoo foraging habitat. Duration assumes successful rehabilitation.
- Direct loss of Carnaby Cockatoo birds through vehicle strike.

Other potential impacts could include:

- Hydrocarbon and chemical contamination of soils and groundwater
- Dust emissions and impacts to surrounding vegetation
- Indirect impact to the Yardanogo Nature Reserve
- Introduction of weeds, dieback, and feral animals
- Altered fire regimes.

A comprehensive aspect and impacts assessment will be conducted at a later stage as the Project development plan becomes more refined.

6.3.3 Environmental management plan

An Environmental Management Plan (EMP) and associated procedures will be developed as part of the HSEC Management System. The following aspects will be included within the plan:

- Air quality
- Hydrocarbon management
- Groundwater management
- Waste control

- Flora and vegetation
- Fauna
- Dieback.

6.4 MINE REHABILITATION AND CLOSURE

6.4.1 Mine rehabilitation

A comprehensive study was undertaken to determine the most suitable progressive rehabilitation method for the Beharra Project based on the existing environment. Consultation and benchmarking with other extractive sand miners in the local area as well as expert rehabilitation practitioners was undertaken to assist in developing the method defined in Table 6-1.

Table 6.1 Beharra rehabilitation method

Activity	Method
Acquire and store seed	A seed mix will be defined based on veg units with a focus on Carnaby Cockatoo foraging species and collected on an annual basis up to 250 kg per annum (benchmarked on Iluka Eneabba program), dependent on reproductive success and climatic conditions. The first location for seed acquisition will be that which can be acquired prior to clearing. This may involve picking seed over the entire LOM project and in adjacent local areas outside of the disturbance footprint within a provenance zone where species relevant to the project vegetation types can be harvested. It will be important not to have the provenance zone too constrained as this can sometimes be the case without practical knowledge from seed pickers and benchmarks from other sites. Seed would be stored at a controlled temperature, in an approved supplier's facility. Different seed types would be treated with various dormancy breaking treatments (scarification/smoky water etc.); however, a percentage of seeds would go untreated. Further work is required on defining recalcitrant flora species (typically *Restionaceae*, *Cyperaceae*, *Dilleniaceae*) and methods for enhancing germination success. Some species may require supply from nursery tube stock and direct planted.
Clear and grub area, mulch vegetation place in separate stockpile	Vegetation will be cut from the surface, usually with a light dozer, and windrowed. If the vegetation has root balls below the surface, ideally these will be removed during clearing and grubbing as they will interfere with the spread of topsoil. The windrowed material will be fed into a tub grinder/mulcher to generate a wood mulch with pieces generally no larger than 50 cm long x 10 cm in diameter, with the majority much smaller. This will be stockpiled separately as with the soil. However, direct placement after soil placement will occur where it is feasible to do so.
Load, haul and dump top 500 mm to soil to stockpile	Load, haul and dump of growth media will occur from areas which has been cleared of vegetation. Although the nominal depth for soil harvest/excavation is 500 mm of soil and subsoil, pit testing demonstrates a very large variety of both soil type near the surface and subsoils at depth. In many cases there will be little value in harvesting the barren sands below the top 100–300 mm of soil. The Project will be best served to manage depth of harvest very carefully and not mix good quality growth media with the underlying barren material which has little if any growth media properties. As such, a smaller volume may be harvested to achieve the best results when re spread. However, this needs to occur based on educating the supervising and operators with to respond to the inherent variability of depth and soil type. Single recovery depth of topsoil only will be the most appropriate approach as there is too little depth and too little distinction between soil types to harvest two soil types. The material will be stored in paddock dumped piles no greater than 2 m high. This soil material is highly susceptible to mechanical degradation. Hence, the material should be placed in dumped piles at the correct density to spread the material to up to 500 mm depth with minimal pushing distance. The material will be rotated onto the next available rehabilitation surface. Where direct transfer is feasible, this should occur.

Activity	Method
Load, haul, dump and spread rejects on floor area	During production activities trucks will return dewatered tails/rejects back to the mined pit floor to increase the distance to the water table and limit seasonal inundation of the root zone and act as growth media. It is important rejects clay content is maintained from 4% to 12% to enable suitable moisture retention within the soil profile for plant availability. This material should be spread evenly on the pit floor (and not dumped on the pit batters) and well mixed so as to not form clay layers that will limit water and plant root penetration. Dumped material will be pushed flat so another layer can be placed. If the material moisture content is too high (rejects anticipated to be around 5% moisture content) it may need to lie fallow for some time before rehabilitation commences to avoid issues associated with compaction. Monitoring of clay content will occur progressively at this time.
Dozer trim all dumped/spread surfaces in preparation for soil growth media placement	Prior to the placement of soil on rehabilitation surfaces, including side batters and pit floor, all rehabilitation will be cut to a very high quality of trim. This is generally completed with a dozer and the objective is to achieve very even compaction and no significant windrows or gaps. Such features will increase the susceptibility of soil erosion post closure. Ideally, after trimming the only thing visible on a surface is track shoe marks. Given the low grades of batters, it may be worth experimenting with a grader. Generally, a light dozer is used otherwise. See below.
Load, haul, dump and spread stockpile topsoil to rehabilitation face	Growth media is rehandled from stockpile to the rehabilitation face. This soil material is highly susceptible to mechanical degradation. Hence, the material should be placed in dumped piles at the correct density to spread between 200 mm and 300 mm depth with minimal pushing distance. A light dozer (Komatsu 155 or Cat D7) would be much more suited to this task to minimise track degradation due to machine weight. Given the low hectares for rehabilitation each year, the surface trimming and topsoil spreading may be best carried out by a contractor with rehabilitation experience and fit for purpose machinery.
Load, haul, dump and spread stockpiled timber mulch to rehabilitation face	As is the case, timber mulch piles placed at the ideal density for spreading evenly, with fit for purpose machinery and an experienced operator. Note the timber mulch should be spread as soon as practicable to protect the soil surface from wind erosion. It will also be a very valuable source of seeds.
Spread native seed	Some sites, where there is a dense placement of timber mulch, choose not to cross rip. Cross ripping is generally undertaken to enhance infiltration and minimise erosion. In this instance the materials into which the seed is sown is high infiltration with adequate clay content and dispersal through the growth media. The timber mulch is similar to a rock mulch or other erosion resistant covers. From a seed broadcast perspective, further to benchmarking and trials, it may be that the seed is hand broadcast at the optimal time of year after the timber mulch is placed at a rate similar to nearby peers. Alternatively, because of the differences in the mining processes at Beharra, if the soils and timber mulch are direct placed which is likely to have suitable seed retention, it may be the case that the rehab success is assessed at least 24 months after final timber spreading in each cell, and if adequate species diversity and density is not achieved per defined completion criteria (pending rehabilitation/closure plan), seed/tube stock can be dispersed. Seed to be dispersed at 5 kg per hectare.
Monitoring/reporting and maintenance	Subject to the development of detailed Rehabilitation Plan, a formal rehabilitation monitoring will commence within 24 months after final rehabilitation activities within the first 15 ha cell and once per annum after that (note this frequency can be adjusted based on findings). Having a regular monitoring regime in the early years will assist identifying opportunities for improvement in the rehabilitation process and adjusting/trialling different operational and rehabilitation methods to improve future revegetation outcomes. It's not uncommon that the first few years of revegetation, consistent with ecosystem regeneration (such as after fire) will feature short lived early colonisers and monitoring results will report this accordingly. Monitoring results will be analysed with previous data and outcomes reported internally to PEC and externally via the regulatory annual reporting processes. The strategies of selecting the highest quality soils, converting tree trash into a mulch product, developing gentle slope angle and the favourable clay contents in the substrate, the project will develop very favourable conditions to re-establish an ecosystem generally similar to that which occurs as the baseline.

Activity	Method
	Based on the low batter angles on the outer pit walls, sandy soil profile and lack of local surface water drainage features that may contribute to water erosion, it is not expected that significant repair or maintenance earthworks will be required after rehabilitation of each cell. Typical maintenance that could be expected would include: • Repair of minor erosion gullies • Respond to unplanned ponding of water locally • Re-seeding where revegetation performance is not aligned with broader performance • Weed surveillance and treatment where required • Reinstatement of drainage control drains and bunds (drains to remove water from topsoil stockpile storage areas, for instance.

6.5 Cultural Heritage

6.5.1 Traditional owners

The recognised traditional owners for the Project are the Southern Yamatji.

6.5.2 Native Title

The Southern Yamatji Native Title claim was concluded in October 2020. An Indigenous Land Use Agreement (ILUA) now exists between the Southern Yamatji and the WA Government. Therefore, Native Title has been extinguished over the project area.

6.6 Community

6.6.1 Community management and development

Long-term relationships with local communities are essential to business success and Perpetual recognises the importance of these strong relationships within the community. Through development of a community engagement plan providing a forum to communicate company activities and receive feedback, Perpetual will achieve active community participation providing tangible benefits and positive outcomes to the local communities.

Local service industry

Majority of services and supplies required during construction and operations are available within the Dongara, Geraldton area and Perpetual shall prioritise utilising these local suppliers where possible.

Employment and recruitment

Perpetual will recruit and employ personnel during the construction and operational phases of the Beharra Project from a range of sources, including:

- Locally, in close proximity to the Project
- Within the WA labour market
- Within the Australian labour market
- Through subcontractor arrangements.

Accommodation and housing

Accommodation will not be required on site due to the proximity of local townships. Dongara has temporary accommodation capacity and availability to meet requirements during the construction phase. During operations, personnel employed at the mine site will be required to provide their own housing within the nearby towns, supporting the local community.

Other risk items

Identified risks related to the community have been detailed in Sections 8.8 and 8.9 of this report, titled Community Based Risks and Non-Environmental Risks, respectively.

6.6.2 External relations and stakeholder management

Perpetual has undertaken an assessment of its key stakeholders that have an interest in the Beharra Project. These are defined in Table 6.2.

Table 6.2 External stakeholders

Group	Stakeholder
Local Government Authorities	Shire of Irwin
Government Agencies	Department of Agriculture, Water and the Environment (Federal) Environmental Protection Authority Department of Mines, Industry Regulation and Safety Department of Water and Environmental Regulation Main Roads WA
Other Interested Parties	Yamatji Southern Regional Council Shire of Irwin Community Beach Energy

Perpetual will maintain a program of engagement throughout the construction, operation and decommissioning phases of the Project. Consultation will be aimed at developing relationships that are mutually beneficial to both parties.

Stakeholders will be engaged early in the planning process, primarily in the interests of achieving a collaborative approach to raise any concerns and provide Perpetual with the means to respond to feedback and to ensure that local knowledge is considered in the design and management of the Project.

A stakeholder register and records of engagement are maintained.

6.6.3 Mine closure

The closure of the site has two components; that of progressive rehabilitation of the land disturbed directly through the mining process and the removal of fixed infrastructure and utilities followed by remediation of the land it occupied.

The ongoing rehabilitation process is described in Section 6.4.1 and involves the progressive backfilling of the mined area, contouring of the material and replacement of topsoil. Vegetation will then be established to stabilise the area. Costs associated with this activity are included in the annual operating costs.

Following completion of mining and processing activity site clearance will be undertaken. The silica sands abstraction process results in no major tailings facility or waste dumps; this along with limited reagent use makes site clearance straightforward.

It is planned that much of the equipment will be retained for other operations or sold. The nature of the plant with portable conveyors, plant design being conducive to relocation within the site and the use of mobile equipment for mining purposes being a substantial component makes this realistic.

Following removal of infrastructure, the land will be contoured, and vegetation established. On this basis, no specific costs have been allocated to site closure following removal of infrastructure and remediation of the land it occupied.

Costs associated with progressive rehabilitation are in the annual operating costs.

7. INDUSTRIAL RELATIONSHIP AND HUMAN RESOURCES

7.1 INDUSTRIAL RELATIONSHIP

7.1.1 Statutory obligations and other commitments

Perpetual will remain compliant with any applicable industrial relations laws and regulations.

Perpetual will utilise the services of employer associations including Chamber of Commerce and Industry WA (CCIWA), the Australian Industry Group, also the Australian Mines and Metals Association to assist in meeting statutory obligations.

7.1.2 Employee relations strategy

A Human Resources/Industrial Relations Management Plan (HR/IR Plan) will be developed during the DFS to enable Perpetual to define the HR/IR Strategy for work on the Beharra Pproject.

7.2 HUMAN RESOURCES

7.2.1 Organisational model and requirements

During the development and construction phases of the Beharra Project, the Perpetual owner's team will be responsible for overall project management, administration/contract management, and site safety. The construction workforce will primarily consist of subcontractors for civil, concrete, and electrical distribution from the power supply to process plant works. The process plant and power station packaged plants will be supplied and constructed by OEM-provided workforces.

The proposed operational workforce will consist of subcontractors for mining and product loadout, with Perpetual employees operating and maintaining the process plant and supporting infrastructure. Figure 7.1 (organisational model) is indicative of the staffing arrangement on which the PFS costs are based and will be optimised further during DFS.

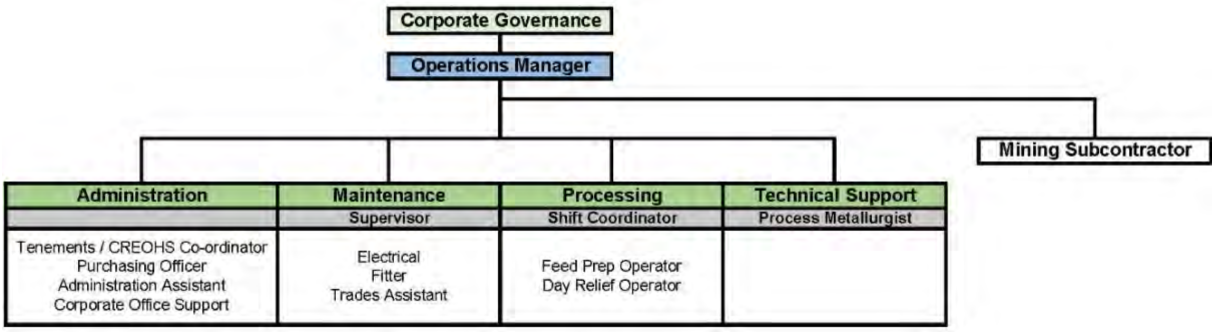


Figure 7.1 Organisational model

8. RISK MANAGEMENT

An internal preliminary risk assessment was carried out to identify and categorise key planning and operational risks to the Beharra Project.

8.1 Objectives

The objectives of the preliminary risk assessment were to:

- Identify and document the key planning and operational risks associated with the current project concept
- Assign a broad risk category to the risks, thereby identifying any potential fatal flaws and to assist in the scoping and focus of technical investigations.

8.2 Scope

The preliminary risk assessment was carried out by Perpetual and key discipline consultants. The assessment was held to identify key planning and operational risks related to the Project, with additional focus on any that may impact on the feasibility of the Project. The exercise covered risks associated with both the construction and operational phases of the Project.

8.3 Methodology

Risks were considered for technical areas that are likely to require investigation during the Project approvals process, including:

- Land use planning
- Surface water and groundwater
- Terrestrial ecology
- Landscape and visual amenity
- Indigenous community
- Social and community impact
- Air quality, noise, and vibration
- Site contamination
- Rehabilitation
- Other.

It was considered that key risks to the Project could exist in these technical areas which could be further investigated at the pre-feasibility level using the existing project description and publicly available information (and with minimal stakeholder consultation).

As risks in each technical area were identified, they were categorised into one of the following four categories:

- **Category F**: Risk areas that may have no viable solution, considered to represent a potential fatal flaw in the Project as described.
- **Category A**: Risk areas requiring detailed investigation and assessment, and complex or detailed management as part of the approvals process.
- **Category B**: Risk areas requiring moderate levels of investigation, targeted assessment, and standard management measures as part of the approvals process.
- **Category C**: Risk areas requiring minimal attention as part of the approvals process and subject to standard management measures.

The matters considered in determining the category for a particular risk were:

- Level of sensitivity
- Potential scale and severity of impacts
- Capacity for management of potential impacts.

Considerations associated with these matters are detailed in Table 8.1.

Table 8.1 Preliminary risk assessment categories

Category	Level of sensitivity	Potential scale and severity of impacts	Capacity for management of potential impacts
F	High sensitivity, significant assets or values lost	Severe impact	Viable measures not expected to be available to manage risk; proposed action or impact unacceptable to regulators
A	High sensitivity, significant assets or values under threat	Medium to high impact	Complex and detailed management measures are available that can be adopted with some tailoring
B	Moderate sensitivity, some significant assets or values may be affected	Medium to low impact	Standard management measures are available that can be adopted with some tailoring
C	Significant assets or values absent or probably avoidable	Low impact	Standard management measures are available

It is recognised that these preliminary assessments were made using information available at the time of study. A conservative approach was therefore adopted whereby reasonable worst cases were assumed when the risk could not be ruled out on the basis of available information.

The method outlined above for the preliminary risk assessment was considered appropriate at this early stage of the Project, given the limited amount of Project-specific information available. It is expected that a later detailed risk assessment would be run using a risk assessment methodology based upon the Australian/New Zealand Standard, AS/NZS ISO 31000:2018 Risk Management – Principles and Guidelines as part of the project impact assessment and approvals process.

8.4 PERMITTING AND APPROVALS

8.4.1 Land use planning

Land use planning is the process of regulating the use of land in an effort to promote more desirable social and environmental outcomes as well as a more efficient use of resources. Land use planning is important to ensure sustainability and minimal impact on future generations.

8.4.2 Identified key risks

The key land use planning related risks identified, rated, and discussed during the assessment are presented below in Table 8.2.

Table 8.2 Land use planning

Risk	Category/risk level
Land use planning	
Mining Act tenement application approval process for mining lease may result in: • Significant delay in project schedule • Cost impacts • At worst, Project not approved.	B
Mining impact to the Yardanogo Nature Reserve which is located on the western boundary of the tenement.	B
Mine site access using existing roads through the Yardanogo Nature Reserve may not be approved.	C

8.4.3 Scope of further investigations

The next steps in this technical area would be:

- Additional review of existing and future land uses of the subject site and adjacent land and their impacts, and determine whether there are any sensitive uses in proximity to these areas
- Consultation with WA Government and local indigenous groups.

8.4.4 Environmental conditions

Identified key risks

The key environmental conditions related risks identified, rated, and discussed during the assessment are presented below. Construction phase risks are presented in Table 8.3 and operational phase risks are presented in Table 8.4.

Table 8.3 Environmental conditions – construction phase risks

Risk	Category risk level
Environmental conditions	
Approval conditions potentially unreasonable and cause significant limitations on mine footprint, operations or staging which adversely impacts the project schedule, design, budget. and economic viability.	B

Table 8.4 Environmental conditions – operational phase risks

Risk	Category/risk level
Environmental conditions	
Approval conditions may be unreasonably onerous and apply significant limitations which adversely impacts schedules, mine operation output/logistics, efficiency, and economic viability.	B
Mine operation may give rise to significant complaints in reference to working with Silica and potential impact of silica dust.	B
Mine operation may give rise to significant complaints (e.g. noise, air, water, and waste).	C

8.4.5 Scope of further investigations

The next steps in this technical area would be:

- Review of WA and local policies
- Implementation of a silica hygiene management policy
- Consultation with WA Government and local indigenous groups.

These actions would provide local area context, help to determine the level of government and community support for the Project and assist in identifying the range of permitting and approval issues associated with the Project.

8.5 SURFACE GROUNDWATER AND HYDROGEOLOGY

8.5.1 Identified key risks

The surface water, groundwater and hydrogeological risks identified, rated, and discussed during the assessment are presented below. Construction phase risks are shown in Table 8.5 and operational risks are shown in Table 8.6.

Table 8.5 Surface water, groundwater, and hydrogeology – construction phase risks

Risk	Category/risk level
Surface water, groundwater, and hydrogeology.	
Uncontrolled spill, discharge from site(s), or erosion may result in significant impact on beneficial uses of surface waters (water quality and hydrogeology) – e.g. stormwater and drainage.	C
Interaction with local groundwater may result in (real or perceived) significant impacts on water level in aquifer, including economic and operational beneficial uses.	C

Table 8.6 Surface water, groundwater, and hydrogeology – operational phase risks

Risk	Category/risk level
Surface water, groundwater, and hydrogeology	
Water allocation from remote aquifer results in additional capital and operating cost increases.	B
Remote water source(s) pump station or supply line is interrupted/damaged.	C
Drawdown of the local aquifer results in impact to groundwater dependent ecosystems (vegetation). Cumulative impact with Tronox Dongara project exacerbates impacts resulting in challenging environmental approvals.	A

8.5.2 Discussion of key risks

Securing a water supply allocation from a nearby source is required to keep both the capital and operating costs to a minimum.

Perceived impacts on the water level, GDE and quality of local aquifers from mining activity needs to be managed through plant design and operation practices.

It is anticipated that potential risks to surface water associated with discharges (during both construction and operation) will be able to be mitigated using standard measures and management strategies.

8.5.3 Scope of further investigation

As the Project matures to a definitive level, further detailed investigation relating to water supply will be required.

8.6 NATIVE TITLE AND HERITAGE

8.6.1 Identified key risks

Risks associated with Native Title and heritage identified, rated and, discussed during the assessment are shown in Table 8.7.

Table 8.7 Native Title and heritage – project risks

Risk	Category/risk level
Heritage	
High level of investigation (field survey work) in relation to development on or near the Southern Yamatji native title land. Recommendation by Southern Yamatji representatives to use previously established historic tracks may alter mine location (to avoid impacts).	C
If human remains, skeletal materials that may be human, or materials that may belong to a human grave are discovered during exploration or resource evaluation within the cleared survey areas, Perpetual must follow the DPLH procedures and stop work immediately.	B
Relationship with indigenous community breaks down, causing delays and increased costs.	C

8.6.2 Discussion of key risks

Disharmony amongst locals relating to land owning rights, employment privileges.

Mining operation reveals human remains, artefacts or materials that may belong to a human grave delaying approvals and Project construction/operations.

Perpetual employees and contractors executing the proposed works must be informed of their obligations under the *Aboriginal Heritage Act 1972*.

8.6.3 Scope of further investigation

Continued consultation and maintaining discussions with the Southern Yamatji people, regarding any future matters that may arise in relation to the areas surveyed, including any further proposed excavation or ground disturbance activities or access to uncleared proximate areas. A Standard Heritage Agreement between Perpetual Resources and Southern Yamatji will be required as a condition of mining tenure.

8.7 TERRESTRIAL ECOLOGY

8.7.1 Identified key risks

The risks to terrestrial ecology identified, rated, and discussed during the assessment are presented below. Construction risks are shown in Table 8.8 and operational risks are shown in Table 8.9.

Table 8.8 Terrestrial ecology – construction risks

Risk	Category/risk level
Terrestrial ecology	
Direct loss of the foraging habitat for Carnaby's Black-Cockatoo a Federally listed threatened (Endangered) bird species.	A

Direct impact to Carnaby's Black Cockatoo as a result of vehicle/machinery strike.	C
Lack of available suitable Carnaby Black-Cockatoo foraging habitat in the local region to offset direct impact from vegetation clearing at a 3:1 ratio. Restricts area of mine disturbance and therefore mine life.	A
Direct loss of restricted wetland vegetation communities and Kwongan sandplains flora species diversity.	A

Table 8.9 Terrestrial ecology – operational risks

Risk	Category/risk level
Terrestrial ecology	
Poor standard of rehabilitation resulting in low recruitment and return of Carnaby Cockatoo foraging habitat in the local area.	A
Direct impact to Carnaby's Black Cockatoo as a result of vehicle/machinery strike.	C
Poor standard of rehabilitation resulting in low recruitment and return of flora species diversity similar to those found in restricted wetland vegetation communities and Kwongan sandplains.	A

8.7.2 Discussion of key risks

Impacts to terrestrial flora and fauna environment need to be avoided/mitigated.

8.7.3 Scope of further investigation

A comprehensive impact assessment needs to be carried out after the development plan becomes more refined.

8.8 COMMUNITY-BASED RISKS

8.8.1 Identified key risks

These generally relate to issues which are routinely managed and investigated during the approvals process and, with the exception of those relating to community opposition, are not expected to represent significant risks to the Project.

Opposition to mining projects from at least some sections of the local communities is a possibility. While such opposition does not often prevent a project from proceeding, it can potentially result in significant delays, increased costs and pose a reputational threat to the proponent. Community-based risks are shown in Table 8.10.

Table 8.10 Community-based risks

Risk	Category/risk level
Additional	
Community may raise concerns that information and communication regarding the approvals process, nature of the Project, management measures and impacts/benefits is inadequate. Community may feel they have not been able to have a say and/or see how their say has been addressed.	C
Community may raise concerns that impact to landscape character, landforms and visual amenity of the countryside is significant.	C
Community/Community Groups may raise concerns that impact to Carnaby Black-Cockatoo foraging habitat is excessive and provide considerable input to environmental approvals process resulting in significant delays.	B
Community and authorities raise concerns that project may have a negative social and economic impact (rather than benefit).	C
Community/landowners may not be satisfied that final landform and rehabilitation will be able to be achieved or could have long-term legacy/risks.	C
Potential community (real or perceived) concern and impacts from hazardous substances and dangerous goods.	C
Potential complaints and non-compliance with health and safety policies during construction and operations regarding air emissions (e.g. silica dust).	C

8.8.2 Scope of further investigation

Continued consultation and maintaining discussions with the local community and local authorities, during the continued development of the Project.

8.9 NON-ENVIRONMENTAL

8.9.1 Identified key risks

Risks identified in Table 8.11 relate to issues within the process plants and mining and marketing.

Table 8.11 Identified risks – non-environmental

Risk	Category/risk level
Resource	
Expected SiO_2 grades are not realised	C
Mining	
Poor mine planning resulting in increased operational costs	B
Process plant	
Slime's removal – handling and disposal	C
Spiral performance/recoveries	C
Equipment configuration	C
Overall plant performance/recoveries	C
Water management	C
Industrial Relations	
Union industrial action at the port delays equipment imports during the construction phases	B
Union industrial action at the port restricts product delivery to port and/or export	B
Marketing	
Product market and offtake availability	B
Force Majeure	
Pandemic (COVID 19) continued outbreaks – preventing receipt of interstate or international based equipment and commissioning crews	A

8.9.2 Discussion of key risks

Project development is following JORC (2012) guidelines ensuring in-situ resource is well understood.

Multiple levels of metallurgical testing and hence confidence supports spiral performance/ recoveries.

Well understood process from multiple phases of testwork with considerable flexibility in equipment configuration. Equipment selection in relation to product stacking and rejects disposal is being incorporated into the design thereby minimising water consumption and make-up water volume requirements.

Material is less than 2% silt/slimes with excellent settling rates demonstrated during testwork.

Suitably qualified mine planner or contract miner to be engaged during operations to ensure compliance and efficiency of mining.

8.9.3 Scope of further investigation

Further optimise circuit flowsheet during further DFS testwork.

Identify, develop and sign-up long term reputable offtake customers during DFS.

Optimise selected mine methodology during DFS.

8.10 SUMMARY OF OUTCOMES

The assessment uncovered a number of issues that require further investigation in the shorter term. There were no Category F risks identified, and Category A risks are shown Table 8.12.

Table 8.12 Summary – key project risks

Risk	Category/risk level
Surface groundwater and hydrogeology	
Drawdown of the local aquifer results in impact to groundwater-dependent ecosystems (vegetation). Cumulative impact with Tronox Dongara project exacerbates impacts resulting in challenging environmental approvals.	A
Terrestrial ecology	

Direct loss of the foraging habitat for Carnaby's Black-Cockatoo a Federally listed threatened (Endangered) bird species.	A
Lack of available suitable Carnaby Black-Cockatoo foraging habitat in the local region to offset direct impact from vegetation clearing at a 3:1 ratio. Restricts area of mine disturbance and therefore mine life.	A
Direct loss of restricted wetland vegetation communities and Kwongan sandplains flora species diversity	A
Poor standard of rehabilitation resulting in low recruitment and return of Carnaby's Cockatoo foraging habitat in the local area.	A
Poor standard of rehabilitation resulting in low recruitment and return of flora species diversity similar to those found in restricted wetland vegetation communities and Kwongan sandplains.	A
Force Majeure	
Pandemic (COVID-19) continued outbreaks – preventing receipt of interstate or international based equipment and commissioning crews.	A

As a further note, the risks identified and rated during this assessment were addressed in isolation only. Snowden has also included Force Majeure as a potential risk which is difficult to quantify, but for the purposes of this study rated as a Category A.

8.11 Recommended Actions

Additional activities during the definitive study phase of the Project which would result in a higher level of risk definition and the capacity/cost to address these include:

- Further stakeholder engagement with government departments, community and Southern Yamatji representatives
- Further process definition to confirm flowsheet and water balance
- Determine availability of suitable Carnaby's Black Cockatoo habitat in the region for environmental offset opportunities
- Desktop flora and vegetation review of Tronox survey data to update classifications and ensure consistent with current survey guidance requirements
- Confirm water bore extraction location for construction/operational purposes, model drawdown and undertake cumulative impact assessment with Tronox data on potential impacts to groundwater-dependant ecosystems.

8.12 Risk Management Plan

A risk management plan and risk register will be developed and maintained as part of the DFS works.

9. PROJECT MANAGEMENT ASPECTS

9.1 PROJECT MANAGEMENT

9.1.1 Objectives

The Project objective is to provide the most cost effective and timely establishment of operations and to ensure the ramp-up to full production is achieved with no lost-time injuries (LTIs) and in an efficient and productive timeframe.

9.1.2 Execution methodology

Upon completion of this PFS, and audit of results, the Project may enter a DFS for further project review and optimisation. The aim of this phase is to address all items raised during the PFS as requiring further works or investigation.

Upon completion of a DFS, a final investment decision will be made and if successful, the Project will be in a position to move into the execution phase, subject to statutory mining and funding approvals.

To expedite the project, prior to receiving Mining Approval, Perpetual may enter into Early Contractor Involvement for the design of a packaged Process Plant and site power supply options.

Once mining and funding approvals have been received, the Project will then progress through the following stages:

- Award of packaged plant supply and power supply contract(s)
- Tender and award of offsite infrastructure supply and installation contract(s) (roads)
- Tender and award of on-site civil, concrete, mechanical and electrical construction and installation contract(s)
- Tender and award on-site service contracts (e.g. fuel, waste management)
- Construction
- Commissioning and handover.

The general execution methodology for the Project will be presented in a series of execution plans outlined below:

- Project Execution Plan
- Project Management Plan
- Health and Safety Plan (including Health and Hygiene Management Plan)
- Environmental Management Plan
- Quality Management Plan
- Risk Management Plan
- HR/IR Plan
- Contract Management and Procurement Plan
- Construction Management Plan
- Operations Management Plan.

These plans will be developed to varying levels of completion during the DFS.

9.1.3 Cost management

The Project estimate produced in the DFS will be used to develop a project budget based against the work breakdown structure which will then be adopted for project cost control purposes.

9.1.4 Quality assurance

A project Quality Management Plan will be developed prior to project execution to ensure best practice during project implementation.

9.1.5 Risk management

A preliminary risk assessment was carried out to identify and categorise key planning and operational risks to the Beharra Project. Refer to Section 8 for further detail. The preliminary risk assessment will form the basis of a project risk register, which will be further developed during the DFS.

9.1.6 Change management

A change management system will be developed and implemented prior to the execution phase of the Project. The change management process will apply to all variations, including project scope, budget, and schedule.

9.1.7 Reporting and coordination

Prior to, and during project execution, formal communication, and reporting requirements with respect to cost, time, regulatory compliance, safety performance and any other issues will be established for all stakeholders.

9.2 PROJECT EXECUTION

9.2.1 Work breakdown structure

A high-level Work Breakdown Structure (WBS) has been developed based on the PFS project scope. The WBS is attached at Appendix 10.

Primary areas are as follows:

- Mining
- Wet processing plant
- Onsite infrastructure
- Offsite infrastructure
- Commissioning
- PCM
- Indirects and owner's costs.

9.2.2 Project organisation

The Project will be developed using an Owner's Team execution model, which is considered appropriate given the size of the Project.

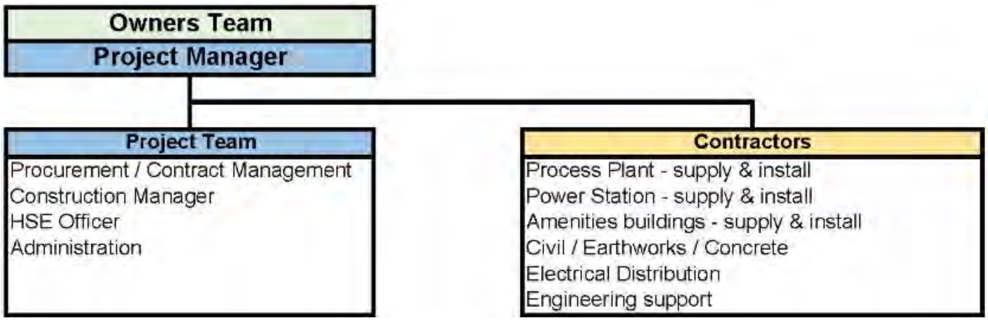
An Owners Team–PCM execution model will be adopted for the Beharra Project through to commissioning. This model is clarified below.

The owner's team will consist of a Project Manager, Procurement/Contracts management/administration team, Construction Manager and HSE Officer.

A variety of packages of work will be awarded to suppliers, such as the process plant, power supply, earthworks with contracts managed directly by the owner's team "**P**".

The owners team Construction Manager will manage, supervise and coordinate all suppliers and contractors on site during the construction phase "**CM**".

The CAPEX has been generated using this model.



9.2.3 Contracting strategies

The project execution and operational models will require a variety of major and minor contracts to be awarded to suppliers. A Contractor Management Plan will be developed during the DFS to define the policies, procedures, and management systems to be used in administration of supply, construction, and service contracts during the execution and operational phases of the Project.

9.2.4 Engineering

Process flow, process plant scope of works and technical specifications, site layout and infrastructure requirements will be developed to near completion, during the DFS.

On completion of the DFS, majority of the engineering works for the Beharra Project will be carried out by the successful process plant supply and install contractor.

Internal Perpetual engineering requirements, will be minimal and consist of finalising process plant scope of works documents, then updating site layouts, infrastructure scope of work documents post process plant sign-off. These works will be subcontracted to an engineering house.

9.2.5 Construction

Perpetual's construction manager will superintend all facets of the site works and road upgrade programs. Prior to commencement of site works, a Project Management Plan, including safety management must be developed and approved by DMIRS.

In addition to the above, a construction management plan will be developed during the DFS detailing methodology and providing a timeline for all phases of the proposed site works.

9.2.6 Commissioning

Key infrastructure, which includes power supply, water supply, diesel storage will be commissioned by the respective vendors prior to process plant commissioning.

Process plant commissioning on water will be conducted by the supply and install contractor, with Perpetual operations staff on site to commence training.

9.2.7 Commissioning handover

When commissioning on water activities is successfully complete and operators are trained to operate the systems and equipment, performance acceptance testing will be conducted.

Performance testing of the plant will be carried out on ore over a period of two to four weeks. In addition to the contractor, Perpetual's project manager, qualified consulting metallurgist and engineer will be overseeing the performance testing. As part of the handover, the contractor shall provide operating and maintenance manuals, and all other project related documentation to Perpetual.

When performance testing and document delivery is successfully completed, Perpetual will accept handover of the process plant from contractor.

10. FINANCIAL ANALYSIS

10.1 CONTEXT

10.1.1 Assumptions

The base Beharra financial model has been prepared by Perpetual with input from Mining Insights Pty Ltd (MI), who has extensive experience in the analysis and evaluation of potential mining projects across multiple commodity sectors. Perpetual and MI have applied the LOM plan and associated physical schedule against appropriate and verified cost inputs. Perpetual has then used this model as a basis to apply a range of assumptions and variables, such as exchange rate, commodity price, equity discount rate, gearing proportion, gearing costs and other financial metrics, to derive outputs such as EBITDA (earnings before interest, taxes, depreciation, and amortisation), operating costs and other important financial outcomes, with the end result being an assessment of project value using NPV and IRR calculations.

Where possible, the Beharra financial model has relied on a first principles assessment of the various inputs into the financial model, with key workstreams tendered to professionals in their respective fields, with the resulting inputs used as the basis for many of the inputs in the financial model.

While primary proposals from potential service providers have been relied upon for many of the key financial model inputs, there remains several key assumptions that Perpetual has made in the financial model, which will be further interrogated and explored as the project progresses through to DFS.

These key assumptions in the financial model are supplied in Table 10.1 below, along with the resultant key financial model outputs shown later in Table 10.2.

Table 10.1 Key financial model inputs

Key financial model input	Units	Assumed value	Notes
Silica Sand Sales Price	US$/t	$50/t	A nominal sales price of US$50/t FOB has been used throughout the forecast period. Perpetual considers this a conservative estimate of the likely sales price and is based on feedback from a range of specialised silica sand market intermediaries, industry forecasters, as well as direct discussions with end users.
Exchange rate	US$	0.75	See Section 10.2.3 below.
Equity discount rate	%	10%	An equity discount rate of 10% has been used, which is consistent with the discount rate used by mining development project peers with projects at a similar stage of evaluation and development.
Debt borrowing rate	%	7.5%	Where a gearing assumption has been made, a debt borrowing rate of 7.5% has been used, which is consistent with the debt borrowing rate achieved by mining development project peers with projects at a similar stage of evaluation and development
Debt payback period	years	10	Where a gearing assumption has been made, a debt payback period of 10 years has been used, which is consistent with typical debt payback periods achieved by mining development project peers with projects at a similar stage of evaluation and development.
Gearing ratio	%	40%	Where a gearing assumption has been made, a gearing ratio of 40% has been used, which is considered an acceptable gearing ratio for a project that exhibits relatively low capital costs, high margins, and quick debt payback, which are all attributes exhibited by the Beharra Project.
Inflation rate	%	2.5%	An inflation rate of 2.5% has been applied to both revenue and costs, throughout the forecast period, which is considered a reasonable long term inflation rate.
Mine life	years	32	The financial model assumes a 32-year mine life, which is considered a reasonable assumption as it represents a subset of the reserve calculation that was prepared by industry specialists, Snowden.

Table 10.2 Key financial model outputs

Project economics at assumed production scenario	Unit	Base case

Total silica sand produced	Mt	47.6
Annual production target	Mt	1.51
Probable Ore Reserves @ 98.6% SiO_2	Mt	64.1
Ore Reserve life	years	32
JORC Mineral Resources	Mt	139
Total LOM revenue	A$ M	4,983
Total LOM capital expenditure	A$ M	76.9
Total LOM EBITDA	A$ M	1,714
Total LOM mine free cash flow	A$ M	1,131
Post-tax DCF (NPV10) – ungeared	A$ M	231
Post-tax IRR – ungeared	%	55
Post-tax DCF (NPV10) – geared	A$ M	236
Post-tax IRR – geared	%	77
Payback period	years	2
FOB costs	A$/t	43.07

Perpetual completed the PFS under a base scenario where production is assumed to be from a single plant that is funded and constructed in year 1 of operations and then fully ramped up during that same year and then operated for a 32-year mine life.

The Beharra Project is forecasted to be strongly cash flow positive, with post-tax capital payback estimated to be achieved in around two years from first production. The strong cash flow profile of the Beharra Project can be seen in Figure 10.1. The cash flow profile shown in Figure 10.1 delivers a predicted post-tax ungeared IRR of 54.6%.

The return profiles are considered highly attractive and are expected to be of interest to a range of debt and equity investors when potential funding is sought.

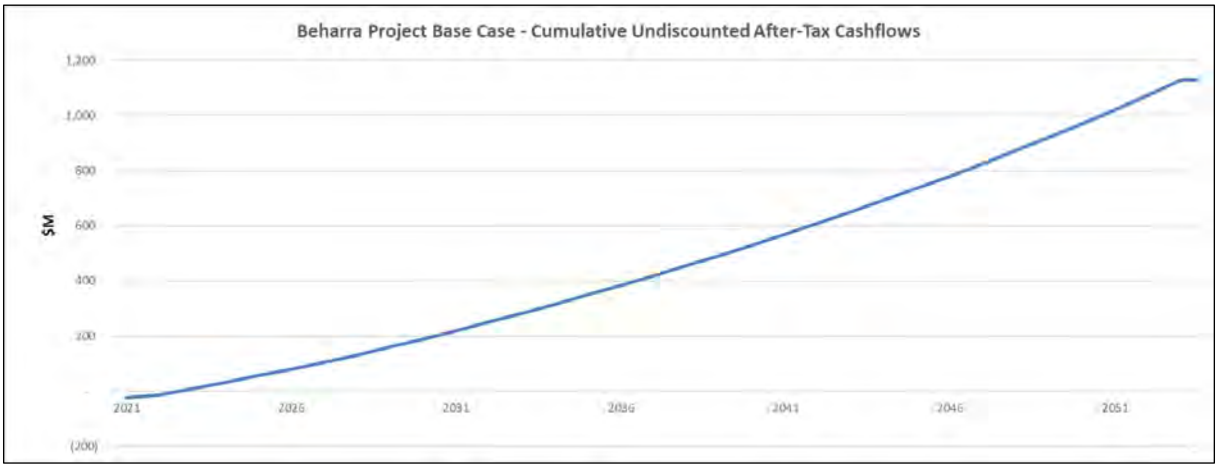


Figure 10.1 Beharra cumulative undiscounted and ungeared after-tax cash flow chart

As shown in the preceding charts, the Beharra Project is forecast to generate very strong annual free cash flow, which position the Project to deliver rapid payback on capital investment (around two years) and very strong post-tax ungeared IRRs. Figure 10.2 below is a graphical representation of the discounted cash flow profile of the Beharra Project.

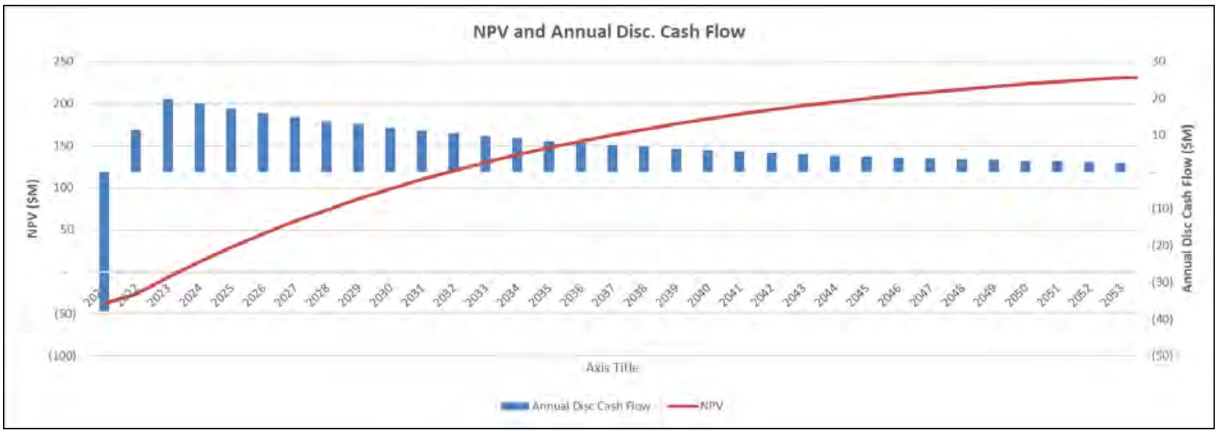


Figure 10.2 Discounted after-tax ungeared cash flow and NPV

10.1.2 Taxation profile

As Perpetual is an Australian public company, with all operations in Australia, it has been assumed that corporate tax applies to all relevant project profits, at the rate of 30%, which is the statutory company tax rate in Australia. Where available, typical tax deductions (such as depreciation and financing costs, among others) have been modelled, in line with relevant tax laws in Australia.

The Beharra financial model does not take into account any accumulated tax losses held by the parent entity, Perpetual Resources Limited, as the applicability of these to the project have not yet been determined. As a result, the Beharra Project is assumed to be tax paying from year 2 of operations.

10.2 CAPITAL EXPENDITURE ESTIMATE

10.2.1 Accuracy and scope of estimate

The CAPEX was produced by Perpetual with input from major equipment, infrastructure and service suppliers. The estimate includes all process plant, onsite/offsite infrastructure and indirect costs associated with installation of a 250 tph processing plant on the Beharra project site.

Enough process information, engineering design and supplier pricing is available to support an estimate at ±25% accuracy, suitable for PFS level.

A summary of the estimate is shown at Figure 10.3.

Perpetual RESOURCES LIMITED

Area	BEHARRA - CAPITAL EXPENDITURE ESTIMATE - SUMMARY SHEET			Equip/ Material		Installation		-		
Area	Area Description	Sub Areas	Details	Unit Cost $	Extended Cost $	Unit Cost	Extended Cost $	Fabrication Detailing	Freight	LINE TOTAL $
1.0	Mining				11,575					This area left blank.
2.0	Wet Processing Plant				19,086,457		85,999		11,728	
3.0	On-Site Infrastructure				3,291,780		177,069		67,879	
4.0	Off-Site Infrastructure				9,242,550		24,431		5,553	
5.0	Commissioning				91,050					
T1	Total Direct Material and Labour			T1 (M)	31,723,412	T1 (L)	287,498			32,010,910
T2	Total Freight								85,159	85,159
T3	Total Fabrication Detailing		All fabrication detailing included in Package Plant							
T4	SUB-TOTAL DIRECT FIELD COSTS (= T1 (M&L)									32,096,069
T5	Labour indirects (% OF T1 (J))	15.0%								43,125
T6	PCM Fees (% of (T4+T5))	7.0%								2,249,744
T7	PCM Home and Site Office Expenses (% of T6)	2.0%								44,995
T8	SUB-TOTAL INDIRECT COSTS (= T5 + T6 +T7)									2,337,863
T9	PROJECT SUB TOTAL (DIRECT+INDIRECT COSTS = T4 + T8)									34,433,932
T10	Project Insurances (% of T9)	0.4%	Indicative only							137,736
T11	Commissioning Spares (% of T9)		Included in Area 2.0							
T12	Year 1 Operational Spares (% of T9)	1.5%	Indicative only							516,509
T13	Owners costs (% of T9)	2.0%	(Staff, travel, accomm, Shire and Development fees etc.)							688,679
T14	Project Contingency (% of T9)	10.0%	Covers unforeseen items; bad weather, bad soil conditions, labour disputes, minor oversights etc.							3,443,393
T15	TOTAL = SUM T9-T14 (Excluding Escalation)		T15 is accurate to PFS level (+/- 25%%)							$39,220,249

This Estimate is exclusive of GST, Taxes, Duties and Interest during construction.

Figure 10.3 Summary of capital estimate

10.2.2 Basis of estimate

A breakdown of the Base Case CAPEX basis of estimate can be found in Appendix 11 (Estimate Basis Memorandum).

10.2.3 Foreign exchange

Perpetual has elected to use a flat A$:US$ exchange rate of 0.75c across the forecast period, which is considered a reasonable estimation of a likely long run average level. As Beharra is a long-life project, wide exchange rate fluctuations are possible, with this risk to be managed by the management team and Board of Directors who may utilise an appropriate exchange rate hedging strategy at the relevant time.

10.3 Operating Cost Estimate

10.3.1 Accuracy and scope of estimate

The operating cost estimate includes all site-related operating costs associated with mining and processing ore to produce a >99.5% + silica sand product and product transport on an FOB ship basis.

The operating cost estimate was developed based on an annual production of nominally 1.51 Mtpa of >99.5% SiO_2 product (the Base Case scenario); the base mining rate required to achieve this is nominally 2.0 Mtpa which are reflected in the Base Case project financial model. A base estimate mining rate of nominally 2.0 Mtpa was established and on this basis the nett cost per tonne of product on an FOB basis is calculated to be A$43.07/t.

Escalation/inflation have not been addressed within the operating cost estimate but have been separately modelled in the financial model at a rate of 2.5% per annum.

10.3.2 Basis of estimate

A breakdown of the basis of estimate can be found in Appendix 11 (Estimate Basis Memorandum).

10.3.3 Summary of estimate

A summarised table of operating cash cost categories are outlined in Table 10.3 below.

Table 10.3 Summary of cash costs

Capital	$A/t ore
Mining ROM + OB	5.18
Processing	2.46
Reject haulage	0.29
Administration	1.18
Transport + Port	19.40
Rehabilitation	0.43
Contingency	1.40
Royalty	1.71
TOTAL OPEX	**32.05**

10.3.4 Cash flow model

MI, in conjunction with Perpetual, undertook the financial analysis of the Project with all price assumptions and operational and capital expenditure estimates provided to MI through Perpetual. These assumptions and estimates were in A$.

The financial analysis has been performed using DCF analysis. All amounts are in A$ and are nominal. Variability of input assumptions for capital, operating and sales price has been assessed using sensitivity analysis.

The key assessment criterion is the IRR on a nominal, after tax basis. NPV (@10%, nominal after tax), payback periods and capital funding requirements have also been assessed.

The financial analysis indicates the following post-tax NPV and post-tax IRR calculations. Scenarios have also been run, assuming the Project is geared to 40% (debt to equity), with a debt payback period of 10 years and a cost of debt of 7.5% per annum. The outcomes of this analysis are shown in Table 10.4 below.

Table 10.4 NPV and IRR assessments under various assumptions

Condition	Base Case
NPV (post-tax) – ungeared	$231 million
IRR (post-tax) – ungeared	54.6%
NPV (post-tax) – geared	$236 million
IRR (post-tax) – geared	77.4%

A maximum cash draw before tax of A$40 million is calculated in year 1 in the financial model, when the Project is assumed to be constructed and commissioned. Payback of the original capital is achieved early in year 2 of operations. Figure 10.4 demonstrates the net undiscounted cash flow profile.

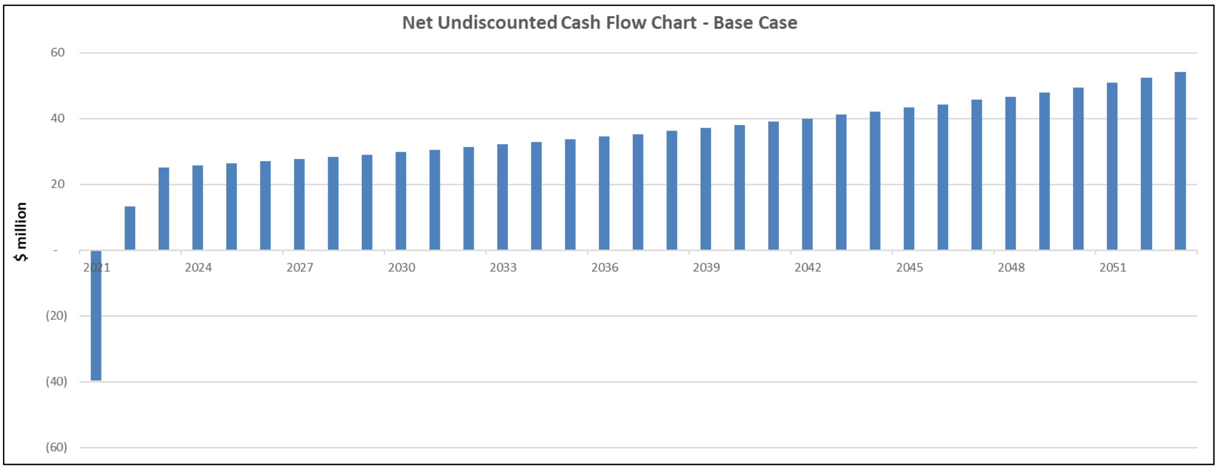


Figure 10.4 Beharra net undiscounted cash flow chart

10.4 Investment Evaluation

10.4.1 Valuation methodology

It is considered that the most relevant valuation methodology for the Beharra Project is a DCF methodology.

DCF is a valuation method used to estimate the value of an investment based on its expected future cash flows. DCF analysis attempts to determine the value of an investment today, based on projections of how much free cash it will generate in the future.

The DCF for Beharra has therefore been constructed by estimating the annual revenue that the Beharra Project could generate and subtracting the various operating, capital, tax and financing expenses (if applicable) in any given year, which generates an annual free cash flow amount for the entire life of the Project, modelled as 32 years.

These annual cash flows are then discounted back to today's dollars using a discount rate of 10%. When project gearing is assumed, a debt-to-equity ratio of 40% is applied.

The summation of the 32 years of after-tax discounted cashflows is then presented as a NPV of the Project, which is used as the base valuation of the Project, and which equals the assessed values shown in Table 10.5 below under gearing assumptions.

Table 10.5 NPV and IRR assessed values

Condition	Base Case
NPV (post-tax) – ungeared	$231 million
IRR (post-tax) – ungeared	54.6%
NPV (post-tax) – geared	$236 million
IRR (post-tax) – geared	77.4%

10.4.2 Key project variables

The results of the PFS demonstrate a robust economic case, with a number of key financial sensitivities that could affect the ultimate financial outcome.

10.4.3 Sensitivity analysis

The key financial sensitivities for the project, and their impact on valuation and return metrics, is summarised in Table 10.6 and *Sensitivity variations are zero due to base case gearing of 0%

Table 10.7 below. Sensitivities have been detailed in this section, as the Base Case sensitivities provide sufficient indicative variability of the key metrics, with the percentage impact on valuation broadly the same irrespective of annual production level.

Table 10.6 NPV sensitivity analysis given a change in one discrete variable of the financial model

Sensitivity	80%	90%	100%	110%	120%
Price	$75.6	$153.3	$230.9	$308.6	$386.2
Exchange rate	$425.1	$317.2	$230.9	$160.3	$101.5
Operating cost	$330.9	$280.9	$230.9	$180.9	$131.0
Project capital	$240.1	$235.5	$230.9	$226.3	$221.8
Gearing ratio*	$230.9	$230.9	$230.9	$230.9	$230.9

*Sensitivity variations are zero due to base case gearing of 0%

Table 10.7 NPV sensitivity analysis given a change in both price and operating cost in the financial model

		Price				
	$230.9	**80%**	**90%**	**100%**	**110%**	**120%**
Operating cost	**80%**	170.0	250.5	330.9	411.3	491.7
	90%	120.0	200.5	280.9	361.3	441.8
	100%	70.1	150.5	230.9	311.3	391.8
	110%	20.1	100.5	180.9	261.4	341.8
	120%	-30.2	50.5	131.0	211.4	291.8

The sensitivity of the post-tax project cashflows and the DCF to changes of ±0 to 20% is shown in Figure 10.5 below.

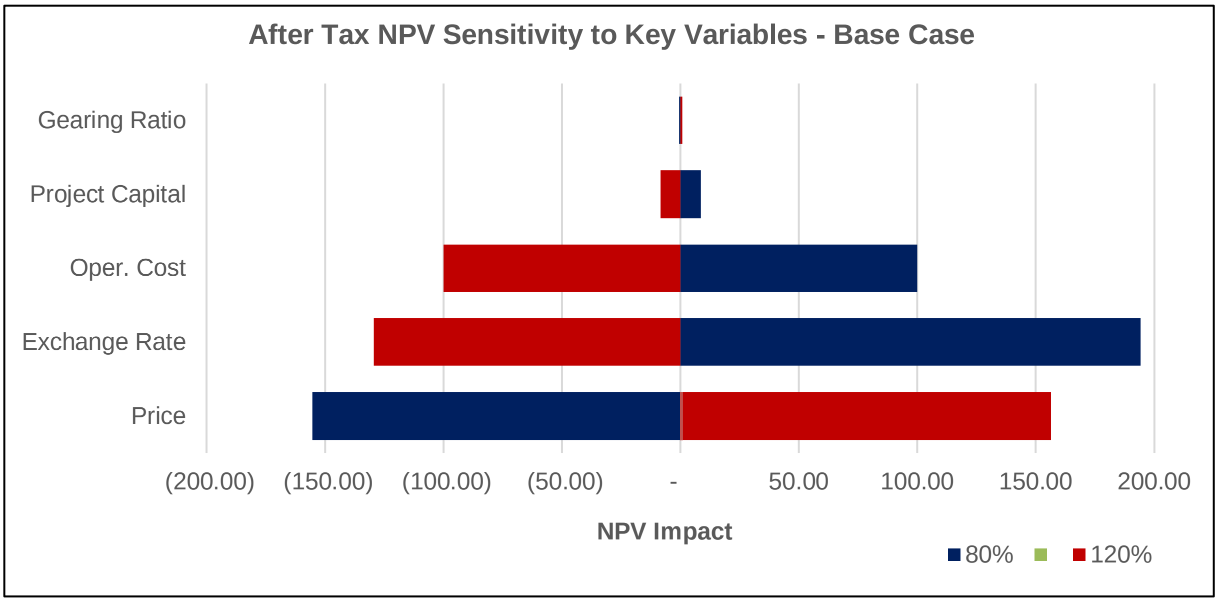


Figure 10.5 After-tax NPV sensitivity to key variables

As is typical with many resource related projects, the key financial metrics are most sensitive to changes in revenue and operating cost assumptions, with exchange rate sensitivity also seen as a major influence on the ultimate financial outcomes of the Beharra Project.

10.4.4 Valuation results and key metrics

Table 10.8 Key financial model outputs

Project economics at assumed production scenario	Unit	Base Case
Total silica sand produced	Mt	47.6
Annual production target	Mt	1.51
Probable Ore Reserves @ 98.6% SiO_2	Mt	64.1
Ore Reserve Life	years	32
JORC Resources	Mt	139
Total LOM revenue	A$ M	4,983
Total LOM capital expenditure	A$ M	76.9
Total LOM EBITDA	A$ M	1,714
Total LOM free cash flow	A$ M	1,131
Post-tax DCF (NPV10) – ungeared	A$ M	231
Post-tax IRR – ungeared	%	55
Post-tax DCF (NPV10) – geared	A$ M	236
Post-tax IRR – geared	%	77
Payback period	years	2
FOB costs	A$/t	43.07

The key financial metrics shown in Table 10.8 above demonstrate that the Beharra Project is considered robust on key financial measures, exhibiting rapid payback, high IRRs and high resulting NPVs, and has potential to become a significant export project in the Mid-West region of WA.

11. JORC CODE (2012) TABLE 1 REPORTING (SECTIONS 1, 2, 3, AND 4)

11.1 SECTION 1: SAMPLING TECHNIQUES AND DATA

Criteria	JORC Code explanation	Commentary
Sampling techniques	Nature and quality of sampling (e.g. cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as downhole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling. Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used. Aspects of the determination of mineralisation that are Material to the Public Report. In cases where 'industry standard' work has been done this would be relatively simple (e.g. 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases, more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (e.g. submarine nodules) may warrant disclosure of detailed information.	Aircore drilling and sampling referred to in this report occurred in two separate programs: March 2020 and September 2020. March 2020: Aircore samples were collected via a cyclone, the entire sample for each 1 m drill interval was collected and placed in a calico sample bag. No splitting on the rig was undertaken. The sample was labelled with the drillhole number and sample interval, and a waterproof tag nominating a sample number was placed in the bag and then sealed with a tie. September 2020: Aircore samples were collected via a cyclone, the entire sample for each 1 m drill interval was collected and placed in a calico sample bag, labelled with the drillhole number and sample interval, and weighed by a spring balance. A 1 kg split was taken by spear and placed in a smaller calico bag, labelled with a sample number. Aircore samples were collected from each metre drilled or part metre if the hole was not ended on a full metre. For the September program, separate samples were taken for 0–0.5 m and for 0.5–1 m. Only the latter had a 1 kg split taken from it. Representative samples of each interval drilled were placed in a chip tray for reference. Auger drilling and sampling referred to in this report and reported previously were obtained from hand auguring to a maximum depth of 2 m. Three auger samples were collected from each hole being surface to 0.5 m, 0.5–1.0 m, and 1.0–2.0 m. The top metre of the hole was split into two samples to allow a separate sample of the top 0.5 m that contains organic matter associated with native ground cover. If sand mining operations were to be carried out, this top 0.5 m would be stockpiled for future rehabilitation, so at this time treating it separately is appropriate. The shallow auger program was carried out to obtain representative sand samples to a maximum depth of 2 m for the reasons as described in the Company release of 12 February 2019.

Criteria	JORC Code explanation	Commentary
Drilling techniques	Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (e.g. core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).	March 2020: A total of 32 aircore drillholes were completed to an average depth of 12.3 m, with the deepest hole ending at 17 m. September 2020 aircore drilling was undertaken using a track mounted KL170 hydraulic top drive rig coupled to a 250 psi compressor. An 84 mm vacuum bit was fitted to a 76 mm outside diameter twin tube rod string. The internal diameter was 51 mm. All holes were drilled vertically. March 2020: A total of 40 aircore drillholes were completed for an average depth of 12.7 m, with the deepest hole ending at 20 m. March 2020 aircore drilling was undertaken using a track mounted Hitachi hydraulic top drive rig coupled to a 130 cfm/100 psi compressor. A 76 mm aircore bit was fitted to 70 mm twin tube rod string. All holes were drilled vertically. Auger drilling consisted of a manually hand operated 75 mm diameter sand auger (Dormer Sand Auger) with PVC casing utilised to reduce contamination potential as the auger is withdrawn from the hole. The auger was driven about 300 mm then retracted and the sample was placed in a UV resistant plastic bag and this continued until the sample interval was completed. The sample was labelled with the drillhole number and sample interval, then placed in a second plastic bag and sealed and removed from site for logging and sample preparation.
Drill sample recovery	Method of recording and assessing core and chip sample recoveries and results assessed. Measures taken to maximise sample recovery and ensure representative nature of the samples. Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	March 2020: Aircore – each sample bag was weighed to determine the actual sample recovery, which resulted in an average sample weight of approximately 7.5 kg/m of sample. September 2020: Aircore – each sample bag was weighed to determine the actual sample recovery, which resulted in an average sample weight of approximately 4 kg/m of sample. March 2020: Aircore sampling was typically terminated on reaching the water table, which occurred around 10–12 m below surface level. September 2020: Aircore sampling was typically terminated 2 m below the water table. Hole depths ranged from 9 m to 17 m. The cyclones were cleaned regularly to ensure maximum and representative recovery. For auger sampling, each sample bag was weighed to determine the actual sample recovery, which resulted in an average sample weight of 7.5 kg/m of sample. The type of sand auger used provided a clean sample with less possibility of contamination compared to a flight auger.

Criteria	JORC Code explanation	Commentary
Logging	Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies. Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography. The total length and percentage of the relevant intersections logged.	The samples have been sufficiently logged including estimates of grain size, sorting and texture, and colour. Particular attention has been taken to ensure a more scientific and less subjective approach to colour has been adopted because colour (white to grey shades, and pale yellow shades) is one of the targeting features. Chip tray samples for each hole were photographed.
Subsampling techniques and sample preparation	If core, whether cut or sawn and whether quarter, half or all core taken. If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry. For all sample types, the nature, quality and appropriateness of the sample preparation technique. Quality control procedures adopted for all subsampling stages to maximise representivity of samples. Measures taken to ensure that the sampling is representative of the in-situ material collected, including for instance results for field duplicate/second-half sampling. Whether sample sizes are appropriate to the grain size of the material being sampled.	Aircore samples were transported to Welshpool in Perth and locked in a secure storage shed. March 2020: Further check logging was undertaken, and representative subsamples were taken for duplicate analysis. Subsampling was carried out by spearing the samples selected and collecting approximately 400 g of sample. The duplicates have been utilised at the rate of 1:20. September 2020: Duplicate 1 kg subsamples were taken in a ratio of 1:18 at site. Blanks were generated from a publicly available washed sand product and taken by spearing a 20-bulk sample: March 2020 approx.400 g samples; September 2020 approx. 1 kg samples. The blanks have been utilised at the rate of 1:20 in March and 1:18 in September. March 2020: The prepared subsamples (duplicates and blanks) plus all the bulk drill samples were submitted to Nagrom Metallurgical Analytical Laboratories located in Kelmscott in Western Perth for drying, further splitting, and pulverisation in a zircon bowl. A subsample of 100 g with a P90 -75 µm particle size was utilised for analysis. September 2020: The 1 kg subsamples, including duplicates and blanks, were submitted to Intertek Genalysis analytical laboratory located in Maddington in Western Perth for drying, splitting to 100 g for pulverisation to a P90 -75 µm particle size in a zircon bowl. Auger samples were submitted to Intertek Laboratory in Maddington for drying, splitting, pulverisation in a zircon bowl. A subsample of 200 g with a 75 µm particle size is utilised for analysis. Allowance was made for duplication by drilling a twin auger hole located within 1 m of each other. Three twin holes were drilled representing 8% duplicate sample. The sample preparation methods are considered industry standard for silica sands. Records were kept describing whether the samples were submitted wet or dry. The laboratory sample size taken is appropriate for the sand being targeted.
Quality of assay data and laboratory tests	The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.	March 2020: All the aircore samples prepared by Nagrom were analysed at the same facility. The assay method for multi-element analysis consisted of prepared samples fused in a lithium borate flux with lithium nitrate additive then analysed by XRF (test method XRF001). LOI

Criteria	JORC Code explanation	Commentary
	For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc. Nature of quality control procedures adopted (e.g. standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established.	was also carried out on each sample out at 1,000°C (test method TGA002). Auger samples were submitted to the Intertek Laboratory in Maddington, Perth, Western Australia. The assay method for multi-element analysis consisted of four-acid digest including hydrofluoric, nitric, perchloric and hydrochloric acids in Teflon beakers with inductively coupled plasma (ICP)-optical (atomic) emission spectrometry finish. Silica is reported by difference. March 2020: Inter-laboratory checking was carried out by submitting 28 prepared representative pulps (umpire samples) to the Intertek Laboratory located in Maddington. The samples were analysed by two methods, XRF (test method FB1/XRF20) and ICP-optical (atomic) emission spectrometry (test method 4ABSi/OE901). Samples for ICP analysis consisted of a four-acid digest including hydrofluoric, nitric, perchloric and hydrochloric acids in Teflon beakers. Silica is reported by difference. March 2020: The same 28 samples analysed by Intertek were also analysed by ICP at Nagrom' s laboratory. For analysis of Al_2O_3 and SiO_2 the samples were fused with sodium peroxide and digested in dilute hydrochloric acid and then analysed by ICP (test method ICP005). All other elements were determined by ICP after dissolution in an acid mixture (test method ICP003). March 2020: Final analyses of the aircore samples were carried out at Intertek's laboratory using four-acid digest followed by ICP determination. The samples used consisted of pulps that were prepared by Nagrom. September 2020: Intertek's analysis method for silica sands analysis consisted of four-acid digestion followed by silica sands 17-element ICP/OE analysis plus LOI at 1,000°C with SiO_2 reported by difference. September 2020: Inter-laboratory umpire analysis was carried out by submitting 20 pulps, and 20 non-pulverised portions of the same samples, from Intertek Genalysis to the Bureau Veritas laboratory located in Canning Vale, Perth. The samples were analysed by mixed acid digest (MA100) followed by 17 elements by ICP-OES (MA101) and LOI (TG001). Silica was reported by difference. The extensive analysis by different laboratories and different methods are industry standard procedures and methods producing high level of confidence on the results produced. The ICP method is considered industry standard for reporting sand grades. No geophysical tools were utilised for the process.
Verification of sampling and assaying	The verification of significant intersections by either independent or alternative company personnel. The use of twinned holes. Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols. Discuss any adjustment to assay data.	March 2020: There were no twin aircore holes. Twin holes were completed for three out of the 38 auger holes. September 2020: One of the September aircore holes was twinned; two of the March 2020 aircore holes were twinned. All drilling and sampling procedures were monitored on site by an independent geologist on a hole-by-hole basis.

Criteria	JORC Code explanation	Commentary
		All primary information was initially captured in a written log on site by a geologist, data entered, imported then validated and stored in a geological database. March 2020: Additional check logging was carried by an independent geologist in Perth prior to samples being submitted to Nagrom for analysis. No adjustments to assay data have been performed. External review of umpire samples reported by Intertek and Bureau Veritas was carried out.
Location of data points	Accuracy and quality of surveys used to locate drillholes (collar and downhole surveys), trenches, mine workings and other locations used in Mineral Resource estimation. Specification of the grid system used. Quality and adequacy of topographic control.	The position of the aircore hole locations was determined by a Trimble R6 RTK global positioning system (GPS) in RTK mode. The survey was carried out by Heyhoe Surveys from Geraldton. Accuracy of 0.05 m relative to SSM Dongara 49. The position of the auger hole locations was determined by a GPS model Garmin GPS Map 64s with an accuracy of 5 m. The CRS used was GDA94/MGA Zone 50 (ex SSM DON49). The topography at the project site currently under exploration is flat to gentle undulating terrain. Site survey (Heyhoe Surveys) have produced a ± 50 cm DTM across the entire project area.
Data spacing and distribution	Data spacing for reporting of Exploration Results. Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. Whether sample compositing has been applied.	The aircore drillholes were spaced on an approx. 350–600 m (east west) x 480 m along strike (north-south) grid. The auger drillholes were spaced on an approx. 400 m (east-west) x 800 m (north-south) grid. The adopted spacing at this time is sufficient based on the geological continuity of the sand formation being tested, and sufficient to be applied in Mineral Resource estimation. No sample compositing of holes has been applied.
Orientation of data in relation to geological structure	Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type. If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	The orientation utilised for the aircore drilling campaign represents the entire strike length of the aeolian dune within the initial prospective target area and as such is not expected to introduce any particular bias.
Sample security	The measures taken to ensure sample security.	All samples have been bagged and removed from site and are under the care of the contract senior geologist and field sampling supervisor. March 2020: Aircore samples initially stored a secure facility in Welshpool where sample reconciliation was undertaken before delivery to Nagrom Laboratory. March 2020: Aircore samples were delivered to Nagrom in Kelmscott. The laboratory carried out a sample reconciliation which was audited against the sample submission sheet. September 2020: Aircore samples and returned samples and pulps from Intertek Genalysis are in the Welshpool

Criteria	JORC Code explanation	Commentary
		facility along with chip trays from both the March and September drill programs. Auger samples were delivered to Intertek Maddington. The laboratory provided a sample reconciliation report which was audited against the sample submission sheet.
Audits or reviews	The results of any audits or reviews of sampling techniques and data.	Guidance was provided by an independent consultant, Andrew Scogings, on sampling lengths and hole spacings who carried out a site visit to inspect the drilling and sampling operations.

11.2 Section 2: Reporting of Exploration Results

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings. The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	Miscellaneous licence L70/219 comprises an effective land area of 10.36 km^2 and was granted on 18 November 2020 for a period of 21 years. The holder is Perpetual Resources Limited. A 1% vendor royalty applies minerals sold from the Licence. The licence area exploration is covered by Crown Land. No impediments on a licence to operate at time of reporting.
Exploration done by other parties	Acknowledgment and appraisal of exploration by other parties.	Past exploration by others targeting heavy mineral sands. Refer to ASX release dated 6 February 2019, historical exploration.
Geology	Deposit type, geological setting and style of mineralisation.	Unconsolidated Quaternary coastal sediments, part of the Perth Basin. Aeolian quartz sand dunes overlying Pleistocene limestones and paleo-coastline.
Drill =ole information	A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drillholes: • easting and northing of the drillhole collar • elevation or RL (Reduced Level – elevation above sea level in metres) of the drillhole collar • dip and azimuth of the hole • downhole length and interception depth • hole length. If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.	Exploration Results are not being reported here; however, drillhole information can be found in ASX release dated 1 April 2020 and 7 December 2020.
Data aggregation methods	In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (e.g. cutting of high grades) and cut-off grades are usually Material and should be stated. Where aggregate intercepts incorporate short lengths of high-grade results and longer lengths of low-grade results, the procedure used for such aggregation should be stated and some typical	Exploration Results are not being reported.

Criteria	JORC Code explanation	Commentary
	examples of such aggregations should be shown in detail. The assumptions used for any reporting of metal equivalent values should be clearly stated.	
Relationship between mineralisation widths and intercept lengths	These relationships are particularly important in the reporting of Exploration Results. If the geometry of the mineralisation with respect to the drillhole angle is known, its nature should be reported. If it is not known and only the downhole lengths are reported, there should be a clear statement to this effect (e.g. 'downhole length, true width not known').	Exploration Results are not being reported.
Diagrams	Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drillhole collar locations and appropriate sectional views.	Refer to figures incorporated in the body of the report.
Balanced reporting	Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	Exploration Results are not being reported.
Other substantive exploration data	Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.	Groundwater was intersected in all holes that exceeded 10 m depth. Water table generally occurred between 10 m and 12 m. Average in situ density (dry) determined to be 1.64 t/m^3 from six sites. Density locations were hand excavated to 0.4 m deep. The Instrument used was an Instrotek model Explorer. Tests were performed by Western Geotechnical & Laboratory Services. For the March 2020 program particle size distribution analysis was carried out on eight representative samples. Tests were undertaken by Western Geotechnical & Laboratory Services. Previous metallurgical testwork was undertaken by Nagrom to establish possible process methods to provide a beneficiated product. Refer to ASX releases of 30 January 2020 and 24 February 2020. Petrological examination by Paul Ashley undertaken and reported on 18 February 2020. An approximate two tonnes bulk sample from the March aircore drilling was process tested by IHCR with results received in December 2020. In-situ PSD was determined for 12 aircore holes from the March 2020 program south of the Mount Adams Road and for six holes from the September 2020 program to the north. The March 2020 samples were tested using a dry sieving method by Diamantina Laboratories, Malaga and the September 2020

Criteria	JORC Code explanation	Commentary
		samples were tested by Nagrom, Kelmscott using a wet screening method. In-situ particle size is predominantly within the range of 0.15 mm to 0.6 mm. About 70% of the sand grains are between 0.125 mm and 0.6 mm. Calculated AFS numbers for the March 2020 samples are predominantly in the range 40–50. The sands appear to become finer grained with depth. This is illustrated by P50 which decreases from about 400 µm to 300 µm for the March 2020 samples. The September 2020 aircore results are generally finer than the March 2020 aircore samples. It appears that there is a general trend of decreasing grain size going north. The apparently finer size of the September 2020 samples may be due to the wet screening method used, compared with dry screening for the March 2020 samples. Wet screening is likely to be more efficient than dry screening. Snowden is of the opinion that the PSD results from both programs need verification, by umpire testing of September 2020 Nagrom samples at Diamantina. Twins 20B019 and 20B032 should be included for testing at both Robbins and Nagrom. Infill holes should also be tested for PSD.
Further work	The nature and scale of planned further work (e.g. tests for lateral extensions or depth extensions or large-scale step-out drilling). Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	The Company will carry out further metallurgical testwork.

11.3 SECTION 3: ESTIMATION AND REPORTING OF MINERAL RESOURCES

Criteria	JORC Code explanation	Commentary
Database integrity	Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes. Data validation procedures used.	Selected checks by Snowden of drillhole data against original assay certificates were completed with no errors identified. Statistical checks completed to ensure all assays fall within acceptable limits. Checks on overlapping or duplicate intervals completed. Checks were completed on all samples which fell below analytical detection limits to ensure samples were assigned half detection limit grades in estimation.
Site visits	Comment on any site visits undertaken by the Competent Person and the outcome of those visits.	The Competent Person, Andrew Scogings, visited the site during the aircore drilling program in March 2020.

Criteria	JORC Code explanation	Commentary
	If no site visits have been undertaken indicate why this is the case.	
Geological interpretation	Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit. Nature of the data used and of any assumptions made. The effect, if any, of alternative interpretations on Mineral Resource estimation. The use of geology in guiding and controlling Mineral Resource estimation. The factors affecting continuity both of grade and geology.	Snowden believes the local geology is well understood as a result of work undertaken by Perpetual and other companies working in the region. Surfaces of the sand layers were interpreted based on a combination of geochemistry and the geological logging. Each layer was treated as a hard boundary for resource modelling. Alternative interpretations of the mineralisation are unlikely to significantly change the overall volume of the layers in terms of the reported classified material.
Dimensions	The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.	The deposit has an extent of approx. 7.1 km north-south x 1.9 km east-west in the south and 1.2 km east-west in the north. The deposit is restricted by tenement boundaries and the Yardanogo Nature Reserve in the west. The deposit is open outside of these limits.
Estimation and modelling techniques	The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used. The availability of check estimates, previous estimates and/or mine production records and whether the MRE takes appropriate account of such data. The assumptions made regarding recovery of by-products. Estimation of deleterious elements or other non-grade variables of economic significance (e.g. sulphur for acid mine drainage characterisation). In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed. Any assumptions behind modelling of selective mining units. Any assumptions about correlation between variables. Description of how the geological interpretation was used to control the resource estimates. Discussion of basis for using or not using grade cutting or capping. The process of validation, the checking process used, the comparison of model data to drillhole data, and use of reconciliation data if available.	Ordinary kriging estimation using a parent cell size of 200 mE x 240 mN x 2 mRL to estimate for SiO_2, Al_2O_3, TiO_2, Fe_2O_3 and LOI. Sample selection honoured geological domains which were developed considering the vertical chemical and geological trends of the profile. Five layers were modelled: Yellow, White Upper, White Lower, Light Grey Pod, Grey Pod and Grey. Statistical analysis by domain was completed. Top cuts were applied to some elements in some layers where appropriate to control sporadic extreme values during estimation; however, no top cut was applied for SiO_2. Variography was completed for all elements. Due to the low number of samples for individual layers, data was combined for variogram modelling. Correlations were largely maintained by using similar estimation parameters. Validation of block estimates included visual and statistical checks, both global and local. Checks were completed against original and de-clustered drillhole samples. The validations show that while smoothed, the block estimates reproduce the trends observed in the drillhole data.

Criteria	JORC Code explanation	Commentary
Moisture	Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.	All tonnages have been estimated as dry tonnages.
Cut-off parameters	The basis of the adopted cut-off grade(s) or quality parameters applied.	No cut-off parameters have been applied as the yellow and white sand being reported appears to be readily amenable to beneficiation to a suitable product specification through relatively simple metallurgical processes as demonstrated by initial reported metallurgical testing results.
Mining factors or assumptions	Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.	It is assumed that the deposit will be mined using conventional open cut mining methods. No assumptions regarding minimum mining widths and dilution have been made. No mining has occurred.
Metallurgical factors or assumptions	The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.	Eight composites were made of three sand types from the 2020 aircore drill program and tested for particle size distribution at Western Geotechnical in Welshpool during April 2020. The samples were described as light grey-white sand, grey clayey sand and yellow sand. The in-situ PSD is fairly consistent irrespective of the type of sand, with approximately 85% of the sand between 0.15 mm and 0.6 mm. A composite sample weighing 178.6 kg from nine shallow auger holes drilled in 2019 was submitted to Nagrom of Kelmscott, WA for process test work which was reported in February 2020. The process flowsheet included screening at 1 mm, washing, attritioning, spiral separation, medium intensity magnetic separation, acid leaching and calcination. Gravcon Consultancy PL was commissioned by Perpetual in June 2020 to review the Nagrom results and the following notes are derived from the Gravcon report. The percentage of SiO_2 in the samples increased during the test process while Fe_2O_3, TiO_2, Al_2O_3 and LOI decreased relative to the head grade. Attritioning and washing the material removed fines and silt, which increased the SiO_2 content. The spirals test produced samples where the largest fraction of SiO_2 was in the light and middlings fractions. Magnetic separation indicated that the largest fraction of SiO_2 was in the middlings and non-magnetic fractions. Acid leach tests showed that hydrochloric acid reduced Al_2O_3 and Fe_2O_3. Repeat leaching had minimal impact and the use of sulphuric acid alone or combined with hydrochloric acid had minimal impact. Calcination tests indicated limited improvement to product quality.

<table>
<tr><th>Criteria</th><th>JORC Code explanation</th><th>Commentary</th></tr>
<tr><td></td><td></td><td>Examples of SiO_2 and Fe_2O_3 results for each process stage are summarised as:
<table>
<tr><th>Process stage</th><th>SiO_2% (XRF)</th><th>Fe_2O_3% (XRF)</th></tr>
<tr><td>Feed -1 mm</td><td>99.037</td><td>0.127</td></tr>
<tr><td>Deslimed +75 micron</td><td>99.297</td><td>0.111</td></tr>
<tr><td>Spiral lights + middlings</td><td>99.594</td><td>0.045</td></tr>
<tr><td>MIMS non-magnetics</td><td>99.647</td><td>0.030</td></tr>
<tr><td>HCl leach</td><td>99.746</td><td>0.009</td></tr>
</table>
The particle size distribution (aircore samples) and process testwork (auger composite sample) indicate that the Beharra deposit may be suitable for the production of silica sand for markets such as glass, ceramics and foundry. However, it is noted that the composite auger sample was from shallow holes less than 2 m depth, that the composite may not be truly representative of the Beharra deposit and that further metallurgical testwork on, for example, aircore drill samples is recommended to verify the auger sample results and to provide samples for potential customers in the target markets.</td></tr>
<tr><td>Environmental factors or assumptions</td><td>Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.</td><td>It is assumed that no environmental factors exist that could prohibit any potential mining development at the deposit.</td></tr>
<tr><td>Bulk density</td><td>Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples.

The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vughs, porosity, etc), moisture and differences between rock and alteration zones within the deposit.

Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.</td><td>Six in-situ bulk density measurements were completed by Western Geotechnical & Laboratory Services using a nuclear densometer and reported on 16 April 2020. The sites were sampled in accordance with AS 1289.1.2.1-6.5.1 and tested in accordance with AS 1289.2.1.1. and AS 1289.5.8.1. The results from the seven measurements are corrected based on the measured moisture factor. The dry density ranged from 1.57 t/m^3 to 1.68 t/m^3 with an average dry in situ density result of 1.64 t/m^3 which was applied to the estimate.

The Competent Person is of the opinion that the bulk density determined using recovered sample weight, and nominal aircore or vacuum hole diameter, supported the results from the nuclear densometer method (1.64 t/m^3) and the loose and tapped methods (1.66 t/m^3). Based on all data, an average density of 1.64 t/m^3 as determined by the nuclear densometer has been assumed for the Project.</td></tr>
</table>

Criteria	JORC Code explanation	Commentary
Classification	The basis for the classification of the Mineral Resources into varying confidence categories. Whether appropriate account has been taken of all relevant factors (i.e. relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data). Whether the result appropriately reflects the Competent Person's view of the deposit.	The Mineral Resource was classified based on data quality, sample spacing, grade continuity, geological continuity of the domains and metallurgical/process test results into Inferred material. The grey sands are considered uneconomic at this stage and have been excluded. The reported Mineral Resource does not include any material within the Yardanogo Nature Reserve which occupies a strip approximately 300 m wide on the western side of the tenement and excludes a buffer of 50 m south and north of Mount Adams Road. The Mineral Resource classification appropriately reflects the view of the Competent Person.
Audits or reviews	The results of any audits or reviews of MREs.	Snowden is not aware of any independent reviews of the MRE. Snowden's internal review process ensures all work meets quality standards.
Discussion of relative accuracy/ confidence	Where appropriate a statement of the relative accuracy and confidence level in the MRE using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate. The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	The Mineral Resource has been validated both globally and locally against the input sample data. Estimates are considered to be accurate to a level which supports mine planning – Indicated. There is no operating mine at the Project, and as such, no production data is available.

11.4 SECTION 4: ESTIMATION AND REPORTING OF ORE RESERVES

Table 11.1 Beharra Probable Ore Reserve, March 2021

Sand	Tonnes (Mt)	SiO_2 (%)	Al_2O_3 (ppm)	TiO_2 (ppm)	Fe_2O_3 (ppm)	LOI (%)
In situ	64.1	98.6	4240	3460	1950	0.235
Saleable product	47.6	99.6	1,789	369	276	0.100

Notes:

- Million tonnes are rounded to one decimal place. Grades are rounded to three significant figures.
- No cut-off is applied to the silica sand product.
- The in-situ and saleable product are not additive, and the saleable product is a portion of the in-situ sand tonnage.

A checklist of assessment and reporting criteria according to JORC guidelines and including Competent Person's assessment and comment on the Ore Reserve estimates, is shown in Table 1, Section 4.

Item	JORC Code explanation	Comments
Mineral Resource for	Description of the MRE used as a basis for the conversion to an Ore Reserve.	Mineral Resources for the Beharra deposit were reported in February 2021 from a Datamine model

<table>
<tr><th>Item</th><th>JORC Code explanation</th><th>Comments</th></tr>
<tr><td>conversion to Mineral Reserves</td><td>Clear statement as to whether the Mineral Resources are reported additional to, or inclusive of, the Ore Reserves.</td><td>“beharra_20210210.dm”. No cut-off grade is applied for the silica sand Mineral Resources and is commensurate with other deposits.

Mineral Resources are reported inclusive of the Ore Reserves.</td></tr>
<tr><td>Site visits</td><td>Comment on any site visits undertaken by the Competent Person and the outcome of those visits.

If no site visits have been undertaken indicate why this is the case.</td><td>Site visits were completed by the following Competent Persons:
<table>
<tr><th>Competent Persons</th><th>Items</th><th>Date of site visit</th></tr>
<tr><td>Frank Blanchfield</td><td>Mining</td><td>Dec 2020</td></tr>
<tr><td>Arno Kruger</td><td>Metallurgy</td><td>Feb 2021</td></tr>
</table></td></tr>
<tr><td>Study status</td><td>The type and level of study undertaken to enable Mineral Resources to be converted to Ore Reserves.

The Code requires that a study to at least PFS level has been undertaken to convert Mineral Resources to Ore Reserves. Such studies will have been carried out and will have determined a mine plan that is technically achievable and economically viable, and that material Modifying Factors have been considered.</td><td>The Beharra Silica Project has been under technical investigation as a PFS completed in March 2021.</td></tr>
<tr><td>Cut-off parameters</td><td>The basis of the cut-off grade(s) or quality parameters applied.</td><td>The ore inventory was required to have a Fe_2O_3 average below 2000 ppm for plant feed consideration.</td></tr>
<tr><td>Mining factors and assumptions</td><td>The method and assumptions used as reported in the PFS or Feasibility Study to convert the Mineral Resource to an Ore Reserve (i.e. either by application of appropriate factors by optimisation or by preliminary or detailed design).

The choice, nature and appropriateness of the selected mining method(s) and other mining parameters including associated design issues such as pre-strip, access, etc.

The assumptions made regarding geotechnical parameters (e.g. pit slopes, stope sizes, etc), grade control and pre-production drilling.

The major assumptions made and Mineral Resource model used for pit and stope optimisation (if appropriate).

The mining dilution factors used.

The mining recovery factors used.

Any minimum mining widths used.

The manner in which Inferred Mineral Resources are utilised in mining studies and the sensitivity of the outcome to their inclusion.

The infrastructure requirements of the selected mining methods</td><td>Snowden completed a mining prefeasibility study for the Beharra Project in 2021. The study reflects the latest understanding of the Project.

An evaluation using pit optimisation to produce an economic mining shell followed by detailed pit design was used to convert the Mineral Resource to an Ore Reserve. A mine layout was developed for mining of staged designs mine layout development. Mine equipment requirements were determined by contractors, who provided pricing using the Snowden mine production schedule as a basis. Selective mining using an open pit load and haul mining cycle is used for mining activities.

Geotechnical

Snowden completed a geotechnical analysis to recommended pit slope design parameters for Beharra for 80 m deep pit as summarised as:
<table>
<tr><th>Batter angle (°)</th><th>Berm width at base of batter (m)</th><th>Batter height (m)</th><th>Inter-ramp slope angle (crest to crest, °)</th><th>Overall slope angle (crest to toe, °)</th></tr>
<tr><td>30</td><td>NA</td><td>10</td><td>NA</td><td>30</td></tr>
</table>
Grade control

The drill density for Indicated Resources is sufficient to define the flat ore basement. As the mining floor limit is elevated by 0.5 m and the grade control in the basement will be visual. There is a 0.5 m roof ore loss and this will be sufficient to maximise or guarantee the quality of the ore.

Dilution</td></tr>
</table>

<table>
<tr><th>Item</th><th>JORC Code explanation</th><th>Comments</th></tr>
<tr><td></td><td></td><td>
Dilution was essentially zero, however there were ore losses from boundary losses (neighbouring nature reserve, Mount Adams Road and 10 m lease offset corridor that were about 5% of the available resources and floor and roof loses and internal waste that was about 8% of the available resources.
Schedule
Snowden identified a LOM schedule of 33 years suitable for Ore Reserve assessment.
No in-pit Inferred Resources were used to quantify Ore Reserves.
</td></tr>
<tr><td>Metallurgical factors and assumptions</td><td>
The metallurgical process proposed and the appropriateness of that process to the style of factors or mineralisation.
Whether the metallurgical process is well-tested technology or novel in nature.
The nature, amount and representativeness of metallurgical test work undertaken, the nature of the metallurgical domaining applied and the corresponding metallurgical recovery factors applied.
Any assumptions or allowances made for deleterious elements.
The existence of any bulk sample or pilot scale test work and the degree to which such samples are considered representative of the orebody as a whole.
For minerals that are defined by a specification, has the ore reserve estimation been based on the appropriate mineralogy to meet the specifications
</td><td>
Metallurgical testwork
To date, metallurgical testing has been carried out in two phases. The first phase of mineralogical examination, PSD of aircore samples and process testing of hand auger samples was reported on previously by Haren and Scogings (2020).
The initial Phase 1 process testwork program was conducted on the composite auger drill samples and indicated that the Beharra deposit was suitable for producing silica sand for markets such as glass, ceramics and foundry.
The second phase of metallurgical test work commenced in Q3 2020 with Perpetual supplying approximately two tonnes of sand samples from the March 2020 aircore drill program to IHCR of Brisbane, a specialist mineral sands laboratory, for bulk process testwork. This programme was conducted using full size or genuinely scalable equipment and the results are demonstrated in IHCR report 1959-PM-REP-0000-8002.
The resultant products derived from the IHCR 2.0T bulk metallurgical test program were of high quality as demonstrated in the table below.
<table>
<tr><th rowspan="3">Testwork Classification</th><th rowspan="3">Product Classification</th><th rowspan="2">Mass by ROM</th><th colspan="5">Assay</th></tr>
<tr><th>%</th><th>ppm</th><th>ppm</th><th>ppm</th><th>%</th></tr>
<tr><th></th><th>SiO2</th><th>Al2O3</th><th>Fe2O3</th><th>TiO2</th><th>LOI</th></tr>
<tr><td></td><td></td><td>%</td><td>97.9</td><td>9990</td><td>680</td><td>910</td><td>0.26</td></tr>
<tr><td>UCC Underflow (calc)</td><td>Beharra Premium #44</td><td>74.4</td><td>99.6</td><td>1789</td><td>276</td><td>369</td><td>0.14</td></tr>
<tr><td>Screen O/S</td><td>Beharra Premium #27</td><td>6.3</td><td>99.7</td><td>1405</td><td>235</td><td>300</td><td>0.13</td></tr>
<tr><td>Screen U/S</td><td>Beharra Premium #46</td><td>68</td><td>99.6</td><td>1825</td><td>280</td><td>375</td><td>0.14</td></tr>
</table>
Calculation and determination of Ore Reserves is based on producing Beharra Premium silica sand product #44, which will have a SiO_2 of $>99.5\%$ and a Fe_2O_3 of <280 ppm. Mass yield into this product as per test work is calculated at 74.4%. (Ref: 1959-PM-REP-0000-8001 Rev 2).
Mineral Processing
The mineral processing flowsheet and plant required for the upgrading of the mined material at Beharra is commonly seen and used both in the quarrying and aggregates and mineral sands industry. The separation techniques employed are commonplace and include screening and desliming, gravity, magnetic and physical separation.
Given the relatively small throughput requirement and simplicity, traditional package plant suppliers were approached for an all-inclusive turnkey solution, based on the provided sound engineering documentation and the proposed flowsheet provided by Perpetual.
</td></tr>
<tr><td>Environmental</td><td>
The status of studies of potential environmental impacts of the mining and processing operation. Details of waste rock characterisation and the consideration of potential sites, status
</td><td>
Environment
Considerable baseline environmental studies, commissioned by Tiwest (now Tronox) for its Dongara titanium minerals project,
</td></tr>
</table>

Item	JORC Code explanation	Comments
	of design options considered and, where applicable, the status of approvals for process residue storage and waste drum s should be reported.	immediately adjacent to the Beharra Project have been procured from Tronox via a data share arrangement. This data significantly contributes to the environmental impact assessment process to support approvals for Beharra and covers factors including groundwater and groundwater-dependent ecosystems, surface water, flora, vegetation, weeds and dieback, terrestrial and subterranean fauna, soil profiles and acid sulphate soils and indigenous heritage. In addition, studies conducted to date by Perpetual to complement the extensive Tronox dataset and cover the following areas: flora and vegetation, terrestrial fauna, groundwater and groundwater-dependent ecosystems and heritage. **Mine rehabilitation** A comprehensive study was undertaken to determine the most suitable progressive rehabilitation method for the Beharra Project based on the existing environment. Consultation and benchmarking with other extractive sand miners in the local area as well as expert rehabilitation practitioners was undertaken to assist in developing the method.
Infrastructure	The existence of appropriate infrastructure: availability of land for plant development, power, water, transportation (particularly for bulk commodities), labour, accommodation; or the ease with which the infrastructure can be provided or accessed.	The Project site is easily accessed via the sealed Brand Highway and unsealed Adams Road. There will be a requirement for some road and intersection upgrade works to support the volume of haul trucks required to transport the final product to Geraldton. An on-site power station and water supply infrastructure will need to be constructed. Labour will be sourced from the nearby towns of Dongara and Geraldton, removing the requirement for onsite accommodation.
Costs	The derivation of, or assumptions made, regarding projected capital costs in the study. The methodology used to estimate operating costs. Allowances made for the content of deleterious elements. The derivation of assumptions made of metal or commodity price(s), for the principal minerals and co- products. The source of exchange rates used in the study. Derivation of transportation charges. The basis for forecasting or source of treatment and refining charges, penalties for failure to meet specification, etc. The allowances made or royalties payable, both government and private.	The capital cost estimate prepared by Perpetual includes direct plant and supporting infrastructure, indirect costs and is to an accuracy level of ±25% with a contingency of 10% included. Budget pricing was received from a process plant supply and install contractor (inclusive of engineering, process and materials handling equipment, E, I & C, process water circuit, and associated structure and piping). Budget pricing was also received for civil works, concrete, fuel storage, power station, administration, amenities and workshop infrastructure. The operating cost estimate was developed as a bottom-up estimate over the 32-year LOM to obtain average operating costs. All significant and measurable items are itemised, with smaller items estimated based on other silica sand operations and the experience/expertise of project consultants. Mining costs were derived from tenders fielded to appropriately qualified contract mining companies using pit models provided by Snowden. A contract mining model has been adopted and the raw mining cost provided by the selected tenderer, has been included in the operating cost estimate. This rate has then been brought forward into the mining model. Rehabilitation costs have been provided by Tetris (Trajectory) based on a $/ha breakdown.

Item	JORC Code explanation	Comments
		Specific consumption rates for reagents and consumables were estimated through a combination of equipment operating data, bench-scale testwork and modelling software. Current market pricing was obtained for all major consumables and reagents based on supplier budget pricing as of December 2020. A small general allowance was made for minor miscellaneous consumables based on historical data from similar operations. Power station supply and install is included as a $kw/hr, BOOM operational cost – supplying power and sized according to the drawn loads on the equipment list. Maintenance costs were estimated based on projected capital estimates for the plant using industry benchmarked factors. Remuneration rates typically expected in this area for discipline personnel were used to establish operating costs, with labour rates being sourced from three contributors: AMMA, Gravcon, and Allied PD. Perpetual has elected to use a flat A$:US$ exchange rate of 75c across the forecast period, which is considered a reasonable estimation of a likely long run average level. Perpetual acknowledges that wide exchange rate fluctuations are possible and could positively or negatively affect the profitability and economic viability of the Beharra Project at any single point in time. This risk will be managed by the management team and Board of Directors who may utilise an exchange rate hedging strategy should it be considered appropriate at the time. **Annual operating costs – average years 1-5 at full production** An average summary of annual operating costs forecast for the first five years of full production are set out below:

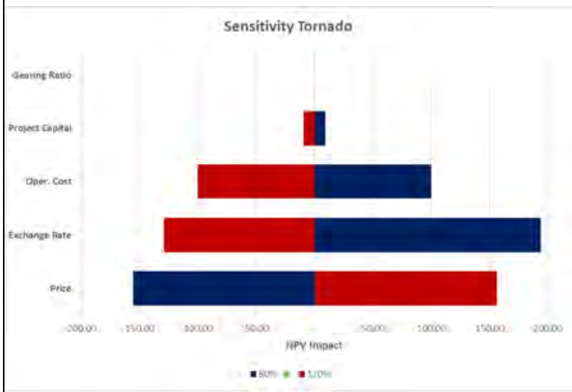
OPEX (A$)	Cost per annum ($'000)	A$/t ore	A$/t product concentrate
Mining (ROM+OB)	10.6	5.18	6.97
Processing	5.0	2.46	3.31
Reject haulage	0.6	0.29	0.36
Administration	2.4	1.18	1.58
Transport + Port/ ship loading	39.4	19.40	26.09
Rehabilitation	1.8	0.43	0.58
Contingency	2.8	1.40	1.88
Royalty	3.5	1.71	2.30
Total OPEX	**66.1**	**32.05**	**43.07**

Pre-production capital costs

A summary of the pre-production capital estimate is set out below:

CAPEX (A$)	Cost ($'000)
Process plant (incl. water distribution)	19,287
Services and onsite infrastructure	3,537
Offsite infrastructure	9,272

Item	JORC Code explanation	Comments
		Indirect, PCM and site office costs: 2,338 Total development capital: 34,434 Owners' costs: 1,343 Owner's contingency (10%): 3,443 Total pre-production capital: 39,220
Revenue factors	The derivation of, or assumptions made regarding revenue factors including head grade, metal or commodity price(s) exchange rates, transportation and treatment charges, penalties, net smelter returns, etc. The derivation of assumptions made of metal or commodity price(s), for the principal metals, minerals and co-products.	The grade of the process feed and iron content is supported by the information in the MRE and driven by the mining and production schedule. Processing recoveries were estimated based on a metallurgical test program completed during the PFS, using scalable processing equipment. Perpetual engaged IMARC, to prepare an independent market assessment of the APAC region, specifically targeting selected countries and product grades. Beharra metallurgical testwork to date has confirmed that Beharra end-product to be suitable for sale into the 200–300 ppm Fe_2O_3 markets in the APAC region. In 2019, silica sand with 200–300 ppm Fe_2O_3 recorded a price of between US$41.10 in China and US$71.60 per metric ton in Japan. Sell prices, in US$, have been forecast out to 2026 by IMARC. Based on the above and advice provided by industry experts, Perpetual is confident that a sell price of US$50 per metric ton and above is achievable.
Market assessment	The demand, supply and stock situation for the particular commodity, consumption trends assessment and factors likely to affect supply and demand into the future. A customer and competitor analysis along with the identification of likely market windows for the product. Price and volume forecasts and the basis for these forecasts. For industrial minerals the customer specification, testing and acceptance requirements prior to a supply contract.	The APAC market assessment revealed the APAC region to be amongst the largest consumers of silica sand in the world based on increasing utilisation in the glass and foundry industries, reaching a value of US$5,133.7 million in 2020. The forecast market value is expected to reach US$7,638.1 million by 2026, exhibiting a CAGR of 7.1% during this period. The forecast market consumption volume is expected to reach 174.25 million metric tons by 2026, exhibiting a CAGR of 4.8% during the 2021–2026 period. In 2020, the glass industry represented the largest end use sector for silica sand accounting for 37.6% of the total APAC market volume, with foundry sand accounting for 27.1%. Perpetual's marketing strategy therefore is focussed on targeting the APAC glass sand industry in the higher end market based on products, initially in the 200–300 ppm range in relation to iron, where prices range from US$41.10/t in China to US$71.60/t in Japan. Pricing for silica sand products in the APAC region vary by a number of factors, mostly dictated by country of purchase and impurity levels. In China, silica sand prices for higher purity grades sell for between US$45/t and US$115/t, in Korea this price range is US$55/t to US$130/t, and in Japan the range is US75/t to US$190/t. Perpetual has conservatively chosen a price of US$50/t FOB Geraldton which provides significant scope for pricing upside as marketing channels are developed. Perpetual has sent a number of samples to potential customers in the APAC region, and has signed one Memorandum of Understanding for offtake for up to 250,000 tons per annum with a Chinese end user called Yaoguo Solar Science & Technology Co. Ltd (Yaoguo). Yaoguo has already tested

Item	JORC Code explanation	Comments
		samples of Beharra silica sand and have provided a positive response, with further samples being sent to develop deeper discussions. Strong indications have been provided by Yaoguo that Beharra silica sand is suitable for the Asian market.
Economic	The inputs to the economic analysis to produce the NPV in the study, the source and confidence of these economic inputs including estimated inflation, discount rate, etc. NPV ranges and sensitivity to variations in the significant assumptions and inputs.	Financial modelling was completed by Perpetual, Snowden is reliant on the commodity price projections advised by Perpetual. Snowden is not an expert in the forecasting of commodity prices, and other than to draw attention to the sensitivity of the project to these projections, is not able to comment on the risk that these projections will change over time. However the commodity price estimate is based on the 2019 price outlook provided by IMARC and also the professional opinion of Stratum Resources, which is a specialist industrial mineral consultancy that provides advice and trading in the silica sand markets regionally. The key financial metrics for just the reserve portion of the project are the IRR 54.6% and NPV 230.9 million @ %10 discount rate. A real, pre-tax discount rate of 10.0% was applied based on Perpetual's calculated weighted average cost of capital and also a comparison to other similar projects. A long-term AUD: USD FX rate averaging 0.75:1 over the LOM was applied, reflecting an approximation of the average exchange rate over the last 40 years. A sensitivity analysis on the NPV is provided below, which looks to analyse the economic impact of key variables for the Beharra project, including: • Revenue per tonne • Changes in operating costs • Changes in capital costs • Exchange rate fluctuations • Changes in levels of project gearing. 
Social	The status of agreements with key stakeholders and matters leading to social licence to operate.	Perpetual has undertaken an assessment of its key stakeholders that have a (statutory) interest in the Project, including local government authorities, government agencies, and other interested parties, i.e. Shires, traditional owners etc). Perpetual will maintain a program of engagement throughout the life of the project. Consultation will be aimed at developing relationships that are mutually beneficial to both parties. Stakeholders will be engaged early in the planning process, primarily in the interests of achieving a collaborative approach to raise any concerns and provide Perpetual with the means to respond to feedback and to ensure that local

Item	JORC Code explanation	Comments
		knowledge is considered in the design and management of the project. A stakeholder register and records of engagement are maintained.
Classification	The basis for the classification of the Ore Reserves into varying confidence categories. Whether the result appropriately reflects the Competent Person's view of the deposit. The proportion of Probable Ore Reserves that have been derived from Measured Mineral Resources (if any).	The Beharra Ore Reserves are classified using the guidelines of the JORC Code (2012). In-pit Indicated Mineral Resources were used as the basis for Probable Ore Reserve.
Other	The status of agreements with key stakeholders and matters leading to social licence to operate. To the extent relevant, the impact of the following on the project and/or on the estimation and classification of the Ore Reserves: • Any identified material naturally occurring risks. • The status of material legal agreements and marketing arrangements. • The status of governmental agreements and approvals critical to the viability of the project, such as mineral tenement status, and government and statutory approvals. There must be reasonable grounds to expect that all necessary government approvals will be received within the timeframes anticipated in the PFS or feasibility study. Highlight and discuss the materiality of any unresolved matter that is dependent on a third party on which extraction of the reserve is contingent.	Perpetual recognises there is a potential human health exposure risk to RCS at Beharra. RCS could be produced as an airborne dust when silica sand is disturbed through mineral extraction, stockpiling, transportation and handling and is dry enough to generate dust particles. These particles can be small enough to lodge deep in the lungs and cause illness or disease such as bronchitis, silicosis and lung cancer. A WES exists for crystalline silica and represents the concentration of an airborne hazardous chemical within a worker's breathing zone that should not cause adverse health effects or undue harm. The current WES for RCS is 0.1 mg/m^3 over an eight-hour working day in Western Australia, with the WES likely to be lowered to 0.05 mg/m^3 by the end of 2020 to meet national standards. RCS exposure and safety requirements are governed by the following Western Australian Legislation: • Occupational Safety and Health Act 1984 • Occupational Safety and Health Regulations 1995 • Mines Safety and Inspection Act 1994 • Mines Safety and Inspection Regulations 1995. Prior to the commencement of any extraction activities at the Project, a HRA will be undertaken to define key sources and the pathways of RCS. With this information, defined dust management procedures to reduce the risk of exposure to personnel above the WES will be developed using the hierarchy of controls – substitution, isolation, engineering, administrative, PPE. Additionally, the HRA will be a key input to the preparation of a HHMP in accordance with the DMIRS Guideline 'Preparation of health and hygiene management plan – guide' (2018) and approved by DMIRS prior to operations commencing at the Project. The HHMP will define as a minimum the sources, pathways management and monitoring of RCS. The HHMP will be reviewed annually to ensure it meets current standards and capture any changes to operational circumstances or procedural controls. This will enable Perpetual to maintain continual compliance with its legislative health and safety obligations. Currently, final product samples of Beharra Premium have been provided from the resultant bulk metallurgical test program to a variety of potential off takers.

Item	JORC Code explanation	Comments
		Perpetual has not entered into any binding agreements or arrangements with marketing agencies or consultants at this time.
Audits or reviews	The results of any audits or reviews of Ore Reserve estimates.	There have not been no external audits ore reviews of the 2021 PFS. The MRE, pit optimisation, design and schedule as developed for the Beharra PFS were reviewed internally by Snowden.
Relative accuracy/ confidence	Where appropriate a statement of the relative accuracy and confidence level in the Ore Reserve estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the reserve within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors which could affect the relative accuracy and confidence of the estimate. The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. Accuracy and confidence discussions should extend to specific discussions of any applied Modifying Factors that may have a material impact on Ore Reserve viability, or for which there are remaining areas of uncertainty at the current study stage. It is recognised that this may not be possible or appropriate in all circumstances. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	The capital cost estimates in this study relating to mining, processing and cost performance are underpinned by a pre-feasibility level study. The capital cost estimate has an assessed accuracy of ±25% and complies with the AusIMM Class 4 PFS criteria.

12. COMPETENT PERSONS STATEMENTS

The information in this report that relates to the March 2020 exploration information for the Beharra Project is based on information compiled and fairly represented by Mr Colin Ross Hastings, who is a Member of the Australasian Institute of Mining and Metallurgy and a consultant to Perpetual. Mr Hastings is also a shareholder of Perpetual. Mr Hastings has sufficient experience relevant to the style of mineralisation and type of deposit under consideration, and to the activity which he has undertaken, to qualify as a Competent Person as defined in the 2012 Edition of the Joint Ore Reserves Committee (JORC) "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Hastings consents to the inclusion in this report of the matters based on this information in the form and context in which it appears.

The information in this report that relates to the exploration information for the Beharra Project from September 2020 onwards is based on information compiled and fairly represented by Mr John Doepel, who is a Member of the Australasian Institute of Mining and Metallurgy and a consultant to Perpetual. Mr Doepel has sufficient experience relevant to the style of mineralisation and type of deposit under consideration, and to the activity which he has undertaken, to qualify as a Competent Person as defined in the 2012 Edition of the Joint Ore Reserves Committee (JORC) "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Doepel consents to the inclusion in this report of the matters based on this information in the form and context in which it appears.

The information in this report that relates to Mineral Resources is based on information compiled by Ms Elizabeth Haren, a Competent Person who is a Member and Chartered Professional of the Australasian Institute of Mining and Metallurgy and a Member of the Australasian Institute of Geoscientists. Ms Haren is employed as an associate Principal Geologist by Snowden, who was engaged by Perpetual. Ms Haren has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Ms Haren consents to the inclusion in the report of the matters based on her information in the form and context in which it appears.

The information in this report that relates to Mineral Resources is based on information compiled by Dr Andrew Scogings, a Competent Person who is a Member of the Australasian Institute of Mining and Metallurgy, a Member of the Australian Institute of Geoscientists, and is a Registered Professional Geologist in Industrial Minerals. Dr Scogings is employed as an Associate Executive Consultant Geologist by Snowden. Dr Scogings has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Dr Scogings consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

The information in this report that relates to the Beharra Ore Reserve is based on information reviewed or work undertaken by Mr Frank Blanchfield, who is a Fellow of the Australasian Institute of Mining and Metallurgy. Mr Blanchfield is an employee of Snowden and has relied on Perpetual for marketing, environmental, permitting, and financial modelling and any costs not relating to mining and metallurgy. The mine design and mining costs and economic viability of the Project were assessed and completed by Snowden under his direction. Mr Blanchfield has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the preparation of mining studies to qualify as a Competent Person as defined by the JORC Code (2012).

The information in this report that relates to process metallurgy is based on information reviewed and work completed by Mr Arno Kruger, who is a Member of the Australasian Institute of Mining and Metallurgy, a metallurgical consultant, and an employee of IHC Robbins. The metallurgical factors including process flowsheet design and costs and assumptions for the bulk aircore sample that relate to Mineral Resources have been reviewed and accepted by Mr Kruger. Mr Kruger has sufficient experience that is relevant to the type of processing under consideration and to the activity being undertaken to qualify as a Competent Person as defined by the JORC Code (2012).

13. EMBEDDED OPPORTUNITIES AND OPTIONS

13.1 DRY MINING AND SLURRIFICATION UNIT (DMSU)

As part of the study investigation into various mining options the DMSU was compared to conventional truck and shovel. The DMSU enables the pulping of slurry in the mine pit where the slurried material is then pumped via pipeline back to the processing plant.

The cost savings are considerable as the pumping aspect largely removes the truck haulage component of the operation.

The unit proposed would be of skid design enabling it to be periodically moved around the pit floor. The ROM would be fed to the unit via FEL, and process water would be piped to the unit. The oversize (O/S) +1.0 mm material would be screened in pit and the remaining screen underflow is mixed in the transfer slurry bin and then pumped to the process plant.

With the very low O/S component between 2 tph and 3 tph, the +1.0 mm in-pit O/S could be either direct trammed or loaded into the reject haul truck using the FEL. Alternatively, the aperture size can be increased to further eliminate the quantity of O/S reporting to screen oversize.

Given the relatively low reject rate, a truck component was retained for the purposes of returning reject to the pit. This provides the added advantages of minimising water loss by returning a largely dewatered reject in lieu of the conventional field cyclone stacking option.

Truck reject deposition also minimises the work required to create the rehabilitation soil profile. At this point, truck and shovel costs have been incorporated in the operating cost estimate given its flexibility irrespective of higher operating cost. Investigation into the DMSU option will be taken early in the DFS works.

A cost comparison was conducted against truck and shovel on an optimum 800 m haul distance which demonstrated the delivery of ore via truck and shovel being $0.99c per tonne of ore vs the DMSU at $0.34c per tonne of ore.

Budget pricing received from IHCR for the DMSU as below, including an additional stage slurry pump unit, was circa A$1.5 million.

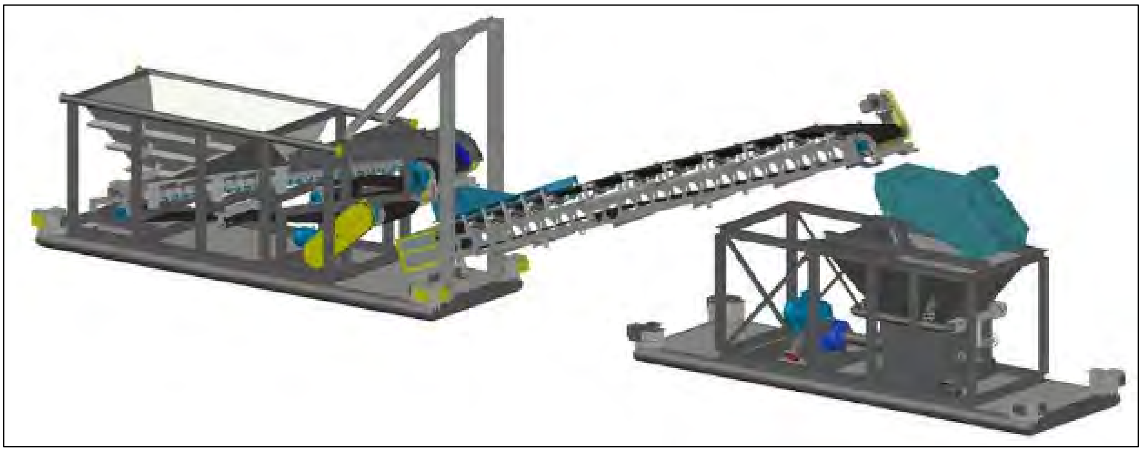


Figure 13.1 DMSU as quoted by IHCR

A variety of design options are available as demonstrated in Figure 13.2 and Figure 13.3.

Figure 13.2 Alternative tracked containerised unit

Figure 13.3 Alternative skid containerised unit

13.2 Campaign Mining

Pros: Potential reduction in cost due to economies of scale and potential to blend ore, if required.

Cons: Additional space required to stockpile ore and rejects and Increased mobilisation and demobilisation costs.

13.3 Other

If specific grade ranges are required mining will be required in multiple cells. This will increase the scheduling complexity and require stockpiling of additional waste and rejects as pit floors will not always be available (i.e. longer to expose floors).

There may be an opportunity to reduce mining costs by utilising an excavator instead of FELs although this would be at the expense of operational flexibility.

There is an opportunity to slurry the rejects back into the pit; however, this would need to be evaluated as it may require the wall angles to be reduced.

14. FURTHER WORKS

14.1 GEOLOGY

Snowden makes the following recommendations to improve confidence in the geology model and product quality.

The in-situ PSD results from both drilling programs should be verified by umpire testing to assess any material difference between wet and dry screening methods.

Twins 20B019 and 20B032 should be included for PSD testing at Nagrom and Diamantina, to compare with AC_16 and AC_38, respectively.

Additional (infill) samples from the March 2020 (if available) and September 2020 drilling programs should be tested for PSD to improve the understanding of trends through the deposit.

The Mineral Resource block model should be used, in conjunction with individual borehole data, to identify domains for further metallurgical testwork.

Metallurgical variability tests should be carried out per geological domain to assess the effect (if any) of subtle geochemical and PSD changes across and vertically through the deposit on processing and product characteristics.

Petrographic and/or microprobe analyses to be completed to determine deportment of Fe_2O_3 and Al_2O_3 contaminants.

14.2 METALLURGY

From the processing of the PFS bulk sample, two metallurgical programs will be progressed to assess possible enhanced projects outcomes.

The resource consists of two different lithologies being "yellow" and "white" sands with the yellow sand predominantly sighted in the top 1–4 m of the orebody and the white sand running from surface or below the yellow sand to the basement of the resource.

The test program will investigate the potential for a higher quality product from a white only lithology.

In the processing of the PFS bulk sample a large mass split was rejected at the wet gravity/spiral stage (i.e. 17.4%). In the knowledge gained in the downstream processing, it is believed that there is significant potential to reduce this loss and hence increase the yield to the final product with little or no deterioration to the product quality.

Variability testing to establish the link between the feed grades that vary from 97.0% to 99.0% SiO_2 with yield and corresponding chemistry upgrades.

Assessments on PSDs for their effects on yield and chemistry upgrades/(downgrades)

14.3 LOGISTICS

Following on from the broad investigations carried out during the PFS, and given the significant apportioned operating cost that the final product transport component contributes, Perpetual intend to further pursue the following opportunities going forward to DFS:

- Perpetual will develop more detailed road option scopes for the progression of civil/road engineering works to further define requirements and firm up costs associated with the Mount Adams Road–Brand Highway intersection and Mount Adams Road upgrade to RAV 7.3 Network standard
- Investigate off site port storage alternatives and short haul solution by road
- Investigate further the road and rail option including upgrade to Carson's Road and development of road rail siding options
- Progress discussion with both above and below rail providers in relation to rail transport, off port warehousing and rail to port solution
- Continue interaction and progress various agreements with relevant stakeholders.

- REPORT END -