18 August 2021

CAPE FLATTERY SILICA SAND PROJECT'S SCOPING STUDY

Highlights

- Successful completion of the Scoping Study supports the continuation of the evaluation and development of Metallica's 100%-owned Cape Flattery Silica Sand (CFS) Project in Far North Queensland.
- The CFS Project is targeting high-purity silica sand required for producing high quality glass, including solar panels.
- The CFS Project contains High Quality Silica Sand Mineral Resources of 38.3 million tonnes (see Table 1, page 6).
- Metallurgical testing indicates high quality 99.8% SiO_2, 170 ppm Fe_2O_3 silica sand can be generated with potential to improve further to less than 70 ppm Fe_2O_3.
- Subsequent to completion of the Scoping Study, additional infill drilling has been completed to improve confidence in the Mineral Resources estimate and to support Pre- Feasibility Studies planned for completion in Q1 2022.

Queensland-based silica sand developer, Metallica Minerals Limited (Metallica, ASX: MLM) is pleased to announce that it has completed a Scoping Study on its 100%-owned Cape Flattery Silica Sand Project in Far North Queensland.

The Study outlines significant preliminary information on the key components of the Project and delivers confidence for Metallica to continue progressing the evaluation for the development of this project in the world-renowned Cape Flattery region.

This ASX Announcement has been approved in accordance with the Company's published continuous disclosure policy and has been approved by the Board.

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Scoping Study Parameters – Cautionary Statements

The Scoping Study (or 'Study') referred to in this Announcement has been undertaken to determine the potential viability of continuing the exploration, evaluation and development of Metallica's CFS Project (or 'Project'). This Study is a preliminary technical based study of low-level technical and economic assessments that are not sufficient to support the estimation of Ore Reserves nor any economic evaluation for the Project. Further evaluation and appropriate studies are required before Metallica can estimate any Ore Reserves or provide any assurance of an economic development for the CFS Project.

The Study is based on Indicated Mineral Resources (14%) and Inferred Mineral Resources (86%). The current level of geological confidence associated with the Project's Mineral Resource is based primarily on the wide-spaced drill coverage. The geology comprises well known aeolian-derived sand dunes. Campaigns of vacuum drilling (22 holes), hand-augering (8 holes) and field work have provided an early stage understanding of the dunefield formation and target dune system geology, and have substantiated that high-quality silica sand with relative low iron (Fe_2O_3) is present across the wider Project area. Further infill drilling is underway that is designed to improve confidence in the Mineral Resources estimate.

The mineralisation of the CFS Project is best described as a surface deposit of sand dunes. The deposit is by far dominated by high-purity (>98.5%) silica (quartz) sand which is principally white in colour and fine-grained. The dunes are mainly stabilised and lightly vegetated but their forefronts are active with exposed white sand. The depths of clean white high-quality sand ranges from zero metres on the fringe of the dunes up to a maximum thickness of 35m. To date, the average drilled thickness is approximately 18.5m. These sands overlie, to varying depths, yellow-orange-brown (coloured) silica sands of lower SiO_2 percentage.

The Project lies in the northern most part of the Quaternary age Cape Flattery-Cape Bedford dunefield complex, immediately adjacent to Cape Flattery Silica Mines Pty Ltd's (CFSM's) mining leases that are owned by Mitsubishi Corporation (Mitsubishi). The Project site is defined by two (2) large, elongated southeast-northwest trending dunes: 1) a 2.5-kilometre-long west dune and 2) a shorter 1+-kilometre-long but wider (up to 900m) elongate dune to the east. A more subdued, less continuous middle or central dune lies between these dunes. They are separated by defined narrow interdune corridors, which in part, expose coloured sands. The dunes have been designated as the West, Central and East dunes and range from 10m to 90m above sea level (ASL).

Given the nature of the Project's mineralisation and locality, Metallica's drilling program that has been completed is reasonably likely to improve confidence in the resource.

The results of metallurgical test work completed to date have been highly positive, demonstrating a high grade 99.8% SiO_2 and relatively low contaminant silica sand with an attractive narrow particle-size distribution can be generated with a high-to-moderate yield. Using gravity upgrading, magnetic separation and particle classification methods, all typically used in silica sands refining, the silica sand that was generated contained 99.8% SiO_2, 450 ppm Al_2O_3, 170 ppm Fe_2O_3, 210 ppm TiO_2 and 2.6% -125-micron particles. This quality of silica sand was achieved with a mass yield of 77.4%.

Additional semi-gridded, infill drilling across the wider Project resource area has been completed and further detailed metallurgical test work is planned. These results are intended to improve confidence in the estimate of the Mineral Resources and to support a Pre-Feasibility Study.

The Scoping Study indicates there is the potential to economically extract the majority of the Indicated and Inferred Mineral Resources using simple mining methodology.

Due to the inclusion of Inferred Mineral Resources and guidance provided by ASX Guidance Note (GN) 31, Metallica has not reported financial metrics such as internal rates for return, net present values or net cashflows in this Study. In addition to this, Metallica has adopted what it considers to be a conservative set of Scoping Study inputs due to inherent uncertainty over future pricing environments and the likely variability in the material assumptions that support the Study. In regards to ASX's Guidance Note Reporting Scoping Studies (November 2016), Metallica does not disclose in this Announcement any production targets, forecast financial metrics or income-based valuations related to the Scoping Study as the Project's current JORC has a significant proportion of Inferred Resources (86%). Accordingly, there is a low level of geological confidence associated with the Inferred mineral resources and there is no certainty that further exploration work will result in the determination of further Indicated mineral resources.

Metallica discloses appropriate information of a technical nature to ensure that the market is properly informed of the Project's prospects and its potential. Accordingly, Metallica hereby outlines certain aspirational

statements and discloses a Scoping Study that does not contain production targets. The content of the Study is based on Metallica's expectations on how the CFS Project may be developed and should not be solely relied on by investors when making investment decisions.

The Study was based on the material assumptions outlined in this Announcement. While Metallica considers that all material assumptions have a reasonable basis, there is no certainty that they will prove to be correct or the range of outcomes indicated by the Study will be achieved.

To achieve the range of outcomes that are indicated in the Study, there will be a further requirement to raise significant additional funding to support the CFS Project's development. Investors should note that there is no certainty that Metallica will be able to raise that amount of funding 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 Metallica's existing shares. It is further possible that Metallica could pursue other 'value realisation' strategies such as a sale or partial sale of its interest in the CFS Project. If it does, this could also materially reduce the Metallica's proportionate interest in the Project.

Given the uncertainties involved, investors should not make any investment decisions based solely on the results of this Scoping Study or any future Scoping Study updates.

Representatives of Hopevale Congress and Walmbaar Aboriginal Corporation completing the installation water monitoring bores. L-R Nathaniel Walker, Naamon Walker, Niall Corbus, Vernon Yoren, Shailand Deeral-Rosendale and Trenton McLean)

Key Scoping Study Outcomes

The Scoping Study (or 'Study') provides Metallica with significant confidence to continue to evaluate and potentially develop its CFS Project (or 'Project').

Metallica's Executive Chairman, Theo Psaros states, "The immediate proximity to the world's largest silica sand mine owned by Mitsubishi, the positive metallurgy test results already released and the potential to construct a jetty solely for transhipping operations for the CFS Project support the continued investment in the development of the Project. Our Project continues to gain support from the local indigenous corporations and government at all levels. We acknowledge we have more work to do and importantly, we need to improve our understanding of our Project's mineral resource. The Scoping Study confirms we have a solid platform to progress the CFS Project."

Following the completion of the drilling program in August (refer to ASX release: 12 August 2021 "98 Hole Drill Program Completed at Cape Flattery Silica") the immediate focus for Metallica following this Study's Announcement is to progress the pre-feasibility study. This drilling program was designed to improve confidence in the estimate of the Mineral Resources. With the metallurgy test results already released (refer to ASX Release: 22 June 2021 'Excellent Metallurgical Test Results on Cape Flattery Silica'), further testing on the samples to be extracted from the drilling program will be a major milestone this year. This testing is expected to provide much needed information on the specifications of the various silica sand products that the Project may deliver.

Project Overview

Metallica's 100%-owned CFS Project is an early-stage silica sand development that is based within Metallica's EPM 25734 at Cape Flattery in Far North Queensland. EPM 25734 is located adjacent to a world-class silica sand mining and shipping operation that is owned by Mitsubishi.

Drilling on EPM 25734 in December 2020 has confirmed that the eastern sand dunes within the tenement contain high-purity silica sand.

The Project's Study has started to evaluate an extraction and export approach that utilises these key activities:

» Open-pit mining

» Sand purification via a processing plant

» Barging of silica sand product via a new jetty and barge-loading facility (BLF) and transhipment to bulk carriers.

This approach is similar to other known silica sand mining operations globally that process silica sand and export their product via a barge loading facility.

Project Area Details

The location of EPM 25734 in Cape Flattery provides Metallica with a potential direct export solution for the Project within the existing Cape Flattery Port area. Export of Project products would be independent of Mitsubishi's current silica sand operations that utilise direct loading to bulk carriers on the southern peninsula of Cape Flattery (Figure 1).

Figure 1: Metallica's EPM 25734 location at Cape Flattery within the Cape Flattery Port limit

The Study's results further confirm the presence of a Project resource that contains high-purity silica sand, as shown in white in Figure 2.

In May 2021, Metallica lodged a Mining Lease Application (MLA) over the Project area to target high-grade silica sand and heavy mineral (HM) operations for a 25-year term (refer to ASX Release: 15 June 2021 'Mining Lease Application lodged for Cape Flattery Sand Project').

The MLA covers an area of 616.1 ha and includes the Project's resource area, potential water bore sites and access from a gazetted road. The MLA's boundary line as red dashes in Figure 2.

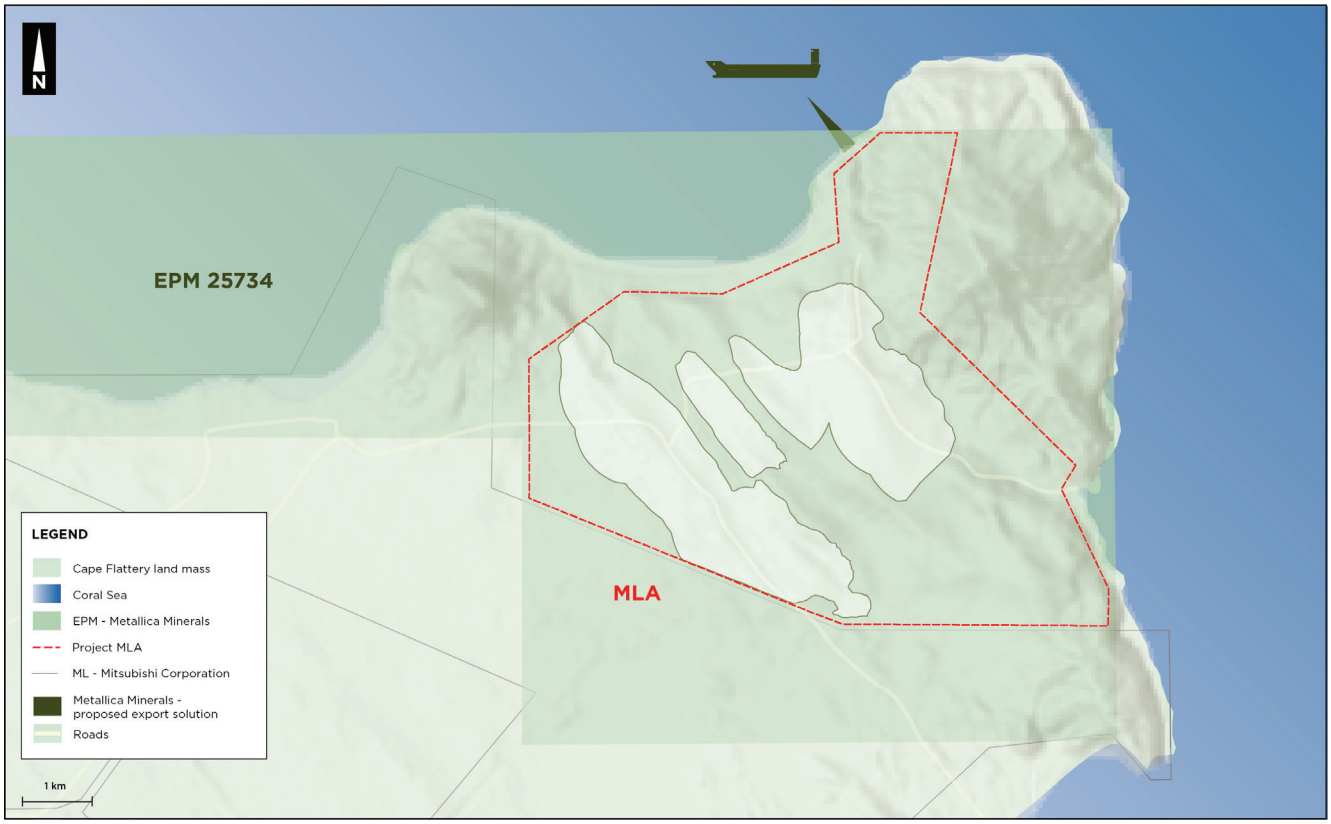

Figure 2: The CFS Project's resource area (white) situated within the Mining Lease Application (MLA) area, with the MLA's boundary line shown as red dashes

Mineral Resource Estimation

The Study was based on Indicated and Inferred Mineral Resources for the Project (Table 1). The Inferred Mineral Resources make up 86% of the total Mineral Resource. For further details, refer to ASX Release: 3 March 2021 'Revised 38 Mt of High Purity Silica Sand Resource'. It should be noted there is a low level of geological confidence associated with Inferred Mineral Resources and no certainty that further exploration work will result in the determination of further Indicated Mineral Resources from this material.

The current Mineral Resource, although mostly Inferred, has been well delineated with drilling. Given the nature of the mineralisation and style of deposit, Metallica's drilling program that has been completed is reasonably likely to improve confidence in the resource

Table 1: Mineral Resource Estimate for the Project Area

Classification	Silica sand Mt	Silica sand Mm^3	Density t/m^3	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO^2 %	LOI %
Indicated Resource	5.4	3.4	1.6	99.1	0.04	0.09	0.13	0.13
Inferred Resource	32.9	20.5	1.6	99.0	0.07	0.12	0.15	0.11
TOTAL	**38.3**	**23.9**	**1.6**	**99.0**	**0.06**	**0.12**	**0.15**	**0.12**

For further details, refer to ASX Release: 3 March 2021 'Revised 38 Mt of High Purity Silica Sand Resource'.

The Mineral Resource Estimate has been reported in accordance with the JORC Code 2012. A cut-off grade 98.5% has been defined based on the surrounding data. These results show there is good potential to produce a premium grade silica product using standard processing techniques.

To reflect the inclusion of Inferred Mineral Resources, uncertainty over future pricing environments, likely variability in the material assumptions supporting the Study as well as the Study's current level of reporting, Metallica has adopted a set of Study inputs that it believes are conservative. The material assumptions and key input assumptions for the Study are presented in this ASX Announcement.

The current Project resource provides an excellent potential development platform for Metallica, with confidence that additional infill drilling currently underway is intended to improve confidence in the estimate of the Mineral Resources and to support a Pre-Feasibility Study. (Figure 3).

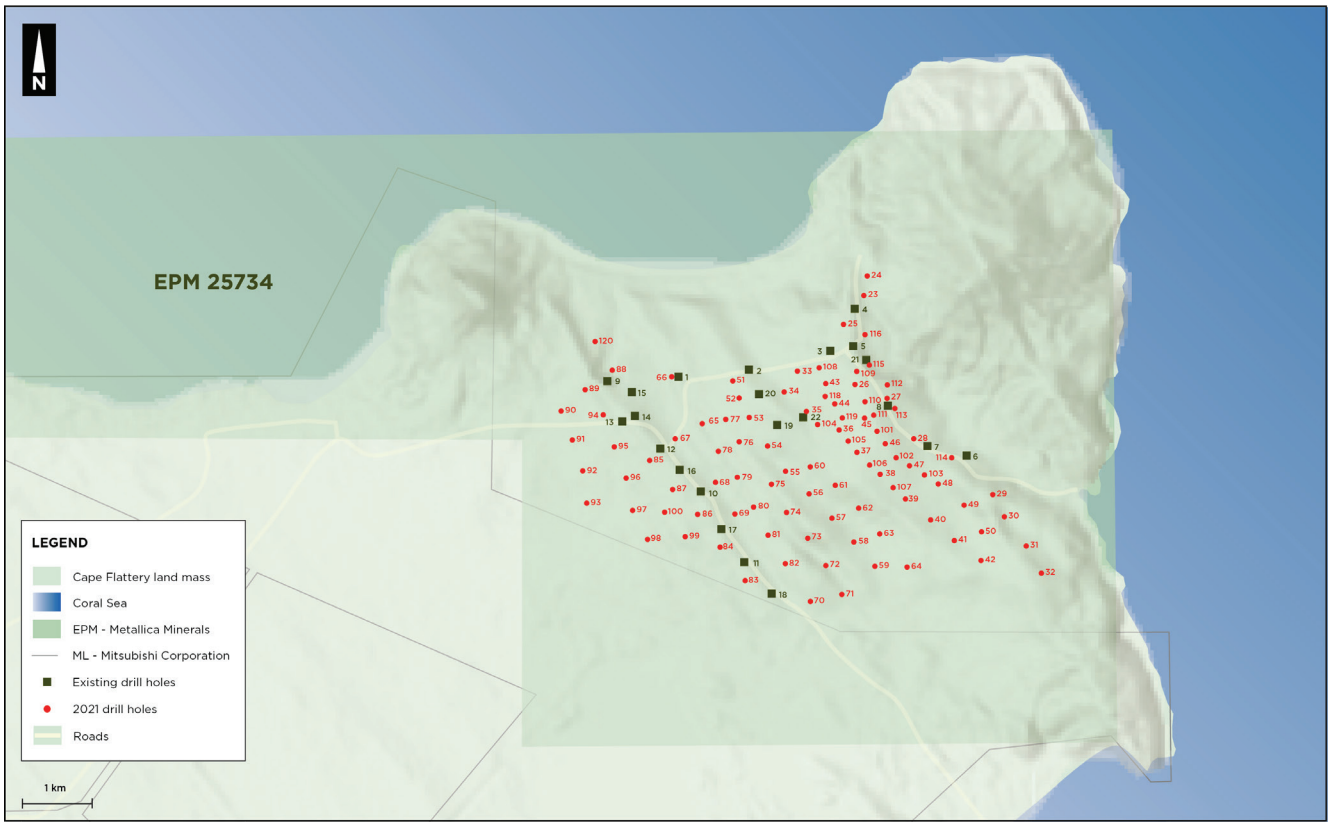

Figure 3: 120 drill hole locations in the Project's resource area, with Metallica's December 2020 drill holes shown in dark green and the July/August 2021 drill holes shown in red

Metallurgical Test Work Results

Metallurgical process development test work for the CFS Project was completed by IHC Robbins Pty Ltd (IHC Robbins) at its Brisbane laboratory.

The highlights of this test work were:

» Bulk sample metallurgical testing confirmed a high-quality silica sand product

» The work demonstrated a low contaminant silica sand product with an attractive narrow particle-size distribution that can be produced at a high-to-moderate yield

» The test work produced a product with 99.8% SiO_2, 170 ppm Fe_2O_3 and 450 ppm Al_2O_3

» The work included a bench top test to reduce Fe_2O_3 from 170 ppm to 70 ppm Fe_2O_3

» Further metallurgical testing is planned to investigate further enhancement of the processed product.

The metallurgical test work sample was derived from drill samples from within the resource area that had an average silica content of greater than 98.5% SiO_2. Using gravity upgrading, magnetic separation and particle classification methods, which are typical to silica sands refining, a Project product was able to be produced containing 99.8% SiO_2, 450 ppm Al_2O_3, 170 ppm Fe_2O_3, 210 ppm TiO_2 and 2.6% -125-micron particles. This product held a mass yield of 77.4%.

Potential exists for Metallica to market the silica sand products derived from earlier processing streams with higher yield and slightly lower quality, such as the feed preparation sand and/or spiral circuit product. Future marketing research is required to enable decision-making on the value of each potential product and best product mix. The mass yield and product quality of each of these options are summarised in Table 2.

Table 2: Potential Product Options

Potential product options	Mass yield %	Assay				
		SiO_2 %	Al_2O_3 ppm	Fe_2O_3 ppm	TiO_2 ppm	LOI 1000 %
Feed preparation sand	97.6	99.7	715	760	1,225	0.07
Spiral product	84.0	99.9	500	240	260	0.10
UCC product	77.4	99.8	450	170	210	0.05

Demand and Market Pricing

Accelerations in construction spending and manufacturing output worldwide are expected to drive growth in important silica sand-consuming industries, including the glass, foundry and building products sectors.

Global consumption of industrial silica sand is expected to climb 3.2% pa through 2022. Asia Pacific growth is higher than global growth and is expected to be around 5% to 6% pa.

Table 3 shows the indicative silica pricing for the Project, based on benchmarking from other similar projects and Metallica's understanding of the market.

Table 3: Indicative Silica Sand Pricing (FOB)

Description	Low Price (AUD/T)	High Price (AUD/T)
Price per sales tonne (USD)	40.00	55.00
Price per sales tonne (AUD, assuming 0.78 Fx)	51.27	70.51

Metallica is undertaking further work to better understand the expected product pricing for each potential product and quality.

Figure 4 and Figure 5 show industry research firm, IMARC Group's (IMARC's) view of the current and projected silica sand pricing for a high-grade product of 150-200 ppm Fe_2O_3 and a medium-grade product of 200-300 ppm Fe_2O_3. Based on these IMARC estimates, Metallica's benchmarking of the silica sand price in Table 3 is considered conservative.

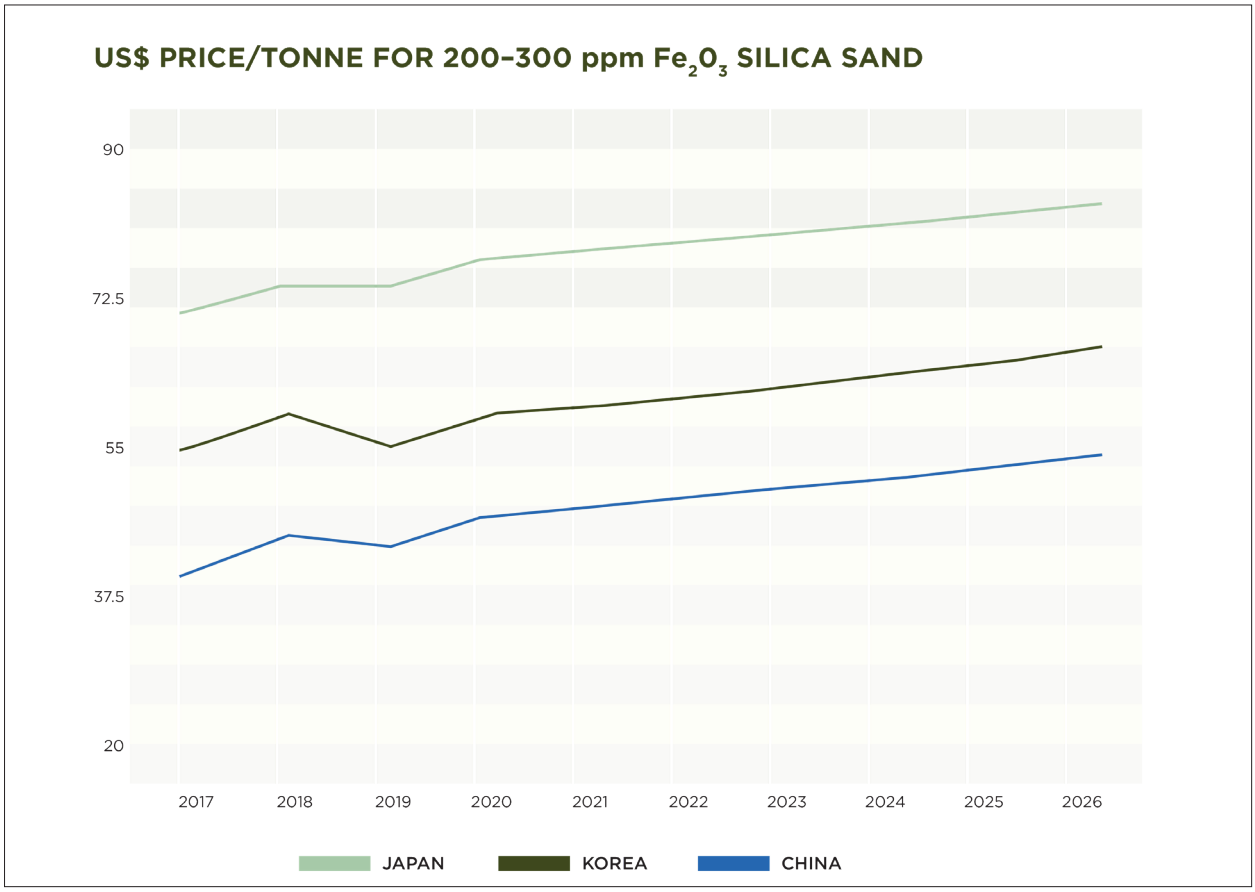

Figure 4: USD price/t for 200-300 ppm Fe_2O_3 silica sand

Source: PEC ASX Release: 30 March 2021 'Corporate Presentation'. From IMARC Group's report: 'Asia Pacific Silica Sand Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026', February 2021

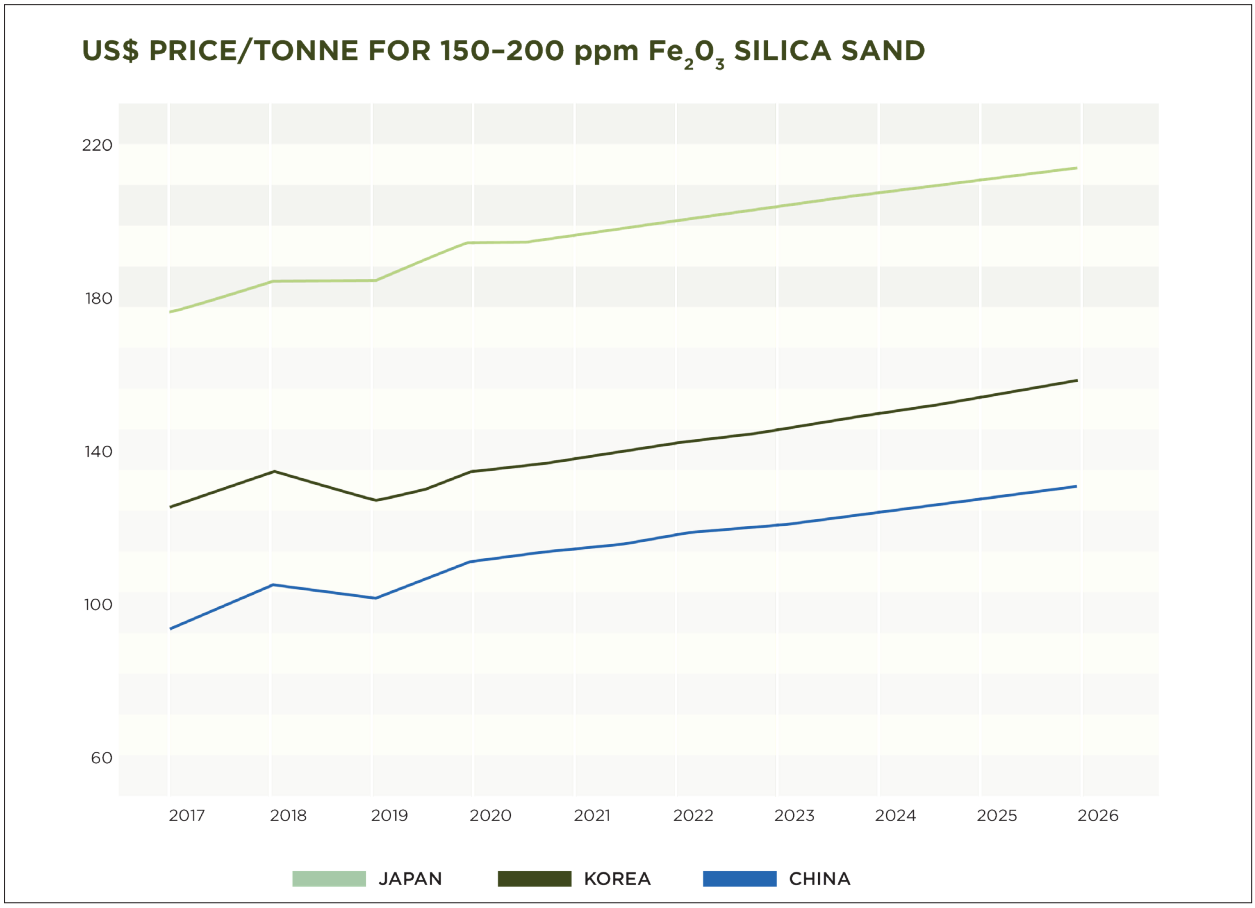

Figure 5: USD price/t for 150-200 ppm Fe_2O_3 silica sand

Source: PEC ASX Release: 30 March 2021 'Corporate Presentation'. From IMARC Group's report: 'Asia Pacific Silica Sand Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026', February 2021

Processing Plant and Estimated CAPEX

Figure 6 illustrates a processing plant that is designed to produce a high-quality silica sand product, as developed by IHC Robbins in this block model diagram.

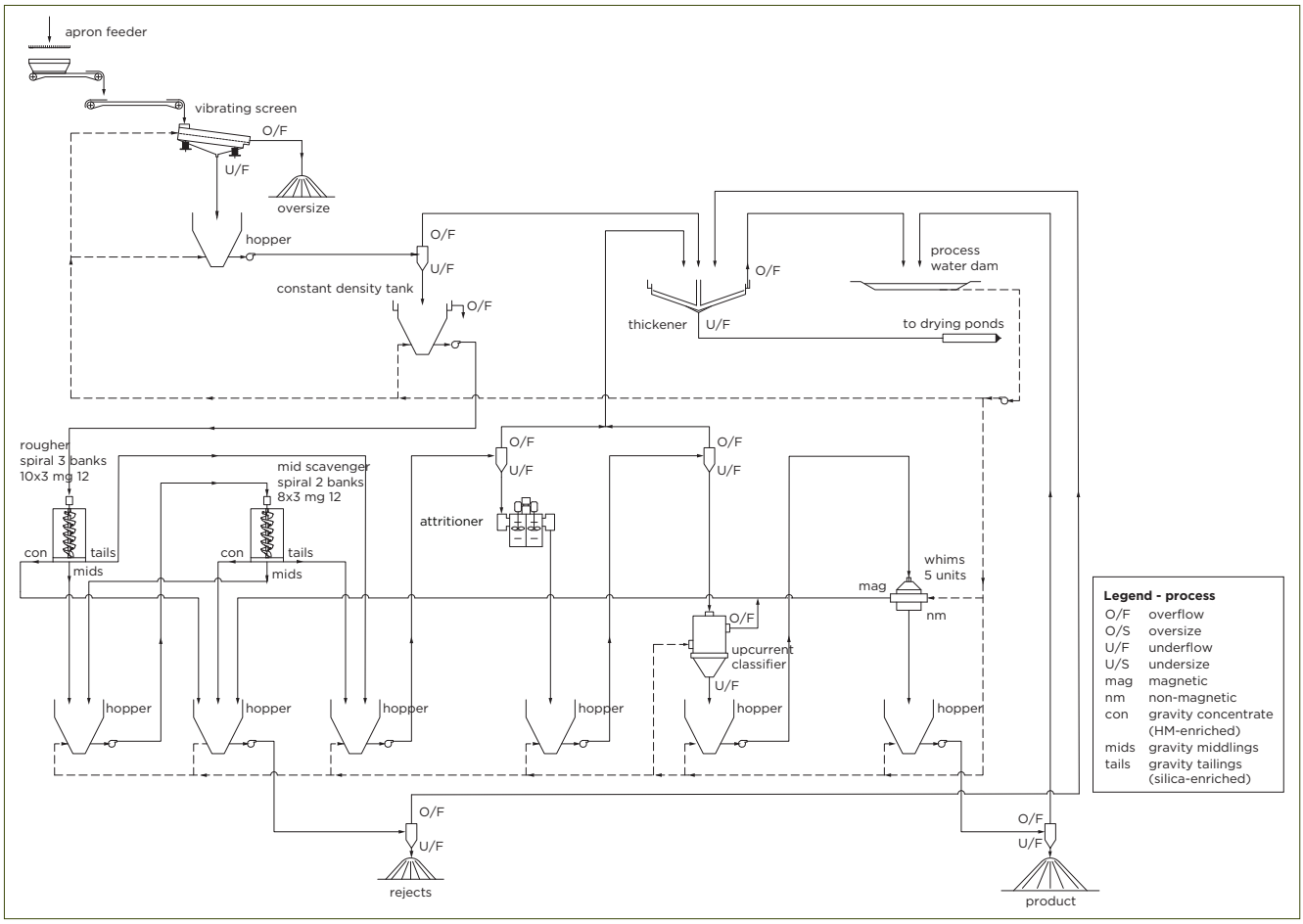

Figure 6: Block flow diagram of a process designed to produce saleable silica sand product

The block flow diagram in Figure 6 shows ROM material in the top left corner as being loaded into a loading bin or hopper with a grizzly and then conveyed to a trommel or vibrating screen for further removal of rocks, vegetation and other debris. The sand is then slurrified in a constant density tank and pumped to the processing plant. Here, hydrocyclones remove problematic fine particles and fine organic matter. The fines report to a thickener/clarifier unit to assist with water recycling.

The prepared sand is then processed through a 2-stage spiral separator circuit that utilises Mineral Technologies MG12 spirals to remove HM contaminants and meet glassmaking specification acceptance ranges. The silica-enriched spiral tailings stream is dewatered and pumped to attritioning cells to scrub away surface-coating contaminants from the silica grains and meet foundry specification acceptance ranges.

The attritioned sand is then washed by hydrocyclones and an up-current classifier (UCC) unit. This washing and classifier step perform a particle-sizing operation, where unwanted fine particles and any residual organic matter from the process are rejected.

The coarse product is then pumped to wet high-intensity magnetic separator (WHIMS) units for final removal of any magnetic or paramagnetic particles that were not rejected by the spiral separators. The combined reject streams are dewatered and stockpiled onsite, with an option to eventually reprocess or further upgrade or sell as a HM intermediate product.

The final silica-enriched product is also dewatered and then stockpiled to allow drainage to a low moisture content prior to transport.

Based on the metallurgical test work conducted, the Study's processing plant was modelled on a basic gravity separation plant that comprised a feed system, feed preparation, fines handling and gravity spiral separation. This plant's configuration could produce a product containing approximately 220 ppm to 240 ppm Fe_2O_3 with a mass yield of 84.0% of the ROM material (750 ppm to 800 ppm Fe_2O_3).

The inclusion of the attritioning, classification and WHIMS operations could produce a product containing approximately 170 ppm Fe_2O_3, with a mass yield of 77.4% of the ROM material. The associated budgeted CAPEX estimate for this type of plant configuration was estimated to be between AUD16m and AUD25m. the CAPEX values considered included supply, delivery, assembly, installation and commissioning.

CAPEX and OPEX Cost Estimates

Indicative CAPEX and operating expenditure (OPEX) costs for the Project were estimated using benchmarking of similar projects, as well as a scoping level design and equipment selection in conjunction with consultants' advice on the input costs for similar projects.

The estimated CAPEX for the Project was estimated to cost between AUD56m and AUD75m. This range was primarily dictated by the final design of the BLF (including the required length of the jetty), the infrastructure needed for transhipping to larger ships and the final design of the processing plant. There was also an additional cost contingency for each CAPEX item in the High CAPEX estimate (Table 4).

Table 4 Potential Project CAPEX

CAPEX item	Low CAPEX (AUD)	High CAPEX (AUD)
Civils, roads and clearing	700,000	1,000,000
Mining (majority of equipment leased)	800,000	1,500,000
Conveyor and slurry pipeline – sand transport	1,500,000	2,000,000
Processing plant	16,000,000	25,000,000
Barge Loading Facility (BLF)	22,000,000	26,000,000
Marine	1,000,000	1,500,000
Camp and other surface infrastructure	4,500,000	5,500,000
Contingency (20%)	9,500,000	12,500,000
TOTAL POTENTIAL CAPEX	**56,000,000**	**75,000,000**

The total OPEX for the Project was estimated between AUD29/t and AUD33/t based on benchmarking similar silica sand development projects in Australia. This range was primarily dictated by the final design of the processing plant (Table 5).

Table 5 Potential Project OPEX

OPEX item	Low OPEX (AUD/T)	High OPEX (AUD/T)
Clearing, mining and rehabilitation	5.50	6.00
Processing plant and BLF	4.50	5.50
Transhipment and marine	7.50	8.50
Royalties, camp and other site infrastructure	9.00	10.00
Contingency (10%)	2.50	3.00
TOTAL POTENTIAL OPEX PER TONNE	**29.00**	**33.00**

In addition to the CAPEX above, Metallica estimates that Sustaining capital is estimated to be between $500,000 to $1,000,000 per annum.

Next Steps

The findings of the CFS Project's Interim Scoping Study are very positive and provide the basis for Metallica to continue to further evaluate and potentially develop the Project. With another successful drilling program completed, Metallica intends to commence further studies to support the completion of a Pre-Feasibility Study.

Metallica is continuing its negotiations with Native Title holders and it intends to progress an Environmental Approval (EA) process with both State and Federal Government authorities. The EA process requires Metallica to undertake further requisite studies before it is granted a Mining Lease.

Once a suite of marketable products has been identified, Metallica intends to seek interest from potential offtake parties and particularly for the purchase of high-purity silica sand product.

Material Assumptions

Table 6 provides the Material Assumptions that Metallica used when undertaking the CFSS Project's Study.

Table 6 Material Assumptions for the Project's Interim Scoping Study

Criteria	Commentary
Mineral Resource Estimate for conversion to Ore Reserves	The Project's Scoping Study is based on Indicated and Inferred resources that have been prepared by a competent person in accordance with the requirements in the JORC Code 2012. Due to the presence of Inferred resources and the relatively early stage of investigation, the mineralisation was not suitable to be defined as an Ore Reserve.
Site visits	A site visit was conducted by Competent Person, Mr B Mutton, on 13-18 Dec 2020 during a drilling program in the Mining Lease Area (MLA) of the Project's site.
Study status	The work reported in the Study is a scoping study level and was based on Indicated and Inferred Mineral Resources (14% Indicated; 86% Inferred). Due to the low level of confidence in Inferred Resources, the Study's results were considered conceptual and may not be realised when subjected to further investigation in a more detailed level of study. This is an interim study only to assess the economic viability of the near-surface mineralisation. Additional evaluation programs remain in progress, including resource drilling, which will contribute to future studies for the Project. A reasonable level of due diligence was undertaken to establish the variables used in the Study. All variables were collated and reviewed by Competent Persons with the relevant skills for their area of expertise.
Cut-off parameters	For the Study, Metallica calculated a marginal cut-off grade of 98.5% SiO_2 for reporting the Mineral Resource. The cut-off grade strategy was developed from sample statistics. The optimisation process for the cut-off grade is yet to be completed. The cut-off grade was benchmarked against similar projects of this scale and in similar locations and was considered reasonable for the style of bulk open-pit mining.
Mining factors or assumptions	The Study was based on standard bulk mining using dozer-push techniques to extract the mineralisation from within its deposits. The Project will utilise dozer-push, load, haul and/or conveyor and processing plant design, with mining to be completed by the Owner's team comprising experienced mining staff and workers. Material that does not meet specification will be stockpiled adjacent to the pit in a designated rejects area. Similarly, processing rejects will be stockpiled adjacent to the processing plant. Estimated mining costs were based on industry standard techniques to estimate the size and cost of a mining fleet for operations at other silica sand projects.
Metallurgical factors or assumptions	Preliminary metallurgical test work was completed on a series of drill hole composites from within the deposit to represent different mineral grades likely to be processed should production proceed. The test work was designed to assess the potential recovery and quality of silica product that could be extracted from the mineralisation. Only silica sand products have been included in this Study. The test work demonstrated that the Project's mineralisation is suitable for processing using conventional, off-the-shelf spiral and attrition techniques to produce a saleable silica product.

Criteria	Commentary
Environmental	An initial baseline study has commenced on site but is limited in its scope, reflecting an early stage of investigation. A wet-season study has been completed while a dry-season study has been planned for Q3 2021. Limited work has been undertaken to assess the environmental impact of mining on the region. However, the Project area is adjacent to Mitsubishi's silica sand mining operation, and the mining area is uninhabited. Metallica is working through the statutory processes and required studies to ensure it appropriately mitigates any environmental and social aspects than may impact the net benefits of the project.
Infrastructure	The Project area lies in a relatively remote part of Eastern Cape York, 57 km north of Cooktown and adjacent to Mitsubishi's owned and operated silica sand mine. The Project can be accessed via a road from Cooktown using sealed and unsealed roads during the dry season only. The Project area can also be accessed via a barge or helicopter. There are no publicly available electricity power lines near the Project's area and power for the Project is expected to be sourced from generators. There is currently no accommodation in the Project area and a camp is expected to be built if the Project proceeds. All other mine infrastructure will need to also be built as part of the Project's development and costs, and such, the estimated cost of this infrastructure is based on similar silica sand projects.
Barge-Loading Facility (BLF)	The Study assumed that a BLF facility similar to that used by other mining projects in Queensland (i.e. Weipa bauxite operations) will not likely be constrained by water access issues. **BLF civil infrastructure** Any material to construct roads and pads will likely be available from site-sourced borrow pits. Site-sourced borrow pit material appears to be adequate and sufficient to construct non-process infrastructure such as: » **Pads/laydown areas** » **Water storage facilities** » **Clean water/dirty water diversions.** No allowance was made for any treatment or management of acid sulphate soils as the nature of the geology and sand environment and the planned activities mean no acid sulphate soils are expected to be encountered. **BLF mechanical infrastructure** To lessen the time for the main barge to be in standby, the apron feeder, barge loader and conveyor are assumed to have capacity to load up to 1,200 tph. However, BLF infrastructure will need to be built as part of the Project's development and costs, and such have been included in the Study's cost estimates.
Transhipment	The Study assumes that transhipment can occur all-year-round; however, the application of lower shiploading productivity rates were made during the months of the year when higher wave movements are most likely to occur. Transhipment has historically been used to load silica sand onto bulk carriers at the Cape Flattery Port by another silica sand operator.

Criteria	Commentary
Costs	**Capital expenditure (CAPEX)** The development of the Project was divided into several phases to sequence capital expenditure. The capital cost estimate for the Study was compiled from preliminary plans for civil engineering works, mining and processing equipment and associated infrastructure. The capital costs were prepared using current inhouse data from other projects, industry standard estimating factors and benchmarking against other projects; and also, for several items, from contractor reports. A 20% capital expenditure contingency allowance was applied to capital costs to provide some conservatism in this level of study. The capital cost estimate was compiled in AU$ with a base date of end of Q2 2021 in real terms, with no allowance for escalation or inflation. Regarding the proposed BLF design, the overwater conveyor and pads are yet to be designed to account for the highest astronomical tide (HAT). Pile heights and bulk earthworks will be engineered with HAT taken into consideration; however, the final design may potentially influence the Project's overall CAPEX. **Operating expenditure (OPEX)** The operating cost estimate for the Study included all operating costs associated with mining, processing, infrastructure and site-based general and administration costs for other similar silica sand projects. The operating costs were developed based on comparative costs for operations of similar size and contractor estimates for key pieces of processing infrastructure.
Revenue factors	Revenue from the Project will be derived from the sale of clean silica product. Metallica has established the characteristics of expected final products through benchmarking against comparable processing operations, and the preliminary metallurgical test work reviewed by the Competent Person for this Study. This benchmarking process underpinned the payability assumptions for the silica product presented. Silica product prices were estimated using industry benchmarks and information from pre-feasibility studies for other silica sand companies. Key risks associated with these assumptions included that the revenue may be lower than expected, the silica product quality may differ from expectations and the price assumptions may not be met.
Market assessment	The market for Metallica's silica sand product is reasonably well-established. The silica sand product that would be produced by the Project is expected to be similar to the product sold from Mitsubishi's adjacently owned and operated silica sand mine, which is currently understood to be exporting approximately 3 Mtpa of silica sand product. There are no actively traded spot markets for silica sands and no known forward dated derivative financial instruments. Prices set in silica sand markets reflect underlying product demand and supply conditions and market sentiment. These prices are often the reference prices used by companies in negotiating offtake and/or sales agreements with counterparties.

Criteria	Commentary
Economics	The Study was a preliminary technical and economic study based on low-level technical and economic assessments (+/-35% accuracy) that are not sufficient to support the estimation of Ore Reserves. Further evaluation work and appropriate studies are required before the Project can estimate any Ore Reserves or provide any assurance of economic development. The royalty payable to the Queensland Government for sale of silica sands is well understood and established, and currently understood to be $0.90/t of silica sand sold.
Stakeholder engagement	The Study considered development of the Project via a staged bulk mining operation with the construction of a processing facility at site, along with a barge-loading facility. Metallica expects that Project development will create significant social and economic benefits for local communities, including employment opportunities. Community programs and social impact studies will commence in the next round of studies and Metallica has been proactive in developing connections with local community members and in particular, Hopevale Congress Aboriginal Corporation Registered Native Title Body Corporate (RNTBC) Trustee – on behalf of the Nguurruumungu Clan, and Walmbaar Aboriginal Corporation – on behalf of the Dingaal Clan. Metallica is also in regular consultation with the regional Cooktown Shire Council, Hope Vale Shire Council, Hope Vale Aboriginal Shire Council and the Queensland State Government.
Classification	No Ore Reserves were classified as part of the Study. Due to the high proportion of Inferred Resources of 86% and the conceptual nature of the capital and operating costs, economic viability was not demonstrated and therefore, no Ore Reserves were declared.
Audits or reviews	All key resource inputs were approved by Competent Persons, as defined by the JORC Code 2012. Resource inputs were the subject of internal peer reviews by discipline experts and were not subject to an external audit.
Discussion of relative accuracy/confidence	The accuracy or confidence used in the Study was commensurate with a scoping study level that is nominally +/-35%. All resource estimates were prepared by Competent Persons with strong experience in their fields and benchmarked against similar projects. Due to the conceptual nature of the Study, a large percentage of resources that are of the Inferred category (86%) and uncertainty over future silica sand product prices, the Study's results are subject to change. It is likely that with additional exploration work, aspects of the resource will change and these will impact the amount of mineralisation available for mining.

CAPE FLATTERY SILICA

SCOPING STUDY

AUGUST 2021

METALLICA MINERALS LTD

IMPORTANT INFORMATION

Nature of Document

This document has been prepared and issued by Metallica Minerals Ltd (Company or Metallica) to provide general information about the Company and the Cape Flattery Silica Sand Project (Project). The information in this document is in summary form and should not be relied on as a complete and accurate representation of any matters that a reader should consider in evaluating the Company or the Project. While management has taken every effort to ensure the accuracy of the material in this document, the information contained herein is provided with confidence levels of +/-35%, commensurate with scoping level studies, and should be treated as such.

Disclaimer

Statements and material contained in this Scoping Study, particularly those regarding possible or assumed future performance, production levels or rates, metal prices, metal markets, resources or potential growth of Metallica Minerals Ltd, industry growth or other trend projections are, or may be, forward-looking statements. Such statements relate to future events and expectations as such, involve known and unknown risks and uncertainties.

The Project is at the advanced evaluation and scoping stage, and although reasonable care has been taken to ensure that the facts stated in this presentation are accurate and/or that the opinions expressed are fair and reasonable, no reliance can be placed for any purpose whatsoever on the information contained in this document or on its completeness.

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Forward-looking statements

Forward-looking statements are based on assumptions regarding the Company, business strategies, plans and objectives of the Company for future operations and development and the environment in which Metallica may operate.

Forward-looking statements are based on current views, expectations and beliefs as at the date they are expressed and are subject to various risks and uncertainties. Actual results, performance or achievements of the Company could be materially different from those expressed in, or implied by, these forward-looking statements. The forward-looking statements contained in this presentation are not guarantees or assurances of future performance and involve known and unknown risks, uncertainties and other factors; many of which are beyond the control of the Company, which may cause the actual results, performance or achievements of the Company to differ materially from those expressed or implied by the forward-looking statements. For example, the factors that are likely to affect the results of the Company include general economic conditions in Australia and globally; ability for the Company to funds its activities; exchange rates; production levels or rates; demand for the Company's products, competition in the markets in which the Company does and will operate; and the inherent regulatory risks in the businesses of the Company. Given these uncertainties, readers are cautioned to not place undue reliance on such forward-looking statements.

Competent Person Statements

The information in this announcement that relates to the Cape Flattery Silica Project area and this Resource Estimation was based on results and data collected and complied by Mr Neil Mackenzie-Forbes, who is a Member of the Institute of Geoscientists and is a Consulting Geologist employed by Sebrof Projects Pty Ltd and engaged by Metallica Minerals Limited. Mr Mackenzie-Forbes has more than 20 years of mining and exploration experience in Australia with major mining and junior exploration companies. Mr Neil Mackenzie-Forbes consents to the inclusion of this information in the form and context in which it appears in this document.

The information in this announcement that relates to the Cape Flattery Silica Sands Project area is based on information and modelling undertaken by Mr Chris Ainslie, Geotechnical Engineer, who is a full-time employee of Ausrocks Pty Ltd and a Member of the Australasian Institute of Mining and Metallurgy. The work was supervised by Mr Carl Morandy, Mining Engineer, who is Managing Director of Ausrocks and a Member of the Australasian Institute of Mining and Metallurgy, and also by Mr Brice Mutton, who is a Senior Associate Geologist for Ausrocks. Mr Mutton is a Fellow of the Australasian Institute of Mining and Metallurgy and a Fellow of the Australian Institute of Geoscientists. Mr Morandy, Mr Ainslie and Mr Mutton are employed by Ausrocks, which has been engaged by Metallica Minerals Ltd to prepare an independent report. There is no conflict of interest between the parties. Mr Morandy, Mr Ainslie and Mr Mutton consent to the disclosure of information in the form and context in which it appears in this document.

The overall resource work for the Cape Flattery Silica Sand Project area is based on the direction and supervision of Mr Mutton, who has sufficient experience that is relevant to the style of mineralisation and type of deposits 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'.

The technical information in this report that relates to process metallurgy is based on information reviewed by Arno Kruger (MAusIMM) and work completed by IHC Mining. Mr Kruger is a metallurgical consultant and an employee of IHC Mining. 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.

CONTENTS

TABLES

FIGURES

TERMS AND ABBREVIATIONS

Term	Definition
%	per cent
@	at
-	negative
+/-	plus or minus
µm	micron(s)
°	degrees
°C	degrees centigrade
>	less than
3:1	a ratio of 3 to 1
3D	three-dimensional
4WD	four-wheel drive
/t	per tonne
~	approximate
=	equals
AUD	Australian Dollars
Al_2O_3	chemical symbol for aluminium oxide
ALS	ALS Laboratory Group Ltd, a provider of laboratory testing, inspection, certification and verification solutions
ASL	above sea level
ASX	Australian Stock Exchange
ASX GN 31	Australian Stock Exchange Guidance Note 31
Ausrocks	Ausrocks Pty Ltd, a mining consultant
b, B, bn, Bn	billion
BFD	block flow diagram
BLF	barge-loading facility
CaO	chemical symbol for calcium oxide
CFS	Cape Flattery Silica Sand project
CFSM	Cape Flattery Sand Mines Pty Ltd, owned by Mitsubishi Corporation
Company	Metallica Minerals Limited
Cr	chemical symbol for chromium
Cr_2O_3	chemical symbol for chromium oxide
DA	Development Authority
days/yr	days per year
DES	Department of Environment and Science (Queensland)

Term	Definition
DNRME	Department of Natural Resources, Mines and Energy (Queensland); may be referred to as the 'Department of Resources'
dwt	deadweight tonne(s)
E	east
e.g.	for example
EA	Environmental Authority
EIS	Environmental Impact Statement
EP Act	*Environment Protection Act 1994*
Epic	Epic Environmental Pty Ltd, an environmental consultant
EPM 25734	Metallica Minerals' Project tenement in Cape Flattery
ERA	Environmentally Relevant Activity
ERC	Estimated Rehabilitation Cost
Fe	chemical symbol for iron
Fe_2O_3	chemical symbol for ferric oxide
FIFO	fly-in/fly-out
FOB	free on board
Fx	foreign exchange rate (AUD/USD)
g	gram(s)
GDA 94	Geocentric Datum of Australia 1994
H	height
H_2O	chemical symbol for water
ha	hectare(s)
ha/yr	hectares per year
HAT	highest astronomical tide
HM	heavy mineral(s)
hr/day	hours per day
i.e.	that is
IDW	inverse distance weighting
IHC Robbins	IHC Robbins Pty Ltd (IHCR), a consultant to the mineral sands industry
JORC	Joint Ore Reserves Committee
JORC Code	The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves
K_2O	chemical symbol for potassium oxide
kL	kilolitres
kg	kilogram(s)
L	length
LOI	loss on ignition
LOI 1000	loss on ignition when pulverised dry samples are heated to 1,000°C for 30 mins and mainly arises from the loss of hydroxide molecules from within the minerals
m	metre(s)
m, M	million(s)
m^3	metre(s) cubed

Term	Definition
Ma	megayear, a time unit defined as exactly one million Julian years, whereby 1 Julian year = 365.25 days
MERFP Act	*Mineral and Energy Resources (Financial Planning) Act 2018*
Metallica	Metallica Minerals Limited
MgO	chemical symbol for magnesium
min(s)	minute(s)
mm	millimetre(s)
Mm^3	million metres cubed
ML	Mining Lease; megalitre(s)
MLpa	megalitre(s) per annum
MLA	Mining Lease Application
MLM	Metallica Minerals Limited
MLpa	million litres per annum
MnO	chemical symbol for manganese
MNES	matters of national environmental significance
MRE	Mineral Resource Estimate
Mt	million tonne(s)
Mtpa	million tonnes per annum
N	north
Na_2O	chemical symbol for sodium oxide
P_2OS	chemical symbol for diphosphorus pentoxide; also called phosphorus anhydride or phosphorus pentoxide at times
pa	per annum
PEC	Perpetual Resources Limited
PFS	Pre-Feasibility Study
PIA	port infrastructure area
ppm	part(s) per million
PRC Plan	Progressive Rehabilitation and Closure Plan
Project	Cape Flattery Silica Sand Project
Qld	Queensland
RL	Reduced Level, refers to elevation above sea level in metres
RNTBC	Registered Native Title Bodies Corporate
ROM	run of mine
S	South
SiO_2	chemical symbol for silicon dioxide
SP	Structural Plan
SSEA	Site-Specific Environmental Authority
STRM	data sourced from ELVIS the Elevation Spatial Database (topography)
Study	Cape Flattery Silica Sand Project Scoping Study
t	tonne(s)
t/m^3	tonne(s) per cubed metre
TGA	Thermal Gravimetric Analyser

Term	Definition
Ti	chemical symbol for titanium
TiO_2	chemical symbol for titanium dioxide
tpa	tonne(s) per annum
tph	tonne(s) per hour
TLO	Traditional Landowner
UCC	up-current classifier
UTM	Universal Transverse Mercator Coordinate System
USD or US$	United States Dollars
V_2OS	chemical symbol for vanadium
W	west; width
WHIMS	wet high-intensity magnetic separator
x	by
XRF	x-ray fluorescence spectroscopy
ZrO_2	chemical symbol for zirconium dioxide
$ZrSiO_2$	chemical symbol for zirconium silicate

High-quality white silica sand SiO_2 >98.5%, with relative low iron Fe_2O_3 < 0.12%, is present across the wider Project area.

CAPE FLATTERY SILICA

1 Purpose

The purpose of this Scoping Study is to summarise the current activity status and further evaluation that supports the development of Metallica Minerals Limited's 100%-owned Cape Flattery Silica Sands Project (Project).

2 Project Overview

Metallica Minerals Limited (Metallica) is an ASX-listed silica sand exploration and development company (ASX: MLM) that is focused on developing silica sand assets in Queensland, Australia.

Metallica's Project is a highly prospective development that is currently being progressed at Cape Flattery in Far North Queensland and is the subject of this Scoping Study (Study). Metallica is proposing to mine and process raw sand from its Project site to produce a silica sand product with a quality suitable for glassmaking and foundry industries. This silica sand product is planned to be exported by ship from Cape Flattery to glass manufacturing and foundry companies, most likely in Asia.

The silica sand resource in Cape Flattery is extensive. Mitsubishi Corporation (Mitsubishi) is well-established in extracting and exporting high-purity silica sand from Cape Flattery. Metallica's Project's site is located adjacent to Mitsubishi's current mining operations and has the potential to support a long mining and production plant life while providing substantial benefits to the region and Queensland generally.

According to industry research firm IMARC Group (IMARC), high-purity silica sands are becoming more sought after, with the global market growing at a compound annual growth rate of around 6% between 2010 and 2017. In 2017, a total of 188 Mt of silica sand was produced globally.

This growth is being driven by silica's application across a broad range of industries including glassmaking, foundry casting, water filtration, chemicals and metals, along with hydraulic fracturing process requirements and the increasing manufacture of hi-tech products, including solar panels. There is strong demand for processed high-purity silica (>99.9% SiO_2) with low iron (100 ppm) for high-tech products. Global silica sand market has been forecast to grow from US$7b to US$20b in 2024 (refer to IMARC).

Metallica's Project is considered strategic and favourably positioned as high-grade silica sand to access these growing markets. Preliminary metallurgy analysis results indicate that the Project's silica sand attributes have the potential to produce saleable products that meet the specification requirements of both global glassmaking and foundry industries. However, it is Metallica's expectation that glass manufacturers are the Project's primary market.

In June 2021, Metallica lodged a Mining Lease Application (MLA) for the Project's identified Mineral Resources in the eastern part of its tenement, EPM 25734. Metallica has also commenced negotiations with Native Title holders and will commence an Environmental Approval (EA) process with both State and Federal Government authorities. The EA process will include Metallica undertaking further requisite studies before it is granted a Project Mining Lease (ML).

Metallica has received enquiries and expressions of interest from organisations and agents in Asia seeking high-purity silica sand from the Project site. Once a suite of saleable products has been identified, Metallica intends to seek interest from potential offtake customers. After completing the Project's mining approvals process, Metallica will finalise these product offtake agreements before it decides to commence mining.

This Study's report was prepared by internal management, with input from various reputable internal and external industry consultants. The findings of the Study are positive, with recommendations that the Scoping Study be updated after further exploration is undertaken in the Project area in 2021, and that the Project be progressed to a Preliminary Feasibility Study (PFS) level of analysis.

2.1 Key Strategic Benefits

The key strategic benefits for Metallica and the region to develop this Project are:

- Establishment of a new silica sand mine in Far North Queensland that will provide economic benefit to Queensland and particularly, the nearby townships of Hope Vale and Cooktown
- Contribution to the growing demand for silica worldwide that is sought for key industries including solar panel manufacturing, a key component of the renewable energy industry
- Employment opportunities for nearby Hope Vale and Cooktown residents
- Royalties for traditional landowners and the Queensland Government
- New economic activity for local contractors and service industries.

3 Location

3.1 Resource

The Project's resource is located within the Cape Flattery area of Northern Queensland, on the eastern coastline of Cape York Peninsula and 220 km north of Cairns (Figure 1).

Cape Flattery is a cape and headland that is 45 km and 55 km from the townships of Hope Vale and Cooktown, respectively. Cooktown is located at the mouth of the Endeavour River while Hope Vale is an Aboriginal community within the Endeavour Valley. The Project can be accessed via gazetted roads and established tracks, including a public road through Hope Vale and then east and north following the eastern coastline.

Figure 1: The Project's location in Far North Queensland

3.2 Cape Flattery Port Area

The Project area is bounded by Cape Flattery coastline that is located within the Cape Flattery Port area (Figure 2). The Cape Flattery Port area is owned and operated by Ports North, a Queensland Government-owned corporation. Ports North is the owner of the jetty leased by Mitsubishi, which is located in the Cape Flattery Port area, just south of the Project's tenement. The ship-loading equipment on the jetty is primarily owned by Mitsubishi.

4 Tenement Details

The entire Cape Flattery Silica Sand Project area is within EPM 25734, which is held by Metallica's 100%-owned subsidiary company, Cape Flattery Silica Pty Ltd. Table 1 outlines the Project's tenement details.

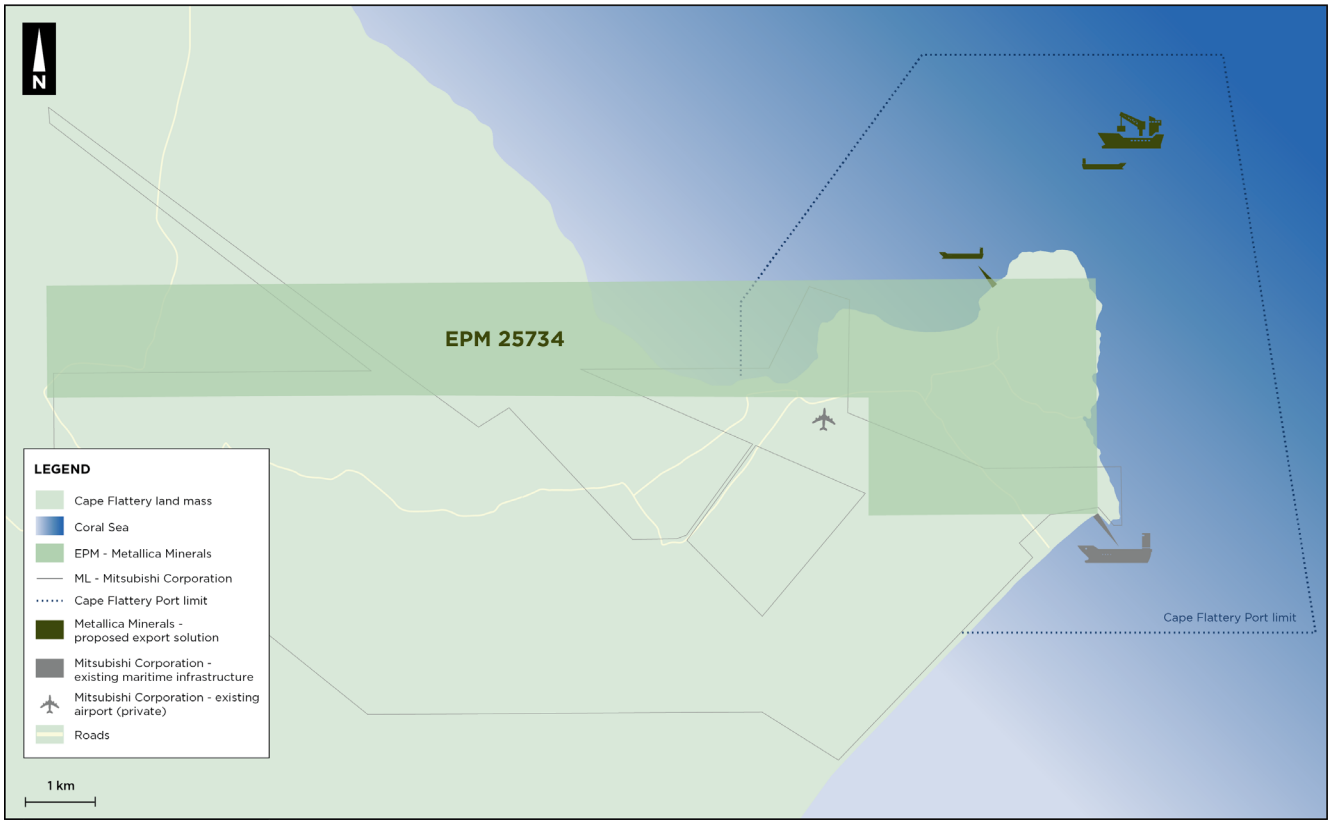


Figure 2: Cape Flattery Port location and Project proximity

Table 1: Tenement Details

Tenement no.	Holder	Grant date	Expiry date	Area (km²)	Sub-blocks
EPM 25734	Cape Flattery Silica Pty Ltd	25 May 2015	24 May 2025	36.42	11

The Project's target area on the tenement is now the location of a Mining Lease Application (MLA), which sits directly to the north of Mitsubishi Corporation's Cape Flattery Silica Mines (CFSM) silica sand operations on ML 2806 and ML 2965.

4.1 Tenure History

The underlying tenure EPM 25734 was granted to Oresome Australia Pty Ltd, which was a wholly owned subsidiary of Metallica Minerals Limited at that time, on 25 May 2015 for 5 years to 24 May 2020. The EPM was renewed for a further 5-year term in 2020 to 24 May 2025, over the total area of 11 sub-blocks. An assignment of 100% interest in EPM 25734 from Oresome Australia Pty Ltd to Cape Flattery Silica Pty Ltd (a wholly owned subsidiary of Metallica Minerals Limited) was approved on 12 August 2020.

4.2 Mining Lease Application

On 20 May 2021, Metallica lodged an MLA over the Project area for targeting high-grade silica sand and heavy minerals (Figure 3). The MLA was prepared by UTM Global Pty Ltd and covers 616.1 ha. The future Mining Lease (ML) will include the Project's resource area, potential water bore sites and access from a gazetted road.

The Cape Flattery MLA includes the Project's silica sand Mineral Resource Estimate of approximately 38.3 Mt (refer to Table 2). The area and shape of the lease is designed to cover the Project's Mineral Resource without sterilising any areas that have the potential for defining further mineral resources. They also allow sufficient room for all the infrastructure that will likely be required for the mining of the Mineral Resource.

Metallica has applied for a ML term of 25 years to cover the potential mine life (ML100284). Allowance during this term was made for renewal of the tenure and final rehabilitation of the site, as well as acceptance time by the Department of Resources (DOR), Department of Environment and Science (DES) and Traditional Landowners.

Figure 3 indicates the Project's resource area, as shown in white on the eastern side of EPM 25734. The resource area is shown in white and situated within the red dashed MLA boundary line. The boundary's coordinate points, numbered from 1 to 14, indicate where each point is located on the MLA boundary line.

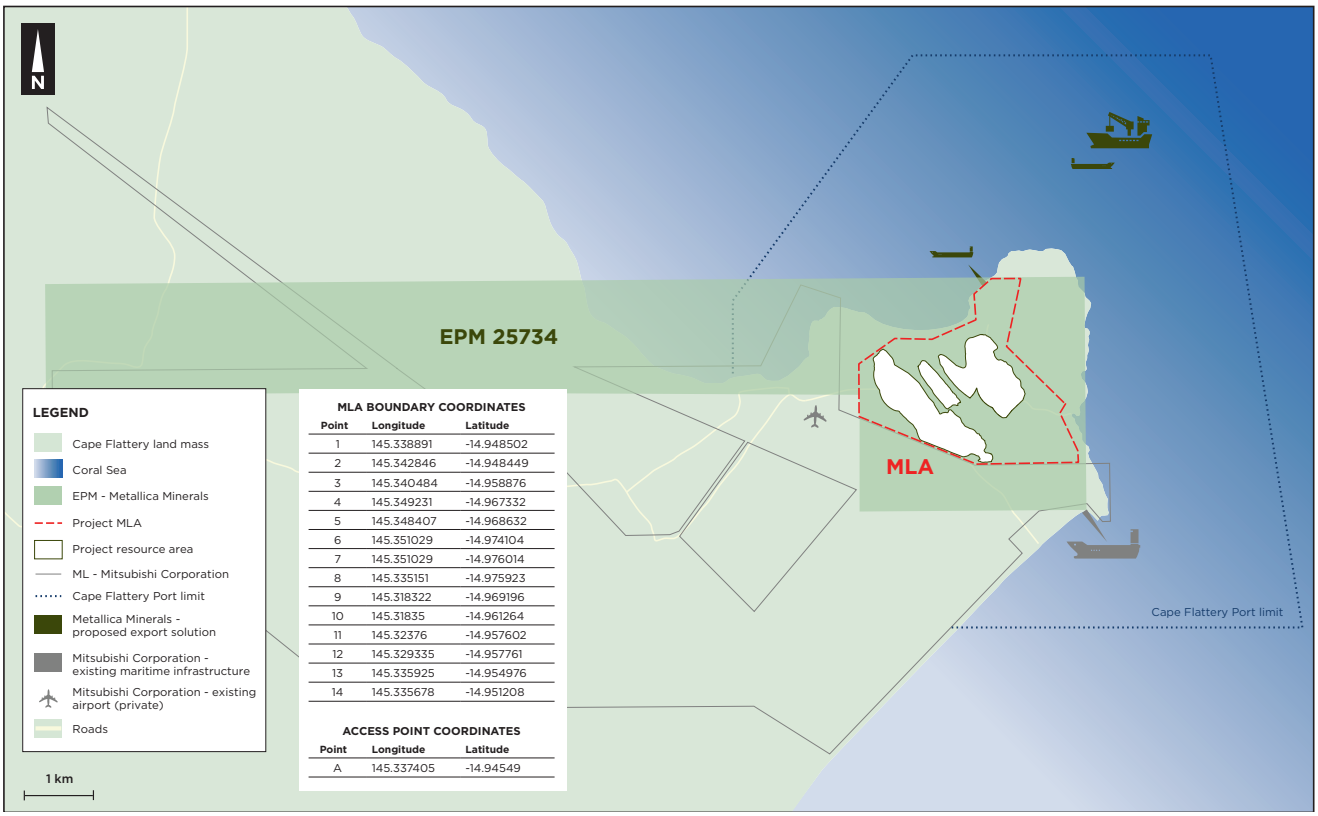


Figure 3: The Project's resource area (in white) shown within the Mining Lease Application's (MLA's) boundary line coordinates (numbered 1-14 in the red dashed line)

5 Native Title

The Project is located wholly within the native title determination of QUD174/1997 Hopevale (QCD1997/001). The Project's EPM 25734 is located on native title freehold land (Lot 35, SP 232620), which is held by Hopevale Congress Aboriginal Corporation. Native title is shared between Hopevale Congress Aboriginal Corporation RNTBC Trustee, on behalf of the Nguurruumungu Clan, and Walmbaar Aboriginal Corporation, on behalf of the Dingaal Clan.

A Conduct and Compensation Agreement (CCA) was executed with Hopevale Congress Aboriginal Corporation on 26 November 2020 for exploration and drilling along pre-existing access tracks. At that time, Metallica had not yet conducted an extensive Aboriginal Heritage clearance survey on the resource area, so all drill lines used in that program were confined to existing and pre-existing tracks. All lines were walked and no sites of significance were noted.

On 31 March 2021, Metallica announced that Aboriginal Cultural Heritage Agreements (ACHAs) had been signed with Hopevale Congress Aboriginal Corporation (as agent for the Nguurruumungu Clan) and Walmbaar Aboriginal Corporation (as agent for the Dingaal Clan) (Figure 4). The ACHAs provide Metallica with a process that allowed drilling to occur off the existing tracks within EPM 25734 in July/August 2021. The additional drilling is expected to increase the size and confidence category of the current Mineral Resource of 38.3 Mt (refer to ASX Release: 3 March 2021 'Revised 38 Mt of High Purity Silica Sand Resource').

Cultural heritage clearance was completed prior to installation of water monitoring bores in April 2021.

Figure 4: Signing of Aboriginal Cultural Heritage Agreements (ACHAs) by Walmbaar Aboriginal Corporation Chairman, Shailand Deeral-Rosendale and directors, Pauline McLean and Travis Bally, with Metallica Minerals' Executive Chairman, Theo Psaros

5.1 Communities

The closest communities to the Project area are Hope Vale, 45 km to the southwest of the Project and Cooktown, 55 km to the south. Both towns are expected to be the main source of personnel for mining and processing operations, and employment opportunities are already underway.

Cooktown has a population of approximately 2,800 people. Its main industries are tourism and agriculture (e.g. tropical fruit and cattle).

Hope Vale Aboriginal community is a 40-minute drive on sealed road north of Cooktown. It is the closest community to Mitsubishi Corporation's CFSM silica sand operations (south and adjacent to the Project).

6 Environment

6.1 Project Approvals

The Project's approval pathway includes three processes:

1. To obtain an Environmental Authority (EA) and mining license (ML) for the mine and associated infrastructure
2. To obtain an Environmental Approval and Development Approval (DA) for the offshore loading facility
3. To address Commonwealth matters of national environmental significance (MNES).

These processes are described generally in the following sections.

6.1.1 Site-Specific Environmental Authority

Granting of the Project's ML and associated infrastructure will be being sought via a Site-Specific Environmental Authority (SSEA) for a mining activity under the *Environmental Protection Act 1994* (EP Act) This process is undertaken by submitting an EA application and supporting environmental impact report describing the Project, existing environment, justification for using the SSEA application, an environmental risk assessment to identify potential impacts associated with the activity, and mitigation measures.

The range of matters to be considered in a SSEA application are described in DES's EA guidelines (Guidelines) for water, land, air, noise levels and waste. Depending on the final Project scope, DES may focus on areas of impact to environmental values for ecology, water, waste and land rehabilitation. The environmental impact report will include a range of technical studies that will provide quantitative data to support the SSEA application being deemed adequate. Unlike an Environmental Impact Statement (EIS), an SSEA will not generally require inclusion of comprehensive technical descriptions of visual amenity, social impact or economic impacts or their mitigation. However, the SSEA assessment will require general assessment of visual amenity and social impacts on sensitive receptors. The likely critical matters within the SSEA application and supporting report will be around ecology (e.g. terrestrial and aquatic), water (including potential waste streams) and rehabilitation. DES has now implemented a new rehabilitation policy and regulations regarding the provision of Progressive Rehabilitation and Closure Plans (PRC Plans), and these must be provided for assessment with an EA application.

Epic Environmental Pty Ltd (Epic) believes that DES will make an assessment-level decision that an SSEA application will be appropriate. It bases this on the current published triggers for an EIS and recent experience with both EIS and SSEA applications for mining projects in the region. A comprehensive pre-lodgement meeting with DES will assist with providing confidence in the assessment level.

Under the recent update to the EP Act and commencement of the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act), SSEA holders must apply for an Estimated Rehabilitation Cost (ERC) decision, have an ERC decision in effect and have lodged a scheme assurance (either a contribution paid or surety under the MERFP Act) before commencing any activities under the EA.

6.1.2 Development Application

To facilitate approval of the offshore BLF, a DA for a Material Change of Use and Operational Works under the Planning Act 2016 will be prepared. The DA is submitted to Ports North as the assessment manager for relevant activities within the designated port area. Inputs required for the DA include:

- Marine Operations Plan
- Land Use Plan in accordance with Transport Infrastructure Act 1994
- Compliance with State Code 8: Coastal development and tidal works
- Compliance with State Code 11: Removal, destruction or damage of marine plants
- Compliance with the Sustainable Port Development Guidelines

» Compliance with Code for assessable development that is prescribed tidal works in Schedule 3 of the Coastal Protection and Management Regulation 2017

» Other detailed plans/approved plans/drawings/ engineering designs

» Construction Environmental Management Plan.

The DA would be submitted separately to the SSEA application and assessed independently; however, DES would be a referral agency to the DA and have the opportunity to comment on environmental matters.

6.1.3 Matters of National State Significance

Relevant matters of MNES will be addressed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Ecological information collected during field investigation will support any processes undertaken under the EPBC Act.

The process under the EPBC Act will run concurrently to the SSEA and DA application processes with the State.

7 Geology

7.1 Regional Geology

The Project is situated approximately 50 km north of Cooktown in northern Queensland. It is located at the northern end of an extensive Quaternary sand mass and dune field that stretches inland from the present coast for approximately 10 km, and extends from north to south from Cape Bedford to Lookout Point.

The dunefield complex is extensive and covers an area of approximately 700 km^2 as a large Quaternary Age silica sand mass. The dunefield occupies a low coastal plain, with older sandstones of the Laura Basin and Hodgkinson Basin bounding its western edge and forming prominent inliers and raised coastal headlands. The dune field fringes the coastline for approximately 50 km and extends inland up to 10 km. The sand dunes are predominantly parabolic in nature.

Various episodes of dune formation in both the Pleistocene (2.5 Ma to 10,000 years ago) and Holocene (10,000 years ago to present) periods have produced massive sets of overlapping dunes. The linear sand dunes developed predominantly during the dry Pleistocene glacial and interglacial periods when the sea-level receded and fluctuated approximately 100m below present-day levels. Prior to sea level rises in the Holocene period, sand was blown inland by the prevailing south-easterly winds to form linear dunes. The land sand masses form mainly as high transgressive or parabolic dunes. Multiple episodes of dune building are evident.

The dunefield complex is characterised by both extensive exposures of pure white sands and heavily vegetated, sharp-featured dunes of various styles and sizes. The nature of their formation and preservation results in a high silica purity of >95%. There are at least nine major landform elements within the dunefield complex (refer to Breen Industrial Silica Qld Pty Ltd, April 1986), namely:

1. Parabolic dunes
2. Elongate parabolic dunes
3. Broad low ridges
4. Inter-dune corridors and Gegenwalle counter wall ridges (less than 2m high)
5. Intra-dune sand plains
6. Lakes, swamps and streams
7. Coastal parabolic dunes and beach ridges
8. Coastal wetlands and estuaries
9. Headlands and bedrock exposures.

The parabolic dunes occur commonly as open U-shaped or V-shaped ridges of sand, with a length-to-width ratio of less than 3:1. They are commonly 20m to 500m long, 10m to 200m wide and 5m to 50m high, although dunes of up to 100m high have been recorded. The Project dunes have steep vegetated leeward slopes and bare upwind slopes. Correspondingly, elongated parabolic dunes are very large, having a length-to-width ratio greater than 3:1 and a range from 500m to 6 km in length. The dunes have built up over several different episodes, with the oldest Pleistocene dunes occurring basal and more westerly, while the younger ones have built up or reworked towards the east towards the current-day coastline.

In addition to silica sands, the Cape Flattery-Cape Bedford dunefield complex has potential to host concentrations of heavy mineral (ilmenite ($FeTiO_3$), rutile (TiO_2), zircon $ZrSiO_2$) sands developed within the dune profile or in preserved placer deposits associated with former shorelines.

Figure 5: Surface terrain within the Eastern Resource Area

7.2 Project Geology

The geology of EPM 25734 is dominated by Cenozoic age sandy sequences overlying Mesozoic and Palaeozoic sediments. The Devonian Hodgkinson formation comprises fine-to-medium-grained greywacke interbedded with siltstone, mudstone and minor conglomerate, and crops out on the eastern part of the tenement at Campbell Bay and in the east of the tenement east of Connie's Beach.

The surface terrain within the Eastern Resource Area where exploration and drilling activities have been occurring is shown in Figure 5.

The dunefield complex outcrops in the central part of EPM 25734 where the current Indicated and Inferred Mineral Resource is located, and in the western part of the tenement in two separate areas which have yet to be assessed. The dunes are dominated by large transgressive elongate parabolic sand dunes which evolved under conditions of persistent south-easterly winds on an exposed coastal aspect.

The deposit is dominated by young clean high-grade silica (quartz) which is principally white in colour. The dunes are mainly stabilised and covered by thick low-lying vegetation; however, the dune forefronts are active with exposed white sand. The white silica sands overlay yellow-orange-brown high ferruginous sands which mainly represent the podsolised B2 horizon and/or in part, the heavily weathered parts of the basement Devonian and Jurassic age formations. In several locations, these ferruginous sands are exposed on surface.

The topography of the site rises from approximately 10m above sea level (ASL) along the southern Project boundary, to 90m ASL in the northwest where steep active dune forefronts occur above the coastline. The topography of the Project area also rises or steps from west to east, possibly in part due to prominent basement shielding hills, which extend from sea level up to 100m, 200m and 250m ASL.

The Project site is defined by two large, elongated dunes:

» 2.5 km long West dune (10m to 75m ASL)

» A shorter, +1-kilometre-long but wider (up to 900m) elongate dune to the east (40m to 90m ASL), called the East dune and shown in Figure 6.

A more subdued less continuous middle or central dune lies between these two dunes. They are separated by defined narrow interdune corridors, which partly expose coloured sands. The East and West dunes are separated by a Central dune. It appears that the East dune is partly shielded to the southeast by a remnant outlier hill of Jurassic age rock, which rises from zero (0) metres to 100m ASL.

Figure 6: View across to the East dune (while standing on the West dune)

Except for the active dune fronts in the northwest, the dunes are stabilised by heath vegetation, with denser vegetation and trees areas along the steeper dune walls or sides. A grey topsoil or humus layer that is estimated to average 0.3m thick occurs throughout; below which and for a metre or two, organic roots grow in clean white high-quality sand.

The depths of clean white high-quality silica sand, based on current wide-spaced drilling, ranges from zero (0) metres on the fringe of the dunes, up to a maximum thickness of 35m. The sands are mainly very fine-grained and pure white in colour and in places, a slight creamy colour. Some of the drill holes have intersected coloured sands only while in others have intersected 2m up to 6m of coloured inter-burden. The distribution and extent of these coloured sands, as interborder and a basement sand profile, cannot be estimated with any degree of certainty at this stage, as more drilling is required to better delineate their extent. If these more ferruginous sands can be 'cleaned up' by processing, they may have the potential to contribute significantly to the current resource. Further metallurgical work is required to determine the quality and characterisation of these coloured sands.

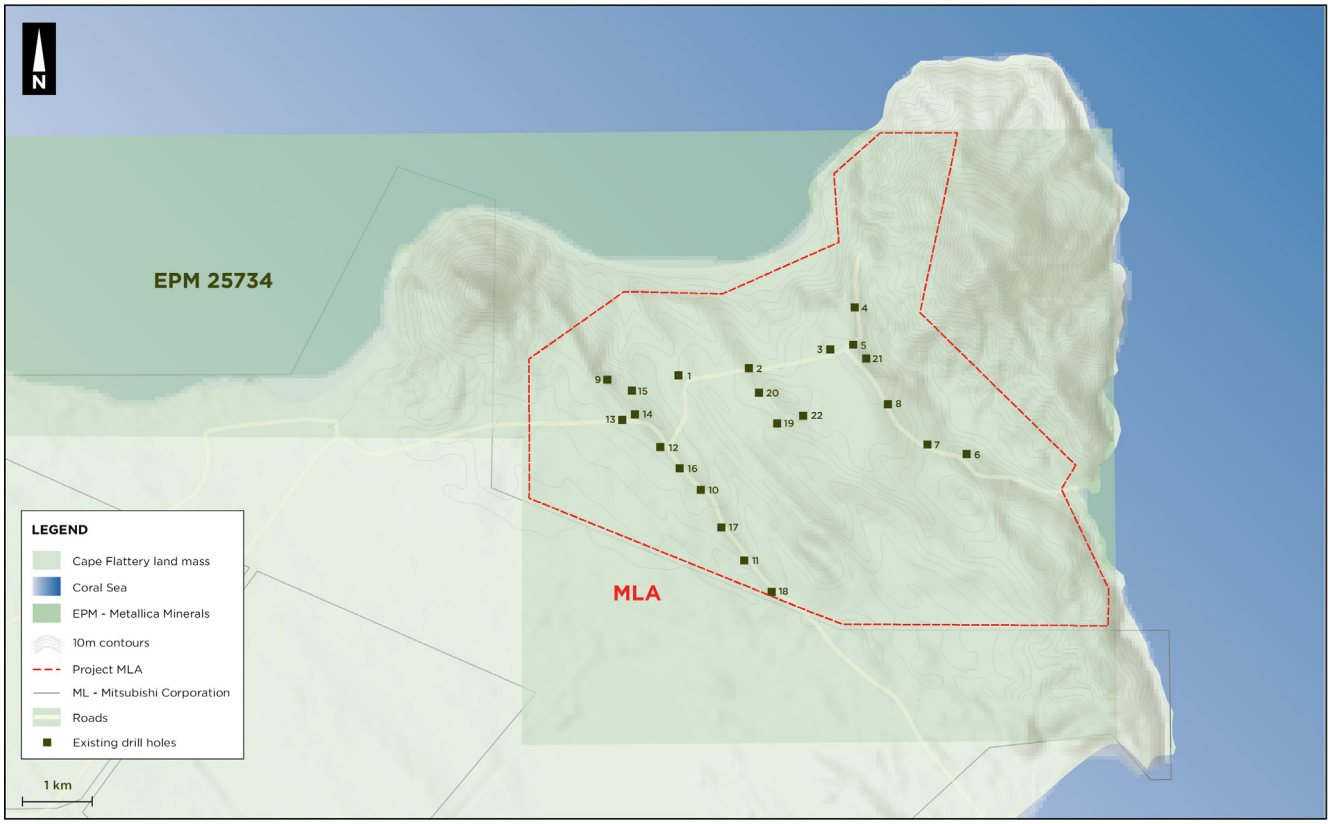


Figure 7: The December 2020 drill holes used in the Project's resource modelling

8 Mineral Resource Estimate

In the past 24 months, Metallica has completed one hand-auger program and two drilling programs in the target eastern area on EPM 25734. The exploration results indicated an area which hosts a significant amount of high-grade (+99%) silica sand, which is referred to as the Project area.

In April 2021, Metallica engaged Ausrocks Pty Ltd (Ausrocks) to complete a silica Mineral Resource Estimate (MRE) for the Project. Ausrocks is a Brisbane-based resources consultancy with expertise in industrial minerals and quarrying. Ausrocks determined that the exploration program to date had obtained sufficient information to enable estimation of an Indicated and Inferred MRE for the Project.

Ausrocks reviewed all the Project laboratory test work data that Metallica provided to ensure only valid and relevant data was used for the MRE.

8.1 Resource Model Development

The Mineral Resource model that Ausrocks has developed for the Project is referenced in the MLM ASX Release: 3 March 2021 'Revised 38 Mt of High Purity Silica Sand Resource'.

The block model's development was based on data from 22 vacuum drill holes and 3 hand-auger holes (Figure 7) as inputs to the Mineral Resource model, with a total of 391 samples used in the MRE. The results were dominated by high-purity silica (quartz) sand, which is principally white in colour.

To complete the Inferred and Indicated MRE, Ausrocks used Micromine 2021 to interpolate and populate a block model. The block model was interpolated using Inverse Distance Weighting (IDW).

As part of the silica resource estimate, the level of certain contaminants (Al_2O_3, Fe_2O_3, TiO_2) were also estimated by the block model. A cut-off grade of 98.5% SiO_2 was applied for the Project. The cut-off grade was determined by analysis of raw assay data down each individual drill hole which was remarkably consistent, with consecutive metre-by-metre silica grades meeting or exceeding 98.5% SiO_2. The cut-off grade applied was consistent with industry practice for these types of high-grade silica sand dune deposits.

The block model was optimised on this cut-off (98.5% SiO_2) and the average silica grade and quantity of the resource at varied reporting levels or categories was computed. Based on the 22 vacuum drill holes and from the 3 hand-auger holes used in

the MRE, the % SiO_2 content in individual sub-blocks ranged from 93.91% to 99.8%.

Parent block sizing was chosen as 50m E x 50m N x 1m RL, which was then sub-blocked to 2m E x 2m N x 1m RL. Parent blocks were modelled using IDW on the parent blocks, with sub-blocks assigned the value from the parent blocks. The block model was trimmed to the nearest sub-block using a wireframe that defined the top and base of the resource.

Prior to interpolating and assigning assay values to each block, an empty block model was created and trimmed to the resource boundaries.

These boundaries were:

» **Top surface:** defined as the base of topsoil which is 0.3m below surface topography

» **Bottom surface:** a gridded surface based on drill hole depths

» **Other boundaries:** the resource boundary was defined by the following considerations:

- The interpreted geological boundary based on aerial images and geological logging
- Regional and local geology
- The area where the top and bottom surfaces intersected
- Surface topography
- Area of Influence around drill holes determined by drill hole spacing and geological continuity.

8.2 Reliance of Mineral Resource Estimate in this Study

This Scoping Study has been undertaken to determine the potential viability of continuing the exploration and development of Metallica's Project in Cape Flattery. The Study is a preliminary technical-based study of low-level technical and economic assessments that are not sufficient to support the estimation of Ore Reserves nor any economic evaluation for the Project. Further evaluation and appropriate studies are required before Metallica can estimate any Ore Reserves or provide any assurance of an economic development for the Project.

The Study is based on Indicated Mineral Resources (14%) and Inferred Mineral Resources (86%). The current level of geological confidence associated with the Mineral Resource is based primarily on the wide-spaced drill coverage. The geology comprises well known aeolian-derived sand dunes. Campaigns of vacuum drilling, hand augering and field work have provided a robust understanding of the dune formation and target dune geology and has substantiated that high-quality silica with relative low iron (Fe_2O_3) is present across the wider Project area. Further drilling will result in a limited increase in resource tonnage, but particularly an increase in resource category, especially to the Indicated Resource category.

The Project's mineralisation is best described as a surface deposit of overlying sand dunes. The deposit is by far dominated by high-purity (>98.5%) silica (quartz) sand which is principally white in colour and fine-grained. The dunes are mainly stabilised and lightly vegetated but their forefronts active with exposed white sand. The depths of clean white high-quality sand ranges from zero metres on the fringe of dunes up to a maximum thickness of 35m. To date, the average thickness is approximately 18.5m. These sands overly to varying depths, yellow-orange-brown (coloured) silica sands of lower SiO_2 percentage.

The Project lies in the northern most part of the Quaternary age Cape Flattery-Cape Bedford dunefield complex, immediately adjacent to CFSM's mining leases owned by Mitsubishi. The Project site is defined by two large, elongated southeast-northwest trending dunes, a) a 2.5-kilometre-long west dune and b) a shorter +1-kilometre-long but wider (up to 900m) elongate dune to the east. A more subdued less continuous middle or central dune lies between these. They are separated by defined narrow interdune corridors which in part expose coloured sands. The dunes have been tentatively designated as the West, Central and East dunes and range from 10m to 90m ASL.

Given the nature of the Project's mineralisation and locality, Metallica's drilling program that has just been completed is reasonably likely to improve confidence in the resource.

The initial metallurgical test work results have been highly positive, yielding a silica grade of 99.8% SiO_2 and showing relatively low contaminant product with an attractive narrow particle-size distribution and a high-to-moderate yield. Using gravity upgrading, magnetic separation and particle classification methods, typical to silica sands refining, a silica sand product was able to be produced containing 99.8% SiO_2, 450 ppm Al_2O_3, 170 ppm Fe_2O_3, 210 ppm TiO_2 and 2.6% -125-micron particles. This product held a mass yield of 77.4%.

Semi-gridded and infill drilling across the wider resource area was completed in August 2021, including further detailed metallurgical test work thereafter.

8.3 Sample Analysis

Analysis of the samples provided an estimated average bulk density of 1.60 t/m^3, which was

suitable for use in the MRE. The resource is currently reported as in-situ tonnage with a moisture content of 2.5%. These density test results are suitable for use in future mineral resource estimates in this area.

To satisfy the requirements of the 2012 edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code 2012) for future mineral resource updates, the following drilling grid will be used as a guideline for assigning resources categories:

» **Inferred Mineral Resource:** ~400m drill spacing

» **Indicated Mineral Resource:** ~200m drill spacing

» **Measured Mineral Resource:** ~50m-150m drill spacing.

Based on the limited wide-spaced drilling, the drill spacing and field geology supports a small portion of the resource being categorised at the Indicated level, with the remainder of the resource classified as Inferred due to the incomplete definition and interpretation of the subsurface geology.

The wide-spaced drilling across the MLA area, while incomplete, has enabled a good understanding of the dune formation and a relatively robust model of the target dune geology to be generated. It was assessed that on completion of a gridded or semi gridded confirmatory drilling program, it is likely that confidence in the resource may be improved.

8.4 Mineral Resource

The Project's sands are mainly fine-grained and pure white in colour and in places a slight creamy colour. The depths of clean white high-quality sand based on the wide-spaced drilling to date, range from zero (0) metres on the fringe of the dunes up to a maximum thickness of 35m. These clean white sands overlay to varying depths (by drilling), distinctive and extensive orange-brown (or 'coloured') high-silica sands. The coloured sands also appear to be partially exposed on surface, principally along interdune troughs and highs, and parts of the dune sidewalls. These coloured sands have a lower SiO_2 percentage and corresponding higher Fe_2O_3 and Al_2O_3 percentage, and may represent paleo sands that were not leached in the A2 horizon.

Campaigns of vacuum drilling, hand auger and field work has substantiated that high-quality white silica sand SiO_2 >98.5%, with relative low iron Fe_2O_3 < 0.12% (or 1,200 ppm), is present across the wider Project area.

The Mineral Resource was estimated by interpolating and populating a block model of the resource using Micromine 2021. Blocks of 50m (L) x 50m (W) x1m (H) with sub blocks 2m (L) x 2m (W) x 1m (H) were used to generate the block model. The blocks were constrained by the model boundaries and populated by the Inverse Distance Weighting (IDW) estimation method. The surface boundary was generated by a combination of ML boundaries, environmental boundaries, observable geology and contour cut-offs. The base of the resource model was initially determined from selected drill hole depths (i.e. silica cut-offs), then modelled and adjustments made for intersections with surface topography and other continuity limits. The model was further controlled by cross-section checks.

The drill spacing and field geology supports a small portion of the resource to be categorised at the Indicated Resource level, with the bulk or remainder of the resource at the Inferred Resource level, due to the incomplete definition and interpretation of the subsurface geology. The estimated Indicated and Inferred Resource for the Project was 38.3 Mt @ 99.0% SiO_2. Of this, 5.4 Mt at 99.1% SiO_2 was classified as Indicated while 32.9 Mt at 99.0 % SiO_2 was classified as Inferred.

On 3 March 2021, Metallica released an ASX statement regarding this upgraded MRE for the Project, as shown in Table 2 and Figure 8. For further details, refer to ASX Release: 3 March 2021 'Revised 38 Mt of High Purity Silica Sand Resource'.

Table 2: Mineral Resource Estimate for the Project Area

Classification	Silica sand Mt	Silica sand Mm^3	Density t/m^3	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO^2 %	LOI %
Indicated Resource	5.4	3.4	1.6	99.1	0.04	0.09	0.13	0.13
Inferred Resource	32.9	20.5	1.6	99.0	0.07	0.12	0.15	0.11
TOTAL	**38.3**	**23.9**	**1.6**	**99.0**	**0.06**	**0.12**	**0.15**	**0.12**

For further details, refer to ASX Release: 3 March 2021 'Revised 38 Mt of High Purity Silica Sand Resource'.

The Mineral Resource Estimate has been reported in accordance with the JORC Code 2012. A cut-off grade 98.5% has been defined based on the surrounding data. These results show there is good potential to produce a premium grade silica product using standard processing techniques.

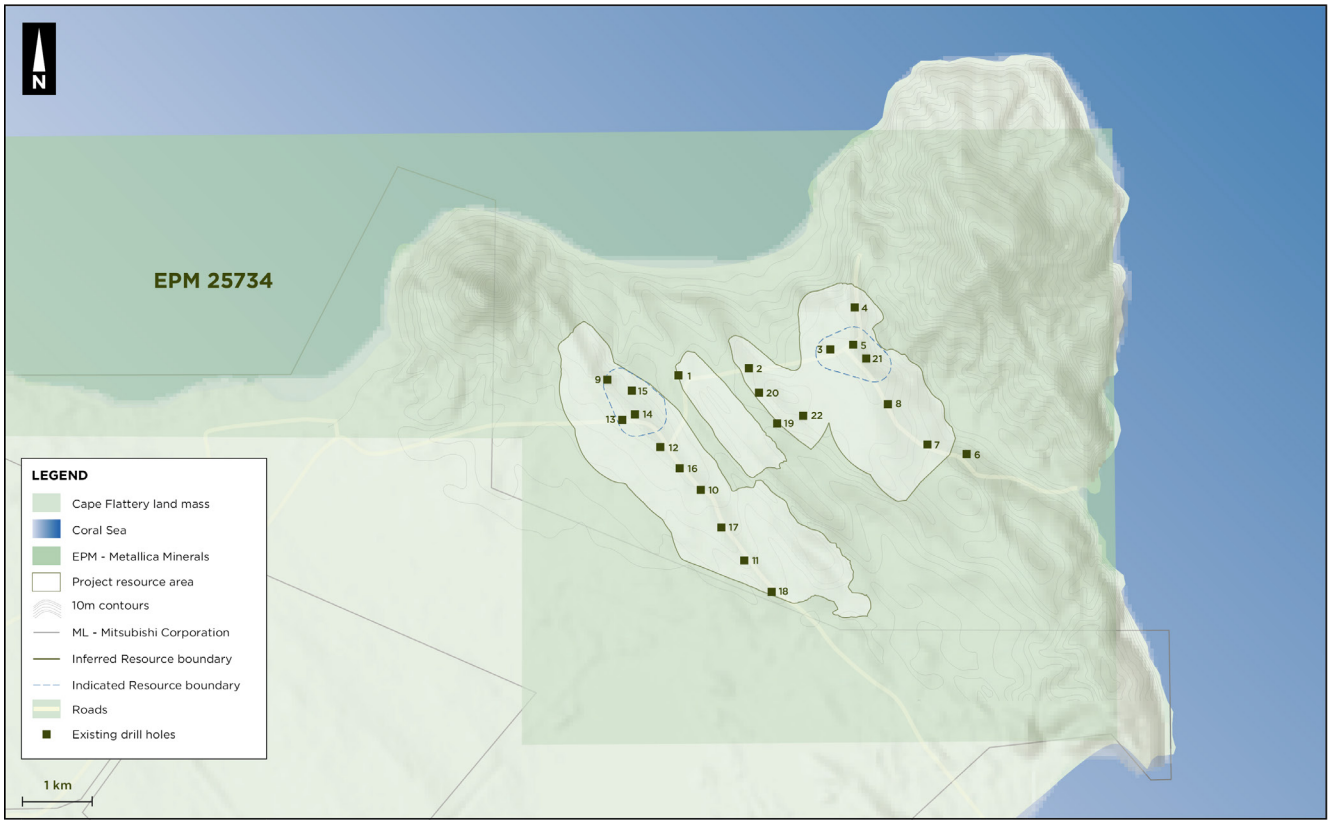


Figure 8: The Project's Mineral Resource Estimate, as shown by the Inferred resource boundaries (in dark green) and the Indicated resource boundaries (by blue dashes)

Figure 8B: Samples from July/August drill program being prepared for transport to the laboratory for processing

9 Exploration Activities

The area covered by EPM 25734 has been, until recently, subjected to three (3) phases of exploration which have culminated in the definition of an Inferred and Indicated resource of 38.3 Mt @ 99.0% Si. Exploration comprised hand-auger holes and drilling in conjunction with mapping and topographic surveys, with the first reported exploration being undertaken on the area in the early 1960s.

Since records have been kept, there have been 11 Authorities to Prospect (ATPs) or Exploration Permits for Minerals (EPMs) fully covering or partially covering EPM 25734. The first tenure over the Cape Flattery area by Mitsubishi Corporation was ATP 246, which confirmed the presence of extensive deposits of high-quality silica sand. This finding led to the formation of Cape Flattery Silica Sand Mines Pty Ltd (CFSM), the granting of MLs and mining commencing in 1967.

CFSM undertook limited exploration work in 1983 and 1984 outside the main ML SML 401, with CFSM identifying five (5) target areas, two (2) of which overlap part of what is currently the Project's EPM 25734 and to which CFSM referred as the East and North areas. CFSM completed exploration drilling in the East area, which Metallica refers to as the East dune. Only CFSM's East area exploration results are relevant to the Project's exploration activities on EPM 25734.

Exploration was completed using the following methods:

» Aerial examination

» Access, site preparation and hand samples

» High-point drilling, from dune crests using hand-auger equipment.

To undertake a drilling program, CFSM established access tracks with a D7 dozer and drilling access via a 4WD. CFSM drilled 7 holes (East No.1 to East No.7) to a total of 84m in the area. These holes intersected sand dunes between 10m and 22m in thickness.

The silica content of these historical drill-hole samples was not ascertained, as CFSM primarily assayed for Fe_2O_3 and heavy mineral (HM) sands. CFSM concluded that the dune's multi-coloured sands contained high levels of contamination, with iron oxides apparent. It further determined that producing a saleable product at that time was not viable.

While CFSM may have rejected this area, based on perceived high levels of contamination due to coloured nature of the sands, the Fe_2O_3 values ranged from 0.08% to 0.45%, which from Metallica's recent work, are considered low, keeping exploration remaining attractive for high-silica/low-iron sands. Significantly, consistent deep intersections of sand (11m to 22m) were encountered. As silica was not assayed, CFSM's coloured sand drilling results were not included in this Study's resource estimation.

The exploration work on EPM 25734 that Metallica has undertaken to date is comprised of:

» Researching and reviewing past exploration

» Desktop mapping, including sourcing and reviewing Landsat, topographic and Google Earth images

» Listing and prioritising areas for field checking

» Site reconnaissance and hand auger sampling

» Drilling and sampling

» Resource estimation.

Metallica has undertaken two phases of hand-auguring on EPM 25734, the first being in 2018, when a total of 26 shallow hand auger holes and 12 grab samples were collected over exposed sand areas. These samples were collected primarily to form the Project target.

Additional auger sampling was undertaken over the Project target in December 2019 and January 2020, with a total of 8 auger holes drilled to an average depth of 4.74m (nominally 5m). The majority of the 8 auger holes returned 1-metre sample intervals of >99% silica dioxide (SiO_2), with auger intercepts averaging between 96.1% and 99.1% SiO_2. Seven of the 8 holes ended in high-purity silica sand, with only 1 hole intersecting yellow-brown sand.

As a result of this work, Metallica contracted Ausrocks in November 2020 to do a preliminary resource estimate on the area covered by the 8 auger holes drilled in 2019. An initial Inferred Resource of 12.85 Mt @ 99.28 % SiO_2 was estimated for the tenement.

In December 2020, Metallica undertook a 22-drill-hole program, which comprised approximately 505m of drilling to increase the resource base of the deposit. The average depth of the holes was 23m, with the deepest hole being 35m (CFS201217) and the shallowest being 2.2m (CFS201222).

All the holes drilled were vertical and sampled at 1-metre intervals. The holes were either drilled to basement or to where brown ferruginous sand was intersected. A low-impact vacuum rig was utilised for this work and the drilling confined to existing tracks to minimise environmental and cultural disturbance.

As a result of the December 2020 drilling program, Ausrocks increased the resource estimate to 38.3 Mt @ 99.0% SiO_2. Hand-augering and drilling activities are shown in Figure 9.

Figure 9: A. A vacuum drill rig in operation at site, and B. Collected and bagged sand samples

9.1 Future Exploration

Metallica completed a second drilling program in the Project area, which comprised 98 drill holes within the MLA area (Figure 10)(see ASX Release 12 August 2021 "98 Hole Drill Program Completed at Cape Flattery Silica". The aims of this second stage of drilling was to infill drill within the existing Mineral Resources envelope to improve data density and confidence in the Mineral Resources estimate.

A conceptual study of the EPM area indicates that there is exploration potential in the EPM that could increase the silica resource base by an Exploration Target of 10 Mt to 60 Mt[1].

[1] The potential quality and grade of the Cape Flattery Silica Sand Project's Exploration Target deposits are conceptual in nature. There is insufficient information at this time to define a mineral resource in these areas and there is no certainty that further exploration will result in the determination of a mineral resource in these areas.

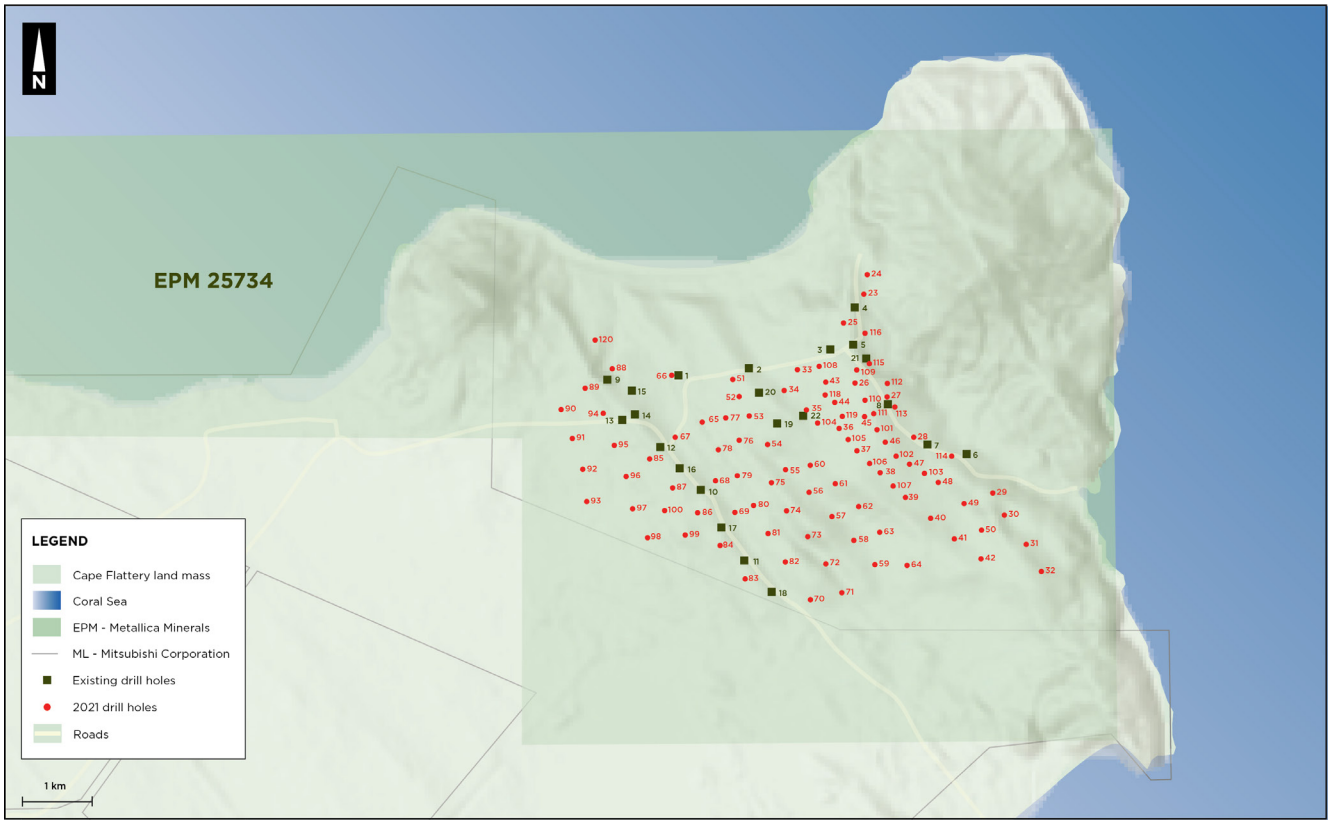


Figure 10: Drill hole location map in the Project's resource area, with Metallica's December 2020 drill holes shown in dark green and the July/August 2021 program drill holes shown in red

10 Metallurgical Testing

In early 2021, Metallica provided IHC Robbins Pty Ltd (IHC Robbins) with drill hole samples from the December 2020 drilling program to generate an approximate 2-tonne representative sample of life-of-mine material, as defined by the Project's resource model. The metallurgical testing was completed at IHC Robbins's Brisbane laboratory.

As announced in the ASX Release: 3 March 2021 'Revised 38 Mt of High Purity Silica Sand Resource', the 2-tonne metallurgical test work sample was derived from drill samples from within the Project's resource area that had an average silica content of greater than 98.5% SiO_2. Using gravity upgrading, magnetic separation and particle classification methods, typical to silica sands refining, a product was produced that contained:

- **between 99.8% and 99.9% SiO_2**
- **450 ppm Al_2O_3**
- **170 ppm Fe_2O_3**
- **210 ppm TiO_2**
- **2.6% -125 µm particles.**

This product held a **mass yield of 77.4%.**

10.1 Metallurgy Testing Process

The head feed sample was composed of 1.7% slimes and negligible oversize mass. The -2.0-millimetre, -63-micron sand fraction represented 98.2% of the as-received drill sample mass (Figure 11) and was assayed at:

- 99.7% SiO_2
- 800 ppm Al_2O_3
- 885 ppm Fe_2O_3
- 1,290 ppm TiO_2
- 0.07% organics (LOI 1000).

Figure 11: As-received drill samples

The material chosen for metallurgical testing was readily screened and deslimed by a typical silica sands feed preparation process to remove the +2.0-millimetre particles, -63-micron fines and organic content.

Flocculent and coagulant were required to achieve an acceptable slimes settling rate and supernatant process water clarity.

The heavy minerals (HMs) were effectively removed by a simple 2-stage spiral separation circuit. Particle attritioning showed evidence of improving product grade via the removal of iron-bearing surface coatings on the quartz grains. Magnetic separation successfully removed additional magnetic and paramagnetic particles, further improving product grade. Up-current classification was successful in selectively rejecting undesirable fine particles while maintaining a high mass yield.

The final product achieved a mass yield of 77.4% and its assay results are shown in Table 3 (as referred to in ASX Release: 22 June 2021 'Excellent Metallurgical Test Results on Cape Flattery Silica Sand').

Table 3: Final Product Assays

SiO_2 %	Al_2O_3 ppm	Fe_2O_3 ppm	TiO_2 ppm	Cr_2O_3 ppm	CaO ppm	K_2O ppm	MgO ppm	MnO ppm	Na_2O ppm	P_2O_5 ppm	V_2O_5 ppm	ZrO_2 ppm	LOI 1000 %
99.8	450	170	210	3	50	30	20	0	20	10	0	30	0.05

IHC Robbins also identified other potential products from earlier process streams and these would require less refining and generate a higher mass yield, as shown in Table 4.

Table 4:Other Potential Products Identified

Potential product options	Mass yield %	Assay			
		SiO_2 %	Al_2O_3 ppm	Fe_2O_3 ppm	TiO_2 ppm
Feed preparation sand	97.6	99.7	715	760	1,225
Spiral product	84.0	99.9	500	240	260

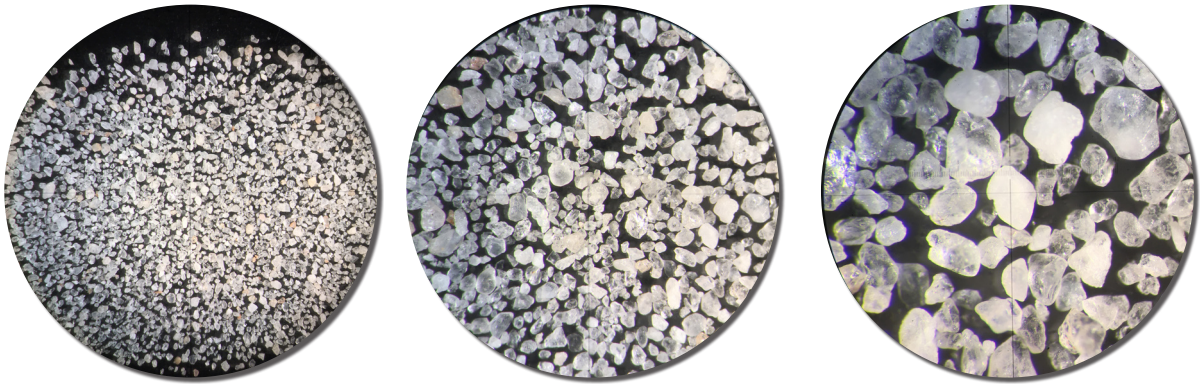
The metallurgical report also recommended that further product grade scoping test work and market investigations be completed in order to realise the full potential and therefore value of the Cape Flattery material.

10.2 Particle Size Results

Photomicrographs of the up-current classifier (UCC) underflow product (Figure 12 and Figure 13) shows that very few discrete/liberated contaminant particles remain in the sample and that the quartz grains appear, by majority, free of surface coatings or inclusions.

A summary metallurgical balance, based on outflow mass and Inductively Coupled Plasma (ICP) method assay data, is listed in Table 5.

Figure 12: UCC laboratory unit



Field of view = 21mm | Field of view = 8.5mm | Field of view = 3.3mm

Figure 13: UCC underflow product photomicrographs

Table 5: Inductively Couple Plasma (ICP) Assay Results

Summary	Mass tph	Mass yield %	Assay					Approximate Distributions			
			SiO_2 %	Al_2O_3 ppm	Fe_2O_3 ppm	TiO_2 ppm	LOI 1000 %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %
Feed preparation oversize	0.1	0.1						0.0	0.0	0.0	0.0
Feed preparation slimes	5.6	2.3						0.0	0.0	0.0	0.0
Spiral concentrate	32.9	13.6	98.6	1884	3613	6318	0.10	13.9	38.3	71.6	78.5
Attritioning slimes	2.3	1.0						0.0	0.0	0.0	0.0
WHIMS mag	4.2	1.7	99.0	2380	3015	3400	0.09	1.8	6.1	7.6	5.4
UCC fines	9.5	3.9	99.8	615	290	360	0.09	4.1	3.6	1.7	1.3
UCC product	**187.2**	**77.4**	**99.8**	**450**	**170**	**210**	**0.05**	**80.2**	**52.0**	**19.2**	**14.9**
ROM	241.7	100.0	96.3	670	686	1094	0.06	100.0	100.0	100.0	100.0

As can be seen above, producing a final product via the as-developed process with a mass yield of 77.4% can result in a product grade of 99.8% SiO_2, 450 ppm Al_2O_3, 170 ppm Fe_2O_3, 210 ppm TiO_2 and 0.05% LOI 1000. This process rejects approximately 50% of the Al_2O_3 content, 80% of the Fe_2O_3 content and 85% of the TiO_2 content, while only rejecting approximately 23% of the ROM feed mass.

The relatively low contaminant product with an attractive narrow particle size distribution is demonstrated by the following.

The final product (UCC underflow) was a successful fines control point. As shown in UCC = up-current classifier, O/F = overflow, U/F = underflow, Cum. = cumulate

Figure 14, the final silica product was left with 2.6% -125-micron particles, correlating to a rejection of approximately 50% of the -125-micron particles from the UCC feed, while only losing 2.5% of the +125-micron particles from the UCC feed. Note that -125-micron particles can be undesirable in the high-purity silica sand market.

Table 6: Particle size distribution

Sample		UCC O/F		UCC U/F (silica sand product)		
Size	Retained	Cum. retained	Passings	Retained	Cum. retained	Passings
µm	%	%	%	%	%	%
1000	0.0	0.0	100.0	0.0	0.0	100.0
850	0.0	0.0	100.0	0.0	0.0	100.0
710	0.0	0.0	100.0	0.2	0.2	99.8
600	0.0	0.0	100.0	0.9	1.0	99.0
500	0.0	0.0	100.0	2.0	3.1	96.9
425	0.0	0.0	100.0	4.7	7.8	92.2
355	0.1	0.1	99.9	8.4	16.2	83.8
300	0.1	0.2	99.8	10.3	26.5	73.5
250	0.2	0.4	99.6	16.0	42.5	57.5
180	1.7	2.1	97.9	29.4	71.9	28.1
125	47.0	49.2	50.8	25.5	97.4	2.6
90	43.1	92.3	7.7	2.6	100.0	0.0
63	6.6	99.0	1.0	0.0	100.0	0.0
0	1.0	100.0	0.0	0.0	100.0	0.0
TOTAL	**100.0**	-	-	**100.0**	-	-

UCC = up-current classifier, O/F = overflow, U/F = underflow, Cum. = cumulate

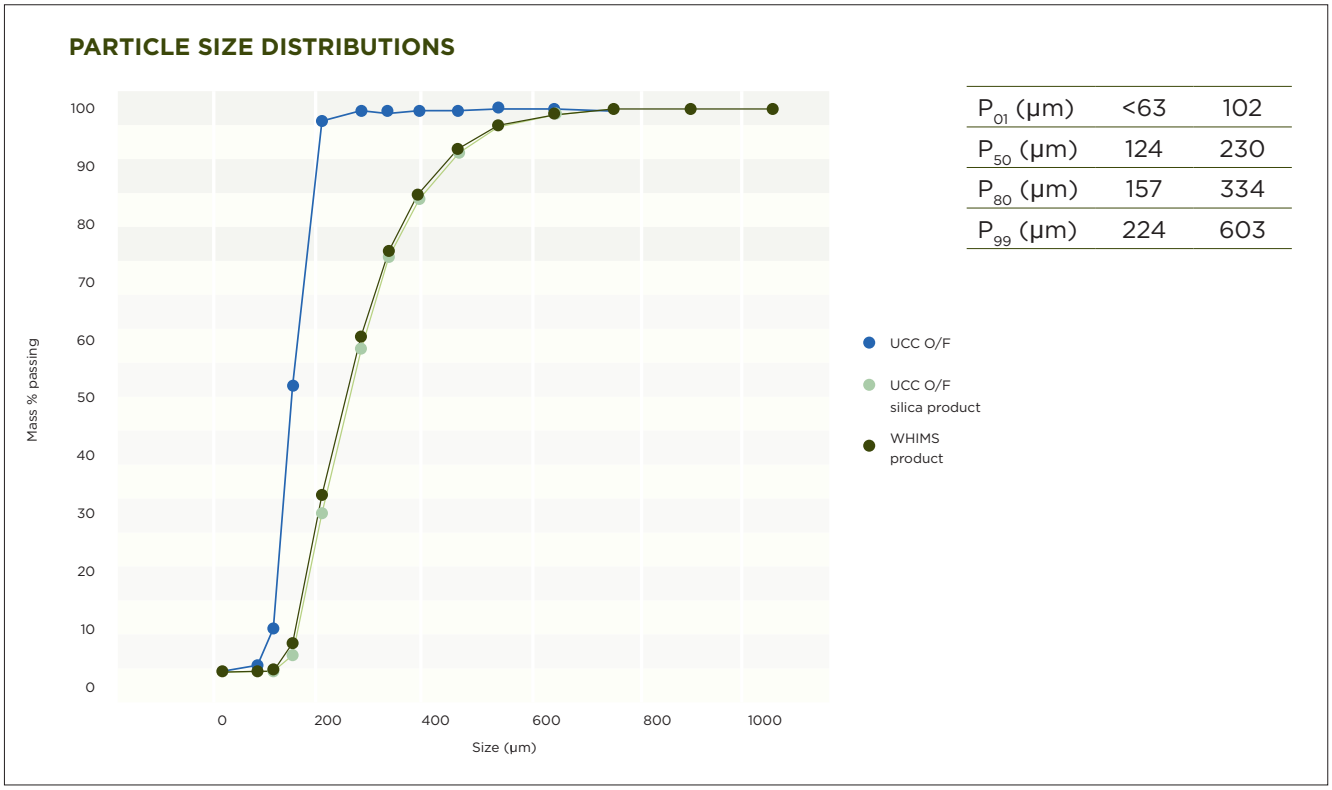


Figure 14: Up-current classifier (UCC) product particle size distributions

10.3 Results Summary

Blending most of the sand produced a SiO_2 result that had minimum level of greater than (>) 98.5%. Benchtop testing which used hot-acid leaching was also undertaken and the results showed a significant decline in Fe_2O_3, from 170 ppm to 70 ppm. Such results showed that processing off-site can produce a very low-iron silica sand product.

The testing indicated that the Project sample was a relatively low contaminant product with an attractive narrow particle size distribution and a high-moderate yield.

Metallica has the option to market products derived from earlier processing streams, such as the feed preparation sand or the spiral circuit product. Future marketing research will provide feedback on the viability of these products. The mass yield and product quality of each of these options are summarised in Table 7.

Table 7: Potential Product Options

Potential product options	Mass yield %	Assay				
		SiO_2 %	Al_2O_3 ppm	Fe_2O_3 ppm	TiO_2 ppm	LOI 1000 %
Feed preparation sand	97.6	99.7	715	760	1,225	0.07
Spiral product	84.0	99.9	500	240	260	0.10
UCC product	77.4	99.8	450	170	210	0.05

These UCC product can be compared to the product published by Mitsubishi (Cape Flattery Silica Mines) on their website:

1. Chemical Analysis	Average Quality
SiO_2	99.93%
Fe_2O_3	0.01%
Al_2O_3	0.03%
TiO_2	0.02%

* Average Quality of last 5 years
* Not-guaranteed Quality

2. Size Distribution	Average Quality	Weight
mesh	µm	%
+20	850	0.00
+28	600	0.36
+35	425	3.68
+48	300	17.26
+65	212	28.87
+100	150	40.08
+150	106	9.26
+200	75	0.42
+270	53	0.06
-200	-53	0.02
		AFS 60.59

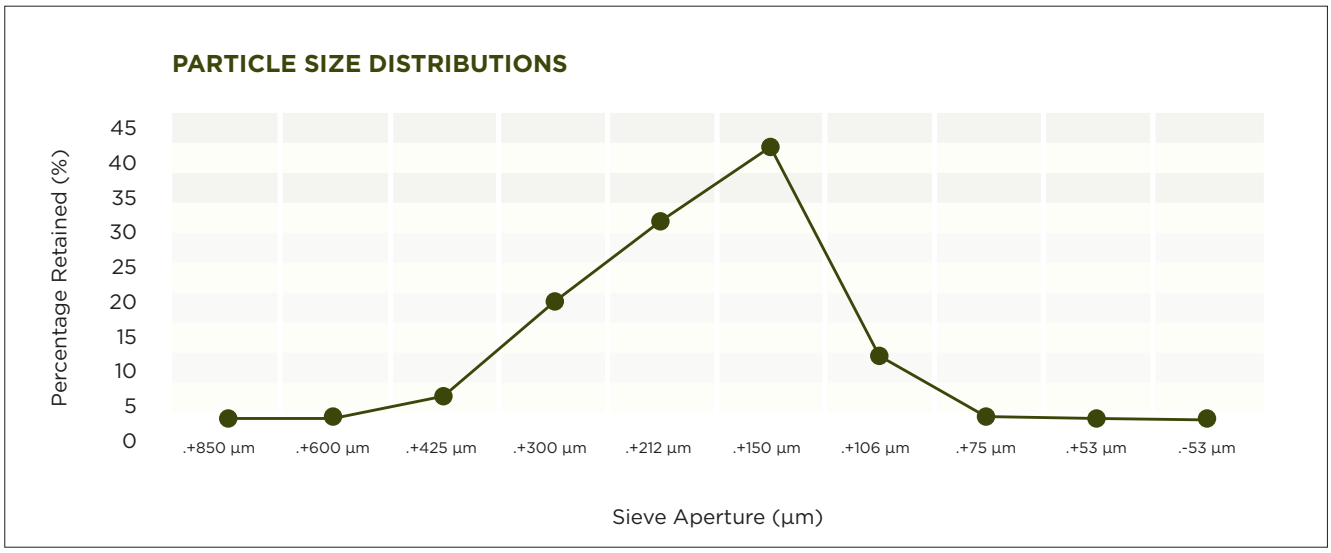


Figure 15: Particle size distributions

Source - www.cfsm.com.au/product

11 Mining Operations

11.1 Overview

Subject to obtaining approvals, funding and an upgraded resource, the Project is intending to mine raw sand, which will be processed on site to produce a high-grade silica sand product. Raw sand is intended to be mined, transported to the processing plant via conveyor, processed and loaded onto ships for export. This will be facilitated by having a Run-of-Mine (ROM) stockpile at the mining area, which is fed to the processing plant by a front-end loader (FEL).

Mining is intended to commence in the northeast area of the resource due to that area's direct access to the proposed jetty and BLF.

11.2 Personnel

The mine is intended to require personnel in varying skillsets including mining, processing, ship loading, maintenance, camp and administration. The workforce will primarily be from Cooktown, Cairns and Hope Vale.

11.3 Mining Equipment

A traditional mining fleet, similar to other benchmarked operations, would likely be required for the Project. This fleet may be comprised of a combination of dozer(s) and FELs, with their size dependent on resource tonnage and productivity rates.

11.4 Mining Process

An industry standard mining and rehabilitation methodology will be adopted that maximises production while minimising environmental impacts. This method would include the continuous completion of rehabilitation for each mining area once each has been mined.

The mining system is expected to follow a repetitive sequential process as the mining face advances:

1. Vegetation clearing and topsoil removal
2. Sand mining
3. Rehabilitation.

Figure 16 depicts a conceptual mine site and infrastructure layout.

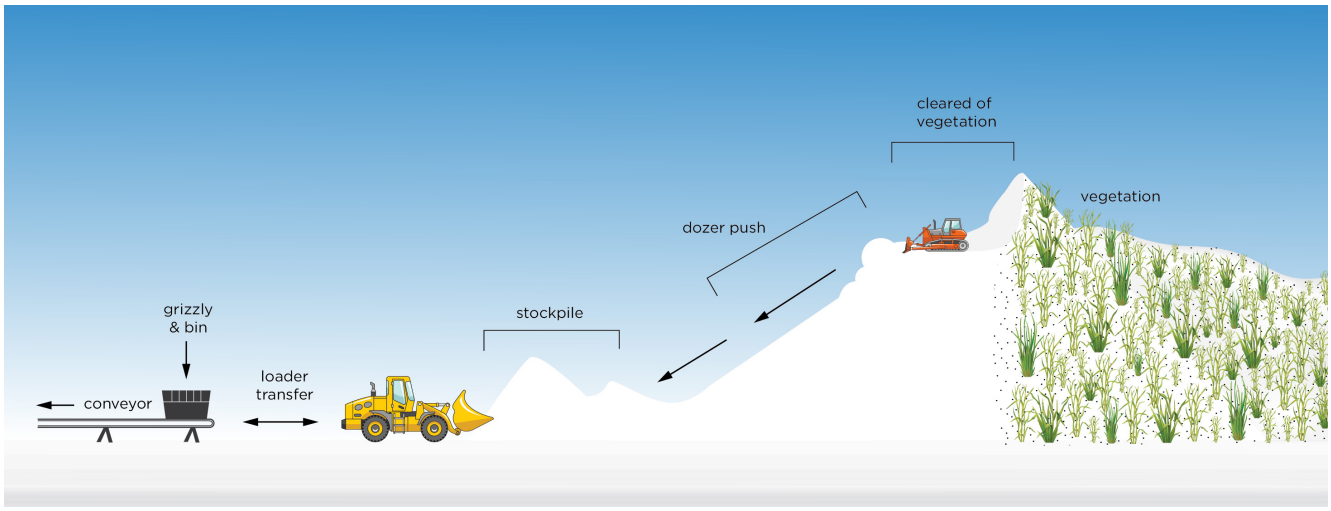


Figure 16: A conceptual Project mine site and infrastructure layout design

11.4.1 Rehabilitation

Following extraction of the mined panel and advancement of the face, the majority of the disturbed area can be planned for rehabilitation. A small portion of each mining area within a dune system would remain disturbed to allow continued access to the mining face and transportation of the raw sand to the conveyor that leads to the processing plant.

Rehabilitation would first likely require minor contouring of the mined surface area and then depositing tailings (e.g. sand fines and organics) on the contours with the dozer. Topsoil replacement could be undertaken by an excavator and articulated dump truck. The topsoil would then be spread by the dozer and seeding undertaken.

Figure 17 shows a schematic of an example of a proposed mine schedule and rehabilitation plan for extracting silica sand product. As shown, the mining area moves across the dune system. The conveyor between the mining area and processing plant (not shown) could be incrementally extended as needed to meet operational requirements. Rehabilitation of earlier mining areas could then occur when it is seasonally optimal for vegetation to regrow and there is enough cleared topsoil available for this purpose.

12 Processing Plant

As detailed in Section 10, metallurgical test work was completed by IHC Robbins on a 2-tonne sample extracted from the Project's target resource. In addition to the test work, a process to upgrade the material to a low-iron silica sand product while maximising yield was identified and prepared by IHC Robbins. Various options were considered for the purpose of a cost-benefit analysis between plant capital expenditure (CAPEX)/operating expenditure (OPEX) vs the quality of product produced.

To reduce metallurgical and Project risk, the following test work conditions were applied:

» The material was confirmed to be suitable for a globally well-established process route for silica sand refining, consisting of gravity concentration, attritioning, classification and magnetic separation.

» Comprehensive test work was conducted using full-scale or scaleable processing equipment from prominent, independent manufacturers.

» The main process **did not use acid or other hazardous reagents.**

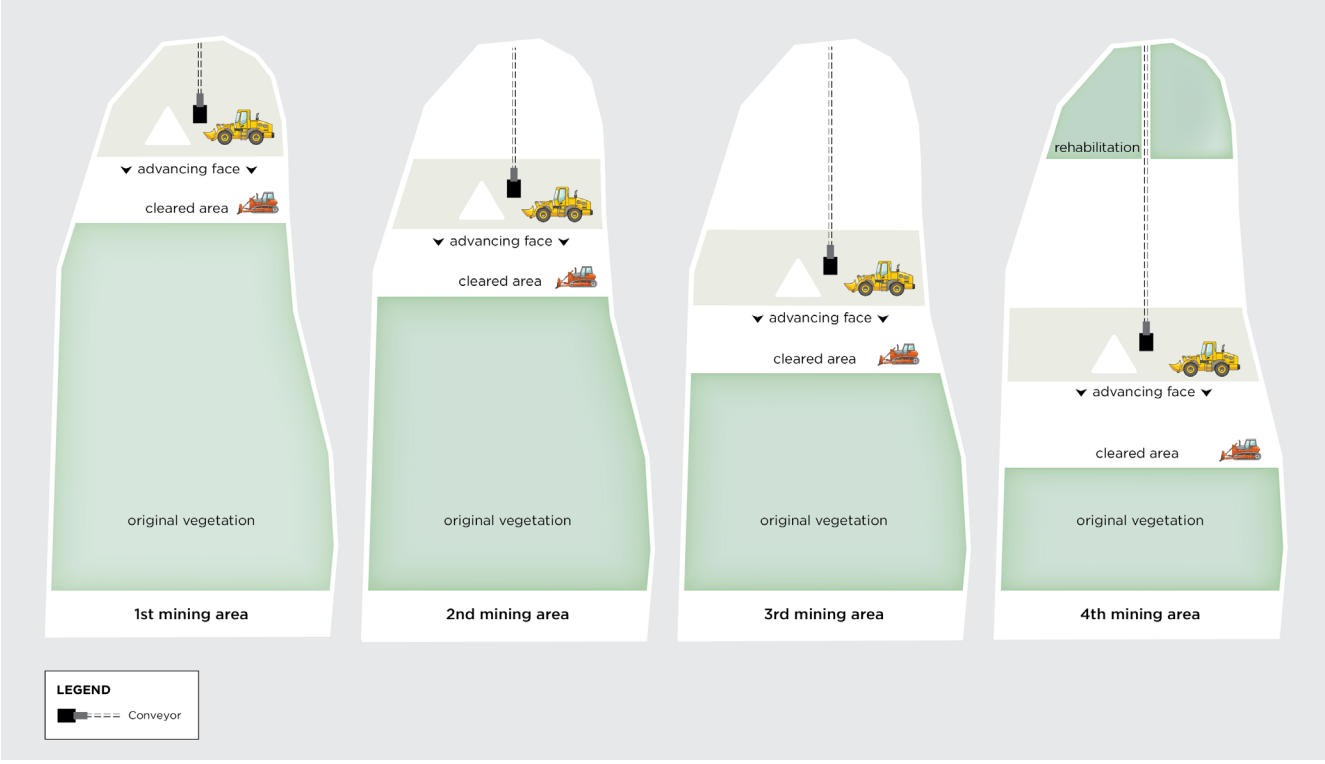


Figure 17: A conceptual illustration of a mining schedule and rehabilitation plan that follows the strike of a sand dune system

12.1 Silica Sand Processing Plant Design

A block flow diagram of an overall processing process design for extracting a high-quality silica sand product, inclusive of mass flows and equipment parameters, is summarised in Figure 18 and explained thereafter.

It is expected that ROM material will be loaded into a loading bin or hopper with a grizzly and then conveyed to a trommel or vibrating screen for further removal of rocks, vegetation and other debris. The sand will then be slurrified in a constant density tank and pumped to the processing plant. Here, hydrocyclones will remove problematic fine particles and fine organic matter. The fines will report to a thickener/clarifier unit to assist with water recycling.

The prepared sand will then be processed through a 2-stage spiral separator circuit that utilises Mineral Technologies MG12 spirals to remove HM contaminants and meet glassmaking specification acceptance ranges. The silica-enriched spiral tailings stream will be dewatered and pumped to attritioning cells to scrub away surface-coating contaminants from the silica grains and meet foundry specification acceptance ranges.

The attritioned sand will be washed by hydrocyclones and an up-current classifier unit. This washing and classifier step will perform a particle-sizing operation, where unwanted fine particles and any residual organic matter from the process will be rejected.

The coarse product will then be pumped to wet high-intensity magnetic separator (WHIMS) units for a final removal of any magnetic or paramagnetic particles that were not rejected by the spiral separators. The combined reject streams will be dewatered and stockpiled onsite, with the option to eventually reprocess or further upgrade or sell as a HM intermediate product.

The final silica-enriched product will also be dewatered and stockpiled to allow drainage to a low moisture content prior to transport.

Based on the metallurgical test work conducted, the study's processing plant was modelled on a basic

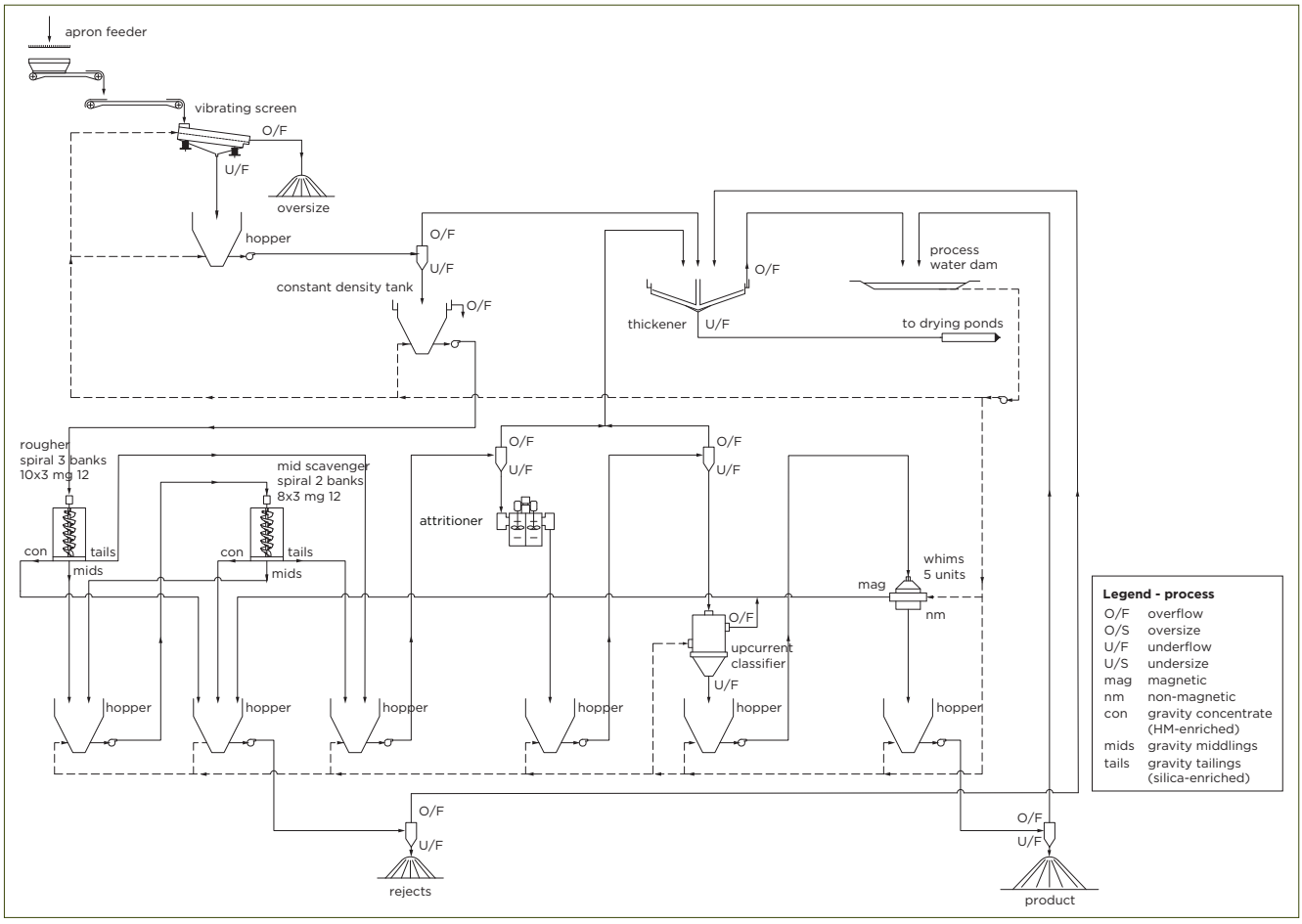


Figure 18: Block flow diagram of a process designed to produce saleable silica sand product

gravity separation plant comprising a feed system, feed preparation, fines handling and gravity spiral Separation. Prior to the WHIMS process, the plant's configuration could produce a silica sand product containing approximately 220 ppm to 240 ppm Fe_2O_3 with a mass yield of 84.0% of the ROM material (750 ppm to 800 ppm Fe_2O_3).

Metallica has reviewed scoping studies and PFSs of similar-sized company projects and based on these companies' projected production targets and advice from equipment providers.

As disclosed from the metallurgical test results (see Section 10.3), the inclusion of the attritioning, classification and WHIMS operations could produce a product containing approximately 170 ppm Fe_2O_3, with a mass yield of 77.4% of the ROM material. Therefore, by using estimates from other silica sand projects, a potential CAPEX estimate for the processing plant could be approximately AUD16-25 million. CAPEX values included supply, delivery, assembly, installation and commissioning, yet excluded owner costs, earthworks and supporting infrastructure capital costs (i.e. power supply, water supply, access roads, port infrastructure, laboratory and administration). OPEX values included plant labour, maintenance, spare parts, reagents (flocculent and coagulant) and electrical power.

The processing plant would be potentially designed to operate as a day/night shift, in a continuous operational process for 24 hr/day and 360 day/yr. The shift roster could be a 4-crew system, with crews rotated on a 7-day-on/7-day-off schedule if finalised during detailed discussions with local employees. Personnel will reside in a Project site camp while undertaking their work rosters.

12.2 Power Supply

The Project's power supply will be a combination of solar and genset power, with both power supplies to be contracted out. Further studies will determine what the power supply and its contingency will need to be.

12.3 Water Supply

The Project is expected to require 600 MLpa to 750 MLpa of water and a number of options are being assessed to provide a secure and stable supply of water for the Project. The Project is located within the Jeannie catchment area of the Water Plan (Cape York) 2019.

The Project's water allocation would be primarily used in mineral processing, where recycling will play a key part in minimising water consumption. It is expected that the Project's water storage facilities would experience a component of water loss via evaporation and seepage from natural processes and therefore, will need supplementing over time.

The balance of the water allocation would be used to satisfy other operational requirements, such as dust suppression for material transfer and stockpiles, as well as water and waste water services for Project personnel use.

13 Barge-Loading Facility

13.1 Current Export Plan

A BLF is expected to be constructed on the south-western side of the Cape Flattery headland along a section of rocky coastline. Export of silica sand would be via a conveyor from the processing plant to the stockpiling pad at the BLF. The sand will be directly loaded onto the BLF conveyor via a FEL into an apron feeder. Once on the conveyor, the product will be loaded onto barges via the BLF stacker and then transported offshore, where it will be transhipped onto bulk carriers.

A proposed BLF design may include:

- A conveyor from the processing plant to the product stockpile at the BLF
- A stockpile pad to allow for stockpiling of material in anticipation of barge arrival. The stockpiling reserve required will be investigated and confirmed in the next stage of the Project, but enough space would be required to provide sufficient buffer against pauses in processing while maintaining feed to the barge-loadout stacker
- A loading bin with an apron feeder coupled with on-ground conveyor modules could be located on the pad. This may be accompanied by a switch room, generators and control equipment
- An over-water conveyor element is likely to comprise conveyor gantry sections. These gantries would be supported by piles. The conveyor would likely need pedestrian access along both sides, with required services attached along the side of the conveyor
- The barge-loadout stacker could be based on a modified slewing stacking conveyor operating on a pontoon. The pontoon would be held in place horizontally by pile guides on piles to allow for the tides to rise and fall in unison with the barge being loaded.

Figure 19 illustrates a possible BLF general arrangement that could provide the Project with an export solution.

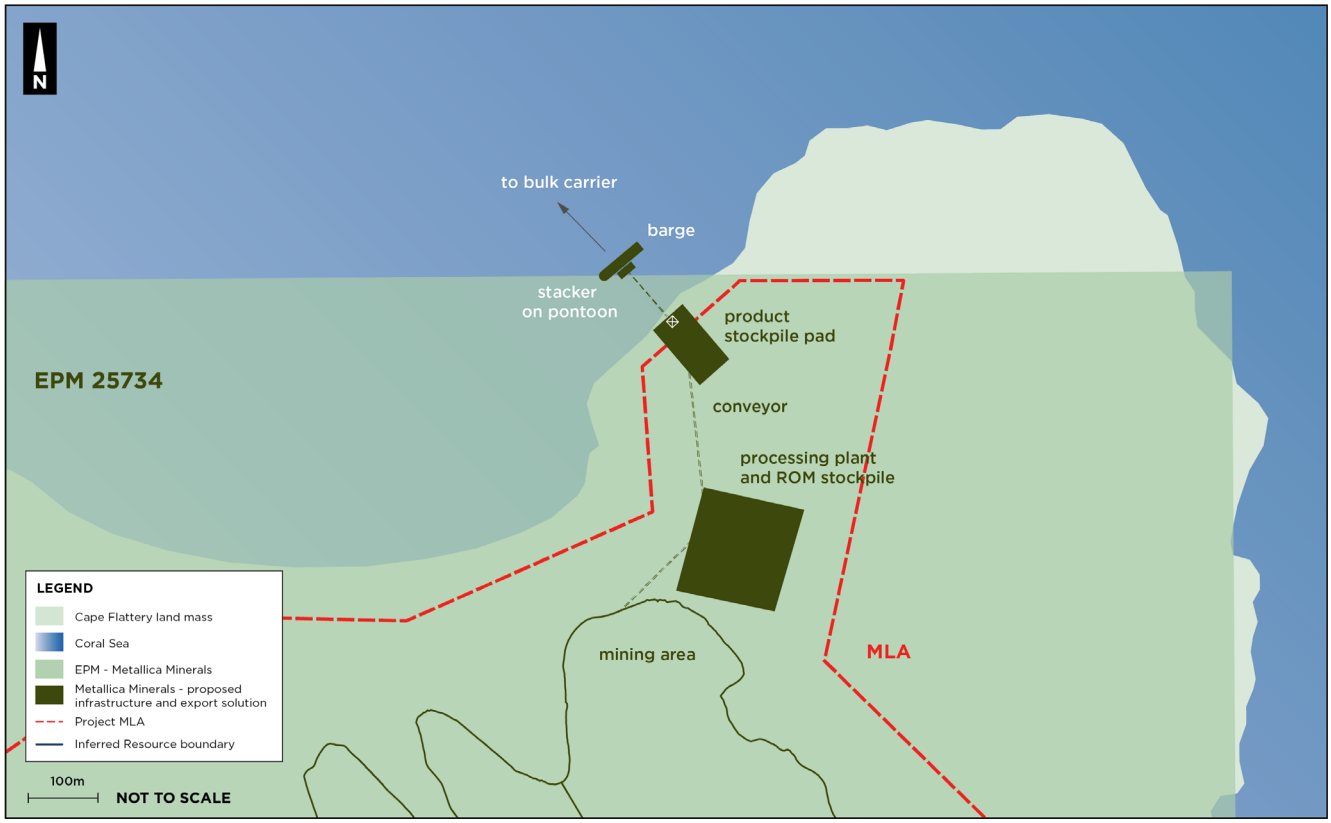


Figure 19: Possible BLF general arrangement that could provide a Project export solution (not to scale)

14 Product Transhipment to Bulk Carriers

14.1 Cape Flattery Port Summary

The Project's proposed jetty and BLF are located within the Cape Flattery Port area, which is operated by Ports North. Metallica has entered into discussions with Ports North regarding a possible development application to approve establishment of a new jetty and BLF within the Cape Flattery Port boundary.

Discussions with Ports North have also been initiated for the establishment of a "roll on/roll off" ramp that will allow equipment and supplies to be delivered to the Project.

The existing jetty operated by Mitsubishi was established solely for the export of silica sand by its company, CFSM. CFSM's mine is the largest exporter of silica sand in the world, with 2·5 Mt being exported in 2018/2019. Mitsubishi's jetty is a single berth serviced by a travelling shiploader for the exporting of sand. Before establishing its existing jetty and shiploader, Mitsubishi exported sand via a tug-and-barge operation.

14.2 Proposed Transhipment Approach

A marine consultant undertook a desktop review exploring the options for exporting silica sand. The review indicated that the export of silica sands could potentially occur by barging operations located approximately two to three (2-3) nautical miles offshore. A bulk carrier could be moored during transfer operations.

This proposed transhipment approach is expected to utilise conventional tug-and-barge operations. There is also an opportunity to use other methods, such as self-propelled barges or self-discharging barges, to load the bulk carrier with silica sand. Transhipment design options will be considered further during the PFS stage of the Project.

An example of silica sand being loaded from a barge to a bulk carrier using a grab crane by another silica sand project is shown in Figure 20.

The Study assumes that transhipment can occur all-year-round; however, the application of lower shiploading productivity rates were made during the months of the year when higher wave movements are most likely to occur.

Figure 20: An example of silica sand being loaded from a barge to a bulk carrier using a grab crane

Transhipment has historically been used to load silica sand onto bulk carriers at the Cape Flattery Port by another silica sand operator.

14.3 Proposed Maritime Project Area

Metallica has identified a point on the Cape Flattery headland (Latitude 145.337405, Longitude -14.94949) that could be suitable for constructing a potential jetty and BLF for the Project.

The proposed BLF location is within two (2) nautical miles of suitable swing basins, potentially making offshore transfer operations possible (Figure 21).

Water depths within the identified anchorage area are approximately 20m. Further work is required to better understand the seafloor characteristics and determine the best method of securing bulk carriers. A survey of the port area water depths was undertaken in July 2021 and this data will identify specifications for the swing basins in addition to the depth of water at the likely location of the jetty.

14.4 Export Ship Sizes

Analyses of Q Ship data and Ports North's annual report indicated that in 2019, there were 50 ship visits to Cape Flattery, with approximately 2,500,000t of silica sand exported. The average shipments from the Cape Flattery were approximately 50,000t. The maximum ship length outlined in the Cape Flattery Port procedures manual was 195m. It is logical to assume that similar ship sizes could be the suitable for the proposed Project.

14.5 Required Offloading Infrastructure

The types of marine infrastructure that would likely be needed to support the Project's proposed jetty and BLF concept includes:

- A product stockpile pad
- A loading bin
- A conveyor from the loading bin to the BLF stacker
- A BLF pontoon.

If the BLF pontoon was designed to accommodate a barge at the 5-metre bathymetric contour depth, then silica sand product could be offloaded onto a moored barge via the BLF stacker and conveyor. The barge would than transhipment the silica sand product to a bulk carrier moored out in deeper water.

Figure 21: The proposed jetty and barge-loading facility (BLF) site on Cape Flattery's northern headland

14.6 Barge and Towage Vessels

Subject to prevailing weather conditions, barges could be guided to both sides of a bulk carrier via tugs. As a barge is emptied by the ship's crane grabs, it could be replaced by another barge.

Metallica recognises that these barge and towage vessel concepts and their combinations, need further review during future Project studies.

14.7 Transhipment Outcomes

After undertaking a desktop review of the Project, the following outcomes were identified:

1. It appears that offshore cargo operations using barges is feasible. However, there has been insufficient metocean information available to make concise recommendations on maritime infrastructure, cycle times and delays. Further accurate information needs to be located or metocean studies need to be undertaken.
2. An analysis of publicly available information indicated that current shipments from Cape Flattery were in 50,000-tonne parcels.
3. The barging options for using tugs was examined. The costs may be potentially further reduced by exploring other options, including using self-propelled barges.

Figure 21B: The proposed jetty and barge-loading facility (BLF) site on Cape Flattery's northern headland looking towards the shore

15 Shipping

The proposed maximum shipment size was 50,000 dwt, with the stockpile located at the processing plant when ship loading commences. It is expected that the ship's grab cranes will be used to load the bulk carrier.

A shipping agent will likely be engaged to manage the Project's ship scheduling and cargo documentation.

16 Personnel

Metallica intends to source employees from the local communities of Hope Vale and Cooktown. Where possible, Metallica will preferentially offer work opportunities to local Indigenous operators and/or suitably qualified contractors as part of Metallica's indigenous employment policy which is currently being developed.

Personnel with skills required to operate this type of mining equipment and processing are well represented within the Queensland mining industry personnel.

Metallica will likely operate and maintain the feeder and processing plant equipment but may opt to contract the transhipment operations, power-generating equipment and mining operations equipment, along with relevant personnel where needed.

Due to its location and format, the mine will most likely require the following roles and rosters until further confirmed:

» Mining staff, day shift only, 7-on/7-off

» FTE processing, port and ship-loading staff, both day and night shift, 7-on/7-off

» FTE maintenance staff, day and night shift, 7-on/7-off

» FTE administration and supervision staff, day and night shift, 7-on/7-off

» FTE camp staff, both day and night shift, 7-on/7-off.

16.1 Personnel Travel

Multiple ways for transporting the workforce in and out of the Project area will be considered in future studies. While using nearby infrastructure may be an option, at this stage, it is most likely that the workforce will fly-in/fly-out (FIFO) of the Project area by helicopter.

Should a helicopter for Cape Flattery be utilised, it will be based out of Cairns. A helipad would be built within the mine site area and with access to the mine camp and facilities.

17 Market and Pricing

Globally, silica sand is in a growth phase due to increasing demand from the construction sector, with both volume and value having increased worldwide. Sales of silica sand experienced a compound annual growth rate of approximately 8.7% in value terms from 2009 to 2016, with a market value of USD6.3 billion. This was due to its applications across a range of industries, including glass making as well as foundry casting, water filtration, chemicals and metals, along with the hydraulic fracturing process.

Accelerations in construction spending and manufacturing output worldwide are expected to drive growth in important silica-sand-consuming industries, including the glass, foundry and building products sectors. Significant growth is projected for the hydraulic fracturing market as horizontal drilling for shale oil and gas resources expands, largely in North America.

The Asia-Pacific region is expected to remain the largest regional consumer of industrial sand through 2025, supported by the dominant Chinese market. The country's container glass industry will drive further silica sand sales, supported by rising production of glass bottles, particularly in the alcoholic beverage sector including wine and beer.

In India, foundry activity has shown strong growth, driven by the production of sand moulds to manufacture metal castings. Indonesia will also register strong growth in silica sand sales through 2022, supported by rapid advances in the output of glass products and metal castings, combined with increased hydraulic fracturing activity.

Outside of the Asia-Pacific region, demand for silica sand in North America is forecast to rise at a faster annual pace than any other regional market. The US and Canada will lead regional growth, driven by expansion in the countries' respective hydraulic fracturing segments. Strength in US oilfield activity will boost demand for sand proppants, as will increases in the number of fracturing stages per well.

Consumption of silica sand in Western Europe was projected to see more modest annual gains through 2020, although such growth will mark a rebound from the declines registered during 2008 to 2015. Recoveries in building construction and manufacturing activity, including a turnaround in flat glass output, will stimulate renewed demand for industrial sand in the region (refer to Ceramic Industry website).

Table 8 shows the indicative silica pricing for the Project, based on benchmarking from other similar projects and Metallica's understanding of the market.

Table 8: Indicative Silica Sand Pricing (FOB)

Description	Low Price (AUD/T)	High Price (AUD/T)
Price per sales tonne (USD)	40.00	55.00
Price per sales tonne (AUD, assuming 0.78 Fx)	51.27	70.51

Figure 22 and Figure 23 show IMARC's view of the current and projected silica sand pricing for a high-grade product of 150-200 ppm Fe_2O_3 and a medium-grade product of 200-300 ppm Fe_2O_3. Based on these IMARC estimates, Metallica's benchmarking of the silica sand price in Table 7 may be considered conservative.

Metallica is undertaking further work to better understand the expected product pricing for each potential product and quality.

17.1 Silica Sand Markets

High-grade silica sand is a key raw material in the industrial development of the world, especially in the glass, metal casting and ceramics industries. High-grade silica sand contains a high portion of silica (over 99% SiO_2) and is used for applications other than construction aggregates. Unlike construction sands, which are used for their physical properties alone, high-grade silica sands are valued for a combination of chemical and physical properties.

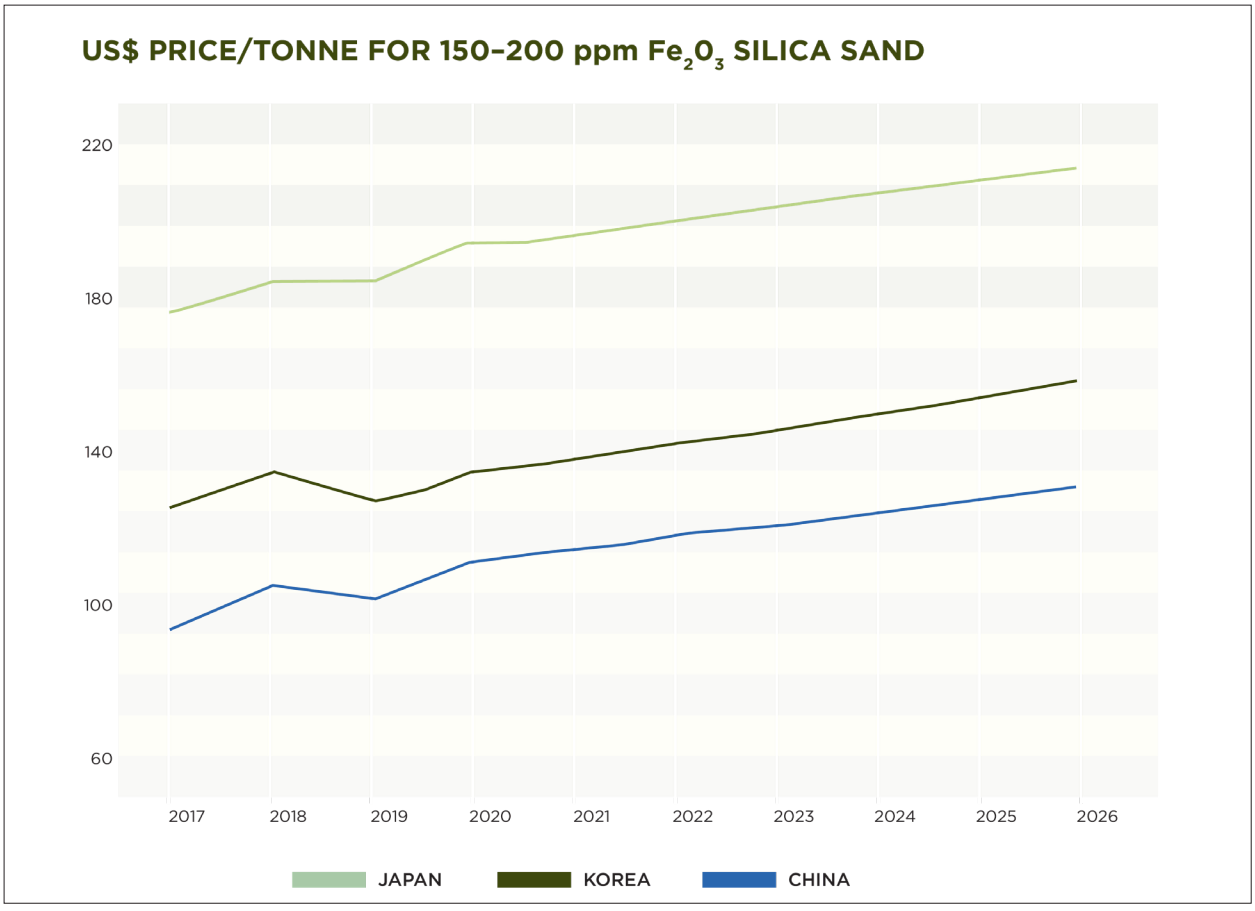


Figure 22: USD price/t for 150-200 ppm Fe_2O_3 silica sand

Source: PEC ASX Release: 30 March 2021 'Corporate Presentation'. From IMARC Group's report: 'Asia Pacific Silica Sand Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026', February 2021

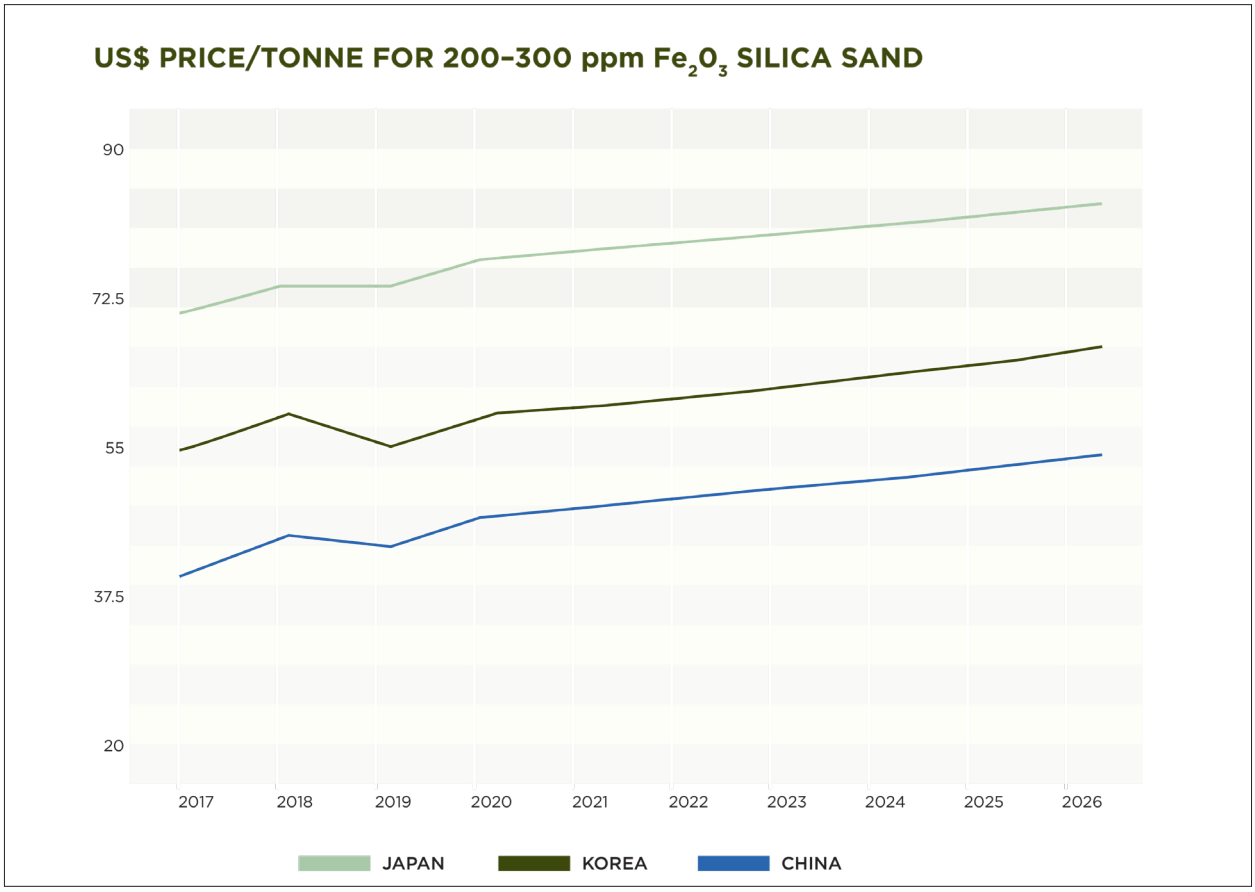


Figure 23: USD price/t for 200-300 ppm Fe_2O_3 silica sand

Source: PEC ASX Release: 30 March 2021 'Corporate Presentation'. From IMARC Group's report: 'Asia Pacific Silica Sand Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026', February 2021

Global consumption of industrial silica sand is expected to climb 3.2% pa through 2022. Asia Pacific growth is higher than global growth and is expected to be around 5% to 6% pa.

Ongoing economic and infrastructure development in the Asia Pacific region will drive further growth, as will hydraulic fracturing activity in North America. Frac sand will be used increasingly in Asia Pacific in future years but it is unlikely to match the use in North America (Figure 24).

Source: Diatreme Limited's Galalar Project Scoping Study, 9 September 2019

Figure 24: Trends in global silica sand market volume and value

17.2 Glassmaking

Silica sand is the primary component of all types of standard and specialty glass. It provides the essential SiO_2 component of glass formulation; its chemical purity is the primary determinant of colour, clarity and strength in glass.

Industrial sand is used to produce flat glass for building and automotive use, container glass for foods and beverages, and tableware. In its pulverised form, ground silica is required in the production of fibreglass insulation and for reinforcing glass fibres. Specialty glass applications include test tubes and other scientific tools, incandescent and fluorescent lamps.

Over the past 20 years, growth in glass demand has exceeded GDP growth and continues to grow at circa 5% per annum.

The Asia Pacific region has dominated the glassmaking industry for some time and Australia is uniquely positioned to supply this increasing demand.

Metallica continues to monitor the various markets for silica sand for glass making and the foundry industry via market specialists and contacts within the industry.

17.2.1 Glassmaking Silica Sand Pricing

The metallurgy test report has delivered a likely product with that has very good SiO_2 levels as well as Fe_2O_3 within a range of 100 ppm and 170 ppm. Based on market price data disclosed by other silica sand companies listed on the ASX, Metallica has estimated a selling price of between US$40 and US$55 free-on-board (FOB) may be achievable.

17.3 Growth Sectors

The sectors that are expected to require growing demand for silica sand will include:

- Increase in vehicle production
- Rebound in building construction activity
- Rising demand for energy efficient windows
- Strong demand for fabricated flat glass products
- Use of glass in solar thermal panels and photovoltaic modules
- Expanding applications of glass in healthcare and electronics sectors
- Demand for glass products with solar control and impact resistance features.

This growth is reflected in the global demand forecast provided in Figure 12 above.

Product requirements will be based on SiO_2 content, other impurities and particle size distribution. There are many and varied requirements generally dependent on the final product.

17.4 Potential North Queensland Solar Panel Manufacturing

Metallica is also in discussion with companies who may establish glass manufacturing in North Queensland that will support solar panel manufacturing. While at a very formative stage, the potential for product to be transported to a Queensland destination would be a positive outcome for Metallica and importantly, for North Queensland.

17.5 Market Risk

A key challenge for industrial minerals projects is not meeting market specifications. The silica sand market has specifications for parameters such as purity (e.g. SiO_2 content) in addition to tight specifications for trace elements such as iron (Fe), titanium (Ti) and chromium (Cr) in the glass industry.

Failure to meet specifications may result in selling the products at discounted rates, or indeed not finding markets at all. Other risks for silica sand may include particle size distribution and physical strength (crush resistance) as in the case of proppants for the oil industry.

Industrial minerals are generally considered to be bulk commodities and are therefore susceptible to distance to market and transport costs; therefore, logistics may pose a risk to supplying markets.

The potential for product to be transported to a Queensland destination would be a positive outcome for Metallica and importantly, for North Queensland.

18 Indicative Financial Parameters

Metallica has reviewed the scoping studies and PFSs of other silica sand developers such as Diatreme Resources Limited (ASX: DRX) and Perpetual Resources Limited (ASX: PEC) and has been provided with a limited range of expenditure estimates from industry consultants to form the basis of the following preliminary capital and operating cost estimates.

Importantly, Metallica does not suggest that the following estimates are based on any forecast production targets. These estimates are very wide-ranging and are subject to further review once further studies are completed in the future.

18.1 Key Assumptions

The financial parameters presented in this Study have been based on the following key assumptions:

Currency	Australian dollars Sales contracts in Asia for silica sand are invariably based USD and an AUD/USD exchange rate of 0.78 has been applied.
Production	The PFS will outline the parameters of a steady state production from future expected Ore Reserves over the life of the mine. For the purposes of this Study and for determining a dollar-per-tonne operating cost rate, an assumed sales tonnage based on other silica sand projects in Australia was applied for calculation purposes.
Construction capital costs	Based on estimates ±35% from various companies with experience in mine cost estimation and internal benchmarking.
Site operating costs	Based on Metallica's review of other silica sand projects' production forecasts in Australia, a potential range of operating costs could be between AUD29/t and AUD34/t. Operating costs were based on benchmarking, first principles and current rates for equipment. A site production operating contingency of 10% has been applied to all production costs.
Sales revenue	Based on readily available market data and in particular, the published PFS of PEC, which used a sales price of USD50 for a similar product to what Metallica has disclosed in Section 10.3, it is estimated that the price for a Cape Flattery product could be between US$40 and US$55 per wet metric tonne FOB, depending on the final product type, product quality, contract terms and quantity (refer Section 18.2).
Environmental bond	Capital costs are construction capital costs only and do not include any bonds at this stage.
CAPEX contingency	20%
State royalty	AUD0.90/t shipped

18.2 Cost Estimation

Metallica again reiterates that there is a low level of geological confidence associated with Inferred mineral resources and there is no certainty that further exploration work will result in the determination of Indicated mineral resources or that any potential production targets can be realised.

Accordingly, capital and operating costs for the Study were estimated based on currently available information from other ASX-listed silica sand developers and industry standards for similar mining operations. Metallica makes no assertion that these costs are based on planned production for its Project.

18.2.1 Potential Capital Expenditure (CAPEX)

Indicative CAPEX costs for the Project were estimated using benchmarking of similar projects, as well as a scoping level design and equipment selection in conjunction with consultants' advice on the input costs for similar projects.

The total CAPEX for constructing the Project was estimated to cost between AUD56m and AUD75m (Table 9). This range was primarily dictated by the final design of both the BLF (including the required length of the jetty), the infrastructure needed for transhipping to larger ships and the final design of the processing plant. There was also an additional cost contingency applied for each CAPEX item in the High CAPEX estimate.

The key CAPEX items included the mining and pre-stripping capital, processing plant, BLF, marine, and surface infrastructure (i.e. power, water, roads, camp, workshop and tailings). To this total, an overall contingency was applied. A cost breakdown is provided in Table 9.

Table 9 Potential Project CAPEX

CAPEX item	Low CAPEX (AUD)	High CAPEX (AUD)
Civils, roads and clearing	700,000	1,000,000
Mining (majority of equipment leased)	800,000	1,500,000
Conveyor and slurry pipeline – sand transport	1,500,000	2,000,000
Processing plant	16,000,000	25,000,000
Barge Loading Facility (BLF)	22,000,000	26,000,000
Marine	1,000,000	1,500,000
Camp and other surface infrastructure	4,500,000	5,500,000
Contingency (20%)	9,500,000	12,500,000
TOTAL POTENTIAL CAPEX	**56,000,000**	**75,000,000**

CAPEX items included in Table 9 were:

» Civils, roads and clearing:
  - Earthworks and civil
  - Access and haul roads (where required)
  - Stockpile pad
  - Loading dock

» Processing plant:
  - Laboratory
  - Spiral-based processing plant with a dewatering module
  - Inclusion of attrition and WHIMS in the High CAPEX estimate

» Marine:
  - Ship anchors
  - Cyclone moorings
  - Workboat, fenders, grabs

» Camp and other surface infrastructure:
  - Office block
  - Freight of construction items to site
  - Maintenance workshop
  - Camp facilities
  - Generators and solar panels
  - Helipad for transport
  - Site communications and infrastructure
  - Fuel storage and pipeline
  - Power
  - Water supply
  - Waste water treatment.

Items excluded from the CAPEX estimates in Table 9 were:

» Insurance

» Environmental or jetty bonds

» Inventory

» Permitting and exploration costs.

Other items that may impact the CAPEX estimates include:

» Exchange rate variances (where items are sourced in currencies other than AUD)

» Inflation up to the point when binding contracts are entered into

» Final Project design

» Additional information gathered from further exploration work

» Final production rate and throughput rates of the components.

18.2.2 Potential Operating Expenditure (OPEX)

Indicative OPEX costs for the Project were estimated using benchmarking of similar projects, as well as a scoping level design and equipment selection in conjunction with consultants' advice on the input costs.

The total OPEX for the Project was estimated between AUD29/t and AUD33/t (Table 10), based on benchmarking similar silica sand development projects in Australia. This range was primarily dictated by the final design of the processing plant. There was also an additional cost contingency applied for each OPEX item in the High OPEX estimate.

The key OPEX items included the mining and pre-stripping and rehabilitation, processing plant, BLF, transhipment and marine, and other site costs including royalties, camp, transport and utilities. To this total, an overall contingency was applied. A cost breakdown is provided in Table 10.

Table 10 Potential Project OPEX

OPEX item	Low OPEX (AUD/T)	High OPEX (AUD/T)
Clearing, mining and rehabilitation	5.50	6.00
Processing plant and BLF	4.50	5.50
Transhipment and marine	7.50	8.50
Royalties, camp and other site infrastructure	9.00	10.00
Contingency (10%)	2.50	3.00
TOTAL POTENTIAL OPEX PER TONNE	**29.00**	**33.00**

OPEX items included in Table 10 were:

» Clearing/grubbing, mining and rehabilitation:
  - Dozer
  - FEL
  - Secondary wheel loader
  - Water truck
  - Light vehicles and service truck
  - Mine equipment lease costs

» Processing plant:
  - Laboratory
  - Spiral-based processing plant with a dewatering module
  - Inclusion of attrition and WHIMS in the High OPEX estimate

» Transhipment and marine:
  - Transhipment contractor
  - Stevedores and load master
  - Ports North harbour, tonnage and security dues
  - Pilotage

» Royalties, camp and other site infrastructure:
  - Administration costs, including management, environment, grade control (etc.)
  - Queensland Government royalty
  - Traditional landowner royalty
  - Communications/IT
  - Camp
  - Workshop costs
  - Power and water supply
  - Exploration and pre-production drilling
  - Barge freight
  - Air freight – transport of personnel via helicopter.

Items excluded from the OPEX estimates in Table 10 were:

» Insurance

» Head office costs.

Other items that may impact the OPEX estimates include:

» Production and shipping rates

» Additional information gathered from further exploration work

» Exchange rate variances (where items are sourced in currencies other than AUD)

» Inflation up to the point when binding contracts are entered into.

Estimated royalties and based on the existing rate for the State Royalty (which is reviewed every 5 years), an allowance for an expected negotiated Native Title party royalty based on production tonnes and a further industry standard agent's fee for marketing and sales of exported products.

A Queensland State Royalty at a rate of AUD0.90/t of product was included as a cash cost. Due to the early stage of the Project, a mining agreement has not yet been finalised with the Traditional Landowners or freehold landowners.

18.2.3 Sensitivity Analysis

As part of the economic assessment of the Project, a series of sensitivity analyses were undertaken to assess the effect of fluctuations in metal pricing, capital cost and operating costs. Each of these variables were tested in ranges of +/- 30% to assess the effect on the economics of the Project. The results indicated the Project is most sensitive to sand pricing.

19 Future Work Program

Metallica will shortly be undertaking the following technical studies that will be key inputs for an upcoming PFS:

» Expected upgrade of resources to Measured and additional Indicated Resources based on 98 holes that were drilled in July/August 2021 (refer to ASX Release: 12 August 2021 "98 Hole Drill Program Completed at Cape Flattery Silica")

» Further metallurgical testing on the samples extracted during the July/August 2021 drilling program

» Planning and design of logistics infrastructure, namely the wholly owned jetty

» Mine plan and mining schedule (subject to results of July/August 2021 drilling program.

19.1 Potential Development Timeframe

Metallica recognises that the Project is still at a very early stage of development. With the next phase of drilling having been completed in July/August 2021, further progress will depend on the completion and knowledge gained from this program.

However, the combination of the following attributes outlined in this Study provide confidence in the continued development of the Project:

» A current Mineral Resource of 38.3 Mt reported in accordance with the JORC Code 2012

» Additional Exploration Target potential in the EPM, including in the western areas of 10 Mt to 60 Mt[2]

» Positive metallurgical testing of the samples taken from the December 2020 drilling program

» Potential to construct infrastructure that is wholly owned to facilitate transhipping operations

» Third party media outlining growing demand for silica sand worldwide.

As disclosed to the market, the MLA has now been lodged (refer to ASX Release: 15 June 2021 'Mining Lease Application lodge for Cape Flattery Silica'). A pre-lodgement meeting will also be held with the DES in relation to the EA process.

PFS preparation has begun. Subject to the timing of the ML and EA being granted, Metallica plans to complete a Definitive Feasibility Study (DFS) in 2022.

[2]The potential quality and grade of the Cape Flattery Silica Sand Project's exploration target deposits are conceptual in nature. There is insufficient information at this time to define a mineral resource in these areas and there is no certainty that further exploration will result in the determination of a mineral resource in these areas.

CAPE FLATTERY SILICA

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