



Lucky Bay Garnet (Balline)

Supporting Document

Works Approval

Part V *Environmental Protection Act 1986*



A Resource Development
Group Company

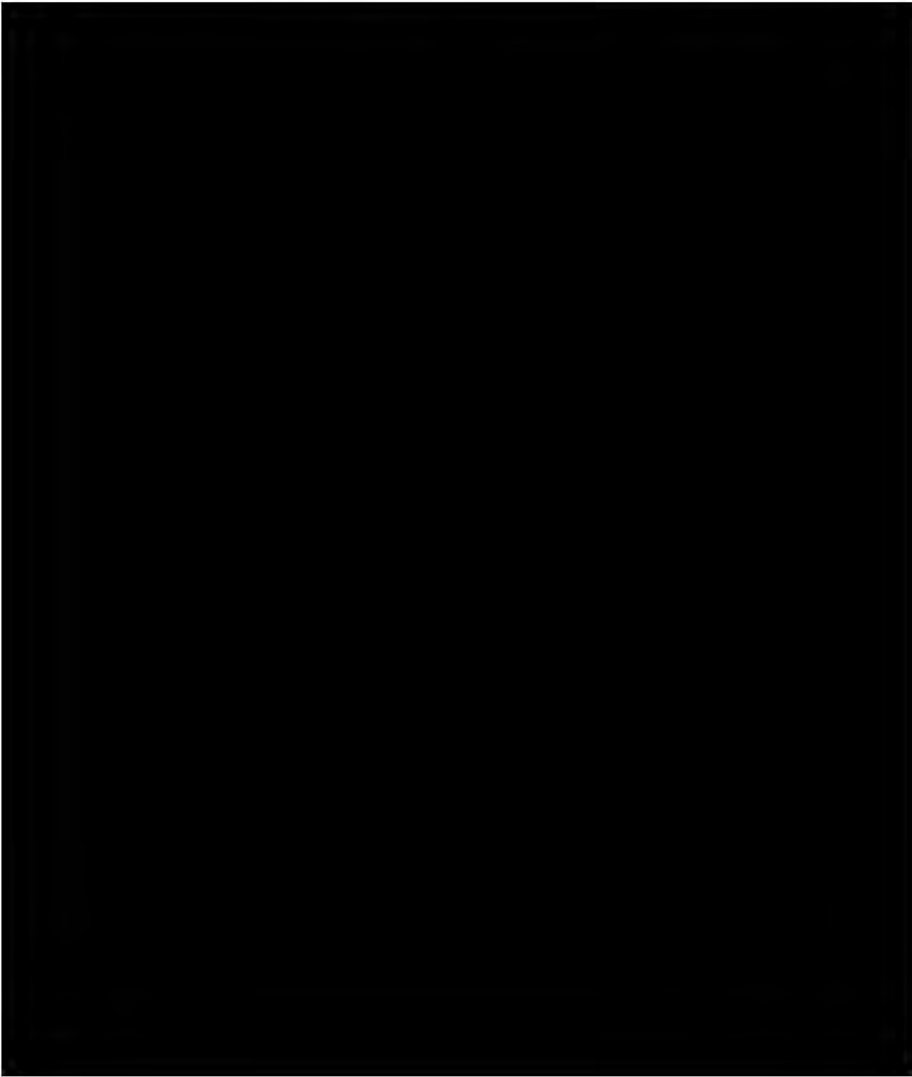


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Abbreviations

Term	Definition
AAQ NEPM	National Environmental Protection (Ambient Air Quality) Measure
ASIC	Australian Securities & Investments Commission
CPA	Central Processing Area
DEMIRS	Department of Energy, Mining, Industry Regulation and Safety
DMP	Dust Management Plan
DSP	Dry Separation Plant
DWER	Department of Water and Environmental Regulation
ECR	Environmental Compliance Report
EPA	Environmental Protection Authority
FEL	Front End Loader
HDPE	High Density Polyethylene
HMC	Heavy Mineral Concentrate
LOM	Life of Mine
MCP	Mine Closure Plan
MP	Mine Proposal
MSP	Mineral Separation Plant
MUP	Mining Unit Plant
NORM	Naturally Occurring Radioactive Material
RCWA	Radiological Council of WA
RED	Rare Earth Drum
REMS	Rare Earth Magnetic Separators
RFI	Request for Further Information
RL	Relative Level
RMP	Radiation Management Plan
SBP	Screening & Bagging Plant
TARP	Trigger-Action-Response-Plan
WCP	Wet Concentrator Plant

1. Introduction

1.1 Background and Purpose

Australian Garnet Pty Ltd (**the Applicant**) operates the Lucky Bay Garnet Project (**the Premises**), which is a heavy mineral sands deposit located at the southern margin of the Carnarvon Basin, approximately 40 km south of Kalbarri and 540 km north of Perth, in the Shire of Northampton. The location of the Premises is illustrated in Attachment 2A.

The Premises includes an above groundwater progressive open pit mine, with a mobile Mining Unit Plant (**MUP**) that feeds to a Central Processing Area (**CPA**) containing a Wet Concentrator Plant (**WCP**), dryer and Dry Separation Plant (**DSP**) (also known as Mineral Separation Plant or **MSP**), Screening and Bagging Plant (**SBP**) and associated plant infrastructure and utilities to produce a heavy mineral concentrate, including garnet and ilmenite final products.

The Premises is regulated by the Department of Water and Environmental Regulation (**DWER**) under Part V of the *Environmental Protection Act 1986* (**EP Act**) and the Applicant holds Works Approval W6214/2019/1 for construction, commissioning and time limited operations. The Applicant has completed the construction and environmental commissioning phases and is currently in time-limited operations under the works approval pending assessment of a Licence Application submitted to DWER in May 2024.

The purpose of this new Works Approval Application includes the following main objectives:

- Implementation of infrastructure upgrades in the CPA to increase production efficiency.
- Implementation of an on-site putrescible landfill site.
- Transformation of the Sand Tailings Storage Area from a temporary feature into a permanent landform.
- Provision of a dried clay slimes tailings storage area to facilitate their transfer off-site for beneficial agricultural use.

This document, together with the completed DWER Application Form constitutes the Works Approval Application pursuant to Part V of the EP Act. Table 1 provides an overview of the application form supporting attachments and the relevant sections of this document that address each item.

Table 1: Information Relevant to the Application

Section in Application	Where Information is presented
Attachment 1A: Proof of occupier status	Attachment 1A
Attachment 1B: ASIC company extract	Attachment 1B
Attachment 1C: Authorisation to act as a representative of the occupier	Not applicable
Attachment 2: Premises map/s	Attachment 2A: Premises Map Attachment 2B: Premises Layout Map Attachment 2C: Siting and Location Plan Attachment 2D: Monitoring Location Plan
Attachment 3A: Environmental commissioning plan	Attachment 3A
Attachment 3B: Proposed activities	Section 2
Attachment 3C: Map of area proposed to be cleared (only applicable if clearing is proposed)	Not applicable
Attachment 3D: Additional information for clearing assessment	Not applicable

Section in Application	Where Information is presented
Attachment 4: Marine surveys (only applicable if marine surveys included in application)	Not applicable
Attachment 5: Other approvals and consultation documentation	Section 5 and Attachment 5: Stakeholder Consultation Register
Attachment 6A: Emissions and discharges	Section 3
Attachment 7: Siting and location	Section 4
Attachment 8: Additional information submitted	Attachment 8A: Detailed process description Attachment 8B: Dry plant upgrade drawings Attachment 8C: Dry plant process flow diagrams Attachment 8D: Erosion study Attachment 8E: Sand Tailings Stockpile Surface Water Assessment Attachment 8F: Groundwater Assessment Attachment 8G: Environmental Noise Assessment
Attachment 9: Category-specific checklist(s)	Not applicable
Attachment 10: Proposed calculation fee	Attachment 10
Attachment 11: Request for exemption from publication	Not applicable

1.2 Prescribed Activities

The Premises comprises of the following Prescribed Premises categories and throughput production/design capacities, as listed in Schedule 1 of the Environmental Protection Regulations 1987. The current prescribed activities and those that are proposed as part of this application, are outlined in Table 2.

Table 2: Prescribed Premises Category

Category	Description	Premises production capacity
Current activities approved under W6214/2019/1		
Category 8: Mineral sands mining or processing	Premises on which mineral sands ore is mined, screened, separated, or otherwise processed.	8,400,000 tonnes per year
Activities proposed in this application		
Category 62: Solid waste facility	Premises on which waste is stored or sorted, pending final disposal or re-use.	20,000 tonnes per year
Category 89: Putrescible landfill site	Premises (other than clean fill premises) on which waste of a type permitted for disposal for this category of prescribed premises, in accordance with the Landfill Waste Classification and Waste Definitions 1996, is accepted for burial.	5,000 tonnes per year

1.3 Applicant and Premises Details

The Premises is owned by Australian Garnet Pty Ltd (as per Certificates of Title in Attachment 1A). The Applicant's details are shown in Table 3 below, and the Australian Securities & Investments Commission (ASIC) company extract is contained in Attachment 1B.

Table 3: Applicant Details

Detail	Response
Applicant	Australian Garnet Pty Ltd
ACN	646 741 157
Registered business address	Level 3, 14 Walters Drive, Osborne Park WA 6017
Authorised representative	Marcus Brown, Registered Manager
Key Contact	Tenaha Wilson, Principal Environment Approvals – Lithium & Garnet Email - tenaha.wilson@mrl.com.au; Mobile – 0428 273 946

The Premises is situated within tenements M70/1280, general purpose lease tenements G 70/253, L 70/215, L 70/134, L 70/178 within Lot 1 on Diagram 91564, Lot 300 on Plan 60565 and Lot 1431 on Plan 251608, as provided in Table 4, with a Premises Map provided in Attachment 2A. Tenements G 70/269, G 70/271, L 70/239, L 70/170 and M 70/1387 are additional tenure as part of this application and have been included in the updated Premises Map.

Table 4: Premises Details

Aspect	Details
Premises name	Lucky Bay Garnet Project
Site description	Tenements M 70/1280, G 70/253, L 70/215, L 70/134, L 70/239, L 70/178, G 70/271, G 70/269, L 70/170, M 70/1387 & L 70/167 within Lot 1 on Diagram 91564, Lot 300 on Plan 60565 and Lot 1431 on Plan 251608.
Site address	George Grey Drive, YALLABATHARRA WA 6535
Occupier status	Registered proprietor
Local Government Authority area	Shire of Northampton

1.4 Approvals Background

Approvals under the EP Act and *Mining Act 1978 (Mining Act)* were granted for the Premises in 2010 to the previous occupier – Altura Mining Pty Ltd (**Altura**) – through its subsidiary company Australian Garnet Pty Ltd (**Australian Garnet**). The project did not immediately proceed due to market conditions.

In 2014, the Applicant acquired the Australian Garnet portfolio from Altura and completed an updated feasibility study, which identified optimisations to the design, extent and operating parameters of the original project. On 23 October 2015, a Mining Proposal (**MP**) (Reg ID: 55347) was approved to further develop garnet mining on tenement M 70/1280 on the Menari deposit and to conduct associated processing activities on G 70/253 with supporting transport infrastructure on L 70/134. A proposal to develop a windfarm was also approved on 16 March 2016 on tenement L 70/178 under (Reg ID: 58732).

On 30 June 2021, an additional MP (Reg. ID 97057) was approved by the Department of Energy, Mining, Industry Regulation and Safety (**DEMIRS**) under the Statutory Guidelines for Mining Proposals (DMIRS, 2020). This MP was approved to include a Site Access Road to connect to George Grey Drive through tenement L 70/215, traversing L 70/178 from the southeast before entering tenements M 70/1280 and G 70/253.

On 27 September 2022, a new MP (Reg. ID 102866) was approved to amalgamate and replace previously approved proposals (Reg IDs: 55347, 58732 and 97057) and further develop the operation, including pit optimisation, increased mining of ore in the Menari deposit, inclusion of additional tenure and updated activity area descriptions, additional Key and Other mine activities, and area increases of previously approved activities including plant site layout, TSF and waste dump locations.

Other approvals relevant to the Premises are detailed in Table 5.

Table 5: Environmental Legislative Requirements

Legislation	Environmental factor regulated / affected	Approval and or status
Environmental Protection Act 1986 - Pt IV (WA)	Flora and Vegetation Landforms Subterranean Fauna Terrestrial Environmental Quality Terrestrial Fauna Inland Waters Air Quality Social Surroundings Human Health	The original proposal was referred to the Environmental Protection Authority (EPA) by a third party in early September 2021 and a referral submission under Section 38 of the EP Act was provided to the EPA on 26 November 2021. A decision was made by the EPA on 7 July 2022 to not assess the proposal.
Environmental Protection Act 1986 - Pt V (WA)	Water resources Emissions and discharges	Works Approval W6214/2019/1 – Phase 1 and 2 of Menari Pit on M 70/1280, G 70/253 and L 70/134. Currently classified as prescribed premises Category 8: Mineral Sand Mining and Processing.
		Application for a licence (L9440/2024/1) submitted to DWER on 8 May 2024 for prescribed premises Category 8. The objectives of the Licence Application are: <ul style="list-style-type: none"> • Transfer the relevant conditions of the Works Approval (W6214/2019/1) over to a Licence. • Identify the mechanisms under Part V and provide details of the process improvements and upgrade that are being proposed and/or have been previously assessed under Works Approval (W6214/2019/1). • Address additional information requested by DWER during previous approval processes. • Address the items and outstanding information from DWER compliance inspection in September 2023.
Environmental Protection Act 1986 – Section 51E (WA)	Clearing of native vegetation	<ul style="list-style-type: none"> • Clearing Permit CPS 3891/4 approved on 7 September 2021 for 90 ha within northern half of M 70/1280 and L 70/134. • CPS 9057/1 approved on 13 July 2021 for 71 ha within the southern half of M 70/1280 and tenements G 70/253, L 70/167, L 70/178 and L 70/215. • CPS 8358/3 approved on 15 Feb 2024 (and amended on 11 August 2022) for 5.24 ha on L 70/178 and G 70/253. An additional amendment will be sought for clearing of ~0.58 ha. • A clearing permit may be required for mining Menari North areas in M 70/1387 in the future and will be sought, as required.
Rights in Water and Irrigation Act 1914 (WA)	Water resources	Approved Groundwater Licence 170860(6) for 2.015 GL per year sufficient for Premises demands supported by Groundwater Operating Strategy. An application for an increase in groundwater allocation has been made to DWER, and is currently under assessment.

Legislation	Environmental factor regulated / affected	Approval and or status
Mining Act 1978 (WA)	Mining Proposal and Closure Plan	<p>The following MPs and Mine Closure Plans (MCPs) have been approved for the Premises:</p> <ul style="list-style-type: none"> • REG ID 55347 (MP/MCP) approved on 23 October 2015. • REG ID 58732 approved on 16 March 2016 for the windfarm on tenement L 70/178. • REG ID 97057 approved on 30 June 2021. • REG ID 102866 approved on 27 September 2022 to amalgamate and replace previously approved MPs (Reg ID: 55347, 58732 and 97057). <p>An updated MP is in preparation and will seek approval for additional activities and variations.</p> <p>An updated MCP is also in preparation, which will accompany the MP and detail how disturbance will be rehabilitated as required by tenement conditions set under the Mining Act.</p>
Dangerous Goods Safety Act 2004 (WA)	Dangerous Goods (DG)/ Storage and Licencing	A DG licence was issued 14 July 2022 and expires 14 July 2027.
Radiation Safety Act 1975 (WA) (RS Act)	Management of radiological risk	<p>Risks to human health and environment are jointly managed by DEMIRS and the Radiological Council of WA (RCWA).</p> <p>As the Premises involves material that contains Naturally Occurring Radioactive Material (NORM) above threshold concentrations, the material is regulated under the RS Act. A Radiation Management Plan (RMP) for the Premises has been assessed and approved by DEMIRS.</p> <p>The RMP outlines the management measures required to ensure worker and public radiation exposures are managed in accordance with the legislation.</p>
Health Act 1911 (WA)	Public health and site emissions	Permit to Install and operate apparatus for the treatment of sewage granted.
Local Government Act 2011 (WA)	Health approval	Wastewater disposal application submitted and approved by Shire of Northampton.

1.4.1 Part V - Works Approval and Licence History

For context, a background in the history of Part V approvals under the EP Act for the Premises is provided below in Table 6.

Table 6: Works Approval History

Date	Reference #	Summary of changes
26/08/2010	W4709/2010/1	Original Works Approval granted to Altura Mining.
23/08/2013	W4709/2010/1	Amendment to extend duration by three years.
29/04/2019	W6214/2019/1	Works Approval granted to Australian Garnet to replace expired approval.
14/07/2020	W6214/2019/1	Amendment to relocate infrastructure.

Date	Reference #	Summary of changes
29/04/2021	W6214/2019/1	Transfer of legal entity and update of registered business address. No name change to the occupier required.
20/04/2022	W6214/2019/1	Amendment to extend duration by 12 months and to include: <ul style="list-style-type: none"> • Premises legal description updated to include Mining Tenements L70/215 and L70/178. • Update to Schedule 1: Maps to show correct site equipment and infrastructure layout, and monitoring locations. • Update to Table 1 (items 4 and 5) to show correct site equipment and infrastructure requirements. • Update to Table 2 to show correct references to Schedule 1: Maps. • Update to Table 3 to show correct emission point height.
26/04/2023	W6214/2019/1	Amendment to: <ul style="list-style-type: none"> • Extend the expiry date from 29 April 2023 to 29 April 2024. • Extend time limited operations duration from 90 days to 270 days to allow for continued operation of the facility until the granting of a licence.
14/12/2023	W6214/2019/1	Amendment for the extension of the expiry date from 29 April 2024 to 29 April 2025 to allow for continued operation of the Premises until the granting of a licence.

An Environmental Compliance Report (ECR) required by Condition 2 of Works Approval W6214/2019/1 was submitted to DWER on 24 October 2022. A compliance inspection was subsequently undertaken of the Premises by DWER on 12 September 2023, including a detailed review of all the information collated following the submission of the ECR and a request for further information (RFI) provided by DWER on 14 September 2023. Monthly updates communicating the progress of the information requests have been sent to DWER, commencing 21 September 2023.

The Applicant submitted a licence application to DWER in May 2023. Revisions were made to the application during assessment in response to RFIs from DWER. As a result, the application was determined to be significantly different from that advertised, and was therefore withdrawn by the Applicant on 6 November 2023. On 8 May 2024 a new licence application was submitted to DWER. The new licence application included information in response to the RFIs received by DWER following the works approval compliance, site inspection and previous licence application processes. The new licence application (L9440/2024/1) has been validated by DWER and is currently under assessment.

2. Current and Proposed Activities

A summary of the current activities carried out at the Premises are provided below and shown on the schematic in Figure 1. A detailed description of the activities is provided in provided in Attachment 8A.

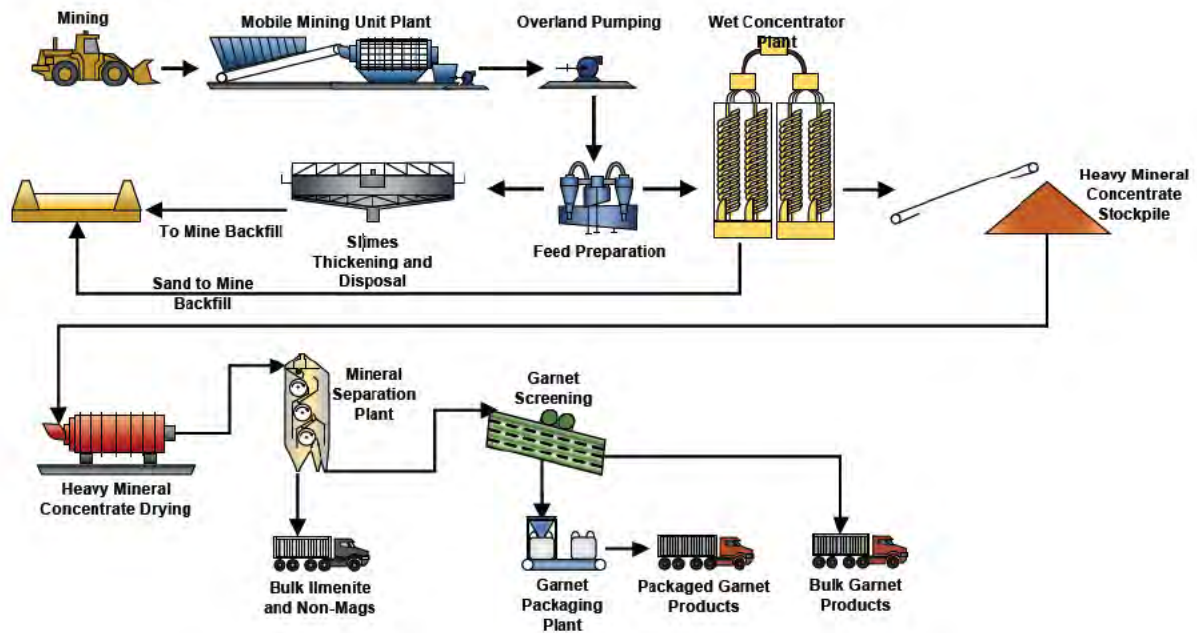


Figure 1: Dry Plant Upgrade Schematics

Since the Premises was constructed and commenced time limited operations (TLO) under Works Approval W6214/2019/1, the Applicant has planned to make several improvements to the infrastructure and processes. These improvements are designed to improve product quality and will not result in significant changes to emissions or discharges or result in the design capacity of the processing plant or the assessed production capacity of the Premises being exceeded.

A list of infrastructure and equipment upgrades within the Premises and relevant to this Works Approval Application is provided in 7. Details of the requested changes are provided further in Section 2.1.

Table 7: Infrastructure and Equipment

#	Premises infrastructure and equipment	Relevant categories	Requirement	Location on Site Layout Plan (Attachment 2B)
1	Dry Separation Plant (DSP), including rotary dryer and baghouses	8	<ul style="list-style-type: none"> • Production capacity: 47 tph. • Separation plant upgrades with pulse jet fabric filter (baghouse) and minimum 3 m high stack. 	Mineral Separation Plant
2	Putrescible landfill site	89	<ul style="list-style-type: none"> • Constructed and operated in accordance with the <i>Environmental Protection (Rural Landfill) Regulations 2002</i>. • Construction: <ul style="list-style-type: none"> ○ Landfill trenches, approximately 236 m long, 20 m wide and 2 m deep (maximum). ○ Fence around the boundary of the landfill site, which is an effective barrier to cattle, horses and other stock. ○ Landfill trenches located at least: <ul style="list-style-type: none"> – 35 m from landfill site boundary fence. – 100 m from any surface water body. – 3 m above highest level of the water table aquifer at the Premises. ○ Bunds to divert stormwater away from landfill trenches. ○ Firebreak of at least 3 m around boundary of landfill site. • Operation: <ul style="list-style-type: none"> ○ Signage will be placed at the entry to the landfill describing accepted waste streams. ○ No more than one cell will be in operation at any one time. ○ Tipping area restricted to excavated cells. ○ Waste will be covered at least weekly with a dense, inert and incombustible material. ○ Windblown waste will be collected weekly and returned to the landfill site. ○ Landfill fencing, stormwater diversion bunds and firebreaks will be maintained. ○ No burning of waste. 	Landfill Site
3	Permanent sand tailings storage area	8	<ul style="list-style-type: none"> • Dimensions: 250 m x 806 m x 25 m. • 12 cyclone stackers are utilised to deposit sand tailings. • Solar drying ponds: <ul style="list-style-type: none"> ○ Constructed with overburden material or similar and track rolled with a dozer, with angle of repose for the outer pond wall being at least 1:2 (V:H). ○ Maximum cell wall height 2.5 m above natural ground level. 	Sand tailings storage area
4	Slimes transfer storage area	62	<ul style="list-style-type: none"> • 4.2 ha storage area. • Bunded, compacted hardstand pad (ramp over bund for vehicle access). 	Slimes transfer storage area

2.1 Premises Upgrades and Improvements

2.1.1 Dry Separation Plant Upgrades

The DSP includes a heavy mineral concentrate (HMC) drier, magnetic separation and screening, and non-magnetic and magnetic (Ilmenite) stockpiling.

Stockpiled HMC from the Wet Concentrator Plant (WCP) is further processed at the DSP, which comprises a bin feeding a rotary dryer, followed by Rare Earth Magnetic Separators (**REMS**). An overview of the major process steps associated with the MSP are described below.

The HMC is fed into the drier feed hopper by conveyor. The dryer's diesel-fired burner and airflow are controlled to automatically maintain a constant discharge temperature regardless of variations in feed rate. The exhaust from the dryer is drawn through a baghouse with reverse pulse filter cleaning by an induced draft fan. The gas is separated from the dust by the fabric bags and is vented to atmosphere via a 2.8 m high muffled stack, with the dust discharged and collected in drums or kibbles and returned to the WCP. Particulate emissions from the baghouse are expected to be less than 50 mg/m³ (target concentration below 20 mg/m³).

The facility includes a second baghouse, after the primary baghouse. Both the primary and secondary baghouses in the DSP have an overall function to reduce emissions, with the primary baghouse reducing emissions from the diesel fired rotary dryer, whilst the secondary baghouse reduces dust emissions produced from operation of the DSP.

The dried material is discharged on to the HMC trash screen that removes oversize material larger than 2 mm to protect the magnets and screens. The screen undersize is transported to the cooler by a bucket elevator. The dried HMC is delivered to the magnet circuit via the primary screen feed elevator to separate the HMC into garnet, ilmenite and non-magnetic material. The primary screen first separates the fine and coarse HMC via a 300 µm screen, removing the coarse HMC and increasing the magnetic separation efficiency. The magnetic separation uses two triple stage Rare Earth Drum (**RED**) magnets to produce the following materials:

- Strong Magnetics (Mags 1) and Magnetics (Mags 2) – the ilmenite product is pneumatically conveyed and stored on-site in the ilmenite storage shed.
- Non-Magnetics (Non-Mags) – these are diluted with water and run through a spiral to further separate the heavy and light minerals. Heavy mineral is partially dewatered through a dewatering cyclone and stockpiled adjacent to the MSP. Lighter minerals (silica sands) are pumped back to the WCP to the tailings hopper.
- Para-magnetics (Mids) – these are conveyed to the bulk garnet storage silos adjacent to the SBP.

The MSP non-magnetics consist of non-garnet and non-magnetic heavy minerals such as leucoxene, rutile, zircon. These are conveyed to a storage stockpile adjacent to the MSP to be reclaimed and loaded on to trucks for sale to a third-party processor.

The magnetics stream consists of predominantly ilmenite. The ilmenite is pneumatically conveyed to the covered storage shed adjacent to the MSP to be stockpiled. The ilmenite is reclaimed by a front-end loader (FEL) and loaded into trucks for sale to a third-party processor. The paramagnetic product (garnet concentrate) is stored in separate silos in preparation for screening.

The Applicant is proposing to install additional dry plant and equipment in the form of screens, magnets and air tables into the DSP to further upgrade process efficiency and product quality. The following upgrades are proposed:

- Fines magnet recirculation to re-treat HMC to reduce magnetics and non-magnetics.
- Installation of a new coarse magnet to process the coarse primary screen fraction across the RED magnet, to improve product quality.
- Introduction of a coarse magnet bypass to direct the primary screen coarse magnet underflow material direct to the secondary coarse screen circuit, to improve product quality.
- Installation of REDs on the final product underflow screens prior to the final product silos, to improve product quality.

- Installation of air tables on final product streams prior to the silos, to improve product quality.

To support the additional equipment an additional baghouse and substation are being installed.

Updated general arrangement and elevation drawings, and process flow diagrams of the DSP are provided in Attachment 8B and 8C, respectively. Images of the proposed upgrades are shown in Figure 2 below.

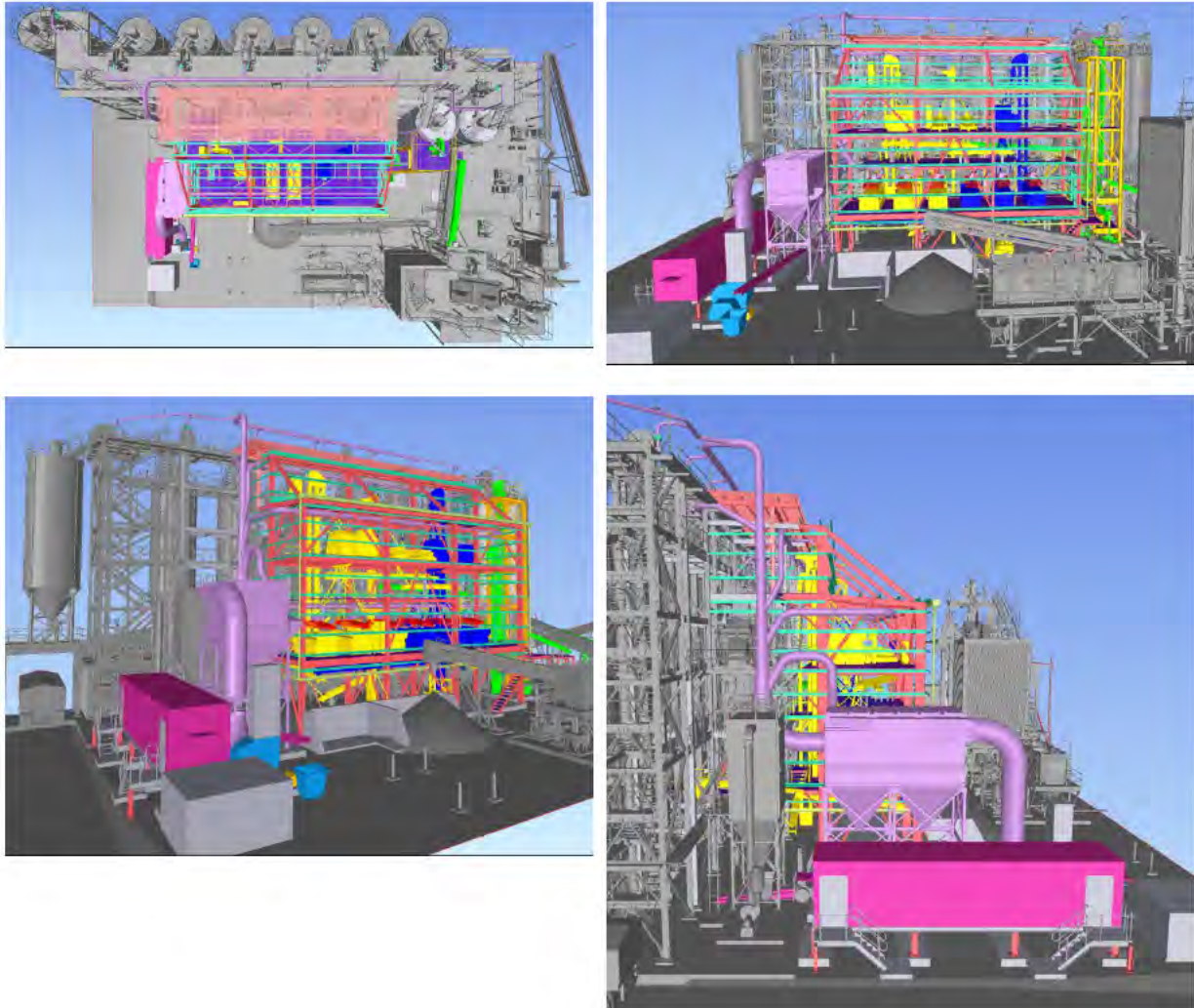


Figure 2: Dry Plant Upgrade Schematics

Environmental commissioning of the DSP upgrades will be carried out in accordance with the Commissioning Plan (Attachment 3A). The environmental performance of the baghouse will be monitored during the commissioning period to ensure that particulate emissions are being adequately controlled. On completion of commissioning and submission of the Environmental Commissioning Report to DWER, the upgraded DSP will continue to operate under TLO provisions of the works approval until the licence is amended to reflect the upgraded infrastructure and equipment.

2.1.2 Landfill Site

During a DWER site inspection in October 2023, it was noted that waste was being disposed of in an old gravel pit. At the time of the inspection, inspectors observed waste such as plastics, treated wood, mattresses, cardboard and paper in the waste disposal area. DWER requested that all waste generated within the Premises be removed from the site to an appropriately licensed facility.

The waste disposed of in the old gravel pit is currently being removed off-site. However, the Applicant has identified the need for an on-site putrescible landfill site to deal with the following waste materials generated at the Premises:

- Wood, pallets.
- Cardboard.
- Calico bags, plastics, conveyor belts.
- Steel and general construction waste.
- Concrete materials.

The waste types that will be disposed of at the landfill site are described in Table 8 as per the Landfill Waste Classification and Waste Definitions 1996 (as amended 2019) (the 'Landfill Definitions'). Domestic type general waste (e.g., from kitchen and office areas) generated on-site will continue to be removed off-site by a licensed waste contractor to a licensed waste disposal facility.

Table 8: Waste Acceptance (Attachment 6B)

Waste type	Rate at which waste is received	Acceptance specification	Monitoring
Clean fill	Combined total of less than 5,000 tonnes per year	N/A	Volume of waste discharged into landfill recorded
Inert Waste Type 1		Waste containing visible asbestos or asbestos containing material (ACM) will not be disposed to this proposed landfill facility.	
Inert Waste Type 2		Tyres, rubber and plastic	
Putrescible Waste		Must meet the acceptance criteria for Class II landfills, as specified in the Landfill Definitions.	

The landfill site will be designed with tapered trenches, each with a maximum size of approximately 236 m x 20 m. Each cell will have a single ramp entry point and only one cell will be operational at any one time to a maximum depth of 2 m. Overburden material excavated to create the cells will be used as landfill cover material.

The landfill site will be constructed and operated in accordance with the *Environmental Protection (Rural Landfill) Regulations 2002*.

Once the first landfill trench is opened and the ECR has been submitted to DWER, use of the landfill site will commence under TLO provisions of the works approval until the licence is amended.

2.1.3 Permanent Sand Tailings Storage Area

The off-mine path Sand Tailings Storage Area is used for the management of clean sand tailings pumped from the WCP. Stockpiling occurs in the designated area to store and dry the slurried sand processed through the WCP. The clean sand tailings generated from the WCP had initially been stockpiled in the current landform pending enough space in the Mine Pit for progressive direct backfilling.

As per the current works approval specification, the sand tailings are required to be stockpiled at a height of no more than 10 m above ground level (25 m relative level [RL]). As noted following the DWER site inspection in September 2023, portions of the sand tailings stockpile exceeded this height.

The Applicant has been actively addressing this issue through a schedule of actions, referred to as a Tailings Height Reduction Program, which aims to progressively reduce the stockpile to height 25 m RL. As part of the height reduction works, re-profiling and rehabilitation of the stockpile is occurring. This will improve dust management and provide the opportunity for trialling a range of rehabilitation methods.

When sand tail stacking at the stockpile is completed, an estimated 2.6 Mm³ of clean sand tails will have been deposited. The Applicant has considered the logistics, costs and environmental implications (e.g., dust, noise, fuel usage and greenhouse gas emissions) of progressively relocating the sands to the mining void and concluded that a better overall outcome can be achieved by rehabilitating the sand tails stockpile in-situ and leaving it as a stable and permanent landform.

To this end, and to support proposed changes to the planned updated submission of the Mining Proposal and Mine Closure Plan in 2024, the Applicant has commissioned a landform stability assessment (Landloch, 2024) and assessments of implications to groundwater (Darkwater, 2024) and surface water (BG&E Resources, 2024). The landform stability assessment concluded that the deposited material can be used to achieve a permanent landform that has acceptable long-term erosion rates provided a suitable rehabilitation regime is implemented.

The proposed permanent landform is illustrated in Attachment 2B. The stability and wind and erosion study are contained in Attachment 8D.

The surface water assessment (BG&E Resources, 2024) concluded that the proposed conversion of the Sand Tailings Storage Area to a permanent landform does not pose a risk to the surface water environment in relation to modification of catchments, erosion potential and water quality. The assessment confirmed that the high infiltration rates reported for the catchment indicate that surface flow will generally infiltrate or evaporate within the catchment, so flood risk is negligible.

A desktop groundwater assessment (Darkwater, 2024) was performed to assess potential impacts to groundwater levels and quality resulting from the proposed modifications to the sand tailings stockpile. The review of existing works suggests that a permanent ex-pit stockpile will not significantly change any impacts to groundwater levels or quality when compared to the previously approved depositional scenario.

The report did identify the potential for water quality changes from the mixing of leachate from the sand tails stockpile (leachate testing reported high pH, low salinity, low concentrations of trace metals) with ground water (circumneutral pH, saline and low concentrations of trace metals). The issue was raised as a knowledge gap and beyond the capabilities of the authors, however the potential for any material changes in water quality through a mixing mechanism is considered low.

Assuming a worst-case scenario that leachate quality is representative of the long-term seepage through the tailings stockpile, the mixing of these waters would likely raise the pH of the groundwater. Generally, metals are less soluble at high pH, hence the raising of the pH will not result in an increase in metal availability. A notable exception is aluminium (Al), which could potentially be leached from the aquifer under a sustained elevated pH scenario.

The livestock drinking water guideline is high for Al at 5mg/L and Al is not known to cause widespread environmental concerns. Water samples have been taken in April 2023 and March 2024 from production bores immediately adjoining the sand tails stockpile and to its south (~ 300 m & 900 m away) and north (~ 600 m, 1400 m and 2500 m away). Results from the water samples analyses show Al at all sites and all occasions below 0.05 mg/L.

The surface water and groundwater assessments are contained in Attachments 8E and 8F, respectively.

The permanent landform will retain the perimeter bunds and drains to capture runoff and minimise washouts. The clean sand tailings will continue to be stabilised, which includes the application of a polymer binder to limit dust generation and will be rehabilitated in accordance with the updated MCP, currently in preparation. The northern end of the Sand Tailings Storage Area (also referred to as Area 1) has been pushed down to meet its permissible height under Works Approval W6214/2019, re-shaped and contoured, and has had topsoil and seed applied.

The Sand Tailings Storage Area will continue to be used under the TLO provisions of the existing works approval until the new licence, currently being assessed, is granted.

Solar Drying Ponds

The original works approval application envisaged a series of solar drying ponds being constructed off mine path before being relocated to the Sand Tailings Storage Area and Mine Pit. However, Works Approval W6214/2019/1 specified the construction of only one pond to the north of the Premises.

After construction of the northern Solar Drying Pond, it was identified that additional storage was required to manage the volume of slimes generated by the processing plant. Consequently, four additional ponds were constructed in the southern portion of the Sand Tailings Storage Area. The retrospective approval for the operation of these ponds has been sought by the Applicant in the current Licence Application.

In addition to these ponds, the Applicant is also proposing to construct six additional ponds on top of the permanent Sand Tailings Storage Area. Consistent with the other solar drying pond structure at the Premises, these ponds will be constructed as a series of single paddock-style dam structures with outer walls at least 1:2 (V:H). The pond floors and walls will be constructed from overburden material or similar. The height of the outer walls will be approximately 1 m to a maximum of 2.5 m high. The pond depths will be approximately 2 m to facilitate easy excavation and optimise drying conditions.

A sloped base (as specified for Solar Drying Ponds in the works approval) is not required for effective operation of the ponds, nor does it provide any operational advantage or environmental risk mitigation. The floor of the ponds will, therefore, be constructed with flat bases.

Slimes will enter the ponds via a pipeline from the WCP and the fine sediment allowed to settle to the base of the ponds. Equipment is available to decant supernatant water from the top surface for return either to the existing Process Water Pond or Turkey Nest for reuse. No lining of the ponds is required owing to the inert and self-sealing nature of the slimes.

Dried slimes will be excavated from the ponds when sufficiently dry and space is available in the Mine Pit. The ponds will be used sequentially, with ponds being returned to operational use following excavation of the slimes.

The clay content of the ponds will be removed at the end of service (i.e., there will be no material amounts of clay left in the cells). The bund wall walls will be pushed in and capped with sand tailings. The encapsulated ponds will then be rehabilitated as part of the Sand Tailings Storage Area, in accordance with the MCP. This will include, as a minimum, the application of topsoil and ripping, to facilitate revegetation.

2.1.4 Slimes Transfer Storage Area

The Applicant has identified that dried slimes potentially have beneficial properties in use as an agricultural lime and is progressing discussions with potential off-take partners. To facilitate the transfer of slimes for beneficial use, including in potential land trials, a storage and loading area is required. The proposed location of the Clay Slime Exports Storage Area is illustrated on the Premises Layout Plan, in Attachment 2B.

The storage area will comprise an approximate 4.2 ha bunded pad, constructed from overburden material or similar and track rolled with a dozer.

A portion of the dried slimes excavated from the Solar Drying Ponds will be taken to the storage area and stockpiled. Prior to transfer, the stockpiled slimes will be broken-up (crushed/flayed) on a campaign basis. Subject to obtaining the required additional approvals to export clay slimes material from the operation, the crushed material will be loaded onto trucks by FEL and taken off-site.

After the storage pad has been constructed and ECR submitted to DWER, the Applicant will commence storage of dried clay slimes in the area under the TLO provisions of the works approval. This is subject to the necessary approvals and agreements being in place for the transfer and re-use of the material off-site.

3. Emissions, Discharges and Waste (Attachment 6A)

The key emissions and discharges and associated actual or likely pathways, during construction and TLO of the proposed works are detailed in Table 9. The table includes the proposed control measures to assist in controlling these emissions, where necessary.

Table 9: Emissions and Discharges

Emission or discharge type	Source of emission or discharge	Volume and frequency	Potential pathways and impacts	Proposed controls	Location on Site Plan (Attachment 8B and 8C)
Particulates (PM₁₀: dust)	DSP: <ul style="list-style-type: none"> Construction of plant upgrades. Upgraded product separation 	Intermittent, fugitive. Continuous (during operation, from baghouse)	Air/windborne pathway causing: <ul style="list-style-type: none"> Impacts on health and amenity at sensitive receptors. Dust deposition on sensitive vegetation. Visual amenity impacts from public roads (e.g., George Gray Drive). 	<ul style="list-style-type: none"> Construction: <ul style="list-style-type: none"> There is sufficient separation between the CPA and off-site receptors (>2.5 km). The proposed works are short-term and will occur during day-time hours only. Abatement of emissions baghouses with reverse pulse filter cleaning. Emissions discharged to air via minimum 3 m high stacks. 	Mineral Separation Plant
	Tailings storage stockpile: <ul style="list-style-type: none"> Wet tailings are pumped to the Sand Tailings Storage Area from the WCP. Tailings rapidly dry and become susceptible to wind erosion. Stockpiling of dried slimes for transfer. 	Intermittent, fugitive.		<ul style="list-style-type: none"> Tailings are initially wet preventing dust emissions when deposited. Application of clay slimes from the thickener. Routine application to the sand tailings storage area and slimes stockpiles of a binding polymer. Exposed surfaces stabilised using various surface treatments – including a polymer emulsion. Re-contouring of stockpiles to minimise wind erosion. Applying topsoil and seeding. Daily forecast and work planning to consider wind speed and wind direction: <ul style="list-style-type: none"> High wind speeds will lead to a review of site activities to ensure dust controls are operational. Watering of exposed tailings to prevent drying out and emissions (water cart available on-site). Implement the Dust Management Plan. 	Sand Tailings Storage Area

Emission or discharge type	Source of emission or discharge	Volume and frequency	Potential pathways and impacts	Proposed controls	Location on Site Plan (Attachment 8B and 8C)
Noise	Noise from mobile and fixed plant operation, including DSP upgrades and slime transfer crusher.	Continuous (processing); intermittent (mining, mobile plant).	Air/windborne pathway causing impacts on amenity at sensitive receptors.	<ul style="list-style-type: none"> • Construction: <ul style="list-style-type: none"> ○ There is sufficient separation between CPA and off-site receptors (>2.5 km). ○ The proposed works are short-term and will occur during day-time hours only. • Motors located in enclosed housings with sound-absorbing materials; mufflers used to manage exhaust noise; and baffles/louvres used to control fan noise. • New equipment selected to be the quietest reasonably available. • Equipment is maintained using a preventative maintenance program following the manufacturer’s recommendations. • Mobile equipment equipped with broadband reversing alarms. • Mobile equipment equipped with flashing lights (to replace alarms) after dusk when headlights are in use. • Daily forecast and work planning to consider wind speed and wind direction. • Implementation of the Noise Management Plan. 	Mineral Separation Plant, Sand Tailings Storage Area and Slimes Transfer Storage Area
Tailings and tailings water	Seepage and overtopping from Solar Drying Ponds.	Continuous; low volume (seepage); Infrequent, unplanned event (overtopping).	Direct discharge to ground and seepage to groundwater causing impacts to ground and groundwater quality and vegetation health.	<ul style="list-style-type: none"> • Base of Solar Drying Ponds in Sand Tailings Storage Area effectively sealed by clay fines settling on base and walls of dams. • Material has natural water retention properties (i.e., >40% clay), minimising seepage. • Fill level of Solar Drying Ponds in Sand Tailings Storage Area at least 1 m below the top of the embankments. • Excess supernatant water can be pumped to Process Water Pond and Turkey Nest. • Placement of production bores around Sand Tailings Storage Area to extract local groundwater. • Implementation of Groundwater Operating Strategy associated with abstraction licence issued under RIWI Act (Attachment 5B). • Groundwater monitoring bore network and groundwater monitoring 	Solar Drying Pond and Sand Tailings Storage Area

Emission or discharge type	Source of emission or discharge	Volume and frequency	Potential pathways and impacts	Proposed controls	Location on Site Plan (Attachment 8B and 8C)
				program.	
Odour	Disposal of waste at landfill site	Fugitive; intermittent	Air/windborne pathway causing impacts on amenity at sensitive receptors.	<ul style="list-style-type: none"> Waste will be compacted and covered at least weekly. 	Landfill site
Litter		Fugitive; intermittent	Air/windborne pathway causing impacts on amenity at sensitive receptors.	<ul style="list-style-type: none"> The landfill site will be fenced and secured, when not in use. No more than one cell will be in operation at any one time. Waste will be covered at least weekly. Windblown waste will be collected weekly and returned to the landfill site. 	
Pest, pathogen and disease vectors		Fugitive; intermittent	Attraction and harbouring of pests causing nuisance and transmission of disease.	<ul style="list-style-type: none"> Landfill site will be inspected regularly for vermin and fauna. The landfill site will be fenced and secured, when not in use. Waste will be covered at least weekly. 	
Leachate		Intermittent, low volume	Seepage to land and groundwater causing contamination.	<ul style="list-style-type: none"> Surface water diverted around the landfill trenches to prevent infiltration into the waste mass. Waste will be covered at least weekly. 	
Contaminated stormwater		Intermittent, low volume	Overland flow causing contamination.	<ul style="list-style-type: none"> Closed trenches will be graded to promote run-off. 	
Fire (smoke; fire-fighting water)		Fugitive; rare	Air/windborne pathway causing impacts on amenity and health at sensitive receptors. Seepage to land and groundwater causing contamination.	<ul style="list-style-type: none"> Firebreak of at least 3 m around boundary of landfill site. No burning of waste permitted. 	

3.1 Emissions Monitoring

3.1.1 Dust Monitoring

A dust monitoring program has been implemented at the Premises, with the monitoring data linked to a Trigger-Action-Response-Plan (TARP) which is defined in the Dust Management Plan (DMP) for the Premises.

The monitoring includes three Kunak AIR Pro dust monitors, which were installed in February 2024, providing continuous real-time PM₁₀ monitoring as detailed in Table 10. The monitoring locations are shown in Attachment 2D and were selected with consideration to up-wind and downwind source-receptor alignment and prevailing wind directions.

Table 10: Dust monitoring program

Parameter	Monitoring location (Attachment 2E)	Unit	Frequency	Averaging period	Sampling method
Particles as PM ₁₀	Monitor (K-A3 Envanalytics) 1 (M1)	µg/m ³	Continuous	24-hour	Nephelometers sited in accordance with AS3580.1.1:2016
	Monitor (K-A3 Envanalytics) 2 (M2)				
Wind speed	Monitor (K-A3 Envanalytics) 3 (M3)	m/s	Continuous	N/A	N/A
Wind direction		Degrees			

The DMP includes provision for a preliminary TARP framework to be established. Three metrics are proposed to be used initially, each with a two-tiered trigger based on the potential risk of an off-site dust impact. The preliminary TARP is described in Table 11.

Once the ambient monitoring described in Table 10 has been in place for six months, the TARP will be revised with quantitative trigger values to support the implementation of responsive dust management actions (i.e. additional dust controls and actions in response to alert levels). Once the long-term Level 3 TARP has been set, it will be reviewed on an annual basis and revised if required.

In the interim, an arbitrary instantaneous value has been set for the dust monitors of 200 µg/m³, which will trigger a response to investigate and, where appropriate, take additional management action. The instantaneous value is arbitrarily set as an early warning for the potential to exceed the 24-hour average standard of 50 µg/m³ set in the National Environmental Protection (Ambient Air Quality) Measure (AAQ NEPM) at the sensitive receptors. The interim level may be revised once an improved understanding of ambient dust levels is obtained from the dust monitoring program.

Table 11: Preliminary TARP

Trigger Level		Visual Observation of Dust	Wind Conditions	PM ₁₀
Level 1 Low Risk of Off-site Impact	Trigger	Visible dust observed from activity.	Wind arc away from sensitive receptors: <ul style="list-style-type: none"> • R1 • R2 • R3 Poor dispersion conditions present or forecast.	N/A
	Action	Check controls in place. If not in place apply appropriate controls outlined in Appendix 2 [of the DMP]		

Trigger Level		Visual Observation of Dust	Wind Conditions	PM ₁₀
Level 2 Medium Risk of Off-site Impact	Trigger	Visible dust observed from activity across site. Visible dust observed leaving activity area(s).	Wind arc toward sensitive receptor: <ul style="list-style-type: none"> • R1 • R2 • R3 Poor dispersion conditions present or forecast.	N/A
	Action	Check controls in place. If not in place apply appropriate controls outlined in Appendix 2 [of the DMP]. Consider need for further action.		
Level 3 (Interim) ^{***} High Risk of Offsite Impact	Trigger	Visibility on George Gray Drive materially impacted. Community complaint received that dust is causing a nuisance or impacting amenity ^{**}	NA	Dust levels at monitor exceeding instantaneous PM ₁₀ level (200 ug/m ³) attributable to site activities [*]
	Action	Review real time dust monitoring data and check visibility at George Gray Drive. If not in place apply appropriate controls outlined in Appendix 2 [of the DMP]. Reduce the level of activity in the affected areas. Divert activities away from the areas where dust is originating. Cease activity until control is applied.		

* Check for localised and transient events and check downwind dust monitors to ensure exceedance isn't due to a broad regional event. Two consecutive 10 minute average exceedances of 200 ug/m³, attributable to Premise activities, initiates requirement for further actions.

** Complaint determined to be genuine (follow up with resident).

*** Long Term Level 3 Trigger to be developed following analysis of minimum 6 months of data

Since the implementation of the TARP, the Level 3 interim PM₁₀ trigger has been activated three times. On two occasions, the triggers were activated due to rain events. The latest trigger was activated at the southernmost monitor (M1) and is currently being investigated.

3.1.2 Noise Assessment and Monitoring

The current licence application is supported by an Environmental Noise Assessment Report (Herring Storer Acoustics, 2024a) and Noise Management Plan (Australian Garnet, 2024). The acoustic modelling contained in the assessment shows that the Premises will comply with the weekday assigned levels (as defined in the Environmental Protection [Noise] Regulations 1997) at the noise sensitive premises (Location Plan in Attachment 2C).

As part of a review of the noise impacts of the Premises, Herring Storer Acoustics was commissioned to measure the environmental noise impacts of the current operations (Herring Storer Acoustics, 2024a). The measurements were carried out in July 2023 and considered representative of the processing and mining operations, post commissioning of the Premises. The findings of the July 2023 measurements confirmed that compliance with the assigned levels contained in the Environmental Protection (Noise) Regulations 1997 was achieved for all time periods.

A separate noise assessment (Herring Storer Acoustics, 2024b) has been completed for the proposed dry plant upgrades using the calibrated acoustic model prepared for the previous assessments. Assessment of noise levels for the addition of the proposed dry plant upgrades to the existing processing operations shows that compliance is achieved for all operating conditions for night periods, which is the most stringent in terms of compliance for the processing plant. The updated noise assessment is contained in Attachment 8G.

Based on the assessment of the proposed upgrades, no changes to the current Noise Management Plan (Australian Garnet, 2024) for the Premises are required.

Two continuous Class 1 sound level meters were installed in March 2024 at permanent locations to the east and west of the Premises (Eastern Noise Monitor and Western Noise Monitor, respectively, as shown on Attachment 2D).

The noise monitors are set to record continuous noise levels, in accordance with the noise descriptors specified in Regulation 8 of the Environmental Protection (Noise) Regulations 1997. The noise monitoring units are connected to the mobile communications network, with real time data available.

The data will be used to provide a long-term reference for the historical comparison of noise levels over time and will be used to:

- Assess the effectiveness of the Noise Management Plan for the Premises;
- Provide early warning of high risk conditions;
- Assist in the investigation of complaints; and
- Demonstrate compliance with the assigned levels in the Noise Regulations.

3.1.3 Groundwater Monitoring

Changes in groundwater level (i.e., mounding) and quality due to mining and processing activities (e.g., storage of tailings) are checked through the groundwater monitoring program implemented at the Premises.

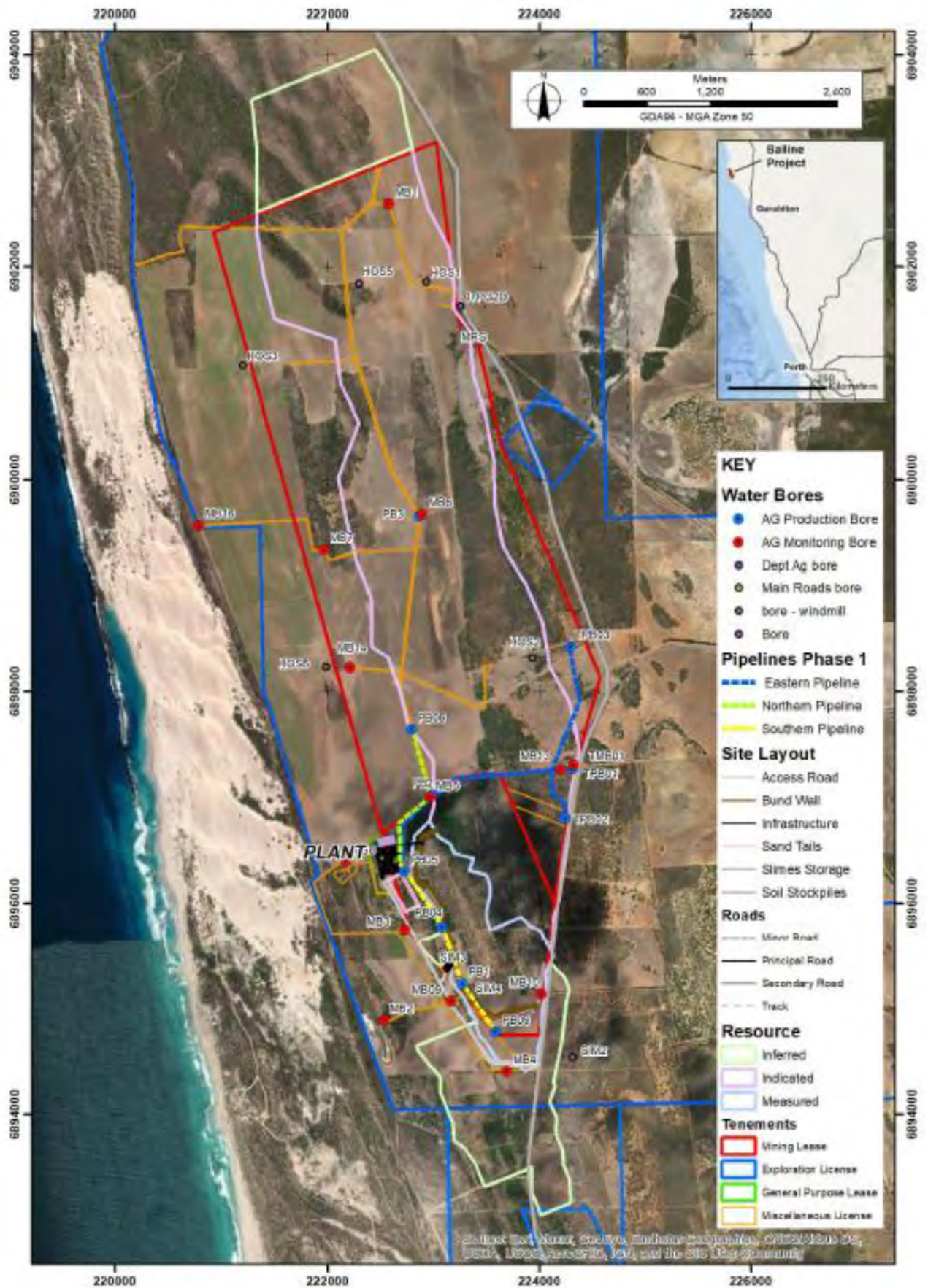
The groundwater monitoring program is described in Table 12 and is carried out following established procedures and work instructions (provided to DWER through the Licence Application). The groundwater monitoring locations are shown in Figure 3.

Table 12: Groundwater monitoring

Monitoring point reference	Parameter	Units	Limit	Averaging period	Frequency
PB1, PB2 PB4, PB5	Standing water level (SWL)	m AHD	1 mbgl	Spot sample	Monthly
MB2, MB3, MB4, MB5, MB8, MB9, MB10; MB12; MB13	pH	-	-		
	Electrical conductivity @ 25°C	µS/cm			
	Redox potential	mV			
	Major ions: bicarbonate, calcium, chloride, magnesium, potassium, sodium, sulfate, total dissolved solids	mg/L			Annually
	Metals and metalloids: aluminium, arsenic, chromium (as CrVI and total), cobalt, copper, iron, mercury, nickel, selenium, thallium, uranium, zinc				

Monthly results for standing water levels, which have been collected since January 2020, show no material variations over time or between seasons.

In addition to the groundwater monitoring, annual groundwater dependent vegetation monitoring is carried out at the Premises. The most recent monitoring, completed on 21 May 2024, confirmed that vegetation condition at the Premises has responded as expected to seasonal climatic conditions and there is no indication that ground water abstraction is impacting the monitoring sites (Botany Lens, 2024).



4. Stakeholder Engagement

The Applicant recognises the importance of keeping surrounding residents, businesses, landowners, decision-making authorities and interested groups fully informed about the Premises. Table 13 summarises the stakeholders identified for the Premises and their key interests associated with the project. A summary of stakeholder activity is included as Attachment 5. Where the operations exist on private property, a Land Agreement has been established with the relevant landowners.

Table 13: Key stakeholders

Stakeholder sector	Organisation	Interest
State Government Departments	Department of Planning, Lands and Heritage (DPLH) Minister of Aboriginal Affairs	Indigenous and Native Title requirements. Heritage, cultural, ethnographic and archaeological sites. Registered Heritage site will not be impacted. Lucky Bay FS1, FS2 and scattered artefacts (Aboriginal heritage places) will not be impacted. Other heritage site – Balline Isolated Artefacts (Place ID 29013) – will not be impacted.
	DEMIRS Mine Safety Inspectorate	Compliance with Mining Act and tenement conditions. Conformance to MCP and MP. Rehabilitation standards and closure criteria. Payment of Mining Rehabilitation Fund (MRF) contributions. Protection of mine worker health and safety during suspensions, decommissioning and rehabilitation. Protection of public safety during suspensions and after closure. Maintaining records of closed mine workings for safety of future mining operations.
	DWER	Part IV (EP Act) Environmental Impact Assessments. Part V (EP Act) Works Approval and Licence. Provision of licences to take and abstract water. Licences to construct a bore. Groundwater quality and quantity.
	Department of Health (DoH)	Environmental health, building and planning compliance.
	Department of Fire and Emergency Services (DFES)	Fire breaks. Provision of emergency services.
	Department of Biodiversity, Conservation and Attractions (DBCAs)	Administers <i>Biodiversity Conservation Act 2016 (BC Act)</i> . Flora, fauna and habitat conservation. Priority listed species. Baseline surveys and licences to take flora and fauna. Administers the Lucky Bay Camping Ground
	Nearest Landowners: 1.2 km 2.3 km Lucky Bay Campground: 2.1 km	Land Access Agreements. Contract opportunities. Groundwater supply impacts. Noise and other emission related impacts.
	Main Roads Western Australia (MRWA)	Use of and modifications to public roads i.e., George Grey Drive
	Western Power	Permit for install and operate Apparatus for the Treatment of Sewage.

Local Government Authorities	Shire of Northampton	Use of public roads and infrastructure. Permits for building, wastewater and other shire approvals. Fire control and firefighting capability.
Indigenous Groups	Traditional Owners Hutt River WC00/1; and Nanda People WC00/13	Project lies on freehold land, so Native Title is extinguished. Registered Heritage Site will not be impacted. Lucky Bay FS1, FS2 and scattered artefacts (Aboriginal heritage places) will not be impacted. Other heritage site – Balline Isolated Artefacts (Place ID 29013) – will not be impacted. Planned development in the Lucky Bay area.
Workforce	Australian Garnet Workforce	Maintain an engaged, satisfied and productive workforce. Preservation of benefits.

5. Location and Siting (Attachment 7)

5.1 Premises Location

The Premises is in the Mid-West region of WA, adjacent to the coast and north of Hutt River, a prominent feature of the locality. The road between Northampton and Kalbarri – George Grey Drive – runs along the eastern edge of the Premises.

The local area has been extensively cleared for agriculture; however, there are large tracts of uncleared land to the north, east and south of the Premises, some of which are vested within conservation areas (e.g. Kalbarri National Park to the north and Utcha Well Nature Reserve to the south).

No specified ecosystems or areas of high conservation value have been identified in proximity that may be directly impacted from the Premises. There are no naturally occurring surface water bodies or surface expressions of groundwater in the immediate area, predominantly due to the high infiltration rates associated with the sand and sandy soils present throughout the Premises (typical rate of infiltration 12-13 mm/hr [URS, 2010]).

5.2 Residential and Sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 14 and the sensitive receptor locations are shown on the Siting and Location Plan (Attachment 2C).

Table 14: Residential and sensitive receptors

Human receptors	Distance and direction from Premises boundary
Residential premises	Three private residences on rural properties: <ul style="list-style-type: none"> • 2276 George Grey Drive (Residential), 1 km east from the Premises boundary and 2.5 km from the CPA (R1). • 2040 George Grey Drive (Garnet International Resources), which is 1.8 km from the Premises and 3.5 km from the CPA. • Hose Road (Residential) 3 km and 4.5 km northeast of the Premises and from the CPA respectively (R3).
Community premises	DBCA managed beach holiday and camping site known as 'Lucky Bay Campground' is located on crown land approximately 2.5 km south-west of the CPA (R2).
Commercial businesses	GMA Garnet mine is located approximately 5 km south of the Premises.

5.3 Environmentally Sensitive Receptors

The potential environmental receptors that emissions and discharges from the Premises may impact are described in Table 15 and shown on the Siting and Location Plan (Attachment 2C).

Table 15: Environmentally sensitive receptors

Environmental receptors	Description	Distance and direction from Premises boundary
Important Wetlands	Hutt Lagoon System	1.3 km south
Environmentally Sensitive Areas	Kalbarri National Park	~15 km north
	Utcha Well Nature Reserve (Non-ESA)	~1.3 km south
Threatened Ecological Communities	N/A	>3 km

Environmental receptors	Description	Distance and direction from Premises boundary
Threatened and/or priority flora	<p>Six Priority taxa were recorded within the 2021 flora survey area (Onshore Environmental, 2022a): <i>Anthocercis intricata</i> (Priority 3), <i>Bossiaea calcicole</i> (Priority 3), <i>Melaleuca huttensis</i> (Priority 3), <i>Ptilotus alexandri</i> (Priority 2), <i>Stenanthemum divaricatum</i> (Priority 3) and <i>Frankenia confusa</i> (Priority 4).</p> <p>Of the six Priority taxa recorded, two Priority taxon (<i>Frankenia confusa</i> and <i>Melaleuca huttensis</i>) were identified within the Premises boundary. However, none of these species exist within the operational areas.</p>	Known to occur within and outside the Premises boundary.
Threatened and/or priority fauna	One Priority 3 species (<i>Lerista humphriesi</i>) under the BC Act has been recorded within the Premises boundary (Onshore Environmental, 2022b).	Known to occur within and outside the Premises boundary.
Aboriginal and other heritage sites	<p>Aboriginal heritage site ID 4647 (a burial and artefact scatter).</p> <p>Heritage Site Place ID 29013 (the Balline Isolated Artefacts)</p> <p>Two archaeological sites, as defined by Section 5(a) of the <i>Aboriginal Heritage Act 1972</i>, were identified during previous survey (Brad Goode & Associates, 2010):</p> <p>Lucky Bay FS1 is a small artefact scatter.</p> <p>Lucky Bay FS2 is a large artefact scatter with an implement and baler shell fragment.</p>	<p>~625 m north of the Premises boundary.</p> <p>~1 km north of the Premises boundary.</p> <p>Lucky Bay FS1 is located within the Premises boundary, but not within the operational areas. Lucky Bay FS2 is not located within the Premises boundary.</p>
Public Drinking Water Source Areas (PDWSA)	N/A	>3 km north (P1 Kalbarri Water Reserve 22 km north)
Other groundwater users	<p>Selected third-party groundwater bores surrounding the Premises also use the licensed groundwater resource. Most bores are for the purposes of stock watering. One bore is held by MRWA to supply water for road construction and maintenance activities.</p> <p>Yanganooka Well bore is in the Yanganooka Reserve, where there are no stock or domestic users.</p>	The nearest bore in the superficial aquifer is 1.4 km from the nearest superficial Production Bore PB6. The nearest Tumblagooda bore is the Neumann Bore located 1.3 km from TPB2.
Rivers, lakes, oceans, and other bodies of surface water	Ocean	~1.3 km west
Acid Sulfate Soils	N/A	>3 km South

5.4 Climate

The Premises experiences a Mediterranean climate characterised by hot, dry summers and mild, wet winters during which 80% of the rainfall occurs (May to September). Only 4% of rainfall occurs during the summer months. The annual evaporation rate is around 2,550 – 2600 mm, which significantly exceeds annual average rainfall of 334.8mm. In recent years, the annual rainfall has been below average (BoM, 2024). Climate data for the Kalbarri Automatic Weather Station are shown in Figure 4.

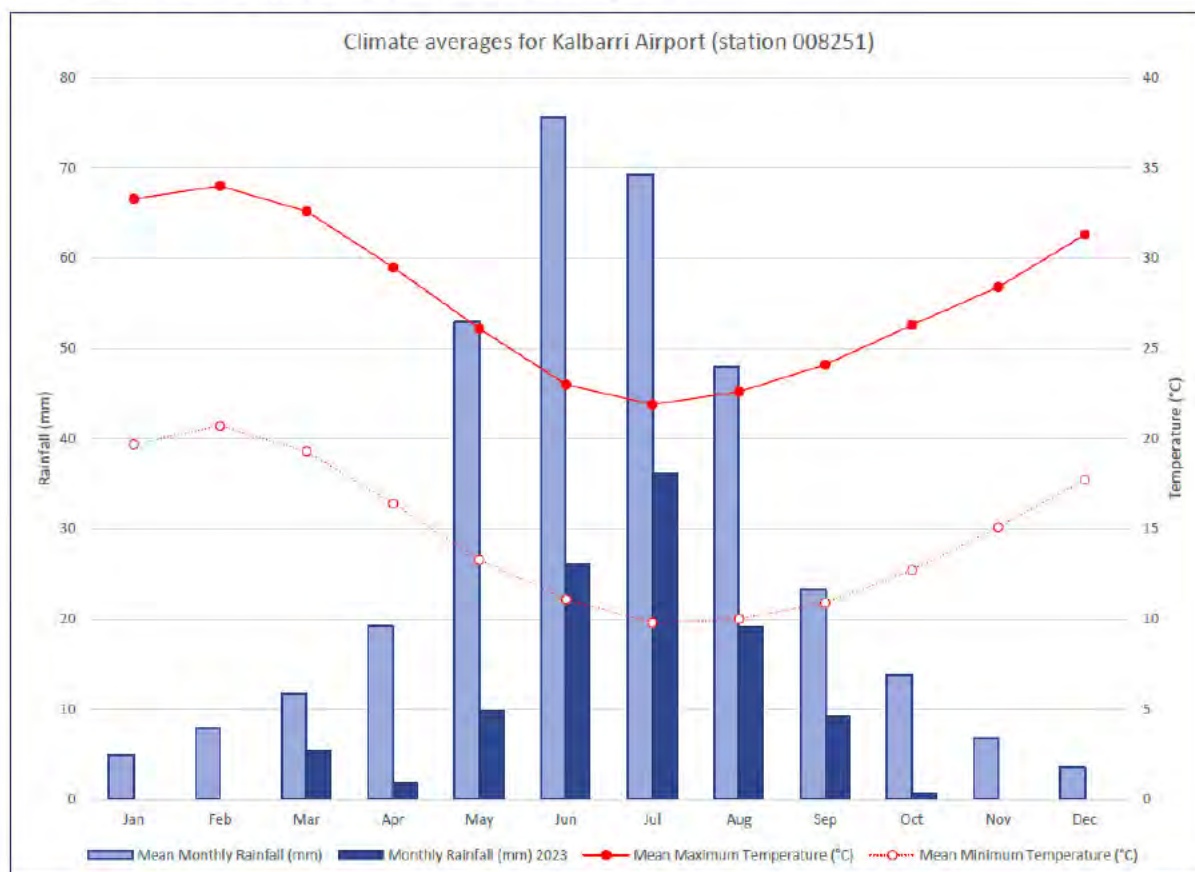


Figure 4: Kalbarri (008251) Climate Data

During summer, the prevailing winds are southerly to south-easterly (typically 21-30 km/hr) in the mornings, and south to south-westerly in the afternoons. Winds are generally stronger in the afternoon during summer. Throughout winter the winds are generally in a more north and easterly direction in the mornings, and south-westerly in the afternoons.

5.4.1 On-site Weather Station

No meteorological monitoring was conducted during the construction and commissioning phases of the Premises carried out under Works Approval W6214/2019/1. Wind speed and direction monitoring is now carried out as part of the dust monitoring equipment at the monitoring locations shown in Attachment 2D.

5.5 Soils

The Premises is located within the Port Gregory Zone of the Carnarvon soil-landscape Province, which occupies 3.7% of Western Australia and is described as coastal plains, sand plains, alluvial plains and sea cliffs. The zone consists of limestone and sand with cretaceous sedimentary rocks of the Carnarvon basin covered by red shallow sands, deep sands, stony soils and calcareous deep sands. Some yellow deep sands and yellow/brown shallow sands also occur. Sandplains make up half of the province with these being predominately flat to gently undulating, although dunes (the targeted resource areas) and broad depressions also occur.

Spatial data (DPIRD-063) show the Premises is entirely distributed over the Tamala Land System. The Tamala Land System falls within the Tamala Limestone District, and it consists of low, rounded limestone rises and stony plains above extensive sandy plains with very recently redeposited soils.

The soil atlas identified the 'Ca28' unit over most of the Premises and the 'B26' unit on the southwest edges of the southern tenements. Ca28 is described as "*gently undulating sand plain with occasional low lateritic residuals: chief soils are leached sands (Uc2.21) and yellow siliceous sands (Uc1.22)*", and B26 is defined as "*undulating dune landscape underlain by aeolianite which is exposed in places: chief soils are siliceous sands (Uc1.22) with some shallow grey-brown sandy soils (Uc6.11). Other (Uc) soils such as (Uc4.22) are likely but have not been recorded*".

5.6 Geology

The Premises occurs at the southern end of the Carnarvon Basin where there is the presence of relatively thin Quaternary alluvial, aeolian and shoreline deposits (Superficial Formations) that sit unconformably over the Silurian-aged Tumblagooda Sandstone.

The Tumblagooda Sandstone forms the bedrock sequence in the Gascoyne coastal domain and is relatively shallow in the project area. To the south near the GMA Garnet Mine, it typically occurs about 20 mbgl.

Cemented sediments of the Superficial Formations (Quaternary alluvial, Aeolian and shoreline deposits) occur at depth throughout the deposit area, with the top of the Tumblagooda Sandstone occurring at between 20 and 75 mbgl:

- Superficial Formations in the deposit area are dominated by unconsolidated calc-arenites, which typically comprise fine to coarse grained quartz (and minor feldspar) sands that are texturally variable (from poorly to well sorted and sub-angular to well rounded). The matrix of these sands typically comprises finer and variably cemented quartz, calcite and clay. Minor amounts of garnet and calcareous fossil shells were also identified;
- In the near-surface zone to about one metre, sediments are often dominated by windblown fine to medium grained quartz sands, with a minor organic soil component;
- Strong (but variable) cementing of the upper sections of the Superficial Formations is prevalent, but cementing also occurs locally in the lower sections; and
- In the north and eastern areas covered by drilling, the Superficial Formations contain significant amounts (>10-20%) of clay, often as dark green calcareous (possibly glauconitic) clays and clayey sands. These clay-rich zones typically occur as bands or layers up to five metres thick in the lower sections of the Superficial Formations.

5.7 Hydrogeology

Based on groundwater investigations conducted at the Premises, the following conceptual hydrogeological model has been developed:

- The Premises is underlain by a highly permeable unconfined aquifer within the unconsolidated calc-arenite sediments of the Superficial Formations;
- The Superficial aquifer is regionally wedge-shaped, and is bounded to the east by the contact with the underlying Tumblagooda Sandstone. To the west of the Mine Pit, the Superficial Formations are at least 35 m thick;
- Groundwater flow is in a westerly to south-westerly direction, with discharge from the Superficial Formations to the ocean near the coastline;
- The Superficial aquifer is highly permeable with hydraulic conductivities in the range of 40-80 m/day. The coarse clean sand and gravel sequences intersected by drilling throughout the area supports the hydraulic conductivities derived from aquifer testing;
- Aquifer testing indicates unconfined aquifer responses but with variable specific yield values;
- Direct rainfall recharge to the Superficial Formations is relatively low, in the order of 1-5%;

- Groundwater salinity within the area is brackish to saline (1,500 to 7,000 mg/L TDS), generally increasing in salinity laterally towards the coastline. Regular salinity profiling of monitoring bores shows generally uniform distributions of electrical conductivity within most monitoring bores. Some sites, such as MB2, MB9, MB14, and MB16 display significant increases in salinity with depth (up to 20,000 mg/L), which is attributable to intersection of the seawater interface within the Superficial Formations aquifer;
- Salinity within the underlying Tumblagooda Sandstone is generally lower, with TDS values ranging from 840 to 1,700 mg/L;
- Groundwater pH within the Superficial Formations is circumneutral, with an average value of 7.3 and ranging from 6.7 to 7.9. Groundwater pH within the Tumblagooda Sandstone is slightly acidic, averaging 6.5 and ranging from 6.0 to 7.1.
- No freshwater lenses are evident at the top of the water table, indicating rainfall recharge rates are low. Most bores display a uniform salinity profile with depth; and
- Soil infiltration rates near the CAP are in the order of 11-18 m/day based on field testing, confirming the relatively high infiltration rates that can be expected (URS, 2010).

5.8 Flora and Vegetation

Beard (1979) has mapped vegetation in the area as consisting predominantly of Shrublands, *Acacia rostellifera* thicket. While much of the coastal area between Kalbarri and Geraldton has been cleared for agricultural purposes, this vegetation association is well represented as fragmented remnants across the Shires of Irwin, Northampton and Shark Bay.

A large proportion of the Premises has been historically cleared; however, there is a large area of remnant vegetation in good to very good condition. Most of the vegetation recorded within the Premises occurs on undulating low hills and ridges comprising limestone and sand, with plant taxa that have no reliance on groundwater. However, vegetation occurring on exposed limestone clay loam flats near the lowest position in the landscape, closest to the coastline in the south-west of the Premises and where depth to groundwater is at its shallowest, is likely to have interactions with groundwater at least seasonally during the year.

6. References

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7. Attachments