Application for Works Approval

Part V Division 3 of the *Environmental Protection Act 1986*

Works Approval Number	W6475/2020/1
Applicant	Strandline Resources Limited
ACN	090 603 642
File Number	DER2020/000541
Premises	Coburn Mineral Sands Project Coburn Road, COBURN Legal description: Mining tenements M 09/102, M 09/103, M 09/104, M 09/105, M 09/106, M 09/111 and M 09/112
Date of Report	21 June 2021
Decision	Works approval granted

Carmen Standring

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A/MANAGER, RESOURCE INDUSTRIES
REGULATORY SERVICES
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

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1. Decision summary

This Decision Report documents the assessment of potential risks to the environment and public health from emissions and discharges during the construction and operation of the Coburn Mineral Sands Project (the Premises). As a result of this assessment, Works Approval W6475/2020/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this Decision Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Application summary and overview of Premises

On 28 October 2020, Strandline Resources Limited (the applicant) submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

The Premises relates to the categories and assessed design capacity under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which are defined in Works Approval W6475/2020/1. The infrastructure and equipment relating to the premises category and any associated activities which the department has considered in line with *Guidance Statement: Risk Assessments* (DER 2017) are outlined in Works Approval W6475/2020/1.

The application is to undertake construction works relating to mineral sands mining and processing, and associated electric power generation at the Premises. The Premises is approximately 30 km from the nearest residence, Hamelin Station. The regional location is shown in Figure 1.

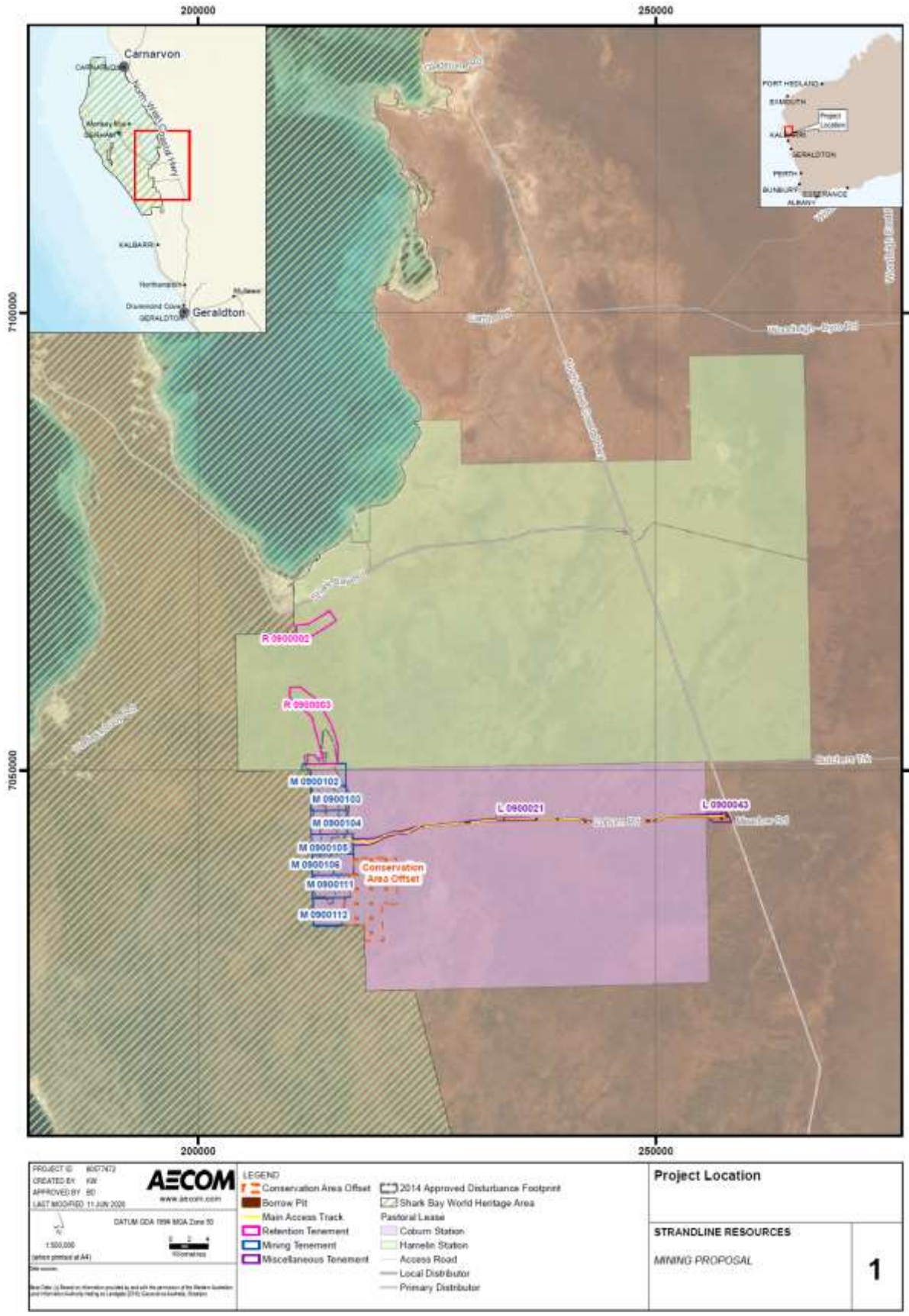

Figure 1: Regional Location on the Coburn Mineral Sands Project

The applicant did not apply for category 85B (water desalination plant) as the anticipated clean water input does not meet the production trigger for this category as stipulated in Schedule 1. The Delegated Officer considers however that category 85B is required, as further discussed later in this section. The Delegated Officer has therefore added category 85B to the works approval.

Mineral Sands Mining

The mining process will be conventional open pit dry mining. A series of pits (interconnected or separate) will be progressively mined using earthmoving equipment to feed dozer mining units (DMU). Ore is stockpiled on a Run of Mine (ROM) pad before being fed into the DMU, slurried and screened and the undersize is piped through ore pipelines to the Wet Concentrate Plant (WCP). Oversize material is backfilled into mined voids. Figure 2 shoes a conceptual layout of mining operations.

Topsoil and subsoil will be stripped by dozer or scraper and placed in stockpiles near the pit or directly on top of recontoured tails areas. Overburden, where present, will be removed by large capacity bulldozers or scrapers and placed in the pit void immediately adjacent. If there is no adjacent void available, the overburden will be moved to an alternative void or off path stockpile via portable conveyors.

No dewatering is expected to be required as all mining is above the water table.

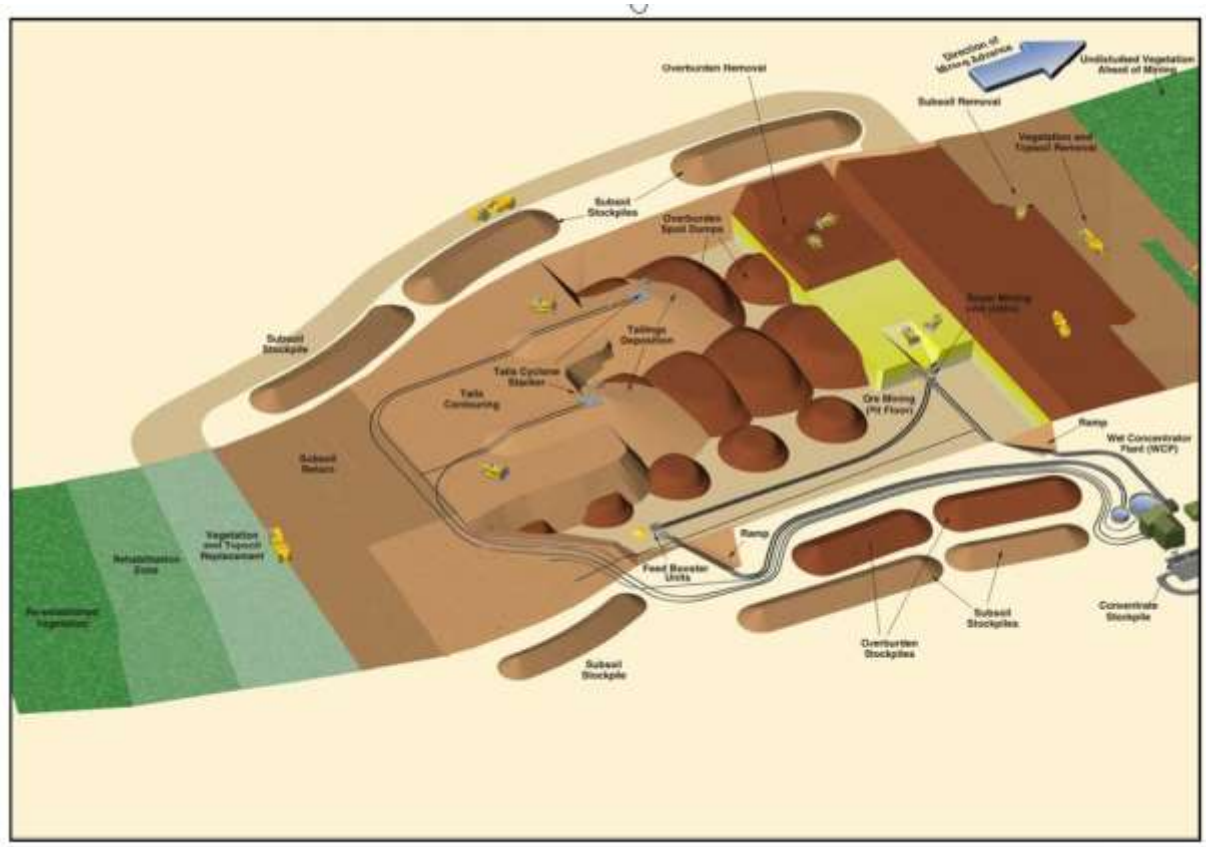

Figure 2: Conceptual layout of mining operations

Mineral Sands Processing

Mined ore is converted to a slurry and piped to the Wet Concentrate Plant (WCP) for primary processing to separate mineral sands from the ore. Physical separation processes are used and the outputs from the WCP are Heavy Mineral Concentrate (HMC) and a tailings stream. The WCP infrastructure will include a process water pond, settling pond, mineral concentrating

infrastructure, and MSP tails and HMC stockpiles. A flocculant (Flopam™ AN 923 SH) and attritioning agent (Frevis 9934) are used as part of the process. Material Safety Data Sheets have been provided for both, and the Delegated Officer is satisfied that neither pose a significant environmental risk as a component of process water or tailings.

Secondary processing is by a Mineral Separation Plant (MSP) to separate ilmenite, zircon concentrate, premium zircon, rutile (includes rutile-leucoxene minerals) and a tailings stream. The MSP will include a raw water pond, stockpiles for Zircon concentrate, MSP tails, HMC and HMC overflow and a truck loading facility.

The final ilmenite, rutile and zircon mineral products will be temporarily stored in product bins at the MSP and discharged into haulage trucks. Storage bins will have the capacity for approximately two days. Products will be loaded into trucks for removal from site to third party storage, and shipping overseas.

Zircon concentrate will be temporarily stored on an outside purpose-built drainage pad.

Tailings disposal – pit voids

Dewatered sand tails and thickened fines/slimes will predominantly be co-disposed into mined voids. An in-pit strip drainage network with pumps captures and returns excess water back to the WCP from the tailings deposition areas. Deposited tailings will be about 35% water by weight, and water recovery is projected to be between 35% and 77%.

The co disposed mixture will be primarily deposited on top of previously placed sandy overburden, behind the current mining face gradually filling the void.

A small sand bund or sumps will be constructed at the toe of the deposition area (beach) on the pit floor to capture initial decant water. An additional series of in pit drains feeding into a strip drain on the western side of the pit will be constructed to capture further decant water. Return water pumps will be placed in sumps along the drain and relocated as the beach advances.

Other engineering controls may be implemented in accordance with the Groundwater Mounding Management Plan (GMMP), which specifies thresholds where additional collection/extraction infrastructure is required.

Tailings disposal – off-path Tails Storage Facility

In the initial stages of mining when there are no pit voids to backfill, tailings will be contained in an off-path tails storage facility (TSF) (Figure 1 of Schedule 1). The selected site is a shallow vegetated sand dune depression with a depth range of between 2.5 and 3m. It covers a 43ha semi-circular area. The design capacity of this storage facility is about 2,500,000 m^3. The facility will have a final height of about 4m above the natural surface.

The area will be cleared and grubbed of vegetation which will be stockpiled for rehabilitation. Topsoil will be stripped and stockpiled. No lining of the deposit area is proposed due to the benign nature of the tails composed primarily of mixed sand and clay, with similar characteristics to the mined ore as there has been no crushing, grinding or chemical processing.

A low bund will be constructed from in-situ materials around the perimeter of the disturbed area, to provide a defined deposition area and to contain any associated supernatant or tailings solids runoff.

A pipeline corridor, with containment bunds, will be constructed between the process plant and the TSF. A series of end discharge locations will be established through the basin from which the tailings will be discharged into the natural depression. A sump pump will be installed in the low point of the depression to recycle supernatant (and rainfall) back to the process plant. No significant ponding will be allowed to occur within the facility

Once sufficient voids have been opened from mining activities, then the interim off path TSF will no longer be required. The rehabilitation process of the final landform will be regulated under the Mine Closure Plan by the Department of Mines Industry Regulation and Safety.

Power station

The power station design will include:

- LNG unloading storage vaporisation facility with four (4) 300 kL LNG storage tanks;
- Ten 2.0 MW gas generator modules to generate at maximum demand 15.9 MW with additional modules allowing for redundancy and shutdowns;
- 4.0 MW, 1.0MWh Battery Energy Storage System; and
- 14.0MW single axis tracking Solar Photovoltaic System.

Of the above, only the gas generators are assessed in this works approval under category 52.

Desalination Plant

A reverse osmosis water treatment plant will be constructed to process 1,700 m^3/day of bore water into approximately 1,200m^3/day fresh (desalinated) water and 500 m^3/day of brine. This brine will be added to the WCP process water circuit, constituting about 1.3% of the feed-in water. This will ultimately be discharged to land, as it will report as a portion of tailings water to the unlined tailings facilities (mine voids or off path TSF).

The Delegated Officer considers that the 'production or design capacity' for category 85B relates to the input capacity. This is stated by the applicant to be 1,700m^3/day, which equates to 0.62GL/yr and therefore exceeds the category 85B threshold of 0.50 GL/yr. The Delegated Officer also considers that although the brine is fed into the process water circuit, it ultimately reports with the tailings stream to unlined facilities which constitutes an emission to land. The environmental risks of this discharge are considered in this assessment as it effects the salinity and therefore potential impacts of the tailings seepage. There are no other significant environmental risks associated with the desalination plant, requiring assessment. The Delegated Officer has therefore added category 85B to the works approval.

Other supporting infrastructure

A landfill and wastewater treatment plant were approved for construction and commissioning under W6258/2019/1. They are therefore outside the scope of this assessment.

A temporary concrete batching plant will operate on site, during the construction period. This does not trigger Category 77 as the products are used exclusively on the premises. The plant is rated to produce up to 125 t of concrete per hour. If operating at peak load for 24 hours and 365 days this would equate to 1.1 million tonnes per year. The applicant suggests a realistic maximum capacity (allowing for maintenance etc. and day shift operation only) is 400,000 tonnes per year.

The Delegated Officer notes that the *Environmental Protection (Concrete Batching and Cement Product Manufacturing) Regulations 1998* are applicable to the operation of the concrete batching plant and are adequate to regulate the risk of any emissions during operations. The applicant has stated that they expect to be able to comply with these regulations. No additional regulatory controls are required, and this plant is not formally assessed as prescribed works on this works approval.

Environmental Commissioning

Environmental commissioning of slurried ore and tailings pipelines will involve running water through all pipelines to their designed flow and/or maximum pumping capacity, and testing pipeline integrity will be for leaks and defects. This will occur before wet commissioning of the processing plants. Water will be deposited to the off-path TSF.

Dry commissioning of the WCP and MSP will involve testing of individual parts, which is part of environmental commissioning as this includes controls that contain materials and minimise the likelihood of spills and dust discharges.

The Delegated Officer considers that 'wet commissioning' of the WCP and MSP (processing small volumes of ore to check all components are working as they should) is not part of environmental commissioning. This phase involves the mining and processing of ore and has the same environmental risk profile as ongoing operations and is considered in this assessment to be within the time limited operations phase.

Commissioning of the gas generators is similarly considered to be operational and not environmental commissioning. No air emissions testing is required as the risk of impacts to receptors is low. Operational commissioning may occur within the time limited operations phase

Time limited operations

The applicant has requested approval for time limited operations for 180 days following the submission of the Environmental Commissioning Report. This period includes the 'wet commissioning' phase for the processing plants and operational commissioning of the gas generators, which may commence after submission of the Environmental Commissioning Report.

2.3 Other approvals

2.3.1 Part IV of the EP Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The Coburn Mineral Sands Project was assessed under Part IV of the EP Act and authorised under Ministerial Statement (MS) 723. In addition, it is a "controlled action" under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The environmental assessment was conducted in accordance with the bilateral agreement between the Commonwealth of Australia and WA, meaning that the Commonwealth accredited the WA environmental impact assessment process.

Condition 7 of MS 723 requires development and implementation of a Groundwater Mounding Management Plan (GMMP), which includes monitoring, threshold elevations requiring action and limits at which mining activities must cease. Condition 12 of MS 723 requires development and implementation of a Dust Management Plan, which includes minimisation measures, monitoring (including dust deposition) and reporting but the risk is considered low enough that no target values or limits are required

Condition 6 of MS 723 stipulates a 100m protective buffer between the project area and the Shark Bay World Heritage Property, and specifies that the only impact allowed on vegetation within this buffer is to implement the GMMP required by MS 723.

Condition 12 requires preparation of a Dust Management Plan prior to commencement of ground-disturbing activities, and its implementation prior to ground-disturbing activity. The Dust Management Plan must include the prevention of visible dust in the Shark Bay World Heritage Property, preventative measures to minimise fugitive dust sources as part of daily operations and monitoring of deposited dust levels at the boundary of the proposal area and at Hamelin Pool for the initial three years of the project.

Other conditions predominantly relate to flora and fauna, which do not relate to this assessment of emissions and discharges, under Part V Division 3 of the *Environmental Protection Act 1986*.

2.4 Mining Act 1978 (WA)

'Mining Proposal 3 2020, Coburn Sand, Coburn Development and Operations 3' for the Coburn Mineral Sands Mine was approved by the Department of Mines, Industry Regulation and Safety (DMIRS) on 2 December 2020 (Reg ID: 89635)

2.5 Radiation Safety Act 1975 (WA)

Mineral Sands deposits contain Naturally Occurring Radioactive Materials (NORMs). The regulation of Radiological Risk (to human health and the environment) is undertaken jointly by DMIRS and the Radiological Council of WA. DWER defers the management of risks from NORMs to these government agencies and will not consider these further in this assessment.

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guidance Statement: Risk Assessments* (DER 2017).

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation which have been considered in this Decision Report are detailed in Table 1 below. Table 1 also details the proposed control measures the applicant has proposed to assist in controlling these emissions, where necessary.

Table 1: Proposed applicant controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Dust	• Earthworks associated with clearing and stripping of vegetation and topsoil, overburden removal, mining • vehicle movements • lift-off from stockpiles	Air/windborne pathway	Management: • Dust will be managed according to the Project's Dust Management Plan as required by MS 723. • Minimise clearing of vegetation to prevent dust occurrence • Water will be applied to any roads or cleared areas that pose a dust risk • Areas will not be disturbed until they are required to be used, where practicable • The area to be disturbed will be minimised • Biodegradable stabilising agents may be used to minimise dust lift-off Monitoring: • Opportunistic inspections for dust emissions will be undertaken during construction of the Project to ensure dust control measures are being implemented and are effective • If visible dust emissions are noted then an assessment of the source will be made and additional water will be applied to key source areas, or alternative treatments applied • The potential for high risk weather conditions for dust emissions (i.e. windy conditions) will be monitored

Emission	Sources	Potential pathways	Proposed controls
			and extra water applied in preparation • An incident reporting system will be maintained to assist in managing environmental incidents such as excessive dust emissions
Noise	Mining; pumping of ore and tailings; mineral processing	Air/windborne pathway	Nearest residential receptor is 30km away. As there is no plausible pathway to impact receptors at this distance, noise emissions will not be considered further in this assessment *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) apply.
Hydrocarbons	Machinery, or storage facilities	Spill to soil and possible infiltration to groundwater	Management: • Hydrocarbons and chemicals will be stored within bunded areas and handled in accordance with AS 1940 The storage and handling of flammable and combustible liquids • Implement Hydrocarbon Management Plan as required by MS 723 • Spill kits will be located at points where hydrocarbons are stored or transferred • Any spills will be controlled, contained and cleaned up in accordance with a Spill Management Procedure • The tanks at the fuel storage facility will be double lined Monitoring: • No specific monitoring for construction hydrocarbons is proposed however the Project will record spill incidents and inspect spill kits regularly to ensure they are fully stocked
Sediment-laden stormwater runoff	Disturbed areas	Surface runoff	Management: • Sediment management will occur as part of the whole site, with drainage reporting to the mine void (if present) or sediment traps adjacent the MSP and WCP • Areas will not be disturbed until they are required to be used, and the area to be disturbed will be minimised where practicable Monitoring: • The site will be inspected for erosion after significant rainfall events
Commissioning and Operation			
Dust	• mining; • vehicle movements; • lift-off from stockpiles and/or stored product;	Air/windborne pathway	• As listed above in ‘construction’ section • Process materials will be moist in the WCP. • All dry processes will be carried out in a fully enclosed (purpose designed) building. Dust extraction will be installed at all dry material key transfer points.

Emission	Sources	Potential pathways	Proposed controls
	• emissions from processing plants		
Slurried ore, process water or tailings	Pipeline failure	Direct discharge to soil; seepage and groundwater	• Leak detection telemetry, with an automatic shut-down of the pipeline tailings feed • Tailings that will be present within the pipe during a shutdown will stop flowing as it is not gravity-fed • Pipelines will be inspected regularly, especially after extreme heat or fire events • Pipelines will be installed along regularly frequented tracks which will allow access for inspections • Tailings pipeline will be clearly marked and identifiable to all Project personnel to avoid accidental pipe damage • Tailings pipelines will be installed along established access tracks. Any spills will report to the access tracks drainage system or be contained on the track within windrows. Any spills will be recovered from the access tracks if practicable • If pipelines have to cross access roads then they will be buried • Investigations will be conducted into the cause of any spills, and remedial actions will be taken to minimise the chance of reoccurrence • Any spills will be recovered and disposed of in pit if practicable.
Noise	Tailings pumps, WCP, MSP and power generation	Air	Nearest residential receptor is 30km away. As there is no plausible pathway to impact receptors at this distance, noise emissions will not be considered further in this assessment *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) apply.
Seepage of process water	WCP – settling pond and process water pond MSP -process water pond	Seepage to groundwater	Dam walls will be compacted and then lined with minimum 1.0 mm HDPE. The ponds will be subject to regular inspection for leaks or seepage.
Spill of process water	Overtopping of process water pond or settling pond	Direct discharge to land	When the process water dam gets to the design capacity (500mm below base of spillway) an online indicator will shut down the production bores supplying the dam. The process water pumps are also able to pump water from the process water dam to the tail deposition area as a backup to prevent process water from discharging to the spillway. In the event of a very significant rainfall event resulting in an overflow, the spillway reports to a cut-off drain that recirculates into the process water system.
Seepage of tailings water	Tailings deposited in depleted mine pits or off-path tailing facility	Seepage to groundwater	• Tailings are chemically inert • Tailings will be solidified as much as possible to reduce water deposition to tailings

Emission	Sources	Potential pathways	Proposed controls
			• Tailings water will be recovered using sump pumps and in-pit drains • Monitoring and management requirements detailed in the GMMP required by MS723 and approved by the EPA
Contaminated stormwater	• Cleared areas • Interim disposal of tailings at a depression bounded by sand dunes • Stockpiling of concentrates	Contamination of groundwater or surface water	Management: • Sediment management will occur as part of the whole site, with drainage reporting to the mine void (if present) or sediment traps adjacent the MSP and WCP • Areas will not be disturbed until they are required to be used, and the area to be disturbed will be minimised where practicable • Hydrocarbon management as listed above for construction phase Monitoring: • The site will be inspected for erosion after significant rainfall events
Gaseous emissions (CO, NOx, PM_{10} and SO_2)	Power generation	Air	Modelling was completed for the power station and vehicle and plant emissions. Modelling found that the maximum ground level pollutants are anticipated to be well below the emission levels permitted under the National Environment Pollution Measure (NEPM) for Ambient Air Quality. Management: • Use of approximately 10 m stack to ensure improved dispersion of exhaust gases • Minimise use of diesel generator where practical • Power plant will be managed with a control system to optimise operations and thereby minimise emissions • The fuel to supply the power plant is LNG which will be stored in Australian Standard AS 3961 *The Storage and Handling of Liquefied Natural Gas* • All generators will be commissioned, operated and maintained according to manufacturer specifications.

3.1.2 Receptors

In accordance with the *Guidance Statement: Risk Assessment* (DER 2017), the Delegated Officer has excluded employees, visitors and contractors of the applicant's from its assessment. Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 2 and Figure 3 below provide a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guidance Statement: Environmental Siting* (DER 2016)).

Table 2: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	**Distance from prescribed activity**
Hamelin Station homestead (Coburn Station homestead is now abandoned)	approximately 30 km away
Environmental receptors	**Distance from prescribed activity**
Shark Bay World Heritage property – covers a total area of 2.2 million hectares including the marine reserves and terrestrial areas.	Immediately adjacent to the western boundary of the premises - Minimum 100m buffer from mining areas specified in MS 723.
Hamelin Pool Marine Reserve – part of the Shark Bay World Heritage Property and Priority 1 – Ecological Community	Approximately 30km north
12 Priority flora species and one threatened flora species	Within the premises
Nine conservation significant vertebrate fauna species are likely to or may occur within the study area.	May occur within the premises
Two conservation significant fauna species have been identified within or adjacent to the disturbance footprint (Hamelin Skink and Malleefowl).	Within the premises
Zuytdorp Nature Reserve	Immediately south of the premises boundary

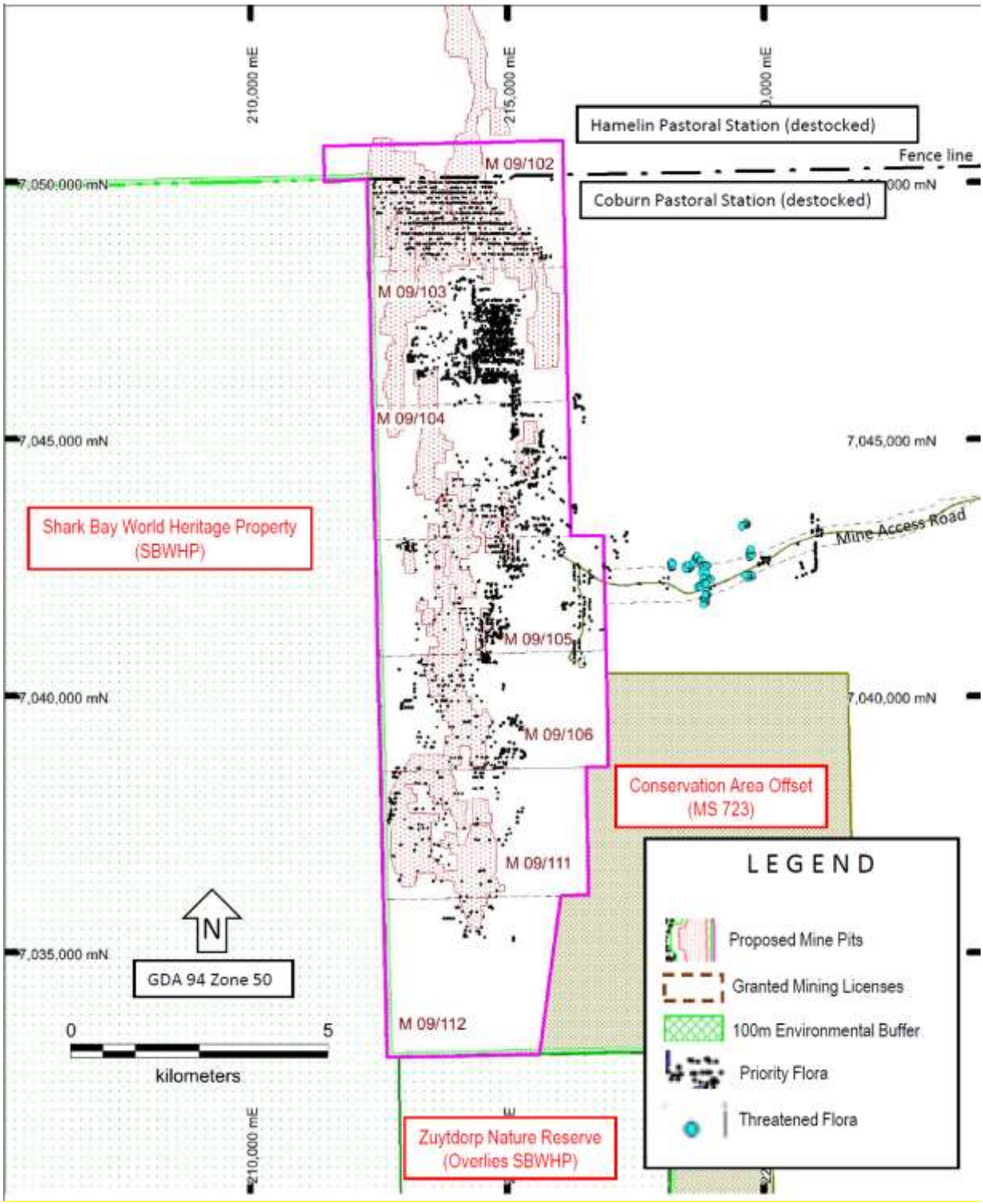

Figure 3: Location of sensitive receptors near the Coburn Mineral Sands Project

The Project Area is internally draining and has few surface water features due to the low rainfall, high evaporative conditions and inferred high infiltration capacity dune soils. There are no defined watercourses, permanent fresh water bodies, or birridas (seasonally inundated, saline lakes) within the area. There are no known sensitive surface water features within the proposed area of disturbance. Most rainfall typically ponds in depression areas and evaporates or quickly infiltrates.

The local groundwater sits within an unsaturated superficial aquifer across the Project area. Flow is to the northwest to discharge through marine clay deposits into the Nilemah Embayment and Hamelin Pool which are approximately 30km away.

The groundwater is generally saline, with salinity increasing further down gradient. Salinity in the region ranges from about 11,000 to 67,000 mg/L total dissolved solids (TDS). Local test bores suggest that the groundwater under the project area is likely to be around 5,000 to 20,000 mg/L TDS. This is saline to highly saline. In some areas it may be suitable for use for livestock but is likely to be too salty for irrigation purposes. The salinity increases down gradient to the north.

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guidance Statement: Risk Assessments* (DER 2017) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the applicant has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the applicant's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the works approval as regulatory controls.

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 3.

Works Approval W6475/2020/1 that accompanies this Decision Report authorises construction, commissioning and time-limited operations subject to prerequisite conditions being met. The conditions in the issued Works Approval, as outlined in Table 3 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

A licence is required following the time-limited operational phase authorised under the works approval to authorise emissions associated with the operation of the Premises i.e. mineral sands mining and processing, power generation and water desalination. A risk assessment for the operational phase has been included in this Decision Report, however licence conditions will not be finalised until the department assesses the licence application.

Table 3: Risk assessment of potential emissions and discharges from the Premises during construction, commissioning and operation

Risk Event					**Risk rating[1]** **C = consequence** **L = likelihood**	**Applicant controls sufficient ?**	**Conditions of works approval**	**Justification for additional regulatory controls**
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Construction								
Topsoil and overburden stripping and stockpiling, including construction of initial noise bunds Construction of WCP, MSP and power plant Installation of monitoring bores	Dust	Air/windborne pathway leading to reduced health and viability (by smothering of leaves) of vegetation	No residential receptor within 30km Shark Bay Word Heritage Property, Priority and Threatened flora found within the project area.	Refer to Section 3.1	C = Minor L = Rare **Low Risk**	Y	NA	Considering the dust minimisation practices committed to in the Dust Monitoring Plan (DMP) approved under Part IV of the EP Act, the Delegated Officer considers that this risk is low. The monitoring committed to in the DMP is adequate and will not be duplicated in this works approval or subsequent licence.

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient ?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
around the initial mining area	Hydrocarbon	Direct spill to ground; infiltration to groundwater causing significant contamination	Soil within disturbed area; groundwater	Refer to Section 3.1	C = Slight L = Unlikely **Low Risk**	Y	NA	Given the controls in place (including Hydrocarbon Management Plan approved under Part IV of the EP Act), there is unlikely to be residual soil contamination during construction activities. Infiltration to groundwater is also unlikely.
Commissioning								
Commissioning of ore and tailings pipelines by flushing with process water	Rupture of pipeline causing process water discharge to land	Direct discharge of brackish water leading to soil contamination and vegetation stress or death	Shark Bay Word Heritage Property, Priority and Threatened flora found within the project area.	Refer to Section 3.1.1	C = Minor L = Possible **Medium Risk**	Y	Condition 1 - construction requirements for pipeline and secondary containment	Standard condition wording, in line with applicant commitments.
	Process water discharge to land – off path TSF	Seepage to groundwater, causing contamination	Shark Bay Word Heritage Property, Priority and Threatened flora found within the project area.	Refer to Section 3.1.1	C = Minor L = Possible **Medium Risk**	Y	Condition 1 – construction of off path TSF Condition 16 – stormwater management	Applicant controls conditioned in accordance with DWER *Guideline: Risk Assessments* (2017)
Operation **(including 'wet commissioning' and time limited operations operations)**								
Mining and in-pit screening of ore	Dust	Air/windborne pathway leading to reduced health and viability (by smothering of leaves) of vegetation	No residential receptor within 30km Shark Bay Word Heritage Property, Priority and Threatened flora found within the project area.	Refer to Section 3.1.1	C = Minor L = Rare **Low Risk**	Y	NA	Considering the dust minimisation practices committed to in DMP approved under Part IV of the EP Act, the Delegated Officer considers that the risk of dust impact to receptors is low. The monitoring committed to in the DMP is adequate and will not be duplicated in this works approval or subsequent licence.

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient ?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
	Contaminated stormwater runoff	Surface water run off containing hydrocarbons or other chemicals, or high sediment load smothering vegetation	Shark Bay Word Heritage Property, Priority and Threatened flora found within the project area.	Refer to Section 3.1.1	C = Moderate L = Possible **Medium Risk**	Y	Condition 16 - reasonable measures to prevent stormwater contamination	Places obligation on works approval holder to actively manage stormwater. This is in line with commitments made. Applicant controls conditioned in accordance with DWER *Guideline: Risk Assessments* (2017)
Transport of slurried ore to the WCP via pipeline; transport of tailings between processing plants and from the processing plants to disposal points	Rupture of pipeline causing slurry or process water discharge to land	Direct discharge leading to smothering of vegetation and/or soil contamination	Shark Bay Word Heritage Property, Priority and Threatened flora found within the project area.	Refer to Section 3.1.1	C = Moderate L = Possible **Medium Risk**	Y	Condition 1 - construction requirements for pipeline and secondary containment	Standard condition wording, in line with commitments made. Applicant controls conditioned in accordance with DWER *Guideline: Risk Assessments* (2017)
Disposal of tailings to mine voids; or to the off-line TSF	Seepage of process water entrained within tailings to groundwater	Seepage to groundwater, causing contamination	Shark Bay Word Heritage Property, Priority and Threatened flora found within the project area.	Refer to Section 3.1.1	C = Minor L = Unlikely **Medium Risk** (see section 3.4 for detailed assessment)	Y	Condition 16 - reasonable measures to prevent stormwater contamination Condition 20 - groundwater quality monitoring	Stormwater management to minimise contamination of process water Monitoring required to validate low contamination risk.
		Seepage to groundwater, causing mounding			C = Minor L = Unlikely **Medium Risk** (see section 3.3 for detailed assessment)	Y	Condition 20 – standing water level (SWL) monitoring Condition 1 – construction of off path TSF	Construction of temporary facility to minimise seepage; SWL monitoring to validate mound height.

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient ?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Operation (including wet commissioning) of Wet Concentrate Plant (WCP) and Mineral Separation Plant (MSP)	Dust	Air/windborne pathway leading to reduced health and viability (by smothering of leaves) of vegetation	No residential receptor within 30km Shark Bay Word Heritage Property, Priority and Threatened flora found within the project area.	Refer to Section 3.1	C = Minor L = Rare **Low Risk**	Y	NA	Considering the dust minimisation practices committed to in the DMP approved under Part IV of the EP Act, the Delegated Officer considers that this risk is low. The monitoring committed to in the DMP is adequate and will not be duplicated in this works approval or subsequent licence.
Storage and use of diesel	Hydrocarbon	Direct spill to ground; infiltration to groundwater causing significant contamination	Soil within disturbed area; groundwater	Refer to Section 3.1	C = Slight L = Unlikely **Low Risk**	Y	NA	Given the controls in place (including Hydrocarbon Management Plan approved under Part IV of the EP Act), there is unlikely to be residual soil contamination. Infiltration to groundwater is also unlikely.
Operation of gas generators	NOx, CO, PM_{10}, SO_x	Air	No residential receptor within 30km	Refer to Section 3.1	C = Slight L = Unlikely **Low Risk**	Y	NA	Considering the separation distance to residential receptors (over 30km), no pathway for air emissions to residential receptors exists. Applicant states that modelling of the power station and vehicle and plant emissions found that maximum ground level pollutants are anticipated to be well below the emission levels permitted by NEPM for Ambient Air Quality (NEPC, 2015).

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guidance Statement: Risk Assessments* (DER 2017).

3.3 Detailed risk assessment of seepage of process water from deposited tailings, leading to groundwater mounding impacts to vegetation

Sand and clay/silt tailings from the Wet Concentrate Plant (WCP) and Mineral Separation Plant (MSP) will be co-disposed either to an off-path tailings facility (in initial stages) or into mine voids. Neither are lined as the tailings are not considered environmentally hazardous. Measures to reduce water volumes to tailings, and recover decant tailings water are outlined in the Groundwater Mounding Management Plan (GMMP) and summarised in section 3.1.1. There will however be some evaporation and some downward seepage of tailings water.

The existing environment into which the tailings are being deposited comprises a predominantly dry superficial sand overlying the Toolonga Calcilutite, which is an aquitard preventing further downward migration of water. The Toolonga Calcilutite is relatively flat, but the surface topography is a complex interference dune system. This results in a highly variable (over 20m) sand depth to the Toolonga Calcilutite.

Mounding of groundwater on top of the Toolonga Calcilutite is likely to occur due to the accumulation of residual process water from the disposal of tailings. If this encroaches into the root zone of vegetation, it could lead to vegetation stress or death due to the saline nature of the tailings water, or due to increased duration of root saturation. The size of the mound will be dependent on the rate of water deposited with the tailings and the effectiveness of water recovery measures.

The GMMP provides non-numerical trigger, threshold and limits for groundwater height and vegetation impact, which are reproduced in Figure 4.

Table 5-1 Trigger, Threshold and Limit Criteria for Groundwater and Vegetation

Criteria	Vegetation			Groundwater		
	Amy Zone	Eastern Perimeter Zone	100 m Buffer Zone and SBWHP	Amy Zone	Eastern Perimeter Zone	100 m Buffer Zone and SBWHP
Trigger	A decline of more than 10% in indicator species health beyond the natural variation in the Amy Zone attributed to groundwater mounding arising from mining activities. A change of more than 10% in species composition beyond the natural variation in the Amy Zone attributed to groundwater mounding arising from mining activities.	A decline of more than 10% in indicator species health beyond natural variation within the Eastern Perimeter Zone attributed to groundwater mounding arising from mining activities. A change of more than 10% in species composition beyond natural variation within the Eastern Perimeter Zone attributed to groundwater mounding arising from mining activities.	Not applicable.	Water table observations and modelling indicate the possible occurrence of depths to the water table (linked to mound heights) beneath the Amy Zone that may saturate root zones along radial flow paths.	Water table observations and modelling indicate the possible occurrence of depths to the water table (linked to mound heights) within the Eastern Perimeter Zone that may saturate root zones.	Water table observations from the 100 m Buffer Zone and modelling indicate the possible occurrence of depths to the water table (linked to mound heights) beneath the Project Area that if allowed to propagate would likely saturate root zones beneath the 100 m Buffer Zone and SBWHP.
Threshold	A decline of more than 20% in indicator species health beyond the natural variation in the Amy Zone attributed to groundwater mounding arising from mining activities.	A decline of more than 20% in indicator species health beyond natural variation within the Eastern Perimeter Zone attributed to groundwater mounding arising from mining activities.	Not applicable.	Water table observations and modelling indicate the occurrence of mound heights that if allowed to propagate would likely reduce depths to the water table and saturate root zones beneath the Amy Zone.	Water table observations and modelling indicate the occurrence of mound heights that if allowed to propagate would likely reduce depths to the water table and saturate root zones within the Eastern Perimeter Zone.	Water table observations from the 100 m Buffer Zone and modelling indicate the occurrence of mound heights and depths to the water table that if allowed to propagate would saturate root zones beneath the 100 m Buffer Zone and SBWHP.
Limit	Not applicable.	Trend of increasing loss of vegetation observed in the Eastern Perimeter Zone beyond natural variation that can be attributed to groundwater mounding arising from mining activities.	Loss of vegetation in the 100 m Buffer Zone or the SBWHP beyond the natural variation that can be attributed to groundwater mounding arising from mining activities.	Not applicable.	Water table observations and modelling indicate an increasing mound height and decreasing depth to the water table attributed to mining activities that would saturate root zones and lead to loss of vegetation within the 100 m Buffer Zone or the SBWHP.	Water table observations from the 100 m Buffer Zone and modelling indicate an increasing mound height and decreasing depth to the water table attributed to mining activities that would saturate root zones and lead to loss of vegetation within the 100 m Buffer Zone or the SBWHP.

Figure 4: Trigger, threshold and limits as defined in the GMMP

Botanical studies on the project area have found that the majority of smaller shrubs and perennials have shallow roots less than 2m deep. A study by Mattiske Consulting Pty Ltd (2009) indicated that around 13% of species present have roots extending 5-10m. It is expected that the majority of these occur on dunes rather than the interdunal swales.

However, some species have an estimated root depth of 22 m (Mattiske Consulting Pty Ltd, 2008). Among these deep rooted species, the sensitivity of different species to change in water availability (and possibly salinity) is expected to vary based on differing physiology.

Groundwater modelling covering the initial mining area for this works approval is planned but not yet available. The modelling provided for this assessment is based in the southern end of the orebody, as the original mine plan was to mine south to north. The plan has since changed to a north to south mining sequence. Updated modelling is required as a priority. Modelling for the southern end indicates that a mound height of up to 10m above the Toolonga Calcilutite may occur immediately below the tailings deposition area. In the 'worst case' modelled scenario, mounding may come withing 4m of the surface in a very low swale area within the Shark Bay World Heritage Area.

The Delegated Officer considers that given the rate of mound formation in the early years modelled for the southern mining area, the risk of groundwater mounding leading to vegetation impacts in the short term is adequately regulated under Ministerial Statement MS 723.

The Delegated Officer considers that seepage controls proposed are reasonable for the short term, and additional seepage recovery measures can be implemented at a later date if required. Time limited operations for mining and processing will be authorised for 180 days as requested. Updated groundwater mounding modelling will be required prior to the commencement of time limited operations. This will inform the risk assessment and groundwater level triggers and limits to be stipulated in the subsequent licence.

A condition has been included in the works approval to require groundwater monitoring at the monitoring bores proposed by the applicant surrounding the initial mining area, for the suite of analytes proposed in the GMMP. These will be used to monitor impacts to groundwater and validate the groundwater mounding model.

The Delegated Officer considers it **unlikely** that seepage from tailings will lead to mounding into the root zone of vegetation in the short term. If this were to occur, it is anticipated that impacts in this timeframe would be **minor**. Groundwater mounding from tailings water seepage within the 180 days of time limited operations is therefore a **medium** risk. The risk of ongoing deposition beyond this period will be assessed at the licence assessment stage, informed by updated groundwater mounding modelling.

3.4 Detailed risk assessment of seepage of process water from deposited tailings, leading to groundwater contamination

Section 3.3 describes the proposed tailings deposition process and the receiving environment.

The tailings are geochemically inert, therefore no acid or metalliferous drainage is expected. No dewatering will be occurring to expose previously saturated strata to the atmosphere. The mined ore will go through a predominantly physical separation process before being returned to the same environment. The only chemical additives in the process are a flocculant (Flopam^{TM} AN 923 SH) and attritioning agent (Frevis 9934). The Delegated Officer has reviewed the material safety data sheets provided for both products and is satisfied that they are not environmentally hazardous.

The abstracted groundwater used to slurry and process the ore will be saline, with TDS approximately 8,900ppm. The salinity of process water is increased by the addition of brine from the reverse osmosis (RO) plant. At full desalination plant capacity, approximately 500m^3/day of brine will be added to the process water circuit. This represents about 1.3% of the daily process water input, and therefore 1.3% of the process water reporting to the tailings facilities.

If the output brine were to have a concentration 10 times higher than the RO plan input, the addition of 1.3% brine to the process water would result in a 1- 2% increase in TDS.

The groundwater in the superficial aquifer above the basement is saline to highly saline, with

TDS values between 7,000 and 19,000 ppm recorded in test pits within the project area. Regionally, salinity increases to the north with TDS values up to 68,00 ppm being recorded near the Nilemah Embayment. Hamelin Pool, approximately 30km north of the premises, is also a groundwater discharge area.

Although the brine adds around 1-2% and it is likely that the process water will increase in salinity slightly due to evaporative losses, tailings seepage is therefore expected be within the range of salinity exhibited in the local aquifer.

Hydrocarbons and other chemicals used on site on an ad-hoc basis could potentially contaminate stormwater, and hence seepage from unlined tailings facilities.

The most plausible contamination arising from seepage of tailings water is elevated salinity, with other contaminants potentially introduced through stormwater reuse. The Delegated Officer considers it **unlikely** that the seepage of process water, even with the addition of 500L/day of brine from the Reverse Osmosis desalination plant, will lead to a measurable change in groundwater chemistry and the impact of any increase is expected to be **minor**. Groundwater contamination from tailings water seepage is therefore a **medium** risk.

4. Consultation

Table 4 provides a summary of the consultation undertaken by the department.

Table 4: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website (18/01/2021)	None received	N/A
Local Government Authority advised of proposal (27/01/2021)	None received	N/A
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal (27/01/2021)	None received	N/A
Applicant was provided with draft documents on 27 May 2021.	Refer to Appendix 1	Refer to Appendix 1

5. Conclusion

Based on the assessment in this Decision Report, the Delegated Officer has determined that a works approval will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

References

1. Department of Environment Regulation (DER) 2016, *Guidance Statement: Environmental Siting*, Perth, Western Australia.
2. DER 2017, *Guidance Statement: Risk Assessments*, Perth, Western Australia.

3. DER 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.

4. URS Australia Pty Ltd 2012, Coburn Zircon Project Groundwater Mounding Management Plan, prepared for Gunson Resources Limited, 15 June 2012

5. Mattiske Consulting Pty Ltd (2008) Review of Plant Root Structures on the Proposed Coburn Mineral Sand Mine Coburn Station, Shark Bay. Unpublished report prepared for URS Australia Pty Ltd. July 2008.

6. Mattiske Consulting Pty Ltd (2009) Eco-hydrological Impacts of Groundwater Mounding. Unpublished report prepared for URS Australia Pty Ltd. September 2009.

Appendix 1: Summary of applicant's comments on risk assessment and draft conditions

Condition	Summary of applicant's comment	Department's response
Draft Decision Report	Minor corrections and clarifications New Receptor map provided Proposed alternative text in validation checklist (Appendix 2) to reflect actual scope of works as assessed	Updated/corrected
1, 5,	Updated premises map provided	Updated Figure and references
1, 7, 8	Requested splitting of pipelines into two stages to allow for construction, commissioning and operation of initial ore pipelines and tailings pipelines to off-path TSF in phase 1, then later construction, commissioning and operation of pipelines to mine voids.	Agree. Conditions reworded to reflect this split.
3	Requested that compliance report timeframe be measured from the last well.	Accepted. Also formatting change to put condition 3 under heading 'Compliance reporting'
3,4,14	Requested 60 days rather than 30 for submission of construction report for monitoring bores and other infrastructure, and report on Time Limited Operations.	Approved.
9	Incorrect table reference	Corrected
10	Requested reference to condition number for clarity.	Accepted
Schedule 1 Figure1, and references throughout works approval	New Premises Map (Schedule 1 Figure 1) provided	Updated Figure and references
Throughout	Minor corrections and clarifications	Accepted

Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY		
Application type		
Works approval	☒	
Date application received		29/10/2020
Applicant and Premises details		
Applicant name/s (full legal name/s)		Strandline Resources Limited
Premises name		Coburn Mineral Sands Project
Premises location		M09/102 expiry 24/10/2025 M09/103 expiry 24/10/2025 M09/104 expiry 24/10/2025 M09/105 expiry 24/10/2025 M09/106 expiry 24/10/2025 M09/111 expiry 17/07/2026 M09/112 expiry 17/07/2026
Local Government Authority		Shire of Shark Bay
Application documents		
HPCM file reference number:		DER2018/001042-4~25 / DER2020/000541
Key application documents (additional to application form):		Strandline Coburn Mineral Sands Project Works Approval Application Groundwater operating strategy Groundwater mounding management plan (GMMP) Ministerial Statement 723 Coburn sand mining proposal Environmental Noise Assessment Dust Management Plan
Scope of application/assessment		

Summary of proposed activities or changes to existing operations.	Works approval for construction of: - Dozer Mining Units, a Wet Concentrator Plant, and associated process water pond and settling pond; - a Mineral Separation Plant, and associated raw water pond and mineral concentrating infrastructure; - support infrastructure such as pumps and pipework for transporting water, slurried ore and tailings; - mobile machinery for earthworks; - mine voids and an off path tailings storage facility; - stockpiles, including overburden, heavy mineral concentrate, zircon concentrate, mineral separation plant tails and heavy mineral concentrate overflow; - a water desalination plant; - a power station, including gas generators; - other supporting infrastructure includes a borefield for groundwater monitoring, concrete batching plant, storage facility for hydrocarbons and flocculant chemicals, an accommodation village, workshop, offices

Category number/s (activities that cause the premises to become prescribed premises)

Table 1: Prescribed premises categories

Prescribed premises category and description	Proposed production or design capacity
Category 8: mineral sands mining or processing: premises on which mineral sands ore is mined, screened, separated or otherwise processed.	Design Capacity: 23.4mtpa Expected throughput: 23.4mtpa
Category 52: Electric power generation: premises (other than premises within category 53 or an emergency standby power generating plant) on which electrical power is generated using a fuel.	Expected: 15.9MW Design capacity: 20MW
Category 85B: Water desalination plant: premises at which salt is extracted from water if waste water is discharged onto land or into waters (other than marine waters).	0.62 GL per year (category added during assessment)

Legislative context and other approvals

Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes ☒ No ☐	Referral decision No: Bulletin 1211 Managed under Part V ☐

		Assessed under Part IV ☒
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes ☒ No ☐	Ministerial statement No: 723 EPA Report No:
Has the proposal been referred and/or assessed under the EPBC Act?	Yes ☒ No ☐	Reference No: EPBC 2003/1221
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes ☒ No ☐	Certificate of title ☐ General lease ☐ Expiry: Mining lease / tenement ☒ Expiry: Other evidence ☐ Expiry:
Has the applicant obtained all relevant planning approvals?	Yes ☐ No ☐ N/A ☒	Approval: Expiry date:
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes ☐ No ☒	CPS No: N/A
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes ☐ No ☒	Application reference No: N/A Licence/permit No: N/A
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes ☐ No ☐	Application reference No: Licence/permit No:
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes ☐ No ☒	Name: N/A Type: Has Regulatory Services (Water) been consulted? Yes ☐ No ☐ N/A ☒
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes ☐ No ☒	Name: N/A Priority: N/A
Is the Premises subject to any other Acts or subsidiary regulations (e.g. *Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004*)	Yes ☒ No ☐	*Environment Protection and Biodiversity Conservation Act 1999* Controlled action *under Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*

		Aboriginal Act 1972. *Biodiversity Conservation Act 2016* *Mines Safety and Inspection Regulations 1995*
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes ☐ No ☒	
Is the Premises subject to any EPP requirements?	Yes ☐ No ☒	
Is the Premises a known or suspected contaminated site under the *Contaminated Sites Act 2003*?	Yes ☐ No ☒	Classification: N/A Date of classification: N/A