



Application for Works Approval

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

Works Approval Number	W2850/2025/1
Applicant	South32 Worsley Alumina Pty Ltd
ACN	008 905 155
File number	DER2017/001998-1~7
Premises	<p>Worsley Alumina Refinery Gastaldo Road, ALLANSON WA 6225</p> <p>Legal description - Lease No 3116/7574 being Wellington Locations 5314-5317 on Deposited Plan 220209</p> <p>As defined by the premises maps attached to the issued works approval</p>
Date of report	28/04/2025
Decision	Determined

Caron Goodbourn

Manager, Process Industries

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

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 time limited operations of a lift to the embankments of currently existing bauxite residue disposal areas (BRDA) BRDA4 and BRDA5 at the South32 Worsley Alumina Pty Ltd (South32; the Applicant) Refinery (the Premises; Refinery). As a result of this assessment, works approval W2850/2025/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this decision report, the Department of Water and Environmental Regulation (the department; DWER) 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 Background and use of BRDAs

South32 operates the Worsley Bauxite-Alumina Refinery in Allanson, approximately 15 km north-west of the town of Collie. Construction of the Refinery commenced in 1980, and the first alumina was produced in April 1984. Its primary function is to refine bauxite mined from the nearby Boddington Bauxite Mine into calcined alumina via the Bayer process.

The Premises operates under multiple prescribed premise categories. The primary prescribed premises category, Category 46: Bauxite refining, is assessed at a production capacity of 4.7 million tonnes per annual period under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which is defined in Licence L4504/1981/17 (L4504). The infrastructure and equipment relating to the premises category and any associated activities which the department has considered in line with *Guideline: Risk Assessments* (DWER 2020) are outlined in Licence L4504.

Bauxite residue, consisting of residual sand and mud from the refining process, is deposited in the BRDAs as alkaline slurry. Excess sodium oxalate unable to be treated by the Liquor Burner is also stored in the BRDAs. The storage of the slurry presents groundwater and surface water contamination risk. This risk is managed through operating a closed water circuit where all contaminated water is directed to a central storage area (Refinery Catchment Lake, RCL) and uncontaminated water directed to a separate temporary storage area (Fresh Water Lake, FWL) away from production areas.

The Premises has two areas where BRDAs are currently in operation. The BRDAs within the Northern Valley of the Premises are BRDA 1; BRDA 2, BRDA 4 (cells 1 & 2) and BRDA 4X (cells 1 & 2 have been merged) and within the Southern Valley of the Premises is BRDA 5 (Cells 1 – 7). The BRDAs are located within the boundary of the Refinery Lease Agreement (Figure 1), which is also the boundary of the Licenced Premises (L4504).

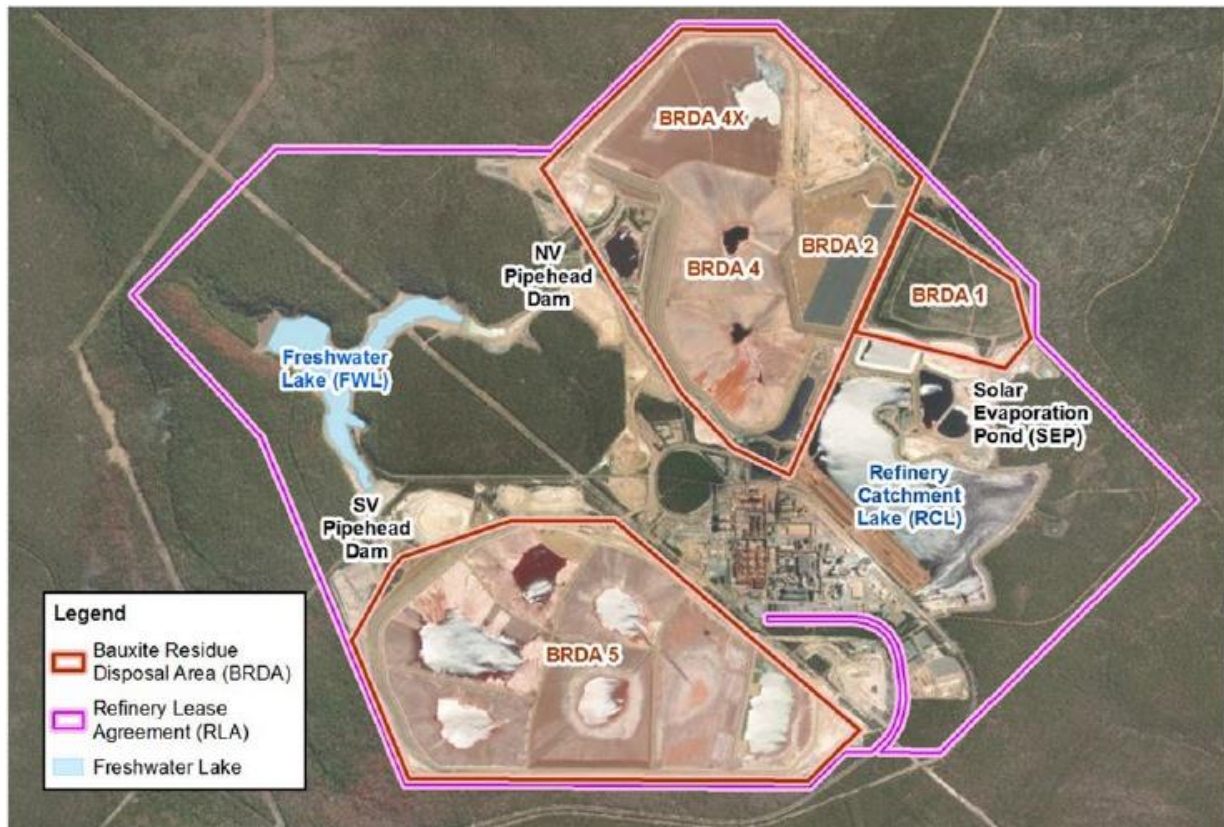


Figure 1: Bauxite Residue Disposal Area layout at the premises

The BRDAs have low permeability clay liners with two under drainage systems which separate uncontaminated groundwater beneath the BRDA from potentially contaminated seepage via a network of underflow collection pipes. The under-drainage systems are separated by a clay drainage blanket. Seepage is directed to downstream pipehead dams where it is collected and returned to the process via the RCL. The uncontaminated groundwater is collected, monitored and if contamination is not detected it is directed into the FWL.

Regular groundwater monitoring is undertaken across the premises, including below the BRDAs, to detect contamination, seepage and changes in water quality in accordance with a Water Resources Management Plan as required by Ministerial Statement 719.

The BRDAs related to this application are BRDA 4 and BRDA 5.

Construction of BRDA 4 commenced in 1994, with a 3 m starter embankment, and subsequent upstream raises completed over a number of years. BRDA4 is bounded along the eastern perimeter by the former downstream batter of BRDA2, and along the northern perimeter by BRDA4X. It is currently an average height of 59 meters. BRDA 4 is currently comprised of two cells, Cell 1 and Cell 2.

Construction of BRDA 5 commenced in 1997, with a 30 m high starter embankment along the west perimeter, and subsequent upstream raises to the starter embankment have been completed over a number of years. Completion of the final floor area was completed in FY16. It is currently an average height of 60 meters. The valley which BRDA5 occupies slopes from east to west. As such, the depth of the residue at the western perimeter will be at its deepest, decreasing toward the east. BRDA 5 is currently comprised of six cells, Cell 1, 2, 3, 5, 6 and 7. Cell 4 was historically combined with Cell 1 and Cell 7 does not form part of this application. However, to reduce the risk of overtopping the RCL and assist with the site-wide water

balance requirements, the Applicant during future Stage 8 works is exploring the use of Cell 7 as a decant pond for extreme storm storage.

2.3 Application summary

On 28 November 2024, South32 submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application is to undertake construction works to raise the embankments of BRDA 4 by 5 metres to a final height of RL 309.0 m AHD as part of Stage 8 works, and BRDA 5 by 5 metres to a final height of RL 295.5 m AHD as part of Stage 7 works. The raise of the embankments will be undertaken progressively at an approximate rate of 1.7 metres per year during financial years of 2026-2031.

This report only assesses the emissions and discharges associated with the construction of the embankment raises of BRDA 4 and BRDA 5. Deposition of bauxite tailings into these areas was assessed under licence L4504. As this application does not include an increase to the amount of bauxite residue deposited into the BRDAs, it is not assessed within this decision report.

2.4 Proposed works for BRDA 4 Stage 8 and BRDA 5 Stage 7

The proposed BRDA 4 Stage 8 predominately comprises of the construction of an upstream embankment raise (constructed on residue) to a final height of RL 309.0 m AHD.

The construction works proposed to be undertaken as part of this works approval are listed below in Table 1 and illustrated in Figure 1.

Table 1: Summary of Works to be undertaken to embankments during Financial Years 2026-2027

BRDA 4 Stage 8 (Figure 1)
<ul style="list-style-type: none">• Upstream embankment construction (western and southern perimeter)• Construction of “Dividing Wall Cell 1/2” separating Cell 1 and 2;• Extending decant towers No. 5 and 6• Operational access for inspection and maintenance• Stormwater runoff features from perimeter embankments• Amphiroller ramps and maintenance pads• Toe buttress

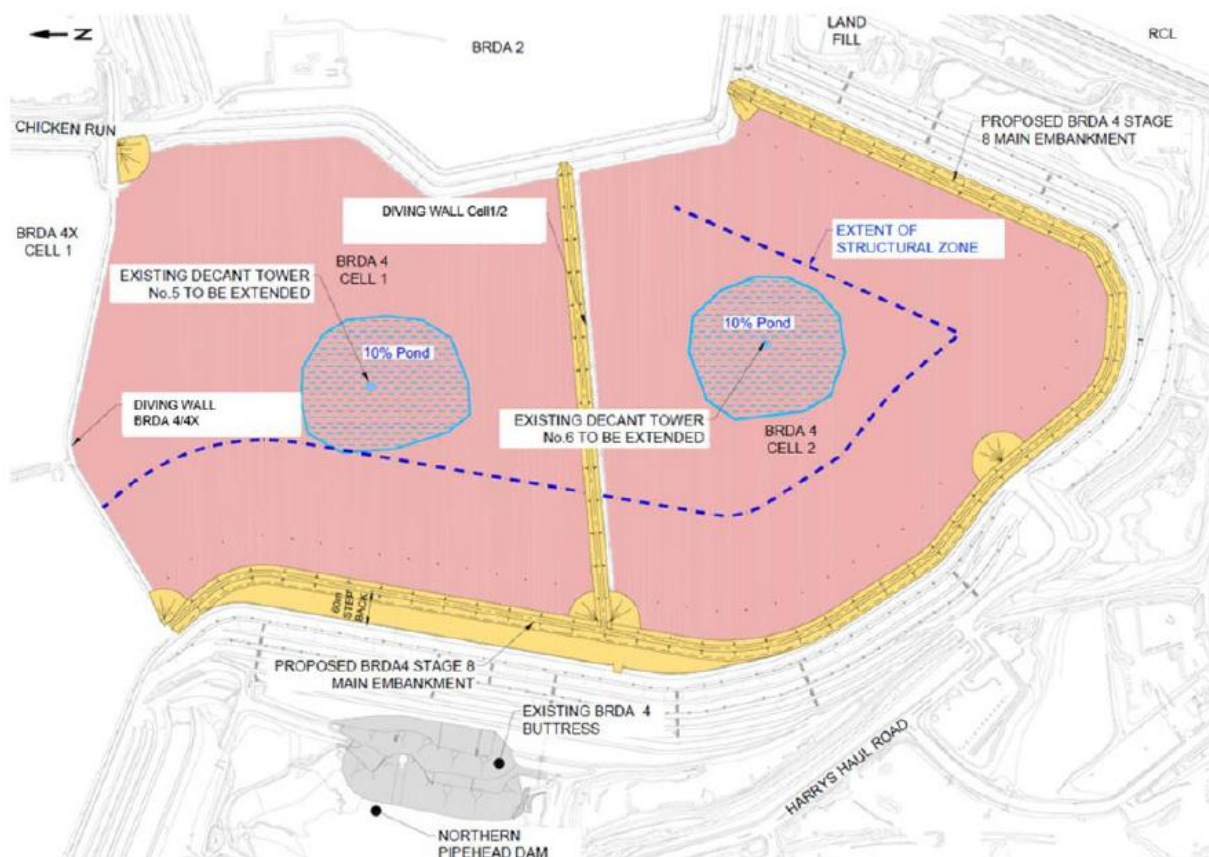


Figure 1: BRDA 4 Stage 8 Proposed Cell Configuration

The proposed BRDA 5 Stage 7 predominately comprises of the construction of an upstream embankment raise (constructed on residue) to a final height of RL 295.50 m AHD and partial centreline construction and extension of decant towers.

The construction works proposed to be undertaken as part of this works approval are listed below in Table 2 and illustrated in Figure 2.

Table 2: Summary of Works to be undertaken to embankments during Financial Years 2027-2031

BRDA 5 Stage 7 (Figure 2)
<ul style="list-style-type: none"> • Partial centerline construction of Splitter Bund and Dividing Walls • Realignment of splitter bund 1 • Upstream construction (perimeter embankments) • Extension of decant towers (No. 1, 2, 3, 4, 6, 12 and 13) • Capping of decant towers 7 and 8 • Decant Access causeways into cells 1, 2, 3, 5 and 6 • Amphiroller ramps and maintenance pads • Operational access for inspection and maintenance • Stormwater runoff features from perimeter embankments

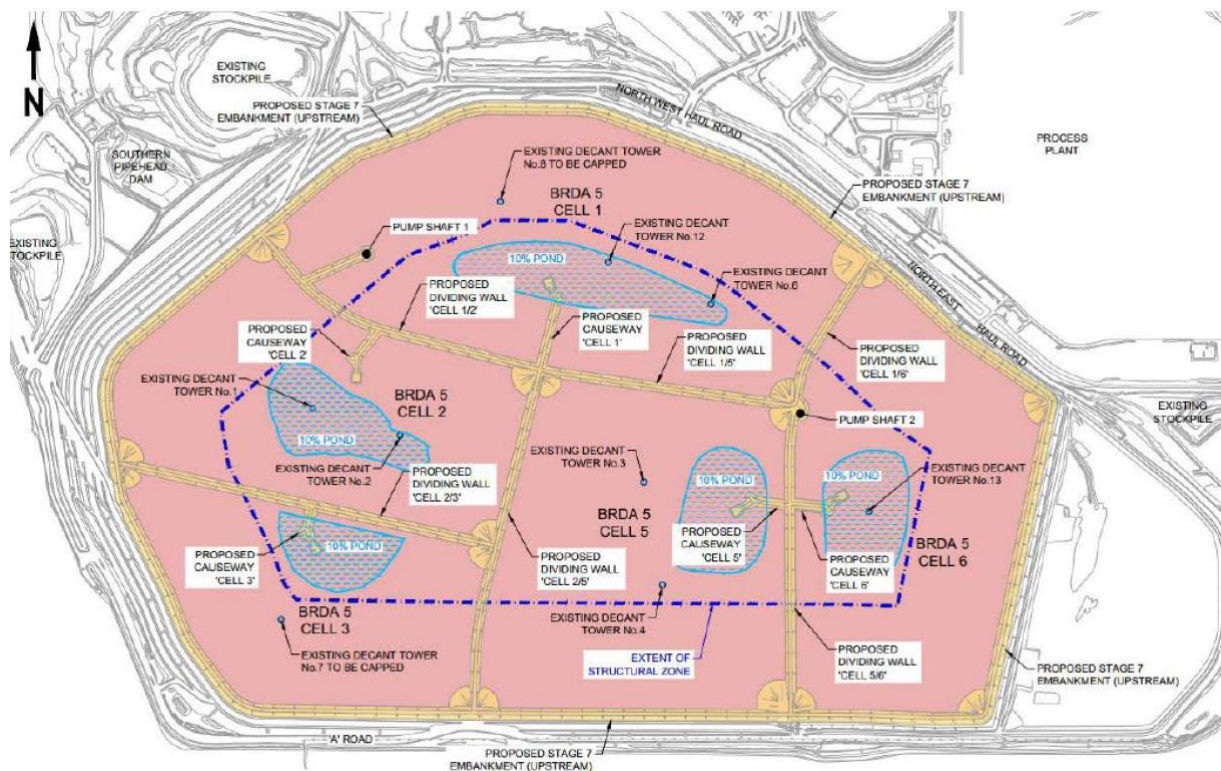


Figure 2: BRDA 5 Stage 7 Proposed Cell Configuration

Detailed construction design diagrams of works to be undertaken for BRDA 4 Stage 8 and BRDA 5 Stage 7 in the 2026 to 2031 financial years are provided in Schedule 1 of the Works Approval.

These works include but not limited to the construction of:

- embankment lift on existing bauxite residue within the BRDA cells
- a toe buttress to support the embankment lift of BRDA 4 (see Figure 1). The toe buttress extending approximately 300 metres by 150m between BDRA4 and the Northern Pipehead Dam and constructed in accordance with the specifications documented in BRDA 4 Buttress Design Report (Life Of Mine Engineering, 2024)
- a mudline deposition pipeline that contains multiple discharge spigot attachment valves around the embankment perimeter
- extending existing decant towers
- underdrainage system drainage pipes for the embankment lift (PVC slotted pipes, decant recovery and stormwater diversion infrastructure that forms part of the closed liquor management system);
- stormwater and erosion management features such geotextile fabric, riser pipes and sand fingers installed along the internal perimeter embankments
- toes drains and diversion drainage connected to the freshwater lake and the refinery catchment lake.
- Bunding on the upstream crest of embankment and dividing walls resulting in batter slope inclination, crest fall, and coverage of trafficable areas.
- Vibrating Wire Piezometers are installed beneath the proposed embankment

It was noted that no upstream toe drainage system or sand fingers will be installed in the

eastern embankment Cell 6 of BRDA 5 during Stage 7 construction works. Instead, a toe drainage system will be installed during Stage 8 works when the embankment is at sufficient height to outlet directly to the Cell 7 decant pond.

Monitoring of embankment settlement during construction will be via settlement plates installed prior to construction of the upstream lift. Long term settlement is assessed via annual survey data of the BRDA embankments and surrounds as well as fortnightly satellite monitoring of the ground deformation using radar images of the BRDA surface and monthly drone survey.

3. Other Approvals

3.1 Part IV of the EP Act

Ministerial Statement (MS) 719 and 1237 applies to the Worsley Alumina Refinery and the associated Boddington Bauxite Mine.

In relation to the current application, Worsley Alumina is required to implement the Water Resource Management Plan for the protection and management of nearby proclaimed water resources and to give effect to a zero discharge to these natural resources, and thereby not diminish their environmental value or use.

The site undertakes a monthly water balance assessment which includes measurement of daily rainfall, pan evaporation and predictive rainfall events such that stormwater capture. BRDAs 4 and 5 decant systems will be designed to accommodate the requirement to maintain a normal operating pond at approximately 10% of the cell area. Capture and diversion allows for zero discharge following the incidence of a 1:1000 year annual exceedance rainfall event. In emergency situations the site undertakes water transfer between all onsite containment systems (as required).

All surface and groundwater monitoring is undertaken under MS 719 with the purpose of noting changing rainfall patterns, and to addresses strategic water source planning and to protection of water quality in the Augustus River, which is located downstream of the refinery. It provides for the maintenance of environmental water use, surface and groundwater quality monitoring and management and clean-up of spills, as well as on site contamination.

In relation to fugitive dust emissions from the BDRA's, MS 719 also applies to the management of fugitive dust emissions, incidents and complaints management as well as annual reporting on ambient particulate air quality. The main source of dust at the refinery is from the BRDA's and this is influenced by the moisture of the dry BRDA's, trafficable area dust lift off, construction activities, prevailing weather and wind conditions and ongoing dust mitigation and management measures.

Two Tapered Element Oscillating Microbalances and one E-Sampler, targeting particulate matter with a diameter of 10 microns (PM10) particles, are used to monitor dust impacts from the BRDAs, roads, tracks and construction areas (including material handling) at the Refinery. PM10 particles are monitored according to the National Environment Protection Measures – Ambient Air Quality Standard and are reported in Worsley's Annual Environmental Report (AER).

3.2 Alumina Refinery (Worsley) Agreement Act 1973 (Worsley State Agreement)

The premises was granted initial approval under *The Alumna Refinery (Worsley) Agreement Act 1973*. The Worsley State Agreement requires the Premises to maintain compliance with zero discharges to nearby sensitive water resources as the premises is located within the

upper catchment of Augustus River and directly adjacent to a Public Drinking Water Source Protection Area (as detailed in Table 4 of this report) during all stages of construction, operation and closure of the facility. The zero discharges provisions within the approval requires high level of management and planning surrounding the BRDA's as the restriction applies to worse case storm events, dam break, spillway, seepage or overflow scenarios.

Reporting against the sections c5A(3) & section c16(10) of the Worsley State Agreement is undertaken annually through submission of the Worsley 10-Year Plan and Annual Review process.

3.3 Mining Act 1978

The design, construction, operation and closure of all tailings storage facilities (TSF) in Western Australian mines must comply with the *Mines Safety and Inspection Act 1994*, *Mines Safety and Inspection Regulations 1995* and *Mining Act 1978* as well as Department of Energy, Mines, Industry Regulation and Safety's (DEMIRS) codes and guidelines. Annual BRDA Audits are conducted by independent third parties and submitted to DEMIRS to ensure compliance with the following DEMIRS guidance:

- Code of Practice: Tailings storage facilities in Western Australia;
- Guide to Departmental requirements for the management and closure of TSF; and
- Tailings storage facility audit.

4. 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 *Guideline: Risk Assessments* (DWER 2020).

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.

4.1 Source-pathways and receptors

4.1.1 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 3 below. Table 3 also details the control measures the applicant has proposed to assist in controlling these emissions, where necessary.

Table 3: Proposed applicant controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Dust	Transport, mixing, compaction of materials for the construction of embankments, internal causeways, splinter bunds, construction ramps,	Air / windborne pathway	<ul style="list-style-type: none"> • Water carts. • Surface binding agents. • Adherence to construction material moisture requirements. • Cessation of a particular operation or an amendment to operational procedure when dust cannot be controlled. • Air Quality Management Plan

Emission	Sources	Potential pathways	Proposed controls
Noise	vehicle movements, lift-off from stockpiles and/or stored product, earthworks etc.		<ul style="list-style-type: none"> All onsite machinery compliant with vehicle noise emission requirements. Site will conduct works in accordance with Section 4 of AS 2436-2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites (standards Australia 2010) Separation distances are such that any noise and vibration from construction works is sufficient that will not occur
Bauxite residue Slurry water: containing Al ₂ O ₃ , Na ₂ , CO ₃ , and SO ₄	Embankment failure (Dam Break)	Direct discharge and overland flow to nearby land and water	<ul style="list-style-type: none"> The construction methods determine the capacity of the embankments to remain stable under a range of conditions during operations. Construction will occur in accordance with the Life of Mine Design Report BRDA 4 – Stage 8 Raise (2024a), Life of Mine Design Package FY '27-30 BRDA 5 – Stage 7 (2024b); and the premises CQA Plan. The Works Approval Holder provides that these reports demonstrate the embankment raise is compliant with the: <ul style="list-style-type: none"> Code of Practice for Tailings Storage Facilities (DMIRS); Australian National Committee on Large Dams (ANCOLD); Guidelines on Tailings Dam Planning Design, Australian National Committee on Large Dams (ANCOLD); and Guidelines on Dam Safety Management (ANCOLD, 2003). The Design Report BRDA 4 – Stage 8 Raise (2024a) and Design Package FY '27-30 BRDA 5 – Stage 7 (2024b) contain an assessment of the Stability of the dams under seismic loading, drained and undrained conditions. The report claims the BRDA 5 when constructed to the above specifications, will meet the minimum factors of safety. Deposition will not commence until these claims have been verified by an independent assessment through a third-party geotechnical assessment of the Design Report and until any critical issues identified through the third party review, are satisfactorily addressed.
Sediment laden runoff. Potentially contaminated	Mobilisation of stormwater	Overland runoff	<ul style="list-style-type: none"> Outside batters of BRDA 4 and BRDA 5 are captured by toe drains, diversion culverts to the FWL via silt traps. Construction of a bund on the downstream side of the construction

Emission	Sources	Potential pathways	Proposed controls
stormwater			<p>areas so that loose materials subject to mobilisation to stormwater runoff will be undertaken such that the drainage of rainfall falls to the upstream side of embankments where possible.</p> <ul style="list-style-type: none"> Water quality monitored within the FWL include parameters for turbidity. If a trigger level is exceeded, as defined in the sites Triggered Action Response Plan (TARP), an investigation into the source of the exceedances and implementation of corrective action will occur to address the cause of the incident.
Operation			
Bauxite Residue Slurry water: containing Al ₂ O ₃ , Na ₂ , CO ₃ , and SO ₄	Embankment failure (Dam Break)	Direct discharge and overland flow to nearby land and water	<ul style="list-style-type: none"> Management of water within the raise prior to deposition mass being consolidated is through careful management of tailings deposition and supernatant in accordance with the BRDA Operating Maintenance and Surveillance Manual: <ul style="list-style-type: none"> Daily inspections of BRDAs Delivery mudline fitted with dropper pipe spigots that minimise velocity of deposition; Spigots paced an average of 72 m apart and managed 4-hourly short pours around perimeter embankments to maintain pond around the decant tower; Beach length of approximately 500 m with tailings deposition of 55% solids and a 0.6% degree beach slope; Wet pours of a maximum of 1.1 m at a time; and Use of Amphirollers on wet pours within 72hours of pour until an undrained shear strength of 28 kPa is achieved for each layer.
	Leaks and spills from pipelines, mudlines, pumps and associated infrastructure		<ul style="list-style-type: none"> Comprehensive and daily monitoring of BRDA's including mudlines delivering bauxite to the BRDA's, decant recovery pipelines and valves; Scheduled maintenance; Incident recording and reporting TARP to identify and respond to issues as they arise; The site is operated as a closed system, contaminated water and leachate from spills is contained within the premises; and Extensive groundwater and surface monitoring is undertaken to validate

Emission	Sources	Potential pathways	Proposed controls
			effectiveness of controls (under Ministerial Statement 719).
	Overtopping of BRDA due to excess loading or heavy rainfall events or both	Overland flow, direct discharge to soil, infiltration to groundwater	<ul style="list-style-type: none"> Maintenance of operational freeboard of 0.5 m between the tailings at the top of the beach and the embankment crest (inclusive of wave action); The beach angle over 100 m of beach is 0.6 m; Only two or three cells are actively used at any one time, may be used in the event of an extreme storm event to temporarily store storm water; Maximum operating levels are calculated to only be exceeded in a 1:1,000 year annual recurrence interval storm event; Ability to move contaminated storm water following high rainfall events to other containment infrastructure on site such that a water from an extreme 1: 1000-year annual rainfall incidence 72 hour duration event is completely contained within the premises infrastructure, enabling compliance with the sites "zero discharge" requirements under the Agreement Act; and TARP to identify and respond to issues as they arise.
Leachate Slurry water: containing Al ₂ O ₃ , Na ₂ , CO ₃ , and SO ₄	Seepage of contaminants through the base of the BRDA liner causing groundwater contamination and mounding	Direct discharge to soil, infiltration to groundwater	<ul style="list-style-type: none"> Inspection of underdrain at pipe head dam inflow; Report any changes Vacuum pumping to unblock pipes if required; TARP to identify and respond to issues as they arise; The site is operated as a closed system, contaminated water and leachate is contained within the premises; and Extensive groundwater and surface monitoring is undertaken to validate effectiveness of controls (under Ministerial Statement 719).
Mobilisation of stormwater	Contaminated stormwater run off		<ul style="list-style-type: none"> Design such that stormwater that falls on the downstream side of perimeter embankments is diverted to of Gravel lined spoon drains at the toe of embankment leading to rock drops; The rock drops report to southern diversion dam through southern valley silt trap to the southern arm of the FWL; and Periodic testing of FWL is undertaken.in accordance with Ministerial Statement 719.
Dust lift off	Dry deposition	Air / windborne	<ul style="list-style-type: none"> Dust from the BRDA's is managed in accordance with the sites Air Quality and

Emission	Sources	Potential pathways	Proposed controls
	surface	pathway	Dust Management Plan – RLA Business Blueprint and includes: <ul style="list-style-type: none"> • Daily visual monitoring of BRDA surface; • Dust monitoring stations upstream and downstream to monitor dust lift off; • Addition of dust suppression and surface binding agents hydro mulch and Gluon500 to control dust over residue deposition areas according to BRDA annual Dust Management Plan; <ul style="list-style-type: none"> ○ Use of water carts and sweeping in dry weather; ○ Mechanical ploughing and ripping of BRDA surfaces; and ○ Trigger levels and corrective action response and reporting.

4.1.2 Receptors

In accordance with the *Guideline: Risk Assessment* (DWER 2020), the Delegated Officer has excluded the applicant's employees, visitors, and contractors from its assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation.

Table below provides 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 (*Guideline: Environmental Siting* (DWER 2020)).

Table 4: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
Single Rural dwellings	No rural dwellings within 5km of the premises. Single residential dwelling approximately 6 km south of the most southern bauxite residual storage areas.
Environmental receptors	Distance from prescribed activity
Priority 1 Public Drinking Water Source Area (PDWSA)	The Priority 1 Harris River Catchment Dam Area
Major watercourses/waterbodies	The refinery Freshwater Lake feeds into the Augustus River
Groundwater	Groundwater beneath BRDA is collected via a specifically designed groundwater underdrainage system that reports to the freshwater lake
Rights in Water and Irrigation Act 1914 (RiWI Act)	Premises lie across the boundary of the following surface water areas: Collie River Irrigation District Brunswick River and tributaries

Waterways Conservation Areas	Leschenault Inlet Management Area adjoins western point of the premises boundary
Threatened/Priority Flora	A number of priority flora species within proximity of the premises boundary, the closest being 580m, 660m south and 1.5 and 1.7km south-west respectively of the BRDA 5.

4.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 4.1. 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 4.1), 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 5.

Works approval W2850/2025/1 that accompanies this decision report authorises construction and operation. The conditions in the issued works approval, as outlined in Table 5 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 5: Risk assessment of potential emissions and discharges from the premises during construction and operation.

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
Category 46: Bauxite Refining – Construction of BRDA lift								
Transport, mixing, compaction of materials for the construction of embankments, internal causeways, splinter bunds, construction ramps, vehicle	Dust from civil and construction activities	Receptors: Single rural dwelling approximately 6 km due south and north of premises Pathway: Air/windborne pathway Impact:	Water carts. Surface binding agents. Adherence to construction material moisture requirements. Cessation of a particular operation or an amendment to operational procedure when dust cannot be controlled. Air Quality Management Plan	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	Medium Acceptable, subject to regulatory controls	Dust may be generated during the construction of the embankment raise from the loading, transport and delivery of construction materials, through construction plant and vehicle movements and through physical earthworks. Due to warm weather and high wind speeds in later part of the year (October/November) there is the potential that dust may travel to affect the surrounding rural dwellings. The Delegated Officer considers the applicant's proposed process controls such as the use of water carts and surface binding agents are likely to result in adequate dust suppression and will minimise the risk to the health and amenity of human receptors outside of the facility. However, the Delegated Officer considers the applicant's management controls are necessary to be	Conditions 1 and 4: Standard works approval construction, compliance and reporting conditions will apply Conditions 10 and 11: require the Works Approval Holder to record and report any complaints or incidents

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
movement s, lift-off from stockpiles and/or stored product, earthworks etc.		Health and amenity					included as construction and operational conditions in the works approval.	
	Noise from civil and construction activities		All onsite machinery compliant with vehicle noise emission requirements. Site will conduct works in accordance with Section 4 of AS 2436-2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites (standards Australia 2010) Separation distances are such that any noise and vibration from construction works is sufficient that will not occur	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	Medium Acceptable, subject to regulatory controls	Noise from construction machinery is likely to create noise that may be carried by the wind to affect the surrounding rural dwellings. The Delegated Officer considers the applicant's proposed process controls such as machinery complaint with vehicle noise emission requirements and maintaining separation distances from receiving receptors are likely to result in adequate protection to the amenity of human receptors outside of the facility. However, the Delegated Officer considers the applicant's management controls are necessary to be included as construction and operational conditions in the works approval.	
Mobilisation of stormwater	Sediment laden runoff. Potentially contaminated stormwater	Receptor: Augustus River approximately 2km north west of the BRDAs Pathway: Overland runoff. Impact: Reduced surface water quality and ecosystem	Outside batters of BRDA 4 and BRDA 5 are captured by toe drains, diversion culverts to the FWL via silt traps. Construction of a bund on the downstream side of the construction areas so that loose materials subject to mobilisation to stormwater runoff will be undertaken such that the drainage of rainfall falls to the upstream side of embankments where possible. Water quality monitored within the FWL include parameters for turbidity. If a	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	Medium Acceptable, subject to regulatory controls	As the southern boundary of BDRA 5 is located immediately adjacent to the licence premises boundary (L4504/1981/17) there is potential for sediment laden runoff to migrate over the boundary and into an area of native vegetation in the State Forest. The most recent report of an incident from the release of potentially impacted stormwater was from 2013. The release of approximately 50m3 process liquor (approximately pH 10) was released into the freshwater catchment area pooling an area of approximately 100m2. A majority of the liquor was removed by vacuum truck and returned to process catchment and contaminated soil was excavated and disposed of with process waste. Testing of the freshwater drainage after the	Conditions 1 and 4: Standard works approval construction, compliance and reporting conditions will apply Conditions 10 and 11: require the Works Approval Holder to record and report any complaints or incidents

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
		disturbance.	trigger level is exceeded, as defined in the sites TARP, an investigation into the source of the exceedances and implementation of corrective action will occur to address the cause of the incident.				<p>cleanup showed no signs of contamination. The blocked drain has since been cleaned out. There have not been any further reports of an uncontrolled release of stormwater on the departments 'Incident and complaints Management System'.</p> <p>The Delegated Officer considers the applicant's proposed process controls such as stormwater runoff features such as toe drains and culverts along the perimeter embankments are likely to result in adequate protection to the receptors. However, the Delegated Officer considers the applicant's management controls are necessary to be included as construction and operational conditions in the works approval to reduce the likelihood of contaminating adjacent land.</p> <p>In addition to this the Works Approval conditions will support compliance with the Worsley State Agreement which requires the Premises to maintain zero discharges to nearby sensitive water resources.</p>	
Embankment failure (Dam Break)	Bauxite Residue Slurry water: containing Al ₂ O ₃ , Na ₂ , CO ₃ , and SO ₄	<p>Receptor:</p> <p>Augustus River approximately 2km northwest of the BRDAs.</p> <p>Native vegetation in State Forest</p> <p>Pathway:</p> <p>Direct discharge and overland flow to</p>	<ul style="list-style-type: none"> The construction methods determine the capacity of the embankments to remain stable under a range of conditions during operations. Construction will occur in accordance with the Life of Mine Design Report BRDA 4 – Stage 8 Raise (2024a), Life of Mine Design Package FY '27-30 BRDA 5 – Stage 7 (2024b); and the premises CQA Plan. 	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	Medium Acceptable, subject to regulatory controls	<p>There are no records of dam failure during previous raises of the BRDAs on the department's 'Incident and complaints Management System'.</p> <p>However, as BRDA 5 is located immediately north of an area of native vegetation in the State Forest. Therefore, the Delegated Officer considers the applicant's proposed management controls in particular the third-party audit of the compliance of the construction of the raises with requirements of the DEMIRS and ANCOLD guidelines are necessary to be included as construction conditions in the works approval to support and post-construction operation of the BRDAs.</p>	<p>Conditions 4, 5, 6, 7, 8 and 9:</p> <p>See Detailed Risk Assessment below</p>

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
		<p>nearby land and water</p> <p>Impact:</p> <p>Reduced surface water quality and ecosystem disturbance. Reduced vegetation health and potential loss of vegetation in some areas.</p>	<ul style="list-style-type: none"> The Works Approval Holder provides that these reports demonstrate the embankment raise is compliant with the: <ul style="list-style-type: none"> Code of Practice for Tailings Storage Facilities (DEMIRS); Australian National Committee on Large Dams (ANCOLD); Guidelines on Tailings Dam Planning Design, Australian National Committee on Large Dams (ANCOLD); and Guidelines on Dam Safety Management (ANCOLD, 2003). <p>The Design Report BRDA 4 – Stage 8 Raise (2024a) and Design Package FY '27-30 BRDA 5 – Stage 7 (2024b) contain an assessment of the Stability of the dams under seismic loading, drained and undrained conditions. The report claims the BRDA 5 when constructed to the above specifications, will meet the minimum factors of safety. Deposition will not commence until these claims have been verified by</p>					

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
			an independent assessment through a third-party geotechnical assessment of the Design Report and until any critical issues identified through the third party review, are satisfactorily addressed.					
Category 46: Bauxite Refining – Operation of BRDA lift								

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
Embankment failure (Dam Break)	Bauxite Residue Slurry water: containing Al ₂ O ₃ , Na ₂ , CO ₃ , and SO ₄	<p>Receptor:</p> <p>Augustus River approximately 2km north west of the BRDAs.</p> <p>Native vegetation in State Forest</p> <p>Pathway:</p> <p>Direct discharge and overland flow to nearby land and water</p> <p>Impact:</p> <p>Reduced surface water quality and ecosystem disturbance. Reduced vegetation health and potential loss of vegetation in some areas.</p>	<p>Management of water within the raise prior to deposition mass being consolidated is through careful management of tailings deposition and supernatant in accordance with the BRDA Operating Maintenance and Surveillance Manual:</p> <ul style="list-style-type: none"> • Daily inspections of BRDAs • Delivery mudline fitted with dropper pipe spigots that minimise velocity of deposition; • Spigots paced an average of 72 m apart and managed 4-hourly short pours around perimeter embankments to maintain pond around the decant tower; • Beach length of approximately 500 m with tailings deposition of 55% solids and a 0.6% degree beach slope; • Wet pours of a maximum of 1.1 m at a time; and • Use of Amphirollers on wet pours within 72hours of pour until an undrained shear strength of 28 kPa is achieved for each layer. 	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	Medium Acceptable, subject to regulatory controls	<p>The hazard class to humans, property and economic loss due to the failure of the embankments of BRDAs 4 and 5 have been assessed under the Australian National Committee on Large Dams (ANCOLD), Department of Mines, Industry Regulation and Safety (DMIRS) and Global Industry Standards of Tailings Management (GISTM). The subsequent ratings were found to be 'High', 'High Hazard' and 'Very High' respectively.</p> <p>There are no records of dam failure post-construction on the department's 'Incident and complaints Management System'.</p> <p>However, based on the proximity of BRDA 4 and 5 to environmental receptors such as native vegetation in the State Forest immediately south of BRDA 5 the Delegated Officer considers the applicant's proposed management controls are necessary to be included as operational conditions in the works approval.</p>	<p>Conditions 4 to 9:</p> <p>See Detailed Risk Assessment below</p>
Leaks and spills from	Bauxite residue, and	<p>Receptor:</p>	<ul style="list-style-type: none"> • Comprehensive and daily monitoring of BRDA's 	Low-level on-	Not likely to occur	Medium Acceptable,	Based on the applicant's proposed controls, the likelihood of a significant loss of residue and	Condition 1, 2 and 3

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
pipelines, mudlines, pumps and associated infrastructure	decant water Slurry water: containing Al ₂ O ₃ , Na ₂ , CO ₃ , and SO ₄	<p>Augustus River approximately 2 km north west of the BRDAs</p> <p>Pathway:</p> <p>Direct discharge and overland flow to nearby land and water</p> <p>Impact:</p> <p>Reduced groundwater quality and impacts to downgradient groundwater users.</p>	<p>including mudlines delivering bauxite to the BRDA's, decant recovery pipelines and valves;</p> <ul style="list-style-type: none"> • Scheduled maintenance; • Incident recording and reporting • TARP to identify and respond to issues as they arise; • The site is operated as a closed system, contaminated water and leachate from spills is contained within the premises; and • Extensive groundwater and surface monitoring is undertaken to validate effectiveness of controls (under Ministerial Statement 719). 	site impacts Minor	in most circumstances Unlikely	<p>subject to regulatory controls</p>	<p>decant water slurry from pipes, mudlines, pumps and associated infrastructure is considered low. There are no records of historic leaks and spills from pipelines, mudlines, pumps and associated infrastructure on the department's 'Incident and complaints Management System'</p> <p>The Delegated Officer considers the applicant's proposed process controls will minimise the likelihood of loss of product from leaks and spills. However, the Delegated Officer considers the applicant's controls are necessary to be included as construction and operational conditions in the works approval.</p> <p>With respect to groundwater quality, the Delegated Officer considers the requirements in Ministerial Statement 719 adequately addresses the protection of groundwater. Therefore, the Delegated Officer does not consider any additional ambient groundwater monitoring to be required.</p>	<p>Standard works approval construction, compliance and reporting conditions will apply</p> <p>Water Balance is managed under the Part IV Ministerial Statement 719</p>
Overtopping of BRDA due to excess loading or heavy rainfall events or both	Bauxite residue, and decant water Slurry water: containing Al ₂ O ₃ , Na ₂ , CO ₃ , and SO ₄	<p>Receptor:</p> <p>Augustus River approximately 2km north west of the BRDAs.</p> <p>Native vegetation in State Forest</p>	<ul style="list-style-type: none"> • Maintenance of operational freeboard of 0.5 m between the tailings at the top of the beach and the embankment crest (inclusive of wave action); • The beach angle over 100 m of beach is 0.6 m; • Only two or three cells are actively used at any one time, may be used in the event of an extreme storm 	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	<p>Medium Acceptable, subject to regulatory controls</p>	<p>There are no records of historic overtopping of the Premises BRDAs on the department's 'Incident and complaints Management System'. Although the Delegated Officer considers the Applicant's proposed controls are likely to minimise the risk of overtopping of BRDAs 4 and 5, it is considered that adequate controls are regulated to reduce the likelihood of overtopping and affecting nearby native vegetation and the Augustus River.</p> <p>Therefore, the Delegated Officer considers the applicant's controls are necessary to be included as construction and operational conditions in the</p>	<p>Condition 1, 2, and 3</p> <p>Standard works approval construction, compliance and reporting conditions will apply</p> <p>Water Balance is managed under the Part IV Ministerial Statement 719</p>

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
		Pathway: Overland flow, direct discharge to soil, infiltration to groundwater Impact: Reduced surface water quality and ecosystem disturbance. Reduced vegetation health and potential loss of vegetation in some areas.	event to temporarily store storm water; • Maximum operating levels are calculated to only be exceeded in a 1:1,000 year annual recurrence interval storm event; • Ability to move contaminated storm water following high rainfall events to other containment infrastructure on site such that a water from an extreme 1: 1000- year annual rainfall incidence 72 hour duration event is completely contained within the premises infrastructure, enabling compliance with the sites “zero discharge” requirements under the Agreement Act; and • TARP to identify and respond to issues as they arise.				works approval.	
Seepage of contaminants through the base of the BRDA liner causing groundwater contamination and mounding	Leachate Slurry water: containing Al ₂ O ₃ , Na ₂ , CO ₃ , and SO ₄	Receptor: Shallow aquifer discharging to FWL and Augustus River Priority 1 Public Drinking Water Source Area (Harris River)	• Inspection of underdrain at pipe head dam inflow; • Report any changes • Vacuum pumping to unblock pipes if required; • TARP to identify and respond to issues as they arise; • The site is operated as a closed system, contaminated water and leachate is contained within the premises; and	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	Medium Acceptable, subject to regulatory controls	The Applicant has stated that groundwater monitoring is undertaken downstream of the BRDAs. This is undertaken as a requirement of Ministerial Statement 719. The Applicant has stated that no impacts to groundwater from the BRDA operations have been detected to date. The Delegated Officer notes that Water Balance and groundwater monitoring are managed under Ministerial Statement 719. However, the Delegated Officer considers the Applicants proposed controls are necessary on the Works Approval to support the conditions in Ministerial Statement 719 and compliance with the Worsley	Condition 1, 2 and 3 Standard works approval construction, compliance and reporting conditions will apply Water Balance is managed under the Part IV Ministerial Statement 719

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
		<p>Catchment Dam Area) on eastern boundary.</p> <p>Pathway: Direct discharge to soil, infiltration to groundwater</p> <p>Impact: Reduced groundwater quality and impacts to downgradient groundwater users.</p>	<ul style="list-style-type: none"> • Extensive groundwater and surface monitoring is undertaken to validate effectiveness of controls (under Ministerial Statement 719). 				State Agreement which requires the Premises to maintain zero discharges to nearby sensitive water resources.	
Contaminated stormwater run off	Mobilisation of stormwater	<p>Receptor: Shallow aquifer discharging to FWL and Augustus River</p> <p>Pathway: Direct discharge to soil, infiltration to groundwater</p>	<ul style="list-style-type: none"> • Design such that stormwater that falls on the downstream side of perimeter embankments is diverted to of Gravel lined spoon drains at the toe of embankment leading to rock drops; • The rock drops report to southern diversion dam through southern valley silt trap to the southern arm of the FWL; and • Periodic testing of FWL is undertaken in accordance with Ministerial Statement 719. 	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	Medium Acceptable, subject to regulatory controls	N/A	No Controls necessary, as this is managed under the Part IV Ministerial Statement 719

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
		Impact: Reduced groundwater quality and impacts to downgradient groundwater users.						
Dry deposition surface	Dust lift off	Receptor: Nearby vegetation, nearby Augustus River approximately 2 km northwest of the BRDAs Pathway: Air / windborne pathway Impact: Reduced vegetation health and potential loss of vegetation in some areas.	<ul style="list-style-type: none"> Dust from the BRDA's is managed in accordance with the sites Air Quality and Dust Management Plan – RLA Business Blueprint and includes: <ul style="list-style-type: none"> Daily visual monitoring of BRDA surface; Dust monitoring stations upstream and downstream to monitor dust lift off; Addition of dust suppression and surface binding agents hydro mulch and Gluon500 to control dust over residue deposition areas according to BRDA annual Dust Management Plan; Use of water carts and sweeping in dry weather; Mechanical ploughing and ripping of BRDA surfaces; and Trigger levels and corrective action response and reporting. 	Low-level on-site impacts Minor	Not likely to occur in most circumstances Unlikely	Medium Acceptable, subject to regulatory controls	<p>Residue at the BRDAs surface tends to dry out as the weather warms and rainfall decreases later in the year. As wind speeds traditionally increase through October/November, the potential of BRDA dust liberation increases. This may result in dust travelling and affecting the surrounding rural dwellings.</p> <p>The Delegated Officer considers the applicant's proposed process controls such as the use of hydromulch and a binding agent (e.g. Gluon 500 polymer) are likely to result in adequate dust suppression to minimise the risk to the health and amenity of human receptors outside of the facility.</p> <p>However, as dust impacts are managed under Part IV Ministerial Statement 719, the Delegated Officer does not consider additional controls on the Works Approval are necessary.</p>	No Controls necessary, as this is managed under the Part IV Ministerial Statement 719

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk Assessments* (DWER 2020).

4.3 Detailed risk assessment of embankment failure

4.3.1 Embankment Failure

The primary control mechanism to prevent, control and mitigate impacts to the environment from embankment raises is the structural integrity of the residue and the BRDA. The design and construction characteristics of the embankment raises are detailed in the design reports titled Design Report BRDA 4 – Stage 8 Raise (2024) and Design Package FY '27-30 BRDA 5 – Stage 7 (2024). In accordance with Conditions 6 and 7 of the Works Approval, the applicant must provide confirmation that the raises have been successfully constructed along with validation by a qualified third party to determine whether the BRDAs have the ability to contain bauxite residue under variable conditions. As such, this application does not support the deposition of bauxite residue into the BRDAs prior to the applicant submitting the necessary information regarding the audit of the BRDA raises, and to provide DWER sufficient time to review the assessment of geotechnical stability information.

On this basis an assessment of embankment stability will be undertaken post construction. Reporting may be undertaken in a staged approach as construction is completed, which will support a staged commencement of deposition within the cells included in this works approval application.

4.3.2 Embankment Construction Material

The Works Approval Holder has advised the use of variable construction materials for the construction of the proposed embankments, splitter bunds and dividing walls. This includes using existing compacted bauxite residue and stockpiled clay materials that meet the material specifications and construction quality assurance practices and auditing requirements as detailed in 070 -Earthworks Specifications FY 2025-2027 (March 2024).

The materials used are required to meet predetermined design criteria and will be blended and tested during construction to ensure they possess suitable engineering properties for use in embankments.

The accepted industry design criteria to be used in this instance is derived from the ANCOLD Guidelines and the Code of Practice for Tailings Storage Facilities in Western Australia (DMP, 2013). Considerations include compaction density, particle size, shear strength, Atterberg limits, consolidation, erosion resistance, dispersion characteristics, elasticity (shrinkage), slake durability, hydraulic conductivity and resistance to liquefactions (DMP 2013).

4.3.3 Construction Quality Control

The Works Approval Holder has a Construction Quality Assurance Plan to oversee the construction works and ensure that the site preparation and construction of embankments, splitter bunds and dividing walls meets the designs specifications contained within the Works Approval Application.

This includes an overview of the design and aims to incorporate any items excluded from the prescribed quality assurance works and construction activities (methods and Materials) such as modifications to proposed construction, compliance testing, health safety and environment. It is an independent certification and reporting of the construction process.

The accepted industry design criteria to be used in this instance are derived from ANCOLD Guidelines and the Code of Practice for Tailings Storage Facilities in Western Australia (DMP, 2013).

Following completion of works the Works Approval Holder is required to submit a critical containment infrastructure report as well as an audit report on the BRDAs, as required by conditions 5 and 7 of Works Approval W2850/2025/1, to confirm that the construction

materials and methods have been undertaken in accordance with the design report as part of this application, and that the foundations of the BRDA are suitable to support the current raise.

5. Consultation

Table 1 provides a summary of the consultation undertaken by the department.

Table 1: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 23 January 2025	None received	N/A
Shire of Collie advised of proposal on 29 January 2025.	None received	N/A
Application advertised in the West Australian on 27 January 2025	None received	N/A
Applicant was provided with draft documents on 14/04/2025	The Applicant requested a change to the required time to provide the audit report to the CEO from 60 days to 30 days.	Condition edited accordingly.

6. 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) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
3. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.