Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Application for Works Approval

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

Works Approval Number	W6859/2023/1
Applicant	Pilgangoora Operations Pty Ltd
ACN	616 560 395
File number	DER2023/000562
Premises	Pilgangoora Operations Mining tenements M45/1260 and M45/1230 MARBLE BAR WA 6760 As defined by the premises maps attached to the issued works approval
Date of report	19/03/2024
Decision	Works approval granted

Jarrod Abrahams
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MANAGER, RESOURCE INDUSTRIES

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

Table of Contents

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 premises. As a result of this assessment, works approval W6859/2023/1 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 Application summary and overview of premises

On 25 August 2023, Pilgangoora Operations Pty Ltd (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 is the Pilgangoora Operations located at Marble Bar, Western Australia (WA) (the premises), for which the applicant also holds EP Act licence L9036/2017/1 (L9036).

The application is for the construction and time limited operations (TLO) of:

- a new tailings storage facility (TSF3) including a decant water storage pond and discharge and decant return pipelines at the premises; and
- a stage 5 embankment lift at the existing Ngungaju Lithium Operations (NLO) Tailings Storage Facility (TSF) at the premises.

The premises relates to the category and assessed production / design capacity under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which are defined in works approval W6859/2023/1. 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 works approval W6859/2023/1.

2.2.1 TSF3 construction and time limited operations

Tailings generated at the premises are currently stored within the existing NLO TSF under L9036. Tailings are also generated at the adjacent Pilgangoora Lithium – Tantalum Project (Tantalum Project), which operates separately under EP Act Licence L9056/2017/1 (L9056), with the tailings being stored within the Tantalum Project TSF. The applicant proposes to amalgamate the two separate tailings materials within the proposed TSF3 which is the subject of this assessment. Once TSF3 is completed and all generated tailings are combined in the new facility, the applicant proposes to commence capping the existing tailings facilities at L9036 and L9056 as per mine closure plans. See Figure 1 below for the location of infrastructure at the Premises.

TSF3 will be located approximately 1.4 km southwest of the Tantalum Project TSF and about 200 m to the west of the NLO TSF (see Figure 1 below). TSF3 is designed as an integrated waste landform facility using both tailings and mine waste. The final design capacity of TSF3 is 100 megatonnes (Mt) through 13 separate lifts to a final height of RL 220.7 m. The works approval will only cover stage 1 and 2 lifts to provide an initial tailings storage capacity of 14 Mt. Latter lifts will require separate approvals under Part V of the EP Act as required.

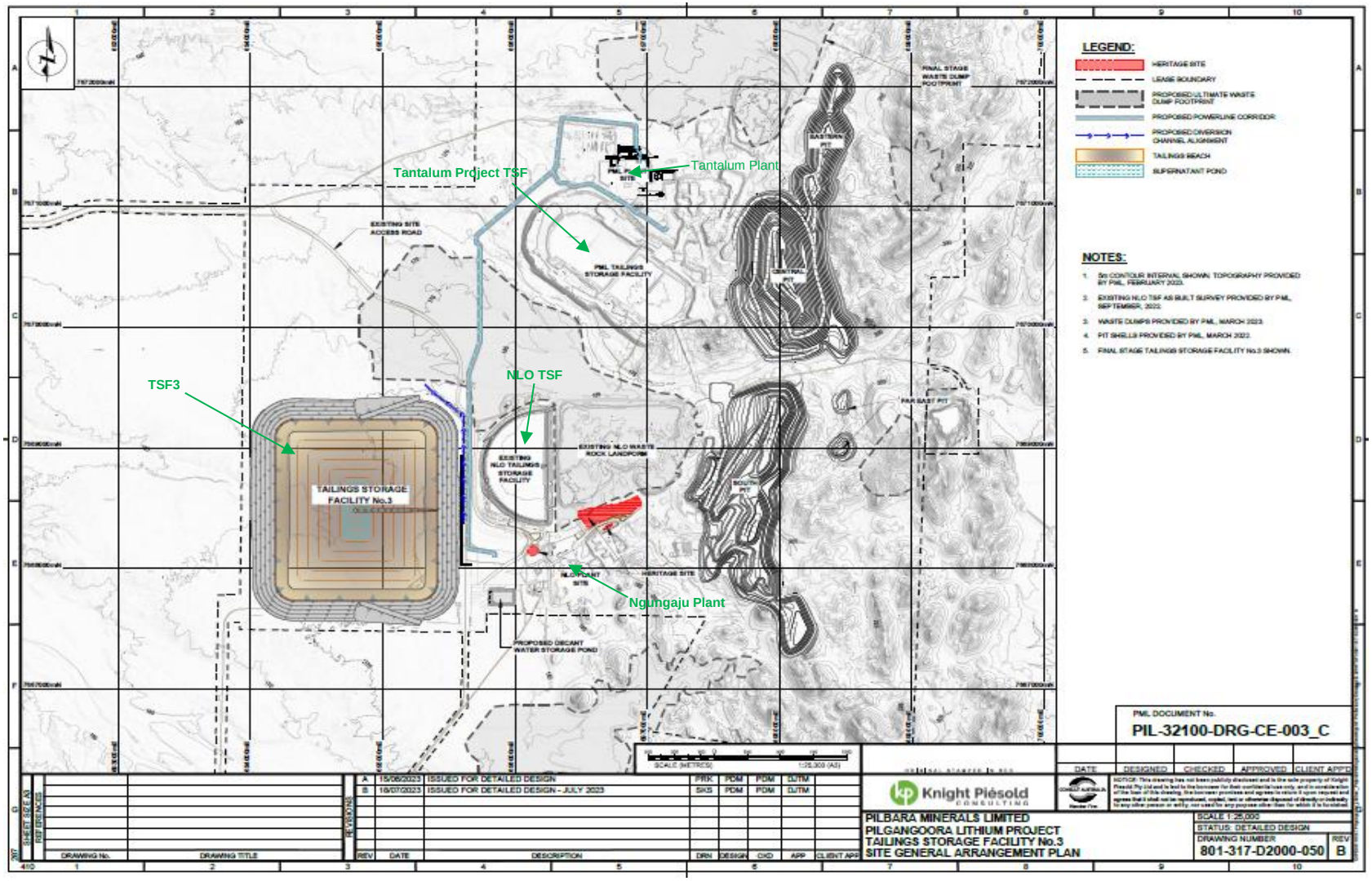

Figure 1: Location of tailings storage and Process Plant facilities

The initial stage of construction for TSF3 (Stage 1) will have a capacity to store up to 6 Mt of tailings which will allow 18 months of production at the premises. Stage 1 will have a footprint of approximately 155 hectares (ha) with an embankment height of 180.2m RL (Figure 2). The stage 2 embankment lift will increase the tailings storage capacity by a further 8 Mt which will allow an additional 24 months of storage. The footprint of TSF3 will be extended by a further 11 ha for stage 2 increasing the total footprint to 166 ha and an embankment height of 184.1m RL.

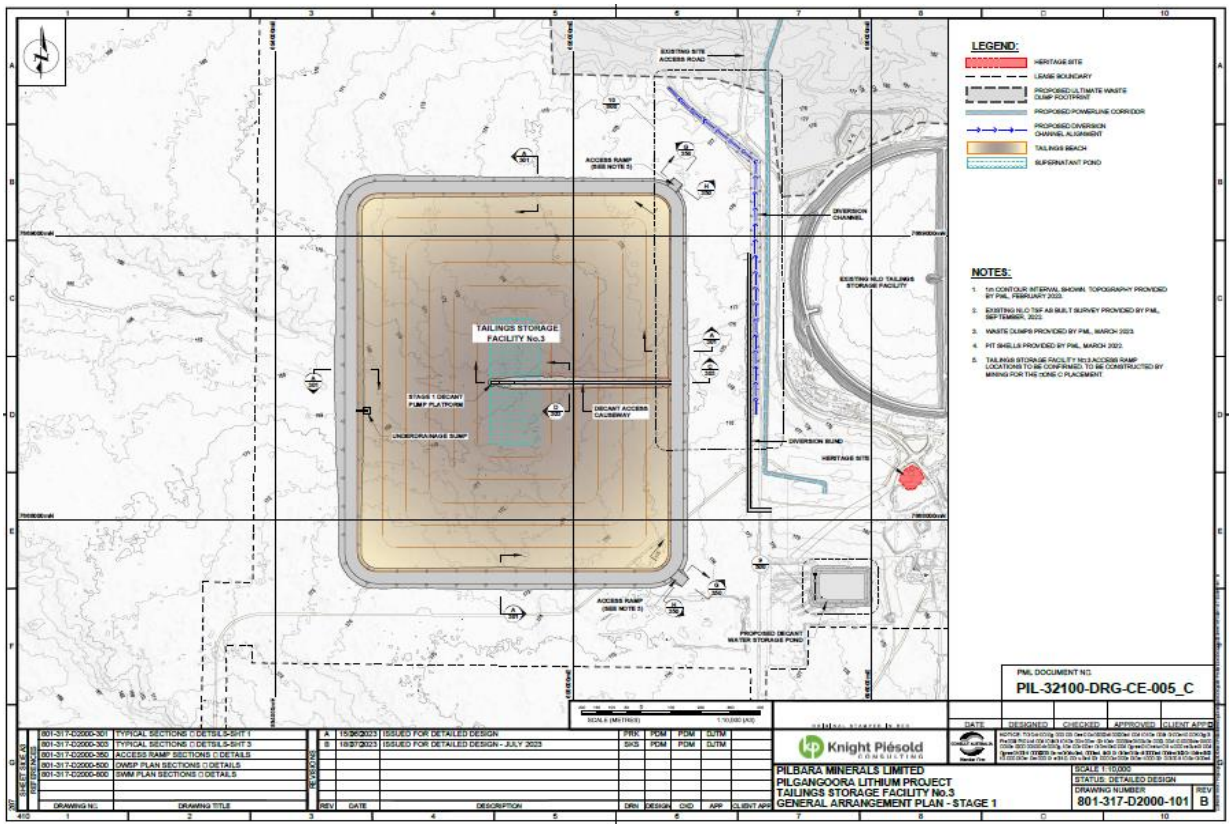

Figure 2: TSF3 General arrangement plan Stage 1

The embankment of TSF3 will be a multi-zoned earth filled embankment. It will consist of an upstream low permeability zone (Zone A) using low permeability fine grained material and a downstream structural zone (Zone C) using mine waste materials. The applicant conducted laboratory tests on the proposed construction materials and determined a geotextile material will be required to form the transition zone between Zone A and Zone C. The applicant has stated should a suitable transition zone material be identified from mine waste stockpiles, the use of the geotextile layer will be reviewed. See Figure 3 below for design details.

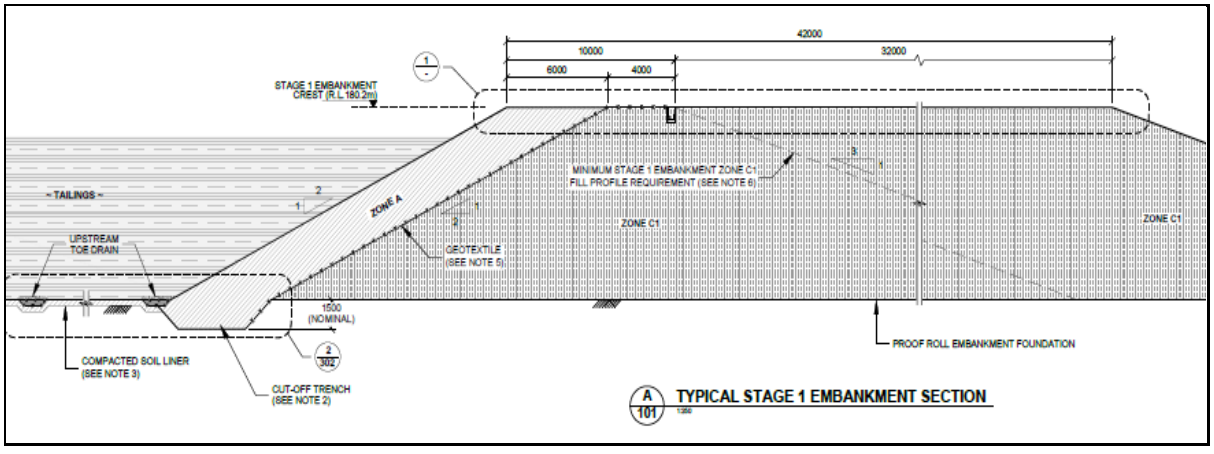

Figure 3: Stage 1 embankment section

TSF3 has been designed to operate without a spillway and will operate with a 500mm minimum freeboard at all times, including in consideration of a 1% Annual Exceedance Probability (AEP) 72-hour storm event.

The base of TSF3 will consist of scarified and re-compacted in-situ material and/or imported, moisture conditioned and compacted suitable low permeability material. A cut-off trench will be located beneath the entire length of the embankment which will be excavated through to a suitable foundation layer.

The applicant proposes to install an underdrainage system which will consist of an embankment toe drain, collector drains located within the existing creek lines and finger drains spaced every 25 m throughout the basin. The collector and finger drains are constructed of corrugated and perforated tubing, with a filter sock surrounded by sand and then wrapped in geotextile material. Collected seepage will flow by gravity to a collection sump which will then be pumped up the upstream embankment into the supernatant pond. See Figure 4 below for design details.

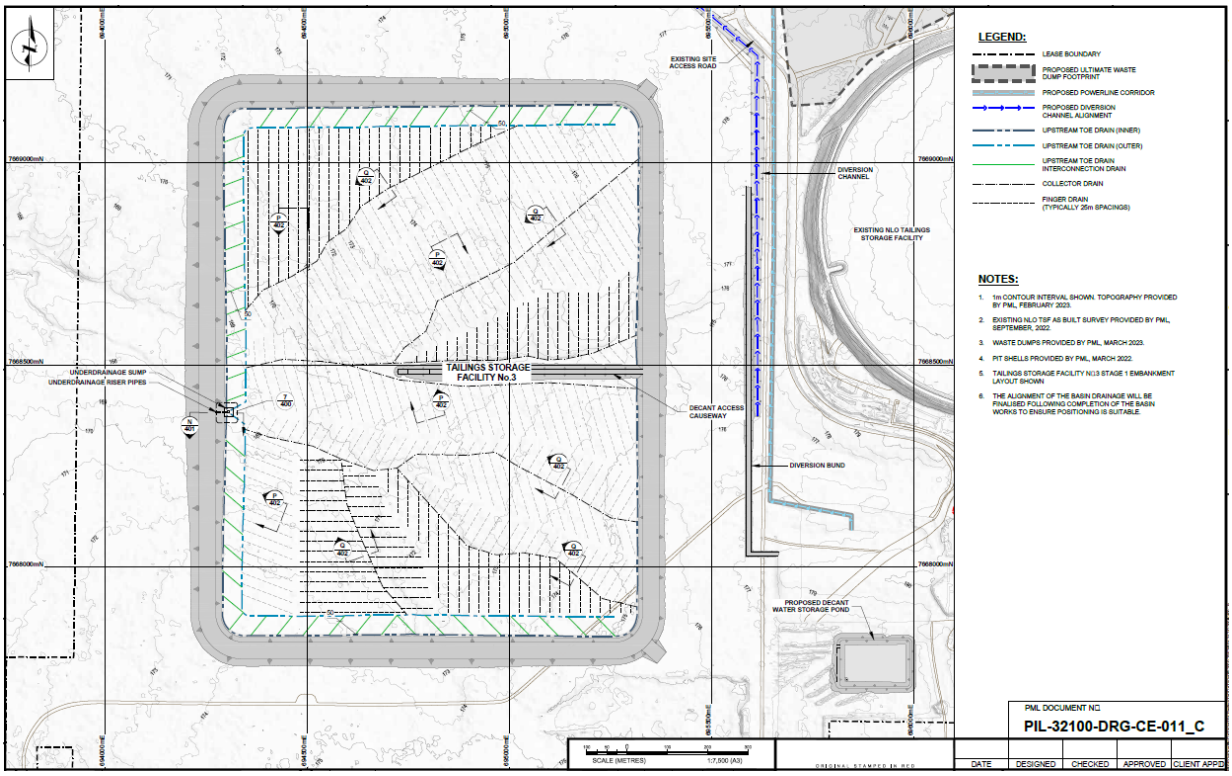

Figure 4: TSF3 underdrainage system

The applicant will install vibrating wire piezometers in the embankments during construction to monitor the phreatic surface during operations. The applicant will also install embankment settlement pins to monitor movement of the embankments.

A decant access causeway and pump platform will be built for each embankment stage so a suction pump and turret can be positioned for the collection of supernatant water and rainfall runoff. The collected water will then be pumped via a HDPE pipeline to a lined external decant pond located to the southeast of the TSF3 (see Figure 2). The stored water will be recovered for use at the processing plants as required.

Tailings will be discharged into TSF3 by a sub-aerial method using a combination of spigots spaced at regular intervals along the embankment. Nominally 6 to 8 spigots will be in operation during each cycle. This method of discharge allows for the maximum amount of water removal from TSF3 by the formation of a large beach for drying and draining. The deposition of the tailings will be cyclic with the tailings being deposited over one area of TSF3 until a suitable tailings thickness is achieved before shifting the discharge to an adjacent area so the deposited

tailings can dry and consolidate. The initial discharge of tailings will first fill the lowest points at the base of the TSF3, before a tailings beach will then start to form from the embankment into the centre where the decant will be located. Once the beach profile is established and the supernatant pond is centrally located, the tailings discharge will be managed (variable discharge) so a consistent beach is maintained, and the supernatant pond is positioned at the centre.

New HDPE tailings pipelines will be installed between each process plant site to TSF3. The pipelines will be positioned within bunded corridors for secondary spill containment. Flow and pressure monitoring systems will be installed at both processing plants and TSF3 to monitor for leakage. A low point scour pit will be installed to facilitate emergency draining of the pipeline in the event of power failure. This will then be captured in a pond designed to store 150% of the volume of tailings contained within the section of the pipeline being drained.

The tailings pipelines will be connected to the distribution pipeline located on TSF3 embankment crest. The infrastructure will be located on the upstream side of the embankment crest so any leakage will flow into the TSF basin instead of being released to the environment. The distribution pipeline will be fitted with spigots offtakes spaced at 25 m intervals. A 1.5 m length of water delivery pipeline will be connected to the spigot offtake which will discharge into a uPVC stormwater drainpipe, slotted along the pipe soffit. This design reduces the risk of erosion when discharging tailings down the upstream face of the embankment. The distribution pipeline and associated offtakes will be removed from the crest for each embankment lift.

The applicant proposes to conduct daily inspections of all discharge and return pipelines, bunded containment corridors, distribution pipelines, spigots and valves and undertake regular maintenance.

The applicant proposes to install 8 groundwater monitoring bores as part of the initial TSF3 Stage 1 construction. The bores will be located on the north, south and west embankments outside of the final life-of-mine footprint (see Figure 5 below). The applicant states the selection of these locations was guided by surface water modelling and a baseline geophysics investigation (electromagnetic survey) that was completed in late 2022.

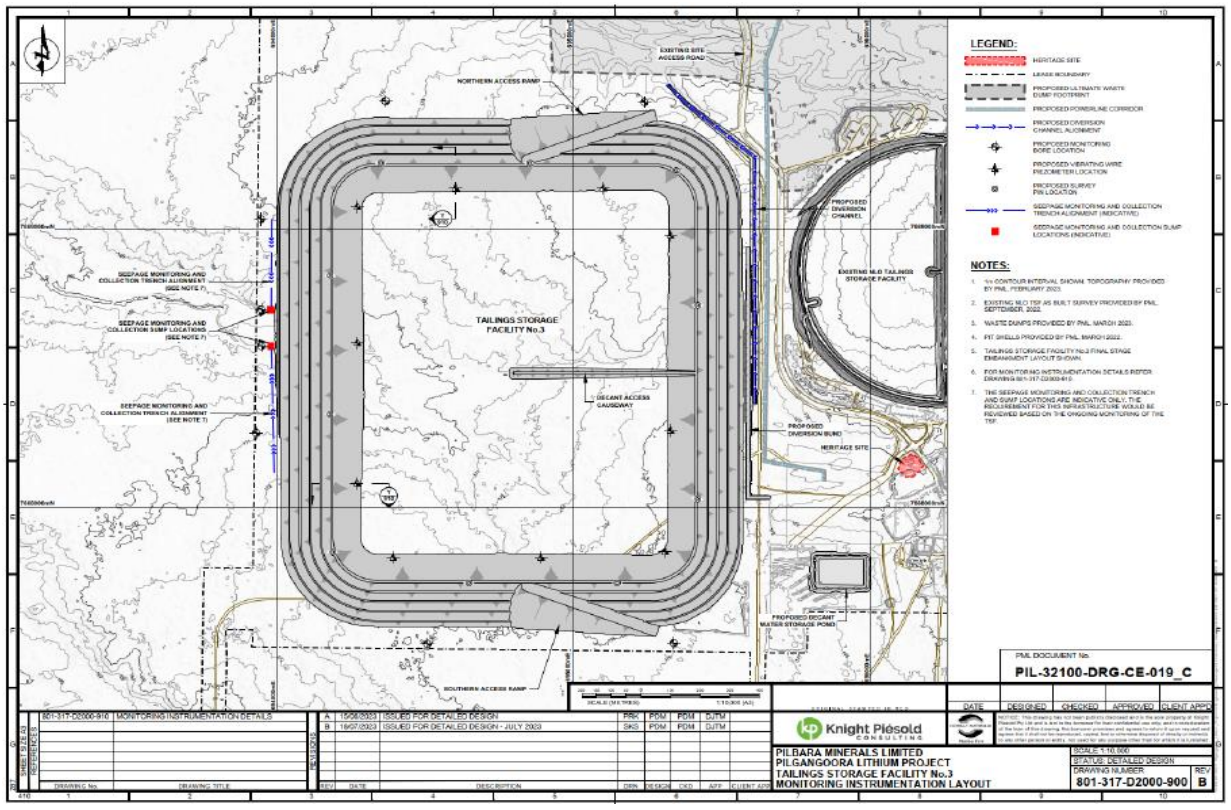

Figure 5: Seepage monitoring and collection sump locations

The proposed groundwater monitoring bores will be dual depth drilled and will be used to measure groundwater levels and water quality. Each proposed monitoring bore station will consist of one shallow bore to a depth of approximately 5 m, and one deep bore terminating in the groundwater table at a depth of approximately 20 m. The shallow bore is intended to detect any seepage from the TSF flowing within the upper subsurface materials, and the deep monitoring bore is designed to monitor groundwater level and chemistry. The applicant proposes each bore will be cased and screened over an interval set in the field during installation and sealed back to surface with low permeability grout. The applicant plans to take baseline readings prior to the completion of the construction of the TSF3. The applicant proposes to monitor the water quality as per existing requirements specified in L9036.

The applicant also proposes to construct a new diversion channel between the NLO TSF and TSF3 to divert surface water around and away from the tailings storage facilities.

2.2.2 NLO TSF Stage 5 embankment lift

The previous owner of the premises completed stage 1 and 2 embankment lifts at the NLO TSF. The applicant then completed stage 3 and 4 lifts in September 2021 (compliance documentation submitted 3/9/2021 DWER ref: DWERDT500343). The applicant now proposes to construct a final stage 5 lift of the embankment. This final stage 5 lift will allow an operational overlap of approximately 6-9 months for transition from the respective operational tailings facilities.

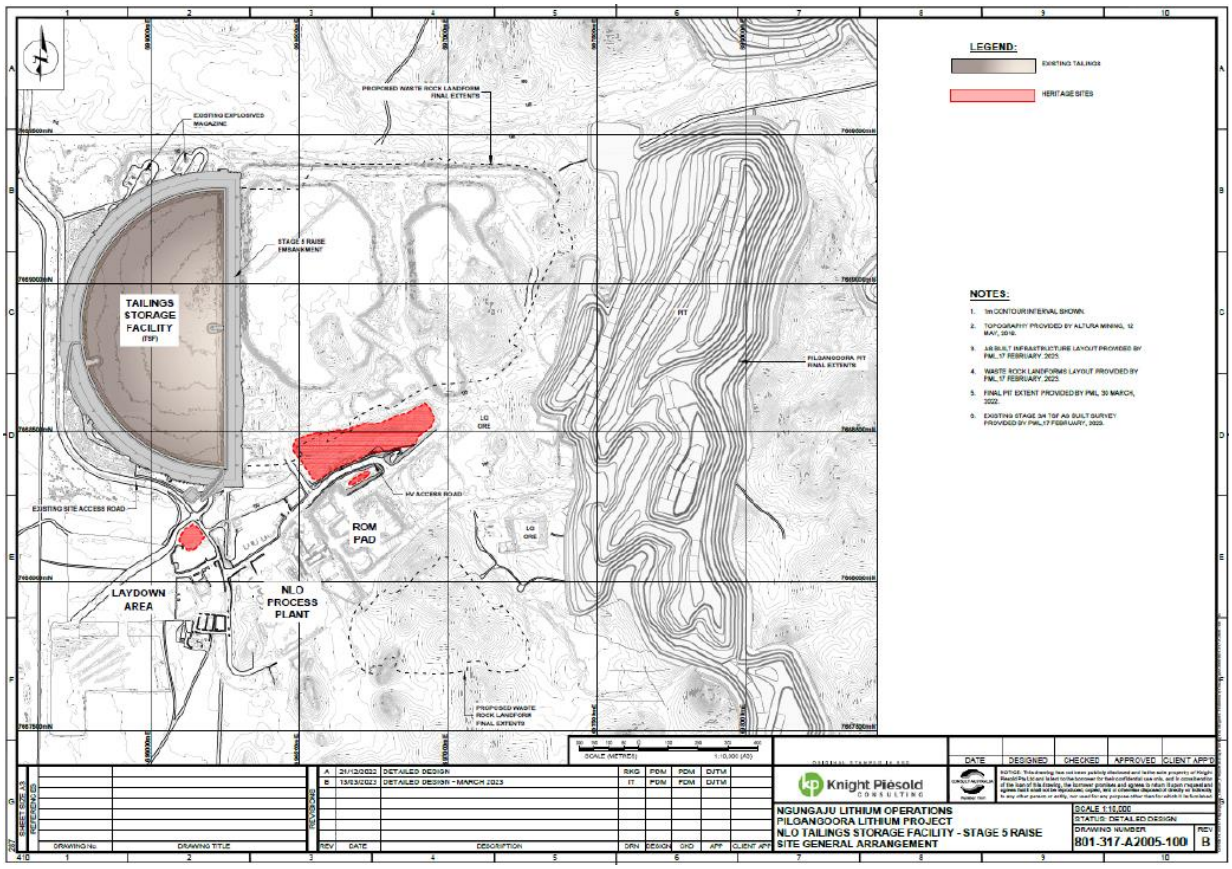

Figure 6: NLO TSF

The NLO TSF comprises a semi-circular embankment design as shown in Figure 6, with an embankment crest height of RL 190.3m and a basin footprint area of approximately 40 ha. The NLO TSF consists of a single cell multi-zoned downstream profile embankment with a cut off trench located beneath the entire length of the embankment.

The NLO TSF was built with an underdrainage system which consists of an embankment toe drain, branch drains and finger drains. The toe drains were placed at the western embankment upstream toe with a second drain offset by approximately 45 m from the upstream toe in the TSF basin. The main collector drains are positioned within existing creek lines that run through the NLO TSF footprint. The finger drains were constructed at 20 m spacing within a 140 m radius at the area of the decant tower. The drains were constructed of corrugated, perforated tubing surrounded by sand and then wrapped in geotextile material. The under-drainage system collects seepage which then flows to a collection sump which is located at the lowest elevated area. The collected seepage is then pumped to the supernatant pond on the NLO TSF. The supernatant water and rainfall water is then recovered by pumps located within the decant tower which is then pumped to the process plant for re-use.

The applicant will use a downstream construction method for the NLO TSF Stage 5 embankment lift (see Figure 7). The embankment will consist of an upstream low permeability zone (Zone A) using suitable borrow material and a downstream structural zone (Zone C2) using mine waste materials. The construction of the embankment lift will be divided into two stages, a northern and a southern section. Tailings will be deposited into one section while construction works are undertaken on the other section. Tailings will be discharge into the NLO TSF sub-aerially using spigots located along the embankment crest and TSF perimeter, except at the waste dump side.

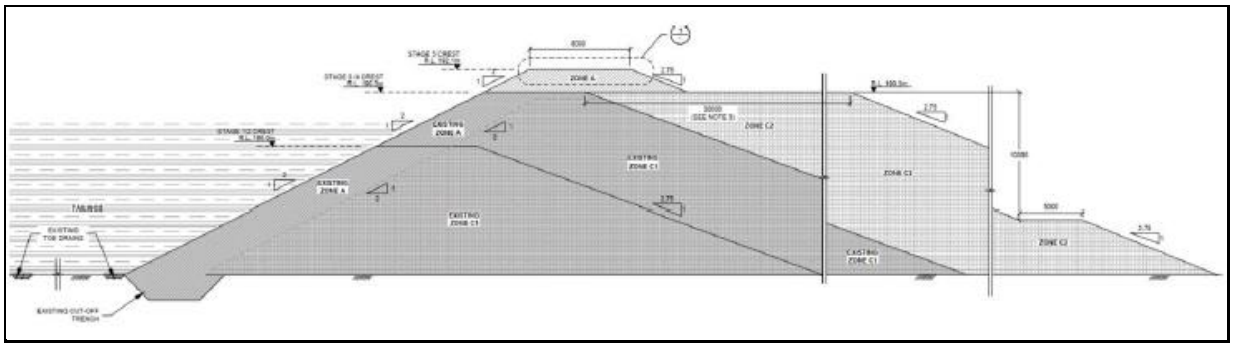

Figure 7: NLO TSF Stage 5 embankment cross section

Groundwater monitoring bores remain in place at the NLO TSF, with the applicant undertaking routine monitoring of the ground water levels and water quality in accordance with the requirements specified in L9036. The latest monitoring results presented in the 2023 Annual Environmental Report (AER, 2023) show:

- the standing water levels have remained well below levels that may impact on groundwater dependent vegetation; and
- the quality of the groundwater remains below ANZECC, 2000 guidelines for stock-watering which is the beneficial use of groundwater in this area.

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 *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.

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 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 of the new TSF3 and the Stage 5 embankment lift at the existing NLO TSF			
Dust	Vehicle movements, lift-off from cleared areas, construction activities, earthworks etc. Wind erosion of embankment walls and drying tailings.	Air / windborne pathway	Minimising the removal of vegetation. Vehicle movements confined to defined haul and access roads with a maximum speed limit of 60 km/h implemented. Use of water carts on roads and construction areas, and the use of dust suppressing agents if required.
Hydrocarbon and/or sediment contaminated stormwater	Run-off from construction areas.	Overland runoff	Previous earthworks (drainage alteration) around the Premises have been designed to direct flow around and away from facilities. Sediment basins are installed within the Premises boundary to capture sediment – laden surface runoff prior to water exiting the Premises. The sediment basins will be inspected as required, and before known significant rainfall events to ensure they are capable of functioning to remove/capture sediment. The Applicant proposes to produce a site-specific spill management procedure to ensure a hierarchy of controls including hydrocarbon spill reporting, spill control and clean-up is maintained on site. All hydrocarbon storage and dispensing will be managed in accordance with AS 1940-2004.
Operation			
Stage 5 NLO TSF			
Increased tailings seepage due to the additional mass of stored tailings	Storage of tailings	Seepage through soils	Tailings deposition designed so the supernatant pond will be positioned at the decant tower, which is located at the waste dump side, remote from the main tailings embankment. Supernatant water will be collected at the decant tower and then pumped to the processing plant for reuse. Existing basin underdrainage system that

Emission	Sources	Potential pathways	Proposed controls
			gravity feeds seepage into a collection sump which is then pumped back to the plant for reuse.
Tailings from embankment failure and overtopping		Direct discharge to land and seepage through surrounding soils	A minimum 500 mm freeboard will be maintained, including in consideration of a 1% AEP, 72-hour storm event. Vibrating Wire Piezometers in the embankments to monitor phreatic surface. Embankment settlement pins to monitor movement of the embankment. Removal of decant water for reuse in the processing plant. Supernatant pond positioned around the decant tower and away from the embankment walls.
Tailings and decant return water	Failure of new stage 5 tailings delivery and decant return pipelines	Direct discharge and seepage through soils	Tailings pipelines reinstated into the newly constructed stage 5 embankment wall. Any failure in the pipelines will result in tailings discharging into the TSF. Note: No change to existing tailings delivery and decant return water pipelines.
Dust	Drying of stored tailings	Air / windborne pathway	The tailings will be deposited sub-aerially on a cyclic basis with the tailings being deposited over one area of the storage until the required layer thickness has been built up. Deposition will then be moved to an adjacent part of the storage to allow the deposition layer to settle and consolidate. This operational method means the surface area of the tailings is often re-wet and is not allowed to significantly dry out over a long period of time.
TSF3			
Tailings seepage	Storage of tailings	Seepage through soils	Base liner constructed of scarified and re-compacted, moisture conditioned in-situ material and/or imported low permeability materials (also to be compacted and moisture conditioned). An underdrainage system consisting of an embankment toe drain, collector drains in the existing creek alignments and finger drains at 25 m spacing throughout the basin. The underdrainage system will flow by gravity to a collection sump at the lowest elevation point in the facility. Underdrainage water collected in the sump will be pumped up the upstream embankment and deposited into the

Emission	Sources	Potential pathways	Proposed controls
			supernatant pond. Supernatant water will be removed from TSF3 via a suction pump and floating intake turret at the decant location. Collected supernatant water will then be pumped to a 50 ML HDPE lined decant pond for storage and reuse in the process plant. Effective management of the supernatant pond by minimising the size and positioning the pond at the decant location, and away from the embankment walls. Tailings slurry 40% solids by weight.
Tailings from embankment failure and overtopping		Direct discharge to land and seepage through surrounding soils	Removal of decant water for reuse in the processing plant. Supernatant pond positioned around the decant tower, and away from the embankment walls. A minimum 500 mm freeboard will be maintained, including in consideration of a 1% AEP, 72-hour rainfall event.
Tailings and decant return water	Tailings delivery and decant return pipelines due to pipeline failure	Direct discharge and seepage through soils	The new tailings and water return pipelines will be located on the upstream crest of the TSF3 embankment, which has a minimum cross fall to the tailings beach of 2%. Any leakage from the pipeline will therefore flow towards TSF3. New tailings delivery and decant return pipelines located within a containment trench with a low point scour station to facilitate emergency drainage in the event of a power failure and mitigate the uncontrolled spill of tailings to the environment. This will be captured in a dedicated pond designed to store 150% of the volume of tailings within the section of the pipeline being drained. The pond will be mechanically emptied following any use. Flow meter, nucleonic density gauge and pressure transmitter installed in tailings delivery line. A flow meter will also be installed in the decant return pipeline. A subsequent flow meter will be placed in the tailings pipeline adjacent to TSF3 and differences in flow between the two meters will indicate a failure in the pipeline.
Dust	Drying of stored tailings	Air / windborne pathway	The tailings will be deposited sub-aerially on a cyclic basis with the tailings being deposited over one area of the storage until the required layer thickness has been built up. Deposition will then be moved to an

Emission	Sources	Potential pathways	Proposed controls
			adjacent part of the storage to allow the deposition layer to settle and consolidate. This operational method means the surface area of the tailings is often re-wet and is not allowed to significantly dry out over a long period of time.
TSF3 decant water storage pond			
Contaminated water	Storage of tailings decant water	Direct discharge from overtopping of the embankment walls	A minimum freeboard of 500 mm will be maintained, including in consideration of a 1% AEP, 72-hour storm event. Visual inspections daily and following a 1% AEP 72-hour rainfall event to check freeboard capacity and for any signs of erosion.
		Seepage through base and embankments to the underlying soils	Embankment lined with 1.5 mm textured HDPE geomembrane liner. Liner anchored within a trench at the crest of the embankment. Compacted soil liner in basin as follows: • Where in-situ materials is unsuitable as compacted soil liner – import 300 mm of Zone A low permeability material. • Where in-situ material is suitable – scarify, moisture condition and then compact to 300 mm.

3.1.2 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 2 and Figure 8 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 2: Sensitive environmental receptors and distance from prescribed activity

Environmental receptors	Distance from prescribed activity
Groundwater Groundwater at the Premises is generally unconfined and occurs in weathered fractured bedrock aquifers comprising granite and greenstone. Recharge is predominantly from surface water runoff and flooding events along the upper reaches of Pilgangoora Creek. The groundwater quality is considered fresh to	Based on field measurements carried out during a site investigation for TSF3, groundwater is located at a depth of approximately 7.5 metres below ground level (mBGL). A pastoral bore is located approximately 1 km to the west and is in use for stock-watering (Wallareenya Station).

Environmental receptors	Distance from prescribed activity
brackish (TDS 600-3,700 mg/L) and is considered suitable for stock-watering purposes.	
Surface water Watercourses are shown in Figure 8 below. The Premises is situated within the Chinnamon Creek sub-catchment of the Turner River catchment which eventually discharges into the sea (tidal flats) west of Port Hedland. The local creeks within the area have small catchments and are dry for most of the year with flows generally only occurring during large rainfall events. The area at the Premises is generally flat with surface water flows from the east and southeast corner which then mainly drain to the west with some flow to the north and south. All run-off at the Premises eventually reaches the Turner River approximately 20 km away.	A number of minor ephemeral creeks dissect the Premises with drainage generally in a westerly direction. The closest onsite creeks are approximately 200 m north and 200 m south of the NLO TSF. The southern minor ephemeral creek also passes through the location of the proposed TSF3.

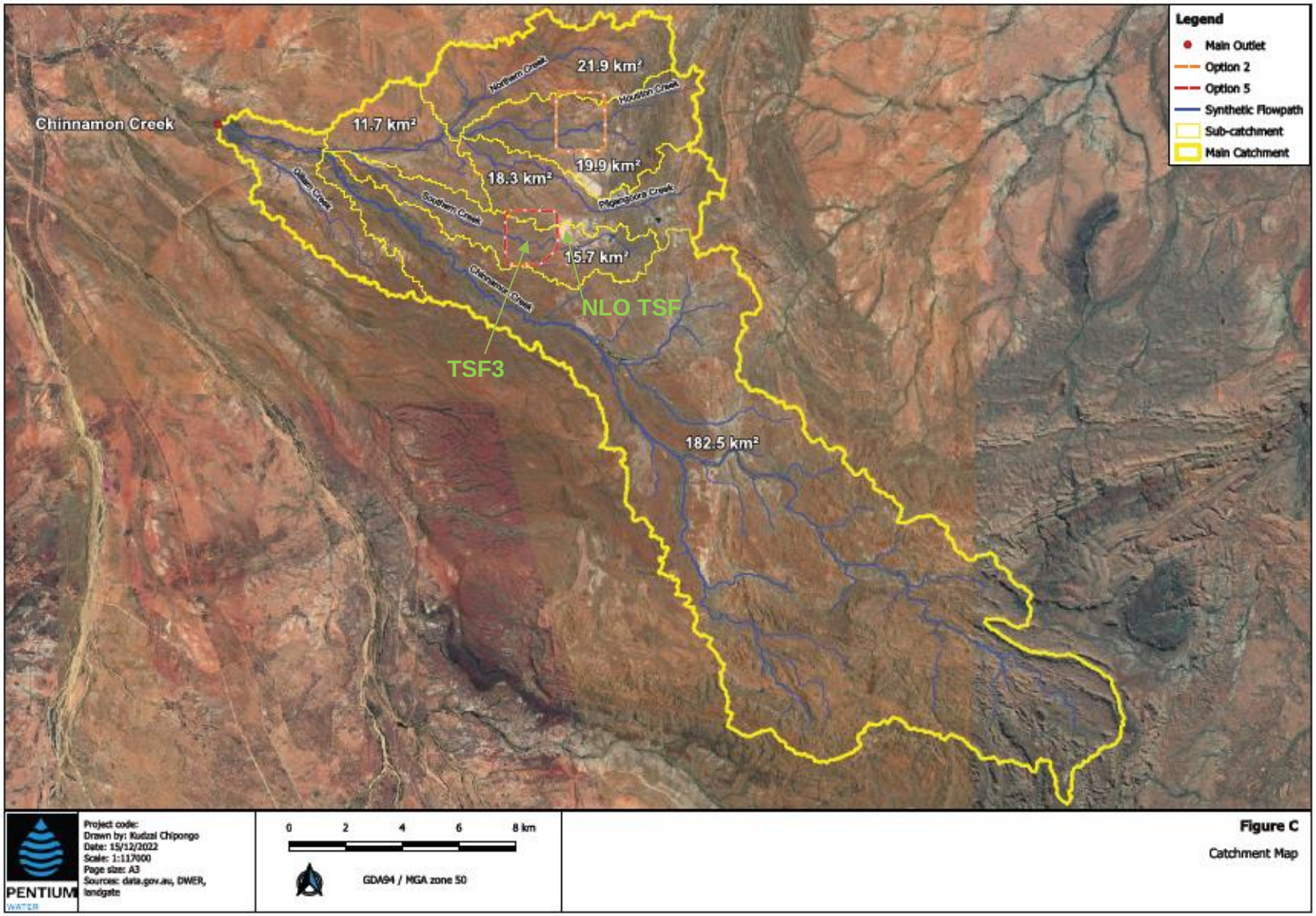

Figure 8: Distance to sensitive receptors

3.2 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 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 W6859/2023/1 that accompanies this decision report authorises construction and time-limited operations. 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 ongoing operation of the premises i.e. Category 5 activities. 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 events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Construction								
Construction of: • NLO TSF stage 5 embankment; • New TSF3; • Tailings discharge and decant return water pipelines and bunded pipeline corridor; • Decant water storage pond; and • Vehicle access tracks and haul roads.	Contaminated/ high sediment laden stormwater	Overland flow causing contamination of nearby creek lines	Ephemeral creeks located 200 m north and 200 m south	Refer to Section 3.1.1	C = Minor L = Unlikely **Medium Risk**	Y	**Condition 1 – surface water management**	Applicant proposed controls for containing and managing contaminated stormwater during construction of the infrastructure has been placed on the works approval as a regulatory control.
Operation **(including time-limited-operations operations)**								
Discharge and storage of tailings in the NLO TSF Stage 5	Tailings and contaminated water	Direct discharge to land (soils and groundwater) from embankment failure and/or overtopping. Related surface run-off and/or impacted groundwater flows causing contamination of nearby creek lines.	Underlying groundwater approximately 7.5mBGL (beneficial use for stock-watering) Ephemeral creeks located 200 m north and 200 m south	Refer to Section 3.1.1	C = Moderate L = Rare **Medium Risk**	Y	Condition 2 – construction requirements relating to freeboard and water recovery (decant tower) **Conditions 6 and 7 – construction auditing and reporting requirements** **Conditions 10 and 11 – relates to commencing time limited operations and duration of time limited operations** **Condition 12 – operational requirements during time**	Applicant proposed controls for freeboard, inspection and maintenance requirements, tailings deposition requirements and water recovery have been placed on the works approval as regulatory controls. DWER control: Standard conditions relating to recording and reporting during time limited operations have been applied. Reviewing and reporting on the water balance for the

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
							limited operations **Conditions 21 and 22 – time limited operations compliance reporting** **Conditions 24 and 25 – requirement to maintain accurate and auditable books**	NLO TSF is already a requirement under conditions of L9036.
		Seepage through base and embankments due to increased tailings mass causing contamination of groundwater and nearby creek lines (from sub-surface groundwater flow).	Underlying groundwater approximately 7.5mBGL (beneficial use for stock-watering) Ephemeral creeks located 200 m north and 200 m south	Refer to Section 3.1.1	C = Moderate L = Possible **Medium Risk**	Y	Condition 2 – construction requirements relating to embankment and decant installation (including liner), positioning of spigots and installing monitoring equipment **Conditions 6 and 7 – construction auditing and reporting requirements** **Conditions 10 and 11 – operational requirements during time limited operations** Condition 12 – operational requirements during time limited operations Condition 13 – authorised discharge location for Stage 5 **Conditions 22 and 23 – time limited operations compliance reporting** **Condition 24 – recording and reporting of received complaints** **Conditions 25 and 26 –**	An existing basin underdrainage system is already in place to capture seepage which is then pumped to the supernatant pond on the NLO TSF. The applicant's proposed controls to minimise the decant pond, install a liner at the extended decant, and monitoring of piezometers and settlement pins are sufficient and therefore have been conditioned on the works approval. The applicant has stated the monitoring of existing NLO TSF groundwater monitoring bores, and the reporting of results, will continue in accordance with the requirements in L9036. The applicant is also required to undertake a monthly water balance in accordance with conditions of L9036.

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
							requirement to maintain accurate and auditable books	
		Pipeline leak/rupture and direct discharge to land (soils and groundwater). Related surface run-off and/or impacted groundwater flows causing contamination of nearby creek lines.	Underlying groundwater approximately 7.5mBGL (beneficial use for stock-watering) Ephemeral creeks located 200 m north and 200 m south	Refer to Section 3.1.1	C = Moderate L = Possible **Medium Risk**	Y	Condition 2 – construction requirements for reinstalling existing pipelines and discharge outlets **Conditions 6 and 7 – construction auditing and reporting requirements** **Conditions 10 and 11 – time limited operation requirements relating to commencing operations and duration of operations** **Condition 12 – operational requirements during time limited operations** **Conditions 22 and 23 – time limited operations compliance reporting** **Conditions 25 and 26 – requirement to maintain accurate and auditable books**	The applicant will remove existing tailings pipelines to allow the Stage 5 lift. The pipelines will then be reinstalled following completion of works. Applicant proposed controls for the installation, inspection requirements and maintaining infrastructure has been placed on the works approval as regulatory controls. DWER control: DWER has included that pipeline construction adhere to the relevant Australian standards. Testing and calibration of pipelines, flow meters and pressure meters has also been conditioned as a construction requirement. Standard conditions relating to recording and reporting have been applied. Note: Licence conditions relating to the use of existing pipelines at the Premises are applied under L9036.
Discharge and storage of tailings in the TSF3	Tailings and contaminated water	Direct discharge to land (soils and groundwater) from embankment	Closest ephemeral creek located approximately 400 m north	Refer to Section 3.1.1	C = Moderate L = Rare	Y	**Condition 2 – construction requirements relating to freeboard and water**	Applicant proposed controls for construction and operation, including freeboard, water recovery

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
		failure and/or overtopping. Related surface run-off and/or impacted groundwater flows causing contamination of nearby creek lines.			**Medium Risk**		**recovery (decant tower)** **Conditions 6 and 7 – construction auditing and reporting requirements** **Conditions 10 and 11 – relates to commencing time limited operations and duration of time limited operations** **Condition 12 – operational requirements during time limited operations'** **Condition 21 – requirement to undertake a monthly water balance** **Conditions 22 and 23 – time limited operations compliance reporting** **Conditions 25 and 26 – requirement to maintain accurate and auditable books**	and inspection requirements, have been placed on the works approval as regulatory controls. DWER control: DWER has additionally included the requirement to install freeboard markers on embankments so the freeboard can be determined visually during routine inspections. DWER has included the requirement to undertake a monthly water balance during time limited operations. This requirement is already conditioned in L9036 for the NLO TSF Standard conditions relating to recording and reporting during time limited operations have been applied. Refer to section 3.3 also (re: water balance requirement specified in Condition 20).

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
		Seepage through base and embankments causing potential impacts to groundwater. Seepage through base and embankments causing contamination of nearby creek lines (from sub-surface groundwater flow).	Underlying groundwater approximately 7.5 mBGL (beneficial use for stock-watering) Closest ephemeral creek located approximately 400 m north	Refer to Section 3.1.1	C = Moderate L = Possible **Medium Risk**	Y	Refer to section 3.3	Refer to section 3.3
		Pipeline leak/rupture and direct discharge to land (soils and groundwater). Related surface	Underlying groundwater approximately 7.5 mBGL ((beneficial use for stock-	Refer to Section 3.1.1	C = Moderate L = Possible **Medium Risk**	Y	**Condition 2 – construction requirements** **Conditions 6 and 7 – construction auditing and reporting requirements**	Applicant proposed controls for pipeline construction and operation have been placed on the works approval. DWER control:

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
		run-off and/or impacted groundwater flows causing contamination of nearby creek lines.	watering) Closest ephemeral creek located approximately 400 m north				**Conditions 10 and 11 – time limited operation requirements relating to commencing operations and duration of operations.** **Condition 12 – operational requirements during time limited operations** **Conditions 21 and 22 – time limited operations compliance reporting** **Conditions 24 and 25 – requirement to maintain accurate and auditable books**	DWER has included that pipeline construction adhere to the relevant Australian standards. Testing and calibration of pipelines, flow meters and pressure meters has also been conditioned as a construction requirement. Standard conditions relating to recording and reporting have been applied.
Storage of tailings decant water in the decant water storage pond	Contaminated water	Seepage through base and embankments causing potential impacts to groundwater. Related groundwater flows causing contamination of nearby creek lines	Underlying groundwater approximately 7.5 mBGL (beneficial use for stock-watering) Closest ephemeral creek located approximately 400 m north	Refer to Section 3.1.1	C = Moderate L = Unlikely **Medium Risk**	Y	**Condition 2 - construction requirements relating to installation of a liner.** **Conditions 6 and 7 – construction auditing and reporting requirements** **Conditions 10 and 11 – time limited operation requirements relating to commencing operations and duration of operations.** Condition 12 – operational requirements during time limited operations **Conditions 21 and 22 – time limited operations compliance reporting** **Conditions 24 and 25 – requirement to maintain**	Applicant proposed controls for construction and operation, including inspection requirements, have been placed on the works approval as regulatory controls. DWER control: Standard conditions relating to recording and reporting during time limited operations have been applied.

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
							accurate and auditable books	
		Direct discharge to land (soils and groundwater) from embankment failure and/or overtopping. Related surface run-off and/or impacted groundwater flows causing contamination of nearby creek lines	Underlying groundwater approximately 7.5 mBGL (beneficial use for stock-watering) Closest ephemeral creek located approximately 400 m north	Refer to Section 3.1.1	C = Moderate L = Rare **Medium Risk**	Y	**Condition 2 – construction requirements relating to freeboard and capacity.** **Conditions 6 and 7 – construction auditing and reporting requirements** **Conditions 10 and 11 – relates to commencing time limited operations and duration of time limited operations.** **Condition 12 – operational requirements during time limited operations'** **Condition 20 – requirement to undertake a monthly water balance.** **Conditions 21 and 22 – time limited operations compliance reporting** **Conditions 24 and 25 – requirement to maintain accurate and auditable books**	Applicant proposed controls for construction and operation, including freeboard, capacity and inspection requirements, have been placed on the works approval as regulatory controls. DWER control: DWER has additionally included the requirement to install freeboard markers on embankments so the freeboard can be determined visually during routine inspections. Standard conditions relating to recording and reporting during time limited operations have been applied.

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

Note 2: Proposed applicant controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

3.3 Detailed risk assessment for TSF3 seepage

3.3.1 Overview of potential risk events

Seepage from TSF3 has the potential to impact the quality of the underlying groundwater (approximately 7.5 mBGL) and contaminate nearby ephemeral creek lines (closest approximately 400 north of the TSF3). This may result in the following risk events which will be further assessed in the sections below:

- flow of seepage impacted groundwater may result in potential impacts to the Wallareenya Station stock-watering bore located approximately 1 km to the west; and
- flow of seepage impacted groundwater may result in contamination of nearby ephemeral creek lines (~400 north of the TSF3) that flow towards Chinnamon Creek.

3.3.2 Source

Tailings characterisation

The applicant is proposing to co-dispose the tailings from the two processing plants at the Premises into TSF3.

To assess the likelihood for the potential release of harmful chemical constituents into tailings porewater, the applicant undertook the following geochemical tests on samples of tailings material from the two processing plants:

- A comprehensive analysis of their elemental composition, and a comparison of these concentrations with the Global Abundance Index (GAI) values for each element; and
- A determination of the acid-base account of the materials to assess whether they would be likely to release acidity and dissolved metals into tailings porewater.

The applicant determined that the results from the tests undertaken on the tailings samples indicates that the tailings are classified as Non-Acid Forming (NAF) based on the negligible sulfur contents, negative Net Acid Production Potential (NAPP) values and circumneutral net acid generation (NAG) pH results. Based on these results, the applicant determined there is no perceived risk of the tailings sample generating acid.

The applicant also submitted tailings samples for supernatant water testing to provide a preliminary indication of the water quality which may be encountered in the facility during operations. The applicant compared the results of the supernatant testing with reference water quality standards for release of water from mining operations and ANZECC/ARCANZ Guidelines for livestock drinking water. The applicant found the supernatant water to be of reasonable quality with no exceedances however when compared with drinking water quality there were some elevated metal(loid)s.

Seepage

An assessment of seepage using the SEEP/W program was undertaken by the applicant to assess the magnitude of seepage losses from the TSF3, as well as the location of the phreatic surface through the tailings and embankment. Results of the seepage modelling are presented in Table 4 below. The applicant noted that the results presented are for idealised conditions and parameters. It is anticipated that a variation in these conditions may be present across the TSF footprint, which can have an impact on the estimated rates.

Scenarios	Underdrainage system	Stage 1 seepage loss (m^3/day)	Final stage seepage loss (m^3/day)
Normal pond	100% functional	51.9	60.1
	80% functional	55.1	64.4
	50% functional	58.9	74.3
	33% functional	62.7	92.7
	0% functional	125.9	1,497.0
Storm pond	100% functional	52.0	60.1
	80% functional	55.2	64.4
	50% functional	58.9	74.3
	33% functional	63.2	92.8
	0% functional	127.6	1,497.1

Table 4: Stage 1 and Final Stage estimated seepage loss

Based on the modelling results, the applicant expects the proposed underdrainage system will help reduce the seepage loss through TSF3. The applicant however is aware that should not all finger drains function the seepage loss will increase. The applicant expects from previous experiences in similar conditions, it will be very difficult to maintain fully functional underdrains during the expect design life of TSF3.

3.3.3 Pathway from the TSF3 to receptors

Seepage from stored tailings is expected through the basin floor so the applicant commissioned an electrical conductivity survey to be undertaken in 2022 (see Figure 9 below). Based upon the results of the survey, the applicant proposes the key pathways for seepage at TSF3 is expected to be primarily through the most permeable sand and gravel layers associated with the underlying creek systems, with the main flow paths away from the facility in a westerly direction towards the larger creek systems.

The groundwater beneath the proposed location of TSF3 sits within a weathered fractured bedrock aquifer comprising granite and greenstone. The westerly trending creeklines likely feature a greater depth of weathering into the underlying bedrock and therefore could act as preferential pathways for groundwater flow although previous field investigations have found relatively low permeability in the bedrock.

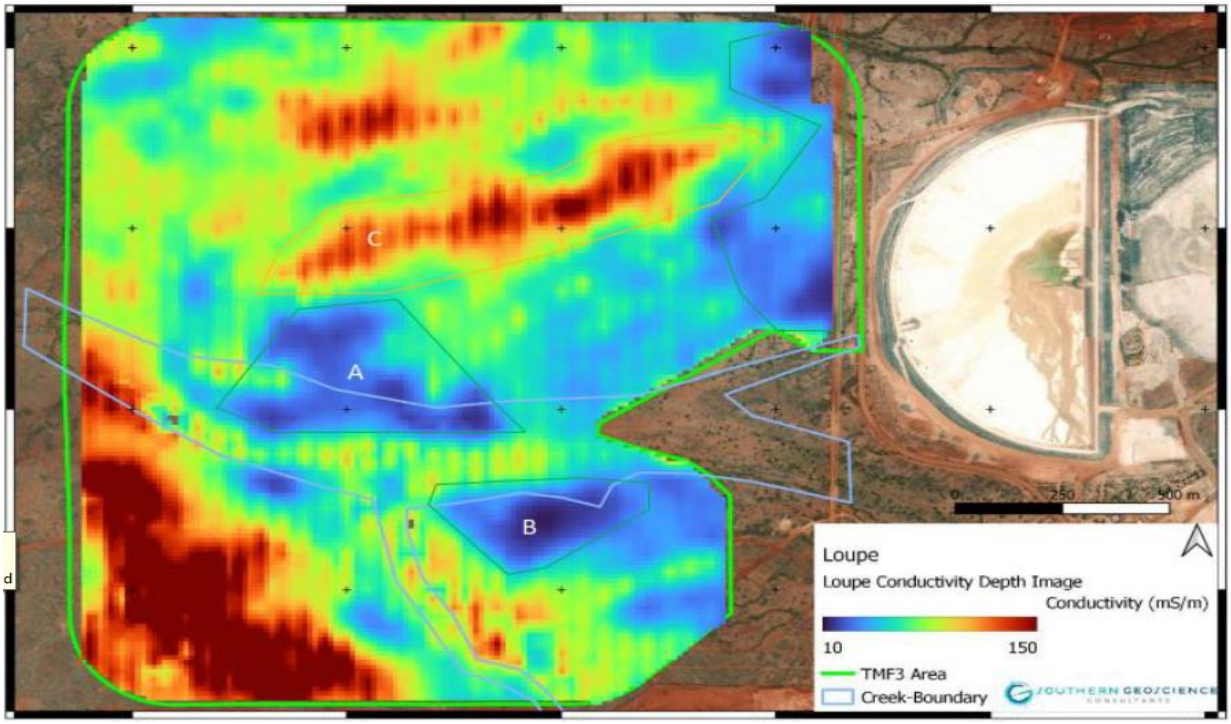

Figure 9: Electrical conductivity at 10 m depth

3.3.4 Surface water and groundwater data

Surface water

The ephemeral creeks within the catchment area are normally dry throughout the year with flows generally only occurring between January to March following heavy rainfall events. Some disconnected pools may be present in the creek beds during the dry season if groundwater levels remain high enough. Surface water flows from the east and southeast corner which then mainly drain to the west with some flow to the north and south. All run-off at the Premises eventually reaches the Turner River which is located approximately 20 km away.

Groundwater

An extensive network of groundwater monitoring bores associated with existing TSF's at the Premises provides a detailed description of the water quality expected at the location of the proposed TSF3 footprint. Analysis of the groundwater prior to mining occurring was undertaken in 2016. Sampling results indicated that groundwater met the criteria for stock-watering purposes. Recent groundwater sampling results from monitoring of bores associated with the adjacent NLO TSF show water quality is circum-neutral and fresh to slightly brackish (TDS ranging from 200 mg/L to 4,000 mg/L).

Groundwater levels are also recorded as part of the monitoring program with depth to groundwater at the location of the proposed TSF3 shown to be approximately 7.5 mBGL.

3.3.5 Proposed seepage management and monitoring

See sections 2.2.1 and 3.1.1 above for the applicant's proposed seepage management and monitoring at TSF3.

3.3.6 DWER assessment and regulatory controls

Geochemical assessment

The department does not believe there would be any negative effects associated with co-disposing tailings from the two processing plants because tailings materials from the two plants are likely to have similar geochemical properties. However, the department has concerns about whether the current samples of tailings materials would be indicative of the full range of physical and chemical properties that would be discharged to TSF3. Although the tests undertaken are commonly carried out on tailings materials from many mineral deposits, recent research (Roy *et al*., 2023) has demonstrated that they are of limited value when assessing tailings from the processing of lithium pegmatite (spodumene) ores. Roy *et al*. (2023) found that elemental mobility in leachate from these materials was generally not related to their GAI values. This research indicated that long-term kinetic tests provided the most reliable assessment of the quality of leachate that would be produced from these materials when discharged to a TSF. Roy *et al*. (2023) found that leachate that is released from tailings that are produced from the processing of spodumene ore in Canada, has circumneutral to alkaline pH values and contains elevated concentrations of lithium and uranium. Elevated concentrations of lithium are also often found in groundwater near mine waste landforms at other pegmatite lithium deposits in Western Australia.

Water balance and seepage assessment

The department considers that the water balance for TSF3 has been undertaken by the applicant in a suitable manner to determine the preliminary water requirements for the facility. However, the department considers that a more detailed water balance would be required while tailings disposal is being carried out to ensure that seepage from the facility is minimised. The department considers the main limitations of the current water balance assessment by the applicant are as follows:

- *The rate of evaporation from the facility has been overestimated.*

The consultant acting for the applicant (Knight-Piésold Pty Ltd) has assumed that the rate of evaporation from the decant pond and wet beach areas of TSF3 will be 90% of the estimated pan evaporation rate for the site, and that evaporation from other beach areas will be 30% of the pan evaporation rate.

The pan-factor for the decant pond on TSF3 is likely to have been overestimated. The department has determined this because data published by Luke *et al*. (1987) suggests that pan-factors in the Pilbara region vary between 0.6 and 0.7, rather than the value of 0.9 that was used by the consultant. Additionally, measurements of evaporation at a site in the Pilbara where the regional pan-factor was assumed to be 0.6 (Jha, 2012) indicated that the site-specific pan-factor was 0.54. Estimates of evaporation using data from regional databases like the SILO database, coupled with pre-determined pan-factors, may give unreliable evaporation rate values for specific sites in the Pilbara region.

These factors mean that it is likely that a much larger proportion of the water that would be discharged to TSF3 would infiltrate into the tailings pile than has been indicated in the water balance that has been submitted by the applicant. This could, in turn, increase the risk of seepage taking place from the facility.

The most effective way of resolving these issues would be to ensure that evaporation and other climatic factors are measured directly at TSF3 during the operational life of the facility.

- *The TSF3 seepage rates determined by modelling may be unreliable*

The consultant acting for the works approval applicant has estimated seepage rates from TSF3 using the numerical model SEEP/W. Although the department considers that this is a suitable model for this purpose, the range of hydraulic parameters and the boundary conditions that have been assumed in the model may not be indicative of conditions that would occur in the operational TSF3. Due to the limited amount of site-specific data that was available to establish and calibrate the model, it would be classified as a Class 1 model by the Australian Groundwater Modelling Guidelines, the lowest category of groundwater model confidence (National Water Commission, 2012).

Therefore, the most effective way of dealing with this issue would be to frequently determine seepage rates during the operational life of TSF3 using an ongoing assessment of the water balance for the facility. Provided that all inputs and other outputs of water from TSF3 are accurately measured on at least a monthly basis (including evaporation as discussed above), the department believes it should be possible to provide reliable estimates of the seepage rate from the facility, and how this rate varies over time. The seepage rate could also be determined from measurements of the degree to which groundwater mounding takes place beneath the TSF, and by using an inverse-modelling approach to match predicted and observed rates of change of groundwater potentiometric heads near the facility.

Significant increases in seepage rates over time that are determined by either of these methods should trigger management responses to reduce the seepage rate. Management measures could include increasing the efficiency of water recovery from the tailings or reducing the water content of the tailings before discharge to the TSF.

- *Suitability of the proposed seepage control measures*

The works approval application documents indicate that seepage from TSF3 would be managed using the following drainage systems:

1) An underdrainage system comprising a network of finger drains spaced at 25 m intervals across the base of the facility which drain to a common water recovery sump;
2) A shallow (approximately 1.5 m deep) toe-drain around the margin of the facility; and
3) Diversion drains to divert surface water runoff around the ephemeral creek on which part of the facility is located.

The department considers that such a drainage system should be effective in minimising the seepage rate from TSF3. Based on research that has been undertaken by Araújo *et al*. (2018), the 25 m spacing of finger drains beneath the TSF3 should be adequate for capturing seepage from the facility. However, this is provided that they continue to work effectively, and do not progressively become clogged with silt or ferruginous bacterial precipitates over time. If this were to occur, the seepage rate through the base of the facility would increase, as would the rate of groundwater mounding near TSF3. Therefore, the department considers it necessary that the seepage rate from the facility is measured on an ongoing basis during its operational life using the methods described above.

Regulatory controls

In response to the assessment and comments made above, the department has imposed the following requirements:

Condition 2

- construction requirements relating to embankments (including liners), seepage recovery systems, decant tower, positioning of spigots and installing monitoring equipment (piezometers and settlement pins)

Condition 3

- requirement to install groundwater monitoring bores that target part/s of the aquifer most affected.

Condition 4

- requirement to undertake ambient groundwater sampling at the TSF3 prior to TLO commence.

Condition 5

- standard condition relating to NATA accreditation.

Conditions 6, 7, 8 and 9

- construction auditing and reporting requirements

Conditions 10 and 11

- time limited operation requirements relating to commencing operations and duration of operations.

Condition 12

- operational requirements during time limited operations

Condition 13

- authorised discharge location for TSF3

Conditions 14 and 15

- requirement to undertake tailings characterisation and provide a report.

Condition 16

- requirement to undertake groundwater monitoring during TLO.

Conditions 18 and 19

- requirement to record, investigate and report on any groundwater monitoring limit exceedances.

Condition 20

- requirement to provide a report on the monitoring undertaken in accordance with condition 16.

Condition 21

- requirement to undertake water balance monitoring at the TSF3.

Conditions 22 and 23 • time limited operations compliance reporting Conditions 25 and 26 • requirement to maintain accurate and auditable books

4. Consultation

Table 5 provides a summary of the consultation undertaken by the department.

Table 5: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 27/11/23	None received	N/A
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) advised of proposal 1/12/23	DEMIRS replied on 11/12/23 and advised: *Both the construction of the TSF(3), and the embankment raise of the NLO TSF referred to are currently under assessment by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) as part of a mining proposal submitted under the Mining Act 1978 (Reg ID 120223).* *I note that the Department of Water and Environmental Regulation (DWER) request that a geotechnical engineer undertakes an assessment for stability of the design for the proposed TSF, and for the embankment lift at the NLO TSF.* *I can confirm that internal DEMIRS geotechnical advice has been received regarding the relevant geotechnical aspects referred to. No geotechnical concerns were raised providing the construction and operation complies with the design intent and specifications relating to both the design and operation of the embankment raise (Stage 5) of the NLO TSF, and the new TSF 3.*	Noted
Nyamal Aboriginal Corporation advised of proposal on 1/12/23	No comments received	DWER notes DPLH's comments below.
Department of Planning, Lands and Heritage advised of proposal on 1/12/23	Comments received 18/12/23 *After reviewing the prescribed premises boundary against the Register of Places and Objects, as well as the Department of Planning,*	Noted

	Lands and Heritage (DPLH) Aboriginal Heritage Database, I can confirm that a portion of the subject area intersects with Aboriginal Heritage Place ID 37226 (Pilgangoora Historic Aboriginal Camp.). However, the location of the proposed TSF construction does not intersect Aboriginal Heritage Place ID 37226 (Pilgangoora Historic Aboriginal Camp.). *The work area is within the Nyamal #1 Determination area who are represented by the Nyamal Aboriginal Corporation (NAC). Pilbara Minerals state in their Application that an Aboriginal heritage survey for the Pilbara Minerals Pilgangoora Lithium Project was conducted over the area in 2010, however, the Department of Planning, Lands and Heritage do not hold a copy of this survey.* *If the TSF construction continues to avoid Aboriginal Heritage Place ID 37226 (Pilgangoora Historic Aboriginal Camp.) then approval under the Aboriginal Heritage Act 1972 AHA will not be required.*	
Wallareenya Station (Carolyn Day) advised of proposal on 1/12/23	No comments received	Noted
Applicant was provided with draft documents on 16/02/2024	Comments received 13/03/2024. Refer to Appendix 1	Refer to Appendix 1. An updated draft was emailed to applicant 15/03/2024. Applicant responded 18/03/2024 confirming the proposed changes were correct and requested the draft works approval document proceeds to final signing.

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.

Time limited operations for NLO TSF Stage 5 and TSF3 stage 1 only has been granted. The applicant will need to apply for an amendment to licence L9036 for operation of the TSF 3 stage 2 embankment.

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2019, *Guideline: Industry Regulation Guide to Licensing, Perth, Western Australia.*
3. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
4. Department of Water and Environmental Regulation (DWER) 2019, *Guideline: Decision making*, Perth, Western Australia.
5. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
6. Pilbara Minerals, Works Approval Application, Ngungaju Operations – Tailings Dam 3 Supporting Information, *Ngungaju Operations – Tailings Dam 3 and NLO Stage 5 Supporting Information*, 25 July 2023.
7. Ngungaju Lithium Operations Pty Ltd, *Pilgangoora Lithium Project, Tailings Storage Facility Stage 5 Raise Design Report*, Knight Piesold Consulting, July 2023
8. Pilbara Minerals Limited, Pilgangoora Lithium Project, *Tailings Management Facility (TMF) Geotechnical Investigation Factual and Interpretative Report*, Knight Piesold Consulting, August 2023.
9. Pilbara Minerals Limited, Pilgangoora Lithium Project, *Tailings Storage Facility No. 3 Detailed Design Report*, Knight Piesold Consulting, July 2023.
10. Pilbara Minerals, *Pilgangoora TMF3 Project TMF3 Site Investigation*, Southern Geoscience, May 2023.
11. Pentium Water, Hydrogeology Assessment, *Tailings Management Facility 3 Option 2 and Option 5 Pilbara Minerals*, 10 February 2023.
12. Pentium Water, Pilgangoora Project, *Tailings Storage Facility 3 - Option 2 and Option 5, Surface Water Assessment*, 12 December 2022.
13. Pilbara Minerals, *TSF Options 2 and 5, Pilgangoora Project Biological Survey, Pilbara, Western Australia*, Animal Plant Mineral Pty Ltd, November 2022.
14. Bennelongia Environmental Consultants, *Pilgangoora Project: Impacts on Subterranean Communities*, Report No: 563, 13 December 2022.
15. Roy, T., Plante, B., Benzaazoua, M. and Demers, I., 2023. Geochemistry and mineralogy of a spodumene-pegmatite lithium ore at various beneficiation stages. Minerals Engineering, 202, 108312. The paper is available from the following website: https://www.sciencedirect.com/science/article/pii/S0892687523003266.
16. GEO-SLOPE International Ltd., “SEEP/W”, 2018.
17. Luke, G.J., Burke, K.L. and O’Brien, T.M., 1987. Evaporation Data for Western Australia. *WA Department of Agriculture, Resource Management Technical Report No 65*. The report is available from the following website: www.dpird.wa.gov.au.
18. Jha, A., 2012. What is a representative pan factor value for the eastern Pilbara? *Proceedings of the International Mine Water Association Conference, 2012*. The paper is available from the following website: www.mwen.info.
19. Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resources Management Council of Australia and New Zealand (ARMCANZ), *water quality guidelines*, 2000.

20. Araújo, M.C.N, de Souza Júnior, F.F., Reveziolli, M.N.B, Teixere, C.A., C.A. and Faro, V.P., 2018. A method for designing finger drains and assessing phreatic lines for dams. *Soils and Rocks, São Paulo*, **41(3)**, 309-317. The paper is available from the following website: www.soilsandrocks.com.br.

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

Condition	Summary of applicant's comment	Department's response
2, Table 1: Item 1 Infrastructure – Tailings Storage Facility 3 (TSF 3) Stage 1	*For all relevant items that are not linked with the referenced Schedule 2 construction design drawings, add the comment: 'In accordance with design details shown in Figure (insert relevant figures).'*	Condition updated for relevant items
2, Table 1: Item 4 Infrastructure – NLO Stage 5 embankment lift	*The basin liner at Ngungaju Lithium Operations Tailings Storage Facility (NLO TSF) decant area has already been constructed as part of a previously approved Works Approval for Stage 1 of the NLO TSF. The basin liner is in place and fully functional. Remove mention of the basin liner in Table 1, Item 4 of Works Approval W6589.*	Supported. Condition updated.
14	The Applicant raised safety concerns regarding obtaining samples on the tailings storage facility surface and requested the following sampling methodology. *Proposed methods for TSF 3 tailings characterisation:* *• Collect the tailings samples off the spigot from the embankment crest.* *• The crest serves as platform/pad for personnel to collect samples.* *• There are approximately 200 x spigots along • Samples will be collected in every 6 x spigots to obtain 30 x samples in total.* *• Each sample will be stored in a dedicated bucket, then delivered to a designated laboratory for kinetic testing. the TSF 3 perimeter.* *Proposed methods for NLO TSF Stage 5 tailings characterisation:* *Collect the tailings samples off the spigot from the embankment crest.* *• The crest serves as platform/pad for personnel to collect samples.* *• There are approximately 60 x spigots along the NLO TSF perimeter.* *• Samples will be collected in every 2 x spigots to obtain 30 x samples in total.*	Supported for sampling of the TSF3 only. Sampling from the NLO TSF Stage 5 will no longer be required as this facility will not be receiving combined tailings from the two processing plants and only has an operational life of 6-9 months. Applicant supported this change (DWER record: A2263434) Condition updated.
14	*Please make Condition 14 clear on whether it applies to the TSF 3, the NLO TSF Stage 5 or both.*	See comment above. Condition updated.
3, Table 2;	Groundwater monitoring bore labels provided.	Works Approval updated.

Condition	Summary of applicant's comment	Department's response
4, Table 3; and 16, Table 6		
3, Table 2	Please allow for a locational difference of +/-25 m, due to placement of bores and construction of adjacent haul road.	Supported. Condition updated to allow a variation of +/- 25 m.
Schedule 2 Construction Details	Updated figures 13-18 provided.	Works Approval updated with the new figures.

Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY					
Application type					
Works approval	☒				
Licence	☐	Relevant works approval number:		None	☐
		Has the works approval been complied with?		Yes ☐ No ☐	
		Has time limited operations under the works approval demonstrated acceptable operations?		Yes ☐ No ☐ N/A ☐	
		Environmental Compliance Report / Critical Containment Infrastructure Report submitted?		Yes ☐ No ☐	
		Date Report received:			
Renewal	☐	Current licence number:			
Amendment to works approval	☐	Current works approval number:			
Amendment to licence	☐	Current licence number:			
		Relevant works approval number:		N/A	☐
Registration	☐	Current works approval number:		None	☐
Date application received		28 August 2023			
Applicant and Premises details					
Applicant name/s (full legal name/s)		Pilgangoora Operations Pty Ltd			

Premises name	Pilgangoora Operations
Premises location	Mining tenements M45/1260, M45/1230 and M45/1231 MARBLE BAR
Local Government Authority	Shire of East Pilbara
Application documents	
HPCM file reference number:	DER2023/000562
Key application documents (additional to application form):	• Pilbara Minerals, Works Approval Application, *Ngungaju Operations – Tailings Dam 3 Supporting Information, Ngungaju Operations – Tailings Dam 3 and NLO Stage 5 Supporting Information*, 25 July 2023 • Ngungaju Lithium Operations Pty Ltd, Pilgangoora Lithium Project, *Tailings Storage Facility Stage 5 Raise Design Report*, Knight Piesold Consulting, July 2023 • Pilbara Minerals Limited, Pilgangoora Lithium Project, *Tailings Management Facility (TMF) Geotechnical Investigation Factual and Interpretative Report,* Knight Piesold Consulting, August 2023 • Pilbara Minerals Limited, Pilgangoora Lithium Project, *Tailings Storage Facility No. 3 Detailed Design Report,* Knight Piesold Consulting, July 2023 • Pilbara Minerals, *Pilgangoora TMF3 Project TMF3 Site Investigation*, Southern Geoscience, May 2023 • Pentium Water, *Hydrogeology Assessment, Tailings Management Facility 3 Option 2 and Option 5 Pilbara Minerals*, 10 February 2023 • Pentium Water, *Pilgangoora Project, Tailings Storage Facility 3 - Option 2 and Option 5, Surface Water Assessment*, 12 December 2022 • Pilbara Minerals, *TSF Options 2 and 5, Pilgangoora Project Biological Survey, Pilbara, Western Australia*, Animal Plant Mineral Pty Ltd, November 2022 • Bennelongia Environmental Consultants, *Pilgangoora Project: Impacts on Subterranean Communities,* Report No: 563, 13 December 2022
Scope of application/assessment	
Summary of proposed activities or changes to existing operations.	Works approval • Construction of a new tailings storage facility (TSF3) up to Stage 2 (RL 184.1 m); and • Construction of the final raise (Stage 5 to RL 192.1 m) at the current tailings storage facility (NLO TSF).

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	Proposed changes to the production or design capacity (amendments only)
Category 5: Processing or beneficiation of metallic or non-metallic ore	4,000,000 tonnes of tailings per annual period. Note: Licence L9036/2017/1 for the Premises currently only authorises the discharge of 770,000 tonnes per annual period of tailings material to the existing NLO TSF. An amendment to the Licence will be required for the increased discharge.	

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: 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: EPA Report No:
Has the proposal been referred and/or assessed under the EPBC Act?	Yes ☐ No ☒	Reference No:
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes ☒ No ☐	Certificate of title ☐ General lease ☐ Expiry: Mining lease / tenement ☒ Expiry: 25/08/2037 (M45/1230) and 5/02/2039 (M45/1260) Other evidence ☐ Expiry:
Has the applicant obtained all relevant planning approvals?	Yes ☐ No ☐ N/A ☒	Approval: Expiry date: If N/A explain why? Mining activities already an approved land use for this area.
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes ☐ No ☒	CPS No: 7449/3 for the NLO TSF Stage 5 lift only which is occurring on M45/1230. Applicant plans to apply for a clearing permit for the construction of the new TSF3 on M45/1260.

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 Licence not required.
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: GWL 183354 (5)
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 ☐ Regional office:
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes ☐ No ☒	Name: N/A Priority: N/A Are the proposed activities/ landuse compatible with the PDWSA (refer to WQPN 25)? Yes ☐ No ☐ 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, State Agreement Act xxxx*)	Yes ☒ No ☐	• Dangerous Goods Safety Act 2004 • Mining Act 1978 • Wildlife Conservation Act 1950 (WA)
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