Amendment Report

Application for Licence Amendment

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

Licence Number	L4680/1988/13
Licence Holder	FMR Investments Pty Ltd
ACN	009 411 349
File Number	2013/003899-1~13
Premises	Greenfields Processing Site Greta Eastern Highway COOLGARIE WA 6429 Legal description – Part of mining tenement M15/1836 and Lot 102 on Plan 40393 As defined by the Premises maps attached to the Revised Licence
Date of Report	03 November 2023
Decision	Revised licence granted

Christine Pustkuchen

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A/MANAGER, RESOURCE INDUSTRIES
REGULATORY SERVICES

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

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1. Decision summary

Licence L4680/1988/13 is held by FMR Investments Pty Ltd (Licence Holder) for the Greenfields Processing Site (the Premises), located on part of mining tenement M15/1936 and Lot 102 on Plan 40393, Coolgardie WA 6429.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the operation of the Premises. As a result of this assessment, Revised Licence L4680/1988/13 has been granted.

2. Scope of assessment

2.1 Regulatory framework

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

2.2 Application summary

On 13 July 2023, the Licence Holder submitted an application to the department to amend licence L4680/1988/13 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought relates to the operation of the Tailings Storage Facility (TSF) 4 Stage 1 starter embankment, up to a height of RL 402.5 m. This amendment is limited to changes to Category 5 activities from the existing licence, with no change to the authorised design/production capacity.

2.3 Overview of TSF4

The Greenfields Mill is a toll milling facility located approximately 4 kilometres (km) north of Coolgardie. Tailings from the mill are currently deposited to the existing TSF3 and TSF4. Located directly north of TSF3 Cell C, TSF4 was constructed to provide additional tailings storage capacity for the premises. The TSF4 starter embankment was constructed under works approval W6547/2021/1.

The TSF4 comprises of a single cell equipped with a central decant tower, an underdrainage system, stormwater diversion channel, as well as a series of vibrating wire piezometers (VWP) and groundwater monitoring bores. The starter embankment height authorised by works approval W6547/2021/1 was RL 403.0 m. However, this was reduced to RL 402.5 m to align with the embankment raises at TSF3.

In 2022, the Licence Holder completed construction of the TSF4 Stage 1 starter embankment to RL 402.5 m, with the southern embankment and the connecting underdrainage accessway and tower constructed to RL 396.5 m. This deviation was done to reduce the amount of clay required towards the end of the Stage 1 construction works. As a result, the department had authorised the operation of the TSF4 starter embankment to a maximum height of RL 396.5 m (DWER 2023).

Construction works to raise the southern embankment from RL 396.5 m to RL 402.5 m commenced in December 2022, with a Critical Containment Infrastructure Report submitted to the department in May 2023. The Licence Holder intends to amendment licence L4680/1988/13 to authorise operation of the TSF4 starter embankment up to RL 402.5 m. The operational aspects of tailings deposition into TSF4 were not proposed to change and have been detailed in a previous Amendment Report (DWER 2023).

Beyond the starter embankment, the Licence Holder intends for TSF4 to undergo up to four

embankment raises, each comprising a 2.5 m lift, to a nominal crest level of RL 413 m AHD (Australian Height Datum). The construction of these embankment raises has not yet been authorised by a works approval or licence.

2.3.1 TSF4 geotechnical assessment

In assessing and authorising the construction of the TSF4 starter embankment under works approval W6547/2021/1, the department consulted with DMIRS for advice on the geotechnical and safety aspects of the proposed TSF. Detailed in the Decision Report for W6547/2021/1 (DWER 2021), the following aspects were noted by the DMIRS based on their review of the relevant geotechnical investigations:

- Surface water flow will be managed through a diversion drain north of TSF4, with sufficient capacity for a 1-in-100-year rainfall event.
- Seepage analysis indicated that a combined seepage of approximately 6 m^3/day to 10 m^3/day was predicted. The phreatic surface derived from the seepage model was utilized in the stability assessment.
- Stability analyses was reported to have been undertaken in general accordance with the *Guidelines on Tailings Dams* (ANCOLD 2019), where the stability for slip surfaces for static and seismic loading being assessed using the vertical slice limit equilibrium method. Adequate factors of safety were derived, which met the recommended minimum factors of safety in the guidelines (ANCOLD 2019).
- Dam break assessment indicated that a dam break was unlikely to inundate the processing plant, with downstream flow depth estimated to be approximately 4.3 m at peak flow, decreasing with distance from the dam failure.
- Flood design requires a minimum total freeboard of 700 mm to be maintained above the normal pond operating level and an operational freeboard of 300 mm.
- An updated TSF operating manual was submitted to DMIRS, as well as a TSF4 Dam Safety Emergency Plan and Decommissioning and Rehabilitation Plan.
- Overall, the information provided by the Licence Holder complied with the relevant Codes of Practices and Guidelines.

In addition to the review, DMIRS also advised the department of tenement conditions that would typically be included for regulating TSF infrastructure (if the facility was located on a mining tenement) for the department's consideration in assessing works approval W6547/2021/1 (and licence L4680/1988/13). These conditions are listed in Table 1, along with the department's response to the advice.

Table 1: DMIRS recommended tenement conditions and department response

Item	DMIRS advice	Department response
Geotechnical assessment		
1	The construction of any tailings storage embankment shall be supervised by an engineering or geotechnical specialist.	A condition requiring the certification of the construction works by a suitably qualified geotechnical engineer had been included in works approval W6547/2021/1. Certification was adequately demonstrated in the Critical Containment Infrastructure Report (Rev 2), submitted to the department on 19 May 2023. No further actions are considered necessary under this amendment.
2	The construction details of any tailings storage embankment shall be documented by an engineering or geotechnical specialist and confirm that the construction satisfies the design intent. The construction document shall include records of all construction quality control testing, the basis of any method specification adopted, and any significant modifications to the original design together with the reasons why the modifications were necessary. The construction document shall also present as-built drawings for the embankment earthworks and pipeworks. A copy of the construction document shall be submitted to *DWER* for its records.	A condition requiring the submission of a Critical Containment Infrastructure Report containing the information specified by the DMIRS had been included in works approval W6547/2021/1. Compliance was adequately demonstrated by the Critical Containment Infrastructure Report (Rev 2), submitted to the department on 19 May 2023. No further actions are considered necessary under this amendment.
3	The tailings storage facility shall be checked on a routine daily basis by site personnel during periods of deposition to ensure that the facility is functioning as per the design intent.	Condition 6 in the existing licence L4680/1988/13 requires daily visual inspection of all TSFs at the premises for signs of erosion, embankment cracking, damp and wet areas on batter slopes and toe areas, supernatant pond size and location, condition of diversion channels and whether operational freeboard of at least 300 mm is maintained. The condition also requires visual inspection of tailings and return water pipelines to be inspected twice daily. No further actions are considered necessary under this amendment.

Item	DMIRS advice	Department response
4	An engineering or geotechnical specialist shall audit and review the active tailings storage facility on an annual basis. The specialist shall review past performance, validate the design, examine tailings management, and review the results of monitoring. Any deficiencies noted in the audit and review report shall be suitably addressed and improved. The audit and review report shall be submitted to *DWER* and should be accompanied by a recent survey pick-up of the facility and an updated tailings storage data sheet.	Condition 24 in the existing licence L4680/1988/13 requires an annual audit and review report be prepared by a suitably qualified engineer or geotechnical specialist and submitted to the department annually. No further actions are considered necessary under this amendment.
5	A minimum operational freeboard of 300 mm be maintained on top of the facility at all times.	Condition 4 of the existing licence L4680/1988/13 requires sufficient freeboard to be maintained at active TSFs as well as process water and return water ponds. A total freeboard of at least 500 mm or sufficient freeboard to contain a 1-in-100-year rainfall event for 72 hours must be maintained, whichever was greater. In addition, condition 6 in the existing licence L4680/1988/13 requires daily visual inspection of all TSFs to ensure an operational freeboard of at least 300 mm is maintained. No further actions are considered necessary under this amendment.
6	At the time of decommissioning of the tailings storage facility and prior to rehabilitation, a further review report by a geotechnical or engineering specialist shall be submitted to *DWER.* This report should review the status of the structure and its contained tailings, examine, and address the implications of the physical and chemical characteristics of the materials, and present and review the results of all monitoring. The rehabilitation stabilisation works proposed and any ongoing remedial requirements should also be addressed.	The department intends to include this requirement as a condition in licence L4680/1988/13 under this amendment.
Closure, decommissioning and rehabilitation		

Item	DMIRS advice	Department response
7	All mining related landforms and disturbances must be rehabilitated, in a progressive manner where practicable, to ensure they are safe, stable, non-polluting, integrated with the surrounding landscape and support self-sustaining, functioning ecosystems or alternative agreed outcomes to the satisfaction of the CEO.	The department intends to include this requirement as a condition in licence L4680/1988/13 under this amendment.
8	The licence holder must submit a Mine Closure Plan in the year specified below. The Mine Closure Plan is to be prepared in accordance with the DMIRS' *Guidelines for Preparing Mine Closure Plans*.	
9	The licence holder cannot surrender its licence until such time that the requirements under the Mine Closure Plan have been met and approved by the CEO.	The department cannot condition this in licence L4680/1988/13 as the Licence Holer has the legal right to surrender the licence at the end of operation. Under section 68A of Part V Division 4 of the EP Act, the department can issue a closure notice for premises that may require ongoing investigation, monitoring or management.

2.4 CEO-initiated amendment

At closure, the Licence Holder intends to have the TSFs at the premises remain as dominant landscape features that are safe, stable and non-polluting. The proposed post-mining land use is to maintain freehold ownership of Lot 102 on Plan 40393 and establish self-sustaining natural ecosystems as similar as possible to the original ecosystem. Effective closure and rehabilitation of TSF infrastructure are necessary to prevent potential legacy environmental issues post-operation.

In a previous assessment (DWER 2023), the department highlighted that the TSF4 (and the wider TSF infrastructure at the premises) is located on freehold land, on part of Lot 102 on Plan 40393, and is not subject to regulation under the *Mining Act 1978*, which typically regulates the closure and rehabilitation aspects of these facilities. As such, the department has initiated an amendment in conjunction with this amendment application. The Delegated Officer has assessed and considered relevant measures and controls to ensure that emissions and discharges associated with rehabilitated TSF landforms do not present an unacceptable risk to human health and environment.

In a letter dated 22 December 2022, the department requested the most current revision of the Mine Closure Plan (MCP) for the premises from the Licence Holder. The MCP was provided to the department on 1 March 2023. The department consulted with DMIRS on the review of the MCP. While the MCP met the minimum requirements of the *Guidelines: Mine Closure Plan Guidance – How to prepare in accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans* (DMIRS 2020), there are aspects where the MCP could be improved, which are broadly summarised as follows:

- The primary comment provided by DMIRS was that decommissioning, closure and rehabilitation planning should be undertaken progressively and not left until closure. The current and future MCP revisions should include any research, investigation or rehabilitation trials planned and accurately reflect progress being made to meet the relevant closure outcomes and completion criteria, which should be designed in accordance with the S.M.A.R.T principle.
- Additional information gaps were identified and should be addressed in greater detail in future MCP revisions, including seepage and groundwater mounding after cessation of tailings deposition, sourcing and characterisation of waste rock and other rehabilitation materials, closure monitoring program, identifying analogue monitoring sites etc.
- Furthermore, it appeared not all closure risks had been identified in the MCP (e.g., unsuccessful rehabilitation, topsoil management). It was recommended that closure risks should be reassessed to ensure that all relevant risks have been identified and included in the MCP. Further consideration should also be given to management practice to ensure they adequately address the relevant risks.

In addition to the review of the MCP, DMIRS also advised the department of tenement conditions that would typically be included for regulating closure, decommissioning and rehabilitation of TSF infrastructure (if the facility was located on a mining tenement) for the department's consideration in assessing this amendment to licence L4680/1988/13. These conditions are listed in Table 1, along with the department's response to the advice.

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 2020b).

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 operation which have been considered in this Amendment Report are detailed in Table 2 below. Table 2 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

Table 2: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Operation (TSF4)			
Dust	Dried deposited tailings at TSF4	Air/windborne pathway	• Use of water carts for dust suppression; and • Rotate spigots around TSF4 perimeter embankment.
Tailings slurry	Deposition of tailings to TSF4	Embankment failure, resulting in loss of containment and direct discharge to land	• Routine inspection for embankment damage or signs of erosion after rainfall events (at least daily); • Visual inspection around TSF4 to assess the condition of embankment, toe area and tailings beach; • Undertaking annual audit of TSF by independent engineers, as well as routine inspections by mill personnel; • Embankment crest sloped inwards (upstream) to shed water into the TSF4 beach; • Downstream slope of embankment covered with rock armour to provide erosion protection; • Monthly monitoring of standing water levels in surrounding groundwater monitoring

Emission	Sources	Potential pathways	Proposed controls
			bores around TSF4 embankment to assess trends in groundwater movement and potential mounding; • Monthly monitoring of vibrating wire piezometers (VWP) installed on the TSF4 embankment; • Settlement pins were installed to measure potential vertical deformation in TSF4 embankment; • Biannual high-resolution survey will be undertaken using an unmanned aerial vehicle; • Cycling of tailings deposition locations around the TSF4 embankment perimeter; • Maintenance of an operational freeboard of at least 300 mm at all times; • Decant water pond kept as small as practicable, with decant water removed via a decant system; • Decant pond to be maintained such that it would always be at least 100 m from the perimeter embankment; and • Catchment runoff from upstream (north) of TSF4 diverted to the east using a diversion drain.
		Overtopping of TSF, resulting in loss of containment and direct discharge to land	• Decant water pond kept as small as practicable, with decant water removed via a decant system; • Maintenance of an operational freeboard of at least 300 mm at all times; • Embankment designed with adequate allowance to store water during a 1% Annual Exceedance Probability (AEP) storm event for 72 hours; • Monitoring of volume of tailings deposited to TSF4; and • Routine inspection of tailings beach (at least daily).
		Pipeline leak or rupture	• Pipelines installed within earthen bunded corridors; • Installation of an automated leakage detection system; • Water recovery system was designed with a minimum capacity of 120 tonnes per hour, including additional capacity to recover water during a 1% AEP storm event
Hypersaline water	Recovery of decant water	Pipeline leak or rupture	

Emission	Sources	Potential pathways	Proposed controls
	from TSF4		for 72 hours; and • Routine inspection and maintenance of pipeline along the routes (at least twice a day).
Tailings seepage	Deposition of tailings to TSF4	Vertical infiltration and horizontal subsurface migration	• Embankment footprint and storage basin areas compacted to a depth of 0.3 m; • Where clay was absent, a compacted clay liner was constructed, with a permeability of 1 x 10^{-8} m/s; • Underground drainage system was installed, comprising underdrainage lines graded towards a sump within a concrete tower; • Decant water will be removed from the TSF surface via a decant system; • Decant pond to be maintained such that it would always be at least 100 m from the perimeter embankment; • Monthly monitoring of standing water levels in surrounding groundwater monitoring bores around TSF4 embankment to assess trends in groundwater movement and potential mounding; • Quarterly groundwater monitoring for groundwater chemistry; • Visual inspection around TSF4 to assess the condition of embankment, toe area and tailings beach.
Decommissioning, closure and rehabilitation			
Dust	Unsuccessful closure, decommissioning and rehabilitation of TSFs, resulting in an unsafe, unstable and/or polluting landform	Air/windborne pathway	Managed through MCP, which proposed the following measures: • At closure, decant structure and pipeline infrastructure will be removed and the supernatant pond area capped with at least 500 mm of selected mine waste sourced from nearby mining operations; • At least 150 mm of topsoil will be spread on reshaped surfaces to maximise vegetation growth and contour rip, followed by hand seeding of topsoiled surfaces with local provenance native seed mix.
Sediment laden		Overland runoff during rainfall events, resulting in	Managed through MCP, which proposed the following measures:

Emission	Sources	Potential pathways	Proposed controls

stormwater		ineffective establishment of vegetation and rehabilitation	• At closure, TSF embankments will be armoured with at least 500 mm of selected mine waste, placed to slope at approximately 18^{o} (1V:3H) with 5m-wide berms;
			• Thicker armouring of up to one metre will be placed in lower portions of the embankment walls to resist erosion based on PMF water levels, which has been conservatively estimated to be approximately 5 metres above natural ground level;
			• Armouring material will be selected based on the following specifications:
			  ○ Competent, durable and free-draining material resistant to chemical and physical breakdown;
			  ○ Minimum and maximum particle size of 100 mm and 500 mm, respectively, with a D50 of approximately 200 mm;
			  ○ Free of organic material or any other deleterious inclusions; and
			  ○ Have a plasticity index of 0% (i.e., non-plastic).

Contaminated stormwater		Overtopping of stormwater on TSF during rainfall events, resulting in loss of containment and direct discharge to land	Managed through MCP, which proposed the following measures: • At closure, the surface of TSFs will be shaped into a concave, water retaining structure to prevent stormwater runoff from discharging down the embankments; • The upper surfaces of the TSFs will be designed to contain a probably maximum flood (PMF) event; • The upper surfaces of TSFs will be sloped with a 1V:2H cross-fall away from the embankment and then approximately 1V:100H fall towards the centre of the TSF; • A berm will be installed with a height of one metre to form a perimeter bund, such that ponding from a PMF event would only reach the toe of the perimeter bund.
Dried tailings and tailings slurry		Embankment failure, resulting in loss of containment and direct discharge to land	Managed through MCP. Refer to proposed controls for sediment laden stormwater and contaminated stormwater.
Tailings seepage		Vertical infiltration and horizontal subsurface migration	Managed through MCP, which proposed the following measures: • At closure, the surface of TSFs will be allowed a minimum of six months to dry;

Emission	Sources	Potential pathways	Proposed controls
			• Currently, monitoring and seepage recovery bores are expected to continue operating for up to 12 months following decommissioning. Ongoing groundwater monitoring and recovery will be reevaluated after that period; • Bores will be decommissioned by sealing and filling in accordance with methods detailed in '*Minimum construction requirements for water bores in Australia, Fourth Edition (2020)*' to prevent surface entry of contaminants and vertical movement of water in the well.

3.1.2 Receptors

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

Table 3 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 2020a)).

Table 3: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	**Distance from prescribed activity**
Coolgardie township	3.5 km south-west of the premises boundary.
Pastoral activities	The premises is surrounded by pastoral leases and used for stock grazing. The nearest pastoral station is the Mungari, located 1.6 km north-east of the premises boundary.
Environmental receptors	**Distance from prescribed activity**
Native vegetation	Low undulating mallee woodland and shrubland, comprising *Corymbia calophylla, Eucalyptus wandoo* and *Eucalyptus camaldulensis* abuts the premises on the northern, eastern and southern boundaries of the premises and the boundary of the TSFs.
Surface water bodies	Brown Lake is an ephemeral salt lake, located 5 km to the east of the premises boundary. Surface water typically drains to the east-southeast, towards Brown Lake. Brown Lake forms part of a chain of salt lakes, including Red Lake, Blue Lake, White Lake and Douglas Lake (in order of increasing distance from the premises). Streamflow in local gullies and watercourses are ephemeral due to the semi-arid environment.
Groundwater aquifer	Groundwater at the premises occurs naturally at depth within a shallow unconfined porous-media aquifer. This aquifer is hosted in lithologies comprising weathered residual soil profile and the underlying weathered rock (gabbro). The lithologies were of low permeability and may act as an aquiclude. Local groundwater mounding was observed at the premises due to seepage from the adjacent TSF3, with the shallowest and deepest standing water level observed at 6.3 mbgl (MB401) and 36.3 mbgl (MB403), respectively in the July 2023 monitoring event (Botanica Consulting 2023). During the June 2023 monitoring event, local groundwater salinity ranged between saline and hypersaline, with total dissolved solid concentrations ranging between 8,600 mg/L and 110,000 mg/L. Trace concentrations of heavy metals and metalloids (e.g., arsenic and nickel) were detected in most groundwater monitoring bores. Weak acid dissociable cyanide (WAD CN) was also measured at concentrations above the limit of reporting at monitoring bores MB302 to MB307 (i.e., along the southern and south-eastern corner of TSF3). There are no groundwater bores registered within 2.5 km hydraulically

	downgradient of the TSF.
Cultural receptors	**Distance from activity / prescribed premises**
Aboriginal heritage places	Four registered Aboriginal heritage places were identified south-west of the premises, including: • Coolgardie Stones (Place ID 1568) – Ceremonial, man-made structure, mythological; located 3.3 km from the premises boundary; • Two Trees (Place ID 1698) – Mythological; located 4 km from the premises boundary; • Kurrkurti (Place ID 1475) – Ceremonial, water source; located 2.2 km from the premises boundary; and • Kurkuthutana (Place ID 3009) – Ceremonial, mythological, camp, meeting pace, plant resource and water source; located 1.2 km from the premises boundary. Two Aboriginal heritage places were also lodged: • Kurlkuli/Coolgardie Lookout (Place ID 32759) – Ceremonial, rock shelter, camp, hunting place, meeting place, named place, plant resource and water source; located 3.1 km south-west of the premises boundary; and • Roundhead/Ngumarn (Place ID 32761) – Ceremonial, mythological, rock shelter, birthplace, camp, hunting place, meeting place, natural feature and plant resource; located 2 km west of the premises boundary.

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020b) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the Licence Holder 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 Licence Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the Licence Holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 4.

The Revised Licence L4680/1988/13 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e., tailings deposition at TSF4.

The conditions in the Revised Licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 4. Risk assessment of potential emissions and discharges from the Premises during operation and closure

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
Operation								
Deposition of tailings into TSF4 Stage 1 starter embankment	Dust	***Pathway:*** Air/ windborne pathway ***Impact:*** Impacts to health and amenity	Coolgardie township; Native vegetation and soil	Refer to Section 3.1	C = Minor L = Unlikely **Medium risk**	Y	N/A	N/A
	Tailings seepage	***Pathway:*** Vertical infiltration and horizontal migration ***Impact:*** Mounding of local water table and potential surface expression of groundwater, resulting in impacts to ecological health	Native vegetation and soil; Groundwater aquifer	Refer to Section 3.1	C = Moderate L = Possible **Medium risk** Refer to Section 3.3	N	Condition 1 Condition 3 Condition 5 Condition 6 Condition 14 Condition 15 **Condition 16** – Submission of seepage management plan **Condition 17** – Requirement of seepage management plan **Condition 18** – Requirement for implementation of seepage management plan	Refer to Section 3.3.
	Tailings slurry	***Pathway:*** Embankment failure, resulting in loss of containment and discharge of tailing slurry to land ***Impact:*** Impact to ecological health	Pastoral activities; Native vegetation and soil; Surface water bodies; Aboriginal heritage places.	Refer to Section 3.1	C = Major L = Rare **Medium risk**	Y	Condition 1 Condition 3 Condition 5 Condition 6 Condition 14	N/A
	Tailings release	***Pathway:*** Overtopping of TSF, resulting in loss of containment and discharge of tailings slurry to land ***Impact:*** Impact to ecological health	Pastoral activities; Native vegetation and soil.	Refer to Section 3.1	C = Moderate L = Unlikely **Medium risk**	Y	Condition 4 Condition 6	N/A
	Tailings release	***Pathway:*** Pipeline leak or rupture, resulting in loss of containment and discharge of tailings slurry to land ***Impact:*** Impact to ecological health		Refer to Section 3.1	C = Minor L = Unlikely **Medium risk**	Y	Condition 2 Condition 6	N/A
	Hypersaline return water	***Pathway:*** Pipeline leak or rupture, resulting in loss of containment and discharge of hypersaline return water to land		Refer to Section 3.1	C = Minor L = Unlikely **Medium risk**	Y	Condition 2 Condition 6	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
		Impact: Impact to ecological health						
Closure (post-operation)								
Unsuccessful closure, decommissioning and rehabilitation of TSFs, resulting in an unsafe, unstable and/or pollutant landform	Dust	***Pathway:*** Air/ windborne pathway ***Impact:*** Impacts to human and ecological health as well as amenity	Coolgardie township; Native vegetation and soil	Refer to Section 3.1	C = Minor L = Possible **Medium risk**	Y	**Condition 29** – Submission of revised MCP **Condition 30** – Decommissioning and rehabilitation outcomes	In considering the current revision of the MCP and advice provided by the DMIRS, the Delegated Officer has decided that additional regulatory requirements are necessary to manage risks associated with unsuccessful closure, decommissioning and rehabilitation. Conditions 29 and 30 have been included in the revised licence L4680/1988/13 to require submission of revised MCPs and implementation of controls proposed in the MCP to meet the desired closure and rehabilitation outcomes. The Delegated Officer has noted that further work needs to be undertaken to refine the MCP and meet closure and rehabilitation outcomes progressively.
	Sediment laden stormwater	***Pathway:*** Overland runoff during rainfall events, resulting in ineffective establishment of vegetation and rehabilitation ***Impact:*** Impacts to ecological health	Pastoral activities; Native vegetation and soil.	Refer to Section 3.1	C = Minor L = Possible **Medium risk**	Y		
	Contaminated stormwater	***Pathway:*** Overtopping of stormwater from TSF during rainfall events, resulting in loss of containment and direct discharge to land ***Impact:*** Impacts to ecological health		Refer to Section 3.1	C = Moderate L = Possible **Medium risk**	Y		
	Dried tailings and tailings slurry	***Pathway:*** Embankment failure, resulting in loss of containment and direct discharge to land ***Impact:*** Impacts to ecological health and amenity		Refer to Section 3.1	C = Major L = Possible **High risk**	Y		
	Tailings seepage	***Pathway:*** Vertical infiltration and horizontal migration ***Impact:*** Mounding of local water table and potential surface expression of groundwater, resulting in impacts to ecological health	Native vegetation and soil; Groundwater aquifer	Refer to Section 3.1	C = Moderate L = Possible **Medium risk**	Y		

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

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

3.3 Detailed risk assessment

3.3.1 Overview of risk event

With the operation of TSF4 starter embankment to RL 402.5 m, it is anticipated that tailings seepage from TSF4 will continue to be released to the environment through infiltration through the base and embankment walls of the TSF. Tailings seepage has the potential to adversely impact surrounding environmental receptors, such as native vegetation that abuts and surrounds the TSF infrastructure, as well as the local groundwater aquifer. Groundwater monitoring undertaken in the 2022/2023 annual period at TSF4 can be assessed to inform the risk rating of authorising operation of TSF4 to RL 402.5 m.

3.3.2 Groundwater assessment

Three monitoring bores MB401, MB402 and MB403 were installed as part of the construction of the TSF4 starter embankment. Assessment of groundwater monitoring data from these three bores between July 2022 and July 2023 is summarised as follows:

- Standing water levels (SWL) of MB401 and MB402 were relatively shallow, ranging between 6.3 mbgl and 14.8 mbgl (Figure 1). Groundwater is deeper at MB403, encountered 35.7 mbgl and 37.2 mbgl. Groundwater monitoring data appears consistent with depth of water strike at the time of bore advancement.
- Standing water levels at all three monitoring bores appeared to be rising at varying rates. The shallowest groundwater was observed at MB401, increasing from 12.4 mbgl (July 2022) to 6.3 mbgl (July 2023), representing an approximate rise of 6 m within the previous annual period (Figure 1). Rate of SWL rise has been lower at the other monitoring bores, increasing by approximately 3 m and 1 m at MB402 and MB403, respectively.
- Groundwater quality varied between the three groundwater monitoring bores (Figure 2). Generally, MB401 contained significantly higher total dissolved solids (TDS) and major ions (i.e., calcium, potassium, sodium, magnesium, chloride). Monitoring bores MB402 and MB403 contained similar concentrations of TDS and major ions, though concentrations in MB402 were slightly higher. The concentrations and trends observed were consistent with baseline monitoring undertaken prior to the time limited operation of TSF4, as required by works approval 6547/20221/1.
- No WAD CN, dissolved mercury and dissolved cadmium were detected above their respective limit of reporting at MB401, MB402 and MB403 during the monitoring period (data not shown). Dissolved copper was only detected at MB403 during the March 2023 monitoring event, while dissolved lead was only detected at MB402 during the November 2022 monitoring event. Dissolved chromium was not detected at concentrations above its limit of reporting, except at MB402 (i.e., ranging between <0.01 mg/L to 0.017 mg/L).
- Dissolved arsenic concentrations ranged between 0.09 mg/L and 2.0 mg/L, with the highest concentrations generally observed at MB402 (Figure 2). However, concentrations have decreased over time and was comparable to concentrations at MB401 and MB403 during the June 2023 monitoring event.
- Dissolved nickel concentrations ranged between 0.024 mg/L and 0.47 mg/L, with the highest concentrations generally observed at MB401 (Figure 2). However, concentrations have decreased over time and was reported below the limit of reporting during the March 2023 and June 2023 monitoring event (data not shown). However, the limit of reporting for samples from MB401 may have been raised due to the high TDS content in the sample matrix. Therefore, comparison of MB401 against MB402 and MB403 may be difficult. Further monitoring is required.

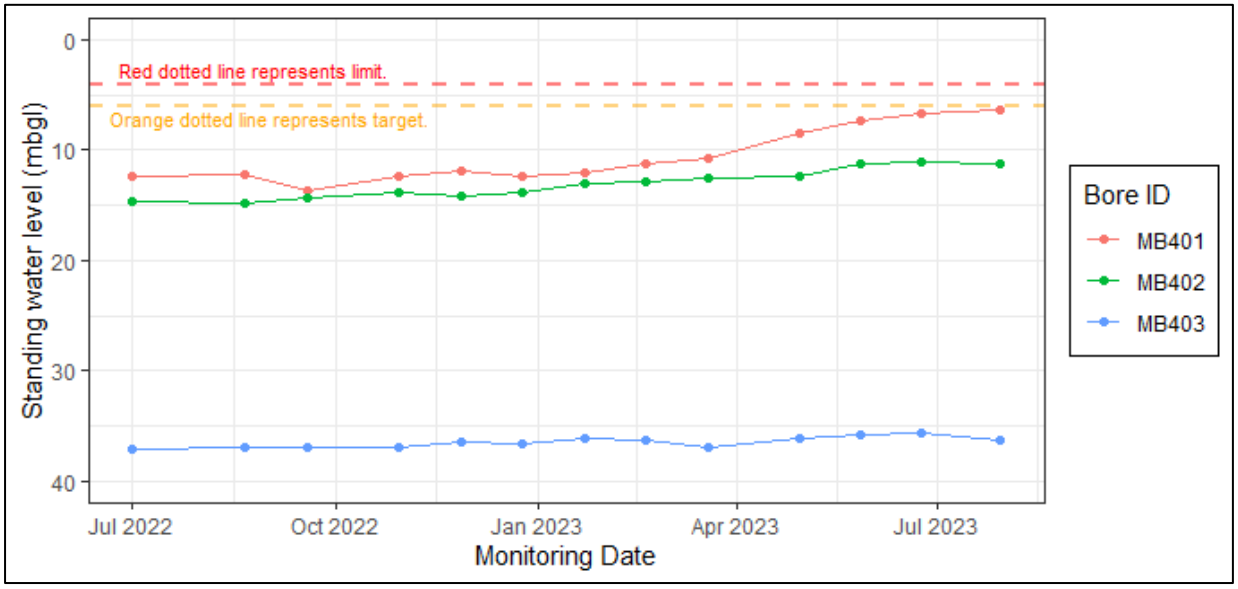

Figure 1: Standing water level at MB401, MB402 and MB403

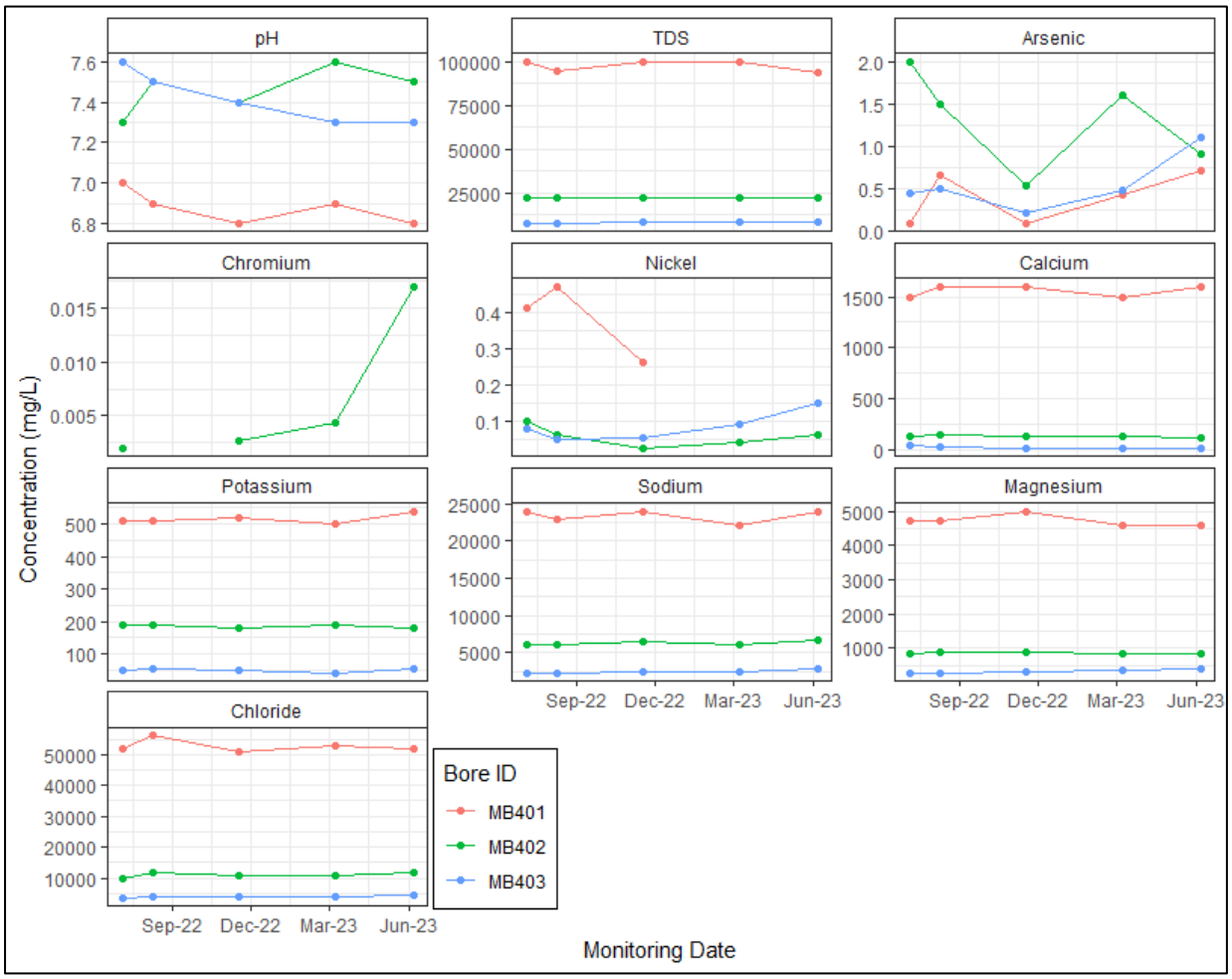

Figure 2: Water quality at MB401, MB402 and MB403

3.3.3 Potential adverse impacts of tailings seepage

Groundwater monitoring at the three monitoring bores around TSF4 has shown indications of localised groundwater mounding, which is characterised by a reduction in groundwater depth over time. Groundwater mounding along the northern portion of TSF4 appeared to be most severe, with SWL at MB401 increasing from 12.4 mbgl to 6.3 mbgl within twelve months, with higher rates of rise in later months (Figure 1). While there are indications of groundwater mounding observed at MB402 and MB403 as well, the extent of mounding appeared to be less severe, compared to MB401.

Seepage from tailings deposited into TSF4 have the potential to contaminate the local unconfined aquifer. Seepage influences from TSF4 appeared to be limited, as no significant changes were observed for TDS and major ions (i.e., calcium, potassium, sodium, magnesium, and chloride) within the monitoring bores (Figure 2). While dissolved arsenic and nickel were observed at detectable concentrations, further monitoring may be required to assess the impacts of tailings seepage more confidently on groundwater quality.

In terms of impacts to native vegetation, groundwater mounding could potentially continue elevating the local water table, such that the root zones of the surrounding native vegetation have been inundated. Waterlogged soils become deficient in oxygen, which disrupts root respiration and normal cellular processes, causing plant stress and potentially death (Pan *et al.* 2021). Furthermore, high salinity conditions, such as exposure to hypersaline groundwater, may exacerbate plant stress (Craig *et al.* 1990; Barrett-Lennard 2003). Native vegetation may also be exposed to contamination if the unconfined aquifer had been contaminated by seepage and mounded to an extent where root contaminant uptake may occur.

In assessing the groundwater monitoring data to date, native vegetation currently abutting the TSF4 northern embankment may be impacted by hypersaline groundwater, being brought close to the surface due to seepage influences. While groundwater mounding has also been observed at other sections of TSF4, there is a relatively lower likelihood of impacting surrounding native vegetation due to their current groundwater depths, especially at MB403.

Groundwater monitoring bores are unlikely to be required west of TSF4, as the ground surface is likely at a similar or higher elevation than the authorised operating height (i.e., RL 402.5 m). Accordingly, no western embankment had been constructed as part of the starter embankment. The requirements for groundwater monitoring in this area will be considered during assessments of future embankment raises to TSF4.

3.3.4 Risk assessment and additional regulatory controls

In considering the potential impacts of groundwater mounding on native vegetation and the local unconfined aquifer, the Delegated Officer has determined a consequence rating of **moderate**. Based on the existing controls on licence L4680/1988/13, the controls proposed by the Licence Holder as well as the findings from the groundwater assessment, the Delegated Officer has determined a likelihood rating of **possible**. The overall risk rating for this risk event is **medium risk**.

While the Licence Holder has not exceeded the SWL limit of 4 mbgl in the licence at MB401, there is potential for an exceedance of either the limit or the target (i.e., 6 mbgl) to occur in the near future due to continued tailings deposition. As such, the Delegated Officer has included new conditions 16, 17 and 18 as additional regulatory requirements to design and implement a seepage recovery plan for TSF4 if the SWL target of 6 mbgl is exceeded. Previous seepage recovery efforts and additional monitoring bore installation south of TSF3 have shown to be an effective method of managing the potential impacts of groundwater mounding.

4. Consultation

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

Table 5: Consultation

Consultation method	Comments received	Department response
Shire of Coolgardie (the Shire) advised of proposal on 11 August 2023.	The Shire had no objections to the proposal as the operating height was consistent with the Shire's approval for TSF4 to operate up to RL 413 m under PA21/23.	Noted.
Licence Holder was provided with draft amendment on 18 October 2023.	The Licence Holder provided comments for the draft amendment on 25 October 2023 and 2 November 2023. Refer to Appendix 1.	Refer to Appendix 1.

5. Conclusion

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

5.1 Summary of amendments

Table 6 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

Table 6: Summary of licence amendments

Condition no.	Proposed amendments
Condition 1	Updated Table 1 to increase the operation height of TSF4 from 396.5 mRL to 402.5 mRL.
Condition 7	Updated Table 5 by removing infrastructure 'Cell A Stage 4 upstream embankment lift (including cell dividing embankment between Cell A and Cell B) and decant raise of TSF3 Cell A'. Compliance was demonstrated on 12 September 2023.
Condition 15	Updated Table 11 to: • remove seepage recovery bores MB302, MB304 and MB305 from standing water level monitoring; and • include seepage recovery bores MB302, MB304 and MB305 for groundwater quality monitoring.
Condition 16	Added new condition to require submission of a Seepage Management Plan if standing water level target (specified in condition 15) is exceeded.
Condition 17	Added new condition to specify requirements of Seepage Management Plan.
Condition 18	Added new condition to require implementation of Seepage Management Plan.
Condition 23	Updated Table 8 to include reporting of works undertaken in implementing the Seepage Management Plan, as required by condition 18.
Condition 28	Updated Table 10 to require reporting of any target exceedance specified in condition 15.

Condition no.	Proposed amendments
Condition 29	Added new condition to require submission of revised Mine Closure Plan.
Condition 30	Added new condition for decommissioning and rehabilitation outcomes.
---	Updated Table 11 to: • include definition for *Mine Closure Plan Guidance*; and • amend the end date of the *annual period* from 30 July to 31 July.
---	Updated Schedule 2: Construction drawings by removing Figures 5, 6 and 7. Compliance was demonstrated on 12 September 2023.

References

1. Australian National Committee on Large Dams (ANCOLD) 2019, *Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure*, Hobart, Tasmania.
2. Barrett-Lennard EG 2003, *The interaction between waterlogging and salinity in higher plants: causes, consequences and implications*, Plant and Soil, 253, pp. 35-54.
3. Craig GF, Bell DT & Atkins CA 1990, *Response to salt and waterlogging stress of ten taxa of Acacia selected from naturally saline areas of Western Australia,* Australian Journal of Botany, 38(6), pp. 619-630.
4. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
5. Department of Water and Environmental Regulation (DWER) 2020a, *Guideline: Environmental Siting*, Perth, Western Australia.
6. DWER 2020b, *Guideline: Risk Assessments*, Perth, Western Australia.
7. DWER 2021, *W6547/2021/1 Decision Report*, Perth, Western Australia.
8. DWER 2023, *L4680/1988/13 Amendment Report*, Perth, Western Australia.
9. Pan J, Shariff R, Xu X & Chen X 2021, *Mechanisms of Waterlogging Tolerance in Plants: Research Progress and Prospects*, Front. Plant Sci. 11:627331.

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

Condition	Summary of Licence Holder's comment	Department's response
Condition 15	The Licence Holder requested further clarification on the new condition 17, specifically the implications of the 'fit for purpose' definition and Note 1 on the existing seepage recovery bores for TSF3 (i.e., MB302, MB304 and MB305). The TSF3 seepage recovery bores were previously groundwater monitoring bores. The conversion of these bores for seepage recovery in the TSF3 Seepage Management Plan (dated 27 August 2020) was accepted by the department. The monitoring requirement for these bores were removed (July 2020) and subsequently reintroduced for standing water level monitoring (August 2022).	The department has modified requirements for seepage recovery bores MB302, MB304 and MB305, such that monitoring for standing water level is no longer required due to the potential impacts of seepage recovery on obtaining accurate, stable standing water level measurements. The standing water level limit may not be applicable at these bores. Furthermore, there is adequate monitoring bore coverage at TSF3 to obtain accurate standing water level data in the area. That being said, continued standing water level monitoring at seepage recovery bores is encouraged for internal monitoring purposes. Groundwater quality monitoring for seepage recovery bores MB302, MB304 and MB305 has been added to Table 7.
Condition 17	To address concerns regarding continuity and reliability of the monitoring data (i.e., standing water level) from seepage recovery bores MB302, MB304 and MB305, the Licence Holder requested that seepage recovery bores be removed from Table 7 for standing water level, and added to Table 7 for quarterly water quality monitoring under a separate heading (i.e., *Seepage Recovery Bores*).	The department acknowledged that the conversion of groundwater monitoring bores to seepage recovery bores has previously been accepted and that these seepage recovery bores have been effective at managing localised groundwater mounding at TSF3. The definition of 'fit for purpose' is currently only applicable to the seepage recovery bores that are installed at TSF4 as part of the Seepage Management Plan and do not apply to existing seepage recovery bores at TSF3. Continuity of monitoring data at the existing bores at TSF4 is important due to the lack of an extensive monitoring bore network at TSF4 (relative to TSF3).
Condition 18	The Licence Holder requested the timeframe for implementing the Seepage Management Plan be increased from three months to six months to ensure sufficient timeframe to obtain any relevant approvals and engage a suitably qualified driller (i.e., current Class 1 waterwell drillers' licence, issued by the Australian Drilling Industry Association, or equivalent certification) to undertake the works.	In assessing the existing controls and risk rating, the department considers that six months is an acceptable timeframe for the implementation of the Seepage Management Plan.
----	In Table 11 (Definitions), the Licence Holder requested that the end date of the annual period be updated from 30 July to 31 July.	The department has amended the date accordingly.

Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)					
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:	L4680/1988/13		
		Relevant works approval number:	W6547/2021/1	N/A	☐
Registration	☐	Current works approval number:		None	☐
Date application received		13 July 2023			
Applicant and Premises details					
Applicant name/s (full legal name/s)		FMR Investments Pty Ltd			
Premises name		Greenfields Processing Site			
Premises location		Part mining tenement M15/1836 and Lot 102 on Plan 40393			
Local Government Authority		Shire of Coolgardie			
Application documents					
HPCM file reference number:					
Key application documents (additional to application form):		• Attachment 1A – Proof of Occupier Status • Attachment 2 – Premises Maps • Attachment 3B – Proposed Activities (same Design Report used to apply for the works approval) • Attachment 7 – Siting and Location • Attachment 9 – TSF Category Checklist			
Scope of application/assessment					

Summary of proposed activities or changes to existing operations.	*Licence amendment* Operation of TSF4 Sage 1 starter embankment, to a maximum height of RL 402.5 m.

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

Table 1: Prescribed premises categories

Prescribed premises category and description	Assessed 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	1,400,000 tonnes per annual period	No change

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 ☐	N/A
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes ☐ No ☒	N/A
Has the proposal been referred and/or assessed under the EPBC Act?	Yes ☐ No ☒	N/A
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes ☒ No ☐	Certificate of title ☒ Lot 102 on Plan 40393
Has the applicant obtained all relevant planning approvals?	Yes ☒ No ☐ N/A ☐	Planning Application PA21/23 approved by Shire of Coolgardie on 7 July 2021.
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes ☐ No ☒	CPS No: CPS 8574/1, CPS 9319/1
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes ☐ No ☒	N/A
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes ☒ No ☐	Licence/permit No: GWL 73070(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: Goldfields Groundwater Area Type: Proclaimed Groundwater Area Has Regulatory Services (Water) been consulted? Yes ☐ No ☒ N/A ☐
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes ☐ No ☒	N/A
Is the Premises subject to any other Acts or subsidiary regulations?	Yes ☒ No ☐	Mine Safety and Inspection Act 1994
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes ☐ No ☒	N/A
Is the Premises subject to any EPP requirements?	Yes ☐ No ☒	N/A
Is the Premises a known or suspected contaminated site under the *Contaminated Sites Act 2003*?	Yes ☐ No ☒	N/A