



Application for Licence Amendment

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

Choose an item.	L4680/1988/13
Choose an item.	FMR Investments Pty Ltd
ACN	009 411 349
File Number	2013/003899-1
Premises	Greenfields Processing Site Great Eastern Highway COOLGARDIE 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	20 January 2025
Decision	Revised licence granted

**MANAGER, RESOURCE INDUSTRIES
INDUSTRY REGULATION (STATEWIDE DELIVERY)**

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 Plant (the premises), located on mining tenement M15/1836 and Lot 102 on Plan 40393.

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 construction and 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 12 August 2024, the Licence Holder applied for an amendment to licence L4680/1988/13 to incorporate the following raises to the tailings storage facility (TSF) 3 embankments:

- TSF3 Cell A to Stage 5 – from RL 405.0m to RL 407.7m AHD
- TSF3 Cell B to Stage 8 – from RL 405.0m to RL 407.7m AHD
- TSF3 Cell C to Stage 8 – from RL 405.0m to RL 407.7m AHD

TSF3 is an above ground facility containing three adjacent cells named Cell A, Cell B and Cell C. The Licence Holder has applied for a TSF embankment raise for Cells A, B and C for ongoing tailings deposition to meet future operational needs. This will include raising the perimeter between containment embankments and dividing cells, decant accessway, decant structures and associated infrastructure. They will utilise dried tailings from TSF3, clayey materials from TSF3 and TSF4 as well as mine waste from other facilities as construction materials.

This amendment is limited only to changes in Category 5 activities from the existing licence. However, no changes to the assessed production capacity for Category 5 activities (i.e. 1,400,000 tonnes per annual period) have been requested by the Licence Holder.

2.3 Background

Greenfields Mill is located approximately 550 km east-northeast of Perth and 4 km north of Coolgardie. The mill extracts gold from ores using a three-stage crushing system, followed by a carbon-in-leach (CIL) process and gravity concentrator. Gold tailings are sent to the adjacent TSF3 cells, as well as TSF4 and the Gunga in-pit TSF (once constructed), for deposition and storage.

TSF3 is an above-ground multi-cell conventional paddock-style TSF constructed on Freehold Land at Lot 102 on Plan 40393. TSF3 consists of three (3) cells, with further details as follow:

- TSF3 Cell A, approximate centre 6,575,800 m North and 328,800 m East on Zone 51 of the MGA geodetic datum (MGA Zone 51). It is located to the south and southwest of TSF1 and TSF2, respectively, and is approximately 0.1 km east of the processing plant (mill) and 0.15 km southeast Three Mile Hill (TMH) Pit, an active mine site owned and operated by Focus Minerals Ltd (FML). TSF3 Cell A covers a footprint area of

approximately 23 ha and has been constructed to Stage 4 crest RL405.0 m from RL402.5 m.

- TSF3 Cell B, approximate centre 6,575,850 mN and 329,375 mE on the MGA Zone 51. It is located to the east and south of TSF3 Cell A and TSF2, respectively, and is approximately 0.9 km east-southeast of the mill. TSF3 Cell B covers a footprint area of approximately 11 ha and is being raised to the Stage 7 crest RL405.0 m from RL402.5 m.
- TSF3 Cell C, approximate centre 6,576,115 mN and 329,655 mE on the MGA Zone 51. It is located to the northeast, east and south of TSF3 Cell B, TSF2, and TSF4, respectively, and is approximately 1.3 km east of the mill. TSF3 Cell C covers a footprint area of approximately 12 ha and was raised concurrently with TSF3 Cell B to the Stage 7 crest RL405.0 m from RL402.5 m.

The TSF3 cells are paddock storages which have predominantly been constructed using compacted clayey borrow material. The Stage 1 (starter) embankments are zoned clay embankments constructed utilising borrow materials won from within the TSF3 footprint. The starter embankments have been raised in 2.5 m lifts to RL 400.0 m using clayey borrow material via upstream construction methods. The embankment raises from RL 400.0 m were constructed using compacted dried tailings to form the bulk of the embankment, and the clayey borrow material formed the downstream capping layer and the upper 0.3 m of the embankment.

2.4 Proposed activities

Construction

The proposed TSF3 Cell A (Stage 5) and Cells B and C (Stage 8) embankment raises will be undertaken using the upstream construction method by 1 x 2.7 m lift. TSF3 Cell A (Stage 5) and Cells B and C (Stage 8) will have a crest level of RL 407.7 m, for maximum embankment heights of approximately 15.7 m, 21.2 m and 22.7 m. This provides a combined storage volume of approximately 0.9 m³, equivalent to a storage capacity of 1.3 Mt based on tailings dry density of 1.4 t/m³, tailings beach slope of 1%, and minimum operational and total embankment freeboards of 0.3 m and 0.7 m, respectively.

The proposed embankment raises will be formed on top of both the existing embankment and on the adjacent dried tailings beach. The raising of the embankments will utilise compacted dried tailings borrowed from within TSF3 and the adjacent decommissioned TSF2, and mine waste sourced from other facilities operated by the Licence Holder or the neighbouring mining operations.

TSF3 decant accessways and structures will also be raised along with the perimeter embankments, using the centreline construction method. The decant accessways are to be raised using traffic compacted well graded mine waste rock. The decant structure is to be raised using select filter rock from mine waste of similar sources as those used for the embankment raise. As with the embankments, the decant accessways and structures will be formed on top of both the existing decant infrastructure and on the adjacent dried tailings beach.

Construction works will be undertaken in accordance with the drawings and the construction specification, scope of work and technical specifications prepared by CMW (2024a) (Figure 1).

Operations

Tailings deposition into the proposed TSF3 embankment raises will be undertaken using the same methodology in accordance with the Licence Holder's TSF operating manual (CMW 2023). Tailings deposition will be conducted from a ring main located adjacent to the upstream crest of the embankment. The tailings slurry is discharged sub-aerially in thin layers via multiple spigots located at 20 m centres as required. Tailings deposition is from several opened spigots at any given time. When the active deposition points are alternated, the aim is to maintain the water pond around the water recovery point (decant tower) and a minimum of 60 m from the

perimeter embankments.

The tailings deposition strategy at the premises will involve alternating between TSF3 Cells A, B and C, TSF4 and Gunga In-Pit TSF. The sequence is dependent on the construction pace of the TSF raises and Gunga In-Pit TSF infrastructure. Liberated tailings slurry water and surface water is removed from the TSFs via a pumped decant structure and underdrainage sumps. Recovered water is returned to the Process Plant for reuse.

Seepage from TSF3 will be monitored by an array of twelve (12) existing groundwater monitoring bores (MB301 to MB312) installed on the perimeter. MB301 to MB308 were installed parallel to the eight (8) vibrating wire piezometers (VWP201 to VWP208), and MB309 to MB312 were installed to the south of TSF3 Cells A and B, as per the recommendations in the TSF3 seepage management plan (SMP) (CMW 2020). Monitoring bores MB301, MB302, MB304 and MB305 are also currently utilised as seepage recovery bores to manage groundwater mounding and impacts of tailings seepage.

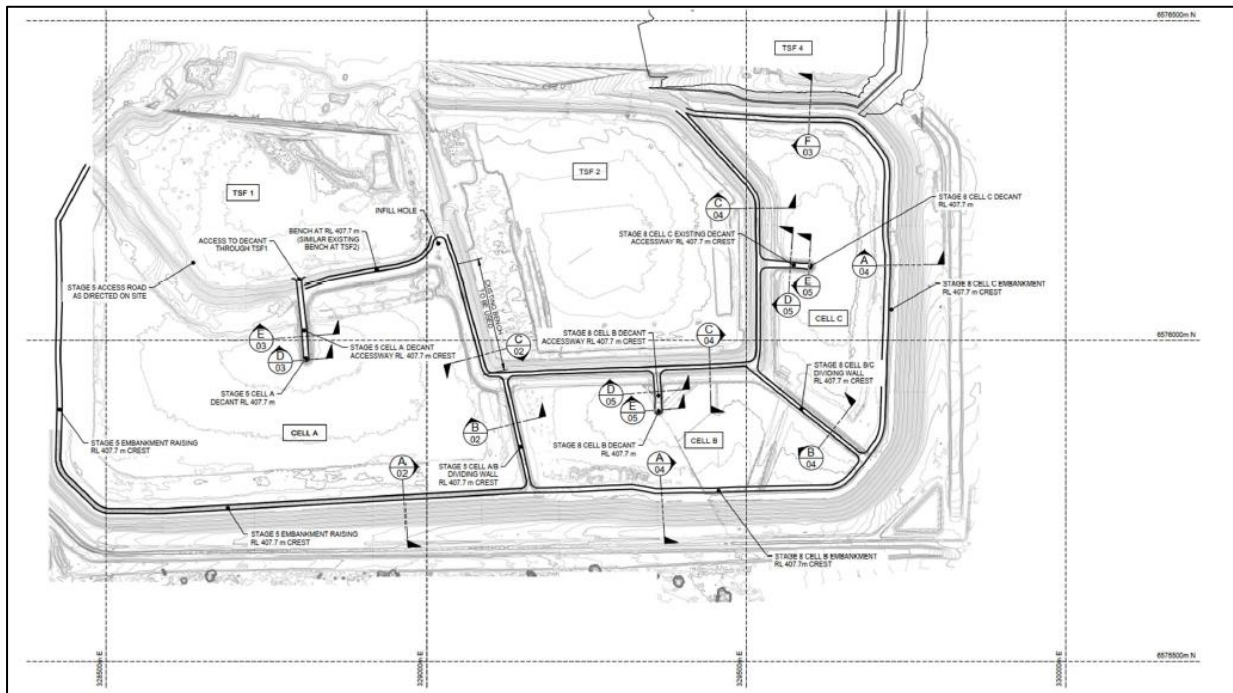


Figure 1: TSF3 Cells A, B and C, RL 407.7 m Plan

2.4.1 Geotechnical advice from DEMIRS

In Western Australia, geotechnical stability and safety of TSFs are typically regulated by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) under the *Mining Act 1978*. As the premises is located on freehold land, the proposed embankment raises have not been assessed by DEMIRS. Nevertheless, the department sought technical advice from DEMIRS on the design report to inform risk assessment of potential embankment failure, resulting in a discharge of tailings slurry and potentially impacting human, environmental and cultural receptors. The department has considered the advice provided by DEMIRS to inform the risk assessment of the proposed activities, which are detailed in Section 3.2.

2.5 CEO-initiated amendment

2.5.1 Seepage recovery and monitoring at TSF4

In authorising the operation of the Stage 1 start embankment for TSF4, licence L4680/1988/13 was amended to require the submission and implementation of an SMP for TSF4, should standing water level (SWL) at the associated monitoring bores become shallower than the

prescribed trigger level of 6.0 metres below ground level.

During a groundwater monitoring event in November 2023, the SWL monitored at monitoring bore MB401 was at 4.7 metres below ground level (mbgl). On 29 February 2024, the Licence Holder submitted an SMP for TSF4 in accordance with the conditions of existing licence L4680/1988/13.¹ The department assessed this SMP on 5 March 2024 and determined it to meet the requirements of the licence.

The recommendations of the SMP for TSF4 included (CMW 2024c):

1. Repair works will be undertaken to bring the underdrainage system to operable condition. The department understands that the underdrainage system was successfully repaired and is currently operational, as of April 2024.
2. Following successful repair of the underdrainage system, routine monitoring of existing groundwater monitoring bores (e.g., MB401, MB402 and MB403) will be undertaken. If evidence of groundwater mounding persists or intensifies after four months of monitoring (i.e., SWLs are not decreasing), the Licence Holder will install two seepage recovery bores and one additional groundwater monitoring bore along the northern perimeter embankment, close to where MB401 is located (i.e., where the shallowest SWL was detected). An adaptive management strategy will be adopted, where the seepage recovery bores will be operated until the Licence Holder is able to comply with the SWL trigger level and limit on the licence.
3. If, following successful repair and operation of the underdrainage system, a declining SWL trend is observed, the installation of the seepage recovery bores and additional monitoring bores will not be considered necessary.
4. Adequate management of the supernatant pond, such that the pond size is minimised and monitored through daily visual inspections. Furthermore, the decant pumping system should be optimised to ensure the pond depth is minimised.
5. SMP will be reviewed annually to identify potential improvements to groundwater management associated with TSF4.
6. Where future uncertainty in relation to the extent of groundwater mounding arises, further investigations may be required, including additional investigation and/or monitoring, geophysical survey (e.g., EM34 survey), aquifer testing and/or groundwater modelling to understand aquifer behaviour.

A technical memorandum was provided to DWER on 1 August 2024 summarised the installation of one monitoring bore (MB404) and two seepage recovery bores (SB401 and SB402) adjacent to TSF4 (Figure 2). The department assessed the document and determined that it met the requirements of the licence.

To ensure adequate seepage recovery and monitoring is being undertaken throughout the operational life of TSF4, the department has initiated an amendment to include the installed monitoring bore MB404 and seepage recovery bores SB401 and SB402 in conditions 3, 14, and 15 of the amended licence L4680/1998/13.

The department has also removed existing conditions 16, 17, and 18 from the amended licence, as these conditions relate to the submission and implementation of the TSF4 SMP, which has been completed at the time of this assessment.



Figure 2: Location of existing groundwater monitoring bores (blue), new monitoring bores (orange), and new seepage recovery bores (yellow) at TSF4

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 construction and operation which have been considered in this Amendment Report are detailed in 1 below. Table 1 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

Table 1: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Dust	Construction of tailings embankment and vehicle movements	Air/windborne pathway	<ul style="list-style-type: none"> Water cart will be utilised for dust suppression.
Noise			None proposed.

Emission	Sources	Potential pathways	Proposed controls
Construction			
Sediment laden stormwater		Overland runoff during rainfall events	<ul style="list-style-type: none"> Catchment runoff associated with TSF3 will be diverted to the drainage lines through existing diversion channels.
Operation			
Dust		Air/windborne pathway	<ul style="list-style-type: none"> Water cart will be utilised for dust suppression. Tailings deposition will be cycled around the perimeter embankment to maintain tailings moisture and minimise dust liftoff. Downstream embankment slope will be covered with rock armour to provide erosion protection and minimise dust liftoff.
Sediment laden stormwater		Overland runoff during rainfall events	<ul style="list-style-type: none"> Catchment runoff associated with TSF3 will be diverted to the drainage lines through existing diversion channels. Upstream embankment crest will slope inwards to shed water onto the tailings beach, which has been designed to provide adequate allowance to store water during a 1% AEP storm event for at least 72 hours; Rock armour will be constructed on downstream embankment to decrease embankment wall erosion to staged embankments.
Tailings seepage		Vertical infiltration and lateral migration	<ul style="list-style-type: none"> Monthly monitoring and plotting of the standing water levels (SWL) to assess trends in groundwater mounding, as well as quarterly monitoring to assess nearby groundwater quality. Minimise decant pond on TSF at all times through continuous decant water recovery. Decant pond will be kept at least 60 m from the perimeter embankment. Operation of underdrainage system to capture tailings seepage, comprising underdrainage lines that grade towards sumps downstream of the perimeter embankments.
Tailings slurry		Tailings release – overtopping of TSF3	<ul style="list-style-type: none"> The tailings storage area will assume the form of a truncated prism with a depressed cone on the top surface and have the capacity to store a considerable volume of water during a storm event. The minimum freeboard for the TSF under normal operating conditions is 0.7 m, which includes an allowance for the temporary storage of the 1:100 years or 1% average exceedance probability (AEP) storm event of 72-hour duration whilst maintaining the

Emission	Sources	Potential pathways	Proposed controls
Construction			
			required total freeboard.
		Tailings/saline water release – pipeline leak or rupture	<ul style="list-style-type: none"> • Routine inspections during each shift of the pipeline route. • Construction of bunded pipeline corridor and use of leakage detection system.
		Tailings release – embankment failure	<ul style="list-style-type: none"> • Tailings in the form of slurry will be discharged sub-aerially and cyclically into TSF3 in thin discrete layers, not exceeding 0.3 m thickness, from multipoint spigots in order to allow optimum density and strength gain by subjecting each layer to a drying cycle. Deposition will take place via multiple spigots located on the upstream perimeter embankment crest. • Tailings deposition is to be carried out such that the supernatant pond is maintained within and around the decant. The pond is to be always maintained away from the perimeter embankments. • Water will be removed from the facility and pumped back to the mill via a decant pump located within the slotted concrete pipes in the decant and underdrainage tower. • Checks for signs of erosion after rainfall events. Crest sloped inwards to shed water into the TSF. • Embankment downstream slope covered with rock armour to protect from erosion.

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

Human receptors	Distance from prescribed activity
Coolgardie township	The Coolgardie township is approximately 3.5 km south-west of the premises boundary.
Pastoral activities	The freehold land on which the TSF is located is surrounded by pastoral leases and used for stock grazing. The nearest pastoral station is the Mungari, located approximately 1.6 km north-east of the premises boundary.

Environmental receptors	Distance from prescribed activity
Native vegetation	Low undulating mallee woodland and shrubland, comprising <i>Corymbia calophylla</i> , <i>Eucalyptus wandoo</i> and <i>Eucalyptus camaldulensis</i> abuts the premises on the northern, eastern and southern boundaries of the premises and the boundaries 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	<p>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.</p> <p>Groundwater levels around TSF3 ranged between 6.9 metres below ground level (mbgl) and 18.6 mbgl during 2023. It is likely that the groundwater levels around TSF3 has been affected by historical groundwater mounding. Regional groundwater flow direction is typically towards the south and south-east.</p> <p>Groundwater in the region is typically hypersaline, though saline groundwater have been observed at some monitoring bores around TSF3.</p> <p>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) (CMW 2024b).</p> <p>There are no groundwater bores registered within 2.5 km hydraulically downgradient of the TSFs.</p>
Cultural receptors	Distance from prescribed activity
Aboriginal heritage site	<p>Four registered Aboriginal heritage places were identified south-west of the premises:</p> <ul style="list-style-type: none"> • Kurkuthutana (Place ID 3009) – Ceremonial, mythological, camp, meeting place, plant resource and water source; located 1.2 km from the premises boundary; • Kurrkurti (Place ID 1475) – Ceremonial, water source; located 2.2 km from the premises boundary; • Coolgardie Stones (Place ID 1568) – Ceremonial, man-made structure, mythological; located 3.3 km from the premises boundary; and • Two Trees (Place ID 1698) – Mythological; located 4 km from the premises boundary. <p>Two Aboriginal heritage places were also lodged:</p> <ul style="list-style-type: none"> • 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 from the premises boundary; • Roundhead/Ngumarn (Place ID 32761) – Ceremonial, mythological, rock shelter, birthplace, camp, hunting place, meeting place, natural feature and plant feature; 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 Works Approval/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 3.

The Revised Licence L4680/1988/13 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises.

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

Table 3. Risk assessment of potential emissions and discharges from the Premises during construction and operation

Risk Event					Risk rating ¹	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	C = consequence L = likelihood			
Construction								
Construction of embankment raises for TSF3 Cell A (Stage 5), Cell B (Stage 8), and Cell C (Stage 8) from RL 405.0 m to RL 407.7 m	Dust	Air/windborne pathway leading to impact to human and ecological health.	Coolgardie township and pastoral activities Native vegetation	Refer to Section 3.1	C = Slight L = Unlikely Low risk	Y	Condition 7 – Construction requirements	The Delegated Officer has determined that the proposed controls for managing dust, noise, and sediment laden stormwater from the construction of the proposed infrastructure to be adequate. No additional regulatory control is required.
	Noise		Coolgardie township and pastoral activities	N/A	C = Minor L = Rare Low Risk	Y	None	
	Sediment laden stormwater	Overland runoff during rainfall events leading to impact to ecological health	Native vegetation	Refer to Section 3.1	C = Minor L = Rare Low Risk	Y	None	
Operation								
Tailings deposition into embankment raises for TSF3 Cell A (Stage 5), Cell B (Stage 8), and Cell C (Stage 8) from RL 405.0 m to RL 407.7 m	Dust	Air / windborne pathway leading to Impact to human and ecological health, as well as amenity	Coolgardie township and pastoral activities Native vegetation	Refer to Section 3.1	C = Minor L = Unlikely Medium risk	Y	None	The Delegated Officer has determined that the proposed controls for managing dust and sediment laden stormwater from the operation of the proposed infrastructure to be adequate. No additional regulatory control is required.
	Sediment laden stormwater	Overland runoff during rainfall events leading to Impact to ecological health	Native vegetation	Refer to Section 3.1	C = Slight L = Unlikely Low risk	Y	Condition 7 – Construction requirements	
	Tailings seepage	Seepage through floor and embankment of TSF3 to groundwater causing groundwater mounding and surface expression of hypersaline groundwater, resulting in impacts to ecological health	Native vegetation and soil Groundwater	Refer to Section 3.1	C = Moderate L = Possible Medium Risk Refer to Section 3.3	Y	Condition 1 – Embankment height limit Condition 3 – Operational requirements Condition 5 – Supernatant pond and seepage management Condition 6 – Inspection requirements	Refer to Section 3.3

Risk Event					Risk rating ¹	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	C = consequence L = likelihood			
							Condition 7 – Construction requirements Condition 14 – Process monitoring Condition 15 – Groundwater and supernatant pond monitoring	
	Tailings slurry	Overtopping of TSF3, where there is a direct discharge of tailings slurry to land, resulting in impacts to health and amenity	Native vegetation and protected ecosystem	Refer to Section 3.1	C = Moderate L = Unlikely Medium Risk	Y	Condition 4 – Freeboard requirements Condition 6 – Inspection requirements	The Delegated officer has determined that the proposed controls for managing tailings slurry and hypersaline return water (as a result of overtopping and pipeline failure) from the operation of the proposed infrastructure to be adequate. No additional regulatory control is required.
	Tailings slurry; Hypersaline water	Pipeline failure, where there is a direct discharge of tailings slurry and/or saline return water to land, resulting in impacts to environment.	Pastoral activities	Refer to Section 3.1	C = Minor L = Unlikely Medium Risk	Y	Condition 2 – Pipeline requirements Condition 6 – Inspection requirements	
	Tailings slurry; Dried tailings	Embankment failure, where there is a direct discharge of tailings slurry to land, resulting in impacts to health, environment and amenity.	Coolgardie township and pastoral activities Native vegetation Surface water bodies Aboriginal heritage places	Refer to Section 3.1	C = Major L = Rare Medium Risk	Y	Condition 1 – Embankment height limit Condition 3 – Operational requirements Condition 5 – Supernatant pond and seepage management Condition 6 – Inspection requirements Condition 7 – Construction requirements Condition 14 – Process monitoring Condition 24 – Annual TSF audit and review	Based on technical advice from DEMIRS, the Delegated Officer has determined that the proposed controls for managing the risk of embankment failure (resulting in a release of tailings slurry and dried tailings to the environment) is adequate. Controls recommended by DEMIRS have been previously conditioned in the existing licence. No changes to these conditions were recommended by DEMIRS for the proposed activities. No additional regulatory control is required.

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 for seepage from TSF3

3.3.1 Groundwater assessment

Seepage occurs as a natural process of TSFs during the drying process of tailings slurry once delivered to the facility. TSFs are designed to allow drainage to assist this process in removing excessive moisture in the tailings. As the tailings are dried through evaporation and seepage, they consolidate, allowing continued tailings deposition at the site. The tailings supernatant that leaches out from the base of the TSF has the potential to impact on the local superficial aquifer underlying the TSF, through the contamination and groundwater mounding. The groundwater aquifer is a primary receptor that may be impacted by tailings seepage.

To inform this detailed risk assessment, the department has assessed groundwater monitoring information provided by the Licence Holder as part of their Annual TSF Audit Review (CMW 2024b).

Groundwater levels

Seepage from TSF3 from continued tailings deposition may result in changes to the localised hydrogeological flow regime surrounding the TSF3. Where groundwater mounding is severe, it may affect the health of adjacent native vegetation, through inundation of the root zone and salt stress (i.e., through exposure to hypersaline groundwater). This can cause severe impacts to health and appearance, and even resulting in death, of vegetation.

The shallowest groundwater level observed around TSF3 in 2023 ranged between 6.9 mbgl (MB303) and 18.6 mbgl (MB308). In the context of the individual cells at TSF3, the shallowest groundwater levels recorded observed at Cells A, B and C were 6.9 mbgl (MB303), 12.5 mbgl (MB305) and 9.7 mbgl (MB306), respectively. Farther away from TSF3 (i.e., monitoring bores MB309 to MB312), the shallowest groundwater levels ranged between 13.9 mbgl (MB312) and 18.8 mbgl (MB309).

Over time, standing water level at groundwater monitoring bores around TSF3 have remained relatively stable since the 2021/2022 annual period (Figure 3). At the time of this assessment, none of the monitoring bores associated with TSF3 have exceeded the limit of 4.0 mbgl, specified in existing licence L4680/1988/13.

There are no strong indications of groundwater mounding observed at any of the monitoring bores immediately adjacent to TSF3. The only exception is monitoring bore MB308, which is located north-east of TSF3 Cell C and near the interface between TSF3 and TSF4. While the SWL at MB308 appears to be rising over time, it is unlikely to impact neighbouring native vegetation as it is still relatively deep.

Groundwater quality

Seepage from TSF3 can affect the quality of groundwater as it may contain potential contaminants (i.e., cyanide, metals and metalloids) that occur in the tailings. Impacted groundwater may have reduced potential for beneficial use. Groundwater at the premises is generally hypersaline and has limited uses, primarily abstracted for mining and ore processing purposes in the region.

Tailings contaminants are typically informed by the geochemistry of the processed ore material. Consequently, seepage. The tailings characteristics have been assessed as being non-acid generating with a low net acid-producing potential (CMW 2024a).

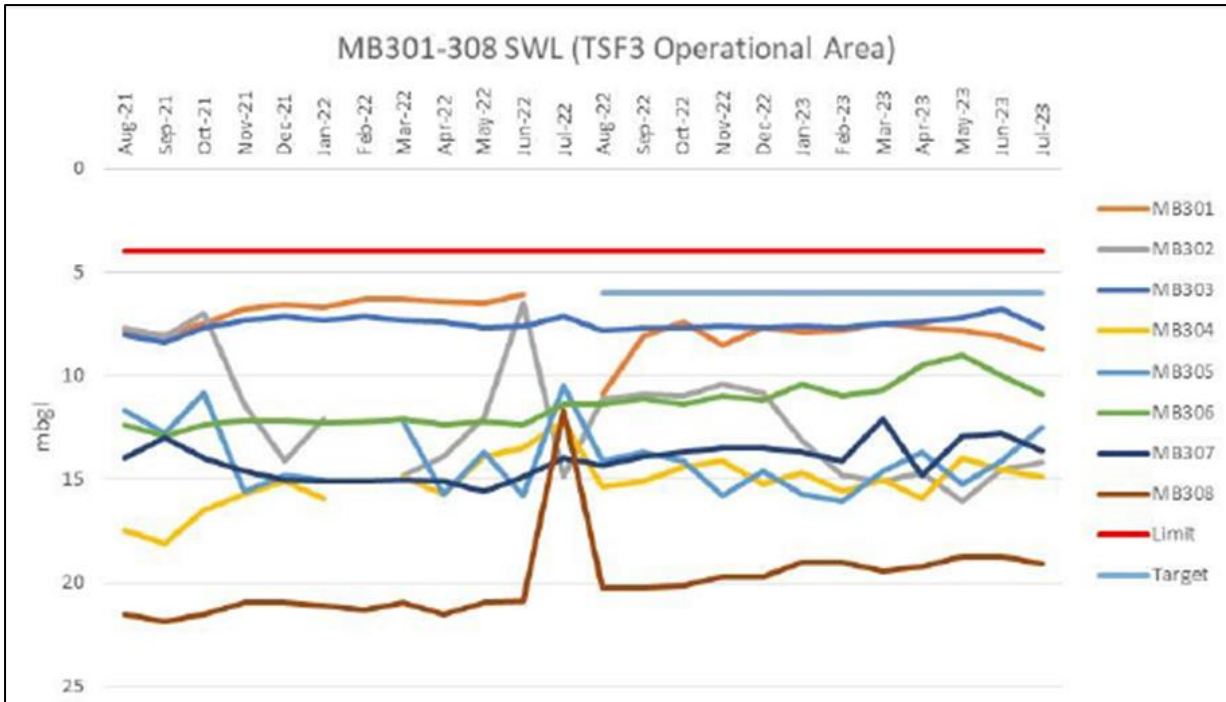


Figure 3: TSF3 monitoring bore groundwater levels (FMR 2023)

The following observations were made on the groundwater quality data during the 2023 annual period:

- Groundwater pH was generally acidic, ranging between 3.0 pH unit and 7.8 pH unit. The latest measurements in December 2023 showed a pH range of 3.0 pH unit (MB303) to 7.8 pH unit (MB402). Based on this monitoring event, it appeared that groundwater at monitoring bores MB301 to MB306 were moderately acidic (i.e., along the southern embankment of TSF3), while the other monitoring bores represented stable circumneutral conditions. The acidic environment would likely have been caused by ion exchange in the clay profiles of the soil as groundwater levels rise (ferrolysis), not from potentially acid forming tailings.
- Total dissolved solids (TDS) ranged from 8,600 mg/L to 130,000 mg/L. During the latest monitoring event in December 2023, TDS ranged between 9,500 mg/L to 110,000 mg/L indicating presence of hypersaline environment.
- Weak acid dissociable (WAD) cyanide concentrations remained below the specified limit of 0.5 mg/L at all monitoring bores, with a highest WAD cyanide level detected at MB302 (i.e., 0.32 mg/L) during the December 2023 monitoring event.

3.3.2 Licence Holder’s controls and performance

The Licence Holder has proposed controls to mitigate and reduce the impacts of seepage to the surrounding environment. As per the existing licence, there are conditions to ensure that seepage will be adequately minimised and managed, in addition to reducing the risk of potential tailings discharge through embankment failure. These include:

- Maintaining the water pond around the decant structure to a minimum of 60 m away from the perimeter embankment
- Maintaining the flow meters to monitor the water recovery and to be compared against the water balance model predictions

- Routine inspections during each shift of the piping system and the return water pump operation
- Monthly monitoring and plotting the water levels to assess groundwater movement trends
- Quarterly groundwater quality sampling and testing for pH, TDS and WAD cyanide
- Recovery of seepage water from TSF transported back to plant for process use.

The four sumps, along with three converted monitoring bores, were utilised as part of the TSF3 SMP in response to previous incidents where the relevant SWL limits were exceeded at TSF3. The annual seepage bore water recovery volumes at Greenfields from 2019/20 to 2022/23 are shown in Figure 4. The implementation of the SMP and undertaking of groundwater recovery coincides with the stabilisation of SWL observed at the monitoring bores associated with TSF3.

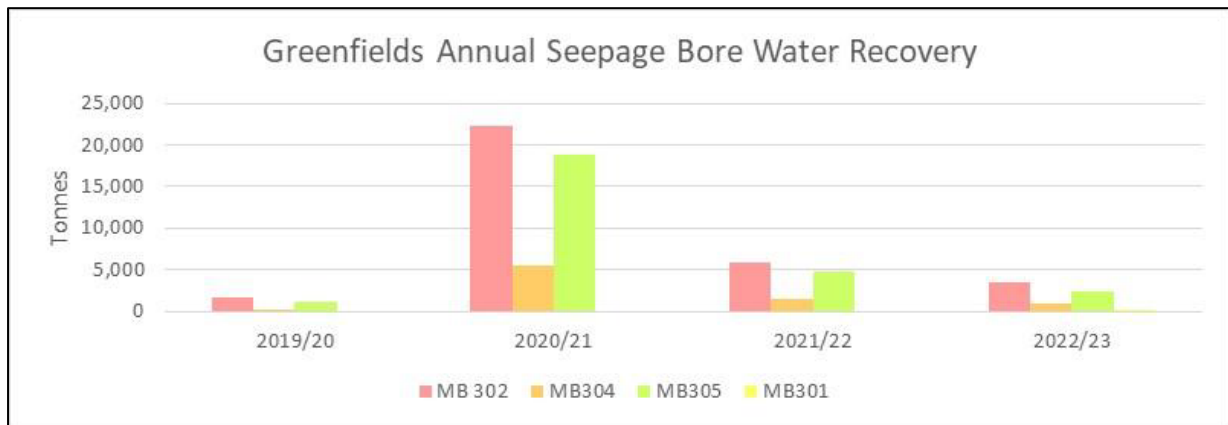


Figure 4: Annual seepage bore water recovery amounts (FMR 2023)

3.3.3 Risk assessment

The Delegated Officer has assessed the risk of seepage associated with the TSF3 embankment raises for Cells A, B, and C to a maximum embankment height of RL 407.7 m. The construction and operation of an embankment raise will increase the pressure of the hydraulic head, subsequently increasing the potential seepage from TSF3.

The Licence Holder has seepage monitoring and management actions to observe the rate of the groundwater mounding and act accordingly. Given the nature of the paddock-style TSF and previous monitoring recordings, the likelihood for seepage to occur has been assessed as **possible**. Seepage from continued tailings deposition can result in further mounding around the TSF, to a level where groundwater may impact the root zone of surrounding vegetation. The relevant limit for SWL has been breached in the past, and although there are new management actions in place, it is possible for an exceedance to occur again, if proper tailings and water management is not adequately put in place. The consequence rating for this event is considered **moderate** due to the potential for vegetation stress and death, as well as contamination of groundwater resource. Therefore, the risk rating for this risk event has been assessed as **medium risk**.

The Delegated Officer has concluded that the Licence Holder's proposed controls, as well as existing licence conditions, are acceptable to sufficiently manage the potential risk of tailings seepage impacting on sensitive human health and environmental receptors. No additional regulatory controls are required to manage this risk event.

4. Consultation

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

Table 4: Consultation

Consultation method	Comments received	Department response
Shire of Coolgardie advised of proposal on 13 September 2024.	No response received from the Shire of Coolgardie.	N/A
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) advised of proposal on 13 September 2024. Advice was requested from DEMIRS on the geotechnical and safety aspects of the proposal.	Advice received on 22 October 2024.	The department has considered the advice in the risk assessment (refer to Section 2.4.1 and 3.3).
Licence Holder was provided with draft amendment on 9 January 2025.	The Licence Holder responded on 15 January 2025 with no comments, waiving the remainder of the consultation period. The Licence Holder also provided updated Figure 1 to Figure 4, upon the request of the department.	The department has updated Figure 1 to Figure 4 of the works approval.

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 5 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 5: Summary of licence amendments

Condition no.	Proposed amendments
Condition 1	Table 1 updated to authorise construction and operating height of TSF3 Cell A, Cell B, and Cell C to RL 407.7 m.
Condition 3	Table 2 updated to require seepage recovery bores SB401 and SB402 to be maintained.
Condition 4	Table 3 updated to increase total freeboard requirements for TSF3 and TSF4 from 500 mm to 700 mm.
Condition 7	Table 3 updated to remove construction requirements for TSF3 Cell B (Stage 7) and Cell C (Stage 7), as these infrastructures have been constructed. Table 3 updated to authorise construction of TSF3 Cell A (Stage 5), Cell B (Stage 8), and Cell C (Stage 8) embankment raises.
Condition 14	Table 6 updated to include process monitoring of seepage recovery bores SB 401 and

Condition no.	Proposed amendments
	SB402.
Condition 15	Table 7 updated to include groundwater monitoring bore MB404.
Condition 20	Table 8 updated to remove requirement to provide information on the implementation of a seepage management plan (as required by existing condition 18), as this requirement has been met.
---	Removed conditions 16, 17 and 18 (existing conditions) from the amended licence, as the requirements of these conditions have been met, relating to the submission and implementation of a seepage management plan.
Schedule 1	Figure 2 updated to include seepage recovery bores SB401 and SB402, and groundwater monitoring bore MB404. Figure 1, Figure 3, and Figure 4 also updated with administrative changes (i.e., no new information).
Schedule 2	Figure 5, Figure 6, and Figure 7 (existing figures) removed due to completion of relevant infrastructure (condition 7). Figure 9 to Figure 13 (five figures) added to specify details of construction for TSF3 Cell A (Stage 5), Cell B (Stage 8), and Cell C (Stage 8) embankment raises.
Schedule 3	Table 12 updated to include seepage recovery bores SB401 and SB402, and groundwater monitoring bore MB404.

References

1. CMW Geosciences (CMW) 2020, *Tailings Storage Facility 3, Seepage Management Plan*.
2. CMW 2023, *Tailings Storage Facilities – TSF3 and TSF4, Operations Manual*.
3. CMW 2024a, *Tailings Storage Facility NO.3 (TSF3) CELLS A, B & C UPSTREAM EMBANKMENT RAISING RL405.0 m – RL407.7 m*.
4. CMW 2024b, *Tailings Storage Facility 3 and 4, Annual Audit & Management Review*.
5. CMW 2024c, *Tailings Storage Facility 4, Seepage Management Plan*.
6. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
7. Department of Water and Environmental Regulation (DWER) 2020a, *Guideline: Environmental Siting*, Perth, Western Australia.
8. DWER 2020b, *Guideline: Risk Assessments*, Perth, Western Australia.
9. FMR Investments Pty Ltd (FMR) 2023, *Prescribed Premises Licence L4690/1988/13 Environmental Report 1 August – 31 July 2023*, submitted 26 September 2023.