Government of Western Australia
Department of Water and Environmental Regulation

Amendment Report

Application for Licence Amendment

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

Licence Number	L9010/2016/1
Licence Holder	Mount Morgans WA Mining Pty Ltd
ACN	612 053 291
File Number	DER2016/002022-1
Premises	Mt Morgans Gold Project Mining tenements M39/236, M39/395, M39/390, M39/272, M39/18, M39/228, M39/264, M39/304, M39/240, M39/248, L39/246, M39/441, M39/250, M39/504, M39/745, M39/403, M39/282, M39/36 and M39/1107
Date of Report	10/07/2024
Decision	Revised licence granted

Fiona Westcott

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A/Manager, Resources 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 L9010/2016/1 is held by Mount Morgans WA Mining Pty Ltd (Licence Holder) for the Mt Morgans Gold Project (the Premises), located on tenements M39/236, M39/395, M39/390, M39/272, M39/18, M39/228, M39/264, M39/304, M39/240, M39/248, L39/246, M39/441, M39/250, M39/504, M39/745, M39/403, M39/282, M39/36 and M39/1107.

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 L9010/2016/1 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 Amendment summary

Mount Morgans WA Mining Pty Ltd (Licence Holder) holds licence L9010/2016/1. The Licence authorises operation of the Premises for activities associated with category 5 (ore processing), category 6 (mine dewatering), category 54 (sewage facility), category 57 (used tyre storage) and category 64 (landfill). The Premises has been in care and maintenance since March 2023 (CMW 2023).

On 6 December 2023, the Licence Holder submitted an application to the department to amend Licence L9010/2016/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The amendment application is seeking approval to operate the tailings storage facility (TSF) Cell 2 at an increased embankment height of 412 mRL (from 408 mRL).

2.3 Premises Background

The Premises contains a hill side paddock TSF that comprises of two cells (Figure 1). Under works approval W6008/2016/1 the construction of the TSF is approved to occur in multiple stages for Cell 1 and Cell 2 to a final height of 414 mRL for both cells.

At the time of writing this report TSF Cell 2's embankment height is 412 mRL with construction being completed on 16 May 2022 (CMW 2022). The Licence Holder submitted an Environmental Compliance Report (ECR) for the construction (stage 9) on 17 September 2022 to the Department. Commissioning for stage 9 occurred between 29 September 2022 through to January 2023.

During an audit by the Licence Holder, it was identified that an environmental commissioning report for stage 9 was not submitted to the Department to allow the commencement of time-limited-operations (TLO) of TSF Cell 2 at the newly constructed embankment height of 412 mRL. Condition 1.3.1 in Works Approval W6008/2016/1 allows TLO to only commence once the environmental commissioning report is submitted to the Department. The Licence Holder has submitted the commissioning report with this application for a licence amendment on 6 December 2023.

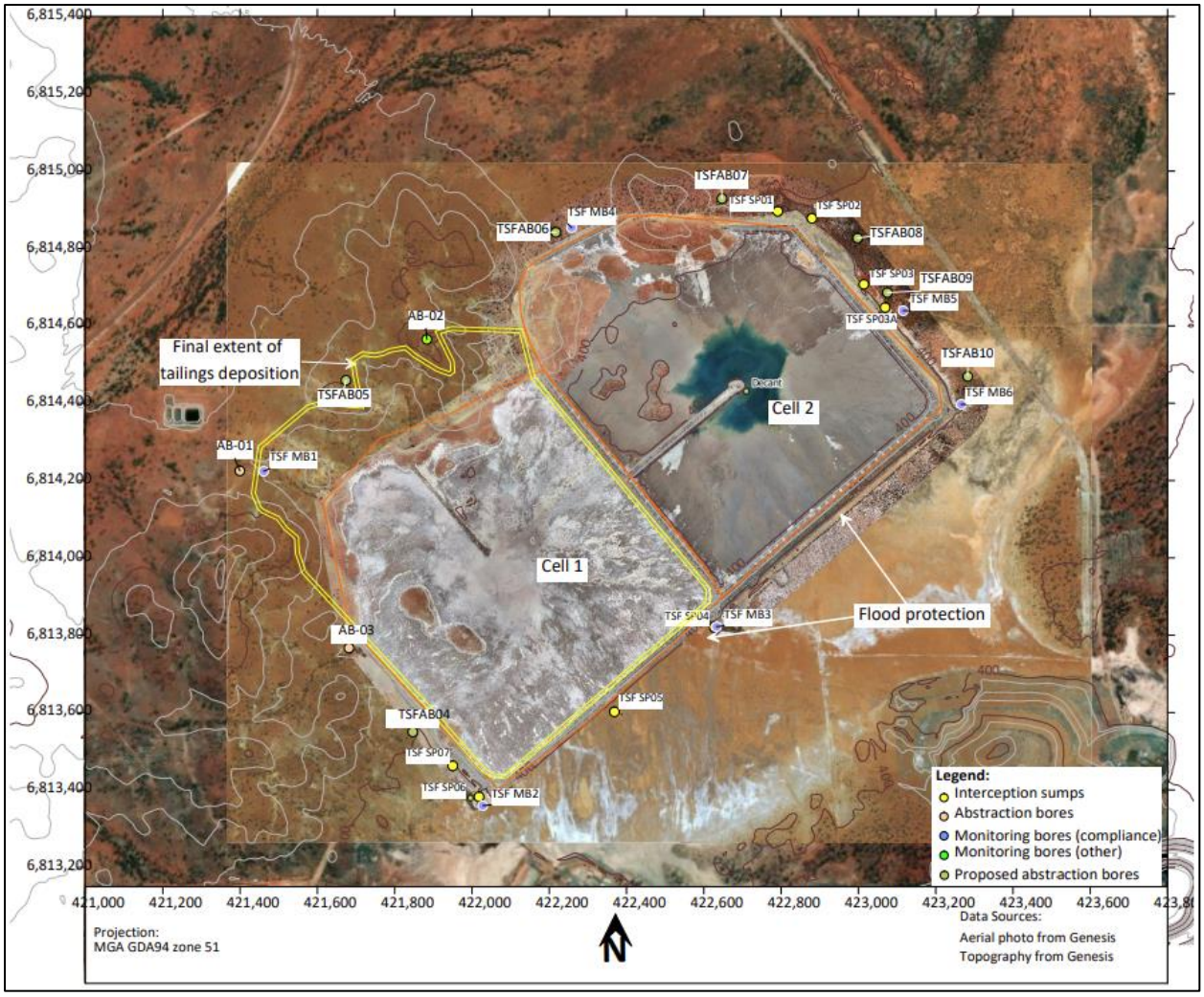

Figure 1: TSF Cell 1 and Cell 2 monitoring and seepage recovery infrastructure (Sourced from GRM 2024)

2.3.1 Groundwater mounding and surface expression

Prior to the operation of the TSF at the premises baseline groundwater levels were reported to be between 0.62 meters below ground level (mbgl) (TSF MB3) and 9.31 mbgl (TSF MB1).

Initial construction of TSF Cell 1 was completed in January 2018 and included an underdrainage system which involved a 1.5 mbgl cut-off lined trench under the upstream toe of Stage 1 Cell 1 embankment to restrict potential seepage under the perimeter embankment. The trench leads to a seepage collection sump consisting of a 1.5 x 1.5 x 1.5 m lined concrete box (Figure 2). TSF Cell 2 was completed in April 2019 and included a cut-off lined trench under the upstream toe of Stage 1 Cell 2 which leads to a seepage collection sump (Dacian 2019).

Figure 2: Seepage collection sump at the construction of TSF Cell 1 Stage 1 (Sourced from Dacian 2018)

Tailings deposition commenced in TSF Cell 1 in March 2018. Since tailings deposition in the TSF began groundwater levels have increased in each monitoring bores surrounding the TSF (Figure 3). Figure 4 and Figure 5 presents the recorded depth to groundwater at TSF MB1 to MB6 along with events that may have triggered a reduction or increase to groundwater levels (i.e. installation of interception sumps and recovery bores).

There has been a history of groundwater mounding and groundwater surface expression towards the eastern and southern embankments of the TSF as a result of the operation of the TSF. The tailings pond water seepage had resulted in groundwater mounding underneath the TSF which has created lateral flows away from the TSF resulting in groundwater expression (GRM 2021).

In October 2022 the Licence Holder installed three groundwater abstraction bores (TSFAB01 – TSFAB03) to reduce the groundwater levels at the northwest embankment of the TSF (near TSF MB1). The reduction of groundwater levels in TSF MB1 was deemed necessary as groundwater levels at TSF MB1 are at a higher elevation than those downgradient (Figure 3).

It was observed that TSFAB02 was receiving low abstraction yields during installation and was therefore constructed as a monitoring bore (GRM 2024). Installation of the seepage recovery bores were completed after tailings discharge to Cell 1 was stopped. Both abstraction bores and cessation of tailings discharged appeared to have a significant reduction of groundwater levels from 4.73 mbgl (Figure 4).

During a targeted compliance inspection on the 18th and 19th February 2020 it was determined that the seepage recovery was deemed insufficient during the day of the inspection. An e-mail was received from the Licence Holder on 29 September 2020 mentioning in the past previous months surface water expression along the southern and eastern embankments of the TSF has been observed. It was also reported that there was damage to native vegetation to the east of the TSF via salt deposited due to the receding of the groundwater expression.

Licence L9010/2016/1 has a preexisting condition requiring monitoring of native vegetation surrounding the TSF which is discussed in Section 2.3.5.

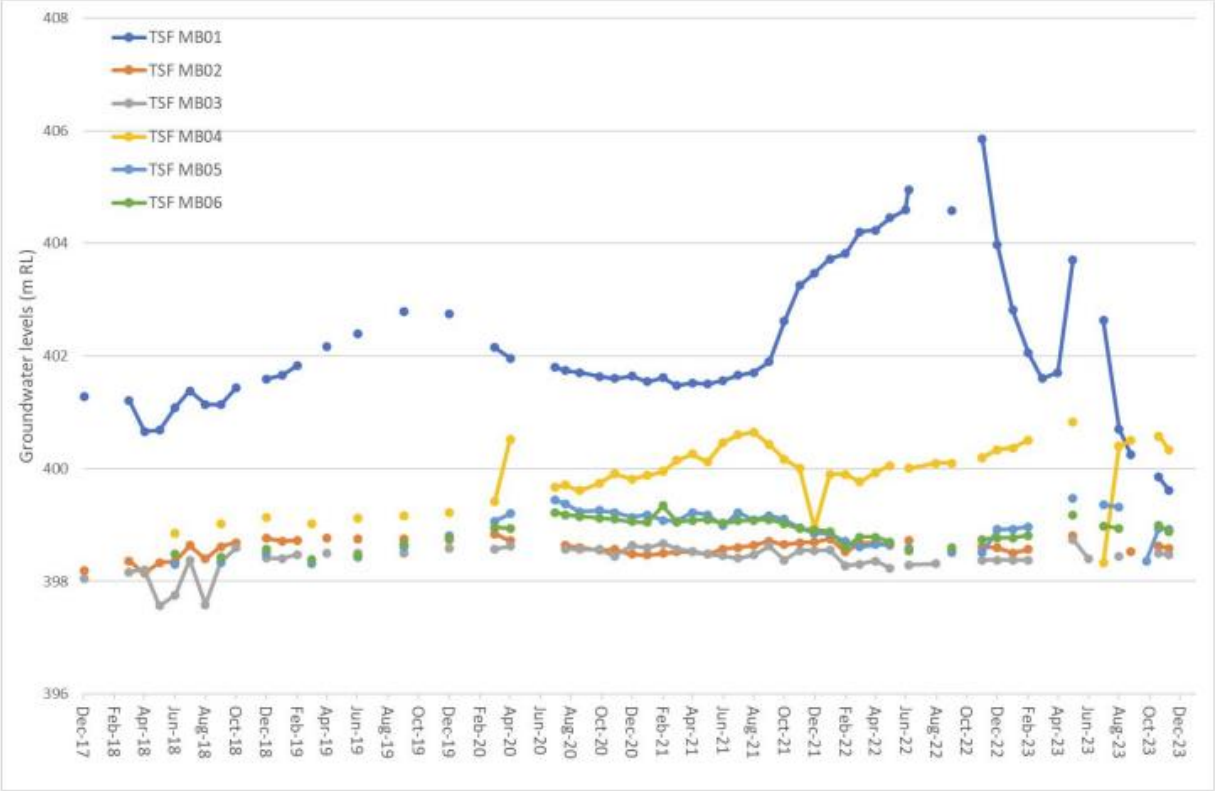

Figure 3: Groundwater levels (mRL) from December 2017 to December 2024 (Sourced GRM 2024)

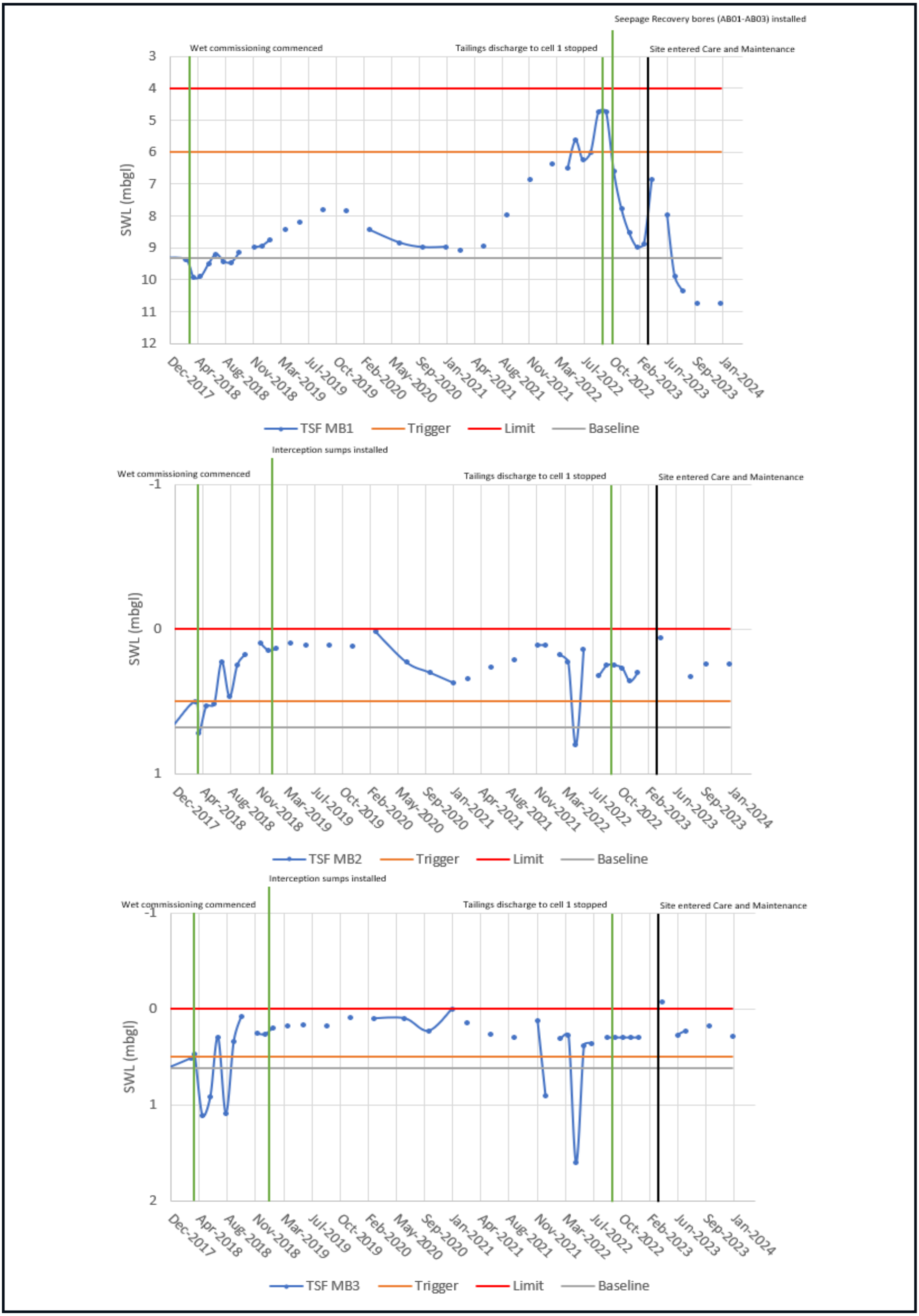

Figure 4: Historical groundwater levels with baseline, trigger and action limit levels for TSF Cell 1, trigger and action values sourced from GRM 2021

Figure 5: Historical groundwater levels with baseline, trigger and limit levels for TSF Cell 2 trigger and action values sourced from GRM 2021

2.3.2 Groundwater Management Plan (GMP)

GMP 2018

The initial Groundwater Management Plan (GMP) was submitted to the Department on 27 June 2018 (Mt Morgan 2018) in response to a GMP requirement condition added to Licence L9010/2016/1 during the March 2018 licence amendment. The GMP was required to be submitted to the Department within three months of the March 2018 licence amendment. The condition was added to the Licence in response to commencement of TSF operations and potential impact to surrounding receptors caused by seepage and mounding. The GMP addressed management actions to be taken in the event of rising groundwater levels surrounding the TSF and a commitment to review the GMP at least biennially to ensure that it is appropriate and effective.

GMP 2021

The GMP was next updated in July 2021 to address the mounding of groundwater and surface expression that was occurring at the southern, eastern and northern embankments of the TSF. Within the GMP seepage analysis was modeled (further presented in Section 0).

In response to the mounding and surface expression of groundwater; seepage interception trenches and eight sumps were installed to reduce seepage around the northern side of Cell 2, the southern corner and south-eastern side of Cell 1.

The approach set by the GMP was to allow for a staged approached and adequate time to observe groundwater level trends while allowing time to implement the installation of infrastructure. The goal of the GMP is to ensure that groundwater levels are below the action values as set in Table 1. Within the 2021 GMP (GRM 2021) trigger and action values were assigned to each monitoring bore surrounding the TSF. The shallow trigger values of 0.5 mbgl were incorporated to allow groundwater to be intercepted prior to surface expression. Trigger values of 1.5 and 2.0 mbgl were included to minimize the impact of inundation or soil salinization. Baseline groundwater levels were considered to aid in the development and assignment of the trigger and actions levels (Table 1).

GRM (2021) notes that monitoring bore TSF MB5 is situated very close to the TSF embankment (approximately 30 m). GRM states that “The monitoring bore is unlikely to assess the effectiveness of the seepage interception system along the vegetated area at the north-eastern side of Cell 2 because of the proximity of the seepage sources and related seepage interception infrastructure” (GRM 2021). GRM has proposed for the Licence Holder to install an additional TSF monitoring bore (TSF MB7) approximately 100 m from the TSF eastern embankment to better represent the groundwater conditions away from the seepage source and associated seepage interception infrastructure (discussed further in section 3.3.8). The Department notes the recommendation on the additional monitoring bore is removed in the GMP 2024 (GRM 2024).

The framework for the 2021 GMP is as follows:

- When the trigger values are reached the Licence Holder should proceed with the construction of additional seepage interception sumps and installation of recovery bores; and
- When the action values are reached the Licence Holder should proceed with the implementation of the groundwater management plan.

GMP 2024

The updated GMP (GRM 2024) was submitted to the Department on 15 April 2024. Amendments to the 2024 GMP involved the following changes:

- The use of “threshold” and “action” values used interchangeably throughout the plan but has the same definition and meaning;
- When the groundwater management action is implemented has changed from when action (threshold) values are reached to “about to be reached;”
- Removal of the recommendation of an additional groundwater monitoring bore to replace TSF MB5;
- The removal of trigger values for TSF MB1, TSF MB2, TSF MB3 and TSF MB5 (Table 2). The following statement was made regarding the removal of the trigger values: “In areas where trigger values have already been reached the seepage interception systems are in place, only threshold values are defined.” (GRM 2024).

Within the GMP (2024) it is mentioned that two abstraction bores (TSFAB01 and TSFAB03) were installed to control groundwater mounding at TSF MB1. Figure 1 provides the current monitoring and seepage recovery infrastructure and the proposed seepage recovery infrastructure if groundwater levels continue to rise surrounding the TSF. GMP (2024) has also recommended that additional seepage infrastructure is installed at TSF MB4, TSF MB5 and TSF MB6 to control the rising groundwater expected from the future tailings deposition at Cell 2. The seepage infrastructure suggested involves abstraction bores equipped with a submersible pump with headworks, gensets and pipelines to pump intercepted groundwater to the TSF surface or to the process plant.

Table 1: TSF monitoring bores trigger and action values for the 2021 GMP (sourced from GRM 2021)

Name	Background GW (m bgl)	Jun 2020 SWL (m bgl)	Trigger Value (m bgl)	Action Value (m bgl)	Required action
TSF MB1	9.3	9.08	4.0	2.0	Interception bores if trigger level is reached
TSF MB2	0.6	0.38	0.5	0.0	Interception sumps already installed
TSF MB3	0.5	0.19	0.5	0.0	Interception sumps already installed
TSF MB4	5.3	4.30	4.0	2.0	Interception bores if trigger level is reached
TSF MB5	1.6	0.85	1.5	1.0	Interception sumps already installed. Interception bores required
TSF MB6	2.2	1.63	1.5	1.0	Interception sumps already installed. Interception bores required

Table 2: TSF monitoring bores trigger and threshold values for the 2024 GMP (sourced from GRM 2024)

Name	Background GW (m bgl)	Dec 2023 SWL (m bgl)	Trigger Value (m bgl)	Threshold Value (m bgl)	Required action
TSF MB1	9.3	10.97	None	2.0	Interception bores already installed
TSF MB2	0.6	0.38	None	0.0	Interception sumps already installed
TSF MB3	0.5	0.19	None	0.0	Interception sumps already installed
TSF MB4	5.3	4.30	4.0	2.0	Interception bores required as trigger level was reached
TSF MB5	1.6	0.85	None	1.0	Interception sumps already installed. Interception bores required
TSF MB6	2.2	1.63	1.5	1.0	Interception sumps already installed. Interception bores required

2.3.3 Modelling

During the initial seepage modelling assessment the predicted seepage indicated that lateral seepage through the constructed embankment boundary was not anticipated while the anticipated lateral seepage rates at the existing perimeter embankment of the TSF is likely to be less than 1 m^3 per day and vertical seepage rates was less than 5 m^3 per day (ATC 2016).

The SEEP/W software used by ATC (2018) to estimate seepage loss from the TSF, it was concluded that:

- Significant lateral seepage through the constructed embankment is not anticipated, particularly with the incorporation of an upstream geomembrane;
- Lateral seepage rates beneath the perimeter embankment of the TSF are likely to be very low (less than 4 m^3 per day), provided the facility is satisfactorily constructed; and
- Vertical seepage rates from the operating cell are likely to be very low (less than 3 m^3 per day) and would be predominantly controlled by the presence of the residual clay materials.

ATC Williams also stated that "*whilst the embankment foundation soils would be saturated under normal operating conditions, the anticipated rate of lateral seepage beneath the embankments is so low that normal daily evaporation should maintain dry surface conditions adjacent to the TSF perimeter and significant daylighting of seepage is not anticipated.*"

During tailings deposition it was identified that actual infiltration rates were higher and this was due to preferential flow pathways and higher than expected permeability zones through the clay layer. GRM (2024) estimates that the revised seepage rate is approximately 40 m^3 per day.

2.3.4 Groundwater quality impacts

There is evidence of groundwater mounding surrounding the TSF, however groundwater quality monitoring data suggests that significant leaching of tailings into the groundwater is not occurring.

Total Dissolved Solids

Baseline TDS groundwater concentrations at TSF Cell 1 ranged from 1,600 mg/L to 8,200 mg/L for TSF MB1 to MB3 and Cell 2 TDS ranged from 25,000 to 44,000 mg/L for TSF MB4 to

TSF MB6. Since TSF operation began TDS concentrations within all monitoring bores have increased from baseline conditions (Figure 6) however there appears to be on a general downward trend from 2021.

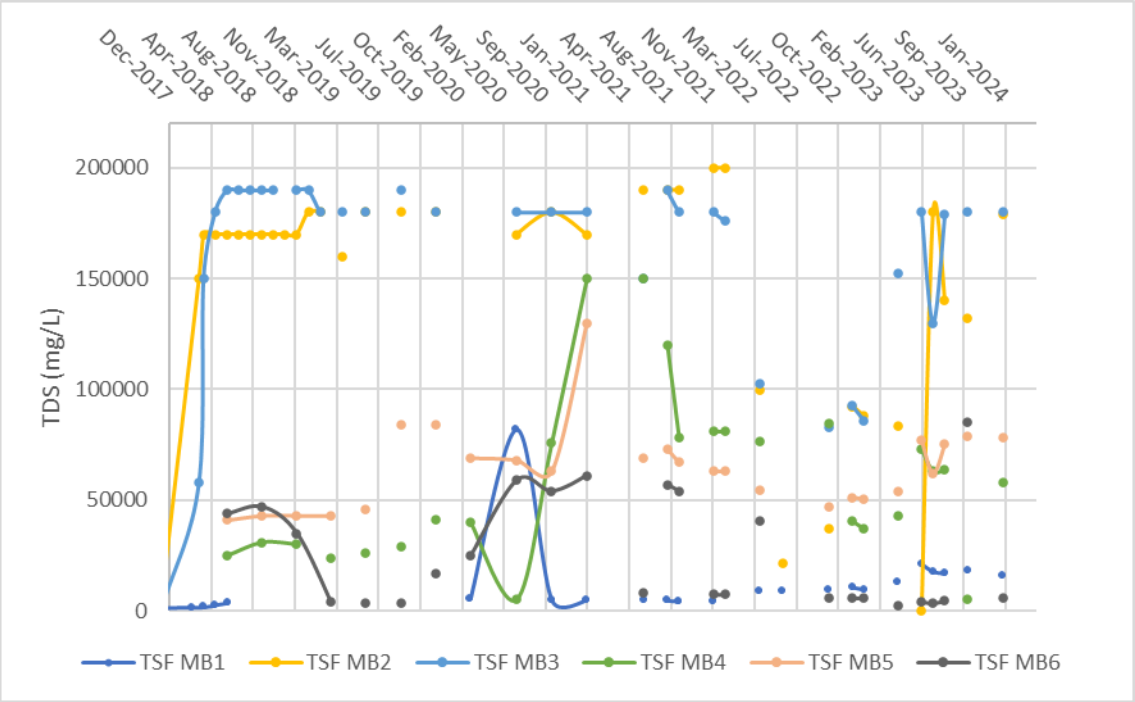

Figure 6: TDS concentration in TSF monitoring bores

Weak Acid Dissociable (WAD) Cyanide

The Licence Holder has historically completed sampling of WAD cyanide at the TSF decant pond and reported concentrations within it ranging from 12 to 36 mg/L (GRM 2024). TSF decant return water returned to the plant has also been recorded between 4 mg/L and 110 mg/L between March 2020 and January 2021 (Dacian 2021).

GRM (2021) has suggested that groundwater quality monitoring data indicates that seepage generated from the TSF does not penetrate deeply into the groundwater zones. Evidence of this conclusion was due to the low concentrations of WAD cyanide reported in groundwater samples (Figure 7) when compared with recent TSF decant pond samples (12 to 36 mg/L) and decant return samples (4 to 110 mg/L). GRM (2021) has noted that there are no other chemical signatures (metals and metalloids) of TSF seepage reaching groundwater. GRM (2021) notes that the potential impact of groundwater expressions on surface on the playa lake is very small because of the dilution affects. The Department notes that groundwater samples collected from monitoring bores surrounding the TSF (Figure 7) suggests that limited seepage of contaminants is occurring.

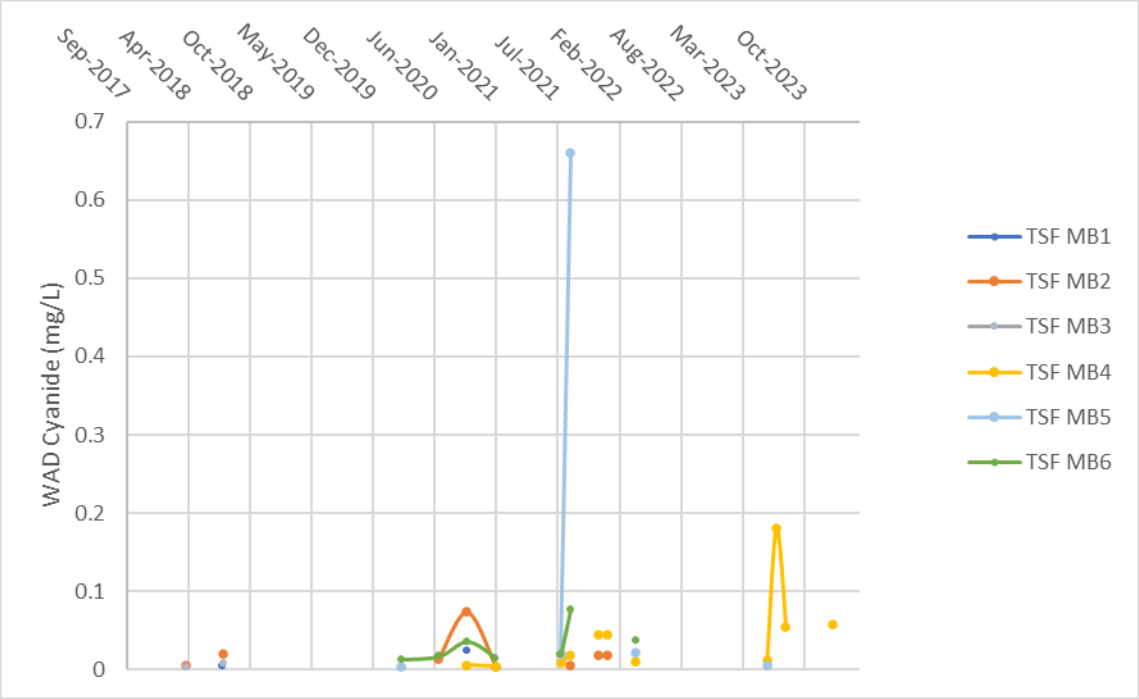

Figure 7: Reported concentrations above LOR of WAD Cyanide in TSF groundwater monitoring bores

2.3.5 Vegetation monitoring and impacts

Vegetation monitoring is a pre-existing condition within Licence L9010/2016/1 (Condition 1.2.6) which requires the Licence Holder to undertake an annual assessment of vegetation within the zone of influence of the TSF. Results are required to be submitted within the Annual Environmental Report (AER) to the Department within 60 days of the end of the annual period.

The first assessment of vegetation was completed by Blueprint Environmental Strategies Pty Ltd (Blueprint 2018). The initial assessment and future monitoring involved the use of a Normalised Difference Vegetation Index (NDVI) (Blueprint 2018). The NDVI provides a spatial representation of how much chlorophyll (green vegetation/biomass) is present in the area (RPM 2024). The second aspect of the annual vegetation monitoring assessment involved a field aspect where vegetation community name, species composition, relative vegetation density and vegetation condition (using the Keighery 1994 criteria) is recorded.

Blueprint completed the 2018, 2019 and 2020 annual vegetation monitoring report until they were acquired by RPM Global Holdings Ltd (RPM) on 30 September 2021. RPM has since completed the 2021, 2022 and 2023 annual vegetation monitoring report as required by Licence L9010/2016/1.

Figure 8 presents the vegetation survey areas including the baseline vegetation assessment site. Figure 9 presents the rainfall recorded from Laverton Aero with a 12-month rolling average. Figure 10 to Figure 13 below presents the history of the assessment areas average NDVI results.

Conclusions presented within the 2023 vegetation monitoring report suggest that there has been an overall decrease in vegetation health and density since the TSF vegetation monitoring program began in 2018. RPM mentions that the vegetation loss extends beyond the TSF zone of influence (Figure 10) and suggests the decrease in vegetation health and density may be attributed to the reducing rainfall trend over the same time-period. RPM states that the southern WRD monitoring location (Figure 8) has notably more vegetation loss than other monitoring locations and suggests that the loss is attributed to dust deposition for the coarse ore stockpile nearby.

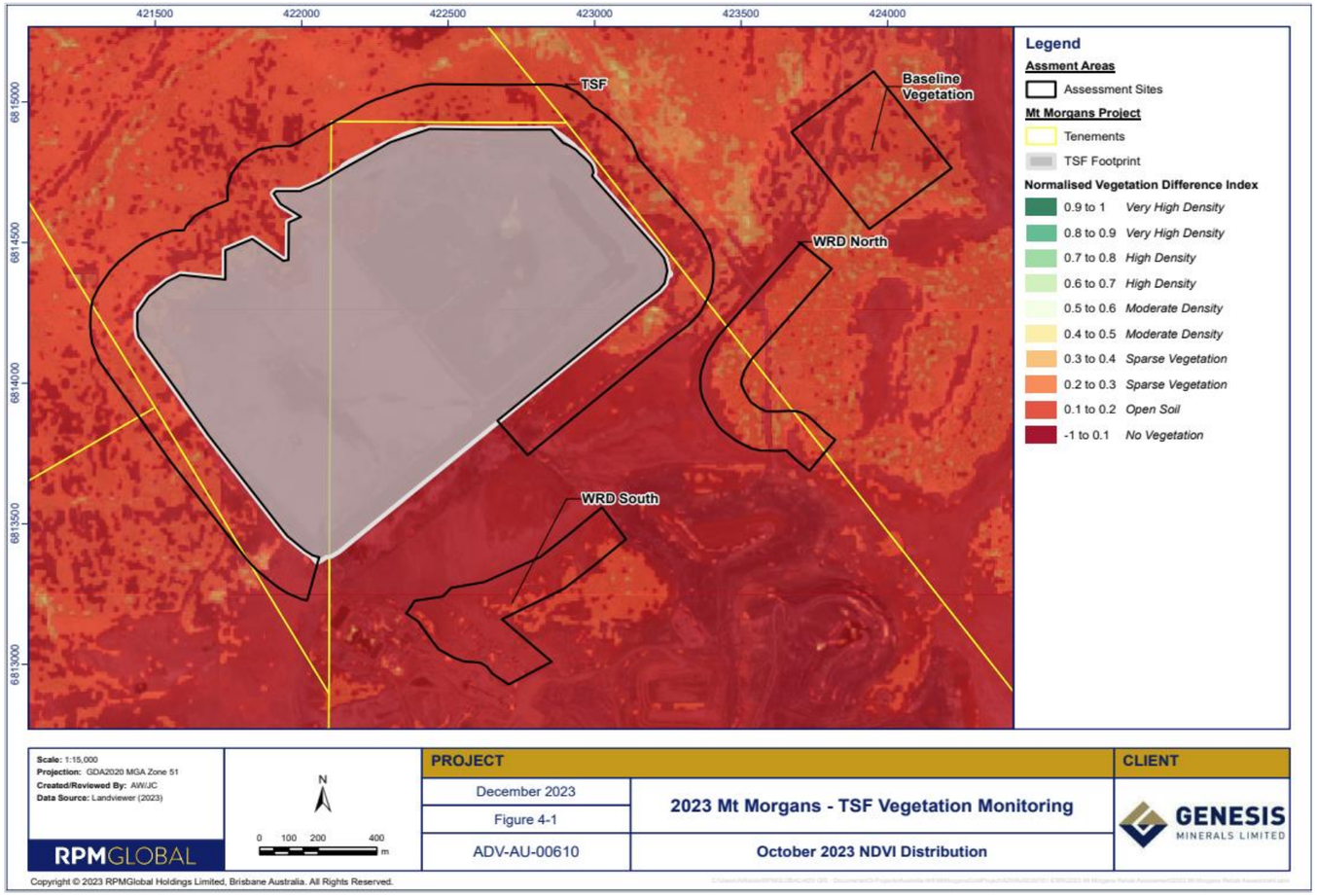

Figure 8: Vegetation monitoring areas with October 2023 NDVI distribution (RPM 2024)

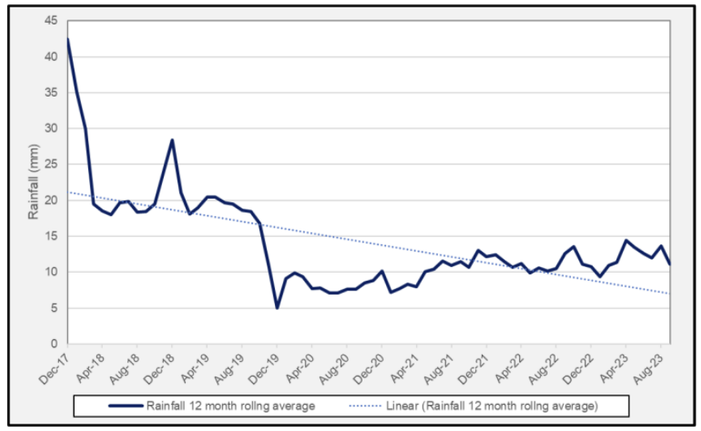

Figure 9: Rainfall time series (RPM 2024)

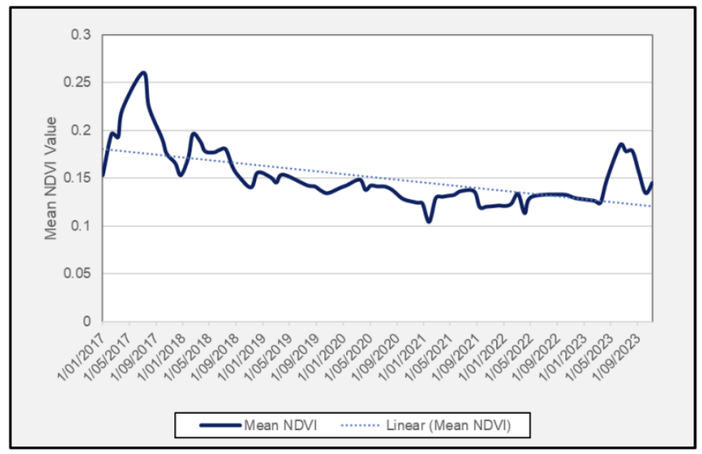

Figure 10: NDVI baseline vegetation monitoring area time series (RPM 2024)

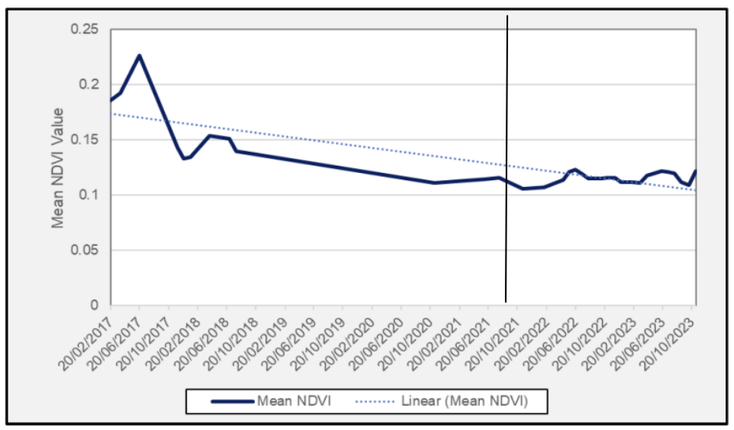

Figure 11: NDVI TSF monitoring area time series (RPM 2024)

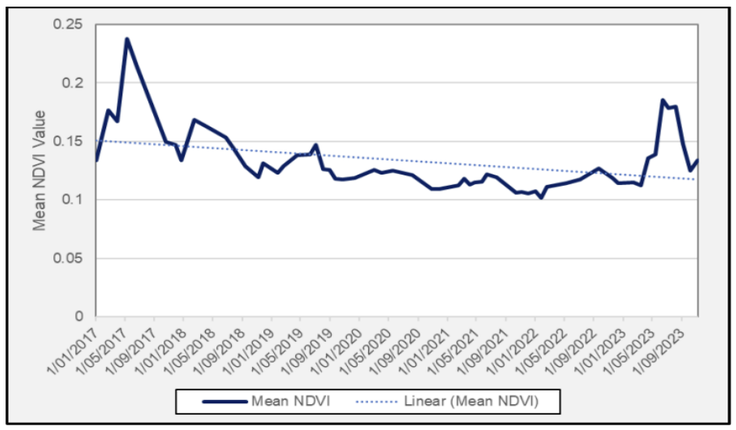

Figure 12: NDVI WRD north monitoring area time series (RPM 2024)

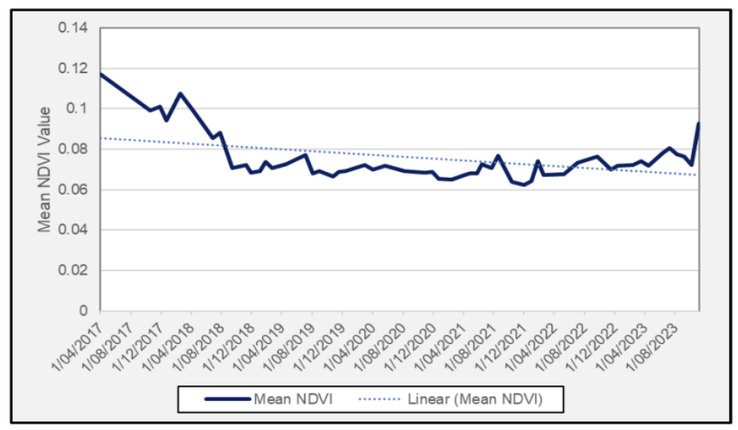

Figure 13: NDVI WRD south monitoring area time series (RPM 2024)

Known incidents of native vegetation loss reported to the Department relating to the operation of the TSF was received from the Licence Holder on the 24 September 2020. The Licence Holder mentioned within the notification that salt deposited from the receding surface water on the eastern side of the TSF has impacted approximately 3.8 hectares of vegetation (Figure 14). Results from the 2020 annual vegetation monitoring event report mentions that there was a slight decrease in overall biomass as observed in the 2020 NDVI but is most likely attributed to a combination of climatic variation and spectral variation (humidity and haze).

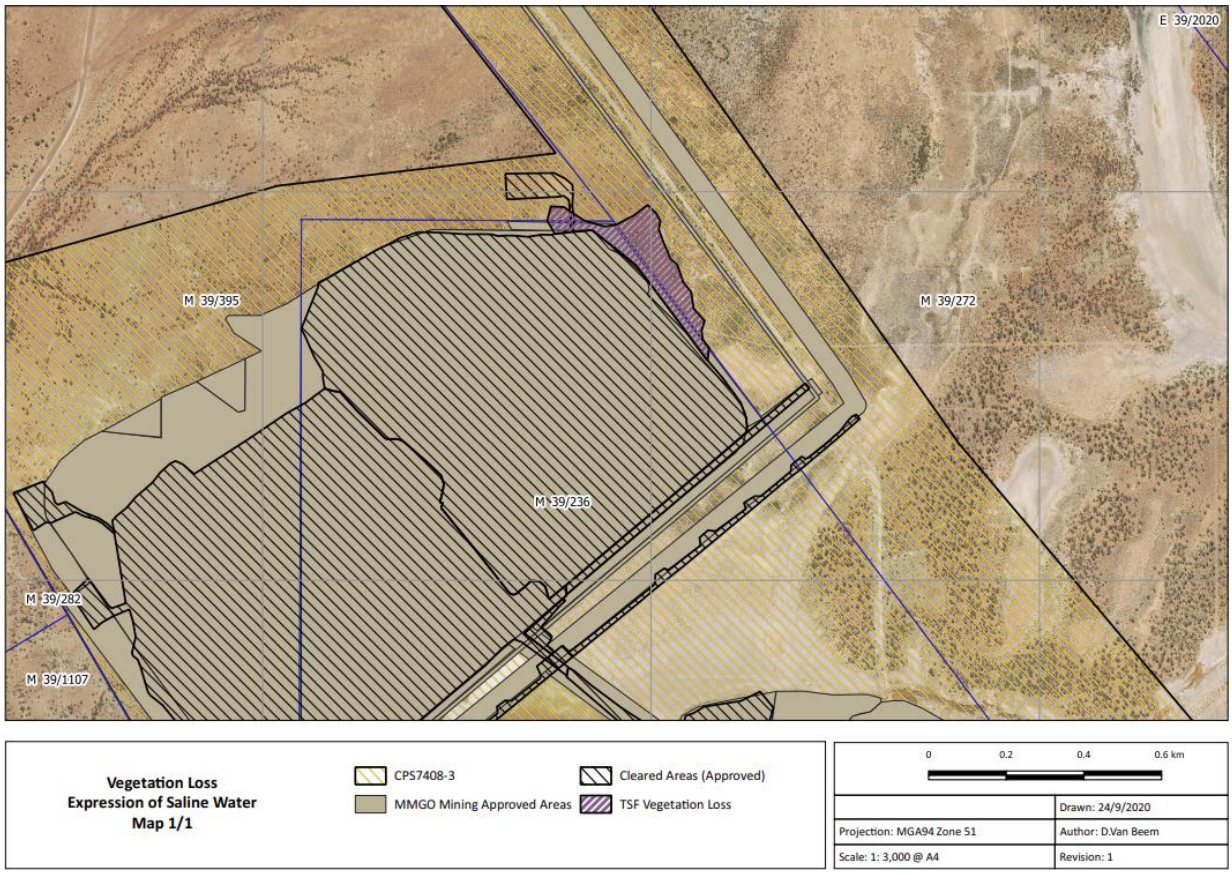

Figure 14: Vegetation Loss via expression of Saline Water

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020).

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

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 3 below. Table 3 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

Table 3: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Tailings or Decant water	Leaks and spills from pipeline transporting tailings / decant water.	Direct contact with surrounding vegetation and soil. Contamination of stormwater through contact with contaminated soil.	• The pipelines on the premises are maintained with telemetry, automatic cutouts and secondary containment • Pipelines positioned within trenches; and • Current Licence condition requires inspection of pipelines and is TSF every 12 hours.
	Overtopping of the TSF.		• 500 mm freeboard is maintained to accommodate inflows from 1:100 year 72 hours rainfall event; and • Routine 12 hourly inspection of freeboard.

Leachate	Deposition of tailings into TSF Cell 2 at the increase embankment height.	Seepage/Infiltration through the TSF base or paddock walls.	• TSF Cell 2 is lined with in-situ clay to a permeability of 2.6 x 10-8 m/s to limit seepage into groundwater;
			• A seepage recovery system (Figure 1) that includes:
			  ○ Interception trenches combined with eight sumps that are installed along the northern and eastern side of Cell 2 and the southern corner and south-eastern side of Cell 1 and Cell 2;
			  ○ Five of the sumps are currently provided with a surface pump to remove seepage affected groundwater that enter the sumps (TSF SP02, SP03A, SP04, SP05 and SP07);
			  ○ Two pumps run more-or-less continuously, while 3 pumps are operated manually and run intermittently; and
			  ○ Two abstraction bores located at the northwestern portion of the TSF.
			• Groundwater management plan (GMP) was updated July 2021 and includes trigger levels and limits for standing water level (SWL) and associated recovery actions. The newest GMP has been updated in 2024.
			• Current trigger levels and action levels set on monitoring bore TSF MB1 by the licence L9010/2016/1; and
			• Spigot arrangement changed from 36 m intervals to 24 m intervals to allow better control for tailings deposition and beaching control.

Dust	TSF Cell 2	Wind/airborne	• Spigot arrangement changed from 36 m intervals to 24 m intervals to allow better

Emission	Sources	Potential pathways	Proposed controls
			control for tailings deposition and beaching control, keeping the tailings surface damp.

3.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), 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 4 below provides a summary of potential human an d environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020)).

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

Human receptors	Distance from prescribed activity
Aboriginal community: Mt Margaret	Approximately 1.5 km west of the northwestern corner of Cell 2 TSF (1 km west of TSF Cell 1). Drinking water sourced for the community is from two bores located approximately 4 km north-east of the central living area (upgradient of the TSF). Water is pumped via a reverse osmosis chlorinator unit and is sampled monthly to ensure it meets water quality standards as prescribed by the Department of Water (DoP 2016). The Mt Margaret Community drinking water has been discounted as a receptor for TSF seepage due to the distance from the drinking water bores to the TSF, Groundwater flow is in a southwesterly direction away from the bores(Genesis, 2023) and TSF seepage modelling indicates that the maximum expected extent of groundwater mounding is 1 km from the TSF when the TSF underdrainage is not operational. Therefore, it is unlikely water supply will be impacted. This receptor has been screened out.
Environmental receptors	**Distance from prescribed activity**
Groundwater	Prior to tailings deposition groundwater depth ranged between 0.5 to 9.3 meters below ground level (mbgl). Since tailings deposition started, groundwater levels at the TSF have increased close to the ground surface with groundwater expressions occurring in places. As of January 2024, groundwater levels range from 0.24 mbgl (TSF MB2) to 10.72 mbgl (TSF MB1) Groundwater Total Dissolved Solids (TDS) ranged from 150,000 to 180,000 mg/L at the playa and 5,800 mg/L to the northwest corner of TSF Cell 1. Groundwater flows in a southwesterly direction (Genesis, 2023).

Lake Carey	The main Lake Carey playa is immediately adjacent south of the TSF. Lake Carey has a significant ecological value and during flood events can become a highly productive ecosystem and is considered a Specified Ecosystem and is used by migratory shorebirds (Outback Ecology et al, 2013).
Priority Fauna	Priority 1 invertebrate species: *Branchinella simplex* identified within the Lake Carey system (MWH 2015).
Native Vegetation	Native vegetation appears to be approximately 390 m southeast of the TSF.
Threatened Ecological Community (TEC) Mount Morgan calcrete aquifer *[Screened Out]*	The Mount Morgans calcrete groundwater assemblage (P1) is located approximately 600 m northeast cross gradient of the TSF. The calcrete aquifer is discounted as a receptor due to the hydrological assessment indicated that it is highly unlikely for the TSF mound to extend towards to the calcrete aquifer (GRM 2024). Ground surface elevation along the corner closest (north) to the aquifer is between 399 and 400 mRL while the aquifer is approximately 400 mRL (GRM 2024). Groundwater flows in a southwesterly direction towards Lake Carey reducing the potential for impacts to the aquifer.
Tecticornia cymbiformis (Priority 3) *[Screened Out]*	Approximately 1.3 km west of the northwestern corner of Cell 1 of the TSF). Due to the distance of the receptor and the TSF it is unlikely for this flora to be affected and therefore is screened out for the risk assessment.
Indigenous Heritage Receptors	**Distance from prescribed activity**
Aboriginal Sites and Heritage Places *[Screened Out]*	There is a total of 14 aboriginal sites and heritage places approximately located within a 1 km radius of TSF Cell 2. The sites include the following uses; Artefacts / Scatter, Repository, Cache, Mythological, Water Source, Skeletal Material / Burial, Man-Made Structure, Camp. Due to the nature of the potential contaminant and the receptor it is unlikely for the aboriginal sites and heritage places to be affected and therefore is screened out for the risk assessment.

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) 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 in-complete 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 5.

The Revised Licence L9010/2016/1 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e. operation of tailings storage facilities.

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

Table 5. Risk assessment of potential emissions and discharges from the Premises operation

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Comments / Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
Operation								
Operation of TSF Cell 2 at 412 mRL	Tailings and decant water	**Pathway** Overtopping of TSF causing discharge of emission/s to ground. **Impact** Direct contact with receptors degrading environmental values	• Surrounding Native vegetation (390 m) • Lake Carey and Playa Systems	Refer to Section 3.1.1	C = Minor L = Unlikely **Medium Risk**	Y	Existing Condition 1.2.2 – TSF freeboard inspection requirement. Existing Condition 1.2.4 – Embankment freeboard requirement.	Existing conditions adequately manage this risk. No additional regulatory controls are required.
		Pathway Leaks and/or spills from pipelines leading to or from the TSF. **Impact** Direct contact with receptors degrading environmental values	• Surrounding Native Vegetation (390 m) • Lake Carey and Playa Systems		C = Minor L = Unlikely **Medium Risk**	Y	Existing Condition 1.2.1 – Requires either telemetry, automatic cutouts or secondary containment of pipelines during operation. Existing Condition 1.2.2 – Pipeline inspection requirements.	Existing conditions adequately manage this risk. No additional regulatory controls are required.
	Decant water	**Pathway** Pooling of decant water (containing WAD CN) at the TSF followed by ingestion of fauna. **Impact** Can cause illness/death in fauna and/or degradation of receptors.	• Priority Fauna • Native Fauna	Refer to Section 3.1.1	C = Moderate L = Possible **Medium Risk**	N	**<u>Updated Condition 3.4.1</u> – <u>Requirement to monitor standing water in Decant Pond Cell 1 and Cell 2.</u>**	The Department has included a requirement within condition 3.4.1 for the Licence Holder to sample TSF Cell 1 and Cell 2 decant ponds on a quarterly basis. The rationale for this additional requirement is to monitor for concentrations of WAD cyanide and TDS within the decant surface water as there is the potential for ingestion of this water by waterbirds that may access the decant pond (if TDS below 50,000 mg/L). Concentrations of WAD cyanide above 50 mg/L that are ingested by fauna may result in illness or death. Some monitoring data has indicated records for WAD cyanide above 50 mg/L and TDS below 50,000 mg/L. More ongoing monitoring is required to inform the risk to water birds.

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Comments / Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
	Leachate	**Pathway** Seepage of leachate through ground or TSF walls to groundwater. **Impact** Can cause groundwater mounding/surface expression impacting receptors.	• Surrounding Native Vegetation (390 m) • Lake Carey • Priority Flora	Refer to Section 3.1.1	C = Moderate L = Likely **High Risk**	N	Existing Condition 1.2.5 – Seepage collection and recovery system requirements. Existing Condition 1.2.6 – Annual assessment of vegetation within zone of influence of the TSF requirement. Existing Condition 1.2.7 – Requires monitoring of the water balance for TF Cells 1 and 2. New Condition 1.2.10 – New monitoring bore construction and design requirements. New Condition 1.2.11 – Compliance reporting of new monitoring bore. Existing Condition 3.4.1 – Requirement to monitor volume of: tailings deposition, volume of water recovered and volumes of seepage recovered and reused in the process plant. **Updated Condition 3.5.1 – Requires groundwater monitoring at monitoring bores surrounding the TSF and bores have SWL trigger and limit levels.** **Updated Condition 3.5.2 – Requirement to implement management of groundwater mounding if trigger values are reached.** Existing Condition 3.5.3 – Requirement to not exceed the limit presented in Condition 3.5.1.	Please see Section 3.3

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Comments / Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
	Leachate	**Pathway** Seepage of leachate through ground or paddock walls and mixing with groundwater resulting in either contaminated groundwater or contaminated surface expression. **Impact** Can cause contamination of groundwater and impact the health of Lake Carey by introducing contaminates to the system (metals and WAD cyanide).	• Lake Carey • Priority Fauna / native vegetation	Refer to Section 3.1.1	C = Moderate L = Unlikely **Medium Risk**	N	Existing Condition 1.2.5 – Seepage collection and recovery system requirements Existing Condition 1.2.7 – Requires monitoring of the water balance for TSF Cells 1 and 2. New Condition 1.2.10 – New monitoring bore construction and design requirements. New Condition 1.2.11 – Compliance reporting of new monitoring bore. **Updated Condition 3.5.1 – Requires groundwater monitoring at monitoring bores surrounding the TSF and bores have SWL trigger and limit levels.** **Updated Condition 3.5.2 – Requirement to implement management of groundwater mounding if trigger values are reached.** Existing Condition 3.5.3 – Requirement to not exceed the limits presented in Condition 3.5.1.	Historical monitoring data (see section 2.3.4) has shown some low levels of WAD CN within groundwater bores surrounding the TSF. The increase in embankment height at Cell 2 has the potential to increase the risk of seepage from this cell due to an increase in hydraulic pressure. Potential impacts on the lake could occur through the mixing of the diluted seepage from the TSF and groundwater transporting concentrations of cyanide and metals towards Lake Carey and ingested/absorbed by native fauna or flora. It has been determined that a trigger level will be conditioned for groundwater monitoring bores surrounding the TSF for WAD cyanide to not exceed concentrations of 0.5 mg/L. The licence holder will need to implement groundwater recovery measures in the event the trigger value is exceeded in accordance with updated condition 3.5.2. It is noted that reported concentrations of WAD cyanide is generally below 0.1 mg/L (Figure 7) with only a single reported exceedance above 0.5 mg/L observed in the past.
	Dust	**Pathway** TSF dust liftoff into air **Impact** impacts to ecological health	• Surrounding Native Vegetation • Lake Carey • Priority Fauna/Flora	Refer to Section 3.1.1	C = Slight L = Unlikely **Low Risk**	Y	Existing Condition 2.3.1 – Required methods to prevent visible dust from leaving the site.	Existing conditions adequately manage this risk. No additional regulatory controls are required.

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

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 TSF

3.3.1 Overview of risk event

Operation of the TSF Cell 2 at the increased embankment height from 408 mRL to 412 mRL may result in additional leachate seeping from the base and walls of Cell 2 due to the increase holding capacity causing further mounding of the groundwater table surrounding Cell 2. This may result in impacts to the health of native vegetation at the surface and to the ecology of Lake Carey.

3.3.2 Identification and general characterisation of emission

The major contaminants of potential concern that may be within the tailings produced at the premises are: cyanide, metals and metalloids. The discharged slurry consists of approximately 45-50% solids.

A network of groundwater monitoring bores exists surrounding the TSF. The location of these bores is shown in Figure 1. Baseline groundwater monitoring was undertaken prior to the commissioning of TSF Cells 1 and 2. The baseline standing water levels (SWLs) are presented in Figure 4 and Figure 5 respectively and demonstrate the influence on groundwater levels with tailings deposition over the operation of the TSF.

These figures show that mounding of the groundwater table has occurred with some bores showing groundwater expressing at the surface. As of January 2024, groundwater levels range from 0.24 mbgl (TSF MB2) to 10.72 mbgl (TSF MB1).

Recently, there has been a reduction in groundwater levels surrounding TSF Cell 2 as presented in Figure 5, however it is noted that the Premises has been in care and maintenance since March 2023 (CMW 2023). Currently the only discharge deposited into the TSF Cell 2 is the leachate recovered from sumps: 02, 03, 03A, 04, 05, 06 and 07 (Figure 1).

The increase in embankment height at TSF Cell 2 is likely to result in additional groundwater mounding due to the increase in hydraulic pressure on the surrounding groundwater.

3.3.3 Receptors and potential adverse impacts from the emission

Lake Carey and priority fauna/flora

The Lake Carey lakeshore is approximately 2.5 km south of the TSF. Ephemeral drainage lines are adjacent to the TSF which during high rainfall events can flood and drain towards Lake Carey. Lake Carey has a significant ecological value and during flood events can become a highly productive ecosystem and is considered a Specified Ecosystem and is used by migratory shorebirds (Outback Ecology *et al*, 2013).

Native Vegetation

The playa lake immediately to the south of the TSF is barren with no vegetation occurring along the south-eastern embankment of the TSF. Vegetation occurs on the north-eastern embankment of Cell 2 and along the northwestern and south-western parts of the Cell 1.

Generally, groundwater levels to the north and northeastern portion of the TSF are lower than the groundwater levels to the east and southern portions of the TSF resulting in vegetation at the southwest and east to be at the greatest risk to groundwater mounding.

Health of nearby native vegetation could be affected if significant groundwater mounding occurs and inhibits the root zone potentially introducing saline water and contaminants of potential concern to the root systems resulting in impacts to vegetation health.

The RPS (2024) 2023 annual vegetation monitoring report (Discussed in Section 2.3.5) indicates that vegetation health and density loss surrounding the TSF is not attributed to the operation of the TSF.

3.3.4 Licence Holder's emission controls

To manage groundwater mounding surrounding the TSF the Licence Holder operates under a GMP, a summary of the current GMP and previous versions are discussed in Section 2.3.2 of this amendment decision report.

To monitor groundwater conditions and to indicate if and to what extent groundwater mounding and seepage is occurring at the TSF the Licence Holder has seven monitoring bores surrounding the TSF (Figure 1). In the GMP, six monitoring bores have SWL limits associated to them to identify if additional seepage recovery infrastructure is required or if the operation of existing infrastructure is required. Table 1 presents the 2021 trigger and action values for the SWL listed within the GMP and Table 2 presents the updated 2024 trigger and action (threshold) values.

The Licence Holder has progressively installed additional infrastructure to reduce seepage and mounding around the TSF, this infrastructure includes:

- An underdrainage system within both Cell 1 and Cell 2;
- Interception trenches combined with eight sumps that are installed along the northern and eastern side of Cell 2 and the southern corner and south-eastern side of Cell 1 and Cell 2;
- Five of the sumps are currently provided with a surface pump to remove seepage affected groundwater that enter the sumps (TSF SP02, SP03A, SP04, SP05 and SP07);
- Two pumps run more-or-less continuously, while three pumps are operated manually and run intermittently; and
- Two abstraction bores located at the northwestern portion of the TSF.

Location of the infrastructure is presented in Figure 1.

Vegetation monitoring occurs annually and is submitted to the Department within the Licence Holders AER. The vegetation monitoring is discussed in Section 2.3.5 of this amendment decision report and its goal is to monitor vegetation health and density surrounding the TSF.

3.3.5 Consequence of Risk Event

It has been determined that the consequence of this risk event is **Moderate** due to the potential for groundwater mounding to result in stressed/death of native vegetation surrounding the TSF.

3.3.6 Likelihood of Risk Event

Provided with the history of groundwater fluctuations surrounding the TSF and the history of groundwater surface expression the Department considers the likelihood of groundwater mounding resulting in impacts to sensitive receptors (native vegetation) occurring at TSF Cell 2 to be '**Likely'**.

3.3.7 Overall risk rating

The Delegated Officer has compared the consequence and likelihood ratings described above within the risk rating matrix (outlined within the department's Guideline: Risk Assessments 2017) and has determined that the overall rating for this risk event is **'High'**.

3.3.8 Additional regulatory controls

As a result of this risk assessment, it has been determined that additional regulatory controls

are required to manage the risk of further groundwater mounding impacting native vegetation surrounding the TSF (as a result of operating Cell 2 at the increased embankment height). The following additional regulatory controls have been conditioned on the licence:

Monitoring bore limit and trigger values

It has been determined that trigger values for standing water levels (SWL) within the groundwater monitoring bores surrounding TSF Cells 1 and 2 will be conditioned within the licence. The trigger values (Table 1) presented within the 2021 GMP (GRM 2021) have been adopted within condition 3.5.1 (Table 3.5.1) as suitable values, with the exception of the values for TSF MB1 which is unchanged due to its pre-existing SWL trigger and limit prior to this amendment.

It has been shown in the past that actions have not been implemented in a timely manner to prevent standing water levels from reaching the limit values outlined in the GMP, because of this the department has found it necessary to condition the trigger values within the licence to ensure action is taken to prevent SWL from expressing at the surface.

The licence already contains a condition requiring action to be taken in response to a trigger value from being exceeded. This condition has been updated (condition 3.5.2) to make it clear that management of groundwater mounding means the installation and operation of groundwater recovery bores to reduce groundwater levels to below the trigger values.

The SWL limit values from the 2021 GMP have also been added to condition 3.5.1 to ensure that groundwater levels are maintained below these levels to reduce the likelihood that impacts will occur to native vegetation surrounding the TSF and to prevent surface expression. If a limit is exceeded this would be a non-compliance with the conditions of the licence and compliance action may be taken.

Additional groundwater monitoring bores

It was confirmed by the Licence Holder that the proposed additional monitoring bore (TSF MB7) mentioned within the GMP (GRM 2021) will be installed in 2024. The addition of TSF MB7 was recommended by GRM (2021) due to TSF MB5 being ‘unlikely to assess the effectiveness of the seepage interception system along the vegetated area at the north-eastern side of Cell 2 because of the proximity of the seepage sources and related seepage interception infrastructure” (GRM 2021).

The Department has added a condition to Licence L9010/2016/1 requiring the Licence Holder to install this (TSF MB7) groundwater monitoring bore and submit a bore construction report to the CEO after construction. The Department has added the requirement of the future monitoring bore (TSF MB7) SWL to be gauged monthly and sampled quarterly for the same analysis suite as the other TSF monitoring bores listed within Table 3.5.1 in Licence L9010/2016/1. At this stage a trigger value and limit value has not been applied to TSF MB7.

The Department notes that three groundwater abstraction bores were also installed in 2022 (TSFAB01 – TSFAB03) in response to the rising groundwater near TSF MB1. TSFAB02 was receiving low abstraction yields during installation and therefore was constructed as a monitoring bore (GRM 2024). It was proposed by GRM (2024) in the revised GMP that TSFAB02 is to be included in the monitoring program for groundwater levels, electrical conductivity and pH. The Department has determined to include this monitoring bore as a compliance bore on the licence and has placed a requirement to gauge groundwater levels monthly and sampled quarterly for the same analysis suite as the other TSF monitoring bores listed within Table 3.5.1 in Licence L9010/2016/1. At this stage a trigger value and limit value has not been applied to TSFAB02.

Bore monitoring frequency

The monitoring frequency for gauging SWL within TSF monitoring bores has been increased

from quarterly to monthly within condition 3.5.1. This has been deemed necessary for the early identification of standing water level trigger and limit exceedances so management actions can be undertaken in a timely manner. The change in SWL monitoring frequency was also recommended in both the annual TSF audit during October 2023 (CMW 2023) and the 2024 GMP (GRM 2024).

4. Consultation

Table 6 provides a summary of the consultation undertaken by the department.

Table 6: Consultation

Consultation method	Comments received	Department response
Licence Holder was provided with draft amendment on (3 April 2024).	The licence holder responded 21/6/2024. Refer to Appendix 1	The Departments response is provided in 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 7 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 7: Summary of licence amendments

Condition no.	Proposed amendments
Front Page	Removed L39/245 from Premises details due to tenement is inactive from 12/10/2018. The Prescribed Premises envelope and boundary is unchanged. Amended category 6 and category 64 unit wording (no change to actual proposed or assessed amounts).
1.1.2	Included AS/NZS 5667.4 sampling standard.
1.2.3 (Table 1.2.2)	Updated table restricting embankments heights from 408 m RL to 412 m RL. Included non-operation frequency inspections.
1.2.8 (Table 1.2.3)	Removed contractor names from used tyre storage areas.
1.2.9 (Table 1.2.4)	Changed backfill requirements from ‘weekly’ to ‘end of the month.’
1.2.10	Added condition listing the requirements of monitoring bore installation.
1.2.11	Added condition requiring Licence Holder to submit a bore presenting the compliance with condition 1.2.10.

3.1.2	Added the requirement for six-monthly monitoring is undertaken at least five months apart. Added the requirement for annual monitoring is undertaken at least nine months apart.
3.2.1 (Table 3.2.1)	Included non-operation frequency monitoring.
3.3.1 (Table 3.3.1)	Included non-operation frequency monitoring.
3.4.1 (Table 3.4.1)	Added additional process monitoring sampling locations (Decant Pond Cell 1 and Decant Pond Cell 2) to require quarterly sampling for TDS and WAD Cyanide. Included non-operation frequency monitoring. Added a note below the table to not requiring monitoring is the decant in a cell is dry.
3.5.1 (Table 3.5.1)	Changed the requirement of quarterly monitoring to monthly monitoring for SWLs. Added additional sampling locations (TSF MB7 and TSFAB02). Added groundwater SWL limits and trigger values to TSF MB2 to TSF MB6. Changed the frequency of standing water level gauging from quarterly to monthly. Added trigger of 0.5 mg/L WAD Cyanide to sample locations. Removed TDS trigger and limit values for TSF MB1.
3.5.2	Removed reference to Cell 1 to include groundwater management requirements for Cell 2.
Schedule 1	Updated Figure TSF Monitoring bore locations – TSF MB1, MB2, MB3, MB4, MB5 & MB6 to include MB7 and TSFAB02 sampling locations. Amended Jupiter tyre storage figure to show the correct figure.
Throughout document	Minor typographical and format errors corrected.

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24. RPM Global 2024, Mt Morgans TSF Vegetation Health Monitoring, Mt Morgans WA Mining Pty Ltd, Job Number: ADV-AU-00610.

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 1.2.3, Table 1.2.2 and Condition 3.5.1, Table 3.5.1	The Licence Holder identified administrative errors within the Licence.	Amended.
Condition 1.2.8, Table 1.2.3	The Licence Holder has requested to remove contractor groups that is mentioned within the licence under the used tyre storage waste type.	The Department has removed the references to the contracting groups for the used type storage waste type from Table 1.2.3. During the amendment the Department identified that the Jupiter site plan figure identifying the tyre storage area at Jupiter HV Workshop was not presented within Schedule 1: Maps. The issue has been amended and no further action is required. There is no change to the condition outcome and requirement is changed.
Condition 3.5.1, Table 3.5.1	The Licence Holder has requested to have the TDS trigger and limit for TSFMB01 removed from the licence. The Licence Holder acknowledges that elevated TDS levels have the potential to impact native vegetation if groundwater levels intersect the root zone. Seepage recovery bore TSFAB01 was installed in response to elevated TDS levels to reduce the SWL in the vicinity of TSFMB01. Since the installation of TSFAB01 water levels have been maintained below the root zone in line with the SWL trigger and limit parameters, therefore mitigating potential impacts on surrounding vegetation from groundwater mounding and achieving the objective of Condition 3.5.2.	The request to remove the TDS trigger and limit parameters for TSFMB01 from the Licence is granted. The Department has reviewed the TDS history of TSFMB01 and TDS concentrations have repeatedly been recorded above the old licence limit of 6,000 mg/L since April 2022 Figure 6. The Licence Holder has demonstrated that ground water levels at TSFMB01 have remained below the Licence trigger of 6 mbgl since the installation of seepage recovery bore TSFAB01 and therefore has removed the active pathway of hypersaline groundwater affecting the root zones of the nearby native vegetation.
Condition 3.4.1, Table 3.4.1	The Licence Holder has requested to modify monitoring requirements to specify monitoring on the active/operational decant. The requires is due to the non-operational decant will likely be dry during a monitoring event voiding this condition.	The Department acknowledges that there will be a non-operational decant during most sampling events. However occasionally there may be surface water present at both decants during sampling events. The intention for this condition is to gain a background understanding of WAD

Condition	Summary of Licence Holder's comment	Department's response
		concentrations and TDS parameters that may present a risk to migratory birds that may have access to the premises. The Department has added a note below Table 3.4.1 to only require monitoring of the TSF Cell 1 and Cell 2 decant when water is available to sample to prevent voiding condition 3.4.1.
Condition 1.2.2, Table 1.2.1; **Condition 1.2.9, Table 1.2.4;** **Condition 3.2.1, Table 3.2.1;** **Condition 3.3.1, Table 3.3.1;** **Condition 3.4.1, Table 3.4.1;** **Condition 3.6.1, Table 3.6.1.**	The Licence Holder has requested to have 'operational' and 'non-operation' monitoring frequencies added to tables: 1.2.1, 1.2.4, 3.2.1, 3.3.1, 3.4.1 and 3.6.1.	The Department has amended tables: 1.2.1, 1.2.4, 3.2.1, 3.3.1 and 3.4.1 to better accommodate the premises requirements during non-operation of the infrastructure or the prescribed premises. Condition 3.6.1, Table 3.6.1 has not been amended as there is no appreciated frequency of monitoring requirements relating to the volumetric flow rate of the sewage plant – effluent flow.