Amendment Report

Application for Licence Amendment

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

Licence Number	L8675/2012/1
Applicant	Millennium Minerals Pty Ltd
ACN	003 257 556
File number	DER2014/002927
Premises	Nullagine Gold Operation – Golden Eagle Project Mining Tenements M46/3, M46/47, M46/50, M46/57, M46/98, M46/129, M46/138, M46/146, M46/163, M46/164, M46/166, M46/167, M46/170, M46/182, M46/186, M46/192, M46/198, M46/199, M46/200, M46/225, M46/261, M46/262, M46/264, M46/265, M46/266, M46/267, M46/272, M46/273, M46/275, M46/276, M46/277, M46/278, M46/300, M46/426, M46/432, M46/433, M46/434, M46/436, M46/441, M46/442, M46/443, M46/444, M46/445, M46/527, G46/2, L46/33, L46/45, L46/88, L46/91, L46/98, L46/105, L46/115, P46/1675, P46/1704, P46/1705, P46/1706, P46/1755, P46/1756, P46/1757, P46/1758, P46/1824, P46/1922, and P46/1923. NULLAGINE WA 6758
Date of report	07 June 2024
Decision	Revised licence granted

Mariana Almeida de Moraes

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SENIOR ENVIRONMENTAL OFFICER, RESOURCE INDUSTRIES
INDUSTRY REGULATION (STATE-WIDE DELIVERY)
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

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1. Decision summary

Licence L8675/2012/1 is held by Millennium Minerals Pty Ltd (licence holder) for the Nullagine Gold Operation – Golden Eagle Project (the Premises), located at approximately eight kilometres (km) south of Nullagine, Western Australia.

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 L8675/2012/1 has been granted.

The revised licence issued as a result of this amendment supersedes the existing Licence previously granted in relation to the Premises. The revised licence has been granted in a new format with existing conditions being transferred, but not reassessed, to the new format.

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 6 May 2022, the licence holder submitted an application to the department to amend licence L8675/2012/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

- change of applicant details and business address (administrative amendment);
- operate TSF2 Stage 2B (399 m RL);
- revision and upgrade of Tailings Storage Facility (TSF) 2 seepage recovery and monitoring network;
- review of the licence holder's trigger action response plan and limit levels;
- reduction in monitoring frequency of the wastewater treatment plant (WWTP) from fortnightly to monthly; and
- revision of the groundwater monitoring network surrounding the Golden Eagle mining area to replace unserviceable monitoring wells with newly established wells.

This amendment is limited to administrative changes and changes to Category 5 and 85 activities from the existing Licence. No changes to the aspects of the existing Licence relating to Category 7, 52, 73 and 89 have been requested by the licence holder. Table 1 below outlines the proposed changes to the existing licence.

Table 1: Proposed changes

Prescribed premises category and description	Assessed design capacity	Proposed changes to the design capacity
Category 5: Processing or beneficiation of metallic or nonmetallic ore	2,000,000 tonnes per annual period	No changes to capacity. TSF raise, change in monitoring network and seepage controls only.
Category 7: Vat or in situ leaching metal	2,000,000 tonnes per annual period	No changes proposed under this amendment
Category 52: Electric power generation	10 MW	No changes proposed under this amendment
Category 73: Bulk storage of chemicals	1,347.8 cubic metres in aggregate	No changes proposed under this amendment
Category 85: Sewage facility	80 cubic metres per day	No changes to capacity. Change in monitoring frequency only.
Category 89: Putrescible landfill site	500 tonnes per annual period	No changes proposed under this amendment

2.2.1 Operation of TSF2 Stage 2B (to 399 mRL)

Mining operations commenced at the Golden Eagle deposit in 2012 with all tailings' deposition directed at this time to the newly constructed TSF1, continuing until early 2017. Prior to this facility reaching design capacity, extensive planning works were undertaken during 2015 and 2016 to outline a new location and provision of design criterion for a new TSF2. TSF2 cell 1 was completed 16 October 2016 and was commissioned in early November 2016. Completion of the TSF2 Stage 1 raise (395 mRL) was completed in September 2019.

In December 2019, the Premises, operated by Millennium Mineral Pty Ltd, entered into voluntary administration and was placed on care and maintenance. Novo Resources acquired Millennium Mineral Pty Ltd in August 2020 and commenced deposition within TSF2 Cell 2 Stage 1 in February 2021.

Construction of the TSF2 Stage 2 lift commenced in mid-2021 with an interim operational approval subject to licence amendment L8675/2012/1 issued on 05 November 2021 for the Stage 2A lift (397.3 mRL). Completion of the remaining Stage 2B TSF2 lift (399 mRL) was finalised on 28 March 2022 with its operational status the subject of this licence amendment.

The TSF2 Stage 2B Critical Containment Infrastructure report was provided as part of this licence amendment application.

2.2.2 Revision and upgrade of TSF2 seepage recovery and monitoring network

Previously a total of six monitoring bores were located downstream of the Stage 1 embankments and utilised to monitor groundwater quality downstream of TSF2. As part of the TSF2 embankment Stage 2 raise, an assessment of groundwater risk and monitoring bore schedule was completed by SRK Consulting Pty Ltd (SRK 2021a). SRK (2021a) further supported the conclusion that groundwater abstraction bores for the Nullagine town drinking water supply is accessing a distinct aquifer system separate from those underlying the TSF2 and based on available data there is no viable pathway between TSF2 and the drinking water supply. SRK (2021a) determined that all monitoring bores adjacent the TSF2 showed an increase in water levels corresponding with tailing deposition into the facility, suggesting a

groundwater mound has been established under the TSF. It was noted that TSF2MB5, which is situated approximately one kilometre (km) downstream of TSF2, was constructed with a screen straddling both the shallow alluvial and deeper bedrock aquifer system which is therefore likely not reflective of TSF operations.

The review recommended additional monitoring and seepage interception (production) bores to be installed. Subsequently, the licence holder drilled and developed the additional monitoring and seepage recovery bores, which are presented in Figure 1. The licence holder has proposed to include these additional bores to the current licence L8675/2012/1, with monitoring requirements aligned with existing TSF2MB series monitoring bores (i.e., monthly standing water level monitoring and quarterly water quality sampling for laboratory analysis.)

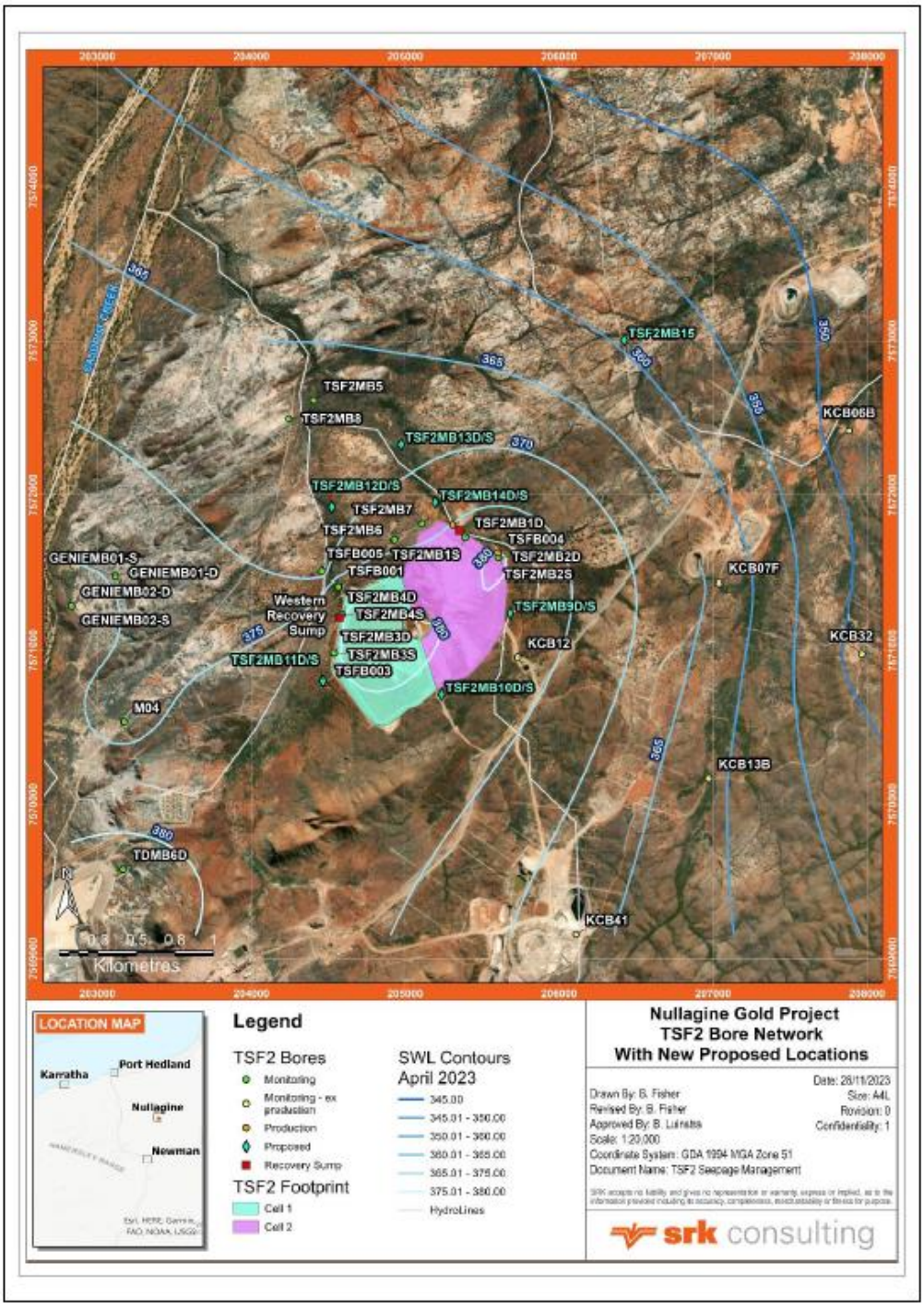


Figure 1: Existing and proposed seepage recovery bores and monitoring network.

2.2.3 Review of the Trigger Action Response Plan and limit levels

SRK (2022, 2023 and 2024) have reviewed the water quality parameter's limit levels as stipulated in the licence and their suitability to monitoring of impacts of the TSF2 into groundwater and surrounding environment. As result of this review, SRK recommended changing the Chloride, Sulfate and Strontium levels. The SRK report also recommends setting different trigger levels for bores immediately surrounding the TSF2 and those located nearby and down-gradient.

2.2.4 Reduction in monitoring frequency of the WWTP

Given the significant reduction in risk associated with the prescribed premises activities with the removal of the site from the Nullagine Drinking Water Reserve, and to align site sampling requirements with regional monitoring practices, the licence holder proposes to revise the monitoring frequency from fortnightly to monthly.

2.2.5 Revision of the groundwater monitoring network surrounding the Golden Eagle mining area.

In addition to modification to TSF2 monitoring network, the licence holder also seeks approval to revise the groundwater monitoring network surrounding the Golden Eagle mining area to replace unserviceable monitoring wells with newly stablished wells as listed in Table 2. The review investigated if impacted bores are required to be reinstalled, or if nearby monitoring bores being monitored are suitable substitutes which can meet the same objectives.

Table 2: Replacement of groundwater monitoring bores surrounding the Golden Eagle mining area.

Bore ID	Easting	Northing	Screen (mbgL)	Screen lithology	Comments
GEWB001	202491	7567815	30 – 102	metapelite	Replaced with GEWB0026.
GEWB0020	202128	7567048	18 – 42	psammite	Bore obstructed at 2 m due to pump centraliser. Replaced with KCB10 and GEWB0021.
KCB10	201968	7566876	18 – 104	psammite	Replacement bore.
GEWB0021	202295	7567038	54 – 60	pelite	Replacement bore.
GEWB005	202428	7568163	25 – 97	metapelite	Replaced with GEWB0015.
GEWB0012A	202626	7568121	27 – 129	metapelite	Replaced with GEWB0015.
GEWB0015	202397	7568191	29 – 110	metapelite	Replacement bore.
GEWB0013A	202140	7567734	40 – 100	metapelite	Replaced with GEWB0026.
GEWB0016	202128	7567731	84 – 124	psammite	Replaced with GEWB0026.
GEWB0026	202040	7567699	48 – 138	metapelite	Replacement bore.
M05	202438	7568490	36 – 72	metapelite	Blocked by headworks. Replaced with MW05A.
MW05A	202425	7568458	24 – 100	metapelite	Replacement bore.
M07	203139	7568347	88 – 100	metapelite	Replaced with M06.
M06	202941	7568199	88 – 100	metapelite	Replacement bore.

2.2.6 Care and Maintenance status

Since submission of the amendment application, the licence holder suspended operations at the Nullagine Gold Project at the end of Quarter 3, 2022 with a controlled and phased wind down of operational activities. During this suspension period the licence holder will continue to investigate options to restart the project as well as continuing closure and rehabilitation activities throughout the project area. A Care and Maintenance Environmental Management Plan has been developed and provided to the Department to demonstrate that environmental obligations will continue to be met during the suspension period.

3. Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) – environmental and geotechnical advice

Environmental and geotechnical advice was sought from DEMIRS on proposed changes to the existing licence. In summary the following advice was received:

- DEMIRS is supportive of the licence holder's proposal to install additional groundwater monitoring and seepage interception bores and commence deposition into the raised TSF2.
- DEMIRS has no comments to provide on the reduction in monitoring frequency of the WWTP.
- The construction of the TSF2 Stage 2B raise has been completed in general accordance with the design specifications and in line with the original design intent. Overall, there are no geotechnical concerns regarding deposition into the raised TSF2.

4. Risk assessment

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

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

4.1 Source-pathways and receptor

4.1.1 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 Slurry	Category 5: Tailings pipeline leaks, ruptures, or failure	Direct discharges to land	• Continue to operate pipelines as per current licence conditions. • Inspection sheets will be maintained and managed in accordance with Licence holder EMS.

Emission	Sources	Potential pathways	Proposed controls
Tailings seepage	Category 5: Increased tailings seepage from increased tailings disposal	Seepage of leachate	• TSF2 raise constructed in accordance with design drawings and earthworks specification. • TSF recovery system in place. Additional recovery bores proposed to maximise seepage recovery. • Groundwater monitoring program implemented and undertaken as per current licence and proposed modifications under this application. • Geoscience Data Management Systems installed a network of Vibrating Wire Piezometers (VWP) in November 2020 which will continue to be utilised to monitor pore pressure development within the TSF2 perimeter embankments. • Water Balance maintained as per current conditions in licence. • Sufficient freeboard to contain a 1:100 AEP 72-hour storm event whilst maintaining 1.0 m of freeboard to the crest. • Supernatant pond is maintained away from the perimeter embankments. • The use of a central rock ring has the benefit of providing a deep operating pond with a constant diameter, which can reduce evaporative losses and maximise water recovery at TSF2. • The water recovery system (decant pumps and piping) is required to have a minimum capacity of 150 m^3/hr. • Based on the water balance, the maximum operating pond volume is not expected to exceed 75,000 m3 under normal operating conditions. The maximum allowable operating pond volume is 534,000 m3 based on the freeboard requirements (1.0 m) and top-down freeboard assessment. • Seepage management plan in place.
Tailings material	Category 5: Overtopping of tailings from increased tailings disposal	Direct discharges to land	• Rock ring constructed from geotechnically and geochemically stable material with particle size not exceeding 500 mm, sound, durable, clean, cohesionless and sub-angular to angular rock fragments and free of deleterious material. Furthermore, conforms to Particle Size Distribution requirements, non-plastic and are well graded. • Maintain and operate full decant rock ring water recovery.

Emission	Sources	Potential pathways	Proposed controls
			• Decant rock ring reduces Rate of Rise and increases in-situ tailings dry density, increasing storage capacity. • Vibrating Wire Piezometers (VWPs) system to be reviewed and monitoring of the phreatic surface. • Annual TSF inspections. • Cone penetrating testing for lifts. • Rubber tyres installed at discharge points to minimise scouring. • Designed to accommodate a 1 in 100-year rainfall event over a 72-hour period. • Beaton Creek Project tailings geophysical and geochemical analysis. • Minimum operating freeboard of 300 mm, where total freeboard of 1000 mm includes operational freeboard of 300 mm, beach freeboard of 200 mm, and additional stormwater freeboard of 500 mm. • Maintain and operate the underdrainage collection system. • Review and operate the TSF Operations Manual. • Undertake daily TSF inspections.
Treated sewage with exceeded quality or volumes	Category 85: Change in effluent frequency monitoring	Direct discharge to Land	• Existing controls apply under the current licence L8675/2012/1

4.1.2 Receptors

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

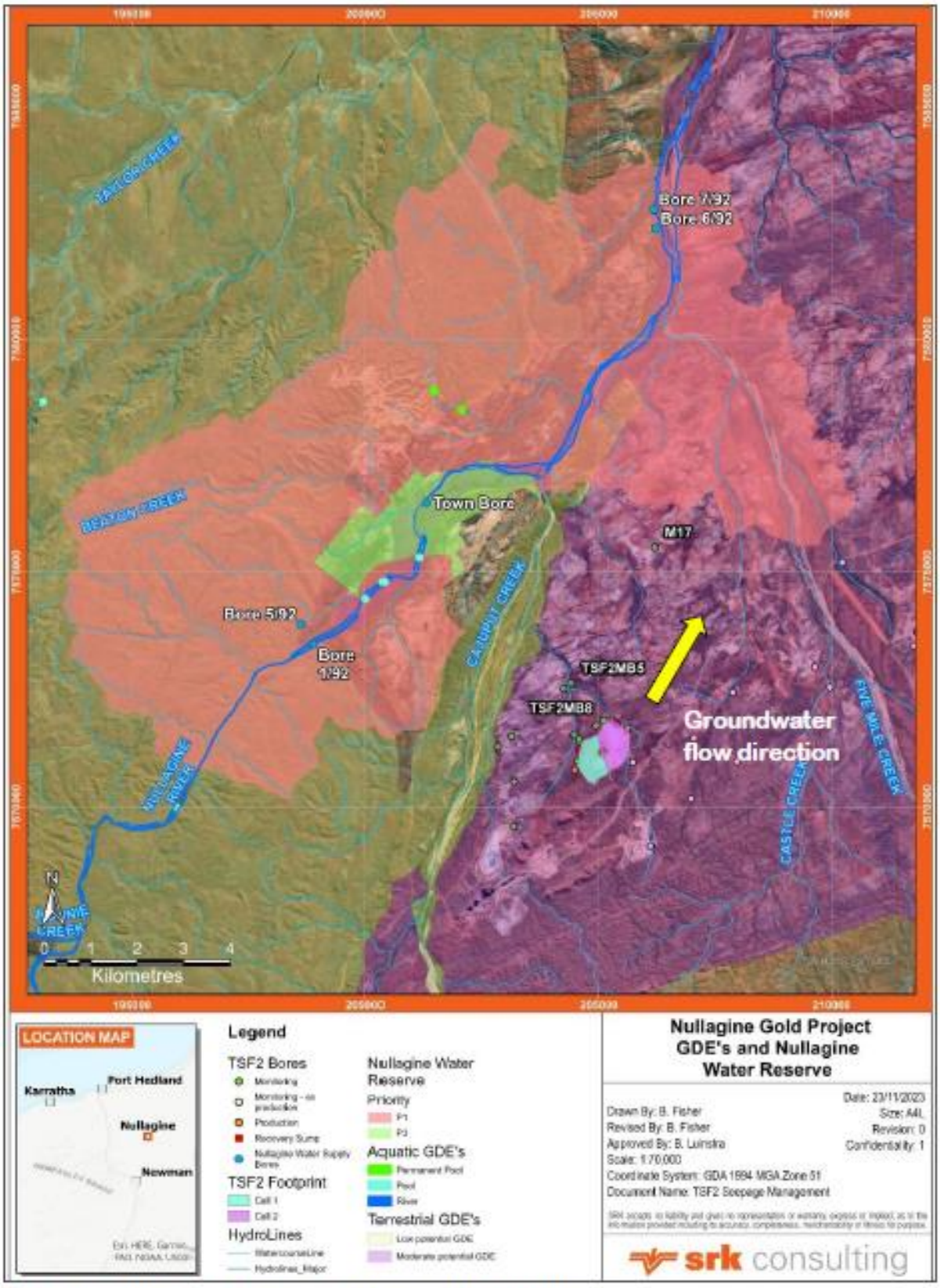
Table 4 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020b)). Figure 2 and Figure 3 displays sensitive receptors and the distance to the Premises.

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

Human receptors	Distance from activity / prescribed premises

Residential Premises	Approximately 6.2 km from TSF2.
Land Affected	
Pastoral Lease Bonney Downs	Underlying the prescribed premises. Pastoral bores and associated infrastructure can be seen southeast of TSF2.
"C" Class reserves – R13866 – Water Corporation R 9700 - De grey Peak Hill Stock Route.	Intersecting tenements involved.
Environmental receptors	**Distance from activity / prescribed premises**
Priority Ecological Community (PEC) PEC Mosquito Land System (Priority 3) Stony Saline Plains of the Mosquito Land System.	Occurs within the prescribed premises.
Underlying groundwater The primary aquifers at the mine site comprise superficial alluvial aquifers and the fractured bedrock, referred to as the Mosquito Creek Formation aquifer (MCFA). Abstraction is limited to fractured bedrock aquifer to minimise risks to groundwater dependent ecosystems (including heritage sites). Recharge to the MCFA is derived via infiltration from the overlying alluvium aquifer, into the basement rock and from direct rainfall infiltration, where fractures are exposed. Groundwater flow is slow and follows generally topography and surface catchments (northwest towards Cajuput Creek). Water quality in the vicinity of TSF2 proposed design can be conceptualised as brackish to moderately saline groundwater to the south and east of the area, increasing in salinity and solutes to the north and northwest.	Underlying the prescribed premises.
Surface Water Cajuput Creek System and its Hyporheic zone - habitat and refuge for aquatic organisms (e.g., microbes, macroinvertebrates, and fish).	Creek lines adjacent to TSF2.
Nullagine Water Reserve (PDWSA) – P3 The water reserve supply reserve and associated bores are separated from TSF2 by the Cajuput Creek and the Nullagine River, which are indicated to represent significant hydraulic barriers to groundwater flow. Applicant indicates that hydrogeological investigation and groundwater risk assessment was completed to demonstrate that proposed mining activities at Nullagine drinking water supply will not be impacted.	Approximately 3 km northwest of TSF2.
Groundwater Dependent Ecosystems Previous studies indicated that 65.5 ha of vegetation has been identified with groundwater dependence potential, while 341 ha has been identified as having a potential surface water inflow dependence with none of these areas pertaining to the location of TSF2.	Southwest of TSF2

Pools can be seen southwest of tenements involved, associated with Cajuput Creek. Some are permanent pools (groundwater dependent).	
Threatened and Priority flora species No Threatened Flora and known to occur within the TSF2 proximity, the below four priority species are considered likely to be present: • *Acacia aphanoclada* (P1) • *Atriplex spinulosa* (P1) - Annual Disturbance Opportunist • *Solanum sp*. Mosquito Creek (P1) - Disturbance Opportunist • *Eragrostis crateriformis* (P3)	Within the prescribed premises boundary.
Threatened and Priority fauna species Of the six conservation significant species identified as potentially occurring within the TSF2 area, the Rapallo field survey observed one species, the Rainbow bee-eater *Merops ornatus* (Migratory). Recent diggings of the Brush Tailed Mulgara *Dasycercus blythi* (P4) were found as well as old Greater Bilby *Macrotis lagotis* (Vulnerable) diggings. Identification of the potential presence of the Greater Bilby and Brush Tailed Mulgara resulted in targeted searches. However, no bilby burrows, diggings, tracks or scats were detected within or surrounding the TSF2 area. The suspected disused bilby burrow identified in June 2015 and further holes surrounding the TSF2 were all confirmed as being varanid lizard burrows. The Brush Tailed Mulgara was found to be present at two locations within the TSF2 area and possibly present at nearby locations that are outside of the TSF2 activity area.	Within the prescribed premises boundary.
Aboriginal and heritage sites Palyku & Njamal claimant groups have been consulted during development of the proposed TSF2 to ensure that the group was fully aware and agreed with the process. An archaeological and ethnographic survey was conducted over the TSF2. Aboriginal site Minturna 704	In accordance with application, no significant archaeological or ethnographic sites were present over the proposed TSF2 area. Heritage sites are found around other sections of tenement and near pipelines. Located approximately 200 m southwest TSF2



Notes: Nullagine Water Supply Bores 5/92 and 1/92 are not currently operating.

Figure 2: Distance to sensitive receptors

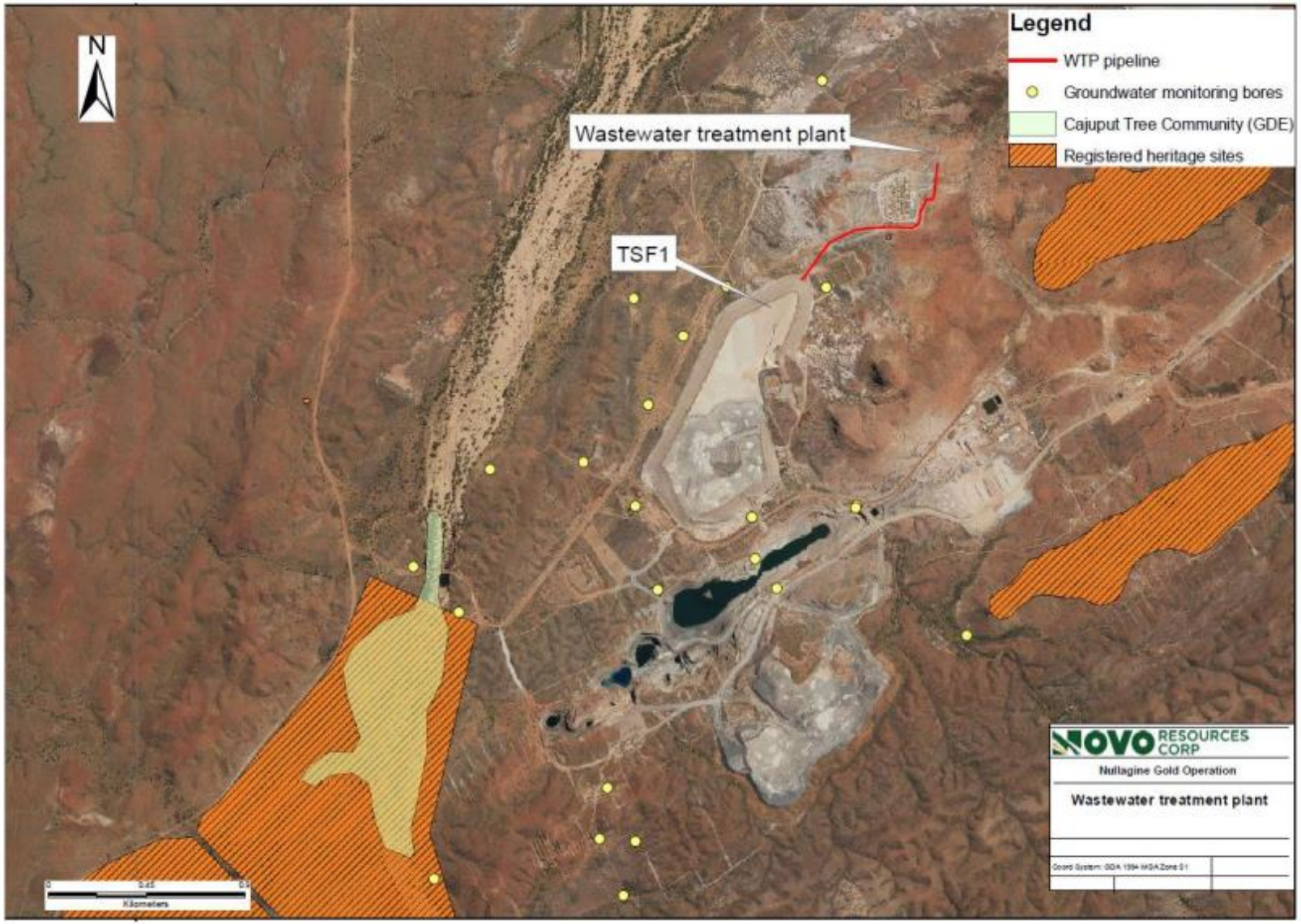


Figure 3: WWTP and TSF1 proximity to Cajuput Tree Community (GDE) and registered aboriginal and heritage sites

4.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020a) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 4.1. 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 4.1), 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 .

The revised licence L8675/2012/1 that accompanies this amendment report authorises emissions associated with the operation of the premises i.e., discharge of tailings into the raised TSF2.

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 events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Operation								
Category 5								
Deposition of tailings into raised TSF	TSF supernatant containing concentrations of elements with environmental significance (metals and metalloids)	Increase in Seepage / Infiltration of supernatant water through basin and embankments resulting in reduced groundwater quality.	Groundwater	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	N	**Conditions** **2, 4, 5 6**, **12**, 14, 15, 16, 17,19, **20, 21**, 22, 23, 24, 25, **26, 27.** **Reporting Conditions** 28 to 36.	**Condition 2** Inclusion of production or design capacity limits of all the categories under the licence to ensure limits are not exceeded. **Conditions 4 and 6** Conditions related to the installation and construction of additional groundwater monitoring bores. Condition 6 relates to the reporting of the monitoring bores constructed. **Condition 5** Condition related to requirements for installation of seepage recovery bores. **Condition 12** Inclusion of condition that has incorporated existing conditions 1.2.4, 1.2.5, 1.2.11, and 1.2.13 as per current licensing standard. Condition relates to site infrastructure operating in accordance with table 9 at the specified location. **Condition 19** Removal of groundwater monitoring bores that were decommissioned / replaced and addition of new groundwater monitoring bores to the existing monitoring network. As part of the amendment application a review

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
								was undertaken of the existing monitoring network and additional groundwater bores were proposed in locations where groundwater monitoring was required. Refer to sections 1.2.2, 1.2.3, 1.2.5, and 4 for further explanation. **Conditions 21** Addition of condition to ensure that the licence holder undertakes management actions in accordance with the Seepage Management Plan and specified in Schedule 3 of the licence. Further explanation is provided in sections 1.2.2, 1.2.3, and 4. **Condition 26 and 27** Condition related to a report to be submitted on the groundwater environment that includes a ground-based geophysical investigation to identify fracture zones to determine suitability of current monitoring and seepage recovery bores network and the requirements for additional bore locations. Refer to section 4 for further details.
		Groundwater mounding resulting in seepage expression on surface, impacting vegetation and reducing surface water quality.	Land/soils Surface water including its potential hyporheic community and vegetation that fringes the creek bed. Surrounding	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	N	**Conditions** **<u>2, 4,</u> 5 6**, **12**, 14, 15, 16, 17,19, **<u>20, 21</u>**, 22, 23, 24, 25, **<u>26, 27.</u>** **Reporting**	Refer to the above justification for additional regulatory controls.

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
			Native Vegetation; including PEC priority flora.				**Conditions** 28 to 36.	
		Overtopping of tailings resulting in direct discharges to land and infiltration to soil resulting in in reduced soil and surface water quality and impacting health of surrounding vegetation	Surrounding Native Vegetation; including PEC priority flora. Land/soils Surface water including its potential hyporheic community and vegetation that fringes the creek bed.	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	N	**Conditions** **2, 4, 5 6**, **12**, 14, 15, 16, 17,19, **20, 21**, 22, 23, 24, 25, **26, 27.** **Reporting Conditions** 28 to 36.	Refer to the above justification for additional regulatory controls.
		Exposure of native fauna (e.g. birds) to potentially contaminated decant water that ponds on surface of the TSF	Conservation Significant Fauna	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	Y	N/A	N/A
Tailings delivery and return water pipelines	Spillage of tailings and decant return water through leaks, pipeline ruptures or failure	Direct discharges to land and infiltration to soil resulting in reduced soil and surface water quality and impacting health of surrounding vegetation	Land/soils Surrounding Native Vegetation; including PEC priority flora. Surface water	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	Y	**Conditions** 3 and 25. **Reporting Conditions** 28 to 36.	N/A

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Category 85								
Discharge of treated Wastewater to land (TSF1) - Change in effluent frequency monitoring	Treated sewage with exceeded quality or volumes discharged to TSF1	Change in monitoring frequency resulting in unsatisfactory management of effluent containing high levels of nutrients impacting the health and growth of surrounding vegetation and causing a reduction in groundwater quality	Groundwater Surrounding Native Vegetation; including PEC priority flora.	Refer to Section 3.1.1	C = Slight L = Possible **Low Risk**	Y	**Conditions** 2, 9, **12**, 13, 14, 15, 16, and 17. **Reporting Conditions** 28 to 36.	**Condition 12** Change in monitoring frequency requirement

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

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

5. Additional regulatory controls

Technical advice was sought from the department's hydrogeologists on adequacy of hydrogeological investigation undertaken to inform suitable monitoring and seepage recovery network and proposed change in water quality triggers at the Premises.

Monitoring and seepage recovery network

The Principal hydrogeologist has indicated the difficulties in determining groundwater flow rates and the directions in fractured rock aquifers, like the Mosquito Creek Formation aquifer (MCFA) in the vicinity of the Premises. The licence holder hydrogeological consultant's (SRK 2023) has used methodologies derived from Darcy's Law to determine regional directions of groundwater flow and average flow rates in the MCFA near the Premises. In its basic form, Darcy's Law indicates that the rate of groundwater flow through a cross-sectional slice of an aquifer is proportional to the hydraulic conductivity of materials in the aquifer, the steepness of the hydraulic gradient through the aquifer, and the size of the cross-sectional area through which groundwater flow takes place.

At a local scale, the principle of hydraulic continuity breaks-down in fractured rock aquifers, and it becomes difficult to determine groundwater flow rates using many hydrogeological techniques based on Darcy's Law. However, as a fractured rock aquifer is progressively viewed at a more regional scale, there comes a point where the fracture-density and the degree of interconnection between fractures allows the system to broadly approximate the behaviour of a porous-medium aquifer.

Although insufficient information was provided about the fracture density and degree of interconnectivity of fracture in the MCFA near the Premises, it is likely that Darcian flow behaviour in this aquifer would only apply at scales more than 100 metres.

In the absence of detailed direct groundwater flow information for a fractured rock aquifer, there are some other hydrogeological tools that can be used to indirectly infer the likely behaviour of groundwater in the system.

One of these tools, which was used by SRK (SRK 2023) at the request of DWER to infer groundwater flow behaviour near the Nullagine mine site, is to look at differences and similarities in the natural major-ion chemical composition of groundwater that is sampled in different bores in the aquifer. The basis for this approach, is that groundwater samples from different bores that have similar composition are likely to be derived from a common groundwater flow system. Additionally, progressive changes in the chemical composition of groundwater due to chemical reactions between the groundwater and aquifer rocks can often be used to infer groundwater flow directions.

The limitation of this approach is that it may not work well if the chemical composition of groundwater is very similar in all monitoring bores. In this situation, the use of stable isotope measurements in groundwater may give better results.

A second group of hydrogeological tools that can be used to infer the presence of groundwater flow-paths in fractured rock aquifers where the Representative Elementary Volume (REV) is large, is the use of geophysical measurements to infer the likely presence of groundwater-bearing fracture systems.

The Principal hydrogeologist noted that SRK (SRK 2023) did not consider the use of geophysical data in the hydrogeological assessment that was undertaken for the area around TSF2 to inform suitable locations for monitoring network and seepage recovery bores.

Given the limitations in hydrogeological investigations undertaken, there would be a significant risk that some seepage recovery bores are not located in optimal locations near TSF2 to capture groundwater that has been contaminated by seepage from the facility.

The reasons for this assessment are:

- The aquifer has a very low hydraulic conductivity, and so individual bores may only have small cones of depression when pumped, which would limit the lateral distance where the capture of contaminated groundwater is possible; and
- The aquifer is likely to have a large REV, and individual fracture zones may be poorly interconnected. This means that a bore that is constructed in one fracture system may not be able to effectively capture contaminated groundwater in an adjacent fracture system that may only be located a few tens of meters away.

Given these potential limitations, the Principal hydrogeologist recommends that an adaptive management approach is taken for recovering groundwater that has been contaminated by seepage from TSF2.

The recommended approach would be to commence pumping using the existing seepage recovery bores. However, while this is taking place, a ground-based geophysical investigation using electrical, or electromagnetic (EM) techniques could be undertaken on transects near the toe of TSF2. These investigations would enable fracture zones to be identified that are potentially significant groundwater pathways.

If groundwater monitoring were to indicate contamination was continuing to migrate away from the TSF, despite the pumping program, additional seepage recovery bores should be constructed on targets that would have been identified by the geophysical investigations.

Regarding construction of the seepage recovery bores the following steps are recommended to optimise the recovery of contaminated groundwater:

- Undertake downhole geophysical logging using resistivity and gamma tools (specific tools are available that would allow these measurements to be carried out through the PVC casing of a constructed bore). Depth intervals in the borehole which have low gamma readings would indicate the presence of permeable horizons associated with fracture zones. The presence of very low resistivity values within these permeable zones would indicate saline groundwater (i.e., more saline than natural background levels) associated with contaminated groundwater.
- Ensure that the pump in each of these bores is installed at the depth where the most contaminated groundwater enters the bore.
- Install inflatable packers above and below the principal zones where contaminated water enters the bore to constrain the depth-interval where pumping would take place.

Regarding the current monitoring network, the proposed distribution of monitoring bores around TSF2 are considered reasonable, however, it is not clear whether all the monitoring bores are installed in fracture zones that would be the principal groundwater pathways for transporting contaminants from TSF2. For this reason, it is recommended that the ground-based geophysical investigation discussed above is carried out, as this would identify targets where additional groundwater monitoring bores may be required.

It is also still recommended that an additional bore is constructed near the southern boundary of the facility to better define the extent and shape of groundwater mounding that would result from ongoing tailings disposal. The requirement for construction of this bore has been added to 27 of the licence.

The licence holder should continue to operate monitoring bore TSF2MB5 as it is the only one in the area that has continuous records since 2016 and can be used to support future assessments.

Proposed change to water quality triggers

The overall approach that was used by SRK to develop site-specific groundwater quality criteria for chloride, sulfate and strontium ions near the mine site is considered to be generally sound, and to be consistent with the approach recommended by the ANZ guidelines. The approach is also consistent with methodologies outlined in guidance produced by the Queensland Department of Environment and Science (Qld DES 2021).

Additional work by SRK (SRK 2023) was undertaken with additional focus on baseline chemistry values, similarities in the sulphate/chloride ion mass ratios and total chloride concentrations. The analysis provided further clarity on the requirement for different trigger levels dependent on bore location at TSF2.

Although, as mentioned above, the overall approach that was used by SRK (SRK 2023) to develop site-specific groundwater quality triggers for chloride, sulfate and strontium ions near the mine site is generally sound, the Principal hydrogeologist recommended that an approach used by the UK Environment Agency (2003) from the document, *Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water* is used to determine suitable limits for water quality information that is collected from monitoring bores. This approach establishes two limits for regulation: an assessment limit (or "trigger value" for action), and a compliance limit (which is based on the concentration required to protect a sensitive receptor).

Conclusions

The licence holder requested SRK to review the previous groundwater trigger and compliance limit statistical work and has provided a revised version to determine the trigger and limit values for specified parameters as mentioned above (SRK 2024). To determine the new trigger and limit values for water quality parameter, SRK (2024) followed the approach from the Environment Agency (2003), where the assessment trigger value was set based on the calculation of an Upper Tolerance Limit (UTL), while the limit value was set as a 'limit to protect a sensitive receptor'. As the groundwater quality varied across the Premises, SRK grouped monitoring bores according to their spatial location and similar groundwater chemistry. Statistical analysis was undertaken, and the results of the new trigger and limit values are provided in condition 20, Table 13 and condition 21, Table 14 of the licence.

In the event of an exceedance, the trigger exceedance response plan (revised by SRK (2024)) will be implemented that is included in the updated Seepage Management Plan as required under condition 21.

6. Consultation

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

Table 4: Consultation

Consultation method	Comments received	Department response
DEMIRS advised of proposal on 27 September 2022	DEMIRS provided a response on 06 October 2022. The response is summarised in section 2.2 of this amendment report.	The department had no response.
Licence holder was provided with draft amendment on 25 March 2024	Licence holder provided initial comments on 16 April 2024, with outstanding comments provided on 06 May 2024. Comments are summarised in Appendix 1.	The department's responses are provided in Appendix 1.

7. 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.

7.1 Summary of amendments

Table 5 provides a summary of the proposed amendments and will act as record of implemented changes. The licence has been reformatted into the current licence template with the changes summarised in the below table. All proposed changes have been incorporated into the revised licence as part of the amendment process.

Table 5: Summary of licence amendments

Condition no. or section	Proposed amendments
-	Revised to current licensing format template, grammatical changes, and wording.
Cover page	Updated the 'Premises details', removal of redundant mining tenements.
Contents page	Removal of contents page.
Introduction	Removal of the introductory explanation – DWER's industry licensing role, licence requirements, licence fees, ministerial conditions, premises description and licence summary.
Licence history	Licence history table has been amended by removing references to works approvals.
Interpretation including definitions	Inclusion of the 'Interpretation' explanatory note as per the current licensing format. Removal of the previous 'interpretation' section, with the definitions moved to Table 20 after the licence conditions. Amended existing definitions, inclusion of new definitions and removal or redundant definitions.
1.1.1 & 1.1.2	Definition under the EP Act has been removed. Condition has been included under the 'Interpretation' explanation as per current licensing format.
1.1.3	Reference to an Australian or other standard in the licence. Condition has been included under the 'Interpretation' explanation as per current licensing format.
1.1.4	Reference to a guideline or code of practice in the licence.
-	Inclusion of the sentence '*The licence holder must ensure that the following conditions are complied with:'* as per the current licensing format.
Subheading	Removal of subheading '1.2 Premises operation'.
1	Renumbering of condition 1.2.1 and minor grammatical changes.
2, Table 1	New condition and table, where the licence holder must ensure the limits (throughput) for each category must not be exceeded.
Heading	Inclusion of the heading 'Infrastructure and equipment'.
3, Table 2	Renumbering of condition 1.2.14. Rewording of the condition as per currently licensing format and inclusion of the 'infrastructure location' column to table 2 (previously Table 1.2.6). Removal of design and construction requirements for TSF2 as TSF2 is now constructed.
1.2.2	Condition has been removed and incorporated into condition 3, table 2 and pipeline design / construction requirements.

Condition no. or section	Proposed amendments
4. Table 3	Inclusion of a new condition for the installation and construction of monitoring bores.
5	Inclusion of a new condition for the reporting of constructed monitoring bores and seepage recovery bores.
6	Inclusion of new condition for the installation and construction of seepage recovery bores.
7, Table 5	Renumbering of condition 1.2.3 and table 1.2.1. Minor changes to the wording and requirements in the table.
1.2.4 & 1.2.5	Conditions have been removed and incorporated into the new condition 9, table 7 as these conditions relate to operational requirements for site infrastructure.
8, Table 6	Renumbering of condition 1.2.8 and table 1.2.3.
9	Renumbering of condition 1.2.9.
10, Table 7	Renumbering of condition 1.2.10 and table 1.2.4.
1.2.11	Condition has been removed and incorporated into the new condition 9, table 7 as these conditions relate to operational requirements for site infrastructure.
11, Table 8	Renumbering of condition 1.2.12 and table 1.2.5. Removal of reference to note 1 – additional requirements for the covering of tyres.
12, Table 9	New condition and table for the operational requirements of site infrastructure.
Heading	Addition of ‘and discharges’ to the heading and removal of ‘2’.
Subheading	Removed reference to ‘2.1’ from the subheading ‘Point source emissions to air’.
13, Table 10	Renumbering of condition 2.1.1 and table 2.1.1.
Heading	Removed reference to ‘3’ from ‘Monitoring’.
Subheading	Removed reference to ‘3.1’ from ‘General monitoring’.
14, 15, 16 & 17	Renumbering of conditions 3.1.1, 3.1.2, 3.1.3, and 3.1.4.
Subheading	Removed reference to ‘3.2’ from ‘Monitoring of inputs and outputs’.
18, Table 11	Renumbering of condition 3.2.1 and table 3.2.1.
Subheading	Removed reference to ‘3.3’ from ‘Process monitoring’.
19, Table 12	Renumbering of condition 3.3.1 and table 3.3.1.
Subheading	Removed reference to ‘3.4’ from ‘Ambient environmental quality monitoring’.
20, Table 13	Renumbering of condition 3.4.1 and table 3.4.1. Removal of monitoring bores that were decommissioned and being replaced. Addition of new groundwater monitoring bores. Inclusion of note 2 related to the additional conditions 20 and 21.
21, Table 14	Inclusion of a new condition related to selected monitoring bores to not exceed corresponding trigger values for chloride, sulfate, nickel, and strontium.
22	Renumbering of condition 1.2.7 and shifted to the ‘Monitoring’ section of the licence.

Condition no. or section	Proposed amendments
23, Table 15	Renumbering of condition 3.4.2 and table 3.4.2.
24, Table 16	Renumbering of condition 3.4.3 and table 3.4.3. Inclusion of a 'Units' column to table 13.
Heading	Addition of the heading 'Inspections'.
25, Table 17	Renumbering of condition 1.2.6 and table 1.2.2.
Heading	Removed reference to '4' from 'Specified actions'.
26	Removal of condition 4.1 related to seepage management plan and inclusion of a new condition related to undertaking ground-based geophysical investigation near TSF2 within a maximum of three months from the day of recommencement of deposition of tailings into TSF2.
27	Inclusion of a new condition related to providing a report on the groundwater environment that includes a ground-based geophysical investigation to identify fracture zones and suitability and effectiveness of the current monitoring network.
Heading	Removed reference to '5' from 'Records and reporting'.
Subheading	Removed subheading '5.1 Records'.
28	Renumbering of condition 5.1.4 and rewording of condition as per current condition standard.
29	Renumbering of condition 5.1.1 and rewording of condition as per current condition standard.
30	Renumbering of condition 5.1.2 and rewording of condition as per current condition standard.
31	Renumbering of condition 5.1.3 and rewording of condition as per current condition standard.
32	Renumbering of condition 5.1.5.
Subheading	Removed subheading '5.2 Reporting'.
33, Table 18	Renumbering of condition 5.2.1 and table 5.2.1. Renumbering of condition and table numbers within table 15.
34	Renumbering of condition 5.2.2.
35, Table 19	Renumbering of condition 5.2.3 and table 5.2.2.
36, Table 20	Renumbering of condition 5.3.1 and table 5.3.1. Renumbering of condition number within table 17.
Schedule 1, Figure 1	Updated figure.
Schedule 1, Figure 2	Amended figure title, replacing table number reference from table 1.2.1 to table 3.
Subheading	Removal of subheading 'Map of emission points'.
Schedule 1,	Amended figure title, replacing table number reference from tables 2.1.1 and 1.2.1 to tables

Condition no. or section	Proposed amendments
Figure 3	8 and 3.
Schedule 1, Figure 4	Updated figure. Amended figure title, replacing table number reference from table 3.4.1 to table 11.
Schedule 1, Figure 5	Inclusion of new figure.
Subheading	Removal of subheading ‘Map of production bores and pastoral bores’.
Schedule 1, Figure 10	Inclusion of a new figure for the existing and proposed groundwater monitoring bores, production bores, and recovery sumps monitoring network around TSF2.
Schedule 2	Updated form as per current licensing template.
Schedule 3, Figure 11	Inclusion of a flow chart for management actions and Seepage Trigger Action Response Plan.

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2020a, *Guideline: Risk Assessments*, Perth, Western Australia.
3. DWER 2020b, *Guideline: Environmental Siting*, Perth, Western Australia.
4. Environment Agency 2003, *Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water,* Bristol, UK.
5. Queensland Department of Environment and Science (Qld DES) 2021, *Using monitoring data to assess groundwater and potential environmental impacts*, Brisbane, Queensland.
6. SRK Consulting Pty Ltd (SRK) 2021a, *Technical Memorandum; Monitoring Network Review*, 26 August 2021.
7. SRK 2022, *TSF2 Triggers review*, Project Code NOV039, prepared for Novo Resources Corp.
8. SRK 2023, *Novo Resources in response to a request for further information*, 15 December 2023 (DWERDT887944).
9. SRK 2024, *Nullagine Gold Project – Water Quality Triggers Review*, 03 May 2024 (DWERDT944754).

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

Condition	Summary of licence holder's comment	Department's response
Cover page	Licence holder requested to change registered business address to: 'Suite 12, Ventnor Street West Perth 6005'.	Amended.
4, Table 3	Licence holder stated that bores (GEW0021, 15, 26, MW05A and MW06) have already been constructed. Bores TSF2MB9-15 will be constructed prior to restart.	Amended.
12, Table 9	The licence holder has stated the following: 'Recommended freeboard from the design engineers (REC) in the operations manual is as follows: - Operational Freeboard (DMIRS) – 0.3 m - Beach Freeboard (DMIRS) – 0.2 m - Additional Stormwater Freeboard (ANCOLD 'High C') – 0.5 m Total Freeboard (min to max operating pond) - 1 m.'	Amended.
20, Table 13	The licence holder has requested the following changes: - M17 is not a new bore, please remove superscript 2 - TSF2MB1-4 are not new bores, please remove superscript 2 - TSF2MB9-15 are all new bores to be drilled - KCB07F, KCB12, TSFB001 are not new bores, please remove superscript 2 - GENIEMB01-02 bores were not requested to be put on the licence. They were only used in the SRK studies for context. Can these be reconsidered?	Amended.
21, Table 14	The licence holder provided the following additional table to be included in the licence.	This table related to the spatial specified trigger and limit values for strontium, nickel, chloride, and sulphate has been included in the licence based on reasoning under section 5 of this

Condition	Summary of licence holder's comment	Department's response
		amendment report.

Spatial Group	Parameter	Assessment Trigger (mg/L)	Compliance Limit (mg/L)	Historical Trigger Limit (mg/L)
TSF2 Distant: KCB07F, M17, and TSF2MB15[1]	Chloride	6,714	8,299	1,500
	Sulphate	11,025	13,769	3,000
	Nickel	1.4	2.2	0.5
	Strontium	8.7	12.1	4.0
TSF2 Immediate Vicinity: TSF2MB1S/D, TSF2MB2S/D, TSF2MB3S/D, TSF2MB4S/D, TSF2MB5, TSF2MB6, TSF2MB7, TSF2MB8, TSF2MB9S/D,[1] TSF2MB10S/D[1], TSF2M11S/D[1], TSF2MB14S/D[1],	Chloride	10,237	18,505	1,500
	Sulphate	12,831	21,246	3,000
	Nickel	0.500	0.649	0.5
	Strontium	9.4	13.6	4.0
TSF2 Nearby Area: TSF2MB12S/D[1] TSF2MB13S/D[1] KCB12	Chloride	10,261	17,074	1,500
	Sulphate	6,355	10,052	3,000
	Nickel	0.605	0.928	0.5
	Strontium	4.2	5.8	4.0
	Assessment Limit at UTL and Compliance Limit at four standard deviation above mean			
	Assessment Limit at UTL and Compliance Limit based on mass balance calculations			
	Using previous trigger limit as Assessment Limit and UTL as Compliance Limit			

Note 1: Bores yet to be drilled.