



## Application for Licence Amendment

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

---

<b>Licence Number</b>	L8151/2005/2
<b>Licence Holder</b>	Round Oak Jaguar Pty Ltd
<b>ACN</b>	060 620 751
<b>File Number</b>	2012/006866-2
<b>Premises</b>	Jaguar Operation  Legal description –  Mining Tenements M37/44, M37/515, M37/1132, M37/1153, M37/1228, M37/1230, M37/1257, M37/1290 and M37/1301  LEONORA WA 6348  As defined by the Schedule 1: Maps attached to the Revised Licence
<b>Date of Report</b>	8 July 2022
<b>Decision</b>	Revised licence granted

**Samara Rogers**  
**A/MANAGER, RESOURCE INDUSTRIES**  
**REGULATORY SERVICES**

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

## Table of Contents

<b>1. Decision summary</b>	<b>1</b>
<b>2. Scope of assessment</b>	<b>1</b>
2.1 Regulatory framework	1
2.2 Application summary	1
2.3 Discharge of mine dewater to Jaguar mining void	1
<b>3. Risk assessment</b>	<b>6</b>
3.1 Source-pathways and receptors	6
3.1.1 Emissions and controls	6
3.1.2 Receptors	6
3.2 Risk ratings	9
3.3 Detailed risk assessment for seepage of saline mine dewater within the Jaguar mining void	12
3.3.1 General characterisation of emission and potential adverse impacts	12
3.3.2 Emissions	12
3.3.3 Pathway	12
3.3.4 Receptor	14
3.3.5 Risk rating and assessment	15
<b>4. Consultation</b>	<b>15</b>
<b>5. Conclusion</b>	<b>16</b>
5.1 Summary of amendments	16
<b>References</b>	<b>17</b>
<b>Appendix 1: Application validation summary</b>	<b>18</b>
Table 1: Proposed throughput capacity changes	1
Table 2: Licence Holder controls	6
Table 3: Sensitive human and environmental receptors and distance from prescribed activity	6
Table 4. Risk assessment of potential emissions and discharges from the Premises during operation	10
Table 5: Water chemistry of Bentley mine dewater and Jaguar box cut standing water	13
Table 6: Hydraulic testing at Jaguar mine in 2021	14
Table 7: Consultation	15
Table 8: Summary of licence amendments	16
Figure 1: Jaguar Operation project location	2
Figure 2: Location and extent of underground mine voids	3
Figure 3: Hydrogeological conceptual site model for the Jaguar mine area	4

Figure 4: Dewatering pipeline infrastructure and discharge point at the Jaguar rising main.....5  
Figure 5: Interpreted hydraulic head contours (m AHD) at the premises for July 2021 .....8

## 1. Decision summary

Licence L8151/2005/2 is held by Round Oak Jaguar Pty Ltd (Licence Holder) for the Jaguar Operation (the Premises), located at Leonora, Western Australia, within mining tenements M37/44, M37/515, M37/1132, M37/1153, M37/1228, M37/1230, M37/1257, M37/1290 and M37/1301.

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 L8151/2005/2 has been granted.

## 2. Scope of assessment

### 2.1 Regulatory framework

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

### 2.2 Application summary

On 5 November 2011, the Licence Holder submitted an application to the department to amend licence L8151/2005/2 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendment being sought related to the addition of the inactive Jaguar mining void as a discharge location for mine dewater.

This amendment is limited only to changes to Category 6 activity from the existing licence. No changes to the aspects of the existing licence relating to Category 5 have been requested by the Licence Holder. Furthermore, no changes to assessed production capacity has been proposed for either Categories.

Table 1 below outlines the proposed changes to the existing licence.

**Table 1: Proposed throughput capacity changes**

Category	Current throughput capacity (tonnes per annual period)	Proposed throughput capacity (tonnes per annual period)	Description of proposed amendment
5	3,200,000	3,200,000	No change proposed.
6	500,000	500,000	No change to throughput proposed. Addition of Jaguar mining void as an authorised mine dewater discharge location.

### 2.3 Discharge of mine dewater to Jaguar mining void

The Jaguar Operation comprises the Jaguar, Bentley and Triumph underground copper-zinc deposits. Currently, only the Bentley deposit is undergoing active mining operations, including dewatering to lower the water table and allow for mining of ore (Figure 1).

Dewatering from the Bentley mine is pumped and discharged to the Teutonic Bore Open Cut Pit (TB Pit), which had been previously mined. The TB Pit had previously been mined from 1980 to 1985, before the current Licence Holder commenced operation in 2006. Currently, the TB Pit is the only authorised location for the discharge of mine dewater to the environment.

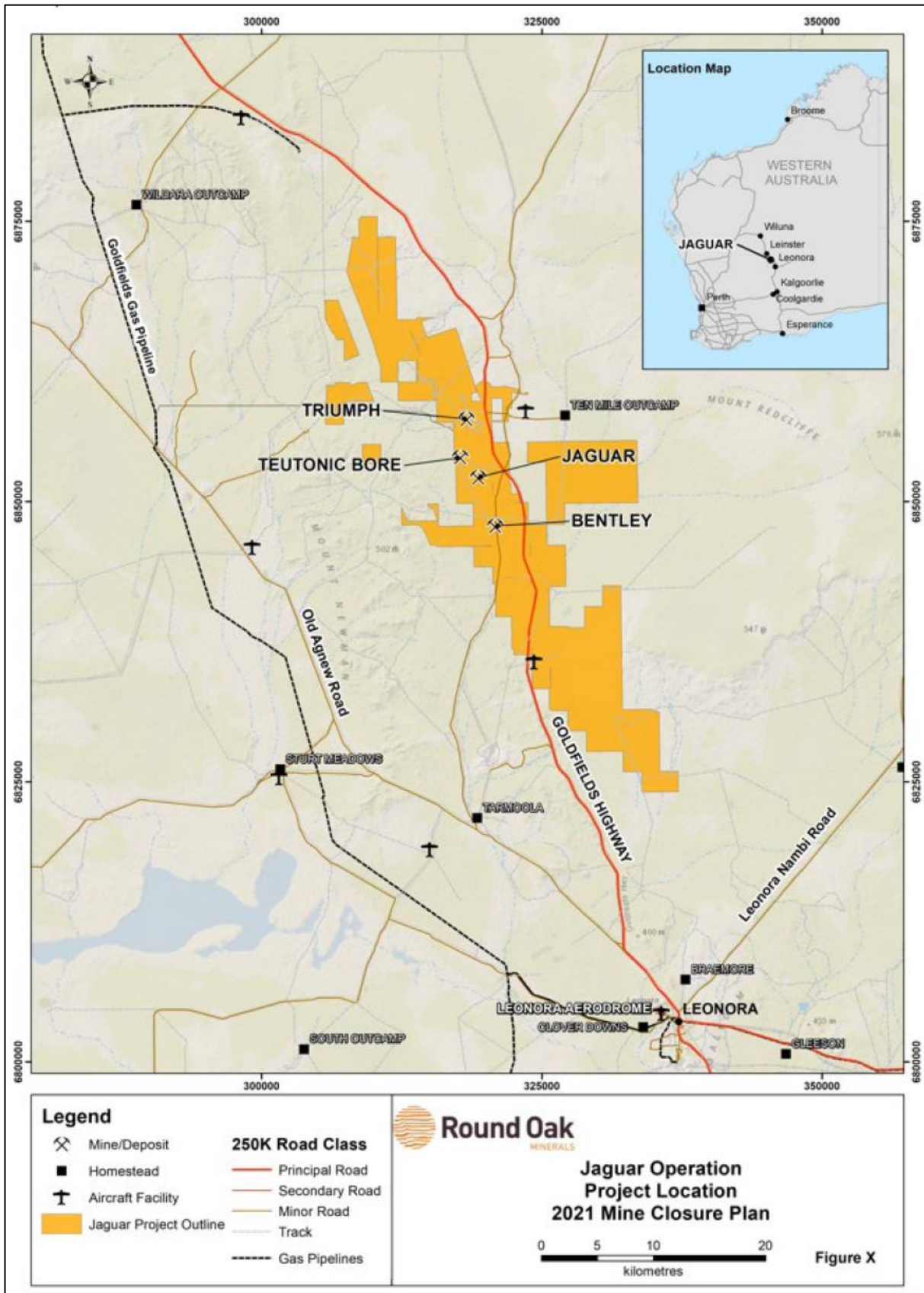


Figure 1: Jaguar Operation project location

The Jaguar underground mine was operational from 2006 to 2014. The mining void is currently inactive and remained as flooded open voids, with most of the stopes backfilled using cemented rock fill. The volume of the mining void is estimated to be approximately 1,800,000 m<sup>3</sup>, with an additional 960,000 m<sup>3</sup> from the box cut, resulting in a total volume of 2,760,000 m<sup>3</sup>. The mining void extends up to six kilometres away from the box cut, as shown in Figure 2.

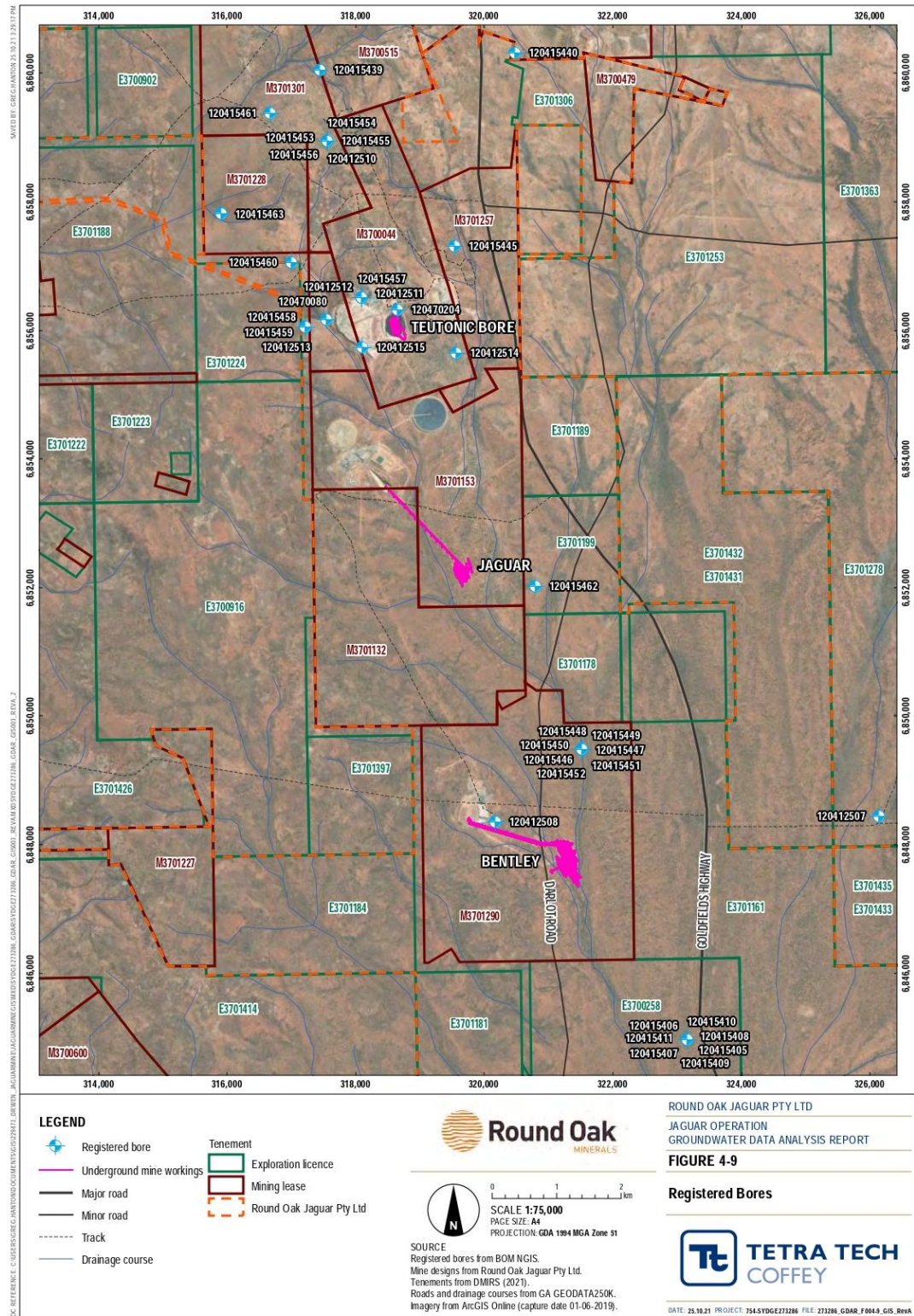


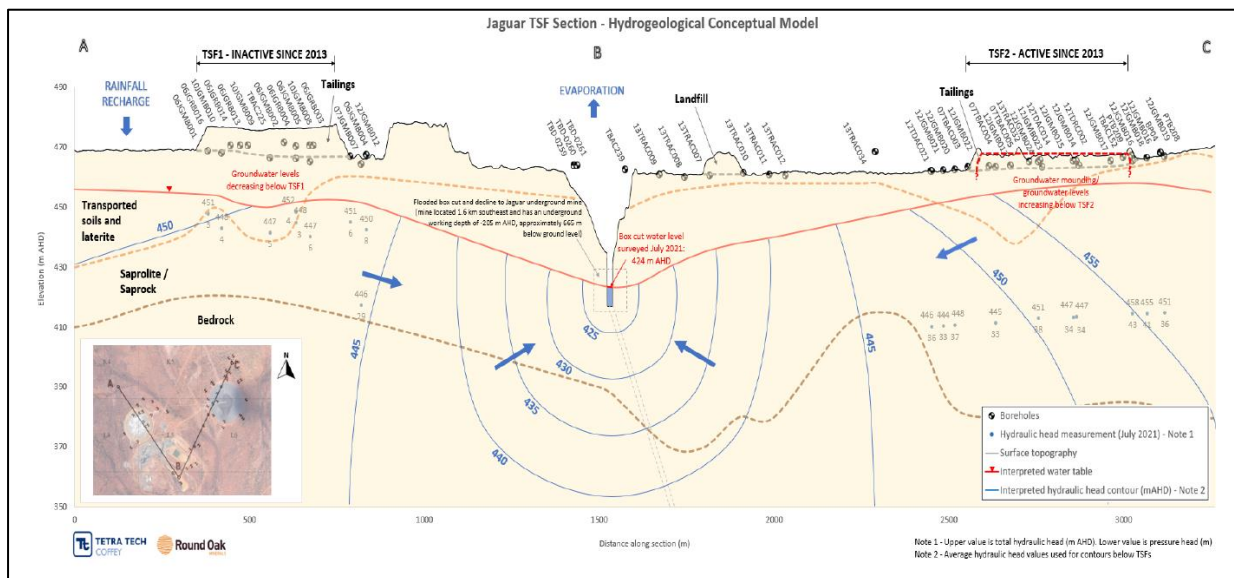
Figure 2: Location and extent of underground mine voids.

Through this amendment, the Licence Holder intends to trial the discharge of mine dewater from the Bentley underground mine into the inactive Jaguar underground mine, as an alternative to the TB Pit. The trial is aimed at establishing the storage capacity of the mining void for mine dewater. Under this amendment, the Licence Holder intends to discharge 100% of mine dewater to the Jaguar mine, in order to facilitate the natural dewatering of the TB Pit.

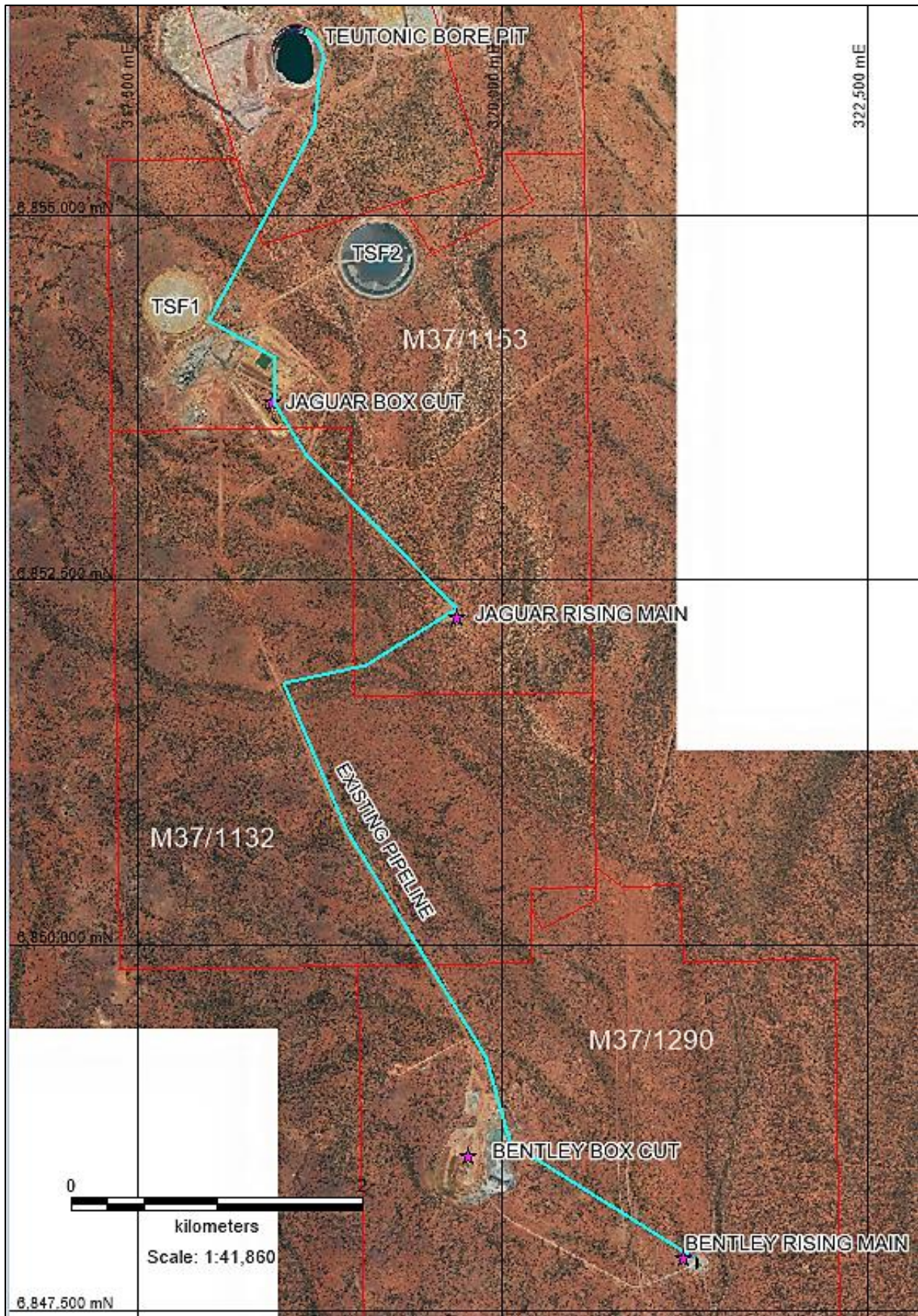
A hydrogeological review undertaken by Tetra Tech Coffey (2021) indicated that groundwater mounding was observed at the Jaguar mine area, despite no longer being operational. This was due to the mine being surrounded by the Premises' two tailing storage facilities (TSF). A hydrogeological conceptual site model suggested that the Jaguar box cut was acting as a sink, with a lower water table due to high evaporative rates and subsequent water loss, resulting in a cone of depression (Figure 3).

The depth of the Jaguar box cut is 60 m below ground level (mgl), with standing water level within the box cut estimated to be approximately 40 mbgl. Groundwater monitoring bores installed at the southern tail-end of the mining void indicated a stable SWL at 25 mbgl between May to October 2021 (Tetra Tech Coffey 2021).

The dewatering pipeline infrastructure is already in place for this new discharge location, as the pipeline from Bentley mine to the TB Pit passes through the inactive Jaguar mine (Figure 4). Only minor changes to routing would be required to divert the discharge point from the TB Pit to the Jaguar mine's rising main, which is approximately 150 m to 200 m below the current SWL. Consequently, no additional clearing or V-drains will be required.



**Figure 3: Hydrogeological conceptual site model for the Jaguar mine area**



**Figure 4: Dewatering pipeline infrastructure and discharge point at the Jaguar rising main.**



### 3. Risk assessment

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

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

#### 3.1 Source-pathways and receptors

##### 3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 2 below. Table 2 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

**Table 2: Licence Holder controls**

Emission	Sources	Potential pathways	Proposed controls
Hypersaline mine dewater	Discharge of Bentley mine dewater to inactive Jaguar mine	Leaks from dewatering pipeline failure	<ul style="list-style-type: none"> <li>Deposition of suspended solids in mine dewater in settlement ponds prior to pumping to reduce internal wear on pipeline.</li> </ul>
		Overtopping of Jaguar box cut	<ul style="list-style-type: none"> <li>Target SWL of 6 mbgl within the Jaguar box cut; and</li> <li>Visual inspection of freeboard at least weekly.</li> </ul>
		Seepage and infiltration from Jaguar mining void	<ul style="list-style-type: none"> <li>Mine dewater to be discharged to the deepest accessible part of the mine through rising main to reduce biological accessibility.</li> </ul>

##### 3.1.2 Receptors

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

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

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

Human receptors	Distance from prescribed activity
None.	N/A
Environmental receptors	Distance from prescribed activity
Native vegetation	Native vegetation comprising open low Mulga ( <i>Acacia aneura</i> ) woodland surrounds the area of proposed activity.

Priority flora	<p>Three priority flora species were recorded within and around the Premises (within 2 km). Most of these were not found in the area of proposed activity:</p> <ul style="list-style-type: none"> <li>• <i>Stenanthemum patens</i> (Priority 1);</li> <li>• <i>Phyllanthus baekeoides</i> (Priority 3); and</li> <li>• <i>Heigenia exilis</i> (Priority 4).</li> </ul> <p>The closest priority flora sighted from the area of proposed activity was <i>Phyllanthus baekeoides</i>, approximately 1.3 km northeast of the Jaguar box cut and 3.1 km northwest of the Jaguar rising main (i.e. point of discharge).</p>
Groundwater aquifer	<p>The standing water level at the Jaguar box cut was estimated to be approximately 40 mbgl. As the box cut is about 60 mbgl, groundwater is likely visible from the surface.</p> <p>Groundwater monitoring at a bore on the south-eastern tail-end of the Jaguar mining void is approximately 25 mbgl, indicating a higher water table in areas surrounding the box cut.</p> <p>Groundwater at the premises is expected to flow in a southerly direction, with a groundwater divide present at the TB Pit, as shown in Figure 5 (Tetra Tech Coffey 2021).</p> <p>Groundwater for a number of bores installed in 2021 indicate groundwater to be more variable in salinity (i.e. total dissolved solids concentrations ranging from 690 mg/L to 4,100 mg/L, depending on location and depth) and pH (i.e. ranging from 6.6 pH units to 7.8 pH units, indicating slightly acidic to slightly alkaline conditions) (Tetra Tech Coffey 2021).</p> <p>The standing water within the box cut is considered saline (i.e. total dissolved solids concentration of approximately 5,000 mg/L) and slightly alkaline (i.e. pH ranging between 7.4 pH unit to 7.7 pH unit).</p> <p>While the groundwater may have other beneficial uses, there are no third-party groundwater users around the premises. However, the Licence Holder does abstract groundwater from a nearby production bore for potable use at their mining camp.</p>
<b>Cultural receptors</b>	<b>Distance from prescribed activity</b>
Aboriginal heritage places	<p>Several Aboriginal heritage places are present near the pipeline between the Bentley mine and Jaguar mining void:</p> <ul style="list-style-type: none"> <li>• Teutonic Bore Rockhole (ID 28842), lodged artefact/scatter and water source located approximately 1 km west of the Bentley mine;</li> <li>• Teutonic Bore 2 (ID 2592), lodged artefact/scatter located approximately 1.6 km east of the dewatering pipeline;</li> <li>• Teutonic Bore Creekline Scatter (ID 28843), lodged artefact/scatter and water source located approximately 1.1 km east of the dewatering pipeline;</li> <li>• Teutonic Bore 1 (ID 2588), registered artefact/scatter located approximately 0.8 km southeast of the Jaguar rising main; and</li> <li>• Well Site (ID 2594), registered artefact/scatter located approximately 1.5 km northeast of the Jaguar rising main.</li> </ul>

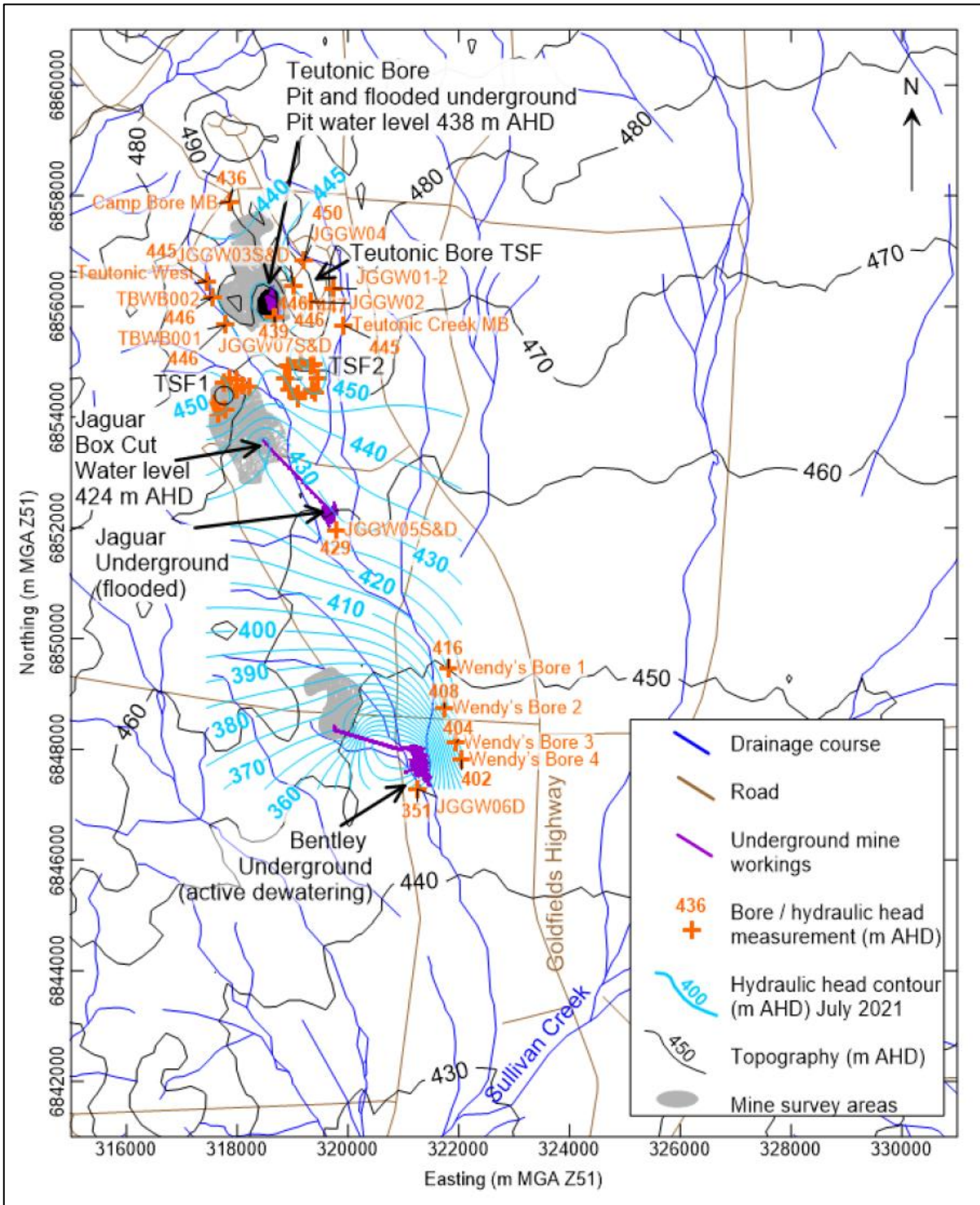


Figure 5: Interpreted hydraulic head contours (m AHD) at the premises for July 2021

## 3.2 Risk ratings

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

Where the Licence Holder has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the Licence Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

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

The revised licence L8151/2005/2 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e. discharge of mine dewater.

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

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

Risk Event					Risk rating <sup>1</sup> C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions <sup>2</sup> of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
<b>Operation</b>								
Discharge of mine dewater from Bentley mine to Jaguar mine void	Saline mine dewater	<p><b>Pathway:</b> Leakage from pipeline infrastructure</p> <p><b>Impact:</b> Discharge to land and potential overland runoff, resulting in ecological disturbance</p>	<p>Native vegetation, including priority flora</p> <p>Aboriginal heritage places</p>	Refer to Section 3.1.1 and Table 2	<p>C = Minor</p> <p>L = Unlikely</p> <p><b>Medium risk</b></p>	Yes	Condition 1.3.5	<p>The Delegated Officer considers the controls proposed by the Licence Holder to be sufficient to control for leaks from pipeline infrastructure resulting in a discharge to land from nearby environmental receptors.</p> <p>Additional regulatory controls are not required, as the pipeline infrastructure proposed are already existing and have been assessed as part of the wider dewatering pipeline network at the premises.</p>
		<p><b>Pathway:</b> Overtopping of Jaguar rising main or box cut</p> <p><b>Impact:</b> Discharge to land and potential overland runoff, resulting in ecological disturbance</p>	<p>Native vegetation, including priority flora</p>	Refer to Section 3.1.1 and Table 2	<p>C = Major</p> <p>L = Unlikely</p> <p><b>Medium risk</b></p>	Yes	<p>Condition 2.1.1</p> <p>Condition 2.4.1</p> <p>Condition 3.4.1</p> <p>Condition 5.2.1</p>	<p>The Delegated Officer considers the controls proposed by the Licence Holder to be sufficient to control for overtopping resulting in a discharge to land from nearby environmental receptors.</p> <p>Additional regulatory controls are not required.</p> <p>The inspection frequency of the Jaguar mine is currently weekly, as a conservative measure proposed by the Licence Holder.</p>

Risk Event					Risk rating <sup>1</sup> C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions <sup>2</sup> of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
		<p><b>Pathway:</b> Seepage and infiltration of mine dewater</p> <p><b>Impact:</b> Discharge to groundwater, potentially resulting in mounding of water table, surface expression of groundwater and degradation of groundwater quality</p>	<p>Native vegetation, including priority flora</p> <p>Groundwater aquifer</p>	<p>Refer to Section 3.1.1 and Table 2</p>	<p>C = Slight</p> <p>L = Possible</p> <p><b>Low risk</b></p>	Yes		Refer to Section 3.3.

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

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

## 3.3 Detailed risk assessment for seepage of saline mine dewater within the Jaguar mining void

### 3.3.1 General characterisation of emission and potential adverse impacts

The primary purpose for this amendment to licence L8151/2005/2 was to authorise the discharge of mine dewater from the Bentley underground mine to the inactive Jaguar mining void. Currently, the Licence Holder is only authorised to discharge mine dewater (from Bentley, Jaguar and Triumph underground mines) to the Teutonic Bore open cut pit (TB Pit).

A detailed risk assessment was undertaken to assess the feasibility of this alternative discharge location and the potential risks presented to the environment. A more detailed assessment of the emission, pathway and receptor environment is required for the potential seepage/infiltration of Bentley mine dewater into the local groundwater system at the Jaguar mining void.

### 3.3.2 Emissions

The emission of concern is mine dewater. Mine dewater could potentially be extracted from three locations at the premises: Jaguar mine, Bentley mine and Triumph mine (Figure 1). Currently, mine dewater is extracted solely from the Bentley mine, as the Jaguar mine is no longer active, and the Triumph project has yet to commence mining operations.

The Licence Holder undertook quarterly analytical testing in 2021 to determine the quality of mine dewater extracted from the Bentley mine (Table 5). Samples were taken from a raw water tank after the mine dewater had been allowed to settle to remove suspended solids. The mine dewater could be characterised as:

- saline, with an average total dissolved solids (TDS) concentration of 6,550 mg/L. This level of salinity is not useful for irrigation but can be consumed by most livestock;
- slightly alkaline, with an average pH of 7.95 pH units;
- dominated by sodium, chloride and sulfate ion; and
- relatively low metal and metalloid concentrations.

According to the groundwater report prepared by Tetra Tech Coffey (2021), the Bentley underground development was -555 mAHD (i.e. approximately 995 mbgl) when surveyed in October 2021. Therefore, it is likely that the dewatering effluent extracted from the Bentley mine is sourced from a deeper aquifer.

### 3.3.3 Pathway

Once discharged into the inactive Jaguar mining void, the saline mine dewater from Bentley mine could potentially enter, and subsequently affect, the local groundwater aquifer and its quality. The determination of whether infiltration/seepage of mine dewater would occur depends on the connectivity between the Jaguar mining void and the local superficial aquifer and whether the mining void acts as a sink or source.

The Jaguar mine was estimated to extend to an elevation of -205 mAHD (i.e. approximately 665 mbgl). The Licence Holder proposed to discharge mine dewater through the rising main at the Jaguar CAF plant, rather than at the box cut. The rising main connects to a part of the underground workings at approximately 150 mbgl to 200 mbgl.

A hydrogeological conceptual site model developed for the Jaguar mine indicated that the Jaguar mine is currently acting as a sink, with high evaporative losses at the Jaguar box cut creating a hydraulic gradient that draws surrounding groundwater towards the Jaguar mine (Figure 3). It should be noted that if the rate of discharge (i.e. input) is greater than the rate of evaporative loss (i.e. output), then the mine may begin to act as a source, rather than sink, promoting the migration of contaminants away from the mining void.

**Table 5: Water chemistry of Bentley mine dewater and Jaguar box cut standing water**

Sample	Unit	Limit of reporting	SOURCE (Bentley mine dewater)						Average <sup>1</sup>	Standard deviation	RECEPTOR (Jaguar boxcut standing water)				Average <sup>1</sup>	Standard deviation
			8/05/2021	9/05/2021	5/06/2021	6/06/2021	16/08/2021	17/08/2021			12/04/2021	7/06/2021	13/09/2021	6/12/2021		
<b>Inorganics</b>																
pH	pH Units	0.1	7.4	7.4	7.6	7.6	7.7	7.7	7.6	0.1	7.9	7.9	8	8	8	0
Electrical Conductivity (EC)	µS/cm	1	6400	6500	-----	-----	-----	-----	6450	71	9600	9200	9500	9400	9425	171
Total Dissolved Solids (grav)	mg/L	5	4900	4800	5100	5100	4900	4900	4950	122	6600	7000	6100	6500	6550	370
Nitrate as N	mg/L	0.005	2.2	1.7	-----	-----	-----	-----	2.0	0.4	22	25	27	20	23	3
<b>Major ions</b>																
Magnesium	mg/L	0.5	72	70	83	82	84	83	79	6	130	140	140	130	135	6
Calcium	mg/L	0.5	560	560	630	640	620	610	603	35	440	470	480	430	455	24
Sodium	mg/L	0.5	780	780	750	750	820	830	785	34	1400	1400	1500	1400	1425	50
Potassium	mg/L	0.5	22	22	22	22	24	24	23	1	27	28	30	27	28	1
Chloride	mg/L	1	1200	1200	1200	1200	1300	1200	1217	41	2500	2500	2600	2600	2550	58
Carbonate as CaCO <sub>3</sub>	mg/L	5	<5	<5	<5	<5	<5	<5	<5	N/A <sup>2</sup>	<5	<5	<5	<5	<5	N/A <sup>2</sup>
Bicarbonate as CaCO <sub>3</sub>	mg/L	5	130	130	120	120	130	130	127	5	120	120	110	110	115	6
Hydroxide as CaCO <sub>3</sub>	mg/L	5	<5	<5	<5	<5	<5	<5	<5	N/A <sup>2</sup>	<5	<5	<5	<5	<5	N/A <sup>2</sup>
Total alkalinity as CaCO <sub>3</sub>	mg/L	5	130	130	120	120	130	130	127	5	120	120	110	110	115	6
Sulphate	mg/L	1	1700	1800	1800	1900	1000	980	1530	423	1200	1300	1400	1300	1300	82
<b>Dissolved metal and metalloids</b>																
Antimony	mg/L	0.001	-----	-----	<0.002	<0.002	<0.001	<0.001	N/C <sup>2</sup>	N/A <sup>2</sup>	0.022	0.025	0.027	0.023	0.024	0.002
Arsenic	mg/L	0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	N/C <sup>2</sup>	N/A <sup>2</sup>	0.012	0.012	0.011	0.007	0.011	0.002
Beryllium	mg/L	0.0005	<0.0005	<0.0005	-----	-----	-----	-----	<0.0005	N/A <sup>2</sup>	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	N/A <sup>2</sup>
Boron	mg/L	0.02	2.3	2.3	-----	-----	-----	-----	2.3	0	2.8	2.4	2.4	2.4	2.5	0.2
Cadmium	mg/L	0.0001	0.0001	0.0001	<0.0002	<0.0002	0.0002	0.0002	0.0002	0.0001	0.049	0.042	0.029	0.029	0.037	0.010
Copper	mg/L	0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	N/A <sup>2</sup>	0.014	0.014	0.008	0.005	0.010	0.005
Lead	mg/L	0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	N/A <sup>2</sup>	0.06	0.045	0.033	0.014	0.038	0.019
Manganese	mg/L	0.005	0.2	0.21	-----	-----	-----	-----	0.21	0.01	0.48	0.46	0.4	0.27	0.40	0.09
Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0005	N/A <sup>2</sup>	<0.00005	<0.00005	<0.00005	<0.00005	<0.0005	N/A <sup>2</sup>
Molybdenum	mg/L	0.001	0.001	0.001	-----	-----	-----	-----	0.001	0	0.019	0.021	0.021	0.023	0.021	0.002
Nickel	mg/L	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.001	0.003	0.005	0.003	0.002	0.003	0.001
Selenium	mg/L	0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	N/C <sup>2</sup>	N/A <sup>2</sup>	0.014	0.016	0.015	0.016	0.015	0.001

Note 1: Red cells indicate that the average concentration for a particular parameter is higher at that sample location, compared to the other sample location.

Note 2: Dashed lines represent no data available as a particular parameter was not analysed for. N/A represents Not Applicable, and N/C represents Not Calculated, due to sample concentrations being below the limit of reporting.



Packer testing and a falling head test was conducted at the Jaguar mine as part of a groundwater investigation in 2004. The hydraulic conductivity assessed from the packer testing of a 456 m test section was 0.0015 m/day (Rockwater Pty Ltd 2004), while falling head test in the 456 m test section was 0.00085 m/day (Rockwater Pty Ltd 2004). In 2021, rising head testing was undertaken at newly installed nested monitoring bores JGGW05S and JGGW05D near the rising main (Table 6). While the testing methodologies and results were varied, the overall hydraulic conductivity is considered to be indicative of low permeability clay and rock, although significant local permeability associated with fractured zones can be present (MBS 2018).

**Table 6: Hydraulic testing at Jaguar mine in 2021**

Monitoring bore ID	Screen depth (mbgl)	Bore depth (mbgl)	Screen length (m)	Screened lithology	Horizontal hydraulic conductivity (m/day)
JGGW05S	44	50	6	Saprolite clay	0.003
JGGW05D	74	80	6	Saprocks	0.03

Although localised groundwater flow regime around the Jaguar mining void is radial, the regional groundwater flow direction is southerly (Figure 5), towards ephemeral lakes and salt pans (MBS 2018). As such, greater consideration should be given to sensitive environmental receptors that are south of the Jaguar mining void.

### 3.3.4 Receptor

The local groundwater aquifer is a significant sensitive receptor that should be considered. The discharge of mine dewater could potentially affect the water quality. It is not known whether both the dewatering point at the Bentley mine and the discharge point at the Jaguar rising main are within the same aquifer.

To assess this, water chemistry from the Bentley mine dewater is compared to groundwater at the Jaguar mining void (Table 5). Overall, the analytical data shows that samples taken from the Jaguar box cut were indicative of a more degraded state, with comparatively higher concentrations of salinity, nitrate, sodium and chloride ions, as well as specific metals and metalloids (e.g. antimony, arsenic, cadmium, copper, lead, manganese, molybdenum and selenium).

It should be noted that the sample taken at the Jaguar box cut may not be representative of the aquifer environment at the Jaguar mine. Firstly, the sample was not taken at the rising main where the discharge location is proposed to be, nor was it taken at a comparative depth. Surface water sampled from the box cut may also be affected by atmospheric and other biological drivers that may not be representative of the deeper discharge environment. For example, the high evaporative rates experienced at the box cut likely led to the concentration of salts, and subsequently an increase in TDS.

Nevertheless, while differences were observed in water quality between the Jaguar and Bentley locations, they are considered to be relatively minor. For example, water was considered saline for both the mine dewater and Jaguar groundwater. Additionally, the Bentley mine is located hydraulically downgradient to the Jaguar mining void. As such, any impacted groundwater at the Jaguar mining void is likely to be captured by either drawdown at the Bentley mine or observed in changes in groundwater monitoring trends in surrounding bores.

The surface expression of groundwater may occur through severe mounding of the water table, which may affect the root zone of native vegetation due to high salinity. While priority flora may also be affected, it is unlikely as they were sighted north of the Jaguar mining void, which is topographically higher. As such, impacted groundwater at the Jaguar mine is unlikely to reach these flora populations.

The high salinity of groundwater at the Jaguar mine and its surrounds also limits its beneficial use. Currently, it is only suitable for use as drinking water for livestock. It is not potable unless treated appropriately. There are no third-party groundwater users in the area. However, the Licence Holder does abstract water for use at their mining camp, though this is hydraulically upgradient from the Jaguar mining void.

### 3.3.5 Risk rating and assessment

The Delegated Officer has considered the extensive information provided by the Licence Holder to support this amendment. Consequently, the outcomes of the detailed risk assessment are as follows:

- The likelihood rating is **possible**, as it is likely that the mine dewater would interact with the local aquifer. While the Jaguar mining void currently acts as a terminal sink for surrounding groundwater, this could be reversed due to additional inputs from mine dewater. Consequently, the mining void could begin to act as a source. Further, while the geology of the Jaguar mine was considered low, there are likely fractured zones that created preferential flow pathway, which may promote the migration of mine dewater.
- The consequence rating is **slight**, as water quality of the discharge (i.e mine dewater) is considered relatively similar to the receiving environment (i.e. Jaguar mine groundwater aquifer). Aside from the aquifer, there are no third-party groundwater users in the area and any impacted groundwater at the Jaguar mining void would flow towards the Bentley mine and be captured by its cone of depression.
- These resulted in a **low** risk rating. The risk event is acceptable.

In accordance with the *Guideline: Risk Assessments* (DWER 2020b), this source-pathway-receptor linkage is likely to only present a low level of risk to sensitive receptors. As such, the Delegated Officer has considered additional regulatory controls to not be necessary at this point. Nevertheless, existing monitoring and reporting conditions in licence L8151/2005/2 have been updated to apply to this dewatering discharge location as well to better understand the impacts of discharges made to the Jaguar mining void (Table 8).

## 4. Consultation

Table 7 provides a summary of the consultation undertaken by the department.

**Table 7: Consultation**

Consultation method	Comments received	Department response
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal on 4 April 2022.	DMIRS provided comments on 6 April 2022 stating that they are currently assessing a Part 2 Mining Proposal Reg ID 101681, which proposed to store mine dewater from the Bentley underground mine in the Bentley turkeys nest dam, with excess dewater discharged to the Teutonic Bore open pit [under GWL159028(7)].  No Mining Proposal relating to the discharge of mine dewater from the Bentley mine to the Jaguar mining void was submitted to DMIRS.	The comments provided did not affect the assessment outcomes of this licence amendment but has been brought to the attention of the Licence Holder when providing draft documents.
Shire of Leonora advised of proposal on	Shire of Leonora responded on 26 April 2022 with no comments to	N/A

4 April 2022.	make in regard to the amendment application.	
Licence Holder was provided with draft amendment on 19 May 2022.	<p>The Licence Holder had no comments regarding the draft amendment.</p> <p>The Licence Holder provided the information requested by the department in the draft amendment.</p>	The department has considered and included the information provided in the amended licence.

## 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 8 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 8: Summary of licence amendments**

Condition no.	Proposed amendments
-	Updated the table describing the licence history in the 'Premises description and licence summary' section
1.3.5	<p>Updated Table 1.3.5 to:</p> <ul style="list-style-type: none"> <li>Clarify the relevant infrastructure for the inspection of the 'embankment freeboard'; and</li> <li>Add the Jaguar mine boxcut as an additional infrastructure for inspection.</li> </ul>
2.4.1	Inclusion of Jaguar mine void as an emission point to groundwater in Table 2.4.1.
3.4.1	<p>Inclusion of:</p> <ul style="list-style-type: none"> <li>Jaguar mine void as a monitoring point; and</li> <li>Limit of 6 mbgl standing water level applied to both Teutonic Bore Pit and Jaguar mine void.</li> </ul>
5.2.1	Inclusion of Jaguar mine void as a reporting requirement in the Annual Environmental Report, in Table 5.2.1.
-	<p>Updated the map of emission points to show mine dewater discharge point at Jaguar mine rising main.</p> <p>Inclusion of map of dewatering pipeline infrastructure.</p>

## 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: Environmental Siting*, Perth, Western Australia.
3. DWER 2020b, *Guideline: Risk Assessments*, Perth, Western Australia.
4. MBS 2018, *Mining Proposal for Jaguar Mine Site TSF2 Embankment Raise and Other Minor Infrastructure M37/1153, M37/1132 and M37/1290*, West Perth, Western Australia.
5. Rockwater Pty Ltd 2004, *Drill Hole Hydraulic Testing and Assessment at Jaguar Base Metal Project. Report for Jabiru Metals Ltd. Report No. 302.0/04/03*, Jolimont, Western Australia.
6. Tetra Tech Coffey 2021, *Jaguar Operation Groundwater Data Analysis Report*, Chatswood, New South Wales.

## Appendix 1: Application validation summary

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)				
<b>Application type</b>				
Works approval	<input type="checkbox"/>			
Licence	<input type="checkbox"/>	Relevant works approval number:		None <input type="checkbox"/>
		Has the works approval been complied with?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Has time limited operations under the works approval demonstrated acceptable operations?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>	
		Environmental Compliance Report / Critical Containment Infrastructure Report submitted?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Date Report received:		
Renewal	<input type="checkbox"/>	Current licence number:		
Amendment to works approval	<input type="checkbox"/>	Current works approval number:		
Amendment to licence	<input checked="" type="checkbox"/>	Current licence number:	L8151/2005/2	
		Relevant works approval number:	N/A	<input type="checkbox"/>
Registration	<input type="checkbox"/>	Current works approval number:	None	<input type="checkbox"/>
Date application received				
<b>Applicant and Premises details</b>				
Applicant name/s (full legal name/s)		Round Oak Jaguar Pty Ltd		
Premises name		Jaguar Operation		
Premises location		Mining tenements M37/44, M37/515, M37/1132, M37/1153, M37/1228, M37/1230, M37/1257, M37/1290		
Local Government Authority		Shire of Leonora		
<b>Application documents</b>				
HPCM file reference number:		2012/006866-2~2		
Key application documents (additional to application form):		Attachment 1A – Tenement Register Attachment 8 – Summary of Proposed Activity Attachment 9 – Fee Calculation Supplementary Information – Licence Amendment to 8151 Jaguar Operation Groundwater Data Analysis Report Jaguar Base Metals Project Management Plan 2005 (Excerpt)		
<b>Scope of application/assessment</b>				

Summary of proposed activities or changes to existing operations.	<p><b>Licence amendment</b></p> <p>Mine dewatering from Bentley underground mine is currently authorised to be discharged to environment at the Teutonic Bore open cut pit.</p> <p>This amendment application proposed to discharge mine dewater to the inactive Jaguar mining void, as an alternative discharge location.</p>
---	--

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

Table 1: Prescribed premises categories

Prescribed premises category and description	Assessed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 5: Processing of beneficiation of metallic or non-metallic ore	3,200,000 tonnes per annual period	No change proposed.
Category 6: Mine dewatering	500,000 tonnes per annual period	No change to production capacity proposed. Changes to authorised discharge point for mine dewater was proposed.

**Legislative context and other approvals**

Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referral decision No: N/A
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Ministerial statement No: N/A EPA Report No: N/A
Has the proposal been referred and/or assessed under the EPBC Act?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Reference No: N/A
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Mining lease / tenement <input checked="" type="checkbox"/> Expiry: 30 January 2026
Has the applicant obtained all relevant planning approvals?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>	Approval: N/A Expiry date: N/A If N/A explain why? Premises is located on mining tenement, regulated under <i>Mining Act 1978</i> . Planning approval not required.
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	CPS No: N/A No clearing is proposed.

Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Application reference No: N/A Licence/permit No: N/A No clearing is proposed.
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Application reference No: N/A Licence/permit No: GWL159028(7) Licence allocation: 2,200,000 kL per annual period
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Name: N/A Type: N/A Has Regulatory Services (Water) been consulted? Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Name: N/A Priority: N/A Are the proposed activities/ landuse compatible with the PDWSA (refer to <a href="#">WQPN 25</a> )? Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>
Is the Premises subject to any other Acts or subsidiary regulations (e.g. <i>Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxx</i> )	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Mining Act 1978
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	N/A
Is the Premises subject to any EPP requirements?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	N/A
Is the Premises a known or suspected contaminated site under the <i>Contaminated Sites Act 2003</i> ?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Mining tenement: M37/1153, M37/44, M37/1301 Classification: Contaminated – restricted use (C–RU) Date of classification: 22 March 2021