



Application for works approval

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

| | |
|------------------------------|--|
| Works approval number | W6388/2020/1 |
| Applicant | Northern Star Resources Limited |
| ACN | 092 832 892 |
| DWER file number | DER2020/000083 |
| Premises | Jundee Operations SHIRE OF WILUNA WILUNA WA 6646 Mining tenements: G53/20 and M53/552 as depicted in Schedule 1. |
| Date of report | 27 May 2020 |
| Decision | Works approval granted |

1. Definitions

Key terms relevant to this decision report and their associated definitions are listed in Table 1.

Table 1: Definitions

| Term | Definition |
|-----------------------|--|
| Applicant | Northern Star Resources Limited |
| Category / categories | Categories of prescribed premises as set out in Schedule 1 of the EP Regulations. |
| Decision Report | refers to this document. |
| Delegated Officer | An officer delegated under section 20 of the EP Act. |
| Department | The department established under section 35 of the <i>Public Sector Management Act 1994</i> and designated as responsible for the administration of Part V Division 3 of the EP Act. |
| DWER | Department of Water and Environmental Regulation |
| Emission | has the same meaning given to that term under the EP Act. |
| EP Act | <i>Environmental Protection Act 1986 (WA)</i> |
| EP Regulations | <i>Environmental Protection Regulations 1987 (WA)</i> |
| JGRSMP | Jundee groundwater recovery seepage management plan |
| mbgl | Meters below ground level |
| Noise Regulations | <i>Environmental Protection (Noise) Regulations 1997 (WA)</i> |
| Occupier | has the same meaning given to that term under the EP Act. |
| Prescribed premises | This has the same meaning given to that term under the EP Act. |
| Premises | refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report |
| Risk Event | As described in <i>Guidance Statement: Risk Assessment</i> |
| SWL | Standing Water Level (mbgl) |
| Works Approval Holder | Northern Star Resources Limited |

2. Overview of premises

2.1 Classification of Premises

Table 2: Classification of premises and assessed design capacity

| Category | Description | Assessed production or design capacity or throughput |
|------------|---|--|
| Category 5 | <p>Processing or beneficiation of metallic or non-metallic ore: premises on which —</p> <p>(a) metallic or non-metallic ore is crushed, ground, milled or otherwise processed; or</p> <p>(b) tailings from metallic or non-metallic ore are reprocessed; or</p> <p>(c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam.</p> | 3,000,000 tonnes per year |

2.2 Description of proposed activity

On 13 February 2020, Northern Star Resources Limited submitted a works approval application to raise the Jundee TSF2. The works applied for are referred to as Stage 9 and 10. Each involve lifting the embankment elevation by 2.5m, to a final elevation of 567mRL. This is the final design height of TSF2. The proposed two lifts will extend the life of the TSF by 2.7 years and enable deposition until 2026.

The infrastructure and equipment are outlined in the table below and the site layout is shown in Figure 1.

| Ref | Infrastructure | Site Layout Plan reference (Figure 1) |
|-----|---|---------------------------------------|
| 1 | Stage 9 upstream embankment raise of TSF2 to RL2564.5m (2.5m raise to the perimeter embankment using compacted mine waste) | TSF 2 |
| 2 | Stage 10 upstream embankment raise of TSF2 to RL2567.0m (2.5m raise to the perimeter embankment using compacted mine waste) | TSF 2 |



Figure 1: Site Layout Plan

TSF2 is identified as Critical Containment Infrastructure, so a Critical Containment Infrastructure Report will be required on completion of the each stage embankment raise. The applicant has applied for Time Limited Operations following completion of stages 9 and 10, but this is not applicable in this case as condition 1.2.2 of the Jundee Licence L6498/1995/11 authorises deposition into TSF2 so no new licence or licence amendment is required.

3. Legislative context and other approvals

The legislative framework for this assessment is the *Environmental Protection Act 1986* (EP Act) and *Environmental Protection Regulations 1987* (EP Regulations).

Relevant guidance documents are outlined in Appendix 1.

Approvals relevant to the premises are outlined in the table below.

| Legislation | Number | Approval |
|--|---------------------------------|---|
| <i>Mining Act 1978</i> | Mining Proposal REG ID 83886 | Jundee Mining Proposal - Tailings Storage Facility 2 (Stages 9 & 10) – Jundee Gold Project - G53/20 & M53/552 - Version 1.2 |
| <i>Environmental Protection Act 1986</i> | W6179/2018/1 | Most recently approved TSF2 raise - stage 8 to RL2562m |
| <i>Environmental Protection Act 1986</i> | L6498/1995/2024 | Operating licence for Jundee Operations |

4. Emission sources, pathways, receptors and controls

4.1 Emissions

The potential for emissions to impact on sensitive receptors has been assessed in accordance with the Department's Risk Framework. The emissions during premises construction which have been considered in this report are dust emissions, emissions of soil/sediment and hydrocarbons.

Noise emissions have not been assessed as there is no receptor present (see section 4.3).

Following completion and compliance with this works approval, deposition of tailings into the newly raised TSF cell will be authorised under existing Jundee licence L6498/1995/11. Key potential emissions during operation will be spills of saline water from tailings or return water pipelines, seepage and failure or overtopping of the TSF embankment. These are risk assessed below to determine if any additional licence conditions are required.

4.2 Pathways

During construction, dust emissions may be dispersed through the air and settle on vegetation, causing reduced photosynthesis and respiration. Sediment and hydrocarbons could contaminate surface water, and run off to impact vegetation.

During operation, hypersaline spills from pipelines or overtopping of the TSF embankment could directly impact vegetation. Hypersaline seepage is likely to cause mounding of contaminated groundwater in the vicinity of the TSF, which may cause vegetation death if it rises into the root zone of the vegetation present. Geotechnical impacts of seepage and overtopping on the stability of the TSF are assessed by the Department of Mines and Industry Regulation, and are beyond the scope of this assessment.

These pathways have been considered in the risk assessment table in Section 5.

4.3 Receptors

Risk is assessed as a combination of emission sources, the proximity and sensitivity of receptors to those emission sources and any pathways that can allow the emission to reach and potentially harm the receptor. The list below provide a summary of human and environmental receptors in proximity to the premises which have a potential to be impacted from site activities, and the risk assessment in Section 5 considers these receptors in the context of emissions and potential pathways.

- Workers, including in the Jundee accommodation camp (located within the Prescribed Premises) are not considered receptors within the scope of the EP Act.
- The nearest residence to the prescribed premises is 33km away. The nearest town is Wiluna, 50km away. The Delegated Officer considers it unlikely that any emissions will impact at this distance. As such, these are not considered to be receptors in this assessment. There are therefore no human receptor identified in this assessment.
- Groundwater in the vicinity of TSF2 is approximately 1000 – 2000mg/L TDS, suitable for stock water. However it is not currently used for stock and the hydraulic conductivity is so low that it is not likely to be a yield significant water. Groundwater is therefore not further considered as a receptor requiring protection.
- The only Environmental Receptor identified is the native vegetation surrounding the TSF.

4.4 Applicant controls

The Applicant has proposed the following management measures as part of the application:

| Emission (as identified above) | Proposed controls or mitigation |
|---|---|
| Hypersaline seepage from TSF 2 (during operation) | <ul style="list-style-type: none">• Ground water management plan• Seepage interception trenches• 15 solar seepage recovery bores• Minimise decant pond size and recover decant water at all times• TSF2 is clay lined |

5. Risk assessment

The identification of the sources, pathways and receptors to determine Risk Events are set out in sections 5.1 and 5.2 below, consistent with the *Guidance Statement: Risk Assessments*. Risk ratings have been assessed for each key emission source and take into account potential source-pathway-receptor linkages.

The controls and mitigation measures proposed by the Applicant have been considered in determining the risk rating. Emissions during construction and operation have been assessed separately to allow clear delineation of activity phases.

The works approval that accompanies this report authorises construction only. Following completion and compliance with this works approval, deposition of tailings into the newly raised TSF cell will be authorised under existing Jundee licence L6498/1995/11. This works approval will require compliance documents to be submitted prior to commencement of deposition into the raised cell.

The conditions in the issued Works Approval, as outlined in sections 5.1 and 5.2, have been determined in accordance with the *Guidance Statement: Setting Conditions*.

5.1 Risk assessment – construction

| Risk Event | | | | Consequence rating* | Likelihood rating* | Risk* | Reasoning | Regulatory controls |
|--|---------------------|--|--------------------|---------------------|--------------------|-------|---|---------------------|
| Source/Activities | Potential emissions | Potential receptors, pathway and impact | Applicant controls | | | | | |
| Vehicle movements on unsealed access roads Earthworks for construction of new TSF raise and associated infrastructure | Dust | Native vegetation (No residences or other sensitive land uses nearby) | NA | Slight | Unlikely | Low | Given the short timeframe of construction, it is unlikely that there will be significant impact to vegetation from increased dust load. | NA |
| | Sediment/soil | Native vegetation impacted through sediment runoff and partial burial | NA | Slight | Possible | Low | No specified ecosystems present. Damage to vegetation by sediment is adequately regulated by the EP (Unauthorised Discharge) Regulations 2004. And general provisions of the EP Act. | NA |
| | Hydrocarbons | Contamination of surface water, and subsequent runoff to vegetation. | NA | Slight | Unlikely | Low | No large storage of hydrocarbons is required, so the risk of hydrocarbon spills is limited to vehicle related and is adequately regulated under the EP (Unauthorised Discharge) Regulations 2004. | NA |

*Consequence ratings, likelihood ratings and risk descriptions are detailed in the Department's Guidance Statement: Risk Assessments (February 2017)

5.2 Risk assessment – operation

| Risk Event | | | | Consequence rating* | Likelihood rating** | Risk* | Reasoning | Regulatory controls (refer to conditions of the granted instrument) |
|---|--|--|--|---------------------|---------------------|--------|---|---|
| Source/Activities | Potential emissions | Potential receptors, pathway and impact | Applicant controls | | | | | |
| Failure of tailings delivery or return water pipeline | Hypersaline tailings or decant water | Direct discharge to native vegetation adjacent to tailings pipelines, causing plant death and soil contamination | As per existing licence | Moderate | Possible | Medium | No specified ecosystems present. In the case of pipe failure, damage to vegetation is possible but existing controls limit the likely volume of discharge and area of damage. | Existing Licence L6498/1995/11 condition: <ul style="list-style-type: none"> 1.2.1 – requirements for pipeline bunding, automatic cut-outs and/or telemetry 1.2.5 - 12 hourly inspections for pipelines |
| Seepage from TSF2 | Increased seepage to groundwater | Mounding of hypersaline groundwater into the root zone of native vegetation, leading to vegetation death. | Please refer to Section 4.4 | Moderate | Possible | Medium | See section 5.3 for detailed discussion. | Existing Licence L6498/1995/11 condition: <ul style="list-style-type: none"> 3.4.1- provides a SWL limit of 1mbg/L for selected compliance bores 5.3.1 – reporting of breach of limit |
| Overtopping of TSF2 | Hypersaline tailings or tailings water | Direct discharge to native vegetation, causing plant death and soil contamination | <ul style="list-style-type: none"> As per existing licence Minimise decant pond size | Moderate | Rare | Medium | Overtopping is unlikely to occur with existing controls. | Existing Licence L6498/1995/11 condition: <ul style="list-style-type: none"> 1.2.4 – specifies minimum freeboard for TSF2 1.2.5 - 12 hourly inspections of freeboard |

*Consequence ratings, likelihood ratings and risk descriptions are detailed in the Department's Guidance Statement: Risk Assessments (February 2017)

5.3 Detailed discussion of Risk event - seepage

There is existing seepage from Jundee TSF2 containing heavy metals, cyanide and TDS in excess of 10000 mg/L. Groundwater mounding due to seepage is likely to severely impact nearby vegetation should it enter the vegetation root zone, due to its salinity. Increasing the height of TSF2 will increase the hydraulic head within the TSF, and is therefore likely to increase the rate of seepage.

The 'Jundee groundwater recovery seepage management plan' (JGRSMP) issued 5/11/2017 and submitted with this works approval application is a mature document that is currently used to manage seepage and groundwater levels. 'Target' and 'trigger' water levels are identified for each compliance monitoring bore, and management actions suggested as per Table 2. It is noted that the original JGRSMP submitted in April 2013 (A625215) included an additional level of management for when the trigger limit is exceeded for 4 consecutive periods which has since been removed.

Table 2: Management Actions from 'Jundee groundwater recovery seepage management plan'

| Groundwater Level/Trend | Potential Management Actions |
|--|---|
| Above target level for two consecutive monitoring periods, with water level rising | <ul style="list-style-type: none"> • Undertake visual assessment in area to assess whether vegetation has been impacted. • Increase pumping rate at nearby recovery bores if practicable. |
| Above trigger level for two consecutive monitoring periods, water level rising | <ul style="list-style-type: none"> • Undertake visual assessment in area to assess whether vegetation has been impacted. • Increase pumping in nearby recovery bores, if practicable. • Undertake preliminary investigation to improve seepage recovery. |
| (Additional row in 2013 version only, not current) | |
| Above trigger level for four consecutive monitoring periods, water level rising | <ul style="list-style-type: none"> • Undertake visual assessment in area to assess whether vegetation has been impacted. • Increase pumping in nearby recovery bores, in area, which may include: <ul style="list-style-type: none"> ○ Undertaking of hydrogeological and geophysical investigations to determine the source of the seepage; ○ Installation of additional recovery bores to intercept seepage mounding; ○ Calibration of the numerical modelling to forecast the effectiveness of any proposed amelioration schemes; and ○ Notification to the DEC outlining course of action and anticipated amelioration outcomes. |

It is a concern that the trigger level for several bores (JMB11, JMB19 and JMB20) is equal to the licence limit. The Delegated Officer recommends that the Licence Holder review the JGRSMP and consider if higher trigger levels are required to ensure licence limits for SWL are met. However due to the department's preference for outcome-based conditions (DER, 2015b), conditions will not be placed on the Works Approval regarding this update. It remains the licence holder's responsibility to ensure that seepage is managed to ensure licence limits are not breached.

A hydrological assessment was undertaken by Saprolite Environmental in October 2019 (Saprolite, 2019) to assess current levels and trends in groundwater levels around Jundee TSFs 1 and 2, and the effectiveness of existing seepage recovery efforts. This identified that the most significant risk of seepage to be mounding within 1m of the surface, as the deepest identified root system in the area was approximately 80cm deep. This is consistent with the existing licence condition 3.4.1, requiring standing water level to remain more than 1m below ground level in selected monitoring bores. It is noted that the limit is not applied to all compliance bores. However those to which it does not apply currently have deeper groundwater so are considered lower risk. Target and trigger SWL limits have been specified

for all compliance bores, including these deeper ones, in the JGRSMP.

The assessment (Saprolite, 2019) established that the ground around and under TSF2 is very low permeability, so groundwater plumes move slowly. It also identified a shallow ferricrete layer between 1 and 6m below the surface, which can lead to perched shallow groundwater mounds. The current groundwater mound around TSF2 is in some areas very shallow, which is thought to be due to the presence of this low permeability stratum.

The assessment (Saprolite, 2019) compares standing water levels at the compliance bores in June 2019 with the target and trigger SWLs. One bore (JMB28) was found to be exceeding its nominated trigger limit, but still outside the root zone with a SWL of 1.26mbgl. Six other bores were shallower than their target SWL but below their trigger levels, and all of these had water levels in excess of 2mbgl. The remaining 9 bores were at or deeper than their target depths.

Increased hydraulic head from the proposed TSF raise is likely to make it more difficult for Northern Star Resources to contain SWLs below their trigger and licence limits. However the limits on the existing licence, if met, provide an acceptable level of environmental protection.

There is a current project underway to increase seepage recovery rates from the existing network of mostly solar operated bores. This involves replacing the aging solar panels, and installing batteries so they can be run overnight as well as during daylight hours. DWER supports this initiative. However due to the department's preference for outcome-based conditions (DER, 2015b), conditions will not be placed on the Works Approval regarding this upgrade.

It is considered **Possible** that mid level on-site impacts to vegetation (**Moderate** consequences) could occur due to increased seepage and associated groundwater mounding around TSF2. The Delegated Officer therefore considers the risk to be **Medium**.

5.4 Regulatory controls

The Delegated Officer considers that there are no environmental risks during construction that require specific regulatory controls. The existing regulatory controls in Licence L6498/1995/11 are considered suitable to control the risks during operation.

The decision report for the previous (stage 8) TSF 2 raise (W6179/2018/1) includes recommendation for additional licence conditions. However these have not been added to licence L6498/1995/11, as it was considered that the existing licence authorised deposition into TSF2, and therefore there was no trigger to require a licence application. A DWER initiated amendment was not undertaken. The recommendations are considered in Table 1.

Table 3: Licence conditions recommended in the decision report for W6179/2018/1

| Recommendation | Comments |
|--|---|
| Reporting of the monthly water balance over TSF2 and TSF1 will be required to be submitted to the CEO on a quarterly basis, detailing the amount of seepage recovered from toe drains and recovery bores and the amount recovered from decant return as percentage of the slurry water discharged. | Provides improved oversight of tailings water management but is not outcomes-based. Will be considered in next licence amendment, but does not preclude issuing of this works approval. |
| An improvement condition will be added to the Licence to characterise the risk posed to wildlife by cyanide discharge in tailings supernatant. | Risk not altered by the works assessed. Will be considered in next licence amendment. |
| The groundwater quality parameters for analysis will be revised, with selenium added and other parameters added where necessary. | Not relating to the works assessed. This arises out of an improvement condition on L6498, and will be considered in the next licence amendment. |

6. Consultation

| Method | Comments received | DWER response |
|---|--------------------------------------|-----------------|
| Application advertised on DWER website (11/5/2020) | None | NA |
| Local Government Authority advised of proposal (6/5/2020) | None | NA |
| Department of Mines Industry Regulation and Safety advised of proposal (6/5/2020) | None | NA |
| Applicant referred draft documents (26 May 2020) | Minor corrections and clarifications | Added/corrected |

7. Conclusion

Based on the assessment in this decision report, the Delegated Officer has determined that a works approval will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Tim Gentle
MANAGER RESOURCE INDUSTRIES
INDUSTRY REGULATION

An officer delegated by the CEO under section 20 of the EP Act

Appendix 1: Key documents

| Document title | In-Text Reference | Availability |
|---|-------------------|---|
| Works Approval (W6388/2020/1) application form and supporting documentation (13/2/2020) | This application | DWER records (Application form A1869810; all attachments in DER2018/001042-3~2) |
| Jundee TSF hydrological assessment and review to June 2019 (Saprolite Environmental) (October 2019) | Saprolite, 2019 | DEWR records (A1849372) |
| DER, July 2015. <i>Guidance Statement: Regulatory principles</i> . Department of Environment Regulation, Perth. | DER, 2015a | accessed at www.dwer.wa.gov.au |
| DER, October 2015. <i>Guidance Statement: Setting conditions</i> . Department of Environment Regulation, Perth. | DER, 2015b | |
| DER, February 2017 <i>Guidance Statement: Risk Assessments</i> . Department of Environment Regulation, Perth. | DER, 2017 | |
| DWER, June 2019 <i>Guideline: Decision Making</i> Department of Water and Environmental Regulation | DWER, 2019 | |
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