Decision Report

Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Works Approval Number	W6195/2018/1
Applicant	Egan Street Rothsay Pty Ltd
ACN	151 137 450
File Number	DER2018/001576
Premises	Rothsay Gold Project Mining Tenements M59/39 and M59/40 PERENJORI WA 6620
Date of Report	15 November 2019
Status of Report	Final

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Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
AACR	Annual Audit Compliance Report
ACN	Australian Company Number
AER	Annual Environment Report
Applicant	Egan Street Rothsay Pty Ltd
ASC NEPM	*National Environmental Protection (Assessment of Site Contamination) Measure 1999* as amended
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CS Act	*Contaminated Sites Act 2003* (WA)
DBCA	Department of Biodiversity, Conservation and Attractions
Decision Report	refers to this document.
Delegated Officer	an officer under section 20 of the EP Act.
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the *Public Sector Management Act 1994* and is responsible for the administration of the *Environmental Protection Act 1986* along with other legislation.
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
LPG	Liquid Petroleum Gas

m^3	cubic metres
Minister	the Minister responsible for the EP Act and associated regulations
MS	Ministerial Statement
mtpa	million tonnes per annum
NEPM	National Environmental Protection Measure
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
Occupier	has the same meaning given to that term under the EP Act.
PM	Particulate Matter
PM_{10}	used to describe particulate matter that is smaller than 10 microns (µm) in diameter
Prescribed Premises	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
Primary Activities	as defined in Schedule 2 of the Revised Licence
Risk Event	As described in *Guidance Statement: Risk Assessment*
RL m	Recurrence Level metres
ROM	Run of Mine
TDS	Total dissolved solids
TSF	Tailings Storage Facility
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
$\mu g/m^3$	micrograms per cubic metre
µg/L	micrograms per litre
WAD CN	Weak acid dissociable cyanide

1. Purpose and scope of assessment

This is a new Works Approval application for the pre-existing Rothsay Gold Project (the Project), applied for by Egan Street Rothsay Pty Ltd (Applicant). The Applicant is seeking approval to recommence underground mining operations for a 6.5 year period to produce approximately 250,000 ounces of gold.

The Applicant has applied to dewater the underground workings, mine the underground resource, construct and operate a carbon in leach process plant for gold production, and expand the existing tailings storage facility.

1.1 Application details

Table 2 lists the documents submitted during the assessment process.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received
Application form: Works Approval / Licence / Renewal / Amendment / Registration	31 October 2018
Egan Street Resources, Rothsay Gold Project, Works Approval Application Supporting Document, M59/39 and M59/40	8 November 2018
Egan Street Rothsay Gold Project - Response to DWER Queries on W6195_2018_1	18 January 2019
Rothsay Works Approval Application W6195/2018/1 - Additional Information for Attachment D of the Egan Street Response Letter	22 January 2019
Rothsay Gold Project W6195/2018/1, Response to Cyanide Monitoring in Groundwater	29 March 2019
Rothsay Gold Project W6195/2018/1: Additional Information Fauna Controls	11 April 2019
Rothsay Gold Project W6195/2018/1: Additional Information Temporary Dewatering Infrastructure	11 April 2019
RE: W6195 Rothsay Premises Boundary	7 May 2019
Rothsay Gold Project: EganStreet Response to DWER Query on Reagent Store and TSF Sampling	21 June 2019
Rothsay Gold Project - Comments on Draft Works Approval Documents	31 October 2019

2. Background

The mine is named after the historical town Rothsay, which was gazetted in 1898 after gold was first discovered in 1894. The Project was previously operated from 1898 – 1902 and was closed mainly due to uneconomical treatment options to remove the copper-rich ore associated with the gold mineralisation.

The mine was reopened from 1935 – 1940 and since then the town site has been abandoned.

The Project was last mined from 1989 – 1991 and mining ceased due to the weakened gold price. Extensive underground development infrastructure remains in place from this time.

However, surface infrastructure was decommissioned and removed from site. Previous Works Approvals and Licenses were obtained from the operators at that time, but all are now inactive.

Table 3 shows what existing infrastructure is to be incorporated into the proposal.

Table 3: Integration of Existing Infrastructure and Historic Workings into the Proposal

Existing Infrastructure and Facilities	Proposed Works Program
Underground workings – portal located in the Woodley's Pit leading to a decline	To be rehabilitated and refurbished.
British Queen Shaft	To be used to run the pipework for initial mine dewatering. May be used as an additional ventilation shaft subject to its condition.
Groundwater monitoring and production supply bores	Water supply bores to be used in the minor and major works program, in accordance with the existing Licence to Take Water. All historic bores will continue to be used for annual monitoring and reporting commitments for the life of the Project and through the mine closure process.
A network of internal roads and tracks	To be upgraded (as necessary) in the minor and major works programs.
An airstrip	The Project will commence as a drive in/drive out arrangement. If an extension to the airstrip is required relevant approvals will be sought.
A tailings storage facility (1 M tonnes)	Approval is being sought in the major works program for annual embankment raises of the existing TSF for the first 5 years of mine life. Environmental approvals will be sought during year three to four of operations in order to accommodate the increased volume of tailings for a 6.5 year mine life.
A stockpile of low grade ore (3,000 m^3)	Either to be blended for processing through the new plant or used as a base stockpile site to add new low grade material, depending on the cut off gold grade.
A waste dump (8,000m^3)	To be addressed in the Mine Closure Plan reporting mechanism through DMIRS.
Five open pits, referred to in this proposal as the Orient Pit and Woodley's Pits.	Abandonment bunds have been established around the perimeter of the pits to maintain a safe work space. Portions of the Woodley's Pit North will be backfilled with construction and demolition waste from mine refurbishment activities. This void has been used previously by Metana for this purpose.
Numerous small historical underground openings and workings; excavated using hand tools from the late 1800's to early 1900's.	Historical workings within the immediate vicinity of the activity areas have been made safe by bunding and signage as necessary. The Shire of Perenjori and the Department of Biodiversity, Conservation and Attractions (DBCA) have been consulted on allowing access to some workings as part of the Karara Rangelands tourism park.
Remnants of the historical Rothsay township including chimney stacks, water storage, a cemetery and an historical mine managers house	These items are included in the Karara Rangelands as part of a tourism initiative by Shire of Perenjori & the DBCA. Signage will be erected to prevent access to these sites during active mining. The cemetery site will be the only historic site to remain open to the public during this time. Information panels will be installed near the cemetery area to provide descriptions and photographs of other historic sites not able to be accessed by the public.

Remanent footings from the demobilised crush and grind circuit and the Run of Mine (ROM) pad.	Historical workings within the immediate vicinity of the activity areas have been made safe by bunding and signage as necessary. The Shire of Perenjori and the Department of Biodiversity, Conservation and Attractions (DBCA) have been consulted on allowing access to some workings as part of the Karara Rangelands tourism park.
Concrete footings and pathways from the demobilised accommodation camp	Old concrete footings and pathways will be removed and disposed of as construction and demolition waste. A new accommodation camp will then be constructed at the same location.
Safety signs, barricades and bunding. Magazine compound and bunding. Survey markers.	These items will be re-used in this proposal as appropriate.

Table 4 lists the prescribed premises categories that have been applied for under this works approval.

Table 4: Prescribed Premises Categories

Classification of Premises	**Description**	***Approved Premises production or design capacity or throughput***
Category 5	Processing or beneficiation of metallic or non-metallic ore: premises on which — (a) metallic or non-metallic ore is crushed, ground, milled or otherwise processed; or (b) tailings from metallic or non-metallic ore are reprocessed; or (c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam.	200,000 tonnes per annum
Category 6	Mine dewatering: premises on which water is extracted and discharged into the environment to allow mining of ore	233,000 tonnes over a four month period (temporary discharge to drainage line) 316,000 tonnes per annum (permanent discharge to Evaporation / Infiltration Pond))
Category 64	Class II or III putrescible landfill site: premises on which waste (as determined by reference to the waste type set out in the document entitled “Landfill Waste Classification and Waste Definitions 1996” published by the Chief Executive Officer and as amended from time to time) is accepted for burial	250 tonnes per annum

3. Overview of Premises

3.1 Operational aspects

Ore processing, dewatering to allow mining of ore and a landfill are the key activities onsite.

Category 5

Crushing and Ore Sorter:

Ore is to be trucked to the ROM pad where separate high, medium and low grade ore stockpiles

will be created prior to blending and feeding into the crushing circuit via a loader.

Tertiary crushing has been selected due to the hardness of the ore, which will comprise of a jaw crusher, two cone crushers and a double deck screen. The crushing will reduce the ore in preparation for optional screening through an ore sorter, while ore of sufficient grade will bypass the ore sorter and continue onto the milling circuit.

The ore feeder processes the lower grade ore.

Milling and Gold Processing:

This circuit can process 200,000 tonnes of ore per annum and consists of the following process stages, as shown in Figure 1:

- Ball milling with gravity concentration – milling reduces the crushed ore to a final product size suitable for gold recovery by gravity concentration or leaching. Quicklime is added to mill feed and process water to main the mill discharge slurry density at 70% solids;
- Leaching and adsorption – mill underflow will be leached into solution as gold cyanide which is adsorbed onto activated carbon;
- Elution and electrowinning – loaded carbon will be stripped and include an acid wash with dilute hydrochloric acid solution to dissolve foulants. This acid and rinse water will be sent to the tailings thickener for disposal to the TSF. Cyanide soluble copper in the ore will be adsorbed onto the activated carbon and a cold elution step is incorporated to remove this copper prior to electrowinning. The cold eluate and rinse water will be discharged into the cyanide detoxification circuit for treatment. Carbon is then treated with a caustic-cyanide solution at a high temperature and pressure. Sodium cyanide solubilises the gold cyanide complex and sodium hydroxide maintains a high pH to minimise toxic hydrogen cyanide gas. The gold on the carbon will desorb into a pregnant solution prior to electrowinning.
- Smelting – Gold recovered from the gravity concentration from the milling circuit and gold recovered from the pregnant eluate solution through electrowinning will be smelted using a LPG fired tilting furnace in the Gold Room. Both smelted products will be sent to a refinery for further processing to produce gold bullion.
- Cyanide Detoxification – Screen leached tailings from the leaching circuit will be pumped to the Cyanide Detoxification tank where residual free and WAD cyanide will be oxidised via addition of sodium metabisulphite and oxygen in the presence of copper in solution as the catalyst. Hydrated lime slurry will be added to maintain a pH of 8 – 9 to neutralise the sulphuric acid generated during the detoxification reaction and to oxidise any released metal species.
- Tailings Thickening – detox material will be pumped to the tailings thickener prior to flocculation and discharge to the TSF. Overflow will be pumped to the Process Water Dam or tank.

TSF:

A single cell configuration TSF with a footprint of 15 ha is to be situated in a valley setting between gently sloping hillsides that form the boundaries along the north and south sides of the existing TSF previously used. Thickened tailings of 45 – 60% solids will be pumped from the Process Plant to the TSF via a single pipeline that connects to the south corner of the TSF. Deposition will occur using sub-aerial multiple spigots distributed along the whole length of the embankment. Deposition locations will be progressively moved to control the location of the supernatant pond away from the embankment and maximise available storage. The decant system will consist of an access causeway from the natural ridge to a concrete decant tower at the centre of the causeway. The causeway will be raised for each stage.

The hazard rating for the main and north embankments is “Medium Category 1” and the hazard rating for the south embankment is “High Category 1” based on the classification criteria outlined in the Code of Practice: Tailings storage facilities in Western Australia (DMP, 2013).

Detailed drawings can be found in Schedule 2, Site Plans 1 – 4 of the Works Approval document and refer to Figure 5.

Embankment staging is described in Table 5.

Table 5: Proposed embankment staging

Stage	Construction Year*	Embankment Configuration	Years Capacity	Embankment Level (RL m)	Rate of rise (m/y)
1	0	Downstream	1	366.5	-
2	1	Downstream	1	368.5	2.0
3	2	Combination*	1	370.1	1.6
4	3	Combination*	1	371.7	1.5
5	4	Combination*	1	373.1	1.5

* Main embankment will be built using upstream configuration, while the south embankment will be built using downstream configuration.

Category 6

Mine dewatering infrastructure is to be located underground with a bore pump installed within the British Queen Shaft. Initially pipelines will be installed to direct the dewatering water to an ephemeral drainage line for temporary disposal for a four month period (233,000 tonnes abstracted over the four months). This raw water will also pond in a previously excavated depression to be used by water trucks in dust suppression during construction. This temporary discharge method will be used for the first four months until the permanent disposal method of the evaporation/infiltration pond method is implemented.

During permanent operations, 505 ML/annum is expected to be abstracted, and excess dewater will be placed within a 21,580 m^3 evaporation/infiltration pond that is to be constructed. The evaporation/infiltration pond will have a permeability of 2mm/hr infiltration.

Some raw water will also be placed within a Raw Water Dam of total capacity 890 m^3 and this water will be used as make up water for the Process Plant.

Category 64

The permanent landfill will be fenced and located approximately 920m south of the camp. Waste will be delivered to trenches in a trailer or by truck and tipped/thrown into the trenches. There will be separate trenches for the putrescible and inert wastes and these are to be covered at least once per fortnight using the excavated trench soils.

Used tyres will be disposed of in accordance with Part 6 of the EP Regulations. Other options for recycling or disposal of tyres offsite are also being investigated.

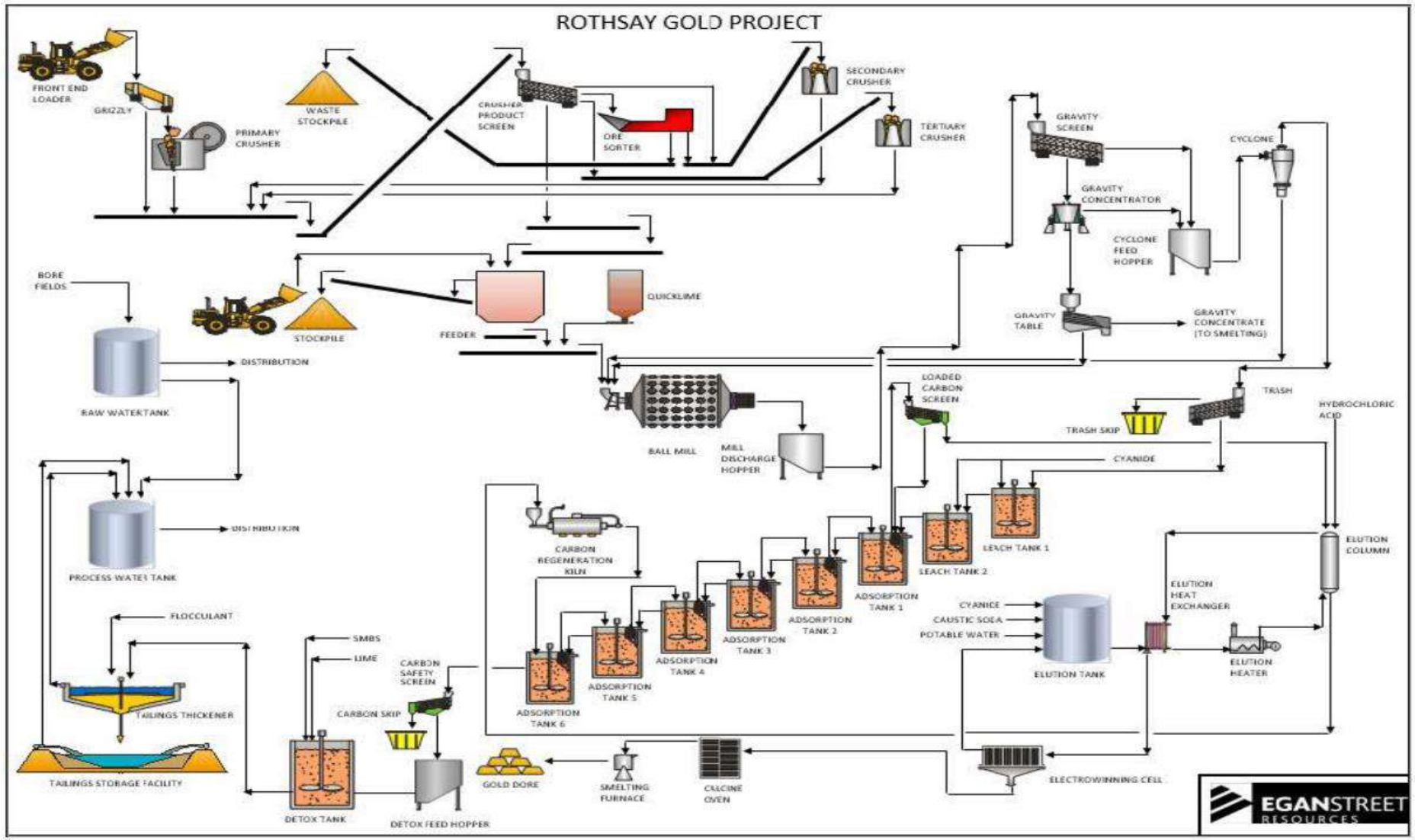

Figure 1: Process Flow Overview

3.2 Infrastructure

The Rothsay facility infrastructure, as it relates to Category 5, 6 and 64 activities, is detailed in Table 6 and with reference to the Site Plan (attached in the Works Approval).

Table 6 lists infrastructure associated with each prescribed premises category. Figure 2 shows the site layout.

Table 6: Rothsay facility Category 5, 6 and 64 infrastructure

	Infrastructure	**Site Plan Reference**
	Prescribed Activity Category 5	
Crushing circuit, ore sorter, milling and gold processing plant		
1	Run of Mine	Schedule 1: Premises map
2	Run of Mine bin	
3	1 x Jaw crusher	
4	2 x cone crushers	
5	1 x double deck screen	
6	Ore sorter utilising optical laser technology and/or electromagnetic scanning technology	
7	Ball milling with gravity concentration	
8	Leaching and adsorption	
9	Elution and electrowinning	
10	Smelter	
11	Cyanide detoxification	
12	Tailings thickening	
13	HDPE lined 2,160 m^3 Process Water Dam	
14	HDPE lined 1,774m^3 Plant Drainage Retention Pond	
15	Tailings Storage Facility, valley setting, single cell configuration, side-hill three-sided embankment (constructed on existing footprint of previous TSF): • 10-15 tailings discharge spigots distributed equally around the perimeter of the TSF. (new infrastructure) • Decant removal system (new infrastructure) • Perimeter cut-off trench (new infrastructure) • Toe drain reporting to underdrainage collection tower (new infrastructure) • Tailings slurry and decant return pipelines within 10^{-9} permeability corridor with sufficient capacity to ensure all solids and liquors are captured within the trench (new infrastructure) • Flow meters installed on pipelines (new infrastructure • Embankment staging: ➢ Lift 1 embankment crest level of RL366.5m; ➢ Lift 2 from embankment crest level of RL366.5m to crest	

	Infrastructure	Site Plan Reference
	level of RL368.5m; ➢ Lift 3 from embankment crest level of RL368.5m to crest level of RL370.1m; ➢ Lift 4 from embankment crest level of RL370.1m to crest level of RL371.7m; ➢ Lift 5 from embankment crest level of RL371.1m to crest level of RL373.1m. • Six groundwater monitoring bores: ➢ BH-01, 488295.9E, 6760632.9N; ➢ BH-02, 488376.2E, 6760715.9N; ➢ BH-05, 488106.4E, 6760666.3N; ➢ BH-06, 488294.3E, 6760940.6N; ➢ BH-07, 487881.8E, 6761033.9N; • Four piezometers (new infrastructure): ➢ PZ-01, 488125.5E, 6760661.8N; ➢ PZ-02, 488301.6E, 6760656.8N; ➢ PZ-03, 488420.9E, 6760803.4N; ➢ PZ-04, 488360.4E, 6760920.0N;	
16	Reagents Store	
	Prescribed Activity Category 6	
Mine dewatering infrastructure located in underground workings.		
1	Conventional bore pump lowered within the shaft	Schedule 1: Premises map
2	110 mm HDPE transfer pipelines run between the bore pump to the disposal point on the surface	
3	Primary pump stations consisting of 2 x helical rotor pumps with a capacity of up to 40L/s	
4	Centrifugal secondary pumps both at drive faces in sumps, with drain holes drilled to connect level sumps and reduce requirements for centrifugal pumps, where possible	
5	Travelling helical rotor pumps to advance down the decline	
6	140 mm HDPE lines to transfer groundwater from the primary pump circuit to a rising main	
7	Rising main consisting of 150 mm diameter steel line connected to a surface disposal pipe	
8	Abstraction point RYDW near the British Queen Shaft	
9	A 1.5km pipeline in an earthen bund to deliver mine dewater from the portal to the Evaporation/Infiltration Pond. Includes a tee section for some offtake to the Raw Water Dam	
10	HDPE lined 890m^3 Raw Water Dam, consisting of two cells	
11	Temporary discharge to ephemeral drainage line	
12	Permanent discharge to Evaporation / Infiltration Pond with a final storage volume of 21,580m^3 + 2mm/hr infiltration. Includes a minor spillway and a 50m diversion bund	
	Prescribed Activity Category 64	

	Infrastructure	Site Plan Reference
Landfill area has been selected 920 m to the south of the camp		
1	Putrescible trenches 20 m long x 1.2 m wide	Schedule 1: Premises map
2	Industrial trenches 30 m long x 4 m deep	
3	Woodley's Pits 130 m long x 15 m wide x 10 m deep Inert construction and demolition waste (old concrete footings and pathways, vent bags and structural mesh mixed with rock from refurbishment of the underground mine)	
4	Tyre disposal, with investigations for recycling or disposal offsite	
5	Scrap metal storage area near the Processing Plant collected for recycling by contractor	
6	Recycling area	
7	Fenced	
8	Bio-pad area within the landfill fenced compound for management of hydrocarbon spills to soil	

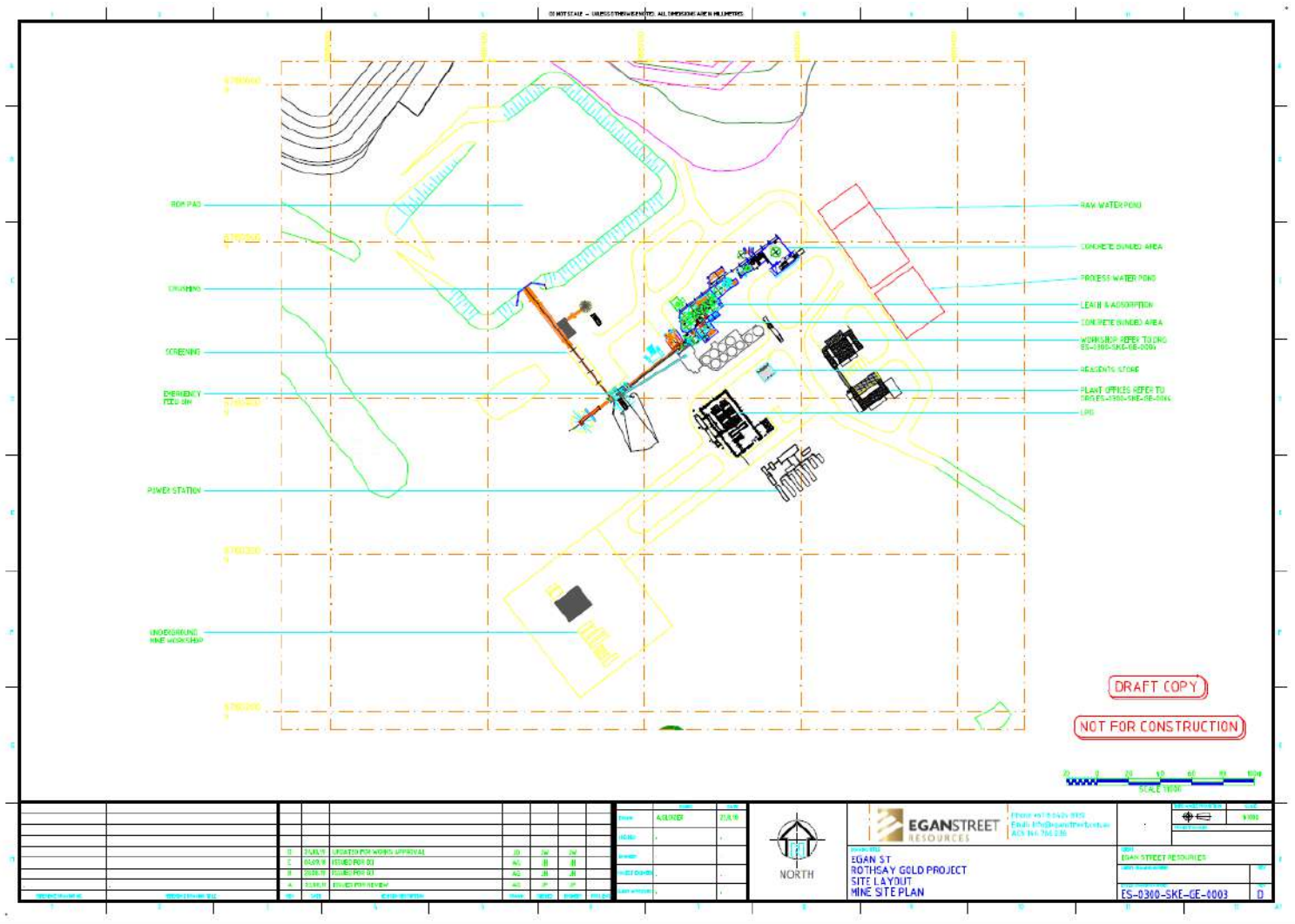

Figure 2: Site Layout

3.3 Exclusions to the Premises

Minor works, as listed in Table 7 for an accommodation camp, power station, landfill and fuel facility are below the triggers of the prescribed premises categories listed in the EP Regulations.

Table 7: Minor Works Program Activities

Minor Works Program Activities	Scale or Production Capacity (Life of Project)
Power Station	6MW
Fuel Storage	440kL
Accommodation Camp	100 persons
Wastewater Treatment System	19m^3/day capacity
Temporary landfill and disposal of inert construction and demolition waste	Less than 20 tonnes per year
Potable Water / Reverse Osmosis Plant	2 x 37.5kL tanks and plant
Mine Workshop and Wash Down Bay	15m x 12m wash down pad
Upgrading and maintenance works to the internal access roads and airstrip	
Explosives magazine compound	
Offices	
Powerlines (part of the Power Station)	
Irrigation sprayfield (part of the Wastewater Treatment System)	
Brine waste pipeline in an earthen bund from the RO Plant to the Evaporation/Infiltration Pond	

4. Legislative context

Table 8 summarises approvals relevant to the assessment.

Table 8: Relevant approvals and tenure

Legislation	Number	Subsidiary	Approval
Rights in Water and Irrigation Act 1914	*GWL 175275*	*Auricup (Rothsay) Pty Ltd*	*A Groundwater Allocation Licence and associated Groundwater Operating Strategy (DWER) -* *Rights in Water and Irrigation Act 1914 allocating 420,000 kL per annum*

4.1 Part IV of the EP Act

This project has not been referred under Part IV of the EP Act.

4.2 Other relevant approvals

4.2.1 Planning approvals

The Applicant has consulted with the Department of Planning, Lands and Heritage (DPLH) and provided results on a heritage survey.

The Applicant has consulted with the Shire of Perenjori, particularly regarding the remnants of the historical Rothsay Township within the Karara Rangelands and the tourism initiative, and also on approvals for the WWTP and irrigation area.

4.2.2 Department of Biodiversity, Conservation and Attractions (DBCA)

DBCA have been consulting with the Applicant due to the Karara Rangelands Park and potential interactions with the public visiting the historical Rothsay sites. DBCA will also be involved in the closure aspects of the site, including the rehabilitation of the TSF.

4.2.3 Department of Mines, Industry Regulation and Safety (DMIRS)

The Applicant has consulted with DMIRS on a Mining Proposal and Closure Plan and on a vegetation clearing permit. Clearing Permit CPS 8444/1 (Egan Street Rothsay Pty Ltd – Rothsay Gold Mine Project) has been Granted under section 51E of the Environmental Protection Act 1986. No appeals were received during the public advertisement period and the Permit became active from 7 September 2019.

DMIRS has indicated that additional tailings studies are required to accurately risk assess potential impacts to sensitive receptors. DMIRS also had concerns with regards to dust management, potential for fibrous/asbestiform materials to be present onsite and potential impacts to riparian vegetation along the drainage line for the temporary mine dewatering discharge to the drainage channel. These concerns have since been addressed.

4.2.4 DWER Water Allocation

The Applicant holds a DWER Water Licence GWL175275 that allows an annual entitlement of 420,000 kL of water to be abstracted. The Applicant consulted with DWER Water with regards to the four month temporary discharge of mine dewatering water. DWER Water provided the following comments and advice to the Applicant:

Vegetation:

- The vegetation types in the area are not classified as Threatened Ecological Communities and do not contain Declared Rare Flora.
- There are no Groundwater Dependent Ecosystems in the discharge area.
- Impacts on vegetation from the proposed discharge are not considered to be significant.

Fauna:

- Test results show water quality is within the acceptable range for livestock drinking water under ANZECC/ARMCANZ Guidelines and so is suitable for dewatering.
- The water is to be discharged into an already established ephemeral drainage line and thus animals inhabiting these areas are adapted to water inundation at sporadic times throughout the year.

Discharge Rates:

- The four month discharge period will minimise the necessary rate of discharge, by maximising the amount of time spent discharging.
- Pumping rates, volumes and water quality will be monitored and recorded during the period of discharge.

- Discharge drainage lines have shallow gradients and wide flow paths, helping to minimise water velocity and sediment mobilisation.

Groundwater:

- The proposed discharge is not expected to have any negative impact on the local aquifer.
- Current groundwater licence GWL175275 has an annual entitlement of 420,000 kL with Dewatering for Mining Purposes an Authorised Activity.

Advice to minimise impact of dewatering on surrounding environment:

- Continue with monitoring and reporting regimes as defined under the Groundwater Licence Operating Strategy.
- Water should be discharged into the ephemeral drainage lines that converge with the Lake Monger system.
- No clearing or disturbance of vegetation to be undertaken for the discharge activity.
- Construction of a spillway or other suitable mechanism to minimise sediment mobilisation down the drainage lines should be considered.
- Dewatering pumps to be situated in water at a depth that does not agitate sediment particles within the shaft.
- Development of a water monitoring plan for the period of discharge to ensure quality remains consistent with pre discharge results. The plan should have trigger values set to indicate that pumps will be shut down immediately until it can be demonstrated that the exceedance has been managed/corrected.
- Proper controls to be taken in the handling and storage of hydrocarbons to ensure contaminants are not mobilised by water runoff.

4.2.5 Department of Health

The Applicant has consulted with DoH on a Potable Water Management Plan.

4.2.6 Federal Legislation

Environment Protection and Biodiversity Conservation Act 1999 (Cth)

Both adjacent reserves have been identified on the Commonwealth Department of the Environment and Energy database for environmental matters of national significance under the *Environment Protection and Biodiversity Conservation Act 1999:*

- Warriedar Station Nature Reserve (11km) containing the Warriedar Hills/Pinyalling vegetation complexes (banded iron formation); and
- Charles Darwin/White Wells Reserve (16km) containing plant species with representatives from both the Southwest Botanical Province and the more arid Eremaean Province. This reserve is managed by Bush Heritage.

4.3 Part V of the EP Act

4.3.1 Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations.

The guidance statements which inform this assessment are:

- *Guidance Statement: Regulatory Principles (July 2015);*
- *Guidance Statement: Setting Conditions (October 2015);*
- *Guidance Statement: Land Use Planning (February 2017);*
- *Guidance Statement: Publication of Annual Audit Compliance Reports (May*

2016);

- *Guidance Statement: Decision Making (June 2019);*
- *Guidance Statement: Risk Assessments (February 2017);* and
- *Guidance Statement: Environmental Siting (November 2016).*

4.3.2 Works approval and licence history

There are no previous approvals for this project.

4.3.3 Clearing

An application has been prepared through DMIRS for a clearing permit. Clearing Permit CPS 8444/1 has been granted. No appeals were received during the public advertisement period and the Permit became active from 7 September 2019.

5. Modelling and monitoring data

5.1 Monitoring of ambient groundwater

Depth to groundwater is approximately 50m below ground level (pre-operations) and quality is classed as brackish at approximately 6,000 mg/L Total Dissolved Solids.

Groundwater monitoring sampling from December 2017 has been provided in **Error! Reference source not found.**and 10 for the British Queen Shaft and Camp Bores to show a comparison of how the British Queen Shaft has been impacted from mining operations. It should be noted that no groundwater monitoring has been conducted in the vicinity of the TSF and cyanide has not been previously monitored.

The water quality within the camp bores meets both the ANZECC/ARMCANZ Livestock Watering Guidelines and the ANZECC/ARMCANZ 95% species protection levels for freshwater.

The water quality within the British Queen Shaft meets the ANZECC/ARMCANZ Livestock Watering Guidelines, so is of good quality, aside from the TDS and EC, which is slightly elevated, but still suitable for most livestock watering. TDS of 5,000 – 10,000 mg/L is *"Generally unsuitable for lambs, calves and weaners. Caution needed with lactating stock if unaccustomed. Suitable for dry, mature sheep & cattle".* Zinc is also elevated when compared to the ANZECC/ARMCANZ 95% species protection levels for freshwater.

Table 9 shows the background groundwater data from the British Queen Shaft.

Table 10 shows the background groundwater data from the Camp Bores.

The existing site layout and ambient groundwater monitoring bore network can been seen in Figure 3.

Table 9: British Queen Shaft background groundwater data 2012 - 2019

			British Queen Shaft					ANZECC
Parameter	**Unit**	**LOR**	**2012**	**2013**	**2017**	**2018**	**2019**	**Stockwater**
pH value	pH Unit	0.01	7.4	7.51	8.19	7.91	8.10	
Electrical Conductivity @25°C	µS/cm	1	7,600	8300	7720	8330	7910	6000
Total Dissolved Solids@180°C	mg/L	10	5,900	6740	5610	5360	4816	4000
Total Suspended Solids	mg/L	5	-	-	21	<5	8	
Salinity	ppt		-	3.37	-	-	-	
Sulphate as SO_4	mg/L	1	-	434	512	460	215	1000
Total acidity ($CaCO_3$)	mg/L		-	2680	-	-	175	
Aluminium	mg/L	0.01	-	-	0.03	<0.01	0.04	5.0
Arsenic	mg/L	0.001	<0.03	0.009	0.014	0.014	0.01	0.5
Cadmium	mg/L	0.0001	<0.002	0.0002	0.0002	0.0002	0.0001	0.1
Chromium	mg/L	<0.001	<0.005	0.002	<0.001	<0.001	0.002	1.0
Copper	mg/L		-	0.004	-	0.013	0.012	
Lead	mg/L	<0.001	-	<0.001	<0.001	<0.001	<0.001	0.1
Manganese	mg/L	0.001	-	-	0.137	0.170	0.041	
Mercury	mg/L		-	-	-	-	-	
Nickel	mg/L		-	0.022	-	-	-	
Nitrate-Nitrogen	mg/L		-	-	-	0.17	2.86	
Selenium	mg/L	0.01	-	0.02	<0.01	<0.01	<0.01	0.02
Strontium	mg/L	0.001	-	-	1.00	1.02	0.473	-
Sulphate	mg/L		-	434	-	-	-	
Zinc	mg/L	0.005	-	0.099	0.263	0.034	0.056	20
Iron	mg/L	0.05	-	1.27	<0.05	<0.05	0.11	
Barium	mg/L	0.001	-		0.064	0.066	0.032	
Mercury (Dissolved)	mg/L	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	0.002
Fluoride	mg/L	0.1	-	0.2	0.1	0.2	0.2	2
WAD Cyanide	mg/L	0.002	-	-	-	-	0.005	

Note: Where more than one full suite of water quality data was collected in a year, the highest value from the samples taken that year is shown in the table for each parameter sampled

Table 10: Camp Bore background groundwater data 2013 - 2018

			RYMP1 Camp Bore				RYMP2 Camp Bore			RYMP3 Mine Bore			RYMP4 Mine Bore		
Parameter	**Unit**	**LOR**	**8/02/13**	**7/03/13**	**8/08/2017**	**12/09/18**	**7/03/13**	**8/08/2017**	**12/09/18**	**7/03/13**	**8/08/2017**	**12/09/18**	**7/03/13**	**8/08/2017**	**12/09/18**
pH value (field)	pH Unit	0.01	8.16		8.21	8.06		7.32	7.88		8.18	7.73		8.18	7.8
EC (lab)	µS/cm	1	1970		1850	1920		3510	3300		4120	4520		4800	5160
Total Dissolved Solids (TDS)	mg/L	10	1220		1060	1050		2500	2340		2460	2580		2930	2890
Total Suspended Solids	mg/L	5			-	<5		<5	<5		-	<5		-	<5
Sulphate as SO_4	mg/L	1	1		74	27		163	134		185	163		224	196
Aluminium	mg/L	0.01	-		<0.01	<0.01		-	<0.01		<0.01	<0.01		<0.01	<0.01
Arsenic	mg/L	0.001	<0.001		0.005	<0.001	0.01	-	0.014	0.023	0.021	0.019	0.005	0.011	0.01
Cadmium	mg/L	0.0001	<0.0001		<0.0001	<0.0001		-	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	-	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001
Copper	mg/L	0.001	<0.001		<0.001	<0.001		0.015	0.012		0.003	<0.001		0.005	<0.001
Lead	mg/L	<0.001	<0.001		<0.001	<0.001		-	<0.001		<0.001	<0.001		<0.001	<0.001
Manganese	mg/L	0.001	-		0.221	0.241		0.002	0.002		<0.001	<0.001		<0.001	<0.001
Selenium	mg/L	0.01	0.01		<0.01	<0.01		-	<0.01		<0.01	<0.01		<0.01	<0.01
Strontium	mg/L	0.001	-		-	0.153		0.686	0.562		-	0.459		-	0.484
Zinc	mg/L	0.005	<0.005	0.032	<0.005	<0.005	0.106	-	0.025	0.031	<0.005	<0.005	0.106	<0.005	<0.005
Iron	mg/L	0.05	-	0.16	0.1	<0.05	0.93	<0.05	<0.05	0.32	<0.005	<0.005	0.8	<0.05	<0.05
Barium	mg/L	0.001	-		-	0.008		0.063	0.053		-	0.051		-	0.039
Mercury (Dissolved)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.002*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Fluoride	mg/L	0.1	0.2	0.1	-	0.2	0.5	0.3	0.4	0.5	-		0.1	-	
Chloride	mg/L	1	593		465	539		974	946		1020	1150		1180	1290
Calcium	mg/L	1	20		34	28		126	96		48	50		51	47
Magnesium	mg/L	1	66		56	57		167	130		102	100		120	107
Ammonia -N	mg/L	0.01	-		0.06	0.07		-	0.03		0.04	<0.01		0.04	0.03
Nitrite - N	mg/L	0.01	<0.10		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01
Nitrite +Nitrate-N	mg/L	0.01	0.01		13.3	<0.01		13.7	15.6		13.1	14.2		12.7	13.3
Total Kjeldahl Nitrogen as N	mg/L	0.1	-		0.8	0.2		-	2.8		0.5	3.2		0.4	3.4
Total Nitrogen-N	mg/L	0.1	-		14.1	0.2		-	18.4		13.6	17.4		13.1	16.7
Total Phosphorus as P	mg/L	0.01	-		0.02	0.01		-	0.07		0.03	<0.05		0.04	0.07
Reactive Phosphorus as P	mg/L	0.01	<0.1		0.01	<0.01		-	0.06		0.03	0.04		0.04	0.04

Note: 2013 data: the highest value from the samples taken that year is shown in the table for each parameter sampled

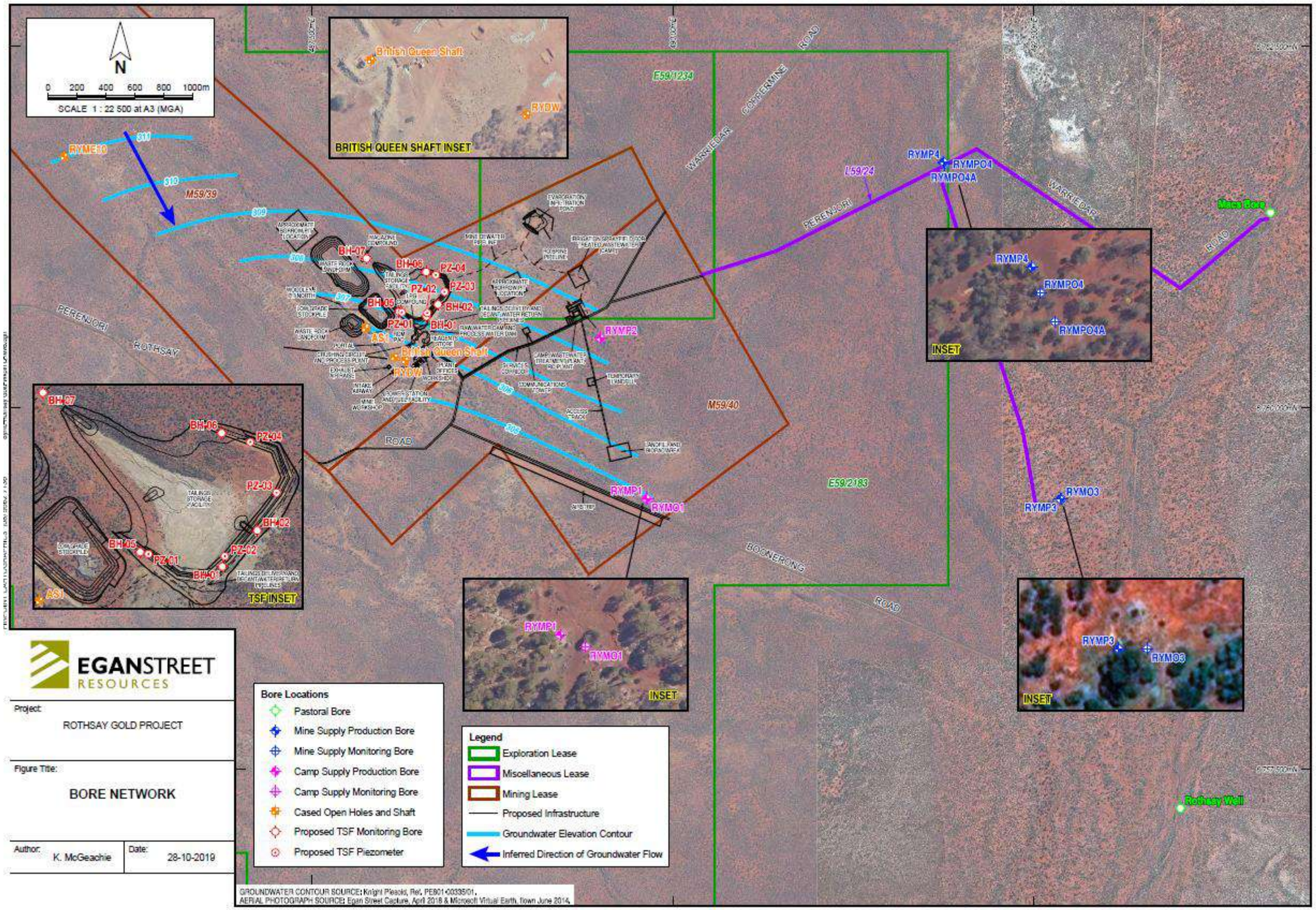

Figure 3: Site Layout and Ambient Groundwater Bore Monitoring Network

Key finding: *Local groundwater quality is suitable for livestock, aside from electrical conductivity/ total dissolved solids in the British Queen Shaft.*

5.2 Tailings characterisation

Tailings materials from the site were subjected to the following geochemical test-work:

- Chemical analysis for a suite of metals and metalloids to determine which specific elements were enriched above crustal background levels;
- Static testing using standard methods to determine the acid-base account for the materials and their potential for producing acid or metalliferous drainage on oxidation; and
- Short-term leaching testing using deionised water to determine the potential for metal/metalloid leaching from tailings.

It is likely that leaching tests have underestimated the potential for some metals and metalloids to be mobilised under geochemical conditions that are likely to be present in the TSF. The leaching tests have not adequately characterised the role of cyanide in buffering alkaline pH values in pore fluid in the tailings or its role in forming stable and soluble complexes of some metals. As the pH in tailings is likely to be higher that the values used in the laboratory leaching tests, it is likely that arsenic, selenium and metals that form soluble oxyanions in solution (particularly molybdenum) will be much higher in pore-water in TSF than simulated in leaching tests. That is, it is likely that the risk of mobilisation of some elements from tailings solids has been underestimated. Therefore, additional testing will be recommended to address this.

The Tailings Storage Facility Feasibility Study (Knight Piesold, 2017) risk assessment has not adequately addressed the effects of contaminants other than cyanide. The leaching tests conducted may have underestimated the extent to which arsenic, selenium and metals that form soluble oxyanions in solution (particularly molybdenum) will be mobilised under the geochemical conditions present in the TSF.

Additional testing that could be undertaken to determine the likely behaviour of elements under a range of leaching conditions include:

- Testing using the LEAF 1313 pH-dependent leaching test coupled with geochemical modelling (US EPA, 2017); and
- Short-term leaching tests using fluids which more closely resemble those likely to be present in the TSF.

6. Consultation

The key project stakeholders are listed in Table 11.

Table 11: Key Project Stakeholders

Group	Stakeholder
Local Government Authority	Shire of Perenjori
Adjacent Landholders	Karara Mining Ltd Karara Rangelands Park (DBCA) Wanarra Pastoral Station Minjar Gold Ltd
State Government Agencies	Department of Mines, Industry Regulation and Safety Department of Water and Environmental Regulation Department of Biodiversity, Conservation and Attractions Department of Aboriginal Affairs Department of Planning, Lands and Heritage

The Applicant has consulted with these stakeholders since 2012.

DWER sent referral letters to the above stakeholders. Responses were received from DBCA and DMIRS and are documented in Section 4.2.

7. Location and siting

7.1 Siting context

The project is located approximately 320 km north-northeast of Perth and 70 km east of the wheatbelt town of Perenjori, within the Southern Murchison region of Western Australia.

7.2 Residential and sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 12. The location of receptors is also as shown in Figure 4.

Table 12: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Karara Station homestead (owned by DBCA and part of the Karara Rangelands conservation park)	Approximately 14 km north of the project
Karara Iron Ore Project	Approximately 20 km north west of the project
Extension Hill	Approximately 30 km southeast of the project
Wanarra Station	Approximately 30 km east of the project
Koolanooka and Blue Hills	Approximately 50 km west of the project
Minjar Gold (now Golden Dragon) Mine	Approximately 50 km north-northeast of the project
Golden Grove Gold Mine	Approximately 50 km north-northeast of the project
Mt Gibson Gold Mine	Approximately 50 km south east of the project

7.3 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at or Emissions and Discharges from the Premises. The distances to specified ecosystems are shown in Table 13. Table 13 also identifies the distances to other relevant ecosystem values which do not fit the definition of a specified ecosystem.

The table has also been modified to align with the *Guidance Statement: Environmental Siting.* Surveys of flora, fauna and heritage have been conducted.

Table 13: Environmental values

Specified ecosystems	**Distance from the Premises**
Parks and Wildlife Managed Lands and Waters	Karara Rangelands tourism park is 14 km north of the project. Karara Station, combined with five other former pastoral stations (including Lochada, Kadji Kadji, Thundelarra and Warriedar) have been purchased by DBCA to form one contiguous conservation park, known as The Karara Rangelands. The Rangelands are under the direct management of DBCA and have been established to restore the landscape, protect biodiversity values and accommodate the demand for outback tourism in the Midwest.
Reserves	The following reserves are in the vicinity of the project: • Warriedar Station Nature Reserve (11km north east) containing the Warriedar Hills/Pinyalling vegetation complexes (banded iron formation); and • Charles Darwin/White Wells Reserve (16km south) containing plant species with representatives from both the Southwest Botanical Province and the more arid Eremaean Province. This reserve is managed by Bush Heritage. Both reserves have been identified on the Commonwealth Department of the Environment and Energy database for environmental matters of national significance under the *Environment Protection and Biodiversity Conservation Act 1999*.
Threatened Ecological Communities and Priority Ecological Communities	No Threatened Ecological Communities (TEC) were identified within the Project Area
Biological component	**Distance from the Premises**
Threatened/Priority Flora	Within the Project area.The area has a highly diverse taxon richness given its small area, with 17 significant flora taxa recorded. No threatened flora taxa were recorded.The Blue Hills (Mount Karara/Mungada Ridge/Blue Hills) vegetation complexes (banded ironstone formation) Priority Ecological Community occurs within the Project area.
Threatened/Priority Fauna	Wthin the Project area.Fauna assessment conducted over the Project area identified 32 species of conservation significance, with some resident and some visitors of the area. The assessment targeted several significant species (Shield-backed Trapdoor Spider, Western Spiny-tailed Skink and Malleefowl). No evidence of these species was found, however, they are expected to be around the margins of the Project area where there is less disturbance. No threatened fauna species were recorded.

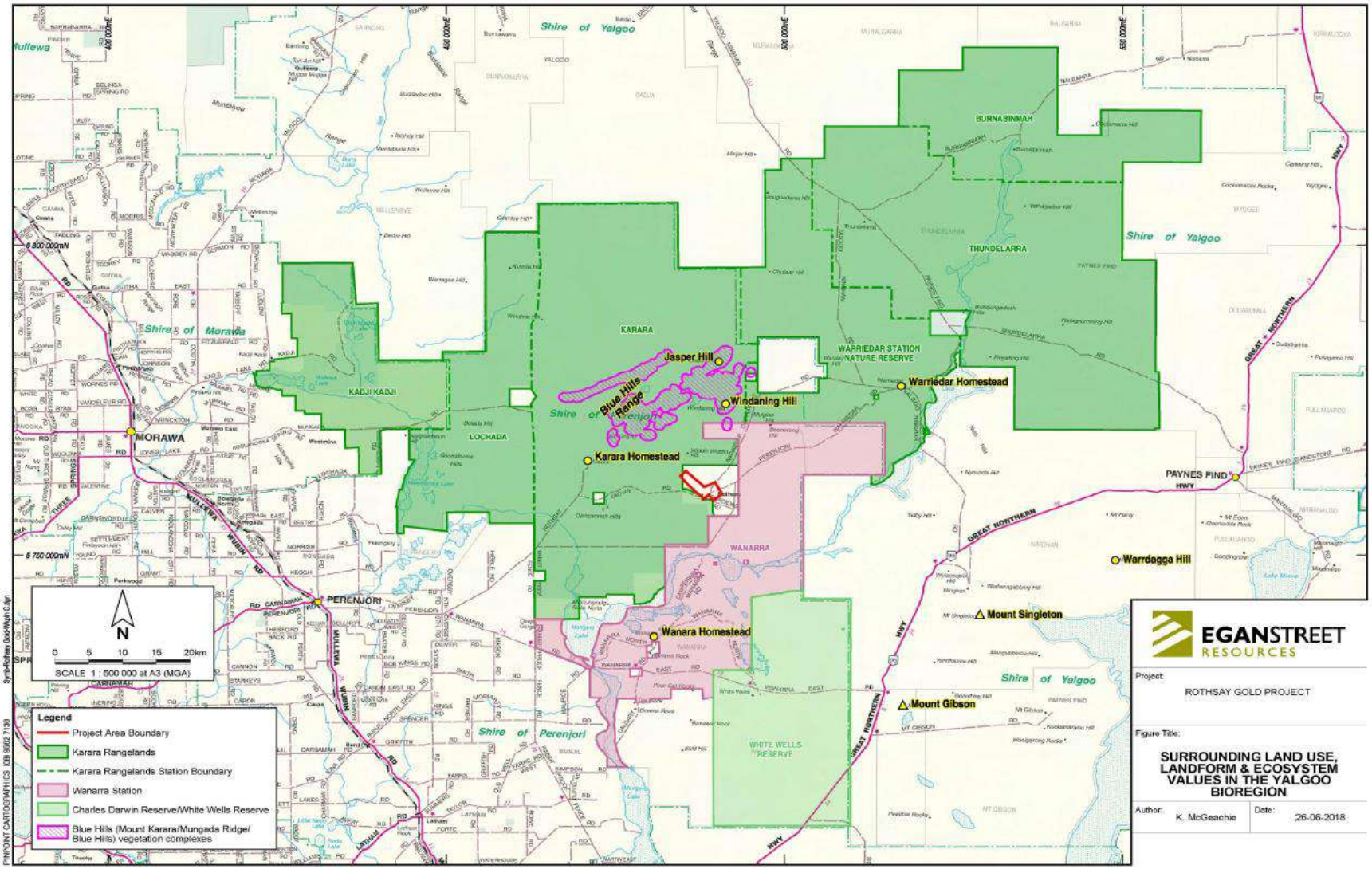

Figure 4: Location of surrounding receptors

7.4 Groundwater and water sources

The distances to groundwater and water sources are shown in Table 14.

Table 14: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
Public drinking water source areas	Perenjori is supplied with potable water from the Arrowsmith Water Reserve, which is approximately 200km northwest from the project area	Potable drinking water for townsites.
Major watercourses/waterbodies	Located in the Yarra Monger Catchment within the Yarra Yarra Drainage Basin that is part of the chain of several thousand ephemeral salt lakes, playas and samphire-covered claypans that stretch for approximately 300 km and cover an area of 250,000 ha. The project area straddles a broad, bedrock strike-ridge separating two small catchments that divide the Project along a northeast to southwest axis. Rainfall drains either side. There is no permanent surface water in the project area. The project area is not within a surface water management area.	These catchments support a variety of flora and fauna.
Groundwater	Depth to groundwater encountered at approximately 11 – 55 m below ground level and quality is classed as brackish at approximately 6,000 mg/L Total Dissolved Solids.	Water is used for potable use via a reverse osmosis plant where site personnel will be housed in an accommodation camp near the old Rothsay township. Water is used for industrial use in the processing plant. Closest bores, that were previously used for pastoral activities, but are no longer equipped for this purpose, are: • Macs Bore, located approximately 6 km north east of the British Queen Shaft; and • Rothsay Well, located approximately 6 km south east of the British Queen Shaft.

7.5 Soil type

Table 15 details soil types and characteristics relevant to the assessment.

Table 15: Soil and sub-soil characteristics

Groundwater and water sources	Distance from Premises	Environmental Value
Soil type classification	Within the premises	The Rothsay Study Area is characterised by undulating gravelly and loam plains supporting woodlands and shrublands. Principal soils include: i) shallow stony loams on hills and rock outcrops; ii) shallow red earthy sands and shallow red earths on small plains. Includes some redbrown hardpan; and iii) shallow red earthy sands on sand plains.
Acid sulfate soil risk	Within the premises	Testwork shows that the waste rock samples from the various lithology's at Rothsay are all classified as Non Acid Forming due to negligible sulphides

7.6 Meteorology

The Yalgoo bioregion climate varies from hot semi-arid to semi-desert Mediterranean. Summers are hot and dry and winters are mild and wet. Evaporation exceeds rainfall in all months, with the majority of rain falling between May and August.

8. Risk assessment

8.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

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. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 16.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 16 and Table 17 below.

Table 16. Identification of emissions, pathway and receptors during construction

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Construction, mobilisation and positioning of infrastructure	*Vehicle movements on unsealed access roads*	*Noise*	*Pastoral stations and other industry. Closest receptor is Karara Station homestead, which is approximately 14 km north of the project.*	*Air / wind dispersion*	*Amenity impacts*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.*
		Dust	*Pastoral stations and other industry, and vegetation*	*Air / wind dispersion*	*Health and amenity impacts*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.*
	Construction of new buildings, plant and infrastructure	*Noise*	*Pastoral stations and other industry. Closest receptor is Karara Station homestead, which is approximately 14 km north of the project.*	*Air / wind dispersion*	*Amenity impacts*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
		Dust	*Pastoral stations and other industry, and vegetation*	*Air / wind dispersion*	*Health and amenity impacts*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.*
		Contaminated stormwater (hydrocarbons and sediment)	*Soil and surface water drainage*	*Direct discharge*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to soil fauna.*	*Yes*	*See Section 8.4 – Stormwater Runoff*
	Use and storage of hydrocarbons and reagents	*Spills and breach of containment causing hydrocarbon or chemical discharge to land.*	*Soil and vegetation adjacent to areas of spill or breach.* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to soil fauna.* *Contamination of groundwater with impacts to beneficial uses*	*No*	*Dangerous Goods Act 2004 and regulations apply. Applicant to comply also with Australian Standard AS 1940 The Storage and Handling of Flammable and Combustible Liquids*

Table 17: Identification of emissions, pathway and receptors during commissioning and operation

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Ore Processing (category 5)	*ROM pad and ore stockpiles*	*Dust*	*Pastoral stations and other industry, and vegetation*	*Air / wind dispersion*	*Health and amenity, vegetation health*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.* *Dust to be managed via dust suppression sprays fitted to feeders in the crushing circuit, water trucks on haul roads and access roads, speed limits.*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
		Noise	*Pastoral stations and other industry*	*Air / wind dispersion*	*Amenity*	*No*	*Environmental Protection (Noise) Regulations 1997. No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.*
		Contaminated stormwater – dry processing	*Soil and vegetation adjacent to the storage area* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to soil fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.4 – Stormwater Runoff*
	Tertiary crushing	*Dust*	*Pastoral stations and other industry, and vegetation/ fauna*	*Air / wind dispersion*	*Health and amenity, vegetation health*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.* *Infrastructure is to be fitted with dust suppression sprays to feeders in the crushing circuit and water trucks to be deployed on haul roads and access roads, with speed limits imposed.*
		Noise	*Pastoral stations and other industry*	*Air / wind dispersion*	*Amenity*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.*
		Contaminated stormwater – dry processing	*Soil and vegetation adjacent to the storage area* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to soil fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.4 – Stormwater Runoff*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Ball milling, gravity concentration, leaching and adsorption, elution and electrowinning	*Processing liquors with elevated metal(loids) cyanide, in solution*	*Soil and vegetation adjacent to the ponds* *Groundwater*	*Direct discharge to land and infiltration to groundwater from pipeline failure, bunding overtopping* *Overflow from Process Water Dam*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.5 – Leaks or Overflows from the Process Plant and Process Water Dam*
		Gaseous emissions from process solutions including acid wash, elution columns, electrowinning cells, CIL tanks, barren */intermediate/ pregnant solution tanks*	*Pastoral stations and other industry, which are a considerable distance away*	*Air / wind dispersion*	*Health impacts*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.*
		Contaminated stormwater (wet processing sedimentation pond)	*Soil and vegetation adjacent to the ponds.* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.4 – Stormwater Runoff*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Process water storage	*Contaminated water - Pipeline failure*	*Soil and vegetation adjacent to the storage area* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.5 – Leaks or Overflows from the Process Plant and Process Water Dam*
		Contaminated water, including cyanide – Process water overtopping ponds.	*Soil and vegetation adjacent to the ponds* *Groundwater*	*Direct discharge to land and infiltration to groundwater.*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to soil fauna.* *Contamination of groundwater with impacts to beneficial uses.*	*Yes*	*See Section 8.5 – Leaks or Overflows from the Process Plant and Process Water Dam*
		Contaminated water - Ponds seepage	*Groundwater*	*Infiltration through ground*	*Contamination of groundwater with impacts to beneficial uses.*	*Yes*	*See Section 8.5 – Leaks or Overflows from the Process Plant and Process Water Dam*
	Raw water storage	*Raw water sourced from British Queen Shaft stored in Raw Water - Pond overtopping*	*Soil and vegetation adjacent to the ponds* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*No*	*Water quality meets the ANZECC/ARMCANZ Water Quality Guidelines for Livestock, aside from the TDS and EC which is slightly elevated, but still suitable for most livestock watering so is of good quality.* *300 mm freeboard maintained.*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
		Raw water sourced from British Queen Shaft stored in Raw Water Dam - Pond seepage	*Groundwater*	*Infiltration through ground*	*Contamination of groundwater with impacts to beneficial uses*	*No*	*Water quality meets the ANZECC/ARMCANZ Water Quality Guidelines for Livestock, aside from the TDS and EC which is slightly elevated, but still suitable for most livestock watering so is of good quality.* *Lined with compacted soil material to prevent loss from seepage through pond floors.*
Tailings Storage Facility (category 5)	*Tailings surface*	*Dust from TSF surface containing tailings contaminants*	*Residences (pastoral stations)*	*Air / wind dispersion*	*Health and amenity impacts*	*No*	*No residences within 14 km. No additional regulatory controls are deemed to be required to mitigate this risk.* *A sprinkler system will be in place to assist with dust suppression on the surface as the existing tails. The water used will be from the mine dewatering delivery pipeline on route to the evaporation/infiltration pond.*
			Soil and vegetation adjacent to the TSF	*Air / wind dispersion*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to terrestrial fauna.*	*No*	*A sprinkler system will be in place to assist with dust suppression on the surface as the existing tails. The water used will be from the mine dewatering delivery pipeline on route to the evaporation/infiltration pond.*
	Tailings pumps, pipelines and decant return	*Accidental spillage of tailings through leaks or failure*	*Soil and vegetation adjacent to the processing plant, TSF and pipelines.* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.7 – Spillage from Tailings Pumps, Pipelines and Decant Return*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Tailings deposition	*Elevated WAD cyanide (>50 mg/L) in tailings supernatant*	*Birds/bats*	*Direct contact*		*Yes*	*See Section 8.6 – Fauna accessing Process Water Storages/ Tailings Containing Cyanide*
	Overtopping of TSF with tailings or stormwater	*Soil and vegetation adjacent to the TSF.* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.7 – TSF Tailings and Stormwater Overtopping*
	Discharge of tailings through TSF embankment failure.	*Residences (pastoral stations* *Surface water bodies in pathway of tailings* *Soil and vegetation in pathway of tailings* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to soil fauna.* *Contamination of groundwater with impacts to beneficial uses*	*No*	*Managed by DMIRS through mining proposal and long term closure planning*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Tailings seepage	*Leachate to groundwater*	*Vegetation, groundwater*	*Seepage to ground adjacent to the TSF and seepage from the base of the TSF with infiltration to groundwater*	*Groundwater mounding* *Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.8 – TSF Seepage*
Dewatering (category 6)	*Abstraction resulting in drawdown of groundwater levels*	*None*	*Groundwater dependent ecosystems*	*Abstraction of groundwater*	*Reduction in groundwater availability for dependent vegetation*	*No*	*Not within scope of Part V of the EP Act. Regulated under the RiWI Act and Part IV of the EP Act.*
	Temporary discharge to drainage line	*Dewater to creek line*	*Soil and vegetation adjacent to and within drainage line*	*Direct discharge*	*Scouring* *Vegetation impacts from increased salinity of abstracted water* *Vegetation degradation following cessation of discharge*	*Yes*	*See Section 8.9 – Temporary Mine Dewatering Discharge to Drainage Line*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Discharge to an evaporation /infiltration pond	*Dewater to groundwater*	*Vegetation, soils,, groundwater*	*Seepage to ground adjacent to the evaporation/infiltration pond and seepage from the base with infiltration to groundwater*	*Groundwater mounding* *Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.9 – Permanent Dewatering Discharge*
	Dewatering pipelines	*Rupture of pipelines causing mine dewatering water discharge to land*	*Soil and vegetation adjacent to the tailings pipeline alignment.* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.10 – Permanent Dewatering Discharge*
Putrescible and inert landfill trenches (Category 64)	*Acceptance of putrescible and inert waste for burial*	*Dust from vehicle movement and burial of waste*	*Residences (pastoral stations)*	*Air / wind dispersion*	*Loss of amenity and nuisance impacts* *Potential suppression of photosynthetic and respiratory functions.*	*No*	*Karara Station is approximately 14 km north of the project.* *Water trucks to be deployed on haul roads and access roads, with speed limits imposed.*
		Noise from vehicle movement and burial of waste	*Residences (pastoral stations)*	*Air / wind dispersion*	*Loss of amenity and nuisance impacts*	*No*	*Karara Station is approximately 14 km north of the project.*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
		Odour from the degradation of putrescible waste	*Residences (pastoral stations)*	*Air / wind dispersion*	*Loss of amenity and nuisance impacts*	*No*	*Karara Station is approximately 14 km north of the project.* *Trenches covered minimum once per fortnight.*
			Threatened/priority fauna	*Air / wind dispersion*	*Increase in vermin* *Potential alteration to local ecosystems*	*Yes*	*See Section 8.11 – Landfill Waste Disposal and Leachate*
		Windblown waste	*Land surrounding the premises. No residences or other sensitive land uses within 25 km*	*Air / wind dispersion*	*Loss of amenity and nuisance impacts*	*No*	*Karara Station is approximately 14 km north of the project.* *Waste materials to be stored in appropriate containers and bins with secure lids prior to disposal to the landfill.* *Fenced.* *Trenches covered minimum once per fortnight.*
		Leachate	*Groundwater (potable)*	*Infiltration to groundwater*	*Leachate has the potential to disrupt ecological processes in soil and groundwater with excess nutrients and metals.* *Contamination of groundwater with impacts to beneficial uses*	*Yes*	*See Section 8.11 – Landfill Waste Disposal and Leachate*

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
		Gaseous emissions from putrescible decompositio n	*Residences (pastoral stations)*	*Air / wind dispersion*	*Loss of amenity and nuisance impacts. Human health impacts*	*No*	*Karara Station is approximately 14 km north of the project.*
		Smoke and fumes from possible fires	*Residences (pastoral stations)*	*Air / wind dispersion*	*Loss of amenity and nuisance impacts. Human health impacts*	*No*	*Karara Station is approximately 14 km north of the project.* *Raw Water Dam for fire suppression.*
Bulk storage of chemicals	*Chemical reagent storage (sodium cyanide, sodium metabisulphite, quick lime, oxygen total, sodium hydroxide, hydrated lime, hydrochloric acid, activated carbon, flocculants)*	*Accidental spillage or discharge of chemical reagents through pipeline, pump or tank leaks or failure*	*Soil and vegetation adjacent to the processing plant.* *Groundwater*	*Direct discharge to land and infiltration to groundwater*	*Soil contamination inhibiting vegetation growth and survival, and health impacts to fauna.* *Contamination of groundwater with impacts to beneficial uses*	*No*	*All chemicals and reagents will be stored in accordance with the Dangerous Goods Safety Act 2004 and the Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007. Regulated by DMIRS.* *Small scale spills will be managed using spill response equipment, which will be stored in all workshops and on maintenance/service vehicles.* *Larger scale spill, earthmoving equipment will be used to construct bunds around the affected area for containment.*
		Dust from handling or unsealed storage.	*Residences (pastoral stations)*	*Air / wind dispersion*	*Health and amenity* *vegetation health*	*No*	*Karara Station is approximately 14 km north of the project.*

8.2 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 18 below.

Table 18: Risk rating matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 19 below.

Table 19: Risk criteria table

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		**The following criteria has been used to determine the consequences of a Risk Event occurring:**		
			Environment	**Public health* and amenity (such as air and water quality, noise, and odour)**
Almost Certain	The risk event is expected to occur in most circumstances	Severe	• **onsite impacts**: catastrophic • **offsite impacts local scale**: high level or above • **offsite impacts wider scale:** mid-level or above • Mid to long-term or permanent impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are significantly exceeded	• Loss of life • **Adverse health effects:** high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • **Local scale impacts:** permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	• **onsite impacts**: high level • **offsite impacts local scale**: mid-level • **offsite impacts wider scale**: low level • Short-term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded	• **Adverse health effects:** mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • **Local scale impacts**: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	• **onsite impacts**: mid-level • **offsite impacts local scale**: low level • **offsite impacts wider scale**: minimal • Specific Consequence Criteria (for environment) are at risk of not being met	• **Adverse health effects:** low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • **Local scale impacts:** mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	• **onsite impacts**: low level • **offsite impacts local scale**: minimal • **offsite impacts wider scale**: not detectable • Specific Consequence Criteria (for environment) likely to be met	• Specific Consequence Criteria (for public health) are likely to be met • **Local scale impacts:** low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	• **onsite impact**: minimal • Specific Consequence Criteria (for environment) met	• **Local scale**: minimal to amenity • Specific Consequence Criteria (for public health) met

^ Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting.*

* In applying public health criteria, DWER may have regard to the Department of Health's *Health Risk Assessment (Scoping) Guidelines.*

"onsite**"** means within the Prescribed Premises boundary.

8.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment Table 20 below:

Table 20: Risk treatment table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled.	Risk Event is acceptable and will generally not be subject to regulatory controls.

8.4 Risk Assessment – Stormwater Runoff

8.4.1 Description of Stormwater Runoff

Disturbed land and construction activities may result in turbid water and sediment discharged on and off the premises.

Stormwater from the gold mining operations has the potential to become contaminated with sediment from dry processing stockpiles, as well as metals, metalloids, hazardous chemicals and hydrocarbons from spills and leaks from pipes, valves and containment structures. Chemicals stored and used will include quicklime, sodium cyanide, hydrochloric acid, sodium hydroxide, and carbon.

A Plant Drainage Retention Pond is to be implemented to capture drainage runoff and overland flows from the plant area, non-process infrastructure, buildings and the ROM pad.

8.4.2 Identification and general characterisation of emission

Stormwater with sediments from disturbed soils, stockpiles and earthmoving activities.

8.4.3 Description of potential adverse impact from the emission

There is no permanent surface water in the project area. Turbid, sediment laden water released to numerous ephemeral drainage lines that converge with the Lake Monger system during storm or extreme rainfall events resulting in poor surface water quality, increased sedimentation and potential loss of riparian vegetation. However, due to very low stream gradients and high evaporation rates, stream flows do not reach the Lake Monger system in most years.

Infiltration through soil of chemicals, salts and hydrocarbons from contaminated stormwater may impact on the beneficial use of groundwater. Groundwater levels have been recorded between approximately 11 – 55 mbgl. Groundwater at the premises is brackish to saline (within the British Queen Shaft) potable to slightly brackish which will be used at the camp for drinking (following

reverse osmosis treatment). Neighbouring ex-station lands that now form part of the Karara Rangeland Park have been de-stocked and therefore do not rely on groundwater sources for maintaining livestock. There are two historical wells previously used by pastoralists in the vicinity of the site (Macs Bore and Rothsay Well), but these are not equipped with a windmill or pumping infrastructure.

8.4.4 Criteria for assessment

Relevant water quality criteria include ANZECC/ARMCANZ guidelines for livestock watering and fresh waters, and ASC NEPM for soils and groundwater.

8.4.5 Applicant controls

Construction and Operation

This assessment has reviewed the controls set out in Table 21 below.

Table 21: Applicant's proposed controls for Stormwater Runoff

Site infrastructure	Description
All infrastructure	
Process area drainage will be designed for a 1:100 year rainfall event of 72 hour duration. The process plant will be divided into individual areas for separate runoff design dependent on the volumes to be handled.	
Overland flows from storm events will be diverted around the outside of the plant by either a diversion drain to the west of the plant or a cut off drain to the east of the plant.	
Runoff will be directed to a Plant Drainage Retention Pond that will act as a sedimentation trap. Water in this pond may be returned to the process water stream for reuse.	
Plant Drainage Retention Pond	
Plant Drainage Retention Pond	*Captures drainage runoff and overland flows from the plant area, including non-process infrastructure, buildings and the ROM pad. This pond acts as a sedimentation trap* *Water collected in this pond may be reused within the Process Plant* *Storage of TSF decant return water via decant return pump* *Storage of overflow from the Raw Water Dam* *Storage of water transferred from the dry plant sedimentation pond, wet plant sedimentation pond and infrastructure sedimentation pond* *Lined with 1.5mm HDPE* *Surface area 24m x 36m* *Total storage capacity 1,774 m^3* *Sized to accommodate a 1 in 100 year AER 72 hour rainfall event* *Maintenance of minimum 300mm freeboard*
Waste Rock Landforms, Low Grade Stockpile and ROM Pad	
Ore Stockpiles on the	*Drainage from the ore stockpiles will be directed to a low point on the southern area of the ROM pad. Runoff will then be directed to the plant*

ROM Pad	*drain that discharges into the plant drainage retention pond*
Low Grade Stockpile	*Drainage runoff from the stockpile will be directed to a sump to allow for some settling of suspended particles.* *Overland flows during peak events will flow to a cut off drain for diversion around the plant area*
Mine and Ore Sorter Waste Rock Landform	*Drainage and overland flows directed to a cut off drain for diversion around the plant area*
Mine and Cement Rock Fill Pillar Waste Rock Landform	
Plant Area	
All Plant Infrastructure excluding the Wet Plant Pad	*Drainage runoff and overland flows will be directed to the plant drain, which is to discharge to the plant drainage retention pond for the settling of suspended solids.*
	Water levels managed to accommodate a 1 in 100 year 72 hour rainfall event by pumping out of the pond to the process stream for reuse at a minimum of 3 hours after the commencement of a storm
	300mm minimum freeboard maintained on the pond
	Water can be returned to the process water stream for reuse
	Pond lined with compacted soil material to prevent loss through seepage and infiltration
Wet Circuit Infrastructure: Milling, Leach Tanks, Metal Recovery, Refining and Reagents	*Areas of the Processing Plant to be concrete bunded includes the following activity areas: leaching and adsorption, elution and electrowinning, smelting, cyanide detoxification and the liquid reagent store, including the cyanide storage tank.*
	Drainage from the wet plant (milling, leaching, metal recovery, refining and reagents areas) will be directed to wet plant sumps. Sump water will be pumped to the HDPE lined Process Water Dam for use within the Processing Plant.
	Drainage and runoff directed to wet plant sumps that report to the Process Water Dam
	Sumps and Process Water Dam HDPE lined, with 500mm minimum freeboard
	CIL tanks to be situated on a concrete pad bunded with containment capacity equivalent to 110% of the capacity of one of the leach tanks
	Electric sump pumps to be installed in the concrete flooring with material spilt inside the bunding to be pumped back into the process stream
Cyanide Dosing	*Liquid cyanide solution will be pumped into the processing plant from a cyanide storage tank using an automated dosing system, as outlined below:* • *The pump will be controlled via a variable speed drive, interlocked to a level indicator located inside the cyanide storage*

	tank. This will prevent the pump from being run dry. • *A flow control valve (installed at the delivery point) will regulate the dosing rate prior to delivery to the leaching and adsorption tanks in the plant.* • *The flow rate (regulated by the flow control valve) will be set based on the mill throughput rate at the time. This is controlled via a setting in the control room.* • *All tank levels will be visually monitored in the field by the Area Operator.* *A second smaller pump will deliver liquid cyanide solution from the cyanide storage tank to the eluate storage tank in the elution circuit. Flow to the eluate tank will be controlled via a manual valve located at the tank. The eluate tank is a closed tank that only requires small volumes of cyanide to be delivered. This tank will also be equipped with level controls.*
Dangerous Goods and Hydrocarbon Storage Areas	
Reagent Store	*Concrete pad that is bunded, with containment draining to sumps with a recovery pump. Material is then reused or directed to the tailings launder where they are mixed with the tailings flurry material and delivered to the TSF.*
Bulk Fuel Facility	*2 x 220kL double walled integral above ground storage tanks*
Power Station	*LNG gensets require 6 x 60 kL storage tanks (bullets) in a dedicated compound*
Bulk LPG	*LPG stored into 3 x 7.5kL vendor supplied bullets*
Bulk Oil Storage Tanks (New and Waste)	*Bunded as per Australian Standards AS1940:2004 The storage and handling of flammable and combustible liquids*
Workshop, Vehicle Refuel Areas, Vehicle Washdown Bay	*Facilities sited on separate concrete pads with a collection sump and oily water separator. The separator will be located within a bunded area and include a small tank for the storage of separated oil*
	1 x vehicle washdown bay 15m x 12m which will be centrally drained through a weir to the sump
WWTP Plant Irrigation area and Landfill	
Earthen bunds will be constructed to divert stormwater runoff from entering these sites.	

8.4.6 Key findings

The Delegated Officer has reviewed the information regarding Stormwater Runoff and has found:

1. *The project is not located in a surface water management area and there is no permanent surface water in the project area.*
2. *Runoff from processing areas is directed to the Plant Drainage Retention Pond and the Process Water Dam.*
3. *Clean stormwater runoff will be diverted around potentially contaminated areas.*

4. *Potential impacts to beneficial use of groundwater if infiltration of contaminated stormwater through ground occurs, though this is unlikely due to its depth.*

8.4.7 Consequence

The Delegated Officer has considered the potential impacts of stormwater runoff, potentially contaminated with sediment or hydrocarbons and determined that beneficial uses may be impacted at a local scale. Therefore, the Delegated Officer considers the consequence to be **minor.**

8.4.8 Likelihood of Risk Event

Based upon the controls proposed by the Applicant, including containment of hydrocarbon and chemicals, direction of clean stormwater around processing areas, removal of spills and containment of stormwater in stormwater ponds, and also the depth to groundwater, the Delegated Officer has determined that the likelihood of the consequence to beneficial use of groundwater may only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood to be **unlikely.**

8.4.9 Overall rating of contaminated stormwater

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of contaminated stormwater runoff on sensitive receptors during operation is **medium**.

8.5 Risk Assessment – Leaks or Overflows from the Process Plant and Process Water Dam

8.5.1 Description of Leaks or Overflows from the Process Plant and Process Water Dam

A HDPE lined impermeable Process Water Dam will store drainage and runoff from the wet plant area, tailings thickener overflow, decant return and raw water makeup. This water will be reused within the Processing Plant.

Accidental spillage or discharge of these solutions from pipelines, pumps, tanks leaks, failure or overtopping may occur.

8.5.2 Identification and general characterisation of emission

Process water is sourced from drainage and runoff from the wet plant, tailings thickener overflow, decant return and raw water makeup.

Processing reagents such as quicklime, cyanide, sodium hydroxide, hydrochloric acid and activated carbon are used in the gold processing circuit. Drainage and runoff from the wet plant that is directed to wet plant sumps will be collected and pumped to the Process Water Dam so the water will be contaminated with these.

8.5.3 Description of potential adverse impact from the emission

The release of process water from the Process Water Dam may inundate and impact on adjacent vegetation, contaminate soils and discharge to local drainage lines. However, if occurring due to an extreme rainfall event then contaminants would be diluted. Groundwater contamination could also result from overflow or leaks, but more likely if the HDPE liner integrity were to be compromised due to the depth to groundwater approximately 55 mbgl in the Processing Plant vicinity.

8.5.4 Criteria for assessment

Relevant water quality criteria include ANZECC/ARMCANZ guidelines for livestock watering and fresh waters, and ASC NEPM for soils and groundwater.

The HDPE liner meets the requirements of the *Department of Water, 2009. Water Quality Protection Note 26: Liners for containing pollutants, using synthetic membranes, Department of Water, Western Australia* (DoW, 2009).

8.5.5 Applicant controls

This assessment has reviewed the controls set out in Table 22 below.

Table 22: Applicant's proposed controls for Leaks or Overflows from the Process Water Dam

Site infrastructure	Description
Process Water Dam	*Drainage and runoff collected from the wet plant (milling, leaching, metal recovery and refining and reagents areas) directed to wet plant sumps and is then to be pumped to this pond* *Water collected in this pond will be recirculated through the Process Plant* *Lined with impermeable HDPE* *Floor of the pond will slope to a small sump where a vacuum truck can pump out settled solids to maintain pond freeboard and prevent sediment mobilisation* *Surface area 24m x 32m* *Total storage capacity 2,160m^3* *Freeboard 500m* *All raw and process water infrastructure will be equipped with a level sensing instrument. The instrument will perform the following functions:* • *transmit a level measurement to the control room; and* • *control a level switch to prevent the pump from running dry.* *Solids that settle out and accumulate on the floor of the Process Water Pond will be periodically removed and disposed of by either:* • *returning the material to an appropriate location in the process stream for treatment; or* • *direct delivery to the Tailings Storage Facility* *These methods will also be used for periodic solids removal from the floor of the Plant Drainage Retention Pond.*

8.5.6 Key findings

The Delegated Officer has reviewed the information regarding wet process circuits and has found:

1. *Infiltration of process solutions and reagents through soil to groundwater may impact on the local terrestrial ecosystem and beneficial uses of groundwater, however, this is unlikely due to the impermeable HDPE lined Process Water Dam and depth to groundwater of 55mbgl at the Process Plant.*
2. *Carbon in leach tanks will be placed on a concrete pad and bunded with leaks*

and rupture of tanks and pipes directed to the wet process drainage system.

8.5.7 Consequence

Based upon the hazardous materials used in the wet processing circuits, and the beneficial use of groundwater in the local vicinity, the Delegated Officer has determined that if a leak or overflow occurs that onsite impacts could occur to soil and potentially groundwater. Therefore, the Delegated Officer considers the consequence to be **minor**.

8.5.8 Likelihood of Risk Event

Based upon the infrastructure and management proposed by the Applicant and the depth to groundwater in the vicinity of the Process Plant, the Delegated Officer has determined that the consequence will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood to be **unlikely.**

8.5.9 Overall rating of wet process circuits

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk to sensitive receptors during operation is **medium**.

8.6 Fauna accessing Process Water Storages/Tailings Containing Cyanide

8.6.1 Description of Fauna Accessing Process Water Storages/ Tailings Containing Cyanide

Tailings discharged to the TSF from the CIL/CIP circuit, and tailings return water discharged to the Process Water Dam, containing soluble cyanide impacting birds and other fauna which may have access to the TSF or pond.

8.6.2 Identification and general characterisation of emission

Approximately 200,000 tpa of thickened tailings (45-60% solids) is to be deposited to the TSF over a five year period. Tailings deposition will result in ponding of water on the TSF within the decant water system and this water will be returned to the Process Water Dam for reuse in the Processing Plant.

The Applicant has stated that assays will be conducted to monitor total cyanide and WAD cyanide by titration, with target concentrations in the TSF to meet the following values:

- <50 mg/L WAD cyanide at the spigot outlet; and
- <50 mg/L WAD cyanide in the decant water pond; and
- 9 – 10 pH.

8.6.3 Description of potential adverse impact from the emission

Fauna may be attracted to the TSF and Process Water Dam to consume water. Ingestion/exposure to WAD cyanide can cause delayed mortality in birds (from *The International Cyanide Management Code*). Fauna surveys identified 33 species of birds, with conservation significant bird species occasionally appearing in areas of open ground, particularly the Rainbow Bee-eater, which has been identified as a likely migrant to the Project are to breed during summer.

8.6.4 Criteria for assessment

The *International Cyanide Management Code: Implementation Guidance* recommends a WAD cyanide concentration in tailings and water ponds of 50mg/L. This is considered to be protective of most wildlife and livestock mortality (ICMI, 2018).

8.6.5 Applicant controls

Site infrastructure	Description
All permanent water ponds, except the TSF	*The Applicant will fence permanent water sources to prevent or control fauna access including:* • *Process Water Dam for storing decant water from tailings for reuse in the Process Plant;* • *Raw Water Dam for storing mine dewatering for use in the Process Plant;* • *Irrigation sprayfield for the disposal of treated wastewater; and* • *Evaporation/Infiltration Pond for the discharge of mine dewatering.* *The TSF will not be fenced due to the site layout and tight footprint, valley setting and annual embankment raises.* *Daily inspections are to be conducted to check for trapped fauna. A checklist is to be included that includes management procedures in the event that trapped fauna is located. Bird activity observed is also to be logged. A Risk, Compliance and Community System will be kept online. In the event of trapped fauna located, the following references documents can be used:* • *General Fauna Management Operating Procedure; and* • *Fauna Register.*
TSF	*The following measures will be implemented to discourage fauna from accessing the TSF:* • *Regular daily inspections;* • *Embankments cleared of vegetation to remove potential fauna habitat and ease of visibility to detect fauna; and* • *Natural terrain slopes on the eastern and western banks.* *Annual water quality monitoring will be conducted at the TSF.*
Process Water Dam	*Quarterly water quality monitoring will be conducted at the Process Water Dam.*
Fauna scaring devices were assessed, however, due to the proximity to the camp and site offices, these were not deemed suitable by the Applicant.	

8.6.6 Key findings

The Delegated Officer has reviewed the information regarding process water storage and has found:

1. The Cyanide Detoxification Unit to be installed has design specification capable of achieving a WAD-CN level of 50 mg/L. This meets *The International Cyanide Management Code: Implementation Guidance*, which recommends a WAD cyanide concentration in tailings and water ponds of 50mg/L. This is considered to be protective of most wildlife and livestock mortality (ICMI, 2018).

8.6.7 Consequence

The Delegated Officer has determined that storage of supernatant water containing a cyanide content of lesser than 50mg/L, meets the Specific Consequence Criteria for the environment. Therefore, the Delegated Officer considers the consequence to be **minor**.

8.6.8 Likelihood of Risk Event

The Delegated Officer has determined that impacts to fauna will probably not occur in most circumstances due the quality of the wastewater. Therefore, the Delegated Officer considers the likelihood to be **unlikely**.

8.6.9 Overall rating of Fauna Accessing Process Water Storages/Tailings Containing Cyanide

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk is **medium**. The Works Approval and Licence will be required to condition the discharge concentration in order to meet 50 mg/L limit.

8.7 Risk Assessment – TSF Pipeline Ruptures and Overtopping

8.7.1 Description of TSF Pipeline Ruptures and Overtopping

Tailings slurry and decant return water containing soluble metals, metalloids and cyanide species has the potential to be released to the environment in the event of a pipeline rupture or overtopping of the TSF embankments.

8.7.2 Identification and general characterisation of emission

Tailings contaminants depend on the geochemical composition of the ore and the chemicals used in the process circuit (such as cyanide). For geochemistry of the historical tailings, refer to Table 23. Note this provides data for solids content only and hence more current information on expected tailings composition for the new processing plant will be required to be obtained during the commissioning period.

Table 23: Chemical composition of Rothsay Tailings in existing TSF

Analyte	Unit	Concentration
Ag	mg/kg	2.69*
Al	%	1.78
As	mg/kg	137.7*
Ba	mg/kg	17.6
Bi	mg/kg	25.24*
C total	%	0.11
C carbonate	%	0.03
Ca	%	3.6
Cd	mg/kg	1.13*
Co	mg/kg	65.1
Cr	mg/kg	1,834*
Cu	mg/kg	2,285*
Fe	%	5.41
Hg	mg/kg	0.08
K	%	0.23
Mg	%	10.99
Mn	mg/kg	986
Mo	mg/kg	1.9
Na	mg/kg	3.83
Ni	mg/kg	371
P	mg/kg	72
Pb	mg/kg	39.4
S total	%	2.93
S sulfide	%	0.17
Sb	mg/kg	1.84
Se	mg/kg	2.42*
Si	%	26.5
Sn	mg/kg	0.5
Sr	mg/kg	58.49
Th	mg/kg	0.54
Ti	mg/kg	0.29
V	mg/kg	87
U	mg/kg	0.22
Zn	mg/kg	114

Notes: i) the highest concentration of the four samples tested in Campbell (May 2016) has been included in the table; ii) * signifies element content 10 to 100 times average crustal abundance

8.7.3 Description of potential adverse impact from the emission

Spillage or discharges from pipelines and pumps may contaminate soils, smother vegetation, and have toxic effects on terrestrial and freshwater ecosystems. There are no significant flora or fauna species, rivers, lakes or other surface water features on the premises or local vicinity.

Infiltration of a significant quantity of tailings may result in soluble contaminants leaching through the soil profile to affect local groundwater quality and may impact on the beneficial uses of groundwater. Groundwater at the premises is considered brackish to saline (saline within the British Queen Shaft) and can be used in the wider locality for stock watering. Groundwater levels at the premises have been recorded between approximately 11 – 55 mbgl. Groundwater in the vicinity of the Process Plant and TSF is approximately 30 - 55 mbgl. Soils are mainly shallow

stony loams on hills and rock outcrops, shallow red earthy sands and shallow red earths on small plains, with some red-brown hardpan and shallow red earthy sands on sand plains.

8.7.4 Criteria for assessment

Relevant land and groundwater quality criteria include ANZECC/ARMCANZ guidelines for livestock watering and fresh waters, and ASC NEPM for soils and groundwater.

8.7.5 Applicant controls

This assessment has reviewed the controls set out in Table 24 below.

Table 24: Applicant's proposed controls for TSF Pipeline Ruptures and Overtopping during Operations

Site infrastructure	Construction	Commissioning and Operation
TSF slurry pipe and pumps *TSF decant water line and pumps*	*Pipelines will be situated within a pipeline corridor in an earthen bund to be compacted to a permeability co-efficient of 10^{-9} or less. The pipeline corridor will act to contain any spillage of materials resulting from leaks or spills.* *Due to the very close proximity of the Process Plant to the TSF (maximum 300m) any spills or leaks will be quickly detected via daily inspections of the infrastructure. Flow meters will be used.*	*<u>Commissioning -</u>* *During commissioning, inspections of the TSF will occur twice per shift for:* • *The integrity of delivery and discharge pipelines within the corridor;* • *Evidence of blockage or damage from discharge;* • *Size and location of the decant pond;* • *The integrity of tailings storage embankments and any indication of seepage; and* • *Any fauna that may have become trapped in the facility.* *Feed rate, slurry densities, pH, sodium metabisulphite and cyanide levels will be monitored.* *Cyanide levels will be monitored monthly at the TSF Spigot Outlet and decant water to the Process Water Dam and targeted at:* • *<50 mg/L WAD cyanide at the spigot outlet;* • *< 50 mg/L WAD cyanide in the decant water pond; and* • *pH 9 - 10.* *This will also be used to inform the efficiency of processing operations and reagent use, with the aim of minimising cyanide in the tailings and decant pond water.* *Verification testing of the geochemistry of the tailings slurry will also occur.* *If a malfunction occurs during commissioning, then the system will be shut down until the fault is rectified. Start up and shut down procedures are progressive for each stage of the circuit to prevent a total system failure. Operators will be trained in procedures during a malfunction.* *<u>Operations -</u>* *Daily inspections will be undertaken of the TSF, tailings delivery pipeline and decant return water pipeline. Daily inspections will include:* • *Pipelines (tailings delivery line and decant water return line) to and from the TSF;* • *Pumps;*

Site infrastructure	Construction	Commissioning and Operation
		• *Spigots and valves;* • *Spigotting and deposition;* • *Location and size of the decant water pond;* • *Decant and decant pump;* • *Any seepage from the embankment toe;* • *Integrity of the embankment;* • *Any changes in existing cracking or seepage at the embankment; and* • *Access roads to and from the TSF.* *In the event of the failure of a tailings pipeline, the material will be contained within the pipeline corridor bund system.* *WAD cyanide targets:* • *<50 mg/L WAD cyanide at the spigot outlet; and* • *<50 mg/L WAD cyanide in the decant water pond.* *pH targets:* • *9-10; and* • *Neutralisation of material will occur in the cyanide leach circuit with the addition of a liming agent to maintain a pH between 9 and 10.*

8.7.6 Key findings

The Delegated Officer has reviewed the information regarding TSF Pipeline Ruptures and Overtopping during Operations and has found:

1. Additional tailings characterisation data for the slurry is required to clarify the risk of tailings releases.
2. Groundwater in the local area is brackish to saline (saline within the British Queen Shaft). Infiltration of leachate from tailings spilt or discharged from TSF pipelines and pumps through soil to groundwater may impact on local terrestrial ecosystems and the beneficial uses of groundwater, however, this is unlikely as the depth to groundwater in the vicinity of the Process Plant and TSF vicinity is 30 – 55 mbgl.
3. The project is located within a groundwater area proclaimed under the *Rights in Water and Irrigation Act 1914.*
4. TSF pipelines will be bunded to contain spills, flow meters and visually inspected daily. However, there is no telemetry or alarms / automated shutoffs proposed to be installed.

8.7.7 Consequence

Based upon the expected contaminants in tailings slurry and return water (only solids data provided) the Delegated Officer has determined that the ASC NEPM may not be met on site with mid-level impacts. Therefore, the Delegated Officer considers the consequence to be **moderate.** This can be reassessed once further results are obtained prior to commissioning of the TSF.

8.7.8 Likelihood of Risk Event

The management controls proposed by the Applicant will reduce the volume discharged and area impacted in the terrestrial environment, and groundwater is 30 - 55 mbgl, therefore, the

Delegated Officer has determined that the likelihood of the consequence to soils and vegetation or to stock drinking water due to TSF pipeline spillage and discharge will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood to be **unlikely**.

8.7.9 Overall rating of TSF Pipeline Ruptures and Overtopping during Operations

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of spillage from tailings pumps, pipelines and decant return line during operation is **medium**.

8.8 Risk Assessment – Tailings Seepage

8.8.1 Description of Tailings Seepage

Tailings are to be deposited into a single cell configuration 15ha TSF. The new facility will comprise a side-hill three-sided embankment constructed on top of the existing TSF that has not been used since 1991. The TSF is in a valley setting situated between gently sloping hillsides that form the boundaries along the north and south sides of the existing facility. Some tailings pore water deposited into the TSF will seep through to the soils and groundwater below. The rate and volume of seepage is dependent on the rate of water recovery, recovery systems for seepage and the permeability of the underlying historical tailings and base of that facility.

The permeability of the base of the existing tailings facility is in the order of 0.04 m/d (5×10^{-7} m/s) in the closest shear to the TSF (Knight Piésold, 2017).

The vertical permeability of the tailings is approximately 2×10^{-6} m/s, with the possibility of the permeability falling by half an order of magnitude with ongoing air drying (Knight Piésold, 2017).

8.8.2 Identification and general characterisation of emission

Short term (24 hour) water extraction leach tests with deionised water were conducted on four tailings samples obtained from the top of the existing historical TSF. Refer to Table 25 following for the results. It is noted that the leaching tests may have underestimated the potential for some metals and metalloids to be mobilised under geochemical conditions that are likely to be present in the TSF, as the tests have not adequately characterised the role of cyanide in buffering alkaline pH values in pore fluid in the tailings or its role in forming stable and soluble complexes of some metals. As the tailings pH is likely to be higher that the values used in the laboratory leaching tests, it is likely that arsenic, selenium and metals that form soluble oxyanions in solution (particularly molybdenum) will be much higher in pore-water in TSF than simulated in leaching tests.

Accordingly, additional testing such as LEAF 1313 pH-dependent leaching tests coupled with geochemical modelling (US EPA, 2017) and short-term leaching tests using fluids which more closely resemble those likely to be present in the TSF have been recommended to be completed during the Works Approval commissioning period.

Table 25: Short term water extraction leachate results for four historical tailings samples (GCA, 2016)

		pH	EC (mS/cm)	Cl (g/L)	SO4 (g/L)	Ca	Mg	Na	K	Fe	Al	Mn	Si
						mg/L							
AUA03001	Fine-Tailings	7.7 (7.8)	78.66 (78.75)	15.09 (15.13)	32.75 (32.42)	582.1 (574.5)	5,159 (5,097)	15,164 (15,002)	364 (363)	<0.5 (<0.5)	<0.1 (<0.1)	<0.1 (<0.1)	1.7 (1.7)
AUA03003	Fine-Tailings	7.7	81.87	18.70	34.84	609.3	5,391	16,440	377	<0.5	<0.1	<0.1	1.8
AUA03002	Coarse-Tailings	6.4	37.45	9.06	9.39	549.2	2,207	5,474	414	<0.5	<0.1	<0.1	3.4
AUA03004	Coarse-Tailings	6.7	64.43	17.59	15.90	671.1	4,069	10,891	711	<0.5	<0.1	3.6	4.2

		As	Sb	Se	B	Mo	F	Ag	Ba	Bi	Co	Cr	Hg
		mg/L											
AUA03001	Fine-Tailings	0.04 (0.05)	0.003 (0.004)	0.48 (0.57)	0.7 (0.7)	0.167 (0.177)	0.14 (0.14)	0.517 (0.533)	0.099 (0.098)	<0.001 (<0.001)	0.15 (0.18)	<0.1 (<0.1)	<0.01 (<0.01)
AUA03003	Fine-Tailings	0.04	0.004	0.49	0.7	0.171	0.14	0.548	0.103	<0.001	0.18	<0.1	<0.01
AUA03002	Coarse-Tailings	0.03	0.003	0.22	0.3	0.031	0.16	0.028	0.056	<0.001	0.10	<0.1	<0.01
AUA03004	Coarse-Tailings	0.03	0.004	0.38	0.3	0.042	0.17	0.167	0.075	<0.001	0.23	<0.1	<0.01

		Ni	P	Pb	Zn	Cd	Cu	Sn	Sr	Tl	Th	U	V
		mg/L											
AUA03001	Fine-Tailings	<0.1 (<0.1)	<1 (<1)	<0.05 (<0.05)	<0.1 (<0.1)	0.025 (0.024)	<0.1 (<0.1)	<0.01 (<0.01)	9.976 (10.170)	<0.001 (<0.001)	<0.001 (<0.001)	<0.001 (<0.001)	<0.1 (<0.1)
AUA03003	Fine-Tailings	<0.1	<1	<0.05	<0.1	0.026	<0.1	<0.01	10.645	<0.001	<0.001	<0.001	<0.1
AUA03002	Coarse-Tailings	0.1	<1	<0.05	<0.1	0.007	<0.1	<0.01	1.050	<0.001	<0.001	<0.001	<0.1
AUA03004	Coarse-Tailings	0.3	<1	<0.05	<0.1	0.031	<0.1	<0.01	1.688	<0.001	<0.001	<0.001	<0.1

Note:
Slurries had a solid:solution ratio of *ca.* 1:2 (w/w) prepared from high-purity deionised-water; bottled-rolled for *ca.* 1 day.
Values in parentheses are duplicate determinations.

8.8.3 Description of potential adverse impact from the emission

Seepage can result in contamination of soils and groundwater, which can then impact on vegetation and the beneficial use of the groundwater.

In particular, the elevated concentrations of selenium that were found in short-term leaching tests of tailings materials are of environmental concern. This is because of the potential for this element to bioaccumulate in vegetation (Winkel *et al*., 2015) that will grow on the TSF after mine closure and to cause impacts on grazing animals that feed on the vegetation. Soil fauna can also bioaccumulate selenium which can then enter local food-webs as these organisms can provide a food source for birds and reptiles. Similarly, molybdenum concentrations in leachate from tailings are at levels that have the potential to be bioaccumulated in plants and cause adverse health impacts (the disease molybdenosis or the "staggers") in grazing animals that feed on the vegetation. These impacts would occur after the closure of the TSF.

There is therefore a risk that localised groundwater contamination could take place near the TSF but the risk of regionally extensive impacts on groundwater quality is considered to be negligible.

The Mine Closure Plan states that the Applicant is proposing to cap the TSF with suitable material on completion of operations or on a determination to cease the Project. The TSF will be capped with 100cm of underground mine waste material to ensure the TSF surface is left safe, stable, erosion resistant and non-polluting. Capping material will be sourced from either stockpiled competent rock from the underground workings, or screened ore sorter waste from the crushing circuit. The capping material will prevent surface dust generation. The Applicant will undertake testing of capping methods for the TSF during the operational phase of the Project. The Applicant has stated that this rock armouring/capping method will remove the risk of potential adverse impacts occurring to grazing animals as the nature of the capping material will not support a vegetation layer.

8.8.4 Criteria for assessment

Relevant land and groundwater quality criteria include ANZECC/ARMCANZ guidelines for livestock watering and fresh waters, and ASC NEPM for soils and groundwater.

8.8.1 Applicant controls

This assessment has reviewed the controls set out in Table 26 below.

Table 26: Applicant's proposed controls for Tailings seepage

Site infrastructure	Construction	Commissioning and Operation
TSF	*Decant removal system to be implemented to return decant water to the processing plant for reuse.* *A perimeter cut-off trench to be located beneath any new abutment embankment and cut to a depth of on average of 0.2 to 0.5m into bedrock refusal. The trench will be backfilled with low permeability fill.* *A toe drain to be constructed along the upstream toe of the existing embankment reporting to*	*Monitor the TSF to ensure that the facility is performing in accordance with its design specifications. This will include Operation monitoring, Compliance monitoring and Performance monitoring as set out in the Tailings Storage Facility Feasibility Study, Knight Piesold Pty Limited, 2017.* *Thickened tailings (45 to 60% solids)* *Decant removal is considered the main seepage control mechanism* *Daily inspections of:* • *Location and size of the decant water pond;* • *Decant and decant pump;*

Site infrastructure	Construction	Commissioning and Operation
	an underdrainage tower. As no underdrainage exists with the existing embankment, this feature should allow future upstream raises. The toe drain will comprise a geotextile wrapped drain coil pipe laid at the base of a 1m wide x 300 mm deep trench in the existing tailings. Drainage will be by gravity into the underdrainage tower for pumping out via a submersible pump for recycling back into the facility. *An underdrainage collection tower to be constructed at the lowest topographic point in the existing basin. This tower will collect solution from the toe drain and return it to the supernatant pond using a submersible pump with float control switches. The pump will run off a portable generator. It is not expected the underdrainage pump will be operated during the first year while beaching is developed and the supernatant pond is migrated to the top northwest point of the facility.*	• *Any seepage from the embankment toe;* • *Integrity of the embankment;* • *Any changes in existing cracking or seepage at the embankment; and* • *Access roads to and from the TSF.*
Decant tower	*Initially a temporary Stage 1 decant tower will be incorporated to migrate the pond from the existing northeast corner to the northwest valley. The decant tower will be accessed from the south ridge with an inlet trench excavated in the tailings beach to direct water to the tower.* *The Stage 2 onwards decant tower will be located in the head of the valley to the northwest. This will be located in the head of the valley to utilise a natural restriction in the topography to ensure that the pond is remote from the main embankment (for stability) and to be able to maintain a small pond area (for a given depth) allowing for greater water return.* *Consists of an access causeway leading from a natural ridge to a concrete decant tower located at the centre of the causeway.* *It will be designed for the*	*Decant removal is the main seepage control mechanism. This water is returned to the Process Water Dam for reuse.* *The decant will operate automatically, reclaiming water from the TSF and pumping it via a HDPE pipeline to the process plant. The decant pump is required to be raised in small increments on a regular basis to ensure that no tailings enter the pump intake (this is a manual operation via a lifting hoist).* *Daily inspections conducted of the decant return water pipeline.*

Site infrastructure	Construction	Commissioning and Operation
	following: • *An excavated inlet slot to allow early return of supernatant water to the tower in the initial stage;* • *An access causeway of varying length off a natural ridge constructed from Zone D material (general fill) for the causeway and Zone G material (clean rockfill) surrounding the tower with a wearing coarse placed on the crest;* • *A concrete decant tower located at the centre of the causeway and consisting of a 1.2 m diameter slotted concrete pipe installed on a concrete footing;* • *A flowmeter equipped submersible pump with float control switches mounted on a lifting hoist within the tower and associated electrical infrastructure located on natural ground; and* • *discharge water pipeline running to the process tank at the process plant*	
Spigots for tailings deposit	*Distributed along the whole length of embankment.*	*Deposition locations will be moved progressively along the distribution line as required (typically daily to weekly) to control the location of the supernatant pond away from the embankment and to maximise the available storage.*
Five groundwater monitoring bores and four piezometers	*Installed adjacent to the TSF at locations indicated in* Table 27*,* *Table* 28 *and Figure 3.* *Monitoring locations have been selected on the downstream edges of the valley containment cell along embankment walls or bounding natural ridges*	*Five monitoring bores and four piezometers are proposed to be installed for monitoring groundwater levels, conductivity, major component water quality analytes and Total CN and WAD CN around the perimeter of the TSF.*

Table 27: TSF groundwater monitoring bores to be installed

Borehole ID	Easting	Northing	Elevation
BH-01	488295.9	6760632.9	364.2
BH-02	488376.2	6760715.9	365.0
BH-05	488106.4	6760666.3	368.5
BH-06	488294.3	6760940.6	371.3
BH-07	487881.8	6761033.9	378.9

Table 28: TSF Piezometers to be installed

Piezometer ID	Easting	Northing
PZ-01	488125.5	6760661.8
PZ-02	488301.6	6760656.8
PZ-03	488420.9	6760803.4
PZ-04	488360.4	6760920.0

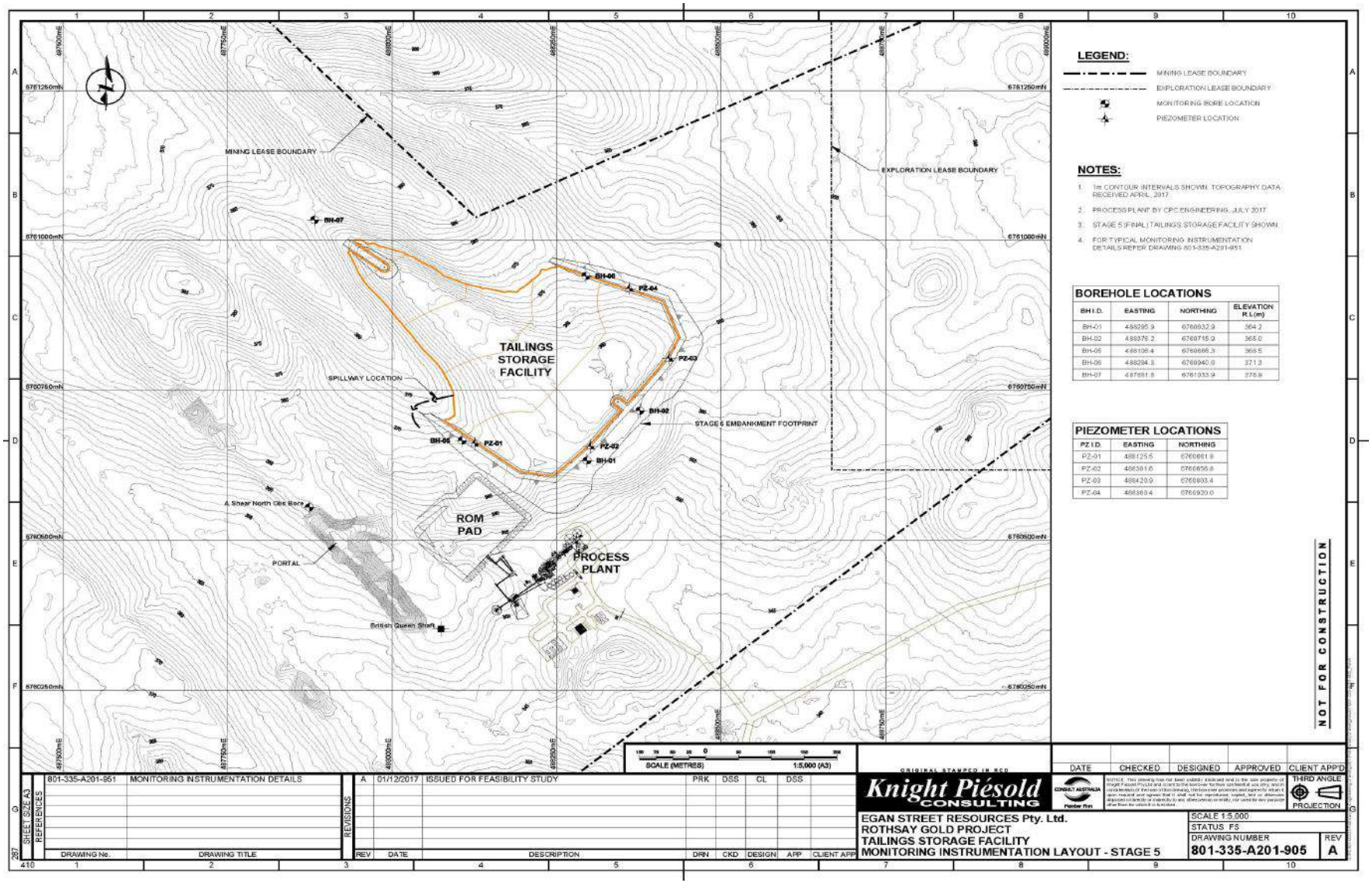

Figure 5: Tailings Storage Facility with monitoring bore and piezometer locations shown

8.8.2 Key findings

The Delegated Officer has reviewed the information regarding Tailings seepage and has found:

1. Tailings are to be deposited for 6.5 years into the TSF. The existing TSF has not been operational for the previous 27 years. The new TSF will be constructed on the base of the existing TSF.
2. Seepage is expected to occur from the TSF. Permeability of 1 x 10^{-7}m/s is assumed for TSF lift seepage calculations by Coffey 2016a, as indicative of the TSF materials to be used.
3. Core Penetration Testing of the existing TSF showed a moisture content of 4.3%. The Applicant has not provided permeability of the TSF or hydrogeological modelling to demonstrate the maximum extent of seepage expected over the life of the TSF.
4. Groundwater in the vicinity of the TSF is approximately 30 - 55 mbgl and suitable for stock watering uses.
5. Tailings contaminants (including soluble metals, metalloids and cyanide species) leached to groundwater may impact beneficial uses of groundwater in the local vicinity.
6. Further tailings characterisation has been deemed to be required.
7. Seepage flow will be impacted by mine dewatering activities.
8. Groundwater should be monitored to enable detection of impacts to groundwater. Five groundwater monitoring bores and four piezometers are to be installed.

8.8.3 Consequence

Although groundwater in the vicinity of the TSF is not currently used for livestock water, and it is not proposed to be used for that purpose during the project, the project should be managed so as to ensure that groundwater quality is maintained at its baseline level.

Groundwater quality should therefore be protected to ensure that groundwater remains suitable for its highest beneficial use. Due to the lack of tailings decant composition data, until additional tailings characterisation testing is completed, the Delegated Officer has determined that the ANZECC/ARMCANZ criteria for stock drinking water may not be met within the local area, therefore, the Delegated Officer considers the consequence to be **moderate**. This can be reassessed once further results are obtained.

8.8.4 Likelihood of Risk Event

The preliminary water balance that has been undertaken for the facility indicates that there should be little or no seepage from the facility under average climate conditions, but this assessment does not consider the potential effects of a series of intense rainfall events on the overall water balance of the TSF. There is a risk that seepage could take place from the facility after heavy rainfall events or if the density of the tailings deposited at the TSF were reduced. Localised groundwater contamination could take place near the TSF under these conditions.

The Delegated Officer has considered that tailings will be deposited for 6.5 years into a TSF with low moisture content and that groundwater in the vicinity of the TSF is 30 - 55 mbgl and that little or no seepage should occur under average climate conditions. The Delegated Officer has determined that the likelihood of the 'moderate' consequence to stock drinking water due to seepage from the TSF will probably not occur. Therefore, the Delegated Officer considers the likelihood to be **unlikely**.

8.8.5 Overall rating of Tailings seepage

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of seepage from the TSF during operation is **medium**.

8.9 Risk Assessment – Temporary Dewatering Discharge to Drainage Line

8.9.1 Identification and general characterisation of emission

In the first four months the Applicant plans to discharge 233 ML of abstracted water from the British Queen Shaft to an ephemeral drainage line. This is because the permanent infrastructure for the long term disposal of mine dewater is not currently in place. There will be two abstraction points for the water. The British Queen Shaft abstraction point will occur by installing primary pump stations, centrifugal secondary pumps and travelling helical rotor pumps. The RYDW abstraction point will consist of a large diameter (10 inch) drill hole connecting to the existing underground mine working at the 1230mRL decline crosscut. This will be sufficient to dewater to the base of the existing underground workings. The hole will be cased where required and a pump lowered down the hole to facilitate dewatering.

The raw water will be ponded in a previously excavated depression along the drainage line for use by water trucks in dust suppression with excess water continuing down the drainage line.

This temporary discharge is required for the first four months of the Project to allow access to the underground workings for mine rehabilitation/refurbishment of the existing portal and decline.

8.9.2 Identification and general characterisation of emission

Groundwater quality from the British Queen Shaft is impacted from mining. The water is brackish with a TDS of approximately 5,000 mg/L (when compared to other bores in the vicinity of the project, the TDS of these range from 1,060 – 2,930 mg/L). Magnesium, chloride and sulfate concentrations are also elevated within the British Queen Shaft, when compared to other nearby groundwater monitoring bores.

It should be noted that the potential for additional abstraction bores to be installed outside of the British Queen Shaft was queried as this would result in better water quality being discharged (not elevated in TDS and EC from the inner workings of the mine shaft), however, this option has a high potential for delayed dewatering of the mine workings from low yield rates and would need to be drilled 250m below the grounds surface and is not preferred.

Hydraulic modelling was used to determine a high-level estimate of downstream surface water expression based on the available terrain data and assumed discharge and infiltration rates. A two-dimensional (2D) hydraulic model was set up using HEC-RAS 5.0.7 (USACE 2019) to simulate a range of discharge rates. The results provided in Table 29 are based on the assumption that discharge rates remain constant for sufficient time to allow storages to fill and steady flow conditions to be reached. Infiltration rates are likewise assumed to be constant and do not vary with flow depth or groundwater table elevation.

Table 29: Estimated wetting front extent for temporary dewatering discharge

Scenario	Discharge (L/s)	Infiltration (mm/hr)	Length (km)
1	5	2	1.5
2	5	4	1.0
3	5	6	0.5
4	11	2	3.0
5	11	4	1.5
6	11	6	1.0

8.9.3 Description of potential adverse impact from the emission

Discharge of dewater could result in scouring impacts to the drainage line and thus impact on vegetation. The vegetation could also be impacted by the quality of the water, particularly by the increased salinity being above that of the rainwater that this vegetation would usually be exposed to. The water quality is suitable for livestock use, so is of good quality, aside from the TDS and EC, which is slightly elevated, but still suitable for most livestock watering. TDS of 5,000 – 10,000 mg/L is “Generally unsuitable for lambs, calves and weaners. Caution needed with lactating stock if unaccustomed. Suitable for dry, mature sheep and cattle”.

The vegetation could also possibly become adjusted to the additional water and be impacted once the discharge is ceased, however, as this is only being discharged for a temporary period and over a localised area, it is only expected to have minor impacts.

There are two vegetation types in the ephemeral drainage line area. These are:

- Low open woodland dominated by *Melaleuca hamata* over tall to open shrubland over a low sparse shrubland typically associated with basalt substrates, including basalt hills and their outwashes (includes three Priority 1 taxa and four Priority 3 taxa. No threatened flora species occurring); and
- Low open woodland dominated by eucalypts over a tall sparse shrubland of mixed species over low sparse shrubland and tussock grassland. These eucalypt woodlands are associated with deeper, slightly saline soils in valleys and on plains (includes three Priority 1 taxa and four Priority 3 taxa. One threatened flora species *Eucalyptus Synandra* has the potential to occur).

The two vegetation types mentioned above are:

- Well represented in the study area;
- Not considered to potentially represent significant vegetation (in both a local and regional context); and
- Do not contain the listed Blue Hills (Mount Karara/ Mungada Ridge/Blue Hills) vegetation complexes (banded ironstone formation) PEC (Priority 1).

8.9.4 Criteria for assessment

The water quality of the groundwater from the British Queen Shaft, although impacted from historical mining practices is suitable for livestock use, aside from TDS and EC, and meets the ANZECC/ARMCANZ 95% species protection levels for freshwater (aside from zinc).

8.9.5 Applicant controls

This assessment has reviewed the controls set out in Table 30 below.

Table 30: Applicant's proposed controls for Temporary Dewatering Discharge to a Natural Drainage Line

Site infrastructure	Description
Mine dewatering pumps	*Dewatering pumps to be situated in water at a depth that does not agitate sediment particles within the mine shaft.*
Ephemeral drainage line discharge	*If project timing allows, the temporary discharge is to occur during the wettest months of the year to dilute the discharge salinity.* *Spillway to minimise sediment mobilisation down the drainage line.* *The spillway will have rock armouring.* *A holding dam will be constructed immediately downstream of the spillway and will partially settle out the sediment.* *A continuous flow will be maintained through a set diameter pipe.* *Daily inspection of the holding dam and spillway area will occur.*
Vegetation	*A monitoring program is to be conducted for vegetation health which includes:* • *the statistical analysis of chlorophyll fluorescence leaf measures taken with a handheld Plant Efficiency Analyser; and* • *Fortnightly visual health inspections.* *Thresholds have been implemented to enable the early detection of vegetation stress. If these thresholds are met, then the Applicant will cease groundwater pumping and subsequent discharge to the drainage line immediately.* *The baseline vegetation monitoring locations and associated data collection have yet to be established along the drainage line. This will inform the content of the Vegetation Monitoring Operating Procedure.*

8.9.6 Key findings

The Delegated Officer has reviewed the information regarding temporary mine dewatering discharge to drainage line and has found:

1. *There is a direct discharge of approximately 233 ML of abstracted mine dewatering water for a temporary period of four months.*
2. *The water quality is slightly elevated in salinity, but is suitable quality for livestock use, so is of good quality.*
3. *Vegetation monitoring is to be conducted.*
4. *Hydrologic modelling has been conducted and indicates a maximum distance of 3kms flow down the drainage line.*

8.9.7 Consequence

Based on the quality of the mine dewatering water having increased salinity and potential for scouring and ponding occurring, the Delegated Officer has determined that the impact of temporary mine dewatering discharge to drainage line will be localised.

The vegetation types in the area are not classified as Threatened Ecological Communities and do not contain Declared Rare Flora. There are no Groundwater Dependent Ecosystems in the discharge area and impacts on vegetation from the proposed discharge are not considered to be significant.

Therefore, the Delegated Officer considers the consequence of temporary mine dewatering discharge to drainage line to be **moderate.** This can be reassessed once results of the hydrologic model are obtained.

8.9.8 Likelihood of Risk Event

The fact that the discharge is only for a temporary period and the Applicant controls of the vegetation monitoring program should ensure that impacts are limited to that detected over a fortnightly period.

The Delegated Officer has determined that impacts from temporary mine dewatering discharge to drainage line could potentially occur as there is a direct discharge. Therefore, the Delegated Officer considers the likelihood to be **possible**.

8.9.9 Overall rating of Temporary Dewatering Discharge to Drainage Line

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 15) and determined that the overall rating for the risk of temporary dewater to a drainage line is **medium**.

8.10 Risk Assessment – Permanent Dewatering Discharge Spillage from Dewatering Pumps, Pipelines and Seepage

The dewatering of groundwater to allow mining of ore within the British Queen Shaft will occur by installing primary pump stations, centrifugal secondary pumps and travelling helical rotor pumps. There will be two abstraction points for the water. The British Queen Shaft abstraction point will occur by installing primary pump stations, centrifugal secondary pumps and travelling helical rotor pumps. The RYDW abstraction point will consist of a large diameter (10 inch) drill hole connecting to the existing underground mine working at the 1230mRL decline crosscut. This will be sufficient to dewater to the base of the existing underground workings. The hole will be cased where required and a pump lowered down the hole to facilitate dewatering. Transfer pipelines of 1.5km will run from this bore pump to an evaporation / infiltration pond on the surface (750m north east of the TSF) where a rising main is located.

Some of this water will be diverted to the Raw Water Dam and mixed with bore water from the mine production bores and used as make up water to supplement water supplies to the Processing Plant.

505,000 tonnes per annum of groundwater is to be abstracted. Depth to groundwater is 24 mbgl.

The Evaporation/Infiltration Pond to be constructed is to manage mine dewatering from the British Queen Shaft at a rate of 10 L/s. Two embankments will be constructed bounding a depression and result in a total storage capacity of 21,580m^3 and infiltration of 2 mm/hour.

8.10.1 Identification and general characterisation of emission

Groundwater quality from the British Queen Shaft is slightly impacted from mining. The water is brackish with a TDS of approximately 5,000 mg/L (when compared to other bores in the vicinity of the project, the TDS of these range from 1,060 – 2,930mg/L). Magnesium, chloride and sulfates are also elevated within the British Queen Shaft.

8.10.2 Description of potential adverse impact from the emission

The release of mine dewatering water via overtopping, spills or leaks could result in inundation

of soils and vegetation or a large release could reach nearby ephemeral drainage lines, however, the water quality is suitable for livestock use, so is of good quality. The higher salinity could impact on vegetation, though it is not extremely saline. The evaporation/infiltration pond is designed to infiltrate. Groundwater mounding could result in inundation of root systems of nearby vegetation, however, groundwater is quite deep at 24 mbgl in the vicinity of the evaporation/infiltration pond.

8.10.3 Criteria for assessment

The water quality of the groundwater from the British Queen Shaft, although impacted from historical mining practices (shown by the elevations in some parameters when compared to other local groundwater monitoring bores) is suitable for livestock use for all parameters tested and meets the ANZECC/ARMCANZ 95% species protection trigger levels for freshwater (aside from zinc and ammonia results).

8.10.4 Applicant controls

This assessment has reviewed the controls set out in Table 31 below.

Table 31: Applicant's proposed controls for Permanent Dewatering Discharge Spillage from Dewatering Pumps, Pipelines and Seepage

Site infrastructure	Description
Mine dewatering pumps	*Situated in the groundwater within the British Queen Shaft at a depth that does not agitate sediment particles within the shaft resulting in sediment laden groundwater*
Mine dewatering pipelines	*110mm HDPE pipelines with bunded pipeline routes*
Evaporation/Infiltration pond	*Final storage volume of 21,580m^3* *2mm/hr infiltration* *Technical advice will be sought from a hydrologist as to the location of the groundwater monitoring bore network that is to be established to monitor groundwater standing levels and quality in the vicinity of the Evaporation/Infiltration Pond. These will monitor and measure the potential for lateral seepage to vegetation.* *Maintaining an efficient water balance for the Project will be a key factor in managing the risk of overtopping of the Evaporation/Infiltration Pond. Objectives of the water balance will be to minimise the need for:* • *Abstraction from mine supply bores (to use as make up water for the Raw Water Dam); and* • *Disposal of raw water from the Raw Water Dam to the Evaporation/Infiltration Pond. Raw water (in the Raw Water Dam) will primarily be sourced from dewatering of mine workings.* *Water can be diverted from the Raw Water Dam to the Evaporation/infiltration Pond if monitoring indicates that freeboard is approaching.* *Raw water consumption over the site can be increased if monitoring indicates that the Evaporation/Infiltration Pond freeboard is approaching.* *The 500mm design freeboard of the Evaporation/Infiltration Pond can*

Site infrastructure	Description
	hold an approximate volume of 6,800 cubic meters of water. This equates to in excess of 190 hours storage at full pumping rates, assuming no evaporation or infiltration. The most likely cause of overtopping, therefore, is through a significant storm event. A diversion bund has been included in the design to direct overland sheet flow away from the Evaporation/Infiltration Pond. A spillway has also been included in the design for the release of diluted pond water into a nearby drainage channel.

8.10.5 Key findings

The Delegated Officer has reviewed the information regarding Permanent Dewatering Discharge Spillage from Dewatering Pumps, Pipelines and Seepage and has found:

1. *505,000 tonnes per annum of groundwater is to be abstracted and directed to the Raw Water Dam for reuse, with excess discharged to the evaporation/infiltration pond.*
2. *The dewatering water is from the British Queen Shaft and has elevated salinity than local groundwater.*

8.10.6 Consequence

Based on the quality of the mine dewatering water having increased salinity and the potential to mound in the vicinity of the evaporation/infiltration pond from seepage, the Delegated Officer has determined that the impact of Permanent Dewatering Discharge Spillage from Dewatering Pumps, Pipelines and Seepage will be localised. Therefore, the Delegated Officer considers the consequence of permanent mine dewatering to be **minor**.

8.10.7 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of *Permanent Dewatering Discharge Spillage from Dewatering Pumps, Pipelines and Seepage* impacting is **possible**.

8.10.8 Overall rating of Permanent Dewatering Discharge Spillage from Dewatering Pumps, Pipelines and Seepage

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 15) and determined that the overall rating for the risk of temporary dewater to a drainage line is **medium.**

8.11 Risk Assessment – Landfill Waste Disposal and Leachate

Putrescible waste, inert waste type 1 and inert waste type 2 (plastics and rubber/tyres) will be disposed of into the permanent landfill. It should be noted that there is also a temporary landfill to be established, however, this does not trigger the landfill categories on the EP Regs.

Cover material is to be sourced from windrows constructed from the trench soils.

Waste is to be delivered to the trenches in a trailer or truck and tripped / thrown into the trenches.

Recycling options are to be investigated to recycle packing materials, aluminium, glass, timber, cardboard/paper and plastic. Scrap metal will be sorted and collected for recycling by a contractor.

Waste oils, oil filters and hydrocarbon contaminated rages will be collected in approved

receptacles and stored in the bulk fuel compound prior to removal from site.

Used tyres will either be removed from site for recycling or disposed of offsite to an approved facility or otherwise, disposed of to the landfill.

8.11.1 Identification and general characterisation of emission

Leachate discharges can enter the environment through seepage and runoff of contaminated stormwater from the active landfilling area resulting in groundwater contamination.

8.11.2 Description of potential adverse impact from the emission

The most significant impact of the putrescible landfill on the surrounding environment is from leachate. Leachate quality varies throughout the operation of the landfill and after closure. During the early stages of waste degradation and leachate generation the composition is acidic and high in volatile fatty acids (the acetogenic phase). This acid leachate my dissolve other components of the wastes, such as heavy metals. The leachate also contains high concentrations of ammoniacal nitrogen and has both a high organic carbon concentration and biochemical oxygen demand.

8.11.3 Criteria for assessment

Relevant land and groundwater quality criteria include the ANZECC/ARMCANZ guidelines for livestock and fresh waters, the *Landfill Waste Classification and Waste Definitions 1996* and ASC NEPM for soils and groundwater.

8.11.4 Applicant controls

The Applicant's controls for the landfill are set out in Table 32 below.

Table 32: Applicant's proposed controls for the Landfill

Site infrastructure	Description
Putrescible trench	• *Total waste for inert and putrescible to be 250 tonnes per annum;* • *20m long x 1.2m wide;* • *Located more than 100m from any marked ephemeral drainage line;* • *Located more than 270m downgradient of camp production bore RYMP2; and* • *Located more than 310m up gradient of production bore RYMP1, which will used as a backup supply for potable water if insufficient volumes from RYMP2.*
Inert trench	• *Total waste for inert and putrescible to be 250 tonnes per annum; and* • *30m long x 4m deep.*
Other	• *Used oil filters and hydrocarbon contaminated rags are to be collected in approved receptacles and stored onsite in the bulk fuel compound prior to removal from site to an appropriate disposal facility; and* • *Hydrocarbon contaminated soils are to be removed to the biopad facility at the landfill.*

8.11.5 Key findings

The Delegated Officer has reviewed the information regarding Landfill Operations Including Waste Disposal and Leachate:

1. *Only putrescible waste, inert waste type 1 and inert waste type 2 in accordance with*

the Landfill Waste Classification and Waste Definitions 1999 are to be accepted at the landfill trenches for disposal. The acceptance of waste for disposal not meeting the types permitted for disposal, may result in a breach of section 53 of the EP Act.

2. *No more than 250 tonnes per year of waste is to be disposed. Waste to be covered at a minimum of once per fortnight with material sourced from trench windrows to reduce windblown waste and reduce scavengers.*
3. *Landfill is to be fenced in a secure compound as a barrier to feral and native animals and to reduce windblown waste.*
4. *Groundwater in the vicinity of the landfill sites is 20 – 24 mbgl.*

8.11.6 Consequence

Based upon the low volumes of waste to be disposed of and the distance to groundwater in vicinity of the landfill 20 – 24 mbgl, the Delegated Officer considers that there may be a minimal on-site impact and therefore considers the consequence to be **slight**.

8.11.7 Likelihood of Risk Event

Based upon the distance to groundwater of 20 – 24 mbgl and Applicant controls the likelihood of an environmental impact will not occur in most circumstances and the likelihood of the consequence to be **unlikely**.

8.11.8 Overall rating of Impacts to from the landfill

Comparison of the consequence and the likelihood ratings described above with the risk rating matrix (Table 18) determines the overall rating for the risk of the landfill during operation to be **low**.

8.12 Summary of acceptability and treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the risk events set out above, with the appropriate treatment and control, are set out in Table 33 below. Controls are described further in section 9.

Table 33: Risk assessment summary

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
1	Stormwater Runoff	Dry processing area Wet processing area Infrastructure drainage	Directly to ground Infiltration of soil to groundwater	Infrastructure design and construction requirements (sedimentation ponds) Requirements regarding operation of infrastructure (300mm freeboard)	Minor consequence Unlikely likelihood **Medium Risk**	Acceptable subject to regulatory controls Applicant controls to be specified as construction requirements for the Works Approval Requirements regarding operation of infrastructure to be included in Licence
2	Leaks or Overflows from the Process Water Dam Possible elevated WAD CN and/or metals	Spillage of solutions from the grinding and classification circuit, gravity recovery circuit, carbon CIL and elution circuit and gold room operations	Directly to ground Infiltration of soil to groundwater	Infrastructure design and construction requirements (CIL tanks bunded, sump pumps) Requirements regarding operation of infrastructure (leaks/spills captured)	Minor consequence Unlikely likelihood **Medium Risk**	Acceptable subject to regulatory controls Construction requirements for the Works Approval Requirements regarding operation of infrastructure and monitoring
3	Fauna accessing Process Water Storages/ Tailings Containing Cyanide	Process water	Fauna, particularly birds, gaining access to the ponds	Inspections and wastewater quality monitoring	Minor consequence Unlikely likelihood **Medium Risk**	Additional regulatory controls to be imposed in the works approval and licence to meet recommended WAD cyanide concentration in tailings discharge. Construction requirements for the Works Approval Requirements regarding operation of infrastructure and monitoring

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
4	TSF Pipeline Ruptures and Overtopping releasing tailings with elevated metal(loid)s concentrations	Transfer of TSF decant return From Raw Water Dam overflow	Directly to ground Infiltration of soil to groundwater	Infrastructure design and construction requirements (Process Water Dam) Requirements regarding operations of infrastructure (300mm freeboard)	Moderate consequence Unlikely likelihood **Medium Risk**	Acceptable subject to regulatory controls Construction requirements for the Works Approval Requirements regarding operation of infrastructure and monitoring
5	Tailings seepage containing soluble Arsenic, Selenium, Copper, Chromium, Molybednum and other trace metal(loids).	Leachate from the TSF	Infiltration to groundwater impacting on groundwater quality Groundwater mounding impacting on root zones of vegetation	Infrastructure design and construction requirements (TSF underdrainage, toe seepage recovery, piezometers, decanting pumping, spigot distribution, groundwater monitoring bores) Requirements regarding operation of infrastructure	Moderate consequence Unlikely likelihood **Medium Risk**	Acceptable subject to regulatory controls Construction requirements for the Works Approval Requirements regarding operation of infrastructure and monitoring
6	Temporary Dewatering Discharge to Drainage Line	Dewatering water from underground mine	Direct discharge to the drainage line Brackish salinity impacting soils	Infrastructure design and construction requirements (pump placement, spillway, holding dam, vegetation monitoring) Requirements regarding operation of infrastructure (inspections)	Moderate consequence Possible likelihood **Medium Risk**	Acceptable subject to regulatory controls Construction requirements for the Works Approval Requirements regarding operation of infrastructure and monitoring

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
7	Permanent Dewatering Discharge Spillage from Dewatering Pumps, Pipelines and Seepage	Dewatering water from underground mine	Infiltration of the dewatering water through the base of the evaporation/infiltration pond	Infrastructure design and construction requirements (pump placement, bunding for pipelines) Requirements regarding operation of infrastructure	Minor consequence Possible likelihood **Medium Risk**	Acceptable subject to regulatory and applicant controls Construction requirements for the Works Approval Requirements regarding operation of infrastructure and monitoring
8	Landfill Waste Disposal and Leachate	Putrescible and inert landfill trenches attracting increased scavengers	Ingestion affecting fauna Infiltration of soil to groundwater	Siting of infrastructure and fencing Requirements regarding operation of infrastructure Restriction on input	Slight consequence Unlikely likelihood **Low Risk**	Acceptable, with applicant controls conditioned.

9. Regulatory controls

A summary of regulatory controls determined to be appropriate for the assessment in section 8 is set out in **Error! Reference source not found.**. The conditions of the Works Approval will be et to give effect to the determined regulatory controls.

9.1 Works Approval controls

9.1.1 Stormwater Runoff Infrastructure

The following environmental controls, infrastructure and equipment should be constructed to manage stormwater runoff at the premises.

Site infrastructure	Requirements (design and construction)
All water containing infrastructure	• *Process area drainage designed to contain a 1:100 year rainfall event (average rainfall intensity of 72 hour duration).*
Ore processing activities	• *All slurry containing facilities will be constructed within bunded concrete areas designed to contain at least 110% capacity of the largest vessel in the bund.*
Plant Drainage Retention Pond (sediment trap for entire plant area)	*Plant Drainage Retention Pond (sediment trap for entire plant area):* • *Captures drainage runoff and overland flows from the plant area, including non-process infrastructure, buildings and the ROM pad.* • *Diversion drain and a cut off drain incorporated into the design to direct peak flows away from the plant infrastructure.* • *Lined with 1.5mm HDPE.* • *Storage capacity of at least 1,774m^3.*
Process Water Dam (dam for wet plant drainage)	• *Drainage from wet plant pad (milling, leaching, metal recovery and refining and reagents areas) directed to sumps.* • *Accepts TSF decant return water via decant return pump.* • *Water collected in these sumps directed to the HDPE lined Process Water Dam for reuse within the process.* • *Lined with an impermeable HDPE membrane.* • *500 mm minimum freeboard maintained in the pond.* • *Storage capacity 2,160 m^3.* • *All raw and process water infrastructure will be equipped with a level sensing instrument. The instrument will perform the following functions:* ➢ *Transmit a level measurement to the control room; and* ➢ *Control a level switch to prevent the pump from running dry.* • *Cyanide Storage Tank with an automated dosing system that includes:* ➢ *Pump controlled via a variable speed drive, interlocked to a level indicator located inside the cyanide storage tanks to prevent the pump from running dry;* ➢ *Flow control valve installed at the delivery point to regulate the dosing rate prior to delivery to the leaching and adsorption tanks in the Processing Plant; and* • *Flow rate regulated by the flow control valve will be set based on the mill throughput rate and controlled via a setting in the control room.*

9.1.2 Chemical Reagent Storage

The following environmental controls, infrastructure and equipment should be constructed to manage chemical reagent storage at the premises.

Site infrastructure	Requirements (design and construction)
Workshop, *Vehicle Refuel Areas,* *Vehicle Washdown Bay, Oily water separator*	• *Separate concrete pads with a collection sump and an oily water separator.* • *Oily water separator located within a bunded area and include a small tank for the storage of separated oil.* • *Vehicle Washdown bay centrally drained through a weir to the sump.*

9.1.3 Process Plant, TSF and Process Water Dam

The following environmental controls, infrastructure and equipment should be constructed to manage the wet process circuits at the premises.

The Delegated Officer considers that in addition to the controls proposed by the applicant, the wet process area should be constructed to contain spills due to the hazardous nature of the process solutions.

Site infrastructure	Requirements (design and construction)
Plant Drainage Retention Pond (sediment trap for entire plant area)	*Plant Drainage Retention Pond (sediment trap for entire plant area):* • *Captures drainage runoff and overland flows from the plant area, including non-process infrastructure, buildings and the ROM pad.* • *Diversion drain and a cut off drain incorporated into the design to direct peak flows away from the plant infrastructure.* • *Lined with 1.5mm HDPE.* • *Storage capacity of at least 1,774m^3.*
Process Water Dam (dam for wet plant drainage)	• *Drainage from wet plant pad (milling, leaching, metal recovery and refining and reagents areas) directed to sumps.* • *Accepts TSF decant return water via decant return pump.* • *Water collected in these sumps directed to the HDPE lined Process Water Dam for reuse within the process.* • *Lined with an impermeable HDPE membrane.* • *500 mm minimum freeboard maintained in the pond.* • *Storage capacity 2,160 m^3.* • *All raw and process water infrastructure will be equipped with a level sensing instrument. The instrument will perform the following functions:* ➢ *Transmit a level measurement to the control room; and* ➢ *Control a level switch to prevent the pump from running dry.* • *Cyanide Storage Tank with an automated dosing system that includes:* ➢ *Pump controlled via a variable speed drive, interlocked to a level indicator located inside the cyanide storage tanks to prevent the pump from running dry;* ➢ *Flow control valve installed at the delivery point to regulate the dosing rate prior to delivery to the leaching and adsorption tanks in the Processing Plant; and* • *Flow rate regulated by the flow control valve will be set based on the mill throughput rate and controlled via a setting in the control room.*
Ponds including tailings supernatant pond containing WAD CN	• *Limit for WAD CN:* ➢ *WAD CN 50 mg/L*

9.1.4 Tailings Pipelines and TSF Infrastructure

The following environmental controls, infrastructure and equipment should be constructed to manage tailings pipelines and seepage from the TSF.

Groundwater flow is from the north to the south/south east towards the Lake Monger drainage system. Five groundwater monitoring bores are located on the downstream edges of the valley containment cell along embankment walls or bounding natural ridges. Four piezometers are to be installed as well.

Site infrastructure	Requirements (design and construction)
TSF containment storage *TSF slurry pipeline and pumps* *TSF decant return water line and pumps*	• *Single cell configuration TSF.* • *Total footprint 15 ha.* • *Constructed on existing footprint of previous TSF.* • *Side-hill three-sided embankment.* • *Embankment staging:* ➢ *Lift 1 embankment crest level of RL366.5m;* ➢ *Lift 2 from embankment crest level of RL366.5m to crest level of RL368.5m;* ➢ *Lift 3 from embankment crest level of RL368.5m to crest level of RL370.1m;* ➢ *Lift 4 from embankment crest level of RL370.1m to crest level of RL371.7m;* ➢ *Lift 5 from embankment crest level of RL371.1m to crest level of RL373.1m.* • *10-15 tailings discharge spigots distributed equally around the perimeter of the TSF.* • *Decant removal system:* ➢ *Temporary Stage 1 (first year of operations up to RL366.5m) decant tower;* ➢ *Stage 2 onwards (year 2 onwards up to RL373.1m) decant tower in the head of the valley to the northwest;* ➢ *Access causeway leading from a natural ridge to a concrete decant tower located at the centre of the causeway;* ➢ *An excavated inlet slot to allow early return of supernatant water to the tower in the initial stage;* ➢ *An access causeway of varying length off a natural ridge constructed from Zone D material (general fill) for the causeway and Zone G material (clean rockfill) surrounding the tower with a wearing coarse placed on the crest;* ➢ *A concrete decant tower located at the centre of the causeway and consisting of a 1.2 m diameter slotted concrete pipe installed on a concrete footing;* ➢ *A flowmeter equipped submersible pump with float control switches mounted on a lifting hoist within the tower and associated electrical infrastructure located on natural ground; and* ➢ *discharge water pipeline running to the process tank at the process plant:* • *Perimeter cut-off trench.* • *Toe drain reporting to underdrainage collection tower.* • *Tailings slurry and decant return pipelines within 10^{-9} permeability corridor with sufficient capacity to ensure all solids and liquors are captured within the trench.* • *Flow meters installed on pipelines.* • *Six groundwater monitoring bores:* ➢ *BH-01, 488295.9E, 6760632.9N;*

	➢ *BH-02, 488376.2E, 6760715.9N;* ➢ *BH-05, 488106.4E, 6760666.3N;* ➢ *BH-06, 488294.3E, 6760940.6N;* ➢ *BH-07, 487881.8E, 6761033.9N;* • *Four piezometers:* ➢ *PZ-01, 488125.5E, 6760661.8N;* ➢ *PZ-02, 488301.6E, 6760656.8N;* ➢ *PZ-03, 488420.9E, 6760803.4N;* *PZ-04, 488360.4E, 6760920.0N.*

9.1.5 Dewatering Infrastructure

The following environmental controls, infrastructure and equipment should be constructed to manage mine dewatering discharge to the evaporation / infiltration pond. The specified infrastructure requirements have been derived from obligations of the application and are considered necessary to ensure regulatory oversight and outline what has been assessed under the issued Works Approval.

Site infrastructure	Requirements (design and construction)
Pumps from the British Queen Mine Shaft	• *Mine dewatering pumps to be situated in water at a depth that does not agitate sediment particles within the mine shaft.* • *Flow meters installed to monitor volumes discharged.*
Temporary discharge to drainage line	• *Spillway to minimise sediment mobilisation down the drainage line.* • *A holding dam will be constructed immediately downstream of the spillway and will partially settle out the sediment.* • *A continuous flow will be maintained through a set diameter pipe.*
Permanent discharge to Evaporation/Infiltration Pond:	• *110mm HDPE pipelines contained within an earthen bund.* • *Evaporation/Infiltration Pond storage capacity 21,580m^3.* • *Surface area and volume with embankments:* ➢ *RL346.50m, surface area 6,730m^2, volume 5,690m^3 (depicted in purple shading in Site Plan 5); and* ➢ *RL348.50m, surface area 13,640m^2, volume 21,580m^3 (depicted in blue shading in Site Plan 5).* • *A diversion bund has been included in the design to direct overland sheet flow from significant storm events away from the Evaporation/Infiltration Pond. A spillway has also been included in the design for the release of diluted pond water into a nearby drainage channel.*

9.1.6 Landfill

The following environmental controls, infrastructure and equipment should be constructed to manage waste disposal and leachate from the landfill facility at the premises. Some additional regulatory controls have been included as a result of the risk assessment.

Site infrastructure	Requirements (design and construction)
Putrescible, inert and tyre landfill trench	• *Landfill located more than 100 m away from any marked ephemeral drainage line.* • *Landfill located greater than 20 m above the groundwater table.* • *Separate industrial and putrescible waste trenches.* • *Fencing installed to prevent access by fauna and capture windblown waste.*

9.1.7 Commissioning and Time Limited Operations

Commissioning conditions have been provided for the Processing Plant and TSF for 30 calendar days as per the Applicant's timeframe. Commissioning conditions have been provided for the Evaporation/infiltration Pond for 7 calendar days as per the Applicant's timeframe. Time Limited Operational conditions have been applied for 180 calendar days.

10. Applicant's comments

The Applicant was provided with the draft Decision Report and draft Works Approval on 25 September 2019, along with a request for further information. The further information has been included in the assessment. The Applicant provided comments on the draft documents are summarised, along with DWER's response, in Appendix 2.

11. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this Decision Report (summarised in Appendix 1).

Based on this assessment, it has been determined that the Works Approval will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

ALANA KIDD
MANAGER, RESOURCE INDUSTRIES
Delegated Officer
under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Works Approval W6195/2018/1 – Rothsay Gold Project	W6195/2018/1	accessed at www.der.wa.gov.au
2.	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	N/A	accessed at www.dwer.wa.gov.au
3.	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.	N/A	
4.	DER, August 2016. *Guidance Statement: Licence duration.* Department of Environment Regulation, Perth.	N/A	
5.	DER, November 2016. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	N/A	
6.	DER, November 2016. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	N/A	
7.	International Cyanide Management Institute, 2018. *International Cyanide Management Code: Implementation Guidance*	ICMI, 2018	Accessed at www.cyanidecode.org
8.	Department of Water, 2009. Water Quality Protection Note 26: *Liners for containing pollutants, using synthetic membranes*, Department of Water, Western Australia	DoW, 2009	Accessed at www.water.wa.gov.au
9.	Department of Mines and Petroleum, 2013. *Code of Practice: Tailings Storage facilities in Western Australia*, Department of Mines and Petroleum, Western Australia	DMP, 2013	Accessed at www.dmp.wa.gov.au
10.	Winkel, L.H., Vriens, B., Jones, G.D., Schneider, L.S., Pilon-Smits, E. and Bañuelos, G.S., 2015. Selenium	Winkel *et al*., 2015	The paper is available from web site https://www.mdpi.com/2072-6643/7/6/4199.

	cycling across soil-plant-atmosphere interfaces: A critical review. *Nutrients*, **7(6)**, 4199-4239.		
11.	US EPA, 2017. *Leaching Environmental Assessment Framework (LEAF) How-To Guide: Understanding the LEAF Approach and How and When to Use It*.	US EPA, 2017	US EPA technical report which is available from web site https://www.epa.gov/sites/production/files/2017-11/documents/leaf_how_to_guide.pdf.
12.	Email titled "Works Approval Application documents for Rothsay Gold Mine" dated 31/10/2019 2:27pm and authored by EganStreet Rothsay Pty Ltd	N/A	DWER records (A1734373)
13.	Knight Piésold, 2017. *EganStreet Resources, Rothsay Gold Project, Tailings Storage Facility Feasibility Study*, November 2017	Knight Piésold, 2017	DWER records (A1734373)
14.	Email titled "EganStreet Rothsay Gold Project - Response to DWER Queries on W6195_2018_1" dated 18/01/2019 3:32pm and authored by Symbiosis Environmental	N/A	DWER records (A1759499)
15.	Email titled "Rothsay Works Approval Application W6195/2018/1 - Additional Information for Attachment D of the EganStreet Response Letter" dated 22/01/2019 12:19pm and authorsed by Symbiosis Environmental	N/A	DWER records (A1759497)
16.	Email titled "W6195/2018/1 - Rothsay Gold Project" dated 13/02/2019 8:49am and authored by DMIRS	N/A	DWER records (A1781109)
17.	Email titled "FW: IR: Content Manager DER Electronic Record - Generic Document : A1765712 : W6195 Rothsay Gold Project - Works Approval Application - Department of Biodiversity Conservation and Attractions comments" dated 18/02/2019 10:10am and authored by DWER	N/A	DWER records (A1781111)
18.	Email titled "Rothsay Gold Project W6195/2018/1, Response to Cyanide Monitoring in Groundwater" dated	N/A	DWER records (A1776980)

	29/03/2019 11:58am and authored by Symbiosis Environmental		
19.	Email titled “Rothsay Gold Project W6195/2018/1: Additional Information Temporary Dewatering Infrastructure” dated 11/04/2019 8:31am and authored by Symbiosis Environmental	N/A	DWER records (A1780702)
20.	Email titled “Rothsay Gold Project W6195/2018/1: Additional Information Fauna Controls” dated 11/04/2019 8:24am and authored by Symbiosis Environmental	N/A	DWER records (A1780701)
21.	Email titled “RE: W6195 Rothsay Premises Boundary” dated 7/05/2019 9:48am and authored by Pinpoint Cartographics	N/A	DWER records (A1787707)
22.	Email titled “RE: W6195/2018/1 - Rothsay Gold Project” dated 7/06/2019 10:48am and authored by DMIRS	N/A	DWER records (A1796547)
23.	Email titled “Rothsay Gold Project: Egan Street Response to DWER Query on Reagent Store and TSF Sampling” dated 21/06/2019 10:42am and authored by Eo levis	N/A	DWER records (A1800390)
24.	Email titled “Rothsay Gold Project: Monitoring Plan for Temporary Discharge” dated 02/07/2019 1:24pm and authored by Eo levis	N/A	DWER records (A1802348)
25.	Email titled “RE: Works Approval Holder” dated 07/11/2018 2:39pm and authored by Egan Street Resources	N/A	DWER records (A1802416)
26.	Email titled “Re: Rothsay Gold Project: Monitoring Plan for Temporary Discharge” dated 06/07/2019 3:33pm and authored by Eo levis	N/A	DWER records (A1804360)
27.	Graeme Campbell and Associates Pty Ltd(2016) *Rothsay Project: Geochemical Assessment of Tailings Samples from Tailings-Storage Facility (TSF) – Implications for TSF Management*, 12 May 2016	GCA 2016	Appendix C of DWER records (A1742236)

28.	Email titled ”FW: Rothsay Gold Project - Comments on Draft Works Approval Documents” dated 31/10/2019 1:09pm and authored by Eo levis	N/A	DWER records (A1837206)

Appendix 2: Summary of applicant's comments on risk assessment and draft conditions

Section	Summary of Applicant comment	DWER response
Decision Report		
Previous Approvals	Egan Street conducted a Freedom of Information search through DWER for the Rothsay Gold Project in December 2016. The search identified the following list of approvals obtained by Metana Minerals N.L between 1989 and 1992.	Included in Decision Report
Category 7 Vat or Insitu Leaching of Metal	Egan Street sought further clarification from DWER (Resource Industries – Licensing and Approvals) in regards to whether proposed leaching activities for the Rothsay Gold Project were potentially a Category 7 activity. DWER provided the following response: "Category 7 is only for heap leach pads or vats constructed from waste rock material. Not when there are tanks. Leach tanks are a common component of mineral processing facilities (all concentrators would have them; i.e. all gold, nickel, copper, lead, silver etc. processing facilities), which is part of Category 5." As mineral processing activities will be limited to the use of leach tanks at Rothsay, Category 7 is not applicable to this proposal.	Category 7 not included
Existing vs New Infrastructure	Some additional pieces of equipment were listed by EganStreet.	Included in Decision Report

Section	Summary of Applicant comment	DWER response
DMIRS Clearing Permit	Clearing Permit CPS 8444/1 (Egan Street Rothsay Pty Ltd – Rothsay Gold Mine Project) has been Granted under section 51E of the Environmental Protection Act 1986. No appeals were received during the public advertisement period and the Permit became active from 7 September 2019.	Included in Decision Report
Groundwater Monitoring Section 5.1 Monitoring of Ambient Groundwater	Most recent groundwater monitoring data provided	Included in Decision Report
Process Water Pond	<u>Alarms</u> All raw and process water infrastructure will be equipped with a level sensing instrument. The instrument will perform the following functions: • transmit a level measurement to the control room; and • control a level switch to prevent the pump from running dry. At the time of writing, an alarm philosophy (and therefore a list of alarms) has not been determined. <u>Disposal of Solids from the Process Water Pond</u> Solids that settle out and accumulate on the floor of the Process Water Pond will be periodically removed and disposed of by either: • returning the material to an appropriate location in	Included in Decision Report

Section	Summary of Applicant comment	DWER response
	the process stream for treatment; or • direct delivery to the Tailings Storage Facility These methods will also be used for periodic solids removal from the floor of the Plant Drainage Retention Pond.	
Processing Plant	<u>Concrete Bunding</u> Areas of the processing plant to be concrete bunded are outlined in a blue line, as shown in Appendix 2. This includes the following activity areas: leaching and adsorption, elution and electrowinning, smelting, cyanide detoxification and the liquid reagent store, including the cyanide storage tank. <u>Cyanide Dosing</u> Liquid cyanide solution will be pumped into the processing plant from a cyanide storage tank using an automated dosing system, as outlined below: • The pump will be controlled via a variable speed drive, interlocked to a level indicator • located inside the cyanide storage tank. This will prevent the pump from being run dry. • A flow control valve (installed at the delivery point) will regulate the dosing rate prior to delivery to the leaching and adsorption tanks in the plant. • The flow rate (regulated by the flow control valve) will be set based on the mill throughput rate at the time. This is controlled via a setting in the control room. • All tank levels will be visually monitored in the field by the Area Operator.	Included in Decision Report

Section	Summary of Applicant comment	DWER response
	A second smaller pump will deliver liquid cyanide solution from the cyanide storage tank to the eluate storage tank in the elution circuit. Flow to the eluate tank will be controlled via a manual valve located at the tank. The eluate tank is a closed tank that only requires small volumes of cyanide to be delivered. This tank will also be equipped with level controls.	
Process Water Containing Cyanide	The Cyanide Detoxification Unit to be installed for the Rothsay Gold Project has design specifications capable of achieving a WAD-CN level of 50mg/L.	Included in Decision Report
Fauna Controls for Ponds	Clarification was sought from DWER (Resource Industries – Licensing and Approvals) in regards to whether further measures would still be required for the control of birds and bats accessing the ponds if WAD-CN concentrations water were limited to 50mg/L? DWER provided the following response: *"if the water quality WAD-CN meets The International Cyanide Management Code: Implementation Guidance, then additional controls are not required."* Egan Street have provided information to demonstrate how this limit will be met for the Rothsay Gold Project.	Included in Decision Report
Tailings	Additional testwork has been completed in 2019 in relation to the expected chemistry of tailings material to be generated by the Rothsay Gold Project. Testwork was undertaken using representative fresh rock samples sourced from the existing underground mine along with groundwater abstracted from site. Egan Street are awaiting a report on the findings. A copy of the report will	The report will be provided by the Applicant.

Section	Summary of Applicant comment	DWER response
	be provided to DWER when it is available. The report will include analytical data to enable the expected chemistry of the tailings slurry and decant water to be estimated. The above work is in addition to the requirements of Condition 33 of the Draft Works Approval which states: *''during the commissioning period the Works Approval Holder shall sample the composition of the tailings decant water and the tailings slurry discharged to the TSF for the parameters in Table 10. A minimum of 5 samples shall be analysed. The data shall be reported to the CEO in the Environmental Commissioning Report as required by Condition 14''* Both the preliminary testwork undertaken by Egan Street in 2019 and the follow up testwork to be carried out during commissioning will provide data to satisfy the DWER request	
Evaporation/Infiltration Pond	<u>Lateral Seepage</u> A bore network will be established to monitor groundwater standing levels and quality in the vicinity of the Evaporation/Infiltration Pond, as required by Condition 25 of the Draft Works Approval. Technical advice will be sought from a hydrologist as the location of these bores to monitor and measure the potential for lateral seepage to vegetation. Details will be provided to the CEO in the Groundwater Monitoring Programme, as per the time requirement in Condition 25. <u>Overtopping Management</u> Maintaining an efficient water balance for the Project will be a key factor in managing the risk of overtopping of the	Included in Decision Report

Section	Summary of Applicant comment	DWER response
	Evaporation/Infiltration Pond. Objectives of the water balance will be to minimise the need for: • abstraction from mine supply bores (to use as make up water for the Raw Water Dam); and • disposal of raw water from the Raw Water Dam to the Evaporation/Infiltration Pond. Raw water (in the Raw Water Dam) will primarily be sourced from dewatering of mine workings. Should monitoring detect that the freeboard minimum of the Raw Water Dam is being approached, increasing amounts of water will be diverted to the Evaporation/Infiltration Pond. Subsequently, in the event that monitoring identifies that the minimum freeboard is being approached at the Evaporation/Infiltration Pond, the initial response will be to increase raw water consumption where ever possible on site. This may be achieved by additional dust suppression or other discretionary uses. It should be noted that the design capacity of the Evaporation/Infiltration Pond is (in itself) a key control to managing the risk of overtopping. The 500mm design freeboard of the Evaporation/Infiltration Pond can hold an approximate volume of 6800 cubic meters of water. This equates to (in excess of) 190 hours storage at full pumping rates, assuming no evaporation or infiltration. The most likely cause of overtopping therefore is through a significant storm event. A diversion bund has been included in the design to direct overland sheet flow away from the Pond. Should a significant rainfall event result in overtopping, a spillway has also been included in the design for the release of diluted pond water into a nearby drainage channel.	

Section	Summary of Applicant comment	DWER response
Operational Aspects	In determining the final ‘’for construction’’ engineering details for the process plant, Egan Street identified that there was potential for variation to occur in the percentage of solids in the tailings (from the original design range used by Knight Piesold 2017). This could occur as a result of process upset or other design variations. Egan Street subsequently commissioned Tetra Tech to conduct a TSF Design Review (October 2018) which included assessing the potential impact of a tailing density below the range considered by Knight Piesold (to densities as low as 39% solids). The outcome of the review was that variation to as low as 39% solids would be acceptable provided that the additional water was removed through the decant return arrangement and not held in the TSF itself. Holding additional water in the TSF would increase the risk of instability of the dam structure. Based on the findings of the report, Egan Street adopted a design density range of 45-60% solids for the tailings. This lower density: • allows for the plant to maintain the required water balance; • aligns with the range detailed in the process design criteria used in the final engineering of the plant; and • provides a margin on the limit assessed by Tetra Tech. A copy of the TSF Design Review (October 2018) is provided	Included in Decision Report
3.2 Infrastructure	Request to add in an abstraction point under Prescribed Activity Category 6. Egan Street request an additional	Included as requested in Decision Report and Works Approval.

Section	Summary of Applicant comment	DWER response
And 8.9 Risk Assessment – Temporary Dewatering Discharge to Drainage Line 8.9.2 Identification and General Characterisation of Emission	abstraction point be included into the Draft Works Approval and Decision Report under Prescribed Activity Category 6. The purpose of this request is the result of further studies conducted by Egan Street into the safety aspects in the underground workings of carrying out the remainder of all mine dewatering via the decline	This was also included in Section 8.10 Permanent Dewatering Discharge Spillage from Dewatering Pumps, Pipelines and Seepage as it is relevant to this section.
5.2 Tailings Characterisation	Request to change the wording of should – to: could So that the sentence reads: Additional testing that could be undertaken to determine the likely behaviour of elements under a range of leaching conditions include: …. This is in line with the original technical advice to Egan Street from the Contaminated Sites Branch in the DWER letter dated 19 December 2018	Updated as requested
8.4 Risk Assessment – Stormwater Runoff	Request to add further clarity to the terminology used. Revise ‘’ entire site drainage designed to contain a 1:100 year rainfall event (average intensity of 72 hour duration)’’ : to – Process area drainage designed to contain a 1:100 year rainfall event (average intensity of 72 hour duration)	Updated as requested
8.5 Risk Assessment – Leaks or Overflows from the Process Plant and Process Water	Updated process plant layout provided	Included in Decision Report

Section	Summary of Applicant comment	DWER response
Dam 8.5.5 Applicant Controls/Table 22/Site Infrastructure		
8.8 Risk Assessment – Tailings Seepage 8.8.3 Description of Potential Adverse Impact From the Emission	An extract from the current Mine Closure Plan has been provided in relation to the potential for adverse impacts to grazing animals and soil fauna via the bioaccumulation of selenium and molybdenum in vegetation that will grow on the TSF after mine closure.	Included in Decision Report
8.9.5 Applicant Controls/Table 29/Ephemeral Drainage Line Discharge	Request to re-word: the temporary discharge will occur during the wettest months of the year to dilute the discharge salinity; to *If project timing allows, the temporary discharge will occur during the wettest months of the year to dilute the discharge salinity.* The timing of this activity will depend on when the Works Approval is issued; as well as the completion of various corporate activities, including accessing finance for construction; allowing site works to commence.	Updated as requested
8.9.6 Key Findings/4. A hydrologic model is to be conducted to estimate the distance the mine dewatering water will flow down the	Hydraulic modelling provided.	Updated as requested

Section	Summary of Applicant comment	DWER response
drainage line.		
Works Approval		
Condition 1: Table 2. Infrastructure and Equipment Requirements Table Stormwater Management	Replace current wording of: entire site drainage designed to contain a 1:100 year rainfall event (average intensity of 72 hour duration) - to *process area drainage designed to contain a 1:100 year rainfall event (average intensity of 72 hour duration)* This is to reflect the terminology in Section 4.6.2 of the Works Approval Application Supporting Document, 31 October 2019.	Updated as requested
Condition 2: Table 3. Critical Containment Infrastructure Design and Construction /Installation Requirements Mine Dewatering	Replace current wording of: Permanent discharge to Evaporation/Infiltration Pond: Pipelines bunded with 110mm HDPE - to *Permanent discharge to Evaporation/Infiltration Pond: 110mm HDPE pipelines contained within an earthen bund*	Updated as requested
Specified Actions Conditions 26 and Condition 27: Groundwater Monitoring Programme Tailings Storage Facility	Replace current wording of: 26. The Works Approval Holder shall, within 30 days of the issue of the Works Approval, … - to *The Works Approval Holder shall, at least 30 days prior to plant construction commencing…*	Updated as requested
	Request to replace current wording of: 27. The Works Approval Holder shall, within 60 days of the issue of the Works Approval, … - to	Updated as requested

Section	Summary of Applicant comment	DWER response
	The Works Approval Holder shall, at least 60 days prior to plant construction commencing…	
Condition 31: Temporary Mine Dewatering Discharge	The hydrologic model requested in this Condition is provided as Appendix 5.	Condition removed as requested
Condition 32: Tailings Characterisation	Request to replace current wording to: *The Works Approval Holder must provide to the CEO results of representative tailings for disposal characterisation studies / investigations, at least 60 days prior to tailings deposition to the TSF commencing. This could include but is not limited to:* *a) testing using the LEAF 1313 pH-dependant leaching tests coupled with geochemical modelling (US EPA, 2017); and or* *b) short term leaching tests using fluids which more closely resemble those likely to be present in the TSF; and* *c) include, but not be limited to, the contaminants listed in Table 10.* This is in line with the original technical advice to Egan Street from the Contaminated Sites Branch in the DWER letter dated 19 December 2018, as follows: *The Contaminated Sites Branch has recommended that the following information be provided: -* *additional testing could be undertaken to determine the likely behaviour of elements under a range of leaching conditions include:* *• Testing using the LEAF 1313 pH-dependent leaching test coupled with geochemical modelling (US EPA, 2017);*	Updated as requested

Section	Summary of Applicant comment	DWER response
	• *Short-term leaching tests using fluids which more closely resemble those likely to be present in the TSF.* Egan Street's response to this query, outlined in the letter dated 18 January 2019, was as follows: "*Egan Street are seeking further advice on this matter, including carrying out further testwork. It is expected that the completion of additional work will take approximately two months. A response will be provided to DWER when this information is available*." Additional testwork has been completed in 2019 and Egan Street are awaiting a report on the findings. A copy of the report will be provided to DWER when it is available. The results of this testwork will inform any further testwork (if appropriate) to satisfy Condition 32 within the timeframe stated: i.e. "*at least 60 days prior to tailings deposition to the TSF commencing*".	

Attachment 1: Issued Works Approval W6195/2018/1