Government of Western Australia
Department of Water and Environmental Regulation

Works Approval

Works Approval Number	W6143/2018/1
Works Approval Holder	Greenmount Resources Pty Ltd
ACN	607 613 650
Registered business address	Level 1 28 Ord Street WEST PERTH WA 6005
File Number	DER2018/000442
Duration	**20/08/2018 to 19/08/2021**
Date of issue	20/08/2018
Prescribed Premises	Category 5 – Processing or beneficiation of metallic or non-metallic ore Category 64 – Putrescible landfill site Category 85 – Sewage facility
Premises	Karlawinda Gold Project Mining tenement M52/1070 CAPRICORN WA 6642

This Works Approval is granted to the Works Approval Holder, subject to the following conditions, on 20 August 2018, by:

Date signed 20/08/2018
Alana Kidd
Manager, Resource Industries
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Explanatory notes

These explanatory notes do not form part of this Works Approval.

Defined terms

Definition of terms used in this Works Approval can be found at the start of this Works Approval. Terms which are defined have the first letter of each word capitalised throughout this Works Approval.

Department of Water and Environmental Regulation

The Department of Water and Environmental Regulation (DWER) is 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 *Environmental Protection Act 1986* (WA) (EP Act). The Department also monitors and audits compliance with licences and works approvals, takes enforcement action and develops and implements licensing and industry regulation policy.

Works Approval

Section 52 of the EP Act provides that an occupier of any premises commits an offence if any work is undertaken on, or in relation to, the premises which causes the premises to become, or to become capable of being, Prescribed Premises, except in accordance with a works approval.

Section 56 of the EP Act provides that an occupier of Prescribed Premises commits an offence if Emissions are caused or increased or permitted to be caused or increased, or Waste, noise, odour or electromagnetic radiation is altered or permitted to be altered from Prescribed Premises, except in accordance with a works approval or licence.

Categories of Prescribed Premises are defined in Schedule 1 of the *Environment Protection Regulations 1987* (WA) (EP Regulations).

This Works Approval does not authorise any activity which may be a breach of the requirements of another statutory authority including, but not limited to, the following:

- conditions imposed by the Minister for Environment under Part IV of the EP Act;
- conditions imposed by DWER for the clearing of native vegetation under Part V, Division 2 of the EP Act;
- any requirements under the *Waste Avoidance and Resource Recovery Act 2007;*
- any requirements under the *Environmental Protection (Controlled Waste) Regulations 2004*; and
- any other requirements specified through State legislation.

It is the responsibility of the Works Approval Holder to ensure that any action or activity referred to in this Works Approval is permitted by, and is carried out in compliance with, statutory requirements.

The Works Approval Holder must comply with the Works Approval. Contravening a Works Approval Condition is an offence under s.55 of the EP Act.

Responsibilities of Works Approval Holder

Separate to the requirements of this Works Approval, general obligations of Works Approval Holders are set out in the EP Act and the regulations made under the EP Act. For example, the Works Approval Holder must comply with the following provisions of the EP Act:

- the duties of an occupier under s.61; and

- restrictions on making certain changes to Prescribed Premises unless the changes are in accordance with a Works Approval, Licence, closure notice or environmental protection notice (s.53).

Strict penalties apply for offences under the EP Act.

Reporting of incidents

The Works Approval Holder has a duty to report to the Department all Discharges of Waste that have caused or are likely to cause Pollution, Material Environmental Harm or Serious Environmental Harm, in accordance with s.72 of the EP Act.

Offences and defences

The EP Act and its regulations set out a number of offences including:

- Offence of emitting an Unreasonable Emission from any Premises under s.49.
- Offence of causing Pollution under s.49.
- Offence of dumping Waste under s.49A.
- Offence of discharging Waste in circumstances likely to cause Pollution under s.50.
- Offence of causing Serious Environmental Harm (s.50A) or Material Environmental Harm (s.50B).
- Offence of causing Emissions which do not comply with prescribed standards (s.51).
- Offences relating to Emissions or Discharges under regulations prescribed under the EP Act, including materials discharged under the *Environmental Protection (Unauthorised Discharges) Regulations 2004 (WA).*
- Offences relating to noise under the *Environmental Protection (Noise) Regulations 1997 (WA).*

Section 53 of the EP Act provides that a Works Approval Holder commits an offence if Emissions are caused, or altered, from a Prescribed Premises unless done in accordance with a Works Approval, Licence or the requirements of a closure notice or an environmental protection notice.

Defences to certain offences may be available to a Works Approval Holder and these are set out in the EP Act. Section 74A(b)(iii) provides that it is a defence to an offence for causing Pollution, in respect of an Emission, or for causing Serious Environmental Harm or Material Environmental Harm, or for discharging or abandoning Waste in water to which the public has access, if the Works Approval Holder can prove that an Emission or Discharge occurred in accordance with a Works Approval.

This Works Approval specifies the Emissions and Discharges, and the limits and Conditions which must be satisfied in respect of specified Emissions and Discharges, in order for the defence to offence provision to be available.

Authorised Emissions and Discharges

The specified and general Emissions and Discharges from the Works authorised through this Works Approval are authorised to be conducted in accordance with the Conditions of this Works Approval.

Amendment of Works Approval

The Works Approval Holder can apply to amend the Conditions of this Works Approval under s.59 of the EP Act. An application form for this purpose is available from DWER.

The CEO may also amend the Conditions of this Works Approval at any time on the initiative

of the CEO without an application being made.

Duration of Works Approval

The Works Approval will remain in force for the duration set out on the first page of this Works Approval or until it is surrendered, suspended or revoked in accordance with s.59A of the EP Act.

Suspension or revocation

The CEO may suspend or revoke this Works Approval in accordance with s.59A of the EP Act.

Definitions and interpretation

Definitions

In this Works Approval, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
AEP	means annual exceedance probability
ANZECC, 2000	Australian and New Zealand Guidelines for Fresh and Marine Water Quality - Volume 1. National Water Quality Management Strategy
AS 1692	means the Australian Standard AS 1692-2006 *Steel tanks for flammable and combustible liquids*
AS 1940	means the Australian Standard AS 1940-2004 *The storage and handling of flammable and combustible liquids*
ASBR	Activated sludge bioreactor
AS/NZS 5667.1	means the Australian Standard AS/NZS 5667.1 *Water Quality – Sampling – Guidance of the Design of sampling programs, sampling techniques and the preservation and handling of samples*
AS/NZS 5667.11	means the Australian Standard AS/NZS 5667.11 *Water Quality – Sampling – Guidance on sampling of groundwaters*
Averaging period	means the time over which a limit is measured or a monitoring result is obtained
Books	has the same meaning given to that term under the EP Act
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department Administering the *Environmental Protection Act 1986* Locked Bag 33 Cloisters Square PERTH WA 6850 info@dwer.wa.gov.au
cfu/100mL	means colony-forming units per 100 millilitres
Commission	means the process of operation and testing that verifies the Works and all relevant systems, plant, machinery and equipment associated with the process plant, TSF and WWTP have been installed and are performing in accordance with Tables 4 and 5.
Condition	means a condition to which this Works Approval is subject under s.62 of the EP Act

Term	Definition
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
Department Request	means a request for Books or other sources of information to be produced, made by an Inspector or the CEO to the Works Approval Holder in writing and sent to the Works Approval's address for notifications, as described at the front of this Works Approval, in relation to: (a) compliance with the EP Act or this Works Approval; (b) the Books or other sources of information maintained in accordance with this Works Approval; or (c) the Books or other sources of information relating to Emissions from the Premises
Discharge	has the same meaning given to that term under the EP Act
DWER	Department of Water and Environmental Regulation
Emission	has the same meaning given to that term under the EP Act
Environmental Harm	has the same meaning given to that term under the EP Act
EP Act	means the *Environmental Protection Act 1986* (WA)
EP Regulations	means the *Environmental Protection Regulations 1987* (WA)
HDPE	means high density polyethylene
Implementation Agreement or Decision	has the same meaning given to that term under the EP Act
Inspector	means an inspector appointed by the CEO in accordance with s.88 of the EP Act
IWL	means integrated waste landform
Material Environmental Harm	has the same meaning given to that term under the EP Act
mbgl	means metres below ground level
mRL	means metres Reduced Level
NATA	National Association of Testing Authorities, Australia
NEPM, 1999	National Environment Protection (Assessment of Site Contamination)

Term	Definition
	Measure 1999 (available at: https://www.legislation.gov.au/Details/F2013C00288/Html/Volume_3#_T oc351712651)
NTU	means Nephelometric Turbidity Unit
Pollution	has the same meaning given to that term under the EP Act
Premises	refers to the premises to which this Works Approval applies, as specified at the front of this Works Approval and as shown on the map in Schedule 1 to this Works Approval
Prescribed Premises	has the same meaning given to that term under the EP Act
ROM	Run of Mine
Serious Environmental Harm	has the same meaning given to that term under the EP Act
Spot sample	means a discrete sample representative at the time and place at which the sample is taken
TSF	Tailings Storage Facility
Unreasonable Emission	has the same meaning given to that term under the EP Act
WAD	Weak Acid Dissociable
Waste	has the same meaning given to that term under the EP Act
Works	refers to the Works described in Schedule 3, at the locations shown in Schedule 1 of this Works Approval to be carried out at the Premises, subject to the Conditions
Works Approval	refers to this document, which evidences the grant of the works approval by the CEO under s.54 of the EP Act, subject to the Conditions
Works Approval Holder	refers to the occupier of the Premises being the person to whom this Works Approval has been granted, as specified at the front of this Works Approval
WWTP	Wastewater Treatment Plant
m^3	means cubic metres
µS/cm	means microsiemens per centimeter

Interpretation

In this Works Approval:

(a) the words 'including', 'includes' and 'include' will be read as if followed by the words 'without limitation';

(b) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

(c) where tables are used in a Condition, each row in a table constitutes a separate Condition;

(d) any reference to an Australian or other standard, guideline or code of practice in this Works Approval means the version of the standard, guideline or code of practice in force at the time of granting of this Works Approval and includes any amendments to the standard, guideline or code of practice which may occur from time to time during the course of the Works Approval; and

(e) unless specified otherwise, any reference to a section of an Act refers to that section of the EP Act.

Conditions

Infrastructure and equipment

1. The Works Approval Holder must install and undertake the Works for the infrastructure and equipment:

(a) specified in Column 1;

(b) to the requirements specified in Column 2;

of Table 4 in Schedule 3.

2. The Works Approval Holder must not depart from the requirements specified in Column 2 of Table 4 in Schedule 3 except:

(a) where such departure does not increase risks to public health, public amenity or the environment; and

(b) all other Conditions in this Works Approval are still satisfied.

3. Subject to Condition 1, within 30 days of the completion of the Works specified in Column 1 of Table 4 in Schedule 3, the Works Approval Holder must provide to the CEO a compliance document from a geotechnical engineer or from a suitably qualified professional confirming each item of infrastructure or component of infrastructure specified in Column 1 of Table 4 in Schedule 3 has been constructed with no material defects and to the requirements specified in Column 2 of Table 4 in Schedule 3.

4. Where a departure from the requirements specified in Column 2 of Table 4 in Schedule 3 occurs and is of a type allowed by Condition 2, the Works Approval Holder must provide to the CEO a description of, and explanation for, the departure along with the certification required by Condition 2(b).

5. The Works Approval Holder shall commission the WWTP for a period of no longer than 6 months, in accordance with the Conditions of this Works Approval, following submission of the report required by Condition 3.

6. Following commissioning of the WWTP, the Works Approval Holder shall submit a

commissioning report including but not limited to, results of final effluent discharge quality, as compared to emission standards in Schedule 3, Table 4, Row 7 collected in accordance with the most recent version of the relevant Australian Standard methodology and analysed by a NATA certified laboratory.

7. The Works Approval Holder shall commission the process plant and TSF for a period of no longer than 6 months, in accordance with the Conditions of this Works Approval, following submission of the report required by Condition 3.

Emissions

8. The Works Approval Holder must not cause any Emissions from the Works authorised through this Works Approval except for specified Emissions and general Emissions described in Column 1 of Table 2, subject to the exclusions, limitations or requirements specified in Column 2, of Table 2.

Table 2: Authorised Emissions table

Column 1	**Column 2**
Emission type	**Exclusions/Limitations/Requirements**
Specified Emissions	
Discharge of tailings to the TSF	Subject to compliance with: • Row 5 of Table 4 in Schedule 3; and • Conditions 1, 2, 3, 4 and 7
Treated wastewater from the WWTP to the Irrigation Field	Subject to compliance with: • Rows 7 and 8 of Table 4 in Schedule 3; and • Conditions 1, 2, 3, 4, 5 and 6
General Emissions (excluding Specified Emissions)	
Emissions which arise from undertaking the Works set out in Schedule 3.	Emissions excluded from General Emissions are: • Unreasonable Emissions; or • Emissions that result in, or are likely to result in, Pollution, Material Environmental Harm or Serious Environmental Harm; or • Discharges of Waste in circumstances likely to cause Pollution; or • Emissions that result, or are likely to result in, the Discharge or abandonment of Waste in water to which the public has access; or

Column 1	Column 2
Emission type	**Exclusions/Limitations/Requirements**
	• Emissions or Discharges which do not comply with an Approved Policy; or • Emissions or Discharges which do not comply with prescribed standard; or • Emissions or Discharges which do not comply with the conditions in an Implementation Agreement or Decision; or • Emissions or Discharges the subject of offences under regulations prescribed under the EP Act, including materials discharged under the Environmental P*rotection (Unauthorised Discharges) Regulations 2004*.

Specified Actions

Ambient Groundwater

9. The Works Approval Holder shall, within 30 days of the completion of the Works specified in Rows 4 and 5 of Table 4 in Schedule 3 and prior to commissioning and deposition:

(a) construct the 9 indicative monitoring bores as shown in the Schedule 1 Map.

(b) construct monitoring bores within a 20 m radius of the process water pond.

(c) establish, develop and sample the monitoring bores in accordance with Section 8.2 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM, 1999).

(d) Conduct baseline sampling as soon as practicable in accordance with Section 8.2.3.5 of the NEPM, 1999.

10. The Works Approval Holder shall, within 60 days of the completion of Condition 9 and prior to commissioning, submit a report to the CEO providing all baseline water quality, sampled in accordance with the most recent version of relevant Australian Standards and analysed by a NATA certified laboratory, for the monitoring bores listed in Condition 9. The report shall provide the following, but not be limited to:

(a) bore logs for any newly constructed monitoring bores;

(b) Updated map depicting the location of the ambient groundwater monitoring bore network; and

(c) baseline water quality, sampled in accordance with condition 12 including a comparison of these results against the ANZECC, 2000 trigger value for protection of 95% of species in freshwater ecosystems.

11. The Works Approval Holder must ensure that monitoring is undertaken in each monthly period such that there are at least 15 days in between the days on which samples are taken in successive months.

12. The Works Approval Holder must monitor emissions:

(a) from each monitoring location;

(b) for the corresponding parameter;

(c) in the corresponding unit;

(d) for the corresponding averaging period;

(e) at the corresponding frequency; and

(f) using the corresponding method,

as set out in Table 3.

Table 3: Emissions monitoring

Column 1	**Column 2**	**Column 3**	**Column 4**	**Column 5**	**Column 6**
Location	**Parameter**	**Unit**	**Averaging period**	**Frequency**	**Method**
14 Monitoring Bores (Existing and Indicative) as shown in the Schedule 1 Map	Standing Water Level	mbgl	Spot sample	Monthly	-
	Total Dissolved Solids	mg/L			AS/NZS 5667.1. AS/NZS 5667.11
	pH	pH units			
	Electrical Conductivity	µS/cm			
	Sodium	mg/L			
	Potassium				
	Magnesium				
	Calcium				
	Chloride				
	Sulfate				
	Bicarbonate				
	Antimony				
	Arsenic				
	Cadmium				
	Chromium				

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Location	**Parameter**	**Unit**	**Averaging period**	**Frequency**	**Method**
	Cobalt				
	Copper				
	Iron				
	Manganese				
	Mercury				
	Molybdenum				
	Nickel				
	Selenium				
	Thallium				
	Uranium				
	Zinc				
	WAD cyanide				
	Total cyanide				
Monitoring bores for the process water pond as defined by Conditions 9 and 10	Standing Water Level	mbgl	Spot sample	Monthly	-
	Total Dissolved Solids	mg/L			AS/NZS 5667.1. AS/NZS 5667.11
	pH	pH units			
	Electrical Conductivity	µS/cm			
	Sodium	mg/L			
	Potassium				
	Magnesium				
	Calcium				
	Chloride				
	Sulfate				
	Bicarbonate				

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Location	**Parameter**	**Unit**	**Averaging period**	**Frequency**	**Method**
	Aluminium				
	Arsenic				
	Boron				
	Cadmium				
	Chromium				
	Cobalt				
	Copper				
	Iron				
	Lead				
	Manganese				
	Mercury				
	Molybdenum				
	Nickel				
	Selenium				
	Thallium				
	Uranium				
	Zinc				

13. The Works Approval Holder shall, within 60 days of the issue of this Works Approval, submit to the CEO a seepage recovery plan to manage seepage from the TSF; detailing the criteria / methods for detection of seepage and triggers to be applied for implementation of the plan.

Contaminants in Tailings

14. The Works Approval Holder shall, within 60 days of the issue of this Works Approval and prior to the deposition of tailings, submit a report to the CEO detailing proposed and effective processes to reduce concentrations of contaminants in tailings supernatant, with a comparison against the following levels:

(a) pH 8 to 10;

(b) Arsenic V <1 mg/L; and

(c) WAD Cyanide <50 mg/L.

Record-keeping

15. The Works Approval Holder must maintain accurate Books including information, reports and data in relation to the Works and the Books must:

(a) be legible;

(b) if amended, be amended in such a way that the original and subsequent amendments remain legible or are capable of retrieval;

(c) be retained for at least 3 years from the date the Books were made; and

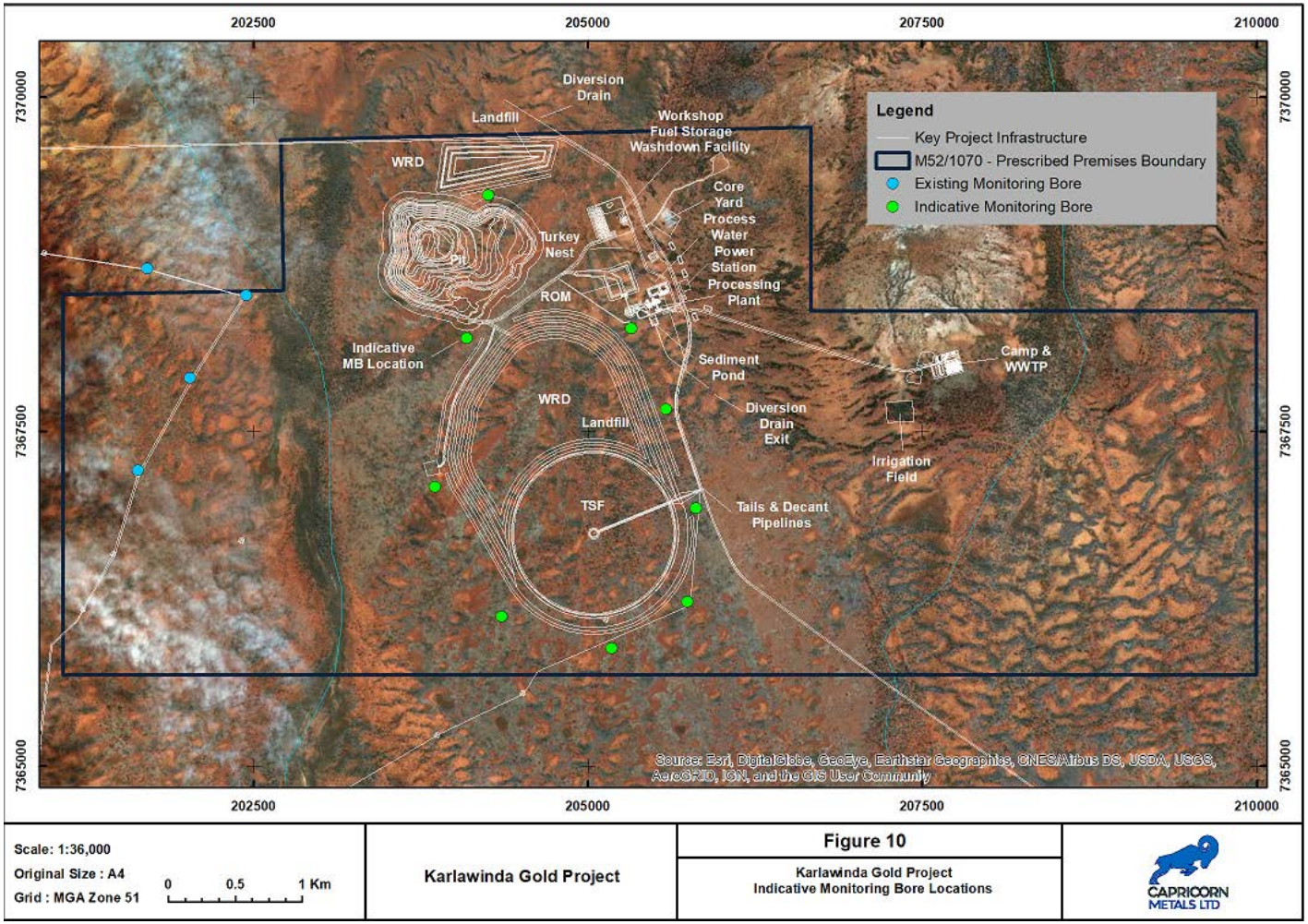
(d) be available to be produced to an Inspector or the CEO.

16. The Works Approval Holder must comply with a Department Request within 14 days from the date of the Department Request or such other period as agreed to by the Inspector or the CEO.

Schedule 1: Maps

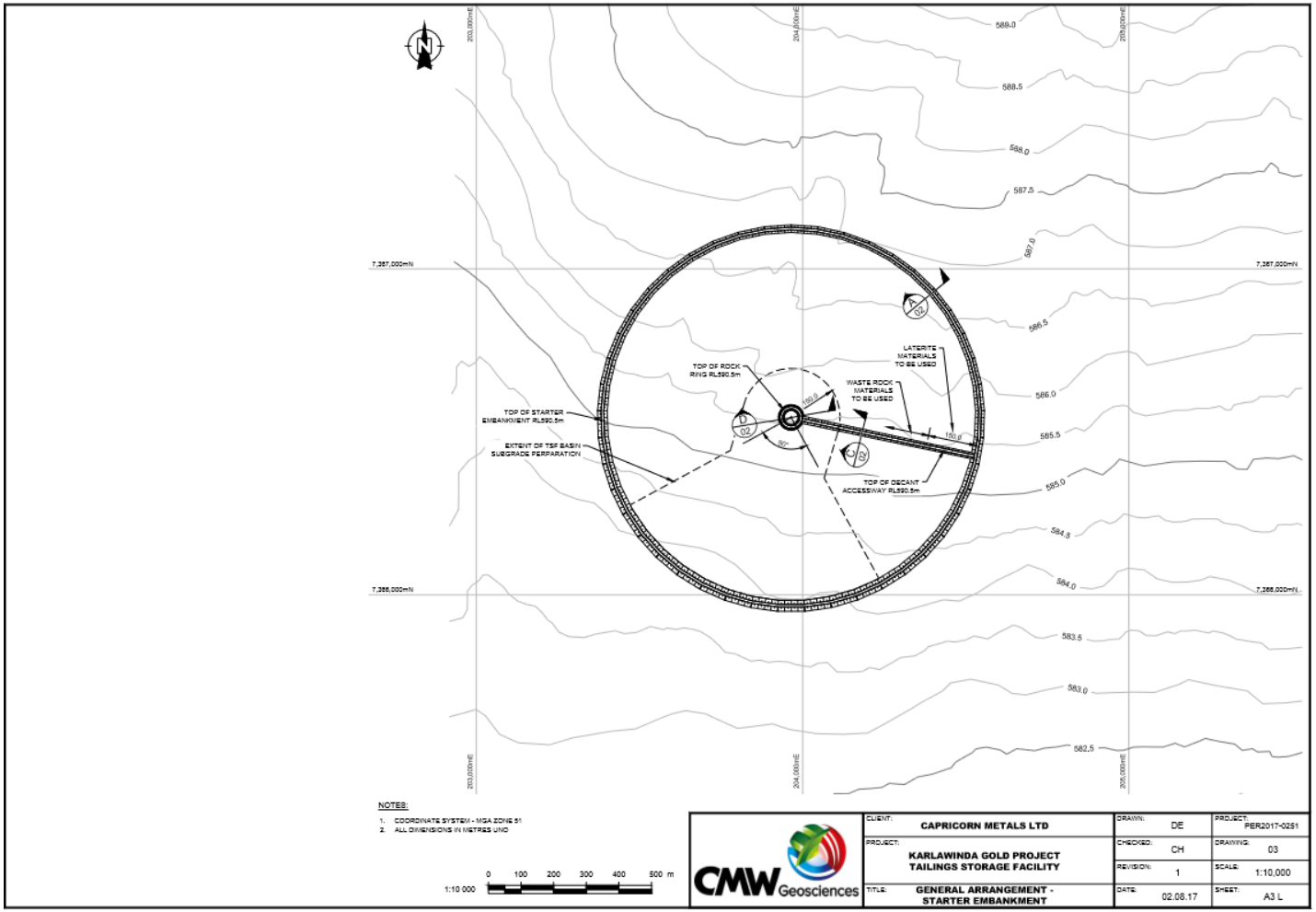
Premises map, TSF monitoring and infrastructure locations

The Premises are shown in the map below. The black line depicts the boundary of the Premises.

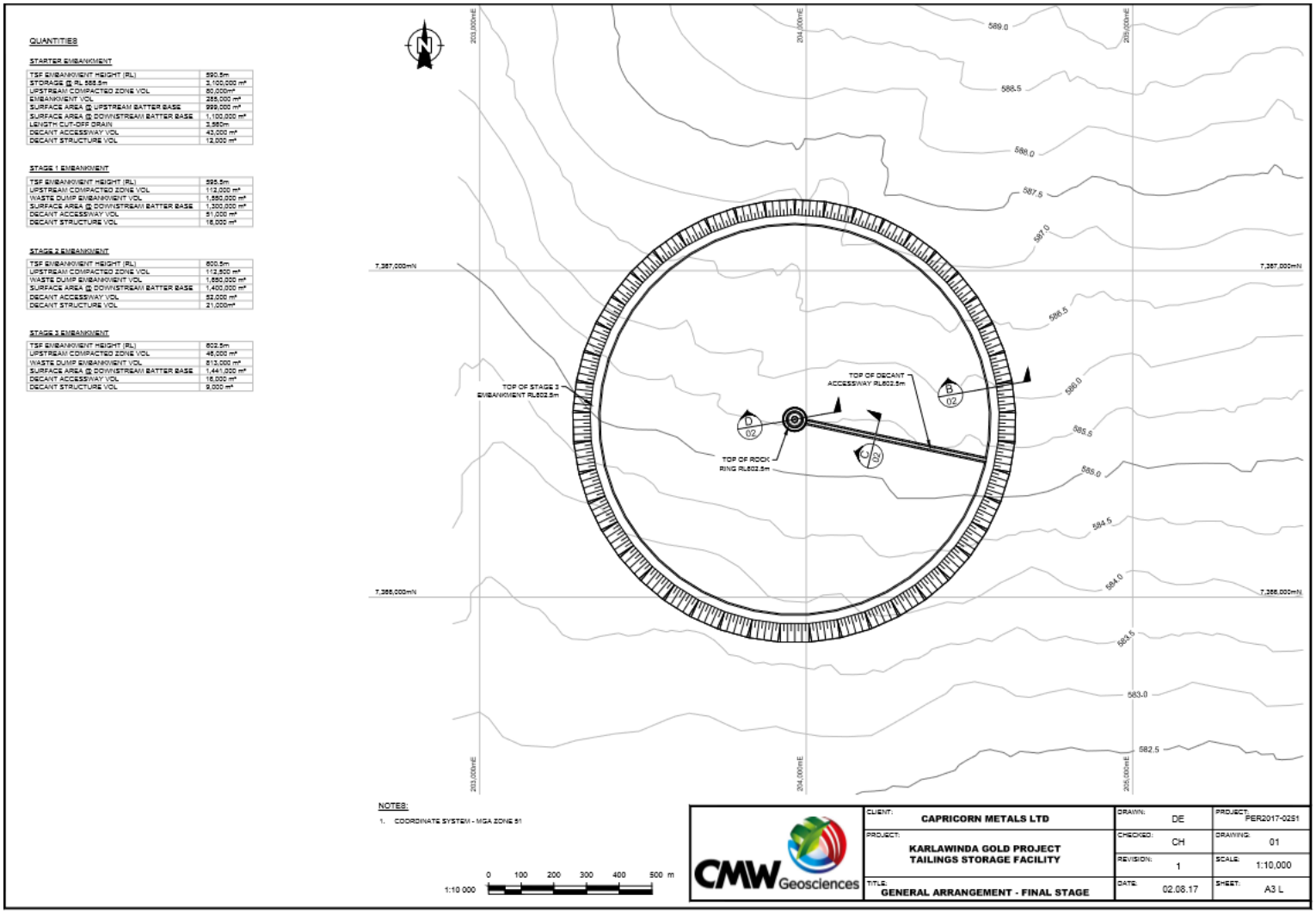


Schedule 2: Site plans

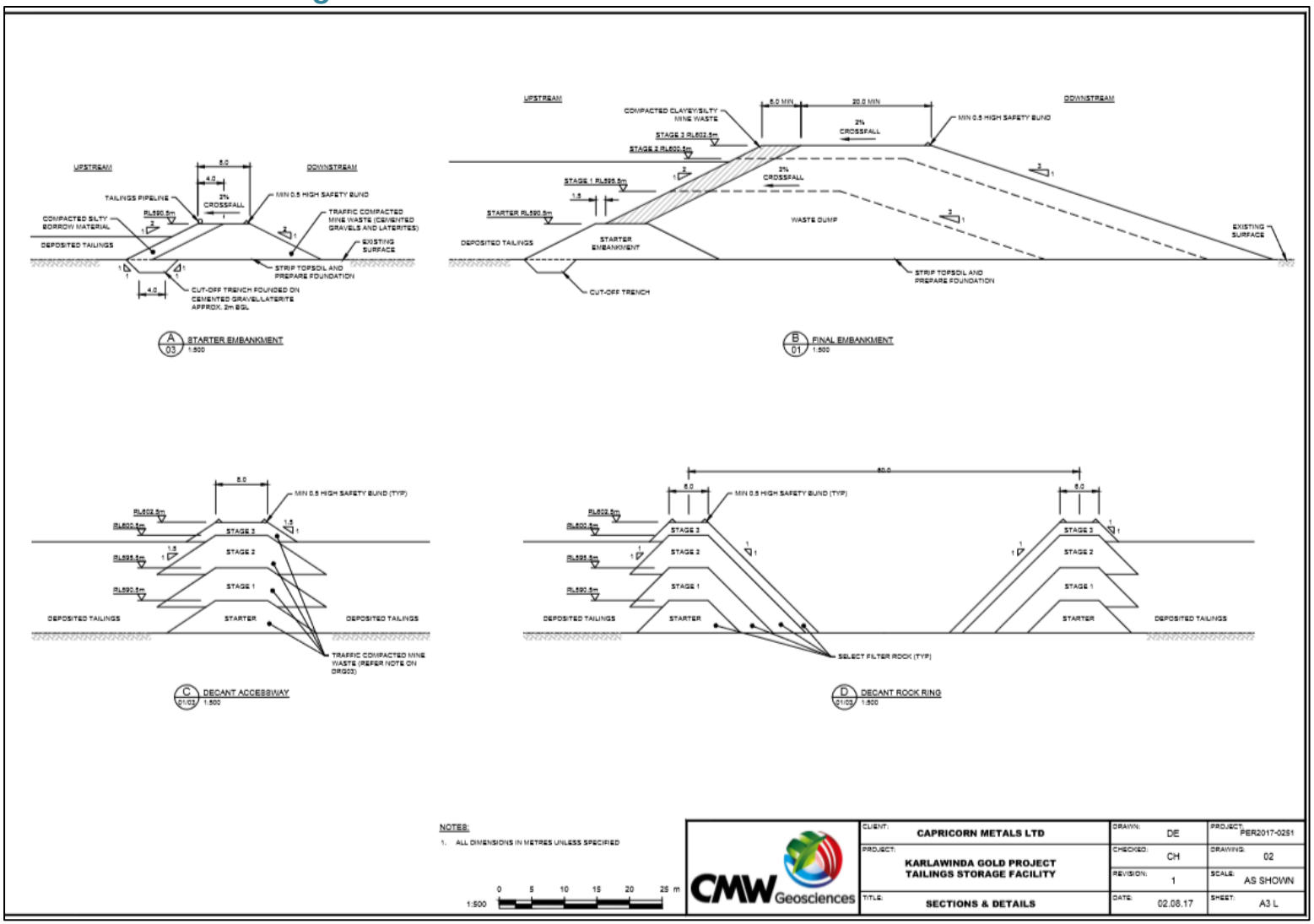
Site Plan 1: TSF general arrangement – Starter embankment



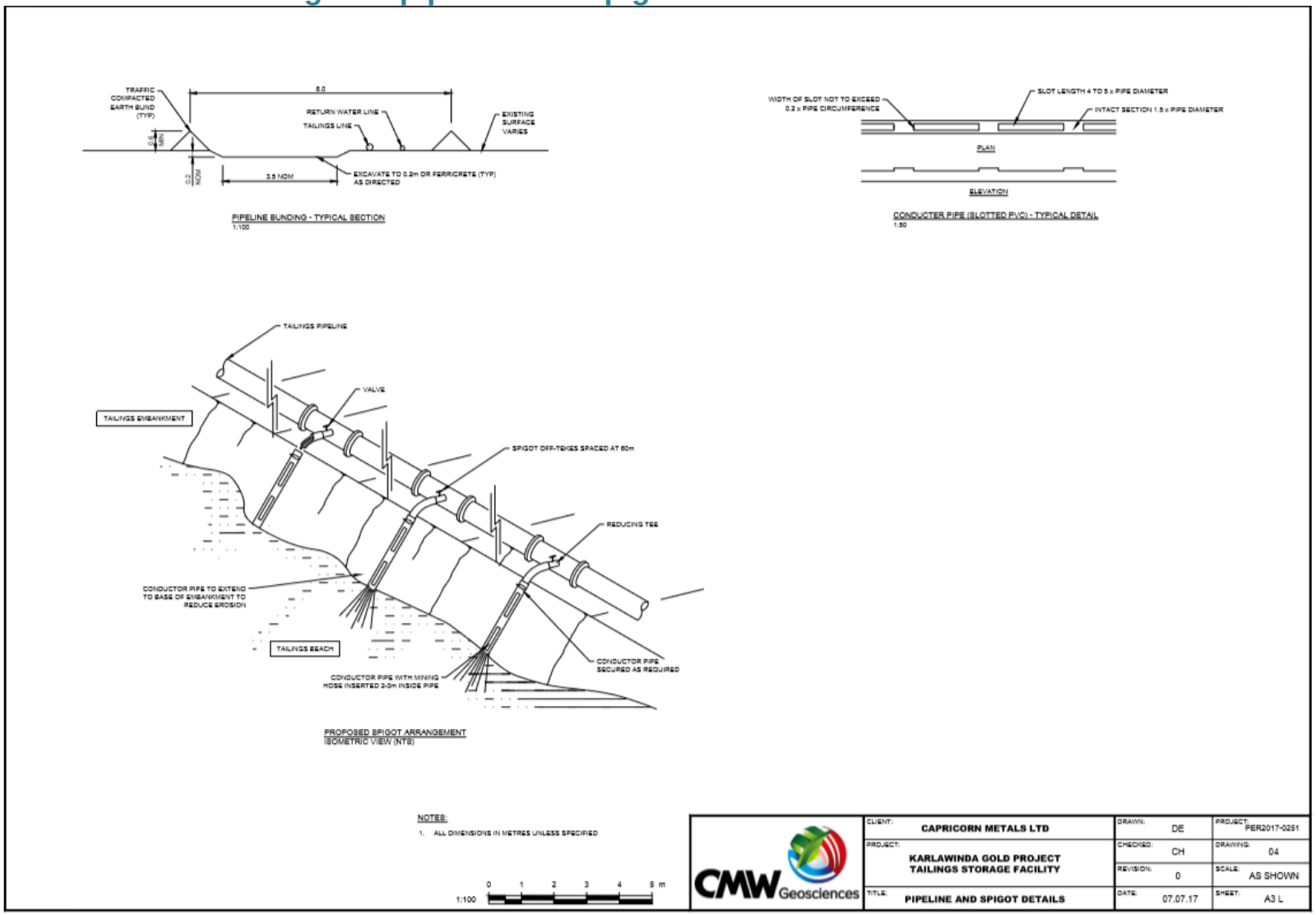
Site Plan 2: TSF general arrangement – Final stage



Site Plan 3: TSF design for sections and details



Site Plan 4: TSF design for pipeline and spigot details



Schedule 3: Works

Infrastructure and Equipment

Infrastructure and equipment which are required to be built are listed in Table 4 as specified by Condition 1.

Table 4: Infrastructure and equipment requirements table

	Column 1	Column 2
	Infrastructure/Equipment	**Requirements (design and construction)**
1	Stormwater management	• Installation of sediment control structures at locations where high sediment loads are anticipated. • Armouring landforms with competent rock. • Stormwater diverted around and away from the processing plant, landfill/s and workshop infrastructure areas by diversion drains.
2	Ore processing activities	All slurry containing facilities will be constructed within bunded concrete areas.
3	Processing reagents	Quicklime: • Dust collector, including maintenance access, installed on top of the lime silo. • Rotary valve to control the discharge rate of the lime to the mill feed conveyor. Cyanide dissolution tank (100 m^3), cyanide storage tank (100 m^3) sodium hydroxide storage tank (60 m^3); and hydrochloric acid storage tank (30 m^3): • Contained within a concrete bund that will incorporate a collection sump to recover spillage. • Sump pump will discharge into the leach feed trash screen underflow distribution box. • Stored in accordance with AS 1940 and AS 1692. • Level indicators to detect leaks, based on drops in level. 500 kilogram activated carbon bulk boxes stored in containers or under tarpaulins.
4	Process water pond	• Lined with an impermeable HDPE membrane. • Capacity of 10,000 m^3.

	Column 1	Column 2
	Infrastructure/Equipment	**Requirements (design and construction)**
		• Freeboard markers installed at the 500 mm mark.
5	TSF	• Single cell circular TSF/IWL. • Designed to store 21 million tonnes of tailings over 6 years. • Starter – Embankment level of 590.5 mRL (as shown in Site Plans 1 and 3 in Schedule 2). • Stage 1 – Embankment level of 595.5 mRL. • Stage 2 - Embankment level of 600.5 mRL. • Stage 3 - Embankment level of 602.5 mRL (as shown in Site Plans 2 and 3 in Schedule 2). • Designed such that a 1% AEP, 72-hour duration storm event can be temporarily stored on top of the TSF. <u>TSF starter embankment as shown in Site Plans 1 and 3 in Schedule 2</u>: • Zoned embankment comprising an upstream zone of low permeability roller compacted silty sand and a downstream zone of traffic compacted laterite gravel material. • Maximum embankment height of 6.5 m. • Incorporate a cut-off trench excavated to cemented laterite gravels in order to reduce seepage losses. • Design slopes of 1(V):2(H) upstream and 1(V):2(H) downstream. • Crest width of 8 m. • Upstream zone: TSF will be prepared by moisture conditioning and compacting the TSF basin subgrade comprising sandy silt/silty sand to produce a low permeability foundation of 10^{-8} m/s. <u>Perimeter embankments</u>: • Design slopes of 1(V):2(H) upstream and 1(V):3(H) downstream. • Compacted upstream embankment will have a crest width of 6 m and will have a 2% cross-fall towards the upstream side and 0.5 m (minimum) high waste

	Column 1	Column 2
	Infrastructure/Equipment	**Requirements (design and construction)**
		windrow at the downstream crest. <u>Tailings deposition and spigots as shown in Site Plan 4 in Schedule 2</u> : Multiple spigots located on the upstream perimeter embankment crest. <u>Decant system and pond as shown in Site Plan 3 in Schedule 2:</u> • Rock-ring type central decant structure. • Decant structure and decant causeway will be raised along with the perimeter embankments. • Decant pump located within the rock ring decant. • Decant causeway – design slopes of 1:1.5 (V:H) and a nominal 8 m crest width, with 0.5 m (minimum) windrows on both sides of the accessway. <u>Pipelines (tailings delivery and decant return water)</u>: • HDPE pipelines installed within an unlined V trench with sufficient capacity to ensure all solids and liquors are captured within the trench. • Flow sensors fitted to tailings delivery and decant return water pipelines to allow detection of loss of content. <u>Ambient groundwater monitoring system</u>: • 9 groundwater monitoring bores will be installed (refer to Schedule 1 Map for TSF indicative monitoring locations). • Monitoring bores will have a depth of approximately 30 m to 60 m, installed through the alluvial zone and in to the bedrock. • Both shallow and deep bores will be installed based on lithology types and groundwater depth characteristics. • Each bore will be cased with pvc pipe with a 80-100 mm diameter to allow for sample abstraction, slotted from 12 m to 60 m and gravel packed.

	Column 1	Column 2
	Infrastructure/Equipment	**Requirements (design and construction)**
6	Inert and Putrescible landfill	• Trenches excavated within the north waste rock dump footprint. • Landfill located more than 100 m away from surface water features. • Landfill located greater than 3 m above the groundwater table. • Fencing installed to prevent access by livestock and capture windblown waste. • Signage erected listing the type of waste facility and materials to be disposed.
7	WWTP	• ASBP WWTP installed adjacent to the accommodation village. • ASBP WWTP located on a compacted bunded pad. • WWTP rated for 300 persons at 300 litres per person per day. • One containerised unit with a combined anoxic/aerobic treatment process. • Alarms on the aerobic treatment tank air blower and discharge pump. • Fitted with high level alarms as well as malfunction alarms. • Pipeline to irrigation field constructed of HDPE. • Designed and constructed to meet the following emission standards: Biochemical Oxygen Demand <20 mg/L Total Suspended Solids <30 mg/L Total Nitrogen <40 mg/L Total Phosphorus ≈ 4 – 12 mg/L Turbidity <5 NTU pH 6.5-8.5 pH units *E.coli* <1,000 cfu/100mL
8	Irrigation Field	• 3 hectares. • Fenced. • Located greater than 500 m from sensitive water resources.

	Column 1	Column 2
	Infrastructure/Equipment	**Requirements (design and construction)**
9	Workshop / wash down facility	• Located on concrete pads constructed so that all drainage from the workshop and wash down facilities drain to a clean water recovery system; and • Oil-water separator system – capable of treating to total hydrocarbon concentration <20 mg/L.

At the time of assessment, Emissions and Discharges from the Works listed in Table 5 were considered in the determination of the risk and related Conditions for the Works Approval.

Table 5: Authorised Works

Works	Specifications/Drawings
Stormwater	Schedule 1 Map: Diversion drain
Processing reagents: • 200 tonne quicklime bulk storage • 100 m^3 cyanide dissolution tank • 100 m^3 cyanide storage tank; • 60 m^3 sodium hydroxide storage tank; • 30 m^3 hydrochloric acid storage tank; and • 500 kilogram activated carbon bulk boxes	Location not defined
Process water pond	Schedule 1 Map: Process Water
Process plant and associated ROM	Schedule 1 Map: Processing Plant and ROM
TSF and associated pipelines	Schedule 1 Map: TSF and Tails and Decant Pipelines
Putrescible and Inert Landfill and Tyre Landfill	Schedule 1 Map: Landfill/s
WWTP and associated pipelines	Schedule 1 Map: Camp & WWTP
Irrigation Field	Schedule 1 Map: Irrigation Field
Workshop and Wash down Facility	Schedule 1 Map: Workshop, Fuel Storage and Washdown Facility

Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Works Approval Number	W6143/2018/1
Applicant	Greenmount Resources Pty Ltd
ACN	607 613 650
File Number	DER2018/000442
Premises	Karlawinda Gold Project Mining tenement M52/1070 CAPRICORN WA 6642
Date of Report	20 August 2018
Status of Report	Final

Table of Contents

1. Definitions of terms and acronyms

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

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AEP	Annual exceedance probability
Annual Period	means a 12 month period commencing 1 January until 31 December
Applicant	Greenmount Resources Pty Ltd
ARI	Average Recurrence Interval
ASBR	Activated sludge bioreactor
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
cfu/100 mL	colony-forming units per 100 millilitres
CIL	Carbon-in-leach
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
EC	Electrical Conductivity
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)

Term	Definition
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ha	hectare
HDPE	high density polyethylene
IWL	Integrated waste landform
Issued Licence	The licence issued under Part V, Division 3 of the EP Act
Issued Works Approval	The works approval issued under Part V, Division 3 of the EP Act following the finalisation of this assessment
m^3	cubic metres
Mtpa	million tonnes per annum
NTU	Nephelometric Turbidity Unit
Occupier	has the same meaning given to that term under the EP Act
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 Table 3 of the Decision Report
Risk Event	As described in *Guidance Statement: Risk Assessments*
RIWI Act	*Rights in Water and Irrigation Act 1914*
RL	Reduced Level
ROM	Run of Mine
SAG	Semi autogenous grinding
TDS	Total Dissolved Solids
TSF	Tailings Storage Facility
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
WWTP	Wastewater Treatment Plant
WAD	Weak Acid Dissociable
WC Act	*Wildlife Conservation Act 1950*
µS/cm	micro Siemens per centimetre

2. Purpose and scope of assessment

Greenmount Resources Pty Ltd (Applicant) submitted an application (Application, 2018) on 13 March 2018 to the Department of Water and Environmental Regulation (DWER) for a works approval under the *Environmental Protection Act 1986* (EP Act). The application is for open cut mining of a gold resource from the Bibra pit at the Karlawinda Gold Project (Premises).

Ore mined from the pit will be transported to a Run of Mine (ROM) pad and then processed through a carbon-in-leach (CIL) processing plant, at a nominal rate of 3.75 million tonnes per annum (Mtpa) for the first three years of production (for oxide material), reducing to 3 Mtpa for the remainder of the life of mine, when processing fresh, hard rock. Process waste (tailings) will be pumped to an integrated waste landform (IWL) Tailings Storage Facility (TSF).

The Premises is located approximately 60 km south-east of the town of Newman in the Midwest region of Western Australia. The Premises is located on mining tenement M52/1070 which is owned by the Applicant, a wholly owned subsidiary of Capricorn Metals Limited.

This Decision Report assesses emissions and discharges associated with the construction and operation of the following:

- CIL process plant;
- TSF and tailings pipeline infrastructure;
- Putrescible and inert landfills; and
- Wastewater treatment plant (WWTP).

This assessment has resulted in DWER issuing Works Approval W6143/2018/1 (Issued Works Approval) which is contained in Attachment 1.

2.1 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
KGP Works Approval_IR-F09_Application form; KGP Works Approval_Appendix 1_GCA 2018_Waste; KGP Works Approval_Appendix 2_GCA 2018_Tailings; KGP Works Approval_Appendix 3_Minelogix 2018_Leach Analysis; KGP Works Approval_Appendix 4_CMW 2018_TSF Design; KGP Works Approval_Appendix 4_LMGS 2018_TSF Cert; KGP Works Approval_Appendix 1A_Proof of occupier status; KGP Works Approval_Appendix 1B_ASIC extract; KGP Works Approval_Appendix 6_Specified Ecosystems; KGP Works Approval_Appendix 7_Works Approval; and KGP Works Approval_Appendix 8_Construction Costs.	13 March 2018
RE: Applicant Notification – CEO291/18 - Request for Further Information, received from James Hesford (Capricorn Metals) including: • 20180406_CMM_DWER_LTR_Response to RFI;	6 April 2018

• 20180406_CMM_DWER_Response to RFI_Table1; • Figure 10 TSF Monitoring Bores_(Revised); and • GRM 2017b_Feas study.	
Applicant Notification – CEO291/18 - Request for Further Information, received from James Hesford (Capricorn Metals) including 20180410_Chromium Concentration in The Bibra Deposit.	10 April 2018
KGP: Revised TSF Location, received from James Hesford (Capricorn Metals) including: • Figure 10 TSF Monitoring Bores_20180531; and • PMP event outline_20180530.	31 May 2018

3. Background

The application relates to the following Primary Activities at the Premises for the prescribed premises categories defined in Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) as listed in Table 3.

Table 3: 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.	3,750,000 tonnes per annual period
Category 64	Class II 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.	1,500 tonnes per annual period
Category 85	Sewage facility: premises – (a) on which sewage is treated (excluding septic tanks); or (b) from which treated sewage is discharged onto land or into waters.	100 m^3/day

4. Overview of Premises

4.1 Operational aspects

The operational aspects as defined within Application, 2018 are detailed below.

Category 5 – Processing or beneficiation of metallic or non-metallic ore

Process plant

The flowchart of the processing circuit is shown in Figure 1.

The stages of processing will comprise:

Crushing

Gold bearing ore from the Bibra pit will be placed on a ROM pad located adjacent to a crushing plant. Segregation of stockpiles will be undertaken according to ore source, ore type and gold grade. Ore will be reclaimed from the stockpiles using a front-end-loader and will be delivered into a 150 tonne capacity ROM Bin. An apron feeder will withdraw ore from the ROM Bin, discharging over a vibrating grizzly. The grizzly will separate fines, nominally material passing 80 millimetres (mm), and will discharge the oversize into the single stage primary jaw crusher. The jaw crusher will operate with a closed side setting of approximately 150 mm. Vibrating grizzly undersize and primary crusher discharge will report onto a sacrificial conveyor, which will discharge onto a stockpile feed conveyor, before discharging onto a 10,000 tonne total capacity, conical open stockpile.

Grinding

Crushed ore reclaimed from the stockpile will be conveyed to the milling circuit. Approximately equal volumes of water sourced from the borefield, tailings return and internal process recycle streams are added at the milling stage. Quicklime will be added to the ore feed to provide for an elevated pH in the downstream gold leaching stage.

The grinding circuit will consist of a 4.8 megawatt (MW) semi autogenous grinding (SAG) mill as the first stage of grinding. The addition of ore feed and water to the mill will be undertaken to achieve the optimum slurry density. Material exiting the SAG mill will pass through a rotating trommel screen, with oversized material directed to a scats storage bunker during oxide ore processing. During fresh ore processing, SAG mill scats will report to a pebble crusher via a series of conveyors. The crushed material is then recirculated back to the SAG mill with new feed.

Trommel undersize material will report to the cyclone feed hopper. Following water addition, the slurry is pumped to a nest of classification hydrocyclones located at the top of the grinding circuit structure. The cyclone underflow will be split, with a portion feeding the gravity circuit and the remainder directed to a 4.8 MW ball mill for a secondary stage of grinding.

Gravity circuit

The cyclone underflow entering the gravity circuit is scalped over a horizontal vibrating screen, directing the coarse material to the ball mill feed. Scalping screen underflow will be fed into a single stage gravity circuit consisting of two centrifugal concentrators operating in parallel. The centrifugal concentrators will operate in a batch mode with gold concentrates discharged hourly to a storage hopper located in a secured area. Rejects from the centrifugal concentrators will be returned to the ball mill feed for further grinding.

The gravity concentrate is collected for a 24 hour period. Each batch is leached with a concentrated cyanide solution. The leached solids are returned to the grinding circuit and the pregnant leach liquor sent to the gold room for electrowinning.

CIL circuit

The cyclone overflow stream from the grinding circuit will report via gravity to a trash screen before being pumped to the CIL circuit. The screen will remove trash material (e.g. plastic, wood fibre, misclassified coarse particles).

Trash will be collected in a bin for disposal or recycling. The screened slurry flows under gravity to the first of a series of seven mechanically agitated CIL tanks.

Cyanide and oxygen are added to the CIL circuit to propagate gold leaching. Each tank will have a live volume of 1,970 cubic metres (m^3). As the gold leaches it will simultaneously be adsorbed and concentrated onto granulated activated carbon particles mixed with the slurry. The gold adsorption process will operate in a counter current direction to the gold leaching process. Slurry will flow via gravity from the first adsorption tank progressively through the other six adsorption tanks in series and over tailings/carbon safety screen. Carbon will be batch pumped upstream, counter-current to the slurry flow, from the last to the first adsorption tank.

As the carbon is moved forward up the CIL train it becomes progressively more concentrated with gold. Loaded carbon will be pumped from the first adsorption tank to the loaded carbon recovery screen where the slurry will return to the tank and the loaded carbon will be discharged to the acid wash column.

Carbon stripping and goldroom circuit

This is an enclosed circuit whereby loaded carbon batches will be initially washed with a hydrochloric acid solution at ambient temperature to remove non-organic contaminants and then rinsed with fresh water before being transferred to the elution column. A split Anglo American Research Laboratories (AARL) elution process is used to remove the gold from the carbon and involves passing hot solution upward through the bed of activated carbon at a temperature of 120ºC. Once the temperature is achieved a “presoak” solution of cyanide and caustic soda is contacted with the carbon to solubilize the contained gold and then hot water is used to flush/elute the gold from the carbon in two stages. In the first stage, weak eluate from the previous elution cycle is used to generate the pregnant eluate. The resulting pregnant liquor generated will be directed to a storage tank for electrowinning. During the second stage of the elution cycle hot water is used to complete the elution cycle, with the resultant weak eluate stored for use in the next elution cycle.

The barren carbon is cooled and either hydraulically transferred back into the last adsorption tank in the CIL circuit or sent to the regeneration kiln for reactivation. The liquefied petroleum gas (LPG) fired kiln heats the carbon to 650ºC, decomposing organic contaminants and increases its adsorption capacity. After cooling/quenching, the reactivated carbon is transferred to the last adsorption tank in the CIL circuit. The carbon is continuously recycled back through the CIL circuit and degrades over time. Minor addition of new carbon is required to maintain inventories and the gradation size of the carbon is maintained by screening and collection of fines. A portion of the fine carbon is recovered from the carbon safety screen.

Final gold recovery to physical form is carried out by electrowinning the pregnant liquors from both the gravity and CIL circuit pregnant solutions. The gold is plated onto cathodes of stainless steel in separate sludging electrowinning cells. The loaded cathodes are manually cleaned on a defined schedule, with the gold sludge being collected, filtered and dried before smelting into doré bars. The 500 ounce bars will contain approximately 80% gold and 20% silver. Barren liquor from the electrowinning process is recycled back to the CIL to take advantage of residual reagent content and to recover any low level residual gold.

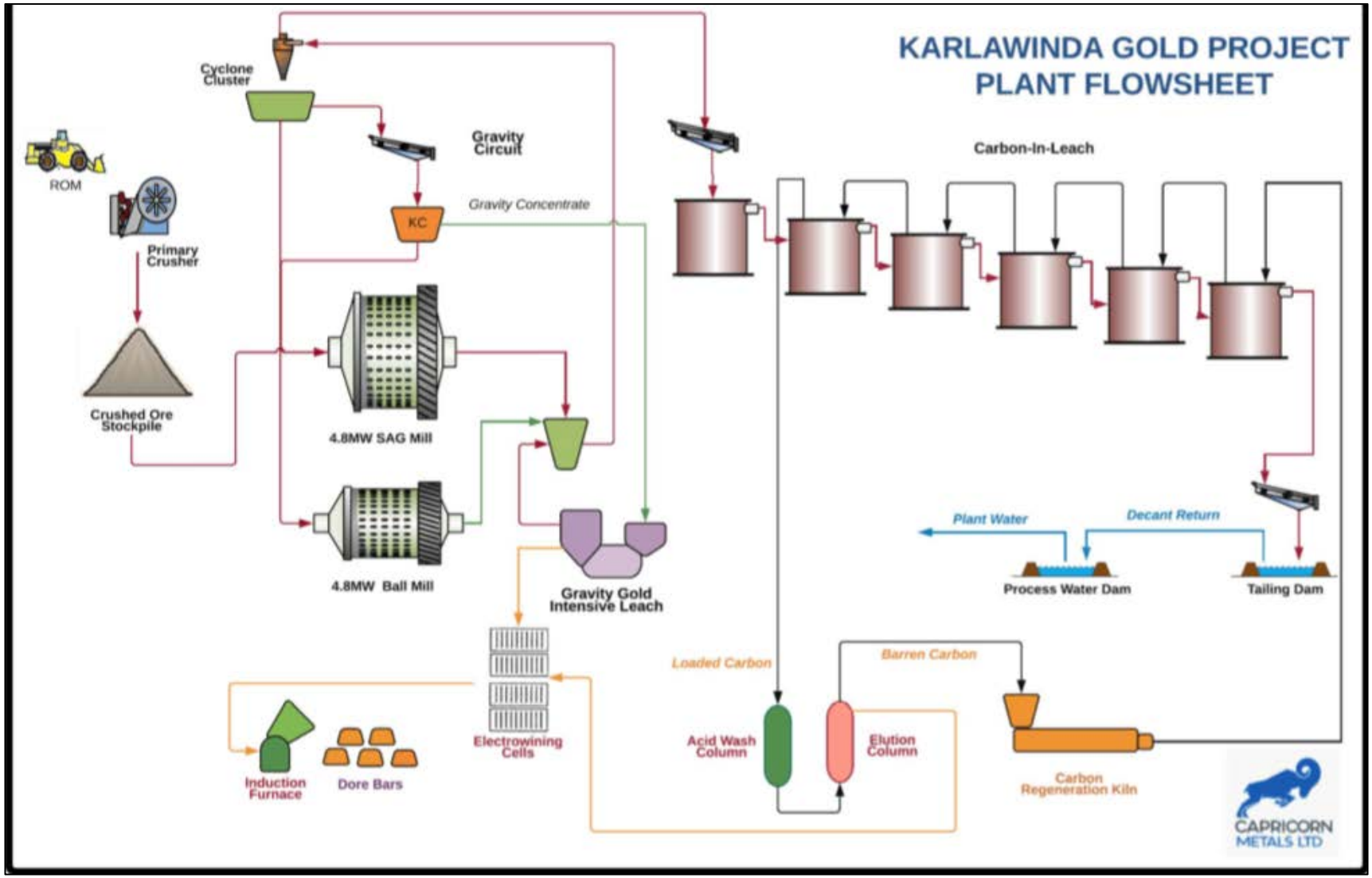


Figure 1: Processing flowchart

TSF

The TSF has been designed to comply with the *Code of Practice for Tailings storage Facilities in* Western Australia and conform to *ANCOLD, 2012* and the *Guide to the preparation of a design report for TSFs*.

Tailings produced from processing ore will be stored in a surface IWL TSF. The TSF will be a single cell circular facility constructed within a waste dump and designed to store 21 million tonnes of tailings over a 6 year period.

Tailings in the form of slurry from the process plant will be discharged sub-aerially and cyclically into the TSF. Deposition will take place via multiple spigots located on the upstream perimeter embankment crest. Spigotting is to be carried out such that the supernatant pond is maintained within and around the rock ring decant. The general configuration of the TSF (starter embankment and final stage) are shown in Figures 2 and 3.

Decant water will be removed from the TSF by a submersible pump located within the rock-ring type central decant structure. Return water will be pumped directly to the process water pond, which will also receive water from mine dewatering. The water from the process water pond will be distributed to various end use points in the process plant.

The TSF embankments will be raised in a minimum of two stages against the waste dump and raises will be nominally 5 m in vertical height. The estimated tailings storage areas, volume and storage capacity of the IWL TSF is shown in Table 4.

Table 4: Estimated tailings storage areas and storage volume

Stage	Crest RL (m)	Area (ha)	Cumulative Volume (Mm3)	Cumulative Storage Capacity (Mt)	Cumulative Storage Life (years)
Starter	590.5	100	3.0	3.75	1.0
1	595.5	105	8.4	10.5	2.8
2	600.5	107	13.8	18.0	5.2
3	602.5	109	16.0	21.0	6.3

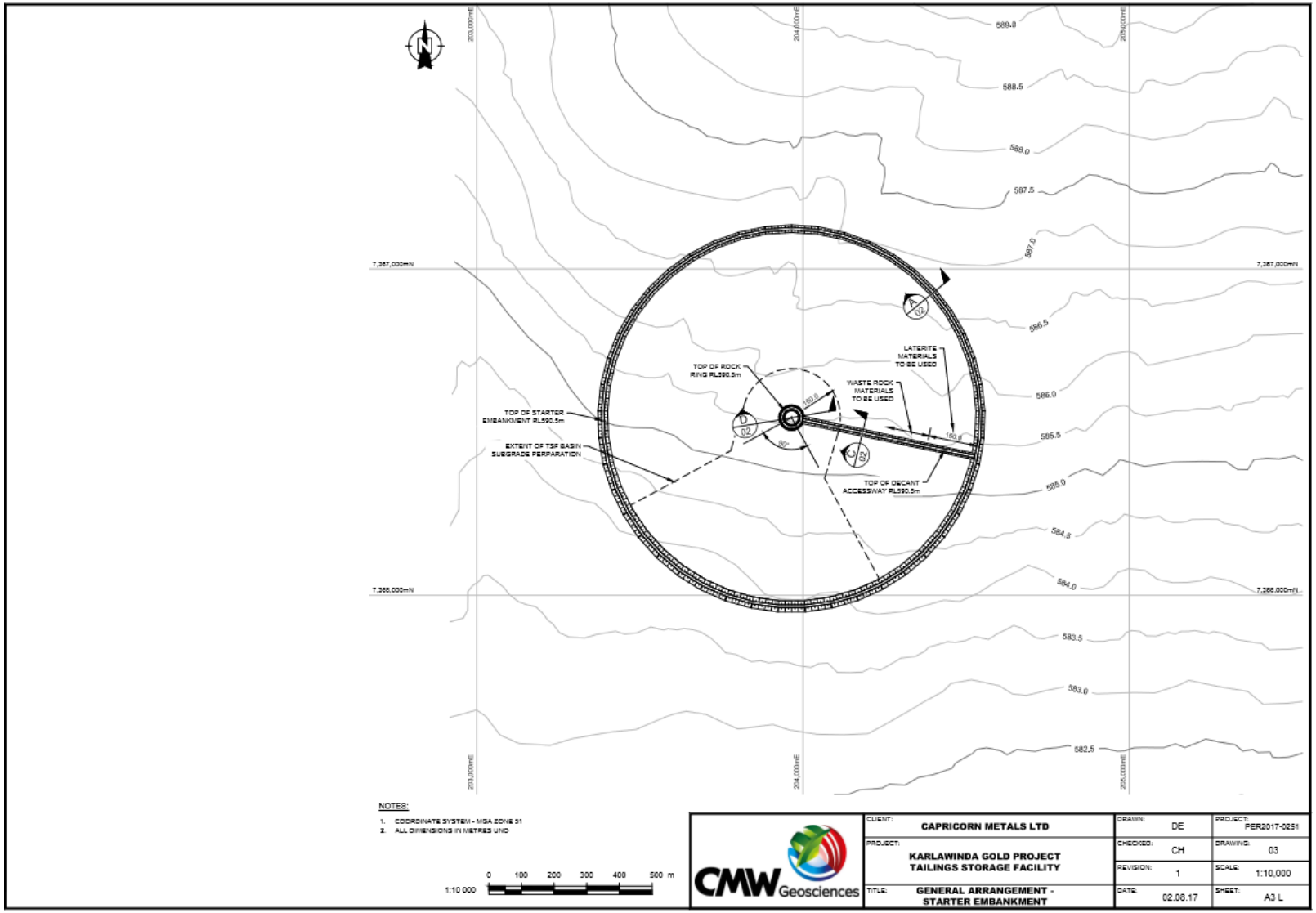


Figure 2: TSF general arrangement – Starter embankment

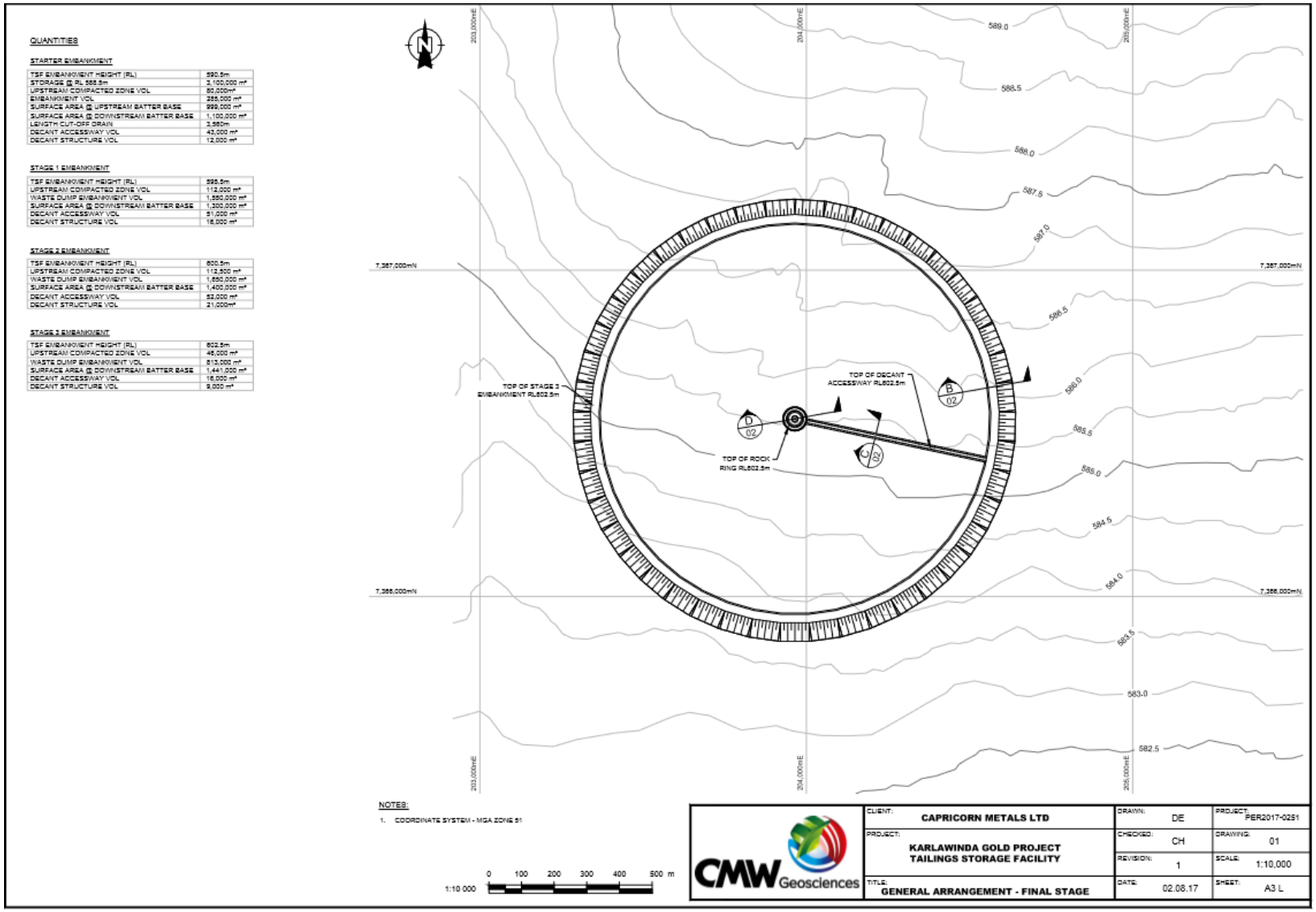


Figure 3: TSF general arrangement – Final stage

Category 64 – Putrescible landfill site

Two Class II landfills are proposed to be constructed within two waste rock dumps at the Premises. One landfill will accept putrescible waste, inert waste type 1 and inert waste type 2 (plastics) and the second landfill will only accept inert waste type 2 (rubbers/tyres) in accordance with the *Landfill Waste Classifications and Waste Definitions*.

Category 85 – Sewage facility

An activated sludge bioreactor (ASBR) WWTP will be installed adjacent to the accommodation village to process wastewater streams from ablutions and other facilities at the accommodation village.

The WWTP will consist of one containerised unit, treating up to 100 m^3/day (Capricorn, 2018c) of wastewater through a combined anoxic/aerobic suspended growth treatment process. A schematic of the WWTP process is shown in Figure 4.

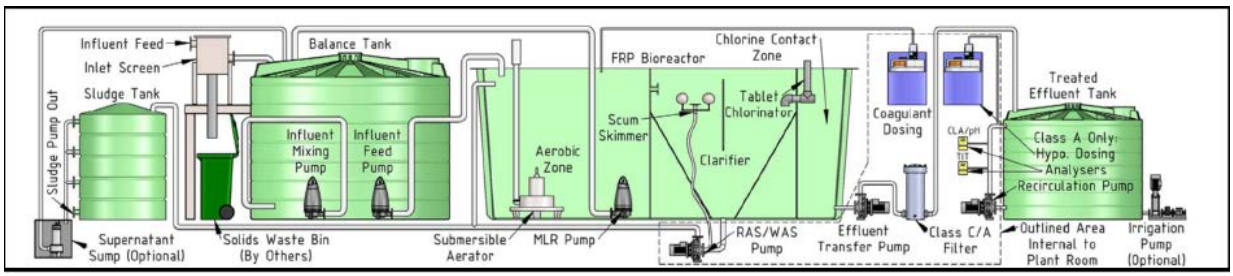


Figure 4: Schematic of WWTP process

Effluent from the WWTP will be treated to a secondary level of treatment (Category C) in accordance with *NWQMS, 1997* with effluent achieving the specifications detailed in Table 5. The treated wastewater will be discharged to a fenced 3 hectare (ha) irrigation field.

Table 5: Effluent specifications

Parameter	Units	Value
pH	pH units	6.5 – 8.5
Biochemical Oxygen Demand	mg/L	<20
Total Suspended Solids	mg/L	<30
Total Nitrogen	mg/L	<40 (or 10 mg/L reduction from influent value)
Total Phosphorus	mg/L	≈ 4 -12
E.coli	cfu/100 mL	<1,000

4.2 Infrastructure

The Premises infrastructure, as it relates to Category 5, 64 and 85 activities, is detailed in Table 6 and with reference to the Site Plan (Figure 5).

Table 6: Premises infrastructure

	Infrastructure	**Site Plan Reference**
	Prescribed Activity Category 5	
Ore mined from the pit will be transported to a ROM pad and then processed through a CIL processing plant. Tailings will be pumped to an IWL TSF.		
1	ROM pad	Figure 5: ROM
2	Primary crusher (ROM bin, apron feeder, vibrating grizzly, primary jaw crusher and conveyors)	Figure 5: Processing plant
3	Stockpiles	
4	Two stage grinding circuit (SAG mill and ball mill)	
5	Single stage gravity circuit consisting of two centrifugal concentrators operating in parallel	
6	Leaching and Absorption (CIL circuit to propagate gold leaching. The gold absorption process (seven absorption tanks in series) will operate in a counter current direction the gold leaching process	
7	Carbon stripping (elution process, electrowinning, carbon regeneration/ reactivation)	
8	Regeneration kiln	
9	Gold recovery (smelting)	
10	Processing reagents (quicklime, cyanide, sodium hydroxide, hydrochloric acid and activated carbon)	
11	Process water pond	Figure 5: Process Water
12	IWL TSF – tailings delivery and decant return water pipelines, rock-ring type central decant structure and cut-off trench	Figure 5: TSF and Tails and Decant pipelines
	Prescribed Activity Category 64	
Putrescible waste, inert waste type 1 and inert waste type 2 (plastics and rubber) will be disposed of within two waste dump landfills. The Premises is expected to produce up to 750 tonnes per annum of inert waste (including tyres) and up to 750 tonnes per annum of putrescible waste.		
1	Inert and putrescible landfill	Figure 5: Landfill
2	Tyre landfill	Figure 5: Landfill

	Infrastructure	Site Plan Reference
	Prescribed Activity Category 85	
An ASBR WWTP will process wastewater streams from ablutions and other facilities at the accommodation village. The WWTP is rated for 300 persons at 300 litres (L) per person per day. After treatment the chlorinated water will be discharged to an irrigation field west of the village.		
1	ASBR WWTP including associated pipelines	Figure 5: Camp and WWTP
2	3 ha irrigation field	Figure 5: Irrigation Field
Other activities		
1	Workshop	Figure 5: Workshop and Washdown Facility
2	Wash down facility	
3	Turkey Nest – water from mine dewatering will be held here prior to being used for dust suppression or directed to the process water pond	Figure 5: Turkey Nest
4	Raw water pond	Not shown on Figure 5, but located next to the Process Water

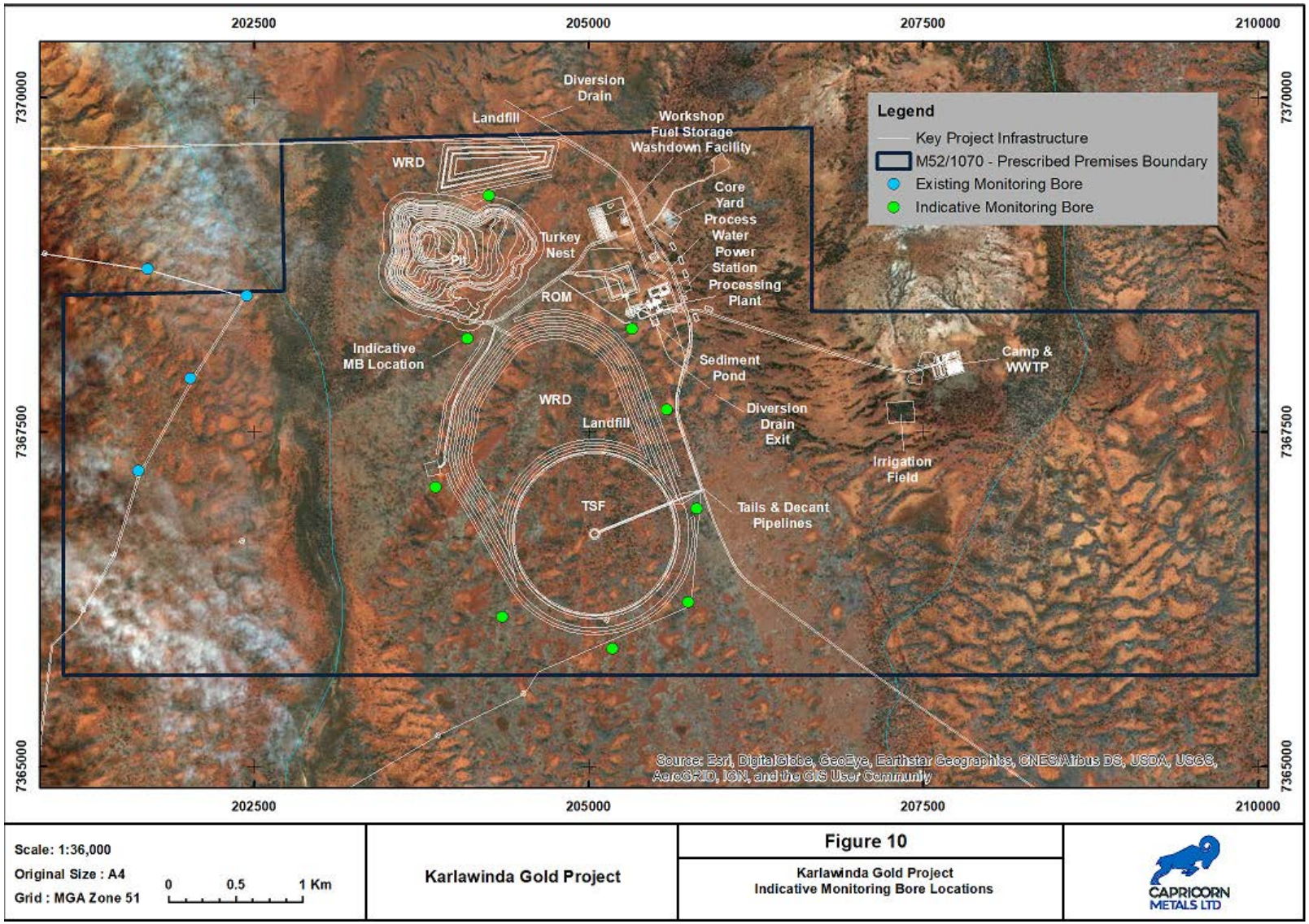


Figure 5: Site Plan

4.3 Exclusions to the Premises

The following activities/infrastructure will be occurring/ located at the Premises which are not included in the scope of this assessment:

- Mining ore from open pits.
- Abstraction of groundwater (production borefield) is regulated under the *Rights in Water and Irrigation Act 1914* (RIWI Act).
- Mine dewatering of the Bibra pit. This activity will not be regulated by DWER as the mine dewater will not be discharged to the environment, instead it will be used in the process plant and for dust suppression (Application, 2018).
- 18 MW gas-fired power station. This infrastructure is not regulated by DWER as it does not trigger category 52 or 84 of the EP Regulations.
- Fuel storage and dispensing compound (4 x 110 kilolitres (kL) self-bunded tanks). This infrastructure is not regulated by DWER as the Applicant has stated that less than 1,000 m^3 in aggregate is planned to be stored on the Premises. The Applicant should note that the general provisions of the EP Act and *Environmental Protection (Unauthorised Discharges) Regulations 2004* apply, as does the *Dangerous Goods Safety Act 2004* and associated Regulations.
- A bioremediation pad is to be established within each of the two waste dumps. They will be approximately 1 ha and will comprise a compacted layer of waste material, with earthen bunds to control runoff. As the facilities do not receive liquid waste from other Premises, it does not trigger category 61 under the EP Regulations. The Applicant should note that the discharge of hydrocarbons to the environment is an unauthorised discharge under the *Environmental Protection (Unauthorised Discharges) Regulations 2004* and the facilities should be constructed and operated to comply with the *Assessment and management of contaminated sites* and the *ASC NEPM*.
- 300-person accommodation camp.
- Leach drain systems at the workshops and administration offices are not regulated by DWER.
- Explosive magazine.
- Administration offices.
- Infrastructure corridors (roads and power corridors).

5. Legislative context

Table 7 summarises approvals relevant to the assessment.

Table 7: Relevant approvals and tenure

Legislation	Number	Subsidiary	Approval
Mining Act 1978	Reg. Id 73030	Greenmount Resources Pty Ltd	The Applicant submitted a Mining Proposal to the Department of Mines, Industry Regulation and Safety (DMIRS) on 21 March 2018. The Mining Proposal with Mine Closure Plan was decided on 30

Legislation	Number	Subsidiary	Approval
			July 2018.
Health Act 1911		Greenmount Resources Pty Ltd	The Applicant requires an Approval to Construct or Install an Apparatus for the Treatment of Sewage from the Department of Health.
RIWI Act	CAW 183479	Greenmount Resources Pty Ltd	26D Licence to construct bores to provide the Project water supply and facilitate the dewatering of the open pit.
	GWL201659	Capricorn Metals Ltd	The Applicant has obtained (19 July 2018) a 5C groundwater licence (GWL) for 4,000,000 kL from the Combined – Fractured Rock West – Fractured Rock Aquifer.

5.1 Part IV of the EP Act

Application, 2018 states that "*consultation was undertaken with DMIRS and DWER to ascertain whether Part IV or Part V is relevant to this project. Advice from DWER concluded that the project could be adequately managed under Part V*".

5.2 Part V of the EP Act

5.2.1 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: Licence Duration (August 2016);*
- *Guidance Statement: Decision Making (February 2017);*
- *Guidance Statement: Risk Assessments (February 2017);* and
- *Guidance Statement: Environmental Siting (November 2016).*

5.2.2 Clearing

The clearing of native vegetation is not approved under the Issued Works Approval. The Applicant holds a Native Vegetation Clearing Permit (NVCP) covering the Premises (CPS 7836/1).

6. Consultation

The Application was advertised in the West Australian on 30 April 2018 for a 21 day comment period.

A letter inviting comment was sent to the Shire of Meekatharra on 2 May 2018 and the following

comments (Meekashire, 2018) were provided on the 9 May 2018:

- "*No mining or activity whatsoever is to be undertaken on any Road Reserve, Road or track controlled or maintained by the Shire of Meekatharra.*
- *All equipment and waste to be removed at the cessation of mining activities".*

A letter of referral was sent to DMIRS on 2 May 2018 regarding the Application. The following advice (DMIRS, 2018) was received on 28 May 2018:

- A Mining Proposal and Mine Closure Plan (Reg ID 73030) is currently under assessment. "*DMIRS identified during assessment that further information was required from proponent is currently waiting for submission of a revised proposal"*.
- "*In general terms, the Mining Proposal has demonstrated that the project can be completed to the required Departmental standards*". However, additional information is required for the issues identified by the Resource Safety division of DMIRS.

DWER notes that the issues mentioned above are listed in DMIRS, 2018, but are not applicable to this assessment.

7. Location and siting

7.1 Siting context

The Premises is located approximately 1,200 km north-east of Perth and 60 km south-east of Newman in the Midwest region of Western Australia as shown in Figure 6. The Premises is located wholly on Weelarrana station, an active cattle and sheep property. Sylvania station is located immediately to the north of the Premises with the Sylvania homestead approximately 18 km to the north-east.

The workforce for the Premises will be accommodated at the on-site camp. The camp is operated by the Applicant, as such will not be considered a sensitive land use or receptor.

7.2 Residential and sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 8.

Table 8: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Closest residential zoned premises (zoned residential East Pilbara Planning Scheme No. 4)	The residential area of Newman is approximately 60 km north-west of the Premises.
Sylvania Homestead	Approximately 18 km to the north-east of the Premises.

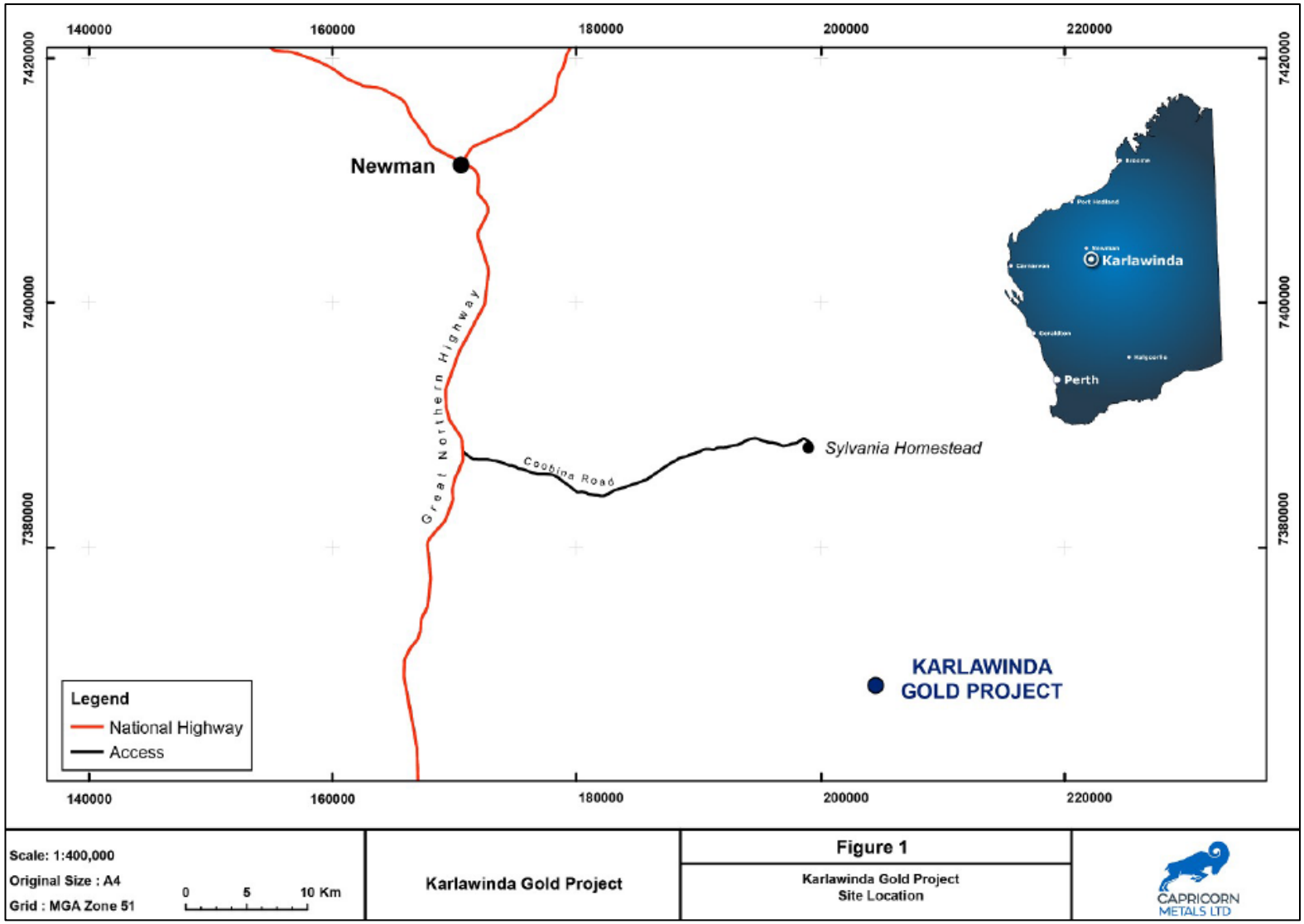


Figure 6: Regional location of the Premises

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 9. Table 9 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.*

Table 9: Environmental values

Specified ecosystems	**Distance from the Premises**
Ramsar Sites in Western Australia	The Fortescue Marsh is located approximately 120 km north-west of the Premises.
Department of Biodiversity, Conservation and Attractions Managed Lands and Waters	Collier Range National Park is located approximately 85 km south-west of the Premises.
Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs)	Application, 2018 states that there are no TECs, PECs of fauna habitat or conservation significance. Bilby identified as a conservation significant species that could potentially occur within the survey area. Based on the results of a desktop assessment and field survey the possibility of the Bilby occurring in the survey area is considered unlikely, the same is true for the Mulgara.
Declared Rare Flora	No Declared Rare Flora pursuant to the *Wildlife Conservation Act 1950* (WC Act) have been recorded.
Biological component	**Distance from the Premises**
Threatened/Priority Flora	No threatened flora species pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been recorded. Two Priority species as listed by the Department of Biodiversity, Conservation and Attractions were recorded: *Eremophila rigida* (Priority 3); and *Rhagodia* sp. Hamersley (Priority 3).
Threatened/Priority Fauna*	11 species protected under the EPBC Act and WC Act were recorded during the survey: • Great Desert Skink (*Liopholis kintorei*) – Vulnerable under the EPBC Act and Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; • Pilbara Olive Python (*Liasis olivaceus barroni*) - Vulnerable under the EPBC Act and Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; • Night Parrot (*Pezoporus occidentalis*) - Endangered under the EPBC Act and Schedule 1 of the Wildlife Conservation

	(Specially Protected Fauna) Notice 2017; • Princess Parrot (*Polytelis alexandrae*) - Vulnerable under the EPBC Act and Priority 4 Fauna; • Grey Falcon (*Falco hypoleucos*) – Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; • Peregrine Falcon (*Falco peregrinus*) – Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; • Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*) - Vulnerable under the EPBC Act and Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; • Northern Quoll (*Dasyurus hallucatus*) - Endangered under the EPBC Act and Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; • Bilby (*Macrotis lagotis*) - Vulnerable under the EPBC Act and Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; • Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) - Vulnerable under the EPBC Act and Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; and • Ghost Bat (*Macroderma gigas*) – Vulnerable under the EPBC Act and Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017.

*Threatened and Priority Fauna List

7.4 Groundwater and water sources

The distances to groundwater and water sources are shown in Table 10.

Table 10: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
Public drinking water source areas	The Priority 1 Newman Water Reserve is approximately 42 km north-west of the Premises.	Town water supply.
Major watercourses/waterbodies	The Premises falls within the Savory Creek Wild River Area. The Savory Creek drainage system is within the Lake Disappointment Basin with the main creek line situated approximately 10 km south of the Premises.	Savory Creek Wild River Area, has been recognised by DWER and the Australian Heritage Commission as a Wild River catchment and has been classified as Priority 1 – in near pristine condition, and of a very high

Groundwater and water sources	Distance from Premises	Environmental value
	Ephemeral drainage lines exist across the Premises which drain to the south towards Savory Creek.	environmental value. Savory Creek currently has no/or minor impact from clearing, road or track construction, or introduced plants or plant diseases. Refer to *Conservation Guidelines for the Management of Wild River Values.* Ephemeral drainages which are highly variable and only convey flows following cyclonic and other depressions related to rainfall events.
Groundwater	The Premises is located in the East Murchison Groundwater Area. Groundwater quality in the region is typically fresh to brackish, with electrical conductivities (EC) generally less than 4,000 micro Siemens per centimetre (µS/cm) and neutral to slightly alkaline waters (Application, 2018). Groundwater levels across the Premises range between 6 to 14 m below ground level (mbgl) (GRM, 2017). The nearest registered operating bore to the Premises is Guildford Bore located around 5 km north-east of the Premises and is used for livestock drinking water supply.	Potable water quality of less than 1,000 mg/L total dissolved solids (TDS). Livestock drinking water supply. Recharge to the groundwater system is most likely through rainfall infiltration in the upper catchment area where the alluvium cover is likely to be thinner (GRM, 2017).

7.5 Groundwater chemistry

Application, 2018 states that the Premises is located in the East Murchison Groundwater Area. Groundwater in the region typically occurs in the following units:

- Calcrete Aquifers: these likely occur to varying degrees along Savory Creek (to the south of the Premises). Where developed, these aquifers are likely to be thin (less than 20 m or so in thickness), unconfined, and have limited areal extent away from the main Savory Creek channel. Although limited in size, they can form moderate to high permeability aquifers.
- Fractured Rock Aquifers: these form as a result of secondary permeability developing in basement rocks from faulting, fracturing and dissolution of soluble minerals in both the Archean and Proterozoic sequences. These aquifers can have moderate to high

permeability, particularly when they intersect other main shear or fracture zones, and are a major source of sustainable mine water supplies in the Pilbara and Goldfields regions, providing abstraction rates are managed. One such aquifer strikes north-north-easterly, a few kilometres to the west of Bibra (Easky Fault zone) and has been targeted as part of these water supply investigations.

- Weathered Bedrock Aquifers: these result from secondary permeability developed dominantly from chemical weathering of basement rocks and various sedimentary units. These aquifers can have significant lateral extent but are often limited in thickness, depending on the depth of oxidation. In the Bangemall Group rocks to the west of Bibra, such an aquifer has developed in a weathered dolomite horizon. This aquifer (known locally as the dolomite aquifer) is around 30 m thick with drilling indicating it to be 3 km or more in length and around 2 km wide with consistent moderate to high permeability.

Five production bores KPB01 to KPB05 as depicted in Figure 7 were test pumped to assess aquifer parameters and help build a conceptual model of the groundwater system in the Karlawinda area. Samples for water quality analysis were collected and the results are tabulated in Table 11.

Results of the laboratory analysis indicate that the groundwater in the Karlawinda area is of very good quality, with all of the analyses showing it to be consistently fresh with less than 500 mg/L of TDS, and neutral to slightly alkaline. Results for dissolved metals were low for most metals, although chromium was slightly elevated. The water is relatively soft with total hardness less than 250 mg/L as $CaCO_3$ (GRM, 2017).

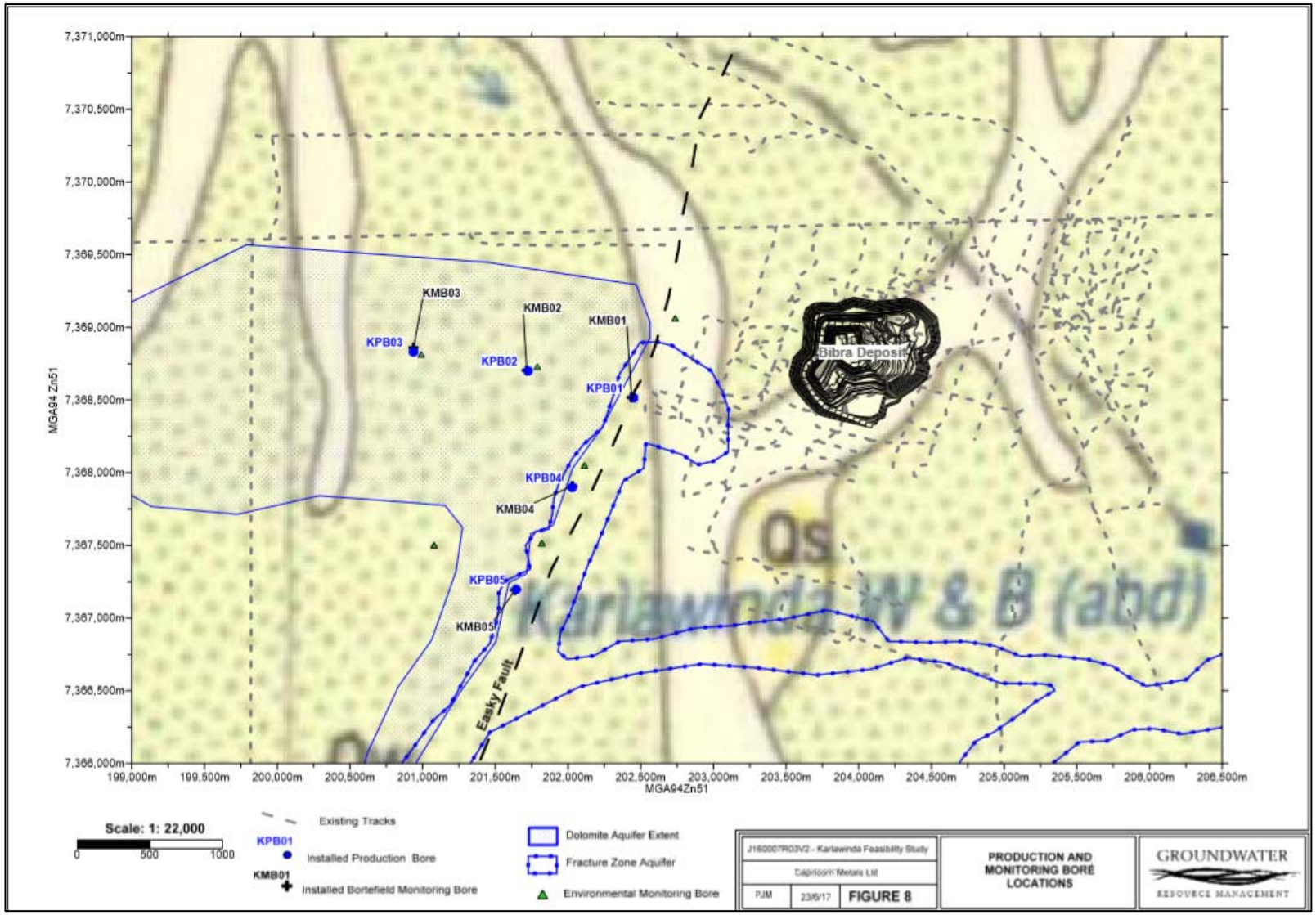


Figure 7: Production and monitoring bore locations

Table 11: Water quality results summary

Analyte	Units	Detection Limit	*ANZECC, 2000 Livestock* (mg/L)	*ANZECC, 2000 95% Freshwater* guidelines (mg/L)	Sample ID and Date						
					KPB01 8/06/2017	KPB02		KPB03 27/05/2017	KPB04 5/06/2017	KPB05	
						30/05/2017	25/04/2018			2/06/2017	10/04/2018
pH	pH Units	0.01	NE	6 to 9	7.89	8.07	7.85	8.06	7.99	8.11	7.76
Electrical Conductivity @ 25ºC	µS/cm	1	NE	NE	507	614	610	612	595	614	643
Total Dissolved Solids @ 180ºC	mg/L	10	<5,000	NE	388	410	472	417	399	413	468
Total Hardness as $CaCO_3$	mg/L	1	NE	NE	158	195	195	207	204	204	198
Bicarbonate Alkalinity as $CaCO_3$	mg/L	1	NE	NE	74	92	102	95	108	102	110
Total Alkalinity as $CaCO_3$	mg/L	1	NE	NE	74	92	102	95	108	102	110
Silicon as SiO_2	mg/L	0.1	NE	NE	4.2	6.7	63.9	4.8	8	5.8	60.1
Silicon	mg/L	0.05	NE	NE	33	30.3	-	29.4	29.1	31	-
Sulfate as SO_4 - Turbidimetric	mg/L	1	1,000	NE	42	46	40	45	46	53	48
Chloride, Cl	mg/L	1	NE	NE	58	72	90	75	70	72	76

Calcium, Ca	mg/L	1	1,000	NE	32	37	37	40	39	39	38
Magnesium, Mg	mg/L	1	<600	ND	19	25	25	26	26	26	25
Sodium, Na	mg/L	1	NE	NE	38	54	58	52	52	58	56
Potassium, K	mg/L	1	NE	NE	8	8	9	9	9	9	9
Total Anions	meq/L	0.01	NE	NE	4.88	5.94	5.41	6.24	6.24	6.33	5.34
Total Cations	meq/L	0.01	NE	NE	5.02	6.46	6.66	6.63	6.58	6.84	6.62
Ionic Balance	%	0.01	NE	NE	1.28	1.18	10.3	1.24	0.62	1.06	10.7
Ammonia as N	mg/L	0.01	NE	NE	0.07	0.13	-	0.4	0.1	0.03	-
Nitrate as N	mg/L	0.01	400	NE	12.4	15.6	-	18	16	16.2	-
Nitrite as N	mg/L	0.01	30	NE	<0.01	<0.01	-	<0.01	<0.01	<0.01	-
Total Kjeldahl Nitrogen as N	mg/L	0.1	NE	NE	3.1	2.4	-	1.6	2.1	1.9	-
Total Nitrogen as N	mg/L	0.1	NE	NE	15.5	18	-	19.6	18.1	18.1	-
Total Phosphorus as P	mg/L	0.01	NE	NE	<0.05	<0.05	-	<0.05	0.07	<0.05	-
Reactive	mg/L	0.01	NE	NE	<0.01	0.02	-	<0.01	<0.01	<0.01	-

Phosphorus											
Dissolved Oxygen	mg/L	0.1	NE	NE	8.2	9	-	9.1	8.6	8.7	-
Total Iron	mg/L	0.05	NE	ID	1.92	0.94	<0.05	<0.05	<0.05	<0.05	0.06
Dissolved Mercury	mg/L	0.0001	0.002	NE	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Dissolved Metals											
Aluminium, Al	mg/L	0.01	5	0.055	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, As	mg/L	0.001	0.5 to 5[1]	0.013 As V 0.024 As III	<0.001	0.002	0.001	0.001	0.001	0.002	0.002
Cadmium, Cd	mg/L	0.0001	0.01	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium, Cr	mg/L	0.001	1.0	0.001 CrVI	0.005	0.015	0.015	0.015	0.015	0.016	0.015
Lead, Pb	mg/L	0.001	0.1	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Manganese, Mn	mg/L	0.001	NT	NE	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium, Se	mg/L	0.01	0.02	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc, Zn -	mg/L	0.005	20	0.008	0.011	0.01	0.010	0.01	0.012	0.008	0.218
Iron, Fe	mg/L	0.05	ID	ID	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

1 May be tolerated if not provided as a food additive and natural levels in the diet are low (*ANZECC, 2000 Livestock*).

ND = Not determined. Insufficient background data to calculate (*ANZECC, 2000 Livestock*)
NT = Not sufficiently toxic (*ANZECC, 2000 Livestock*)
NE = Not established (*ANZECC, 2000 Livestock*)
ID = Insufficient data to derive a reliable trigger value (*ANZECC, 2000 95% Freshwater* guidelines).
Purple highlight indicates *ANZECC, 2000 95% Freshwater* guidelines exceedance values.

7.6 Tailings waste materials characterisation

Geochemical assessment of simulated process waste (tailings) samples was undertaken by Graeme Campbell & Associates Pty Ltd (GCA 2018). Further analysis was undertaken by Minelogix Pty Ltd (Minelogix 2018) to assess cyanide and arsenic concentrations in tailings leachate.

Two simulated tailings samples were analysed, comprising:

- Oxide-ore tailings; and
- Primary-ore-tailings.

Static analyses were undertaken on both the solid tailings sample and the tailings slurry water. Analysis comprised:

- Sulfide-S;
- Acid-Neutralisation-Capacity (ANC);
- Net-Acid-Generation (NAG);
- NAG-pH;
- pH and EC;
- Multi-element analysis; and
- 24-hour and 48-hour leach tests.

Based on the initial geochemical analysis (GCA 2018) and subsequent additional leach testing on simulated tailings samples (Minelogix 2018), the conclusions presented in Table 12 are made regarding tailings streams at the Premises.

Table 12: Tailings Characterisation (Application, 2018)

Sample Description	Characterisation
Oxide Bulk (Solids) Tailings Sample (results shown in Table 13 below)	• The sample contained "negligible-sulfides" (Sulfide-S value of 0.01%). • The sample was classified as Non-Acid Forming. • The sample had contents of major and minor elements typically below, or close to, those recorded for soils, regoliths, and bedrocks derived from unmineralised terrain. The exception to this was arsenic.
Oxide Tailings Water Leachate (results shown in Table 14 below)	Leachate from oxide tailings from the operating TSF is expected to be: • Alkaline, with a pH value of 10. • Fresh, with a TDS content of 896 mg/L. • Low in Weak Acid Dissociable (WAD) cyanide (less than 50 mg/L), following volatilization of cyanide in open tanks and discharge into the TSF. • Low in concentrations of cyanide-complexing metals (e.g. iron and zinc). • Low in concentrations of other elements, either below or close to the respective limit of detection, including

	low concentrations of arsenic (0.1 mg/L).
Fresh Bulk (Solids) Tailings Sample (results shown in Table 13 below)	• The primary ore tailings sample contained "trace-sulfides" (Sulfide-S value of 0.071%). • The sample was conservatively classified as potentially acid forming – low capacity (PAF-[LC]). • The sample had contents of major and minor elements typically below, or close to, those recorded for soils, regoliths, and bedrocks derived from unmineralised terrain. The exception to this was arsenic and molybdenum.
Fresh Tailings Water Leachate (results shown in Table 14 below)	Leachate from fresh tailings from the operating TSF is expected to be: • Alkaline, with a pH value of 10. • Slightly brackish, with a TDS value of 1,400 mg/L. • Low in free cyanide (less than 50 mg/L), following volatilization of cyanide in open tanks and discharge into the TSF. • Slightly elevated in concentrations of cyanide-complexing metals (namely, iron and copper). • Low concentrations of other elements, including low concentrations of arsenic (~1.2 mg/L) based on anticipated plant conditions of approximately 24-hour leach times (Minelogix 2018)*.

*Follow up metallurgical evaluation in January 2018 to assess arsenic solubility.

Table 13: Multi-Element-Analysis Results for Tailings-Solids Samples (GCA 2018)

GCA-SAMPLE NO.	TAILINGS TYPE	S	Ca	Mg	Na	K	Al	Fe	Si	As	Sb	Se	Mo	B	F	Ni	Cr	Co	Cu	Zn	Cd	Pb	Hg	Ag	Tl	Ba	Sr	Bi	P	Mn	Sn	V	Th	U
		%								mg/kg						mg/kg			mg/kg					mg/kg												
GCA11652	Oxide-Ore-Tailings	<0.01	1.1	1.08	1.84	0.46	6.20	9.15	27.9	72.2	0.88	0.10	8.9	<50	255	154	233	65.9	87	120	0.07	3.4	0.02	0.27	0.22	211.0	132.1	0.18	551	1,244	1.3	171	3.45	1.23
GCA11653	Primary-Ore-Tailings	0.84	3.2	1.66	2.68	0.58	5.96	7.79	29.6	248.0	0.52	0.23	38.6	<50	273	267	499	29.0	59	56	0.03	3.8	<0.01	0.06	0.15	152.1	125.0	0.13	724	870	1.5	112	3.91	1.05
	Average-Crustal Abundance (Bowen 1979)									1.5	0.2	0.05	1.5	10	950	80	100	20	50	75	0.11	14	0.05	0.07	0.6	500	370	0.05	1,000	950	2.2	160	12	2.4

Highlighted Assays:

signifies element content 10-100 times average-crustal abundance

signifies element content 100+ times average-crustal abundance

Reference: Bowen HJM, 1979, "Environmental Chemistry of the Elements", Academic Press, New York

Table 14: Analysis Results for Tailings-Slurry-Water Samples (GCA 2018)

ELEMENT/ PARAMETER	Oxide-Ore-Tailings (GCA11652)	Primary-Ore-Tailings (GCA11653)	ELEMENT/ PARAMETER	Oxide-Ore-Tailings (GCA11652)	Primary-Ore-Tailings (GCA11653)
Major-Parameters			*Cyanide-Complexing Metals (mg/L)*		
pH	9.9	10.3 (10.2)	Fe	0.15 (0.17)	34.0
pH (GCA)	10.0	10.4	Cu	1.88 (1.90)	11.6
EC (µS/cm)	1,742	2,485 (2,480)	Ni	0.42 (0.43)	1.28
EC (GCA, µS/cm)	1,771	2,350	Zn	0.81 (0.83)	0.06
TDS-(grav.) [mg/L]	896	1,363 (1,395)	Co	0.0961 (0.0933)	0.202
			Ag	0.14	<0.01
Major-Ions (mg/L)			*Minor-Ions (µg/L)*		
Na	268.7 (272.7)	457.7			
K	8.1 (8.0)	16.4	As	7.4 (8.1)	7,400
Mg	4.21 (4.16)	0.12	Sb	0.42 (0.42)	9.60
Ca	57.97 (58.06)	5.48	Se	1.0 (0.7)	0.5
Cl	560 (558)	648	B	<10 (<10)	70
SO4	40 (40)	110	Mo	117.2 (114.1)	6.48
HCO3 (as CaCO3)	<2	<2 (<2)	Mn	<10 (<10)	<10
CO3 (as CaCO3)	153	241 (241)	Al	0.23 (0.23)	0.44
OH (as CaCO3)	323	328 (328)	Cd	6.8 (7.5)	<0.5
F	0.2	0.8 (0.8)	Pb	4 (5)	<2
Si	1.59 (1.57)	10.23	Cr	60 (60)	<10
			Hg	1.3 (1.3)	<0.1
Nitrogen-Forms (mg/L)			Bi	0.006 (0.027)	<0.005
			P	<100 (<100)	<100
NH3-N	1.6	2.4	Ba	31.90 (31.27)	5.16
NO3-N	0.86	0.36	Sr	260.9 (263.4)	28
			Tl	0.02 (0.05)	<0.01
Cyanide-Forms (mg/L)			V	<10 (<10)	10
			Sn	0.5 (0.5)	<0.1
CNtot	307	369	U	0.106 (0.118)	0.236
CNwad	291	296	Th	0.011 (0.016)	<0.005
CNfree	290	268			
SCN	1.1	38.3			

Notes:
EC = Electrical-Conductivity; CNtot = Total-Cyanide; CNwad = Weak-Acid-Dissociable Cyanide; CNfree = Free-Cyanide
TDS-(grav.) = Total-Dissolved-Solids-(gravimetric)
Values in parentheses represent duplicate determinations.

7.7 Soil type

Soils are typically red shallow loams (often with hardpans), red loamy earths, stony soils and red deep sands with some red shallow sands (Application, 2018).

7.8 Meteorology

7.8.1 Regional climatic aspects

The climate is described as desert with bimodal rainfall (Application, 2018). Climatic conditions in the region are dominated by tropical cyclones which can occur in all summer months, but predominately between late December and end of March.

7.8.2 Rainfall and temperature

The Bureau of Meteorology (BoM) station at Mundiwindi is the closest to the Premises and its mean and medial annual rainfalls of 261 mm and 230 mm respectively and the mean annual pan evaporation of approximately 3,611 mm is considered to be representative of conditions at the Premises (Application, 2018). The 1 in 100 year Average Recurrence Interval (ARI), 72-hour storm event for the Premises is approximately 3.4 mm per hour, or a 243 mm event. Figure 8 provides the mean rainfall and maximum temperatures for Newman Aero (mean maximum temperature 1996-2018 and mean rainfall 1971-2018).

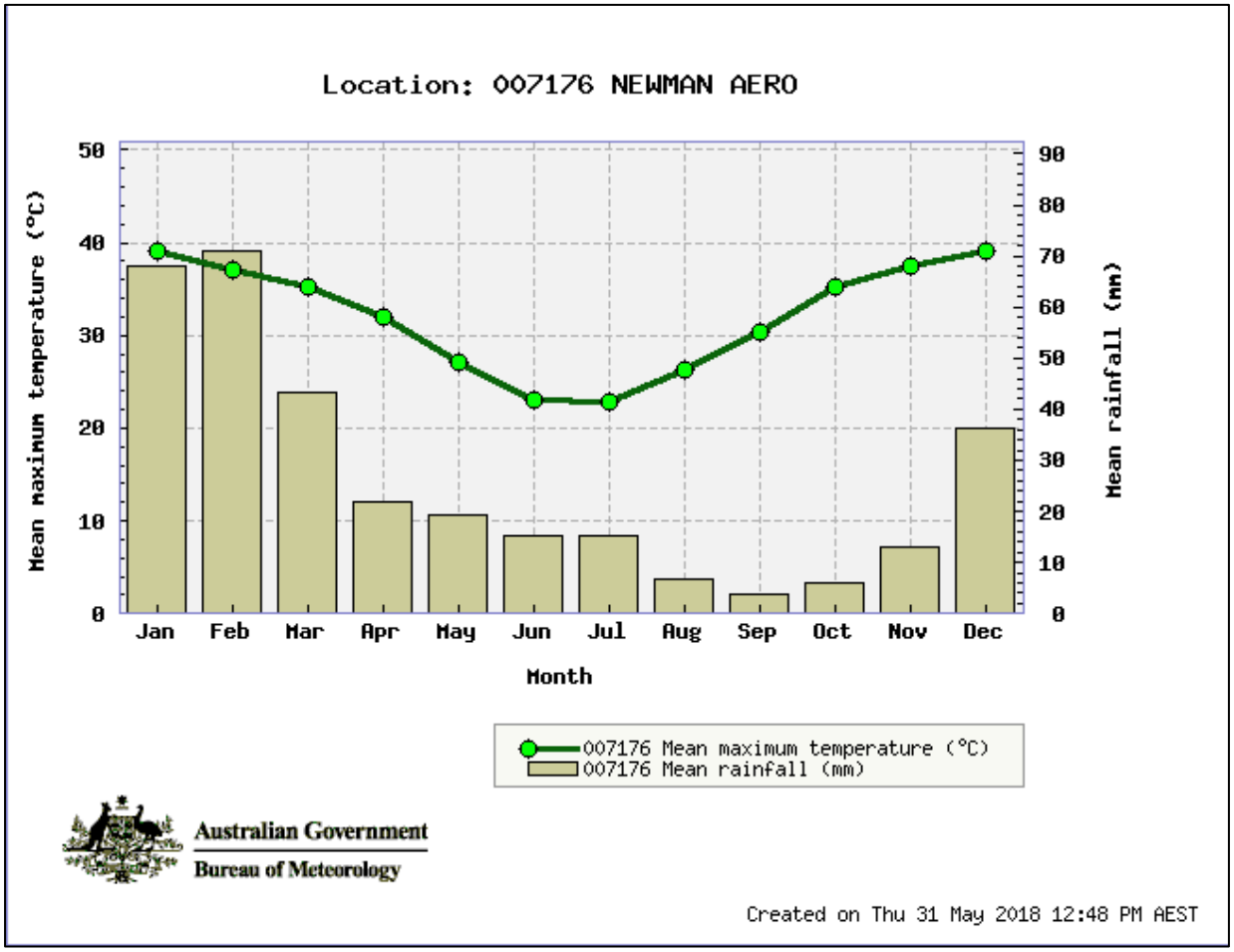


Figure 8: Mean temperatures and rainfall, Newman Aero

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 Tables 15 and 16.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Tables 15 and 16 below.

Table 15. 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	No residences or other sensitive receptors in proximity	Air / wind dispersion	None	No	No receptor present.
		Dust			None	No	No receptor present.
	Earthworks, construction of new buildings, plant and infrastructure	Noise	No residences or other sensitive receptors in proximity	Air / wind dispersion	None	No	No receptor present.
		Dust	No residences or other sensitive receptors in proximity	Air / wind dispersion	None	No	No receptor present.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
			Flora and vegetation		Potential to be deposited on vegetation and may prevent photosynthesis and plant respiration	No	The natural dust tolerance of vegetation species should prevent vegetation impacts. There are also no Declared Rare Flora, TECs or PECs within or in a 30 km radius of the Premises.
		Contaminated stormwater	Drainage lines Riparian vegetation	Stormwater runoff Gravity flow overland	Contamination of drainage lines with sediment, metals in sediment Loss of riparian vegetation	Yes – refer to section 8.4.	Potential impact on water quality and riparian vegetation.
	Storage and use of hydrocarbons and chemicals	Spills and breach of containment	Soil and vegetation adjacent to the area of spill or breach	Direct discharges to land	Soil contamination inhibiting vegetation growth and survival	No	Managed under a Dangerous Goods licence. The general provisions of the EP Act and *Environmental Protection (Unauthorised Discharges) Regulations 2004* apply, as does the *Dangerous Goods Safety Act 2004* and associated Regulations.

Table 16: Identification of emissions, pathway and receptors during operation and commissioning

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Category 5 Processing or beneficiation of metallic or non-metallic	Operation of process plant, movement of ore through conveyors in crushing and grinding circuit	Dust	No residences in proximity	Air / wind dispersion	None	No	No receptor present.
			Adjacent vegetation		Potential suppression of photosynthetic and respiratory functions	No	Limited impact on vegetation (dust impacts are temporary and no adjacent conservation significant flora).

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
ore	Wet processing (leach and adsorption, elution electrowinning and tailings disposal to tailings hopper)	Gold processing slurry with cyanide and metals in solution	Terrestrial ecosystems adjacent to where the spillage has occurred Groundwater Drainage lines and riparian vegetation	Pipeline failure or tank/bund overflow causing spill to ground; flow to vegetation and drainage lines dependent on size	Death or adverse impact to adjacent vegetation Soil and/or groundwater contamination	Yes – refer to section 8.5	Potential to cause soil contamination if spills occur; large spills may result in potential impact on water quality and aquatic biota in tributaries and drainage lines of Savory Creek.
	Process water pond and associated pump and piping system	Decant return water containing cyanide and metals in solution, which could increase in concentration over time	Terrestrial ecosystems adjacent to the pond	Overflow from Process water pond Seepage through liner	Soil and/or groundwater contamination	Yes – refer to section 8.6	Potential to cause soil and groundwater contamination if overflows or leaks occur.
	Carbon regeneration Gold room operation	Gaseous and particulate emissions from carbon regeneration kiln and smelting furnace	No residences in proximity	Air / wind dispersion	Poor ambient air quality	No	No receptor present; potential Occupational Health and Safety risk to workers to be managed under *Mines Safety and Inspection Act 1994*. The smelting furnace emission point will be defined as a 'specified emission' on the Issued Licence.
	All processing activities	Noise	No residences or other sensitive receptors in proximity	Air / wind dispersion	None	No	No receptor present.
		Contaminated stormwater	Drainage lines Riparian vegetation	Stormwater runoff Gravity flow overland	Contamination of drainage lines with sediment and metals in sediment Loss of riparian vegetation	Yes – refer to section 8.4.	Potential impact on water quality and riparian vegetation.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
		Leaks and spills of hydrocarbons and chemicals	Terrestrial ecosystems adjacent to where the spillage has occurred	Spill to ground or leak, overflow during filling or leak from pipework	Soil and/or groundwater contamination	No	Managed under a Dangerous Goods licence. The general provisions of the EP Act and *Environmental Protection (Unauthorised Discharges) Regulations 2004* apply, as does the *Dangerous Goods Safety Act 2004* and associated Regulations.
	TSF	Tailings overflows from the TSF	Terrestrial ecosystems adjacent to the TSF	Direct discharges to land and infiltration to soils	Soil contamination inhibiting vegetation growth and survival	Yes – refer to section 8.7	Potential to cause soil contamination if overflows occur.
		Discharge of tailings through TSF embankment failure	Drainage lines in pathway of tailings Soil and vegetation	Direct discharges to land and infiltration to soil	Death or adverse impact to adjacent vegetation Soil contamination	No	Managed by DMIRS under the *Mining Act 1978*.
		Tailings seepage	Adjacent vegetation Soil Groundwater, which is used for livestock drinking water	Seepage to groundwater adjacent to TSF and seepage from the base of the TSF with infiltration into soils	Groundwater mounding Inundation of vegetation root zones, resulting in poor vegetation health or death Groundwater contamination Soil contamination inhibiting vegetation growth and survival	Yes – refer to section 8.7	Potential to cause groundwater mounding inundating root zones of vegetation, groundwater and soil contamination.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
		Dust from surface of TSF containing tailings contaminants	No residences or other sensitive receptors in proximity	Air / wind dispersion	Potential to be deposited on vegetation and may prevent photosynthesis and plant respiration	No	The Delegated Officer considers the natural dust tolerance of vegetation species should prevent vegetation impacts. There are also no Declared Rare Flora, TECs or PECs within or in a 30 km radius of the Premises.
		Spillage of tailings through leaks, pipeline ruptures or failure	Terrestrial ecosystems adjacent to the TSF, process plant and pipelines	Direct discharges to land and infiltration to soil	Soil contamination inhibiting vegetation growth and survival	Yes – refer to section 8.7	Potential for soil contamination through release of tailings slurry/tailings supernatant.
Category 64 Class II putrescible landfill	Landfilling to active trench/cell	Dust	No residences or other sensitive receptors in proximity	Air / wind dispersion	Potential suppression of photosynthetic and respiratory functions	No	Limited impact on vegetation (dust impacts are temporary and no adjacent conservation significant flora).
		Noise	No residences or other sensitive receptors in proximity		None	No	No receptor present.
		Leachate	Adjacent vegetation Soil Groundwater	Via soil and groundwater	Groundwater contamination	Yes – refer to section 8.8	Potential impact to groundwater, which is used for livestock drinking water.
		Odour	No residences or other sensitive receptors in proximity	Air / wind dispersion	None	No	No receptor present.
		Gaseous emissions from putrescible decomposition	No residences or other sensitive receptors in proximity	Air / wind dispersion	None	No	No receptor present.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Poor management of landfill operation	Windblown rubbish	Terrestrial ecosystems	Direct discharge/ movement by surface water following rainfall	Soil contamination May attract vermin/feral animals	Yes – refer to section 8.8	Potential for impact to terrestrial ecosystems.
Category 85 Sewage facility	Treatment of sewage	Odour	No residences or other sensitive receptors in proximity	Air / wind dispersion	None	No	No receptor present.
	Sewage pipes and holding tanks	Sewage discharge from the rupture of pipes / overtopping and storage tanks failure	Vegetation adjacent to discharge area	Direct discharges to land and irrigation	Soil contamination inhibiting vegetation growth and survival	Yes – refer to section 8.9	Potential soil contamination from the release of untreated effluent.
	Irrigation of treated effluent	Treated effluent discharged to irrigation field	Terrestrial ecosystems		Facilitated growth of weeds Increase in nutrient levels in soil Ponding in the irrigation field	Yes – refer to section 8.9	Potential for ponding in the irrigation field and increase in nutrient levels in soil if effluent is not treated to recommended levels.
Ancillary activities	Workshop and wash down facility	Hydrocarbons	Soils and groundwater	Release to ground	Soil and/or groundwater contamination	Yes – refer to section 8.10	Potential to cause soil and groundwater contamination if poor management of drainage or discharge occurs.

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 17 below.

Table 17: 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 18 below.

Table 18: 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 19 below:

Table 19: 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

Construction and Operation

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

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

Turbid, sediment laden water released to Savory Creek drainage lines and associated catchment during storm or extreme rainfall events resulting in poor surface water quality, increased sedimentation and potential loss of riparian vegetation.

8.4.4 Applicant controls

Construction and Operation

- Installation of sediment control structures at locations where high sediment loads are anticipated;
- Armouring landforms with competent rock; and
- Stormwater diverted around and away from the processing plant, landfill/s and workshop infrastructure areas by diversion drains shown in Figure 5.

8.4.5 Consequence

The impact from contaminated stormwater runoff at the Premises could result in short term impacts to the Savory Creek drainage lines and associated catchment area; an area of very high environmental value. Therefore, the consequence is **major**.

8.4.6 Likelihood of Risk Event

Based on the Applicant's controls (stormwater diversion drains and sediment control structures), an environmental impact from stormwater runoff will probably not occur in most circumstances. Therefore, the likelihood of the consequence is **unlikely**.

8.4.7 Overall rating of stormwater runoff

Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 17) determines the overall rating of risk for stormwater runoff at the Premises to be **medium**.

8.5 Risk Assessment – Spills of processing reagents during operations

8.5.1 Description of spills of processing reagents during operations

During wet processing of gold ore, processing reagents released to ground may occur from overflowing tanks (poor or faulty process control), pipeline failures, failures of bunding or sump pumps, or catastrophic mechanical failures of tanks.

8.5.2 Identification and general characterisation of emission

Alkaline liquors with metals and cyanide in solution.

8.5.3 Description of potential adverse impact from the emission

The release of gold processing slurries may inundate and destroy adjacent vegetation and result in localised soil contamination. A large spill due to a pipeline or tank failure or overflow may result in release to drainage lines.

8.5.4 Applicant controls

The Applicant's controls to manage spills of processing reagents during operations are set out in Table 20 below.

Table 20: Applicant's controls for processing reagents

Site infrastructure	Controls
Ore processing activities	All slurry containing facilities will be constructed within bunded concrete areas.
200 tonne quicklime bulk storage	Dust collector, including maintenance access, installed on top of the lime silo. Rotary valve to control the discharge rate of the lime to the mill feed conveyor.
Processing reagents including: • 100 m^3 cyanide dissolution tank and 100 m^3 cyanide storage tank;	Contained within a concrete bund that will incorporate a collection sump to recover spillage. Sump pump will discharge into the leach feed trash

• 60 m^3 sodium hydroxide storage tank; and • 30 m^3 hydrochloric acid storage tank	screen underflow distribution box. Stored in accordance with *AS 1940* and *AS 1692.* Level indicators to detect leaks, based on drops in level.
500 kg activated carbon bulk boxes	Stored in containers or under tarpaulins.

8.5.5 Consequence

If a spill occurs and impacts on vegetation, this could result in low level on-site impacts. Therefore the consequence is **minor**.

If a large spill occurs resulting in release to the drainage lines of the Savory Creek, this could result in short term impacts to an area of very high environmental value. Therefore, the consequence is **major**.

8.5.6 Likelihood of Risk Event

The likelihood of a spill resulting in impact to vegetation is **unlikely**.

The likelihood of a spill impacting on the surface water quality of the Savory Creek Wild River area is **unlikely**.

8.5.7 Overall rating of spills of processing reagents during operations

Comparison of consequence and likelihood ratings described above with the risk rating matrix (Table 17) determines the overall rating of risk for processing reagent spills impacting on vegetation to be **medium**.

The overall rating for processing reagent spills resulting in a release to the Savory Creek drainage lines is also **medium**.

8.6 Risk Assessment – Leaks or overflows from the process water pond

8.6.1 Description of leaks/overflows from the process water pond

A high density polyethylene (HDPE) lined process water pond will store TSF decant return water and raw water pond overflow. Process water will be distributed from the process water pond to various end use points in the process plant by the process water pumps. Releases to the environment may occur through overflows due to poor process controls (i.e. pump failure or liner leaks) or extreme rainfall events.

8.6.2 Identification and general characterisation of emission

Processing reagents such as quicklime, cyanide, sodium hydroxide, hydrochloric acid and activated carbon are used in the gold processing circuit. TSF decant return water mixed with raw water and smaller amounts of saline liquor will be stored within the process water pond prior to being used in the processing plant.

8.6.3 Description of potential adverse impact from the emission

The release of process water from an overflow may inundate and impact on adjacent vegetation and result in localised soil contamination. A large spill due to an overflow may result in release to Savory Creek drainage lines, resulting in adverse surface water quality. However if occurring during an extreme rainfall event, the contaminants will be diluted. A leak of the HDPE liner may result in localised soil and groundwater contamination, depending on the duration of the leak.

8.6.4 Criteria for assessment

The physical and chemical properties of the tailings materials proposed for discharge to the TSF have been characterised by *GCA 2018* and *Minelogix 2018* as detailed in section 7.6. As shown in Tables 12 and 14 (section 7.6) pH and arsenic values for both ores are above the corresponding *ANZECC, 2000 95% Freshwater and* applicable *Livestock* values.

8.6.5 Applicant controls

Construction and Operation

- Process water pond will be lined with an impermeable HDPE membrane;
- Capacity of 10,000 m^3; and
- A freeboard of 500 mm will be maintained.

8.6.6 Key findings

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

1. TSF decant return water (including processing reagents) mixed with raw water and smaller amounts of saline liquor will be stored within the process water pond prior to being used in the processing plant. No water quality data has been provided to verify that the *ANZECC, 2000 95% Freshwater* criteria can be met.
2. Based on the location of the process water pond within the Savory Creek Wild Rivers Catchment the Delegated Officer will require the Applicant to construct shallow bores (to detect seepage within the surface sediment) and deep bores (to monitor any changes in the chemical composition of the groundwater) within the vicinity of the process water pond. Bore construction and sampling requirements will need to be undertaken prior to commissioning and deposition into the process water pond.

8.6.7 Consequence

If a leak or overflow occurs and impacts on vegetation, this could result in mid-level on-site impacts. Therefore the consequence is **moderate**.

If a large leak or overflow occurs resulting in release to the drainage lines of the Savory Creek, this could result in short term impacts to an area of very high environmental value. Therefore, the consequence is **major**.

8.6.8 Likelihood of Risk Event

The likelihood of a spill resulting in impact to vegetation is **unlikely**.

Due to the process water pond being located over a 1 km from the Western Creek line, the likelihood of a spill impacting on the surface water quality of the Savory Creek Wild River area is **rare**.

8.6.9 Overall rating of leaks/overflows from the process water pond

Comparison of consequence and likelihood ratings described above with the risk rating matrix (Table 17) determines the overall rating of risk for leaks/overflows from the process water pond to be **medium**.

The overall rating for leaks/overflows from the process water pond resulting in a release to the Savory Creek drainage lines is also **medium**.

8.7 Risk Assessment – TSF pipeline ruptures, overtopping and seepage during operations

8.7.1 Description of TSF pipeline ruptures, overtopping and seepage during operations

A total of approximately 21 Mt of tailings is expected to be produced over a period of six years. All tailings produced from processing will be pumped in the form of a slurry (46% solids) from the process plant to the TSF via a HDPE pipeline. Decant water recovered from the TSF will be pumped back to the process water pond and then to the process plant for re-use.

8.7.2 Identification and general characterisation of emission

While the physical and chemical properties of the tailings materials proposed for discharge to the TSF have been characterised by *GCA 2018* and *Minelogix 2018* and detailed in section 7.6, the testing of leachate has not considered changes over time with migration into different chemical conditions.

Arsenic:

The tailings are significantly enriched in arsenic (refer to section 7.6).

GCA 2018 states that the follow-up investigations by *Minelogix 2018* corresponding to process conditions simulating closely those operative within the full-scale mill indicate that the slurry-water of the primary-ore-tailings stream should be within the range of 1-2 mg/L for arsenic concentrations. It should be noted that the *ANZECC, 2000 Livestock* drinking water value for arsenic is 0.5 - 5 mg/L.

Chromium:

The Applicant has stated "*In the Bibra deposit the greatest abundance of chromium occurs in the hangingwall ultramafic. This ultramafic is barren of any economic gold mineralization and will not be processed. The chromium, which is in the ore has been remobilized from the ultramafics into the laterite and parts of the upper saprolite. This ore category accounts for only 3% of the material which will be processed by the mill and pumped to the tails dam*". Since there is a lack of manganese in the laterite/oxide zone, and manganese acts as a catalyst in the conversion of Cr III to Cr VI, there is a very low likelihood of Cr III converting to Cr VI at Bibra due to this lack of manganese (Capricorn, 2018b). .

Weak Acid Dissociable (WAD) Cyanide:

The more toxic forms of cyanide in TSFs are measured as WAD cyanide, free cyanide and complexed forms. At 'no discharge' mine facilities 50 mg/L WAD cyanide for cyanide solutions accessible to wildlife is widely recognised by the mining industry as a water quality benchmark for the protection of wildlife (Cyanide Management).

Minelogix 2018 states "*After 24-hours of leaching, with an initial starting cyanide concentration of 265 ppm, and activated carbon added to the leach, WAD cyanide levels in the tailings were measured at 140 mg/L, of which 133 mg/L was present as free cyanide. This indicates only a minor amount of cyanide is forming stable complexes with copper, nickel and zinc. In practice a percentage of the free cyanide will volatilize from the open tanks, allowing the leaching circuit to be run so that the free cyanide levels are below 50 mg/L as the tailings are discharged to the TSF*".

pH:

The tailings are alkaline with a pH value of 8 to 10. The *ANZECC, 2000 95% Freshwater* value is 6 to 9 pH units.

8.7.3 Description of potential adverse impact from the emission

Seepage from the TSF has the potential to cause mounding of contaminated groundwater. Discharge of tailings through pipeline failure or embankment overtopping will impact upon adjacent vegetation through toxicity and physical smothering as well as sedimentation, and contamination of surface water systems. There is a high risk to Savory Creek drainage lines and the associated catchment area through groundwater contamination from leachate from the TSF.

Application, 2018 states that a permeability investigation was undertaken at the TSF to test the in-situ materials. Permeabilities of both the in-situ materials and tailings are listed in Table 21 and these values were used in a seepage analysis.

Table 21: Permeability values of in-situ materials and tailings

Material Zone	Permeability, K (m/s)	Comments on Assumptions
Deposited Tailings	3.7×10^{-8} – 1.8×10^{-8} (Oxide Tailings) 1.5×10^{-7} ('Fresh Tailings)	Values based on Rowe Cell test-work
Compacted Clayey/Silty Mine Waste	10^{-8}	Based on field test-work and laboratory testing
Foundation Soils	10^{-7} (uncompacted) 10^{-8} (compacted)	Based on field test-work and laboratory testing
Foundation	10^{-8}	Based on field test-
Mine Waste – Waste Dump	10^{-6}	Assumed value based on materials specification and textbook values

A worst-case scenario was applied to the analyses, using a maximum water pond level of Reduced Level (RL) 603.5 m and the pond was assumed to be adjacent to the perimeter embankment (i.e. not normal operating conditions). The Case 1 and 2 flows represent lower bound flow rates and Case 3 and 4 represent upper bound flows (i.e. due to an extensive pond from a large to extreme storm event). The seepage flow determinations from the analyses are summarised in Table 22.

Table 22: Results of Seepage Analyses

Case	Seepage Flow (m^3/day/m of embankment)	Approximate Embankment Length (m)	Estimated Seepage per day for embankment section (m^3/day)
1 – Starter Embankment Without compaction of the subgrade of the TSF basin	0.0012	3,560	4.3
2 – Starter Embankment With compaction of the subgrade of the TSF basin	0.00041	3,560	1.5
2A – Starter Embankment	0.000032	3,560	0.11

With compaction of the subgrade of the TSF basin and pond 340 m from embankment			
3 – Final Stage Without compaction of the subgrade of the TSF basin	0.049	3,560	174
4 – Final Stage With compaction of the subgrade of the TSF basin	0.049	3,560	174
4A – Final Stage With compaction of the subgrade of the TSF basin and pond 340 m from embankment	0.0039	3,560	13.9

The *TSF Design Report* states the following:

- The seepage analyses indicate low seepage flow can be expected from the TSF (average/typical flow will be around 50 m^3/day) under worst case condition;
- During Stage 1 (starter) operation, the compaction of the subgrade of the TSF basin will reduce seepage by approximately one third;
- The analyses for the final stage indicate there is little difference in seepage quantity for the cases of with and without compaction of the TSF basin;
- The analyses indicated that, as a minimum, partially lining of the TSF should be considered in order to reduce seepage during the 'start-up' phase of the TSF operation; and
- Following the start-up stage, the clayey tailings deposited into the TSF will consolidate to form a low permeability layer around 1.8 x 10^{-8} m/s (nominally 6 m thick) on the base of the TSF basin.

8.7.4 Criteria for assessment

Table 23 outlines the TSF design criteria and specifications (TSF Design Report). The TSF has also been designed in accordance with the *TSF Code of Practice* and the design conforms to *ANCOLD, 2012* and *Guide to the preparation of a design report for TSFs.*

Table 23: TSF design criteria and specifications (TSF Design Report)

TSF	
Type	IWL
Footprint	100 ha
Embankment height	18.5 m (maximum)
Storage capacity	21 Mt of tailings over a 6 year period
Tailings Density	Delivered at approximately 46% solids 1.25 t/m^3 (dry) – Years 1 to 3 1.4 t/m^3 (dry) Year 4+

Hydraulic conductivity	1.0 x 10^{-7} m/s to 1.0 x 10^{-8} m/s
Tailings beach slope	0.3% to 1%
Tailings Deposition Method	Sub-aerial deposition

8.7.5 Applicant controls

The Applicant's controls for the TSF are set out in Table 24 below. The Applicant will also develop and implement a TSF Operations Manual (to be compiled), which will undergo independent audits annually.

Table 24: Applicant's controls for the TSF (refer to Figures 2, 3, 9 and 10)

Site infrastructure	Construction	Operation details
TSF general	Single cell circular TSF/IWL. Designed to store 21 million tonnes of tailings over 6 years. The TSF will be constructed progressively over the life to the mine. Starter – Embankment level of 590.5 mRL. Stage 1 – Embankment level of 595.5 mRL. Stage 2 - Embankment level of 600.5 mRL. Stage 3 - Embankment level of 602.5 mRL. Designed such that a 1% annual exceedance probability (AEP), 72-hour duration storm event can be temporarily stored on top of the TSF.	Minimum of 500 mm total freeboard comprising minimum operational freeboard (vertical height between the tailings beach and embankment crest) of 300 mm and a minimum beach freeboard of 200 mm plus allowance of the 1% AEP 72 hour event of 222 mm. The tailings discharge points, return water pump, beach, decant pond level and tailings level will be visually inspected twice every 24 hours to validate operation is in accordance with design and operational expectations and check for any evidence of embankment instability. TSF walls will be regularly monitored during the operation of the TSF.
TSF starter embankment	Zoned embankment comprising an upstream zone of low permeability roller compacted silty sand and a downstream zone of traffic compacted laterite gravel material. Maximum embankment height of 6.5 m. Incorporate a cut-off trench excavated to cemented laterite gravels in order to reduce seepage losses. Design slopes of 1(V):2(H) upstream and 1(V):2(H) downstream. Crest width of 8 m. Upstream zone: TSF will be prepared by moisture conditioning and compacting the TSF basin subgrade comprising sandy silt/silty sand to produce a low permeability foundation of 10^{-8} m/s.	
Perimeter	Design slopes of 1(V):2(H) upstream	

Site infrastructure	Construction	Operation details
embankments	and 1(V):3(H) downstream. Compacted upstream embankment will have a crest width of 6 m and will have a 2% cross-fall towards the upstream side and 0.5 m (minimum) high waste windrow at the downstream crest.	
Tailings deposition	Multiple spigots located on the upstream perimeter embankment crest.	Discharged sub-aerially and cyclically into the TSF in thin discrete layers, not exceeding 300 mm thickness to allow optimum density and strength gain by subjecting each layer to a drying cycle. Deposition will take place via multiple spigots. Spigotting will be carried out such that the supernatant pond is maintained within and around the rock ring decant. Daily inspections.
Decant system and pond	Rock-ring type central decant structure. Decant structure and decant causeway will be raised along with the perimeter embankments. Decant pump located within the rock ring decant. Decant causeway – design slopes of 1:1.5 (V:H) and a nominal 8 m crest width, with 0.5 m (minimum) windrows on both sides of the access way.	Decant pond is maintained away from the perimeter embankment at all times. Decant water will be removed from the TSF by a submersible decant pump and pumped directly to the process water pond.
Pipelines (tailings delivery and decant return water)	HDPE pipelines installed within an unlined V trench with sufficient capacity to ensure all solids and liquors are captured within the trench. Flow sensors fitted to tailings delivery and decant return water pipelines to allow detection of loss of content.	The tailings delivery and water return pipes and containment corridor will be visually inspected twice every 24 hours for any visible leakage or damage.
Seepage recovery system		Cased bores. Slotted within the zone of predicted seepage. Bores fitted with low flow (1-2 L/s) pumps). Recovered groundwater will be pumped back into the TSF onto the tailings beach where it will report to the decant system. Seepage recovery bores will be regulated under the Licence and will

Site infrastructure	Construction	Operation details
		include monitoring requirements.
Ambient groundwater monitoring system	5 existing monitoring bores are installed and an additional 9 groundwater monitoring bores will be installed (refer to Figure 5). Monitoring bores will have a depth of approximately 30 m to 60 m, installed through the alluvial zone and in to the bedrock. Both shallow and deep bores will be installed based on lithology types and groundwater depth characteristics. Each bore will be cased with pvc pipe with a 80-100 mm diameter to allow for sample abstraction, slotted from 12 m to 60 m and gravel packed.	Standing water level (SWL) on a monthly basis. Quarterly ambient groundwater quality monitoring for the following parameters: pH, EC, TDS, sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, antimony, arsenic, cadmium, chromium, cobalt, copper, iron, manganese, mercury, molybdenum, nickel, selenium, thallium, uranium, zinc, WAD cyanide and total cyanide.

8.7.6 Key findings

The Delegated Officer has reviewed the information regarding the operation of the TSF and has found:

1. Structural integrity of the TSF is regulated by DMIRS under the *Mining Act 1978*.
2. The TSF Operating Manual was not provided with the Application.
3. No seepage recovery system is envisaged by the Applicant. Capricorn 2018 states "*should seepage be detected either visually or from the monitoring bores, Greenmount can react quickly and install a recovery system based on the confirmed location and depth of the seepage*". Based on the location of the TSF within the Savory Creek Wild Rivers Catchment, the Delegated Officer has set a condition within the Works Approval requiring the Applicant to submit a seepage recovery plan to manage seepage from the TSF; detailing the criteria / methods for detection of seepage and triggers to be applied for implementation of the plan. The seepage recovery system will be regulated by monitoring requirements under the Issued Licence.
4. The Delegated Officer considers that ambient groundwater monitoring under the Issued Works Approval at the 14 locations specified in Figure 5 and prior to commissioning will provide adequate baseline data. Due to the location of the TSF within the Savory Creek Wild River Area, the results are to be compared against the *ANZECC, 2000 95% Freshwater* values.
5. It is recommended that the Applicant remove the chromium from the waste product prior to the disposal of the cyanidation process output leachate and provide proposed processes to remove/reduce and control concentrations of chromium, arsenic, cyanide and pH prior to disposal to the TSF.

8.7.7 Consequence

The vegetation impact of TSF pipeline ruptures and overtopping during operations could result in mid-level on-site impacts. Therefore, the consequence is **moderate**.

If seepage alters local groundwater quality, the *ANZECC, 2000 95% Freshwater* trigger values could be exceeded. Furthermore, the TSF is located within the Priority 1 Savory Creek Wild

River Area. The impact of seepage during operations could result in short term impacts to the Savory Creek drainage lines and the associated catchment; an area of very high environmental value. Therefore, the consequence is **major**.

8.7.8 Likelihood of Risk Event

Based on the Applicant's controls and distance to Savory Creek, an environmental impact from TSF pipeline ruptures and overtopping during operation will only occur in exceptional circumstances. Therefore, the likelihood of the consequence is **rare**.

Based on the Applicant's ambient groundwater monitoring requirements and that the seepage recovery system will be regulated under the Issued Licence, an environmental impact from seepage during operations will probably not occur in most circumstances. Therefore, the likelihood of the consequence is **unlikely**.

8.7.9 Overall rating of TSF pipeline ruptures, overtopping and seepage during operations

Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 17) determines the overall rating of risk for TSF pipeline ruptures, overtopping and seepage during operations to be **medium**.

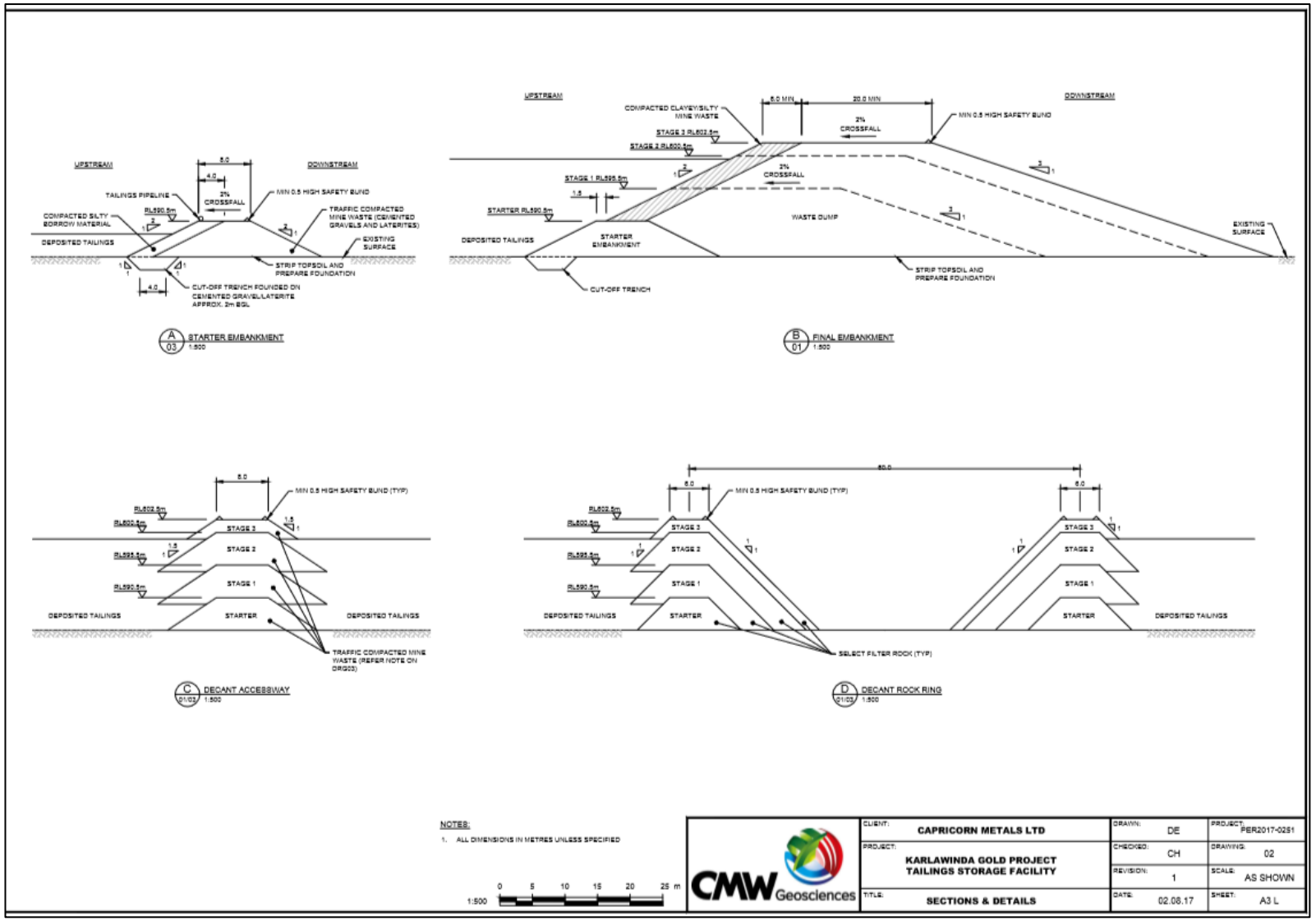


Figure 9: TSF design for sections and details

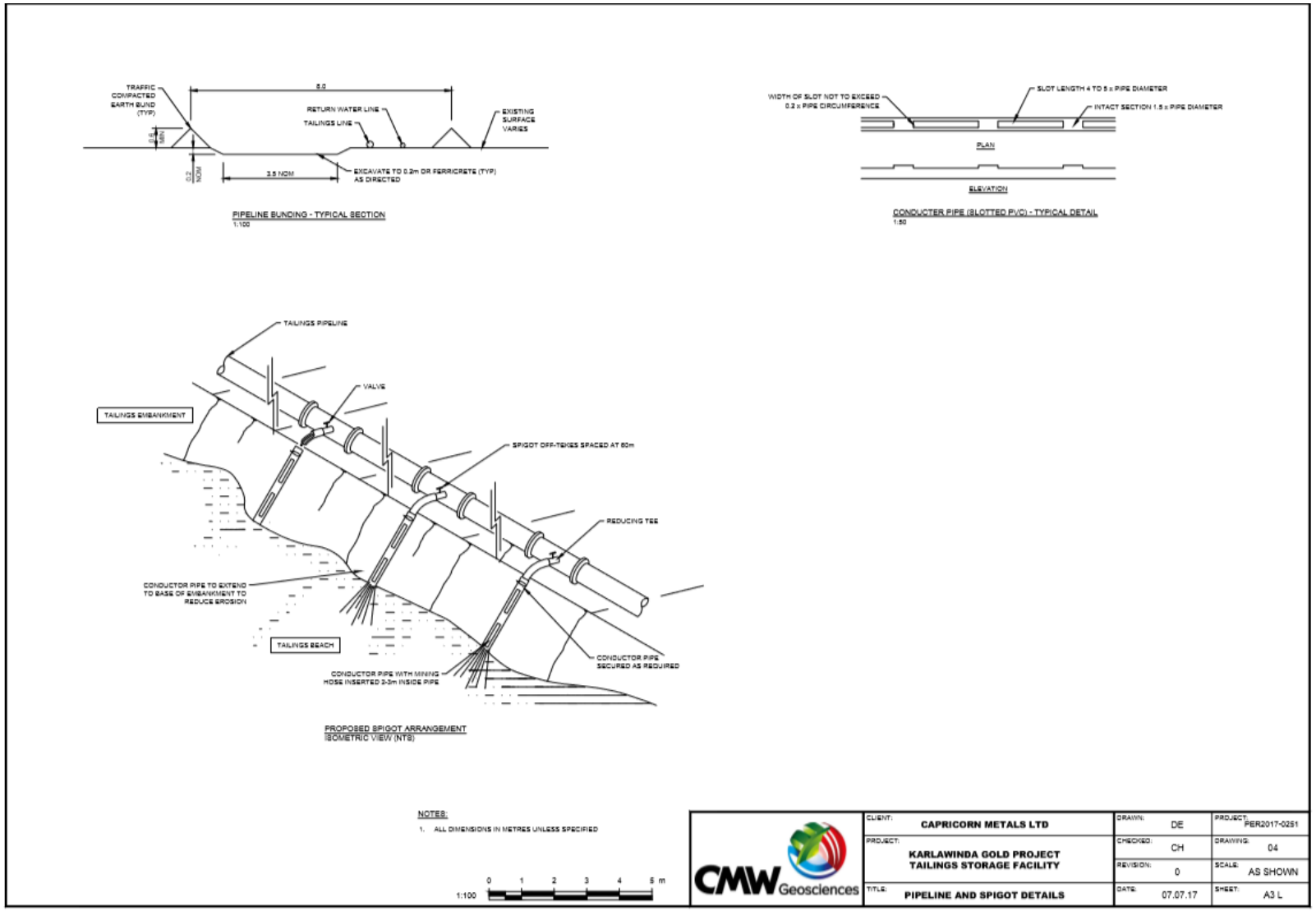


Figure 10: TSF design for pipeline and spigot details

8.8 Risk Assessment – Landfill operations including waste disposal and leachate

8.8.1 Description of Landfill operations including waste disposal and leachate

Putrescible waste, inert waste type 1 and inert waste type 2 (plastics and rubber/tyres) in accordance with the *Landfill Waste Classifications and Waste Definitions* will be disposed of into the Premises landfills. The most significant impact of the putrescible landfill on the surrounding environment is from leachate.

8.8.2 Identification and general characterisation of emission

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

8.8.3 Description of potential adverse impact from the emission

Leachate quality varies throughout the operational life of the landfill and after its closure as well. 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 may 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 a biochemical oxygen demand.

8.8.4 Criteria for assessment

Landfill Waste Classification and Waste Definitions and *ASC NEPM*.

8.8.5 Applicant controls

The Applicant's controls for the Landfills are set out in Table 25 below.

Table 25: Applicant's controls for the Landfills

Site infrastructure	Construction	Operation details
Inert and Putrescible landfill	Trenches excavated within the north waste rock dump footprint. Landfill located over 100 m away from surface water features. Landfill located greater than 3 m above the groundwater table. Fencing installed to prevent access by livestock and capture windblown waste. Signage erected listing the type of waste facility and materials to be disposed.	Tipping area not greater than 30 m in width and 3 m in depth. Landfill will be covered on a fortnightly basis with inert material. Regular inspections. Windblown waste will be collected and put back in the landfill.
Tyre landfill[1]		Used tyres will be disposed of within the north and south waste rock dump footprint. Tyres to be disposed in batches not exceeding 1,000 used tyres. Tyres covered at regular intervals such that

Site infrastructure	Construction	Operation details
		no more than 1,000 used tyres are left exposed at any one time. Each batch will be separated by at least 100 mm of soil or another dense inert and incombustible material, with a final cover not less than 500 mm.

Note 1: Requirements for landfilling tyres are set out in Part 6 of the EP Regulations.

8.8.6 Consequence

Based on the distance to groundwater (6 to 14 mbgl) and waste to be accepted at the Landfills an environmental impact from the waste disposed and leachate could result in low level on-site impacts. Therefore, the consequence is **minor**.

8.8.7 Likelihood of Risk Event

Based upon the distance to groundwater and Applicant controls, the likelihood of an environmental impact from waste disposal and leachate associated with the Landfills will not occur in most circumstances. Therefore, the likelihood of the consequence is **unlikely**.

8.8.8 Overall rating of Landfill operations including waste disposal and leachate

Comparsion of the consequence and likelihood ratings described above with the risk rating matrix (Table 17) determines the overall rating for the risk of the Landfills during operation to be **medium**.

8.9 Risk Assessment – WWTP rupture of pipes, storage tank failure and irrigation during operation

8.9.1 Description of WWTP rupture of pipes, storage tank failure and irrigation during operations

Sewage from the ablutions and other facilities at the accommodation village will be treated through an ASBR WWTP with treated wastewater then discharged to an irrigation field. If the WWTP was to have a breakdown of pumps, rupture of pipes and tank failure, there is the potential for partially treated wastewater to be released to the environment.

8.9.2 Identification and general characterisation of emission

Treated wastewater may contain high levels of pathogens and nutrients which have been identified as key environmental hazards.

8.9.3 Description of potential adverse impact from the emission

Wastewater accidently discharged to the environment during the treatment process may cause soil contamination. If wastewater is discharged to the irrigation field prior to meeting emission standards this could lead to the facilitated growth of weeds, increase in nutrient levels in soil and ponding in the irrigation field.

8.9.4 Criteria for assessment

The Applicant has provided a commitment (Application, 2018) that the effluent will be treated to a secondary level of treatment (Category C) in accordance with *NWQMS, 1997* with effluent

achieving the specifications detailed in Table 5. Relevant land and groundwater quality criteria include the *ASC NEPM* and *ANZECC, 2000 for Freshwater and Livestock* water quality.

8.9.5 Applicant controls

The Applicant's controls for the WWTP and irrigation field are set out in Table 26 below.

Table 26: Applicant's controls for the WWTP and irrigation field

Site infrastructure	Construction	Operation details
WWTP	ASBP WWTP installed adjacent to the accommodation village. ASBP WWTP located on a compacted bunded pad. WWTP rated for 300 persons at 300 L per person per day. One containerised unit with a combined anoxic/aerobic treatment process. Alarms on the aerobic treatment tank air blower and discharge pump. Fitted with high level alarms as well as malfunction alarms. Pipeline to irrigation field constructed of HDPE.	Design capacity of 100 m^3/day. The wastewater will be treated before being discharged to a dedicated irrigation field. The WWTP will meet the following emission standards: Biochemical Oxygen Demand <20 mg/L Total Suspended Solids <30 mg/L Total Nitrogen <40 mg/L Total Phosphorus ≈ 4 – 12 mg/L Turbidity <5 NTU pH 6.5-8.5 pH units *E.coli* <1,000 cfu/100mL
Irrigation field	3 ha. Fenced. Located greater than 500 m from sensitive water resources.	Minimum water table depth – 2 m below natural ground level. Effluent discharge managed to ensure there is no surface ponding or runoff from the irrigation field.

8.9.6 Consequence

Based on the information detailed above and that the wastewater will undergo treatment prior to discharge, the impact of WWTP pipe rupture, tank failure and the irrigation of treated wastewater will result in low level on-site impacts. Therefore, the consequence is **minor**.

8.9.7 Likelihood of Risk Event

Based upon the treatment applied to the wastewater prior to irrigation and Applicant controls, the likelihood of an environmental impact from WWTP pipe ruptures, tank failure and the irrigation of treated wastewater will not occur in most circumstances. Therefore, the likelihood of the consequence is **unlikely**.

8.9.8 Overall rating of WWTP rupture of pipes, storage tank failure and irrigation during operations

Comparison of the consequence and likelihood ratings described above with the risk rating

matrix (Table 17) determines the overall rating for the risk of discharges to land from the WWTP and irrigation field is **medium**.

8.10 Risk Assessment - Hydrocarbon discharges during operation of the workshop/wash down facilities

8.10.1 Description of hydrocarbon discharges from the workshop/wash down facilities during operations

Oils, greases and diesel released to ground during operations from maintenance workshops and wash down facilities associated with failures of bunding or sumps or catastrophic mechanical failures of tanks.

8.10.2 Identification and general characterisation of emission

Oils and greases (hydrocarbons) may be released to ground (through spills, poor handling or inadequate bunding). Incorrectly sized or a poorly maintained oil/water separator may result in overflow/release of hydrocarbons to ground or to stormwater.

8.10.3 Description of potential adverse impact from the emission

Releases of hydrocarbons outside bunded areas may result in localised soil contamination. Long term undetected spills or leaks may also result in groundwater contamination. Spills may be transported with stormwater during rainfall events.

8.10.4 Criteria for assessment

For large spills or leaks, the criteria in the Schedule B5 of the *ASC NEPM* will be applied as reference data to determine level of impact.

8.10.5 Applicant controls

The Applicant's controls for the workshop and wash down facility are set out in Table 27 below.

Table 27: Applicant's controls for the workshop/wash down facility

Site infrastructure	Controls
Diesel compound at workshop area	Comprise up to 4 x 110 kL self-bunded tanks.
Wash down facility and workshop area	Located on concrete pads constructed so that they drain to a clean water recovery system. Sediment from wash down pad will be collected in a concrete sump. Hydrocarbon contaminated water will be directed to an oil-water separator system (treated hydrocarbon concentration <20 mg/L), which will report to a turkey's nest dam, prior to reuse at the wash down facility and/or dust suppression around the Premises.
Bulk oil	Stored in bunded area or on self-bunded pallets. Waste oil will be collected in designated waste oil tanks and removed from site by a licensed contractor.
All	Spill kits will be located at all hydrocarbon and chemical storages on Premises to ensure immediate clean-up of any spills of contaminates. Oily rags, vehicle filters and other hydrocarbon waste will be collected and

	stored in bins, tanks or on bunded pallets for periodic collection and disposal offsite by a licenced contractor.

8.10.6 Consequence

If a localised release of hydrocarbons to ground occurs, then the Delegated Officer has determined that the impact of the spill will be **minor** (on site low-level impact).

If a large release of hydrocarbons was to occur resulting in groundwater contamination or release to the drainage lines of the Savory Creek, this could result in short term impacts to an area of very high environmental value. Therefore, the consequence is **major**.

8.10.7 Likelihood of Risk Event

The likelihood of a localised release of hydrocarbons resulting in soil contamination is **possible**.

The likelihood of a large release of hydrocarbons impacting on the groundwater and surface water quality of the Savory Creek Wild River area is **unlikely**.

8.10.8 Overall rating of discharges from the workshop/wash down facility during operations

Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 17) determines the overall rating for the risk of discharges to land (localised spill) from the workshop/wash down facility is **medium**.

The overall rating for discharges to land (large release of hydrocarbons) from the workshop/wash down facility resulting in groundwater contamination and poor surface water quality of the Savory Creek drainage lines is also **medium**.

8.11 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 28 below. Controls are described further in section 9.

Table 28: 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	Ore processing and handling area Stormwater runoff Infrastructure drainage	Stormwater runoff from cleared and operational area potentially causing soil contamination and sedimentation	Stormwater management as detailed in section 8.4.4	Major consequence Unlikely likelihood **Medium Risk**	Acceptable subject to Applicant construction controls conditioned. • Installation of sediment control structures at locations where high sediment loads are anticipated; • Armouring landforms with competent rock; and • Stormwater diverted around and away from the processing plant, landfill/s and workshop infrastructure areas by diversion drains. Submission of compliance document to ensure that infrastructure has been constructed as per *Application 2018*. Subject to other regulatory controls, no operational controls required.

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
2(a)	Spills of processing reagents during operation	Wet processing gold plant	Discharges to land causing death or poor vegetation health; localised soil contamination	Processing plant bunding, processing reagents storage and containment as detailed in section 8.5.4	Minor consequence Unlikely likelihood **Medium Risk**	Acceptable subject to Applicant construction controls conditioned. Submission of compliance document to ensure that infrastructure has been constructed as per *Application 2018.* Subject to other regulatory controls, no operational controls required.
2(b)	Spills of processing reagents during operation	Wet processing gold plant	Release to drainage lines of the Savory Creek; poor surface water quality		Major consequence Unlikely likelihood **Medium Risk**	
3(a)	Leaks or overflows from the process water pond	Process water pond breaches	Overflow or leak to land causing poor vegetation health and localised soil contamination	HDPE liner Freeboard maintained	Moderate consequence Unlikely likelihood **Medium Risk**	Acceptable subject to Applicant construction controls conditioned. Requirements for bore construction and sampling will be imposed under the Issued Works Approval and prior to commissioning. Submission of compliance document to ensure liner and freeboard markers have been constructed as per assessed design. Operational controls for the operation of infrastructure (freeboard) and monitoring requirements.
3(b)	Leaks or overflows from the process water pond	Process water pond breaches	Release to drainage lines of the Savory Creek; poor surface water quality		Major consequence Rare likelihood **Medium Risk**	

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
4(a)	TSF pipeline ruptures and overtopping during operations	Rupture of pipelines (tailings and return water) Overflow of TSF tailings	Direct discharge to land potentially causing soil contamination inhibiting vegetation growth and survival Inundation of vegetation rooting zone Release to Savory Creek drainage lines and associated catchment and poor surface water quality	Refer to Applicant controls as detailed in section 8.7.5	Moderate consequence Unlikely likelihood **Medium Risk**	Acceptable subject to Applicant construction controls conditioned. Submission of compliance document to ensure that infrastructure has been constructed as per *Application 2018* and *TSF Design Report.* Operational controls for the operation of infrastructure and monitoring requirements.
4(b)	TSF seepage during operations	Seepage from TSF	Groundwater contamination	Refer to Applicant controls as detailed in section 8.7.5	Major consequence Rare likelihood **Medium Risk**	
5	Landfill operations including waste disposal and leachate	Disposal of waste Leachate to soil	Discharges to land Seepage through soil	Refer to Applicant controls as detailed in section 8.8.5	Minor consequence Unlikely likelihood **Medium Risk**	Acceptable subject to Applicant construction controls conditioned. Submission of compliance document to ensure that infrastructure has been constructed as per *Application 2018*. Operational controls regarding operation of infrastructure and monitoring requirements.

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
6	WWTP rupture of pipes, storage tank failure and irrigation during operation	Ruptures of pipes Overtopping of tanks due to failure of equipment Irrigation of treated effluent	Discharges to land potentially causing soil contamination Facilitated growth of weeds Increase in nutrients in soil Ponding in irrigation field	Refer to Applicant controls as detailed in section 8.9.5	Minor consequence Unlikely likelihood **Medium Risk**	Acceptable subject to Applicant construction controls conditioned. Submission of compliance document to ensure that infrastructure has been constructed as *per Application 2018.* Operational controls including monitoring requirements.
7(a)	Hydrocarbon discharges during operation of the workshop/ wash down facilities	Workshop Wash down facilities	Hydrocarbon spills resulting in localised soil contamination	Refer to Applicant controls as detailed in section 8.10.5	Minor consequence Possible likelihood **Medium Risk**	Acceptable subject to Applicant construction controls conditioned. Subject to other regulatory controls, no operational controls required.
7(b)	Hydrocarbon discharges during operation of the workshop/ wash down facilities	Workshop Wash down facilities	Large hydrocarbon spill resulting in groundwater contamination and poor surface water quality of Savory Creek drainage lines		Major consequence Unlikely likelihood **Medium Risk**	

9. Regulatory controls

A summary of regulatory controls determined to be appropriate for the Risk Event is set out in Table 29. The risks are set out in the assessment in section 10 and the controls are detailed in this section. DWER will determine controls having regard to the adequacy of controls proposed by the Applicant. The conditions of the Works Approval will be set to give effect to the determined regulatory controls.

Table 29: Summary of regulatory controls to be applied

		Controls **(references are to sections below, setting out details of controls)**		
		9.1.1 – 9.1.7 Infrastructure and equipment	**9.2.1 – 9.2.4 Operational requirements**	**9.2.5 – 9.2.8 Monitoring**
Risk Items (see risk analysis in section 10)	**1. Stormwater runoff**	•		
	2. Spills of processing reagents	•		
	3. Leaks or overflows from the process water pond	•	•	•
	4. TSF pipeline ruptures, overtopping and seepage	•	•	•
	5. Landfill	•	•	•
	6. WWTP	•	•	•
	7. Workshop / wash down facilities	•		

9.1 Works Approval controls

9.1.1 Stormwater infrastructure and equipment

The following infrastructure shall be constructed as proposed by the Applicant, as controls for stormwater management:

- Installation of sediment control structures at locations where high sediment loads are anticipated;
- Armouring landforms with competent rock; and

- Stormwater diverted around and away from the processing plant, landfill/s and workshop infrastructure areas by diversion drains.

9.1.2 Processing reagents infrastructure and equipment

The following infrastructure (Table 30) should be constructed to manage the risk of spills from the processing reagents:

Table 30: Infrastructure requirements for processing reagents

Infrastructure	Requirements (Design and Construction)
Ore processing activities	All slurry containing facilities will be constructed within bunded concrete areas.
200 tonne quicklime bulk storage	Dust collector, including maintenance access, installed on top of the lime silo. Rotary valve to control the discharge rate of the lime to the mill feed conveyor.
Processing reagents including: • 100 m^3 cyanide dissolution tank and 100 m^3 cyanide storage tank; • 60 m^3 sodium hydroxide storage tank; and • 30 m^3 hydrochloric acid storage tank	Contained within a concrete bund that will incorporate a collection sump to recover spillage. Sump pump will discharge into the leach feed trash screen underflow distribution box. Stored in accordance with *AS 1940* and *AS 1692.* Level indicators to detect leaks, based on drops in level.
500 kilogram activated carbon bulk boxes	Stored in containers or under tarpaulins.

9.1.3 Process water pond infrastructure and equipment

The following infrastructure shall be constructed as proposed by the Applicant, as controls for the process water pond:

- Lined with an impermeable HDPE membrane;
- Capacity of 10,000 m^3; and
- Freeboard markers installed.

DWER has also imposed conditions within the Issued Works Approval for the construction of monitoring bores within the vicinity of the process water pond. Monitoring of these bores will also be required prior to commissioning with a comparison against the *ANZECC, 2000 95% Freshwater* values.

9.1.4 TSF infrastructure and equipment

The following infrastructure and equipment (Table 31) should be constructed to manage the TSF:

Table 31: Infrastructure requirements for the management of the TSF

Infrastructure	Requirements (Design and Construction)
TSF general	Single cell circular TSF/IWL. Designed to store 21 million tonnes of tailings over 6 years. Starter – Embankment level of 590.5 mRL. Stage 1 – Embankment level of 595.5 mRL. Stage 2 - Embankment level of 600.5 mRL. Stage 3 - Embankment level of 602.5 mRL. Designed such that a 1% AEP, 72-hour duration storm event can be temporarily stored on top of the TSF.
TSF starter embankment	Zoned embankment comprising an upstream zone of low permeability roller compacted silty sand and a downstream zone of traffic compacted laterite gravel material. Maximum embankment height of 6.5 m. Incorporate a cut-off trench excavated to cemented laterite gravels in order to reduce seepage losses. Design slopes of 1(V):2(H) upstream and 1(V):2(H) downstream. Crest width of 8 m. Upstream zone: TSF will be prepared by moisture conditioning and compacting the TSF basin subgrade comprising sandy silt/silty sand to produce a low permeability foundation of 10^{-8} m/s.
Perimeter embankments	Design slopes of 1(V):2(H) upstream and 1(V):3(H) downstream. Compacted upstream embankment will have a crest width of 6 m and will have a 2% cross-fall towards the upstream side and 0.5 m (minimum) high waste windrow at the downstream crest.
Tailings deposition	Multiple spigots located on the upstream perimeter embankment crest.
Decant system and pond	Rock-ring type central decant structure. Decant structure and decant causeway will be raised along with the perimeter embankments. Decant pump located within the rock ring decant. Decant causeway – design slopes of 1:1.5 (V:H) and a nominal 8 m crest width, with 0.5 m (minimum) windrows on both sides of the access way.
Pipelines (tailings delivery and decant return water)	HDPE pipelines installed within an unlined V trench with sufficient capacity to ensure all solids and liquors are captured within the trench. Flow sensors fitted to tailings delivery and decant return water pipelines to allow detection of loss of content.

Infrastructure	Requirements (Design and Construction)
Ambient groundwater monitoring system	9 indicative groundwater monitoring bores will be installed (refer to Figure 5). Monitoring bores will have a depth of approximately 30 m to 60 m, installed through the alluvial zone and in to the bedrock. Both shallow and deep bores will be installed based on lithology types and groundwater depth characteristics. Each bore will be cased with pvc pipe with a 80-100 mm diameter to allow for sample abstraction, slotted from 12 m to 60 m and gravel packed. Monitoring of all bores prior to commissioning to provide baseline data for the project, with a comparison against *ANZECC, 2000 95% Freshwater* values.
Other	Proposed and effective processes to reduce contaminants in tailings supernatant with a comparison against the following levels: • pH 8 to 10; • Arsenic V <1 mg/L; and • WAD Cyanide <50 mg/L.

9.1.5 Landfill infrastructure and equipment

The following infrastructure and equipment (Table 32) should be constructed to manage the Landfill:

Table 32: Infrastructure requirements for the management of the Landfill

Infrastructure	Requirements (Design and Construction)
Inert and Putrescible landfill	Trenches excavated within the north waste rock dump footprint. Landfill located over 100 m away from surface water features. Landfill located greater than 3 m above the groundwater table. Fencing installed to prevent access by livestock and capture windblown waste. Signage erected listing the type of waste facility and materials to be disposed.

9.1.6 WWTP and irrigation field infrastructure and equipment

The following infrastructure and equipment (Table 33) should be constructed to manage the WWTP and irrigation field:

Table 33: Infrastructure requirements for the management of the WWTP and irrigation field

Infrastructure	Requirements (Design and Construction)
WWTP	ASBP WWTP installed adjacent to the accommodation village. ASBP WWTP located on a compacted bunded pad. WWTP rated for 300 persons at 300 L per person per day. One containerised unit with a combined anoxic/aerobic treatment process. Alarms on the aerobic treatment tank air blower and discharge pump. Fitted with high level alarms as well as malfunction alarms. Pipeline to irrigation field constructed of HDPE.
Irrigation field	3 ha. Fenced. Located greater than 500 m from sensitive water resources.

9.1.7 Workshop/wash down facility infrastructure and equipment

The following infrastructure shall be constructed as proposed by the Applicant, as controls for the workshop/wash down facility:

- Located on concrete pads constructed so that they drain to a clean water recovery system; and
- Oil-water separator system - treated hydrocarbon concentration <20 mg/L.

9.1.8 Works Approval reporting

The Applicant has stated that construction is scheduled to commence in Quarter 3 2018. Stages of construction are detailed in Table 34. Works will be completed progressively, with compliance reporting required for the WWTP, Landfills, process plant and TSF. A suitably qualified person will be required to confirm that each item of infrastructure specified in the works approval has been constructed to the specified requirements.

Commissioning of the WWTP is authorised under the Issued Works Approval for a period of no longer than six months following submission of the compliance report.

Commissioning of the process plant and TSF is authorised under the Issued Works Approval for a period no longer than six months following submission of the compliance report.

The Applicant will require an Issued Licence, prior to the operation of the WWTP, Landfills, process plant and TSF.

Table 34: Proposed construction schedule

Stage	Component	Estimated Construction Completion Date
Stage 1	WWTP	Q3 2018
Stage 2	Landfill	Q3 2018

Stage 3	Processing Plant	Q2 2019
Stage 4	TSF – Starter (590.5 mRL)	Q2 2019
Stage 5	TSF – Stage 1 (595.5 mRL)	Q1 2020
Stage 6	TSF – Stage 2 (600.5 mRL)	Q4 2021
Stage 7	TSF – Stage 3 (602.5 mRL)	Q1 2024

9.2 Licence controls

The following controls will be imposed as conditions on the Issued Licence to manage the risk of emissions during operation at the Premises. It should be noted that these controls are not final and will be subject to compliance with conditions of the Issued Works Approval and may change if additional information becomes available to further inform the risk assessment (as per *Guidance Statement: Risk Assessments*).

9.2.1 Operational requirements for the process water pond

Site Infrastructure	Management controls
Process water pond	Daily visual inspections Freeboard of 500 mm maintained

9.2.2 Operational requirements for the TSF

Site Infrastructure	Management controls
TSF general	Minimum of 500 mm total freeboard comprising minimum operational freeboard (vertical height between the tailings beach and embankment crest) of 300 mm and a minimum beach freeboard of 200 mm plus allowance of the 1% AEP 72 hour event of 222 mm. Operated according to the *TSF Design Report*. Operated according to the TSF Operations Manual (to be compiled). The tailings discharge points, return water pump, beach, decant pond level and tailings level will be visually inspected twice every 24 hours to validate operation is in accordance with design and operational expectations and check for any evidence of embankment instability. TSF walls will be regularly monitored during the operation of the TSF.
TSF deposition	Discharged sub-aerially and cyclically into the TSF in thin discrete layers, not exceeding 300 mm thickness to allow optimum density and strength gain by subjecting each layer to a drying cycle. Deposition will take place via multiple spigots. Spigotting will be carried out such that the supernatant pond is maintained within and around the rock ring decant. Daily inspections.
TSF pipelines	Telemetry. The tailings delivery and water return pipes and containment corridor will

Site Infrastructure	Management controls
	be visually inspected twice every 24 hours for any visible leakage or damage.
Decant system and pond	Decant pond is maintained away from the perimeter embankment at all times. Decant water will be removed from the TSF by a submersible decant pump and pumped directly to the process water pond.
Seepage recovery system	Cased bores. Slotted within the zone of predicted seepage. Bores fitted with low flow (1-2 L/s) pumps). Recovered groundwater will be pumped back into the TSF and onto the tailings beach where it will report to the decant system.

9.2.3 Operational requirements for the Landfill

Site Infrastructure	Management controls
Inert and Putrescible Landfill	Tipping area not greater than 30 m in width and 3 m in depth. Landfill will be covered on a fortnightly basis with inert material. Regular inspections. Windblown waste will be collected and put back in the landfill.
Tyre Landfill	Used tyres will be disposed of within the north and south waste rock dump footprint. Tyres to be disposed in batches not exceeding 1,000 used tyres. Tyres covered at regular intervals such that no more than 1,000 used tyres are left exposed at any one time. Each batch will be separated by at least 100 mm of soil or another dense inert and incombustible material, with a final cover not less than 500 mm.

9.2.4 Operational requirements for the WWTP

Site Infrastructure	Management controls
WWTP	Design capacity of 100 m^3/day. The wastewater will be treated before being discharged to a dedicated irrigation field. The WWTP will meet the following emission standards: Biochemical Oxygen Demand <20 mg/L Total Suspended Solids <30 mg/L Total Nitrogen <40 mg/L Total Phosphorus ≈ 4 – 12 mg/L

Site Infrastructure	Management controls	
	Turbidity	<5 NTU
	pH	6.5-8.5 pH units
	E.coli	<1,000 cfu/100mL
Irrigation field	Minimum water table depth – 2 m below natural ground level. Effluent discharge managed to ensure there is no surface ponding or runoff from the irrigation field.	

9.2.5 Monitoring requirements for the process water pond

Site Infrastructure	Management controls
Process water pond	Monthly ambient groundwater quality monitoring for Standing Water Level. Six monthly ambient groundwater quality monitoring for the following parameters: sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, aluminium, arsenic, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, thallium, uranium and zinc.

9.2.6 Monitoring requirements for the TSF

Site Infrastructure	Management controls
TSF	Monthly ambient groundwater quality monitoring for Standing Water Level. Quarterly ambient groundwater quality monitoring for the following parameters: sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, antimony, arsenic, cadmium, chromium, cobalt, copper, iron, manganese, mercury, molybdenum, nickel, selenium, thallium, uranium, zinc, WAD cyanide and total cyanide. Annual water balance.
Decant (supernatant) pond of the TSF	Monthly analysis for arsenic, WAD Cyanide, pH, chromium and TDS including limits for WAD Cyanide, pH and arsenic.

9.2.7 Monitoring requirements for the Landfills

Waste acceptance criteria (including waste type, quantity limit and specifications), cover requirements and the monitoring of inputs will be applied to the Issued Licence for the Landfills.

9.2.8 Monitoring requirements for the WWTP

Waste acceptance criteria (including waste type, quantity limit and specifications); monitoring of inputs and outputs (volume – continuous and monthly cumulative); and the quarterly monitoring of the treated wastewater shall be applied to the Issued Licence for the WWTP.

9.2.9 Licence reporting

An Annual Audit Compliance Report will be required to be submitted as a condition of the Issued Licence.

10. Determination of Works Approval conditions

The conditions in the Issued Works Approval in Attachment 1 have been determined in accordance with the *Guidance Statement: Setting Conditions*.

Table 35 provides a summary of the conditions to be applied to this Issued Works Approval.

Table 35: Summary of conditions to be applied

Condition Ref	Grounds
Infrastructure and equipment Conditions 1, 2, 3, 4, 5, 6 and 7	These conditions are valid, risk-based and contain appropriate controls.
Emissions Condition 8	This condition is valid, risk-based and consistent with the EP Act.
Specified Actions Ambient Groundwater: Conditions 9,10, 11, 12 and 13 Contaminants in Tailings: Condition 14	These conditions are valid, risk-based and contain appropriate controls.
Record-keeping Conditions 15 and 16	These conditions are valid and are necessary administration and reporting requirements to ensure compliance.

DWER notes that it may review the appropriateness and adequacy of controls at any time and that, following a review, DWER may initiate amendments to the works approvals under the EP Act.

11. Applicant's comments

The Applicant was provided with the draft Decision Report and draft Works Approval on 2 August 2018 and 16 August 2018. The Applicant provided comments on 8 August 2018 (Capricorn, 2018c) and 16 August 2018 (Capricorn, 2018d) which are summarised, along with DWER's response, in Appendix 2.

12. 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 Issued 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.	Applicant notification – CEO291/18 – Request for Further Information, received from James Hesford (Capricorn Metals Ltd), 10 April 2018	Capricorn, 2018b	DWER records (A1650825)
2.	Assessment and management of contaminated sites, Contaminated sites guidelines, Department of Environment Regulation, December 2014	Assessment and management of contaminated sites	accessed at http://www.der.wa.gov.au
3.	Australian Standard AS 1692-2006 Steel tanks for flammable and combustible liquids	AS 1692	accessed at www.saiglobal.com
4.	Australian Standard AS 1940-2004 The storage and handling of flammable and combustible liquids	AS 1940	
5.	Code of Practice for Tailings storage facilities in Western Australia, Department of Mines and Petroleum, 2013	Code of Practice for Tailings Storage Facilities in Western Australia	accessed at http://www.dmp.wa.gov.au
6.	Cyanide Management, Leading Practice Sustainable Development Program for the Mining Industry, Department of Resources Energy and Tourism, May 2008	Cyanide Management	accessed at https://industry.gov.au
7.	DER2018/000442, Shire of Meekatharra, 9 May 2018.	Meekashire, 2018	DWER records (A1670713)
8.	Department of Mines and Petroleum Code of Practice, Tailings storage facilities in Western Australia, 2013	TSF Code of Practice	accessed at www.dmirs.wa.gov.au
9.	*Guidance Statement: Regulatory principles,* Department of Environment Regulation, July 2015	Guidance Statement: Regulatory principles	accessed at www.dwer.wa.gov.au
10.	*Guidance Statement: Setting Conditions,* Department of Environment Regulation, October 2015	Guidance Statement: Setting conditions	

	Document title	In text ref	Availability
11.	*Guidance Statement: Licence duration,* Department of Environment Regulation, August 2016	Guidance Statement: Licence duration	
12.	*Guidance Statement: Risk Assessments*, Department of Environment Regulation, February 2017	Guidance Statement: Risk Assessments	
13.	*Guidance Statement: Decision Making*, Department of Environment Regulation, February 2017	Guidance Statement: Decision Making	
14.	*Guidance Statement: Environmental Siting*, Department of Environment Regulation, November 2016	Guidance Statement: Environmental Siting	
15.	Guide to the preparation of a design report for tailings storage facilities (TSFs), Department of Mines and Petroleum, August 2015	Guide to the preparation of a design report for TSFs	accessed at http://www.dmp.wa.gov.au
16.	Guidelines on Tailings Dams, Planning, Design, Construction, Operation and Closure, Australian National Committee on Large Dams, May 2012	ANCOLD, 2012	accessed at www.ancold.org.au
17.	Karlawinda Gold Project Hydrogeological Feasibility Study (J160007R03V2), prepared by Groundwater Resource Management for Capricorn Metals Ltd, July 2017	GRM, 2017	DWER records (A1650573)
18.	Karlawinda Gold Project Works Approval Application, M52/1070 Supporting Document (CAP-KARL-2018-001 Rev 1), Capricorn Metals Ltd, 13 March 2018	Application, 2018	DWER records (A1633762)
19.	Karlawinda Project: Geochemical Assessment of Oxide- Ore-Tailings-Slurry and Primary-Ore-Tailings-Slurry Samples Derived from the Bibra Deposit – Implications for Process-Tailings Management, Graeme Campbell & Associates Pty Ltd for Capricorn Metals Ltd, 8 March 2018	GCA 2018	DWER records (A1633762)
20.	Karlawinda Tailings Used for TSF Studies Rev 2, Minelogix, 8 March 2018	Minelogix 2018	
21.	Landfill Waste Classification and Waste Definitions 1996 (as amended 2018), Department of Water and Environmental Regulation, April 2018	Landfill Waste Classification and Waste Definitions	accessed at http://www.der.wa.gov.au

	Document title	In text ref	Availability
22.	National Environment Protection (Assessment of Site Contamination) Measure 1999	ASC NEPM	accessed at http://www.nepc.gov.au
23.	National Water Quality Management Strategy, Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Paper No. 4, Volume 1) Trigger values for freshwater (95% species level of protection), Australian and New Zealand and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, October 2000	ANZECC, 2000 95% Freshwater	accessed at www.environment.gov.au
24.	National Water Quality Management Strategy, Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Paper No. 4, Volume 3) Primary Industries – Rationale and Background Information, Australian and New Zealand and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, October 2000	ANZECC, 2000 Livestock	accessed at http://www.agriculture.gov.au
25.	National Water Quality Management Strategy, Australian Guidelines for Sewerage Systems Effluent Management, Agriculture and Resource Management Council of Australia and New Zealand and Australian and New Zealand Environment and Conservation Council, 1997	NWQMS, 1997	accessed at www.environment.gov.au
26.	Part C – A Code for the Management of Wild Rivers, Conservation Guidelines for the Management of Wild River Values, Department of the Environment and Energy, 1998	Conservation Guidelines for the Management of Wild River Values	accessed at http://www.environment.gov.au/node/20154
27.	RE: Applicant Notification – W6143/2018/1 – Application for a Works Approval – Draft Instrument and Decision Report, received from James Hesford (Capricorn Metals Ltd), 16 August 2018	Capricorn, 2018d	DWER records (A1712105)
28.	RE: Karlawinda draft WA documents for comment, received from James Hesford (Capricorn Metals Ltd), 8 August 2018	Capricorn, 2018c	DWER records (A1710209)
29.	Re: Karlawinda Gold Project Works Approval – Request for Further Information, received from James Hesford (Capricorn Metals Ltd), 6 April 2018	Capricorn, 2018a	DWER records (A1649755)
30.	Tailings Storage Facility Karlawinda Gold	TSF Design	DWER records (A1633762)

	Document title	In text ref	Availability
	Project, near Newman, WA – Design Report (PER2017-0251AB Rev 1), prepared by GMW Geosciences Pty Ltd for Capricorn Metals Ltd, 1 March 2018	Report	
31.	Threatened and Priority Fauna List, Department of Biodiversity, Conservation and Attractions	Threatened and Priority Fauna List	accessed at http://www.dpaw.wa.gov.au
32.	Threatened Fauna – Specially Protected Fauna Notice, Department of Biodiversity, Conservation and Attractions	Wildlife Conservation (Specially Protected Fauna) Notice 2017	
33.	Works approval applications W6143/2018/1, Department of Mines, Industry Regulation and Safety, 28 May 2018	DMIRS, 2018	DWER records (A1681954)

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

Condition	Summary of Applicant's comments	DWER response
Works Approval		
Condition 5	The Applicant has requested that the commissioning period for the WWTP be for 6 months as the occupancy level increases over the first 6 months and the WWTP will not be fully operational until then.	DWER has changed the commissioning period for the WWTP to "for a period of no longer than 6 months".
Condition 9	The Applicant has requested that this condition be updated so that it is stated "*30 days after the construction of the relevant infrastructure and before discharge of waste – TSF, plant, PWP. There is no risk to environment, and we want to construct bores once only and in the correct position*". The Applicant has also stated for condition 9(a) that "*Indicative gives us flexibility, we will construct the relevant amount of bores, in relevant locations under instruction from GRM and Chris Lane, and achieve the required outcomes*".	DWER has changed the wording to include the words in bold and remove the strikethrough words: The Works Approval Holder shall, within 30 days of the ~~issue of this Works Approval~~ **completion of the Works specified in Rows 4 and 5 of Table 4 in Schedule 3 and prior to commissioning and deposition**:
Condition 10	The Applicant has stated "*See additional data water quality data. Reword. The bores will be installed after development of prescribed premises activities – this monitoring will get done at the time of the bore installation*".	DWER has changed the wording to include the words in bold and remove the strikethrough words: The Works Approval Holder shall, within **60** ~~120~~ days **of the completion of Condition 9** ~~issue of this Works Approval~~ and prior to commissioning, submit a report to the CEO providing all baseline water quality, sampled in accordance with the most recent version of relevant Australian Standards and analysed by a NATA certified laboratory, for the monitoring bores listed in Condition 9. The report shall provide the following, but not be limited to:

Condition	Summary of Applicant's comments	DWER response
Works Approval: Condition 13 Decision Report: Section 9.1.4 - TSF infrastructure and equipment - other	The Applicant has stated: "*These criteria in supernatant water are a new precedent and very difficult to achieve by any gold processing plant technology, and are thus unachievable for the Karlawinda Gold Project. It suggests that what is in supernatant is what will enter the environment, this is incorrect. The Dalgaranga Works Approval conditions are more applicable to this project, and we seek these criteria to be revised in line with those. Note that the risk assessment completed by DWER defined a medium risk of release of contaminants to the environment – not high or extreme risk.* *There are no freshwater or specified aquatic ecosystems in the vicinity of the Project, so this standard is not relevant to Karlawinda. If we were next to a permanent river or wetland, then yes it would be relevant however it then becomes a question of the level of residual risk after engineering, monitoring and management controls are in place. The highest beneficial use of the groundwater is for livestock, and therefore livestock criteria are relevant.* *When we met with DWER on 16 April, Steve Appleyard stated a 1 mg/L criteria in supernatant would be set for As. Ferric Sulphate will be added to achieve 1mg/L this is a more achievable level.* *See correspondence from Capmet 10 April 2018 which discusses the risk of Cr III converting to Cr VI. In our opinion Cr VI in ore/tails has been dealt with in consultation with DWER on 16 April and again 15 May 2018. No possible means exists to reduce Chromium to these near solubility limits in any case.* *Very difficult to achieve using standard detoxification technologies, few technology suppliers would guarantee < 1-2mg/L let alone <0.5mg/L, typical supernatant water will have a range of 10-30 mg/L - biological affects >50 mg/L. See International Best Practice Standards – Gold Industry & World Bank (International Cyanide Code www.cyanidecode.org). Also*	DWER has changed the wording to include the words in bold and remove the strikethrough words: The Works Approval Holder shall, within 60 days of the issue of this Works Approval and prior to the deposition of tailings, submit a report to the CEO detailing proposed and effective processes to reduce concentrations of contaminants in tailings supernatant, **with a comparison against** ~~to meet~~ the following levels: (a) pH ~~6~~ **8** to ~~9~~ **10** ~~(ANZECC, 2000 trigger value for protection of 95% of species in freshwater ecosystems)~~; (b) Arsenic V ~~0.013 and Arsenic III 0.024~~ **<1 mg/L** ~~(ANZECC, 2000 trigger value for protection of 95% of species in freshwater ecosystems)~~; (c) ~~Chromium VI 0.001 (ANZECC, 2000 trigger value for protection of 95% of species in freshwater ecosystems);~~ and (d) WAD Cyanide <~~0.5~~ **50** mg/L.

Condition	Summary of Applicant's comments	DWER response
	see Dalgaranga WA".	
Decision Report		
Page 11 – Category 85 – Sewage facility	The Applicant has stated that the camp they have purchased is a 300 man camp, which is an increase from 230. They will install an ASBR 100 m^3/day WWTP. Exactly the same unit and same effluent specifications, just larger tanks.	DWER notes this. The design capacity of the WWTP has been increased from 75 m^3/day to 100 m^3/day and the irrigation field has increased in size from 2.5 ha to 3 ha.
Section 8.4.4 Applicant controls	The Applicant has requested that the wording below be updated to include the word in bold stating that "*This only applies to the TSF and the Waste Rock Landforms*". Armouring **landforms** with competent rock; and	DWER has changed the wording to that proposed by the Applicant.
Section 8.4.5 Consequence	The Applicant considers the consequence of stormwater runoff at the Premises to be minor. Stating that "*If there is ever enough rainfall and surface flow to mobilise sediment, the flood waters are so heavily laden with sediment from upstream there will be negligible effect from any sediment from site*".	Advice from Regulatory Services (Water) is that "*Ephemeral drainage lines exist across the subject which drain to the south towards Savory Creek. The activity poses risks to the catchment through potential runoff of contaminants, increased sedimentation and loss of riparian vegetation*". Also noting that the Premises is located within the Priority 1 Savory Creek Wild River Area (an area of very high environmental value), so in accordance with Table 18 the consequence is major.
Section 8.6.4 Criteria for assessment	The Applicant has stated that "*Livestock should be the criteria set as the highest beneficial use of groundwater, what is the receptor and the impact to that receptor that suggests 95% freshwater ecosystem should be used?"*	DWER has changed the wording to include the word in bold: "As shown in Tables 12 and 14 (section 7.6) pH and arsenic values for both ores are above the corresponding *ANZECC, 2000 95% Freshwater and* **applicable** *Livestock* values".
Section 8.6.6	The Applicant has agreed with the recommendation to construct shallow bores (to detect seepage within the surface sediment)	N/A.

Condition	Summary of Applicant's comments	DWER response
Key findings	and deep bores (to monitor any changes in the chemical composition of the groundwater) within the vicinity of the process water pond. Bore construction and sampling requirements will need to be undertaken prior to commissioning and deposition into the process water pond. The Applicant has stated that their hydro consultants will guide the best locations and depths to ensure seepage should it occur in any horizon is identified.	
Section 8.6.8 Likelihood of Risk Event	The Applicant considers the likelihood of a spill from the process water pond impacting the surface water quality of Savory Creek to be rare. The Applicant has stated that the toe of the process water pond "*is over 1 km from the Western creek line. The possibility of this happening is rare. The likelihood of a large leak of process water or even supernatant entering the environment before the malfunction is identified and controlled is rare. The likelihood of surface water contamination happening is also rare. Any spillage, in the rare event it occurs would be contained and cleaned up immediately and needs to travel 1 km through scrub*".	DWER has changed the wording to include the words in bold and remove the strikethrough words: **Due to the process water pond being located over a 1 km from the Western Creek line,** the likelihood of a spill impacting on the surface water quality of the Savory Creek Wild River area is **rare** ~~unlikely~~.
Section 8.7.2 Arsenic	The Applicant has requested that reference to the *ANZECC, 2000 95% Freshwater* value be removed and have stated that the *ANZECC, 2000 Livestock* drinking water value for arsenic is 0.5 to 5 mg/L.	DWER has changed the wording to include the words in bold and remove the strikethrough words: It should be noted that the *ANZECC, 2000 Livestock* drinking water value for arsenic is **0.5 - 5** ~~0.1~~ mg/L~~, while the *ANZECC, 2000 95% Freshwater* value is 0.013 mg/L (As V) and 0.024 mg/L (As III)~~.

Condition	Summary of Applicant's comments	DWER response
Section 8.7.2 Chromium	The Applicant has requested that reference to the *ANZECC, 2000 95% Freshwater* value be removed and have stated "*See Capmet correspondence 10 April and results of discussions with DWER on 16 April 2018. There is extremely low risk of Cr VI being generated as there are no oxidizing agents*".	DWER has changed the wording to include the words in bold and remove the strikethrough words: ~~Elevated concentrations of chromium in the leachate from the oxide-ore tailings of 0.06 mg/L (Table 14) and with the high pH values may result in chromium being present in its most toxic hexavalent form.~~ **The Applicant has stated "*In the Bibra deposit the greatest abundance of chromium occurs in the hangingwall ultramafic. This ultramafic is barren of any economic gold mineralization and will not be processed. The chromium, which is in the ore has been remobilized from the ultramafics into the laterite and parts of the upper saprolite. This ore category accounts for only 3% of the material which will be processed by the mill and pumped to the tails dam*". Since there is a lack of manganese in the laterite/oxide zone, and manganese acts as a catalyst in the conversion of Cr III to Cr VI, there is a very low likelihood of Cr III converting to Cr VI at Bibra due to this lack of manganese (Capricorn, 2018b).** ~~The *ANZECC, 2000 Livestock* drinking water value for Cr VI is 0.1 mg/L, while the *ANZECC, 2000 95% Freshwater* value is 0.001 mg/L~~.
Section 8.7.2 WAD Cyanide	The Applicant has stated that *"<50 mg/L is an acceptable level in decant solution*".	DWER have noted this, but no change is required to the Decision Report.
Section 8.7.2 pH	The Applicant has requested that "8 to" be included to the statement about pH.	DWER has changed the wording to include the words in bold: The tailings are alkaline with a pH value of **8 to** 10. The *ANZECC, 2000 95% Freshwater* value is 6 to 9 pH units.

Condition	Summary of Applicant's comments	DWER response
Section 8.7.3 Description of potential adverse impact from the emission	Under this section it refers to embankment overtopping. The Applicant has stated "*the likelihood of this happening is 'rare', the decant system is cycled back to the process water pond, and with evaporation rates the only potential for overtopping is from a PMP event causing a breach which would then ultimately result in significant dilution*".	DWER notes that Applicant's comments. While the Applicant may consider the likelihood of embankment overtopping to be rare, it is still a risk event that DWER needs to consider.
Section 8.7.5 Applicant controls - Seepage recovery system	DWER requested a map be provided depicting the number and location of the seepage recovery bores. The Applicant stated that "*These will only be installed if adverse seepage is detected in the monitoring bores, and the analyte criteria exceeded. So the location depends on where the adverse seepage is occurring, no commitment can be made at this time*". DWER questioned whether the seepage recovery system would incorporate shallow and deep bores and if so at what depth. The Applicant stated "*This is dependent on the lithological type, depth of adverse seepage so no commitment can be made at this time*".	DWER notes the Applicant's response. DWER has removed the construction controls for the seepage recovery system. These will be set as operational controls. The Delegated Officer has set the following condition within the Works Approval: Condition 13: The Works Approval Holder shall, within 60 days of the issue of this Works Approval, submit to the CEO a seepage recovery plan to manage seepage from the TSF; detailing the criteria / methods for detection of seepage and triggers to be applied for implementation of the plan.
Section 8.7.5 Applicant controls – Ambient groundwater monitoring system	DWER asked whether the bores are all at the same depth. The Applicant responded that "*Both shallow and deep bores will be installed based on lithology types and groundwater depth characteristics. This will assist in determining the depth of adverse seepage should it occur*". The Applicant also included the detail below: The tailings discharge points, return water pump, beach, decant pond level and tailings level will be visually inspected twice every 24 hours to validate operation is in accordance with design and operational expectations and check for any evidence of embankment instability.	DWER has included the following under construction - "Both shallow and deep bores will be installed based on lithology types and groundwater depth characteristics". The additional detail provided by the Applicant in relation to inspections has been included under operation in the following sections: TSF general; and Pipelines (tailings delivery and decant return water).

Condition	Summary of Applicant's comments	DWER response
	The tailings delivery and water return pipes and containment corridor will be visually inspected twice every 24 hours for any visible leakage or damage. TSF walls will be regularly monitored during the operation of the TSF.	
Section 8.7.6 Key findings	The Applicant has stated that the *ANZECC, 2000 Livestock* trigger value is 0.5 – 5 mg/L.	DWER has removed the words in strikethrough below, as the follow-up investigations by *Minelogix 2018* indicated that the slurry-water of the primary-ore taiings stream would be within the range of 1-2 mg/L for arsenic, which is within the *ANZECC, 2000 Livestock* trigger values: ~~2. Arsenic concentration in both (oxide and fresh) tailing samples were above the ANZECC, 2000 Livestock trigger values.~~
Section 8.7.7 Consequence	The Applicant has stated the following: • "*There are no freshwater aquatic ecosystems identified for the Project, why are these criteria relevant? Note Dalgaranga has ANZECC 2000 Livestock Drinking water defined in its Works Approval risk assessments and the groundwater they have is similar to ours 900-2600 TDS. We have no stygo/troglo/GDV/permanent pools associated with the Project nor in the vicinity. Savory Creek is over 6 km to the south, any impact on that is rare".* • "*Pipelines bunded and contain spillage, so why is this a risk? Need to consider management actions, control/contain and clean-up".* • *"Dilution factors must be considered, only a PMP event is the risk, and with this much water any pollutants are heavily diluted".*	DWER has changed the wording to include the words in bold and remove the strikethrough words: **The vegetation impact of TSF pipeline ruptures and overtopping during operations could result in mid-level on-site impacts. Therefore, the consequence is moderate.** If seepage alters local groundwater quality, the *ANZECC, 2000 95% Freshwater* trigger values could be exceeded. Furthermore, the TSF is located within the Priority 1 Savory Creek Wild River Area. The impact of ~~TSF pipeline ruptures, overtopping and~~ seepage during operations could result in short term impacts to the Savory Creek drainage lines and the associated catchment; an area of very high environmental value. Therefore, the consequence is **major**. Baseline groundwater quality indicates that the only parameters currently above the *ANZECC, 2000 95%*

Condition	Summary of Applicant's comments	DWER response
		Freshwater values are CrVI and Zn (refer to section 7.5). The management actions listed by the Applicant (i.e. pipelines bunded to contain spillage); distance to Savory Creek and dilution factors are associated with the **likelihood** of the risk event.
Section 8.7.8 Likelihood of Risk Event	The Applicant considers the likelihood of an environmental impact from TSF pipeline ruptures and overtopping to be rare; and seepage during operations to be unlikely. The Applicant believes the likelihood of the risk event should be rare.	DWER has changed the wording to include the words in bold and remove the strikethrough words: Based on the Applicant's controls ~~(Table 24)~~ **and distance to Savory Creek** an environmental impact from TSF pipeline ruptures and overtopping during operation **will only occur in exceptional circumstances. Therefore, the likelihood of the consequence is rare.** **Based on the Applicant's ambient groundwater monitoring requirements and that the seepage recovery system will be regulated under the Issued Licence** ~~to be conditioned on the Issued Works Approval~~, an environmental impact from ~~TSF pipeline ruptures, overtopping and~~ seepage during operations will probably not occur in most circumstances. Therefore, the likelihood of the consequence is **unlikely**.
Section 8.7.9 Overall rating of TSF pipeline ruptures, overtopping and seepage during operations	The Applicant doesn't believe the criterial set reflects the medium level of risk.	In accordance with Table 17, a major consequence and rare likelihood = Medium risk, as does a major consequence and unlikely likelihood.

Attachment 1: Issued Works Approval W6143/2018/1