



Licence Number	L7798/1993/6
Licensee	Deflector Mining Limited
ACN	101 224 999
File Number:	2010/003052
Premises	Gullewa Gold-Copper Operations Mining Tenements M59/49, L59/49, L59/64, M59/68, M59/356, M59/391, M59/392, M59/335, M59/442 L59/35, M59/507, M59/336, M59/522 and L59/71 Morawa - Yalgoo Road
Date of Amendment	16 October 2018

Amendment

The Chief Executive Officer (CEO) of the Department of Water and Environmental Regulation (DWER) has amended the above Licence in accordance with section 59 of the *Environmental Protection Act 1986* (EP Act) as set out in this Amendment Notice. This Amendment Notice constitutes written notice of the amendment in accordance with section 59B(9) of the EP Act.

Alana Kidd

Manager, Resource Industries

Regulatory Services (Environment)

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

Definitions and interpretation

Definitions

In this Amendment Notice, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AER	Annual Environment Report
Amendment Notice	refers to this document
ANZECC	means the most recent version and relevant parts of the <i>Australian and New Zealand Environment guidelines for fresh and marine water quality Volume 1 – 3</i> (Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand);
Category/ Categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department Administering the <i>Environmental Protection Act 1986</i> Locked Bag 33 Cloisters Square PERTH WA 6850 info@dwer.wa.gov.au
Delegated Officer	an officer under section 20 of the EP Act
Department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986</i> (WA)
EP Regulations	<i>Environmental Protection Regulations 1987</i> (WA)
Existing Licence	The Licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of and during this Review
Licensee	Deflector Mining Limited

m ³	cubic metres
mbgl	Metres below ground level
Minister	the Minister responsible for the EP Act and associated regulations
mRL	Metres Reduced Level
Occupier	has the same meaning given to that term under the EP Act.
Operational Freeboard	is defined as the vertical height between the lowest elevation of the perimeter embankment and the tailings beach immediately inside the embankment.
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.
Risk Event	as described in <i>Guidance Statement: Risk Assessment</i>
SWL	Standing Water Level
TDS	Total Dissolved Solids
tpa	tonnes per annum

Amendment Notice

This amendment is made pursuant to section 59 of the *Environmental Protection Act 1986* (EP Act) to amend the Licence issued under the EP Act for a prescribed premises as set out below. This notice of amendment is given under section 59B(9) of the EP Act.

This notice is limited only to an amendment to allow an embankment lift at the Gullewa Tailings Storage Facility (TSF) and the use of the Monarch pit as an in-pit TSF.

The following guidance statements have informed the decisions made on this amendment:

- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessment (February 2017)*
- *Guidance Statement: Environmental Siting (November 2016)*

Amendment description

Deflector Mining Limited (Deflector) operates the Gullewa Gold-Copper Operations (Premises) through Licence L7798/1993/6 (Licence). The prescribed activities authorised through the Licence are described below:

Table 2: Prescribed activities at the Premises

Category Number	Category description	Category production or design capacity	Approved Premises production or design capacity
5	Processing or beneficiation of metallic or non-metallic ore	50,000 tonnes or more per year	700,000 tonnes per annual period
6	Mine dewatering: premises on which water is extracted and discharged into the environment to allow mining of ore	50,000 tonnes or more per year	750,000 tonnes per annual period
64	Class II landfill site	20 tonnes or more per year	4,000 tonnes per annual period
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	More than 20 but less than 100 cubic metres per day	35 cubic metres per day

Deflector submitted an application to DWER on 20 March 2018 for an amendment to their Licence to allow an increase in the embankment height at the TSF and to use the Monarch Pit as an in-pit tailings storage facility. Further detail is provided in the sections below.

Monarch in-pit tailings storage facility

The Monarch open pit will be used as an in-pit TSF for the deposition of tailings material to provide additional tailings storage capacity at Deflector.

The Monarch open pit is an open pit that was historically mined from 1994 and completed during 1995. The pit is located approximately 150 m south of the TSF (see Figure 2 below) with a majority of the pit located on mining tenement M59/507 with a small portion on mining tenement M59/49.

The Monarch pit is circular (165 m x 180 m) and is 54 m deep measured from the top of ramp to the base of the pit. The pit consists of a pit lake which is approximately 30 m deep.

Construction of the in-pit TSF is limited to the installation of slurry and return water lines from the existing lines between the processing plant and existing TSF as part of the slurry and return water systems.

The newly installed pipelines will be bunded with any spilled tailings reporting to either catchment sumps or into the in-pit TSF. The existing safety bund around the in-pit TSF will be retained to divert stormwater.

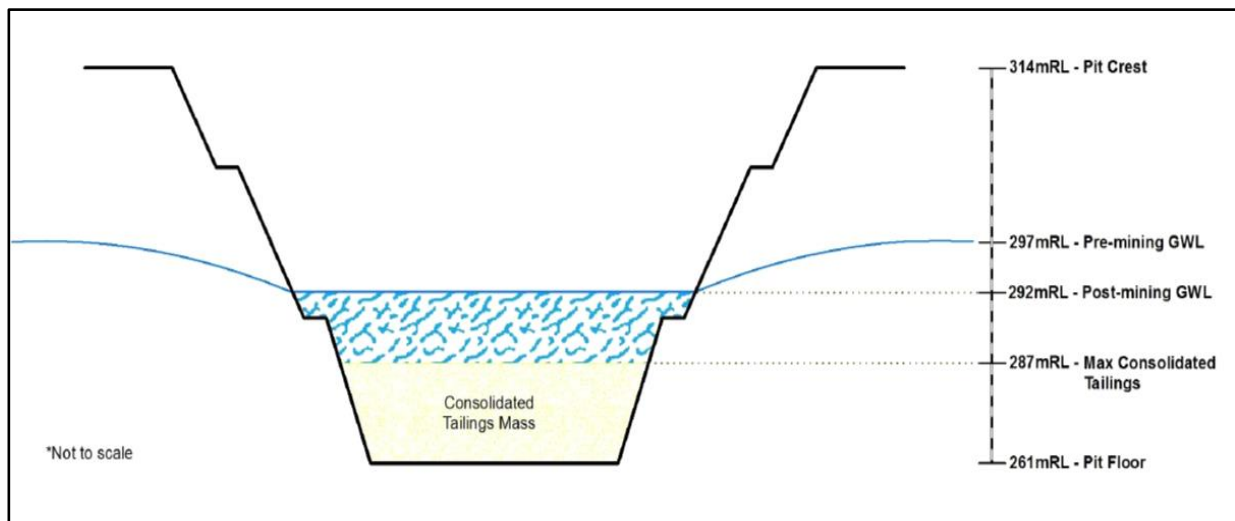
The tailings at the Premises have been assessed as potentially acid forming (PAF) and therefore Deflector has determined that the subaqueous deposition of tailings into the in-pit TSF is the most suitable method. Subaqueous deposition isolates the tailings mass from oxidation caused by atmospheric oxygen interaction which can result in Acid Mine Drainage.

Additionally, retaining a pit lake within the in-pit TSF through the subaqueous deposition of tailings continues to facilitate the functioning of the pit as a seepage interceptor for the adjacent TSF.

Tailings will be deposited through a single discharge point. The tailings will be deposited into the southern end of the pit and moved to ensure the even build-up of a consolidated tailings profile below the water. The pit lake will not be dewatered prior to tailings discharge and instead water will be removed from the pit during operations by the use of a floating pontoon and pump with return lines to the ramp. Collected water is pumped back to the process plant for reuse.

Tailings will be deposited into the in-pit TSF to ensure the final consolidated tailings bed will not exceed a maximum height of 287 mRL which is 5 m below the post mining groundwater level of 292 mRL (see Figure 1 below).

Figure 1: Monarch in-pit TSF



Deposition of tailings will occur on an intermittent basis to ensure that no impacts to groundwater or vegetation occur and the supernatant pond does not rise above 297 mRL. An underdrainage system has not been included in the in-pit TSF design.

TSF Embankment lift

The TSF is currently an above ground, side-hill type facility comprising southern, eastern and western perimeter embankments and a decant system (see Figure 2).

The most recently completed embankment raise at the TSF which was approved under Works Approval W5188/2012/1 was completed in 2017. The finished height of the embankment was 327.5 mRL. Downstream toe drains and sumps were installed on the southern embankment

and north-eastern embankment toes as part of the 2017 TSF embankment raise.

Deflector will now undertake an additional eight metre lift of the embankment at the TSF through four 2.0 metre raises with a final crest height of 335.5 mRL (Table 3).

Table 3: Estimated storage capacity

Crest mRL	Maximum Available Storage Volume (Mm3) including provision for minimum freeboard	Cumulative Total Storage Volume (Mm3)	Tonnage per raise at the design in situ dry density (1.35 t/m3)	Cumulative Tonnes per raise at the design in situ dry density (1.35 t/m3)	Storage Life (Years) at 0.454 Mtpa	Cumulative Storage Life (Years) a
327.5	0.49	0.49	0.66	0.66	1.45	1.45
329.5	0.47	0.96	0.64	1.30	1.41	2.86
331.5	0.50	1.46	0.67	1.97	1.48	4.34
333.5	0.50	1.96	0.67	2.64	1.47	5.81
335.5	0.50	2.46	0.67	3.31	1.47	7.28

Deflector will utilise an upstream construction method for raising the existing embankments which will also be extended to form a hillside storage. An additional saddle embankment will be constructed on the north-western corner of the facility. The final increased height of the embankment at the TSF will provide an additional storage capacity of approximately 7 years.

The embankments will be constructed using an upstream method utilising tailings from within the TSF. The downstream slope will be rock armored for protection against erosion from rainfall runoff. The crest of the embankment will have a minimum of two percent cross fall towards the TSF beach.

Existing spigots, which are located at 25 metre intervals along the perimeter embankment and are used for the deposition of tailings into the TSF, will be lifted at each embankment raise. Slurry will be discharged into the TSF sub-aerially and cyclically from the spigots such that the supernatant pond is located within and around the decant facility. The sub-aerial deposition allows for maximum removal of water from the facility by forming a large beach for draining and drying. It also enables the supernatant pond to be managed to a small size and increase tailings settled density, thereby improving the storage potential of the facility (CMW Geosciences, 2018a).

The TSF has been designed to safely and temporarily store a 1 in 100 year rainfall event for a duration of 72 hours by maintaining a minimum operational freeboard of 0.3 m at all times during operation.

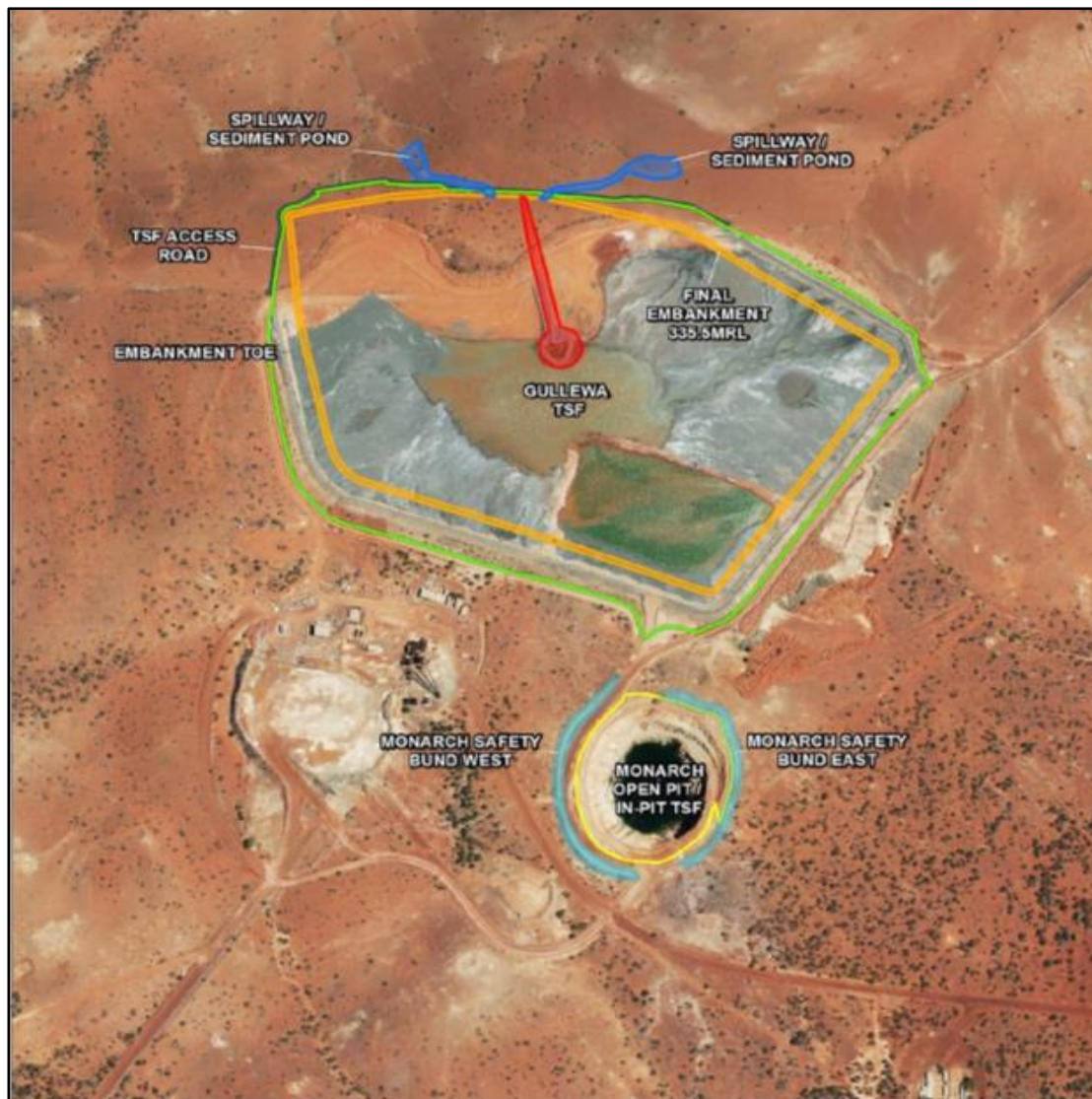
A pump is installed in a decant rock ring which is installed centrally in the TSF. Water collected is either pumped to evaporators located on the TSF embankment and/or to the process plant for re-use. An access track to the decant rock ring extends southeast from the northern ridge. The access causeway will be raised with each perimeter embankment lift.

A stormwater diversion drain will be constructed initially along the northern ridge (328 mRL) to intercept and divert rainfall runoff away from the TSF. As the embankment is raised with each lift, additional diversion drains will be constructed.

A total of 10 groundwater monitoring bores are installed around the TSF which are routinely sampled and analysed in accordance with the requirements of the Licence and Deflector's TSF

Management Plan. No additional groundwater monitoring bores are being established as part of the embankment raise program. A number of the groundwater monitoring bores have been designed to be used as recovery bores if required.

Figure 2: Gullewa Tailings Storage Facility



Amendment history

Table 4 provides the amendment history for L7798/1993/6.

Table 4: Licence amendments

Instrument	Issued	Amendment
L7798/1993/6	25/07/2008	Licence amendment to transfer the Licence from ATW (Australia) Pty Ltd to Mutiny Gold Ltd
L7798/1993/6	21/01/2016	Licence amendment to change the occupier name to Deflector Mining Ltd, include dewatering to the Golden Stream Pit and Salt River, and convert the Licence to template version 2.9
L7798/1993/6	Amendment	Increase the production of category 5 from 300,000 tonnes to 700,000 tonnes per annual period, addition of category 64 class II putrescible landfill,

	Notice 1 11/06/2018	addition of category 85 sewage facility and extension of the prescribed premises boundary.
L7798/1993/6	Amendment Notice 2 20/07/2018	Increase dewatering discharge to current amount being discharged at the Salt River discharge location while alternative methods of disposal are planned and implemented.
L7798/1993/6	Amendment Notice 3 16/10/2018	Amendment to allow an embankment lift at the Gullewa Tailings Storage Facility and the installation of an in-pit TSF at the Monarch Pit.

Other Approvals

Department of Mines, Industry Regulation and Safety (DMIRS)

Deflector has submitted to DMIRS a Mining Proposal (Reg ID73017) for an increase in the embankment height at the Gullewa TSF and use of the Monarch Pit as an in-pit TSF.

DMIRS has advised DWER on 2 October 2018 that conditional approval is likely to be granted for the TSF embankment lift and use of the Monarch pit as an in-pit TSF.

Location and receptors

Table 5 below lists the relevant sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to this amendment.

Table 5: Receptors and distance from activity boundary

Residential and sensitive premises	Distance from Prescribed Premises
<p>The Premises is isolated with the nearest town of Yalgoo located approximately 60 km away.</p> <p>The Barnong Station homestead which is located 10 km away is managed by the Department of Biodiversity, Conservation and Attractions (DBCA). The homestead is unoccupied and is in a state of disrepair. DBCA has advised DWER there are no plans to repair the homestead for the purpose of occupation.</p>	60 km from the Premises

Table 6 below lists the relevant environmental receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 6: Environmental receptors and distance from activity boundary

Environmental receptors	Distance from Prescribed Premises and description
Salt River	<p>Located approximately 10 km away in an east to south easterly direction from the TSF and monarch pit.</p> <p>One of a number of ephemeral creeks in the area that discharge into salt lakes. Flows are generally during heavy rainfall events with remnant pools remaining for several weeks or months.</p> <p>Water quality is highly saline (20,000 - 23,000 mg/L TDS) and alkaline (pH 8.3 - 8.4), with elevated concentrations of total nitrogen and some metals.</p> <p>The local surface water drains from the northwest to the southeast across the Premises towards the Salt River system.</p> <p>The area is typically associated with sheet flow that contributes to the nearby Salt River during periods of heavy rainfall. The river is the main drainage channel for the catchment. In the vicinity of the mine, the river flows in a southerly direction for approximately 15 km, before intercepting a chain of salt lakes including Burra Lake which is the local terminus. While the river is substantial in length, drainage</p>

	along the channel and surrounding floodplain can be highly diffuse (Stantec, 2017).
Groundwater	<p>Pre-mining groundwater depths at the Premises were between 10 to 25 metres below ground level (mbgl).</p> <p>Groundwater quality measured at the nearby Gullewa production borefield shows TDS concentrations of between 600 to 1,200 mg/L, pH ranging between 7.1 and 8.1, nitrate levels are naturally high (50 to 130 mg/L) which is common in semi-arid regions of Western Australia, and WAD CN concentrations are below detection limits.</p> <p>Groundwater flow is assumed to be in a southeasterly direction towards Salt River where static water levels are higher.</p> <p>Recent groundwater sampling of the monitoring bores at the TSF shows TDS levels of between 3,500 to 6,000 mg/L.</p> <p>WAD CN has been recorded in six groundwater monitoring bores at the TSF before tailings deposition commenced which indicates impacts from historical tailings deposition associated mining activities at the Premises.</p> <p>The nearby Monarch pit acts as a local evaporation sink and captures seepage emanating from the TSF.</p>
Fauna	<p>The occurrence of potentially conservation significant fauna is considered highly unlikely in the area, due to the lack of suitable habitat, a long history of land disturbance from grazing, timber cutting and mining, and disturbance created by mining, including light exposure at night and the noise associated with operations and equipment (Ninox Wildlife Consulting 2011).</p> <p>The surface drainages and salt lakes in the region are dry for much of the time however infrequent heavy rainfall events cause endemic brine shrimp to hatch in some of these lakes. Recent sampling conducted by the Licensee shows brine shrimp are absent from the Salt River, however are present in the Burra Lake.</p> <p>Brine Shrimp are a known food source for migratory birds.</p>
Flora	<p>No threatened or priority flora species have been identified from Department of Biodiversity, Conservation and Attractions (DBCA) database searches, or recorded during previous surveys of the area associated with the Deflector Mine.</p> <p>The dominant vegetation formations in the area of the Gullewa project are mulga and low acacia shrublands with local eucalypts, chenopods and halophytic communities in the saline drainages.</p>

Risk assessment

Tables 7 and 8 describe the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments*. The table identifies whether the emissions present a material risk to public health or the environment, requiring regulatory controls.

Table 7: Risk assessment for proposed amendments during construction

Risk Event					Consequence rating	Likelihood rating	Risk	Reasoning	
Source/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts					
Cat 5 TSF embankment lifts and Monarch In-pit tailings storage facility	Earthworks and construction of infrastructure	Dust	Sensitive premises (Town of Yalgoo)	Air/wind dispersion	Amenity	Slight	Rare	Low	Nearest sensitive premises is the town of Yalgoo which is 60 km away.
		Noise							No additional regulatory controls are required to mitigate this risk. The distance is considered too great to impact offsite receptors.
									Nearest sensitive premises is the town of Yalgoo which is 60 km away.
									No additional regulatory controls are required to mitigate this risk. The distance is considered too great to impact offsite receptors.

Table 8: Risk assessment for proposed amendments during operation

Risk Event					Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts				
Cat 5 In-pit tailings storage facility	Discharge of tailings into a disused mine pit (Monarch)	Waste: Seepage from tailings material	Groundwater Surrounding soils and vegetation	Direct interaction with groundwater and mounding Migration through soils	Contamination of groundwater potentially used for stock watering purposes. Impacts to vegetation	Moderate	Possible	Moderate 1. Refer to detailed risk assessment (risk event 1) below.
		Waste: Tailings and return water from rupture or leaks of pipelines.	Surrounding soils and vegetation Groundwater	Direct discharge to land and infiltration to groundwater	Impacts on vegetation Contamination of surrounding soils with metals and metalloids, dissolved solids and cyanide affecting soil and groundwater quality	Minor	Possible	Moderate The newly installed pipelines will be located within earthen containment corridors. Any spilled tailings or return water reports to either catchment sumps or back into the in-pit TSF. The vegetation in this area is highly disturbed due to historical mining activities and pastoral use. Depth to groundwater is between 10 to 25 mbgl. There are no groundwater dependent vegetation located in this area. Existing Licence condition 1.3.4 requires the Licensee to ensure all pipelines containing tailings materials are equipped with automatic cut-outs, provided with secondary containment, or provided with telemetry systems and pressure sensors. Existing Licence condition 3.3.1 requires the Licensee conducts daily inspections

									<p>of the tailings pipelines and return water pipelines and all inspections are noted in a log book kept in the plant control room.</p> <p>The Licensee management measures and licence controls are satisfactory and the likelihood of pipeline failure is possible, and the risk to the environment is therefore moderate. No additional regulatory controls are required to mitigate this risk.</p>
		<p>Waste: Discharge of tailings due to overtopping of the pit embankment</p>	<p>Surrounding soils and vegetation</p> <p>Groundwater</p>	<p>Migration through soils</p> <p>Sheet flow across land</p>	<p>Impacts on vegetation</p> <p>Contamination of surrounding soils with metals and metalloids, dissolved solids and cyanide affecting soil and groundwater quality</p>	Moderate	Rare	Moderate	<p>Deflector has updated the 'Deflector TSF Management Plan' to include the operation of the Monarch in-pit.</p> <p>Deflector has committed to two inspections to be undertaken during each shift.</p> <p>An existing abandonment bund surrounding the Monarch in-pit TSF prevents the ingress of stormwater.</p> <p>The separation distance from the top of the pit to the pit lake is 22 metres. Deflector plans to retain the current height of the pit lake during tailings deposition by pumping water back to the processing plant for reuse. This separation distance provides sufficient freeboard for the temporary storage of a 1 in 100 year rainfall event for a duration of 72 hours.</p> <p>Impacts to groundwater due to overtopping of the embankment at the Monarch in-pit TSF are not expected due the depth of the groundwater being greater than 10 metres.</p> <p>The Licensee management measures are satisfactory and the likelihood of</p>

									overtopping is determined to be rare, and the risk to the environment is therefore moderate . The Monarch in-pit TSF will be included into the existing regulatory controls for maintaining freeboard and routine inspections.
Cat 5 Embankment lifts at the TSF	Increased tailings storage in the TSF	Waste: Increased seepage from tailings material	Groundwater Surrounding soils and vegetation	Infiltration to groundwater Migration through soils caused by water mounding and seepage from TSF embankment	Contamination of groundwater potentially used for stock watering purposes. Impacts on vegetation Contamination of surrounding soils with metals and metalloids, dissolved solids and cyanide affecting soil and groundwater quality	Moderate	Possible	Moderate	<p>Groundwater modelling concluded that the nearby Monarch pit will act as a groundwater sink for any seepage from the TSF. The discharge of tailings into the Monarch pit are proposed and have been assessed as part of this amendment, however the tailings deposition will cease 5 metres below the predicted post mining groundwater water level. This method will enable the Monarch pit to continue to act as a local evaporative sink and capture seepage from the TSF.</p> <p>Of the 10 existing groundwater monitoring bores (bores) installed at the TSF and Monarch in-pit TSF, 5 of these bores have been constructed to act as recovery bores if required. According to the geological logs, the bores are screened in the fractured rock and saprolite, which constitute the main aquifer at the Premises. These 5 bores have been place downstream of the TSF and in-pit TSF to capture any migrating seepage if required.</p> <p>Existing condition 3.4.1 requires quarterly ambient monitoring of bores located at the TSF and in-pit TSF. A limit of 0.5 mg/L for weak acid dissociable cyanide (WADCN) already exists in the Licence with reporting of an exceedance required in the Licence. Historical monitoring results indicate levels for WADCN are shown to be well below the</p>

									<p>Licence limit of 0.5 mg/L.</p> <p>Existing condition 1.3.3 requires the maintaining of the existing toe drain at the TSF so any seepage is contained and collected.</p> <p>12 evaporators are located on the TSF embankment to increase the evaporation rate and therefore assist in reducing the supernatant pond.</p> <p>Existing condition 3.3.1 requires the Licensee to conduct daily inspects of the ponding on the surface of the TSF and the external walls of the TSF to assess for any seepage.</p> <p>The nearest groundwater bore is 4 km away from the TSF however is located at the Premises and is not in use.</p> <p>There are no groundwater dependent vegetation located in this area.</p> <p>Infrequency use of sodium cyanide during ore processing.</p> <p>Existing condition 3.4.1 table 3.4.2 requires routine photo monitoring at various locations upstream and downstream of the TSF to record any changes to vegetation health.</p> <p>The Licensee management measures and existing licence controls are satisfactory and the likelihood of seepage is possible, the risk to the environment is therefore moderate. No additional regulatory controls are required to mitigate this risk.</p>
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		<p>Waste: Tailings and return water from rupture or leaks of pipelines.</p>	<p>Surrounding soils and vegetation Groundwater</p>	<p>Direct discharge to land and infiltration to groundwater</p>	<p>Impacts on vegetation Contamination of surrounding soils with metals and metalloids, dissolved solids and cyanide affecting soil and groundwater quality</p>	<p>Minor</p>	<p>Possible</p>	<p>Moderate</p>	<p>Existing pipelines are located within earthen containment corridors. Any spilled tailings or return water reports to catchment sumps.</p> <p>Infrequency use of sodium cyanide during ore processing.</p> <p>Existing Licence condition 1.3.4 requires the Licensee to ensure all pipelines containing tailings materials are equipped with automatic cut-outs, provided with secondary containment, or provided with telemetry systems and pressure sensors.</p> <p>Existing Licence condition 3.3.1 requires the Licensee conducts daily inspections of the tailings pipelines and return water pipelines and all inspections are noted in a log book kept in the plant control room.</p> <p>The Licensee management measures and licence controls are satisfactory and the likelihood of pipeline failure is possible, the risk to the environment is therefore moderate. No additional regulatory controls are required to mitigate this risk.</p>
		<p>Waste: Discharge of tailings due to overtopping of the embankment</p>	<p>Surrounding soils and vegetation Groundwater</p>	<p>Migration through soils Sheet flow across land</p>	<p>Impacts on vegetation Contamination of surrounding soils with metals and metalloids, dissolved solids and cyanide affecting soil and</p>	<p>Minor</p>	<p>Rare</p>	<p>Low</p>	<p>The TSF has been designed to safely and temporarily store a 1 in 100 year rainfall event for a duration of 72 hours by maintaining a minimum operational freeboard of 0.3 m at all times during operation.</p> <p>A stormwater diversion drain will be constructed initially along the northern ridge (328 mRL) to intercept and divert rainfall runoff away from the TSF. As the embankment is raised which each lift, additional diversion drains will be</p>

					groundwater quality				<p>constructed.</p> <p>Infrequency use of sodium cyanide during ore processing.</p> <p>Existing Licence condition 1.3.3 requires the Licensee maintains a minimum top of embankment freeboard of 300mm and stormwater is diverted away from the TSF.</p> <p>Existing Licence condition 3.3.1 requires the Licensee conducts daily inspections of the internal embankment freeboard and all inspections are noted in a log book kept in the plant control room.</p> <p>The Licensee management measures and existing licence controls are satisfactory and the likelihood of overtopping rare, the risk to the environment is therefore low. No additional regulatory controls are required to mitigate this risk.</p>
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Detailed Risk Assessment

1. Risk Event: Discharge of tailings into a disused mine pit

Description of Risk Event

The discharge of 700,000 tonnes per year of tailings material into a disused mine pit which was mined to below the water table with the possibility of tailings interacting with groundwater.

Identification and general characterisation of emission

Geochemical test work was undertaken on a tailings slurry sample in October 2017. The test work focused on acid formation potential (AFP), multi element composition and mineralogy of the tailings solids samples. Results from the test work are provided below.

Tailings solids:

- Contains accessory-pyrite in a gangue containing trace-carbonates, at most, and classified as Potentially-Acid Forming (PAF);
- Contains major/minor elements either below, or close to, those typically recorded for soils, regolith's and bedrocks derived from un-mineralised terrain. The tailings are slightly enriched with arsenic, selenium, cobalt, copper, silver and bismuth;
- A gangue comprising mainly of a mineral consisting of a silicate of calcium, magnesium, and iron, which occurs in many igneous and metamorphic rocks (hornblende), and a series of tectosilicate (framework silicate) minerals within the feldspar group (plagioclases); and
- The population of pyrite grains in the tailings solids includes varieties that are intrinsically reactive.

Water fraction:

- pH value of between 7.0 to 7.3;
- TDS of 31,503 mg/L;
- Concentration of cyanide forms below the respective detection limits which reflects the infrequent use of sodium cyanide during ore processing; and
- Concentrations of a wide range of minor elements in the tailing slurry water sample were either below, or close to, the respective detection limits.

Description of impacts from the increased emission

Potential contamination of the local groundwater, determined as suitable for stockwatering purposes in accordance with ANZECC guidelines, with tailings materials which is PAF, containing some slightly elevated metals, and high in TDS.

Currently the Monarch pit acts as an evaporation basin. Increasing the water level within the pit by the discharge of tailings may act to reverse flow from the evaporation basin into the surrounding aquifer.

Criteria for assessment

DWER 'Water Quality Protection Guidelines No.2, Mining and Mineral Processing, Tailings facilities', 2000.

The Department of Mines, Industry Regulation and Safety, Code of Practice 'Tailings Storage Facilities in Western Australia', 2013.

Relevant freshwater quality criteria for comparison include ANZECC guidelines for livestock drinking water quality.

Licensee controls

Deflector will incorporate the management of the in-pit TSF into the existing TSF operational manual. The operational manual outlines the operating procedures, inspection criteria, monitoring requirements and maintaining log sheets.

Tailings will be deposited through a single discharge point. The tailings will be deposited into the southern end of the pit and moved to ensure the even build-up of a consolidated tailings profile below the water. The pit lake will not be dewatered prior to tailings discharge and instead water will be removed from the pit during operations by the use of a floating pontoon and pump with return lines to the ramp. Collected water is pumped back to the process plant for reuse.

Deflector will deposit tailings intermittently into the in-pit TSF by also using the TSF concurrently to allow the tailings to settle and consolidate to ensure maximum storage capacity, reduce seepage from the pit and maintain the in-pit TSF as an evaporation basin.

Tailings will be deposited into the in-pit TSF to ensure the final consolidated tailings bed will not exceed a maximum height of 287 mRL which is five metres below the post mining groundwater level of 292 mRL. Retaining a pit lake within the in-pit TSF through the subaqueous deposition of tailings continues to facilitate the functioning of the pit as a seepage interceptor for the adjacent TSF. Additionally, subaqueous deposition eliminates the potential for the saturated tails to come into contact with the atmosphere, thereby preventing acidification of the tailings mass via oxidization.

Two inspections of the in-pit TSF will be undertaken for each 12 hour shift. These inspections will include checking the:

- pipelines, pumps and valves for leaks;
- discharge location;
- location and the size of the decant pond;
- integrity of the pit walls to determine any changes to existing cracking or any new ones; and
- the freeboard is being maintained.

A monthly inspection will also be conducted by a geotechnical engineer.

Two groundwater monitoring bores have been installed near the in-pit TSF to monitor groundwater levels and quality. These bores have also been constructed as dual purpose bores and can be converted to recovery bores if seepage is detected during routine monitoring.

Monitoring of the SWL in the groundwater monitoring bores will be undertaken on a monthly basis to determine any increase in groundwater levels as a result of tailings deposition into the in-pit TSF. A trigger level of 8 metres below ground level has been adopted to enable additional seepage management measures to be implemented. If the trigger level is reached, these two bores will be utilised for seepage recovery. Sampling for water quality will be conducted on a quarterly basis.

Deflector will maintain flow meters to monitor water recovery from the in-pit to assess against the water balance model predictions.

Consequence

The consequence of discharging tailings materials into the in-pit TSF is considered **moderate** due to the potential contamination of the local groundwater due to seepage which would result in a detrimental impact on the future use of the groundwater for stockwatering purposes, and over pressurisation of the pit water that could force water into the open void system that could result in surface expression and potential discharge as surface drainage.

Likelihood of Risk Event

The likelihood of an occurrence is **unlikely** given Deflector's management measures are satisfactory, recovery bores are installed and the ongoing consolidation of the tailings material will progressively seal the base of the pit thereby reducing seepage.

Overall rating of Risk Event

The risk rating for the discharge of tailings material into a disused mined pit is therefore considered **moderate**.

Decision

TSF Embankment lift

Based upon the applicant supporting documentation, the Delegated Officer has determined that the construction of the embankment lifts at the TSF presents a low risk to the environment. Construction conditions and compliance reporting have been included as new conditions to the Licence as shown below.

Condition 1.3.7 has been included as a new condition for the construction of the embankment lifts at the TSF.

Condition 1.3.8 has been included as a new condition requiring the Licensee to provide engineering certification to DWER within 60 days following the completion of each embankment lift at the TSF.

Based upon the applicant supporting documentation, the Delegated Officer has determined that the operation of the TSF with an increased embankment height presents a moderate risk to the environment due to an increase in seepage and discharge of tailings due to pipeline failure, and presents a low risk to the environment due to overtopping of the embankment wall. However these risks are acceptable subject to the existing regulatory controls in the Licence.

In-pit TSF

Based upon the applicant supporting documentation, the Delegated Officer has determined that the installation of infrastructure associated with the use of the Monarch pit as an in-pit TSF, presents a low risk to the environment therefore no additional regulatory controls are required to mitigate this risk.

Based upon the applicant supporting documentation, the Delegated Officer has determined that the operation of the in-pit TSF presents a moderate risk to the environment due to potential seepage from the pit, surface expression due to increase pressure, and discharge of tailings due to pipeline failure and overtopping of the pit wall. However these risks are acceptable subject to amendments to the existing regulatory controls in the Licence as shown below.

Condition 1.3.3 Table 1.3.2 is amended to include the Monarch in-pit TSF as containment infrastructure for the storage of tailings materials and requirements for the operation of the in-pit TSF.

Condition 3.3.1 is amended to include the Monarch in-pit TSF as a monitoring location.

Condition 3.4.1 Table 3.4.1 is amended to increase the frequency of monitoring the standing water levels in ground watering monitoring bores from quarterly to monthly and include a limit of 8 metres below ground level.

Schedule 1 Maps is amended by the inclusion of a new map which identifies the Monarch in-pit TSF as defined in Table 1.3.2

Amendment

- The Licence is amended by the inclusion of the bold text shown in underline below.

Table 1.3.2: Containment infrastructure for management of waste			
Storage vessel or compound as shown on the Premises map in Schedule 1	Material	Management Strategy	Requirements
TSF	Tailings and slurry	Containment in the TSF	<p>The Licensee must:</p> <ul style="list-style-type: none"> (i) maintain all installed toe drains and associated cut offs along the external toe of the TSF perimeter embankments, so that any liquid matter resulting from seepage or breach of the TSF embankments is contained and recovered; (ii) maintain a minimum top of embankment freeboard of 300 mm; and (iii) divert stormwater away from the TSF to minimise threat of accidental loss of stored matter due to flooding or erosion.
<u>Monarch in-pit TSF</u>	<u>Tailings and slurry</u>	<u>Containment within the pit</u>	<p><u>The Licensee must:</u></p> <ul style="list-style-type: none"> (i) <u>ensure the final consolidated tailings bed is greater than 5 metres below the predicted post mining groundwater level of 292 mRL; and</u> (ii) <u>divert stormwater away from the Monarch in-pit TSF to minimise threat of accidental loss of stored matter due to flooding or erosion.</u>
Golden Stream Pit and Settlement pond/s	Dewater	Containment in the Golden Stream Pit and settlement pond/s prior to discharge to Salt River	<p>Prior to discharge to Salt River, the Licensee must:</p> <ul style="list-style-type: none"> (i) direct dewater to the Golden Stream Pit and Settlement Pond/s; and (ii) retain dewater in the Golden Stream Pit and Settlement Pond/s for a sufficient time to reduce Total Suspended Solids to less than 5,000 mg/L. <p>The Licensee must maintain a minimum top of embankment freeboard of 300mm.</p>

2. The Licence is amended by the inclusion of the bold text shown in underline below.

Table 3.4.1: Monitoring of ambient groundwater quality					
<i>Monitoring point reference and location as depicted in Schedule 1</i>	<i>Parameter</i>	<i>Units</i>	<i>Limit</i>	<i>Averaging Period</i>	<i>Frequency</i>
Monitoring bores: TSFMB01; TSFMB02; TSFMB03; TSFMB04; TSFMB05; TSFMB06; TSFMB07; SMW1; SMW2; SMW3; WB1; and WB2	Standing Water Level ¹	m(AHD)	<u>8 mbgl</u>	Spot sample	<u>Monthly</u>
	pH ²	-	-	Spot sample	Quarterly
	Major ions and metals – Aluminium Arsenic <u>Bicarbonate</u> Cadmium <u>Calcium</u> Chloride Chromium <u>Cobalt</u> Copper Iron Lead Magnesium Manganese Mercury Molybdenum Nickel <u>Nitrate</u> <u>Potassium</u> Selenium Sodium <u>Sulfate</u> Thallium Zinc	mg/L			
	Total dissolved solids				
	Weak Acid Dissociable Cyanide (WADCN)		<u>0.5 mg/L</u>		

3. The Licence is amended by the inclusion of the bold text shown in underline below.

Table 3.3.1: Process monitoring				
<i>Monitoring point reference</i>	<i>Process description</i>	<i>Requirements</i>	<i>Frequency</i>	<i>Method</i>
<u>TSF and Monarch in-pit TSF</u>	Tailings and slurry contained in TSF for drying and storage	The Licensee shall undertake daily visual inspections of the <u>TSF and the Monarch in-pit TSF</u> . As a minimum the following shall be inspected: (i) tailings delivery lines; (ii) return water lines; (iii) tailings deposition; (iv) ponding on the surface of the <u>TSF and the Monarch in-pit TSF</u> ; (v) internal embankment freeboard; and	Daily	Visual inspection

		<p>(vi) <i>the external walls of the TSF.</i></p> <p><i>The Licensee shall ensure a log book is kept for all visual inspections. The log book shall be signed by the person undertaking the inspection and shall indicate any problems noted.</i></p> <p><i>The Licensee shall ensure the log book is retained in the plant control room and is made available to an inspector on request.</i></p>		
<i>Dewatering Pipeline and discharge points</i>	<i>Dewatering water</i>	<p><i>The Licensee shall undertake daily visual inspections of the dewatering pipeline and discharge points to:</i></p> <p><i>(i) identify any potential or actual pipeline failures and any erosion of the discharge sites; and</i></p> <p><i>(ii) identify any seepage, spills or leaks.</i></p> <p><i>The Licensee shall ensure a log book is kept for all visual inspections of the dewatering pipeline and discharge points.</i></p>	<i>Daily</i>	<i>Visual inspection</i>

4. The Licence is amended by the inclusion of the bold text shown in underline below.

Table 4.3.1: Notification requirements			
Condition or table	Parameter	Notification requirement¹	Format or form²
<u>L1.3.2, and L2.2.1 and Table 3.4.1</u>	<i>Breach of any limit specified in the Licence</i>	<p><i>Part A: As soon as practicable but no later than 5pm of the next usual working day.</i></p> <p><i>Part B: As soon as practicable</i></p>	<i>N1</i>
<u>Table 1.3.5</u>	<p><u>Geotechnical Investigation Report certifying each item of infrastructure or component of infrastructure specified in Column 1 of Table 1.3.5 has been constructed with no material defects and to the requirements specified in Column 2.</u></p> <p><u>The report must be prepared or reviewed by a person with tertiary qualifications in Civil or Geotechnical Engineering and at least two years employment in geotechnical structures.</u></p>	<u>Within 60 days of the completion of each stage of the works specified in Column 1 of Table 1.3.5</u>	<u>None specified</u>
3.1.5	<i>Calibration report</i>	<i>As soon as practicable.</i>	<i>None specified</i>
<u>Table 3.3.1</u>	<i>The Licensee shall notify the CEO of any TSF pipeline failures and provide an estimate of the tailings and slurry lost due</i>	<p><i>As soon as practicable but no later than 5pm of the next usual working day.</i></p> <p><i>Volume estimate provided within one week of the incident.</i></p>	<i>None specified</i>

	<i>to the failure within one week of the incident.</i>		
<i>Table 3.3.1</i>	<i>The Licensee shall notify the CEO of any dewatering pipeline failures and provide an estimate of the mine dewatering water lost due to the failure within one week of the incident.</i>	<i>As soon as practicable but no later than 5pm of the next usual working day. Volume estimate provided within one week of the incident.</i>	<i>None specified</i>
<i>Table 3.4.3</i>	<i>The Licensee shall notify the CEO of any identified detrimental vegetation impacts including details of a strategy for remediation works.</i>	<i>Within one week of the detrimental vegetation impacts being identified.</i>	<i>None specified</i>

Note 1: Notification requirements in the Licence shall not negate the requirement to comply with s72 of the Act

Note 2: Forms are in Schedule 2

5. The Licence is amended by the inclusion of the conditions shown in bold text in underline below.

1.3.7 The Licensee must install and undertake the works for the infrastructure and equipment:

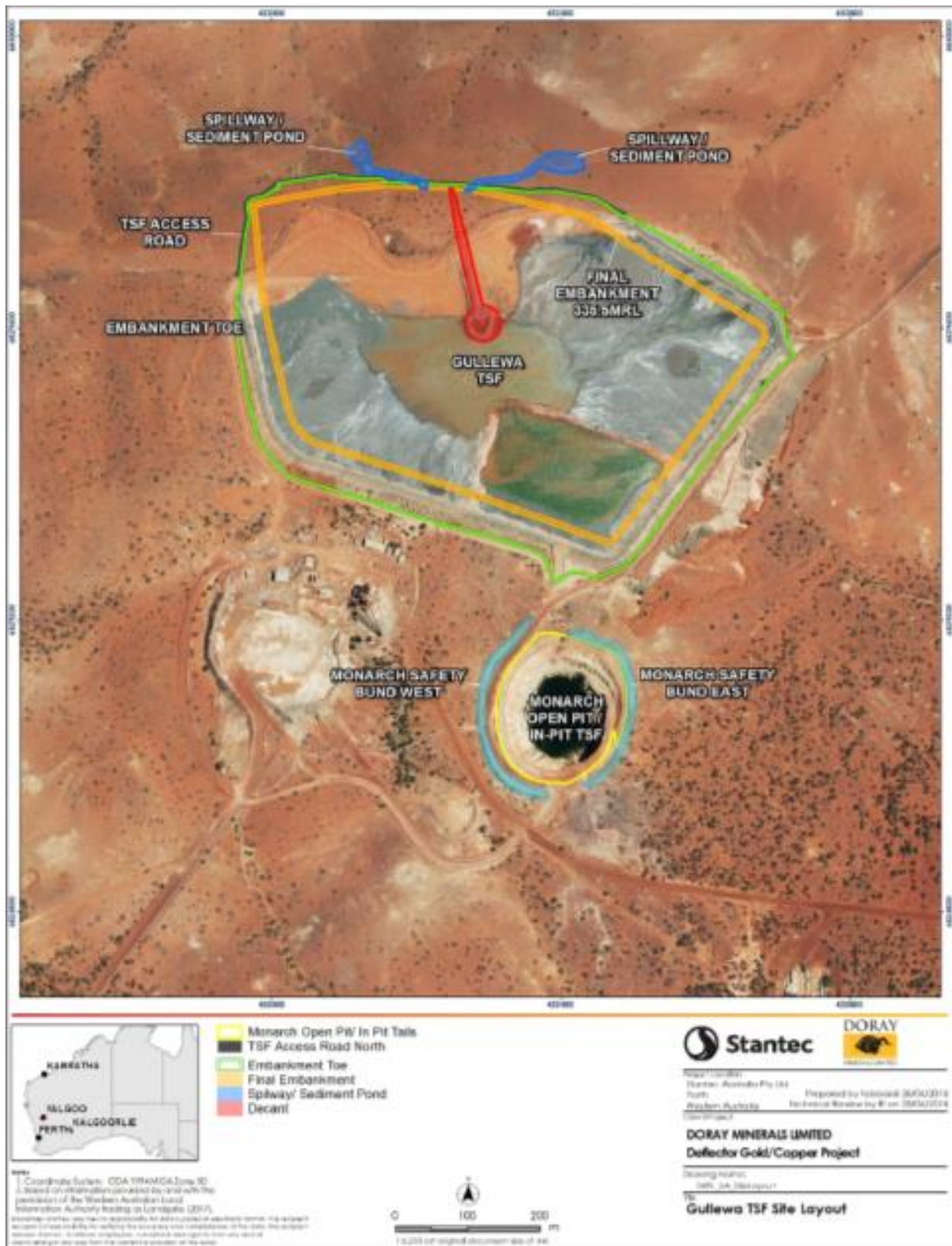
- (a) specified in Column 1; and**
(b) to the requirements specified in Column 2;
of Table 1.3.5 below.

Table 1.3.5: Infrastructure and equipment requirements table

<u>Column 1</u>	<u>Column 2</u>
<u>Infrastructure</u>	<u>Requirements (design and construction)</u>
<u>Stage 5 TSF embankment lift and associated infrastructure</u>	<u>2.0 metre lift of the TSF embankment wall, utilising an upstream construction method, from the current height of 327.5 mRL to a final crest level of 329.5 mRL</u>
<u>Stage 6 TSF embankment lift and associated infrastructure</u>	<u>2.0 metre lift of the TSF embankment wall, utilising an upstream construction method, from the current height of 329.5 mRL to a final crest level of 331.5 mRL</u>
<u>Stage 7 TSF embankment lift and associated infrastructure</u>	<u>2.0 metre lift of the TSF embankment wall, utilising an upstream construction method, from the current height of 331.5 mRL to a final crest level of 333.5 mRL</u>
<u>Stage 8 TSF embankment lift and associated infrastructure</u>	<u>2.0 metre lift of the TSF embankment wall, utilising an upstream construction method, from the current height of 333.5 mRL to a final crest level of 335.5 mRL</u>

6. The Licence is amended by insertion of the map below into Schedule 1 Maps:

Map of containment infrastructure as defined in Table 1.3.2 is shown below:



Licensee comments

The Licensee was provided with the draft Amendment Notice 3 on 11 October 2018.

Comments received from the Licensee have been considered as shown in Appendix 2.

Appendix 1: Key documents

	Document title	In text ref	Availability
1	Licence L7798/1993/6 – Gullewa Gold/Copper Operations	L7798/1993/6	accessed at www.dwer.wa.gov.au
2	Works Approval W5188/2012/1	W5188/2012/1	DWER records (A947191 and A1537279)
3	Deflector Mine Tailings Storage Facility, Stage 4 Upstream Raise to RL327.5m Construction Report.	CMW Geosciences. (2017a)	DWER record A1639705
4	Steve Appleyard, DWER Principal Hydrogeologist, Contaminated Sites , memorandum, 1 November 2017	Appleyard, 2017	DWER record A1565716
5	Deflector Mining Limited Annual Environmental Report 2016	AER, 2016	DWER record A1406065
6	Deflector Mining Limited Operations, Licence Amendment Application Supporting Documentation, 20 March 2018	-	DWER record A1639700
7	Email from Doray Minerals Limited, Confirmation of changes to tailings deposition method, 18 June 2018	-	DWER record A1722134
8	Amendment to CEO321/18 – Licence Application for Deflector Mine Site. Updated supporting information, 1 August 2018	-	DWER record A1709650
9	Steve Appleyard, DWER Principal Hydrogeologist, Contaminated Sites , memorandum, 22 August 2018	-	DWER record A1722155
10	Doray Minerals Limited – Hydrologist technical response to further information required, 11 September 2018	-	DWER record A1719169
11	Memo, Lazarus Leonhard, Senior Hydrogeologist, MWG, Deflector Mining Limited - TSF Modification, 19 September 2018	-	DWER record A1722171

Appendix 2: Summary of Licensee comments

The Licensee was provided with the draft Amendment Notice 3 on 11 October 2018 for review and comment. The Licensee responded on 11 and 12 October 2018. The following comments were received on the draft Amendment Notice.

Reference	DWER Licence — Points for clarification/discussion	Summary of Licensee comment	DWER response
A1728269 (11/10/2018)	No comments	The Licensee requested the Licence be amended as presented in the draft.	Licence prepared for final signing
Phone call from David Niven, Environmental Superintendent – Deflector (12/10/2018) to clarify the description of 'Operational Freeboard' in the Licence.	Draft Licence Amendment 3 referred to the minimum 'Operational Freeboard' at the TSF as 0.7 m.	Minimum 'Operational Freeboard' in accordance with DMIRS guidelines for operation standards for tailings storage is normally set at 0.3 m.	Licence Amendment updated with definition of 'Operational Freeboard' and minimum requirement amended to 0.3 m.