Government of Western Australia
Department of Water and Environmental Regulation

Amendment Report

Application for Licence Amendment

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

Licence Number	L8676/2012/1
Licence Holder	AngloGold Ashanti Australia Limited
ACN	008 737 424
File Number	2012/002666-3~6
Premises	Tropicana Gold Mine Legal description Part of M39/1096 As defined by the Premises maps attached to the Revised Licence
Date of Report	4 June 2024
Decision	Revised licence granted

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MANAGER, RESOURCE INDUSTRIES
REGULATORY SERVICES
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

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1. Decision summary

Licence L8676/2012/1 is held by AngloGold Ashanti Australia Limited (licence holder) for the Tropicana Gold Mine (the premises), located within Mining Tenement M39/1096 in the Shire of Menzies.

This amendment report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the construction and operation of the premises. As a result of this assessment, revised licence L8676/2012/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

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

2.2 Amendment summary

On 24 October 2023 AngloGold Ashanti Australia Limited (the Licence Holder) submitted an application to the department to amend L8676/2012/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The application is seeking approval to construct and operate a new in-pit Tailings Storage Facility (TSF) within the existing Havana South Stage 2 open pit.(HSS2) at the Tropicana Gold Mine.

No construction will be required for the in-pit TSF, however a new 6 km long tailings pipeline and decant return water pipeline will be needed between the process plant and Havana South Stage 2 open pit. The route of the pipeline will follow an existing infrastructure corridor developed for a powerline to the proposed Havana Underground. No change to existing category 5 capacity has been requested. Figure 2 outlines the layout of the proposed infrastructure.

Once mining of HSS2 open pit is complete, it will be approximately 138 m deep. Use of the pit for in-pit tailings deposition will allow storage of up to 3 million tonnes per annum (Mtpa) (or approximately 30% of the total tailings stream generated at Tropicana Gold Mine) over a period of approximately five years (mid 2025 to mid-2029). With an expected total storage capacity of approximately 13 Mt, HSS2 In-pit TSF will be operated in conjunction with the existing above-ground TSF to provide improved overall management of tailings across the premises.

2.2.1 HSS2 in-pit TSF

HSS2 open pit, a sub-pit of the broader Havana South open pit, is currently being mined and is scheduled for completion by early 2025. Once complete, the pit will have a maximum depth of 138 m below surface which is approximately 215 mRL. The design identifies the area to be occupied by tailings will be ~22.5 hectares.

The northern extent of the HSS2 In-pit TSF is in contact with a backfilled waste dump within the Havana South open pit. The waste dump is predominately coarse fresh rock. As a mechanism to limit seepage, a continuous zone of oxide mine waste has been incorporated as part of the backfilled waste dump (Figure 1). The oxide mine waste was placed by the open pit mining fleet during operations, with traffic compaction undertaken during this process.

Deposition will be sub-aerial from a single primary deposition point located at the north-east of the HSS2 In-pit TSF, with allowance for secondary deposition points if required to control the decant pond location.

Construction works are proposed to occur in two stages. Stage 1 involves the construction of the tailings delivery pipeline (and deposition spigot's) between the processing plant and HSS2 in-pit TSF. Pipelines will be constructed within secondary containment (bunding) with scour sumps located along the pipeline route in appropriate locations. Once this work has been completed the Licence Holder will submit an Environmental Compliance Report to allow tailings deposition to occur.

A decant system will be installed to recover decant water which is expected to be driven towards the southern end of the facility (Figure 3). Decant recovery will commence as soon as practicable from the decant pond which is nominally expected to occur up to 12 months following commencement of tailings deposition. Decant return is not initially practical based on the very rapid rate of rise during the initial filling of the pit base which will limit the formation of a settled decant pond. As it will not be practical to pump decant water in HSS2 In-pit TSF for up to 12 months after commencement of tailings deposition, the Licence Holder is proposing to submit a second Environmental Compliance Report once the decant recovery system and return water line have been installed.

Four pairs of groundwater monitoring bores have been installed around HSS2 open pit to monitor groundwater levels and water quality. Location of these bores are shown in Figure 2.

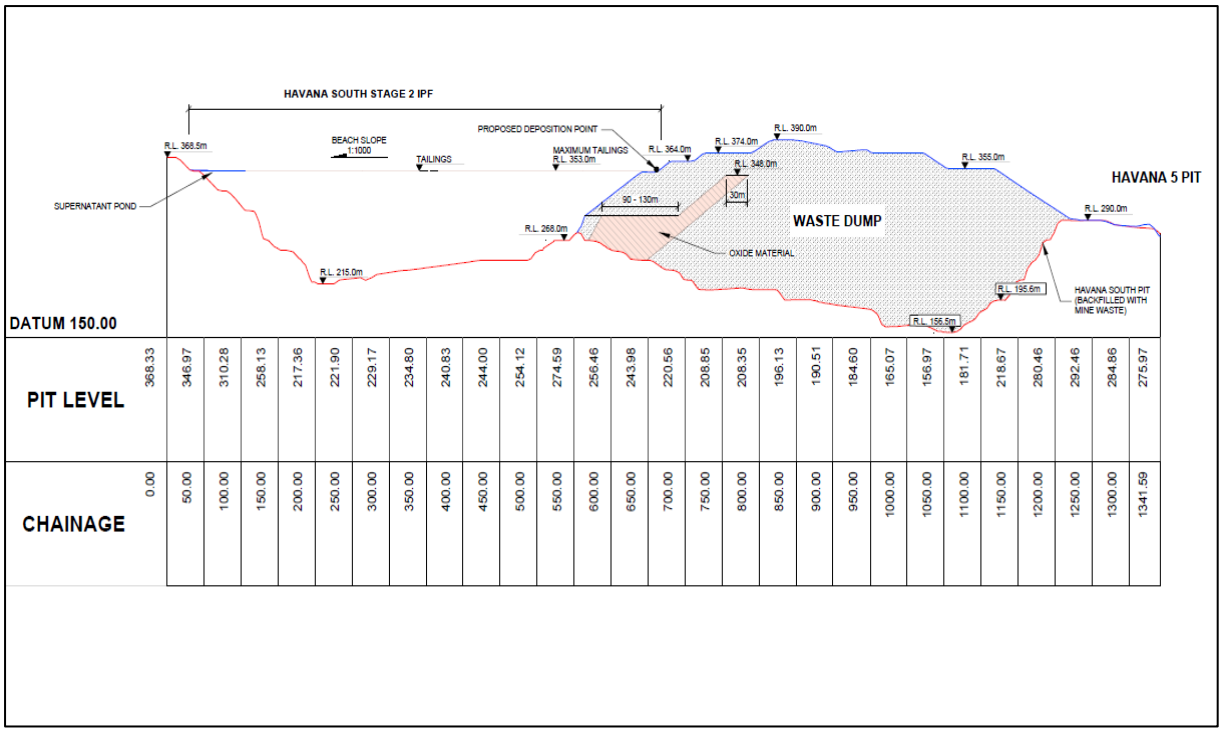

Figure 1: Cross section showing oxide material incorporated into waste dump to limit seepage.

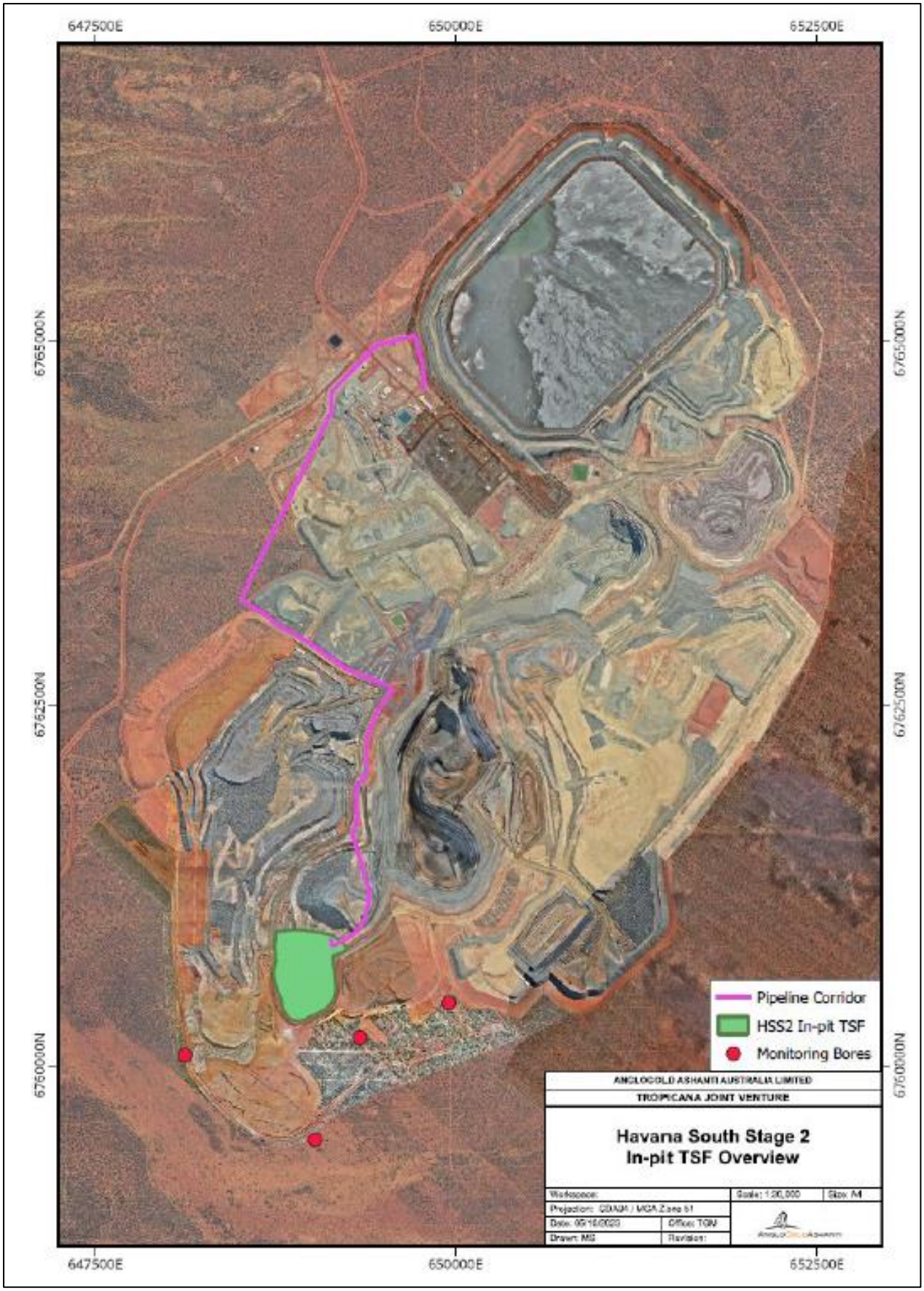

Figure 2: Location of the proposed pipeline corridor, HSS2 in-pit TSF and groundwater monitoring bores.

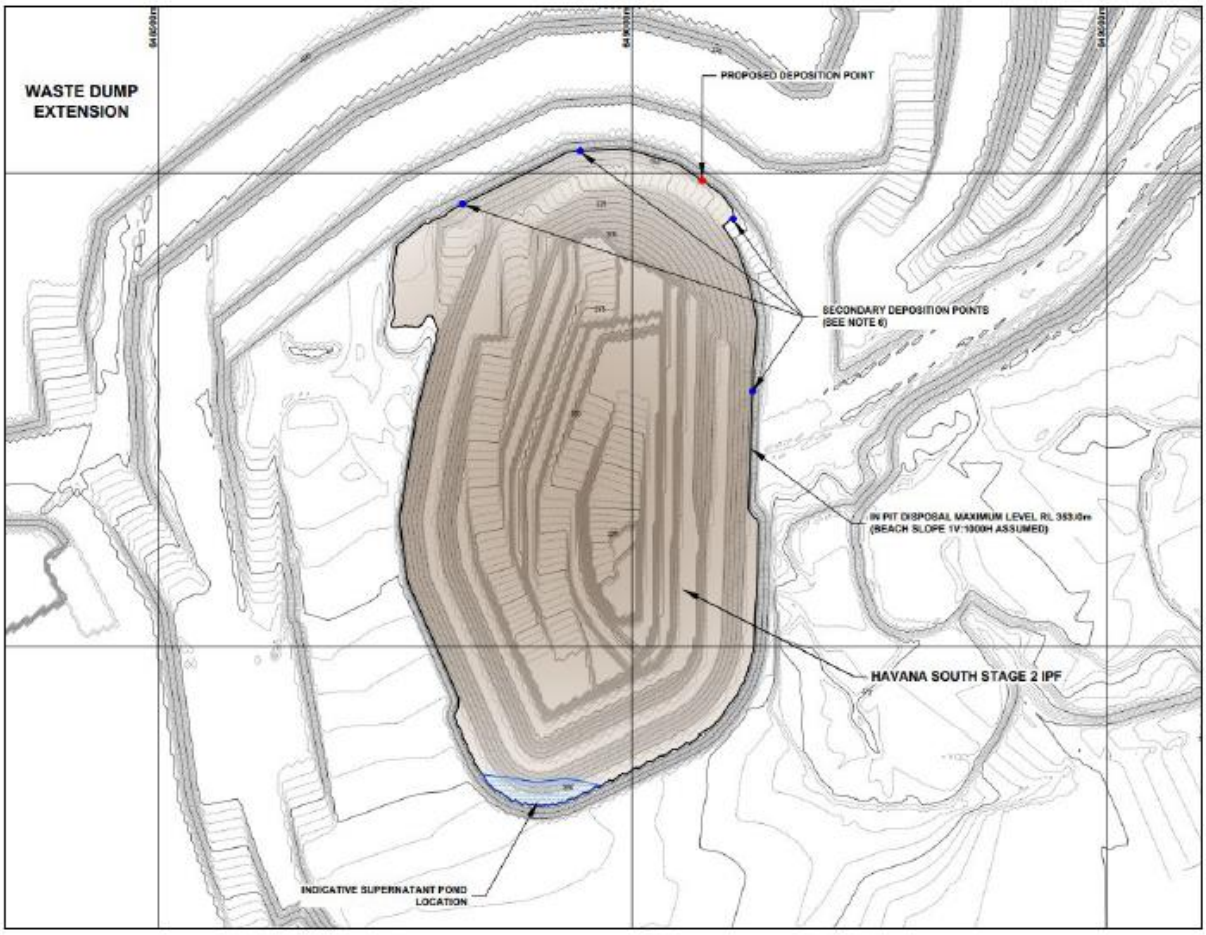

Figure 3: HSS In-pit TSF when filled to 353 mRL

2.3 Part IV of the EP Act

The construction and operation of the Tropicana Gold Project was assessed and approved by the Environmental Protection Agency (EPA) in 2010. The proposal included the construction and operation of a paddock style TSF.

Major findings were published in the EPA assessment report (ID: 1361) and Ministerial Statement (MS) 839 which was granted 24 September 2010.

On 1 August 2023 the Licence Holder submitted a section 45C application to the department which includes the HSS2 In-pit TSF. As a result of this, the following revision to wording of MS 839 has been made:

- Removal of the word “possible” from the physical element Tailings storage facility in Table 2 of Attachment 7 to read “Single-cell tailings storage facility with in-pit deposition”.

Existing MS 839 conditions applicable to this licence amendment are:

- Flora and vegetation
    - No loss of plants of Declared Rare Flora species due to construction or operational activities
    - Monitoring of condition and abundance of vegetation and flora at reference and potential impact sites
    - At 25% of decline in cover or productivity, CEO of EPA to notified and

implement action

- Threatened species
    - Minimise adverse impacts to conservation significant species and communities
- Groundwater and surface water quality
    - Run-off and/or seepage from the tailings storage facility does not impact the quality of surface water

3. Risk assessment

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

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

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 1 below. Table 1 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

Table 1: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Saline seepage containing cyanide	HSS2 In-pit TSF deposition of tailings	Seepage infiltration	• Decant recovery system will be constructed to mimise the size of the decant pond. Return decant water to go to the process plant for re-use. • 30m wide oxide layer placed in the southern end of Havana South open pit as part of mining operations to minimize seepage into waste rock dump. • The initial tailings deposition location has been selected north east of the pit to locate a supernatant pond away from the waste dump backfill north of the facility, limiting seepage potential into Havana 5 pit located north east of the area. • Installation of four monitoring bores and monitoring in accordance with existing conditions detailed in Table 6 of L8676/2012/1

Emission	Sources	Potential pathways	Proposed controls
Saline seepage containing cyanide and/or other elements associated with potential acid generation	HSS2 In-pit TSF deposition of tailings	Oxidation of tailings stored in HSS2 In-pit TSF	• Tailings are deposited and stored at field capacity, providing an environment deprived of oxygen. • Spigotting will be limited to a primary spigot with secondary deposition points as required, resulting in tailings being continuously covered by tailings. • Installation of four monitoring bores and monitoring in accordance with existing conditions detailed in Table 6 of L8676/2012/1
Saline tailings / decant water containing cyanide	Tailings / return pipeline	Release from pipeline to soil and vegetation	• Pipelines will be located within bunding as secondary containment, with scour sumps installed as appropriate along the pipeline corridor. • Flow meters on pipelines linked to alarms in the Tropicana Operations Centre via telemetry. • Twice daily pipeline inspections
Stormwater mixed with saline decant water /tailings	Overtopping HSS2	Direct discharge to land	• Design is able to contain a 72 hour Probable Maximum Precipitation event during operations or closure. • Operational freeboard of greater than 0.5 m
Dried tailings	Dust	Windblow dust affecting native vegetation	• Tailings expected to retain high moisture content throughout deposition and therefore minimal dust is expected.

3.1.2 Receptors

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

Table 2 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020)).

Table 2: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
Town of Laverton	Is approximately 220 km north-west of the Premises. The town is not considered to be within influencing

	distance of the premises and has been screened out.
Environmental receptors	**Distance from prescribed activity**
Groundwater (predominately saline – hypersaline)	Variable groundwater levels - approximately 20m below ground level (mbgl). The Licence Holder is the only groundwater user in the area. No other users of groundwater occur within 100 km of the Premises. Groundwater is generally saline to hypersaline with total dissolved solids (TDS) between 20,000 mg/L – 100,000 mg/L. Recent groundwater monitoring data for around HSS2 open pit indicates groundwater is less saline with a TDS of ~ 6000mg/L
Surface water	Drainage is to the north-east toward a chain of ephemeral palaeochannel lakes which extend from the ephemeral Lake Rason to the Eucla Basis (lakes are approximately 7 km north-east of the TSF). Other than the Tropicana Gold Mine diversion drain, there are no defined surface drainage features with runoff predominantly occurring as sheet wash (Groundwater science, 2019).
Fauna	Leipoa ocellata (malleefowl) has been sited within the premises boundary (3 km west of TSF) and adjacent (west) to the Premises.
Native Vegetation.	14 species of priority flora recorded across the premises. Closest record from 2020 vegetation survey is 2 km south of HSS2 In-pit TSF Native vegetation occurs approximately 50 m southeast of HSS2 open pit, although this area is planned for disturbance as an ore stockpile area. Beyond the planned stockpile area vegetation occurs approximately 0.6 km south of the HSS2 open pit. A section of the tailings deposition and return water pipeline route runs through an area of native vegetation.

3.2 Risk ratings

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

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

Additional regulatory controls may be imposed where the Licence Holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 3.

The Revised Licence L8676/2012/1 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e. class 5, 12, 52, 54, 64 and 73 activities.

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

Table 3. Risk assessment of potential emissions and discharges from the Premises during operation

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
Construction								
Construction of Tailings delivery line and spigots; Return water line and decant pump/s.	Dust	Airborne pathway resulting in impacts to vegetation health (smothering)	Closest vegetation is approximately 50 m from HSS2 In-pit TSF, but is an area planned to become an ore stockpile area. Closest retained vegetation is located ~0.6 km from HSS2 Inpit TSF	N/A	C = Slight L = Rare **Low Risk**	N/A	N/A	N/A
Operation								
HSS2 In-pit TSF deposition of tailings	Seepage (hyper saline water/cyanide and or/other contaminants)	Seepage infiltration leading to mounding and groundwater quality changes including potential for acid generation and release of metals	Groundwater Closest vegetation is approximately 50 m from HSS2 In-pit TSF, but is an area planned to become an ore stockpile area. Closest retained vegetation is located ~0.6 km from HSS2 Inpit TSF	Refer to Section 3.1	C = Moderate L = Unlikely **Medium Risk**	N	Condition 12 – existing inspection requirements applicable to new TSF Condition 9 – requirement to minimize decant pond Condition 29 – construction of decant recovery pump system **Condition 20 – Groundwater monitoring Limit applied to new bores**	Refer to detailed risk assessment in section 3.3 and 3.4

	Tailings /decant water	Overtopping of HSS2 in-pit TSF causing land contamination and impacts to vegetation health	Soil Closest vegetation is approximately 50 m from HSS2 In-pit TSF, but is an area planned to become an ore stockpile area. Closest retained vegetation is located ~0.6 km from HSS2 Inpit TSF	Refer to Section 3.1	C = Moderate L = Unlikely **Medium Risk**	Y	Condition 9, Table 3 – operational freeboard to be maintained. Condition 12 – existing inspections applicable to new TSF.	N/A
		Discharge to land (pipeline leak or failure) resulting in impacts to vegetation health	Primarily AE1 vegetation community adjacent to infrastructure corridor.	Refer to Section 3.1	C = Minor L = Unlikely **Medium Risk**	Y	Condition 10 – Existing pipeline requirement condition applicable to new pipelines Condition 12 – existing inspection requirements applicable to new pipelines Condition 29, Table 9 – construction requirements specific to new pipelines	N/A
	Dust (from tailings)	Airborne pathway resulting in impacts to vegetation health (smothering)	Closest vegetation is approximately 50 m from HSS2 In-pit TSF, but is an area planned to become an ore stockpile area. Closest retained vegetation is located ~0.6 km from HSS2 Inpit TSF	Refer to Section 3.1	C = Slight L = Rare **Low Risk**	Y	N/A	N/A

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

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

3.3 Detailed risk assessment for seepage from HSS2 in-pit TSF causing groundwater mounding.

3.3.1 Description of Risk Event

Tailings deposition into the HSS2 in-pit TSF may result in seepage of leachate from the base and walls of the HSS2 pit into groundwater. This may result in localised mounding of the groundwater table near the in-pit TSF which has the potential to enter the root zones of native vegetation at the surface causing impacts to vegetation health (from waterlogging and high salinity of the groundwater).

The degree to which groundwater mounding could take place as a result of tailings disposal in HSS2 in-pit TSF depends on the expected seepage rate from the in-pit TSF and hydraulic conductivity of surrounding rock.

Existing groundwater levels are variable at site, generally in the range of 20 metres below ground level (mbgl). The background groundwater at the site is typically saline to hypersaline (total dissolved solids (TDS) between 20,000 and 50,000 mg/L, increasing up to 100,000 mg/L near the Lake Rason).

The closest patch of native vegetation to the HSS2 in-pit TSF is approximately 50 m from the pit, however this area is planned to become an ore stockpile area in the future. The closest retained vegetation is located approximately 0.6 km from HSS2 Inpit TSF.

3.3.2 Licence Holder Proposed controls

To manage the risk of seepage from the in-pit TSF, the licence holder is proposing the following controls:

- installation of a decant recovery system to return water to the process plant for re-use. Commencement of decant pond pumping is not expected for up to 12 months after commencement of tailings deposition.
- Daily inspection of decant pond size and location.
- Four monitoring bores pares (deep and shallow) have already been established around HSS2 open pit for monitoring of groundwater level and quality.

3.3.3 Review of Groundwater Model

The Licence Holder has undertaken groundwater modelling to verify the predicted groundwater response to tailings deposition into HSS2 In-pit TSF. The Licence Holder has provided a technical report (Groundwater Consulting Pty Ltd 2023) that model the impact of tailings disposal into HSS2. Two different models were undertaken:

- a simple analytical model based on the Darcy's Law equation; and
- a standard numerical groundwater flow model using the model-code MODFLOW

The results of the models indicate that tailings deposition into the HSS2 pit over the operational period is predicted to raise water levels in the immediate vicinity of the HSS2 pit. However, the footprint of that impact is predicted to be relatively small and localised to the mine disturbance footprint. This is shown in Figure 4 which shows that impact of tailings deposition at HSS2 on regional water levels would not extend more than 700m away from the pit in all directions.

The modelling indicates that the main influence on regional water levels surrounding the mine (or southern side of the mine) during the operational period would come from dewatering at the Havana open pit, which is the deepest pit at the Tropicana Gold mine. Since commencement of groundwater abstraction for mining at the premises, groundwater levels have reduced around

HSS2 open pit as a result of developing a cone of depression, driven by mining at Havana open pit. With mining at HSS2 open pit, the cone of depression is locally exacerbated around the pit and will be at least 150 mbgl by the completion of mining (Groundwater Consulting Pty Ltd 2023). Havana open pit is predicted to act as a groundwater sink in the long-term.

A technical review of the models has been undertaken. The Department considers that the choice of models is generally appropriate and that the general trend of changing groundwater levels near HSS2 is likely to be correct. However, a number of issues have been identified with how the modelling was undertaken that is likely to reduce the accuracy of the predicted groundwater levels.

Issue 1:

The Licence Holder has based the predicted rate of groundwater flow between HSS2 and an adjacent mine void on the standard formulation of Darcy's Law. In this equation, the groundwater flow rate would be calculated assuming that groundwater potentiometric heads would decrease in a linear fashion with distance between HSS2 and the adjacent mine void. However, it is considered that it would be more likely that these levels would decrease approximately in a parabolic fashion between these two features, which would cause significant changes to the calculated groundwater flow rates.

Therefore, the department considers that the groundwater flow rates and potentiometric heads between the two mine voids during tailings disposal would be better estimated using the Dupuit-Forcheimer equation. This is because this equation of groundwater flow assumes parabolic variations in potentiometric heads take place with distance between water bodies that contain water at different elevations.

Issue 2:

The Licence Holder appears to have assumed an evaporation rate that applies to the evaporative loss of water from the surface of a freshwater body, not from the hypersaline water that would probably be present in the decant pond in the HSS2 facility.

For most tailings storage facilities in Western Australia, mine proponents usually assume that the monthly rates of evaporation from the tailings decant pond at a mine site is equivalent to the monthly rates that are measured at the nearest Bureau of Meteorology (BOM) weather monitoring station, multiplied by a pan-factor of about 0.7 to 0.8. Although this assumption may be in some cases be adequate for decant ponds that contain water with a low salinity, the actual rate of evaporation from a decant pond will progressively decrease with the increasing salinity of water in the pond.

This means that the evaporation rate from a pond that contains hypersaline water will be much lower than from a freshwater body. For instance, based on evaporation rates that have been measured in TSFs in the Goldfields region, Newson and Fahey (2003) found that a pan factor of about 0.4 should be applied to BOM monitoring data for evaporation from decant ponds in the area, and that a pan factor of about 0.2 should be applied to determine the rate of evaporation from the beach areas of these facilities.

Additionally, research that was carried out in Western Australia by CSIRO (McJannet *et al*., 2017) has shown that there can be a poor relationship between evaporation rates that are actually measured at a mine-site and those measured at the nearest BOM weather station. That is, the assumption that regional evaporation data can be used as a substitute for site-specific measurements may not be valid. This is particularly the case for in-pit TSFs, where measured evaporation rates from a water surface in a mine void can be very different to those measured on the land surface adjacent to the void (McJannet *et al*., 2017).

Therefore, it is suggested that the evaporation rate in both models that were developed for HSS2 have been greatly over estimated and consequently, it is likely that the seepage rate from the facility, and the degree to which local groundwater mounding would take place, will be higher than predicted by the model.

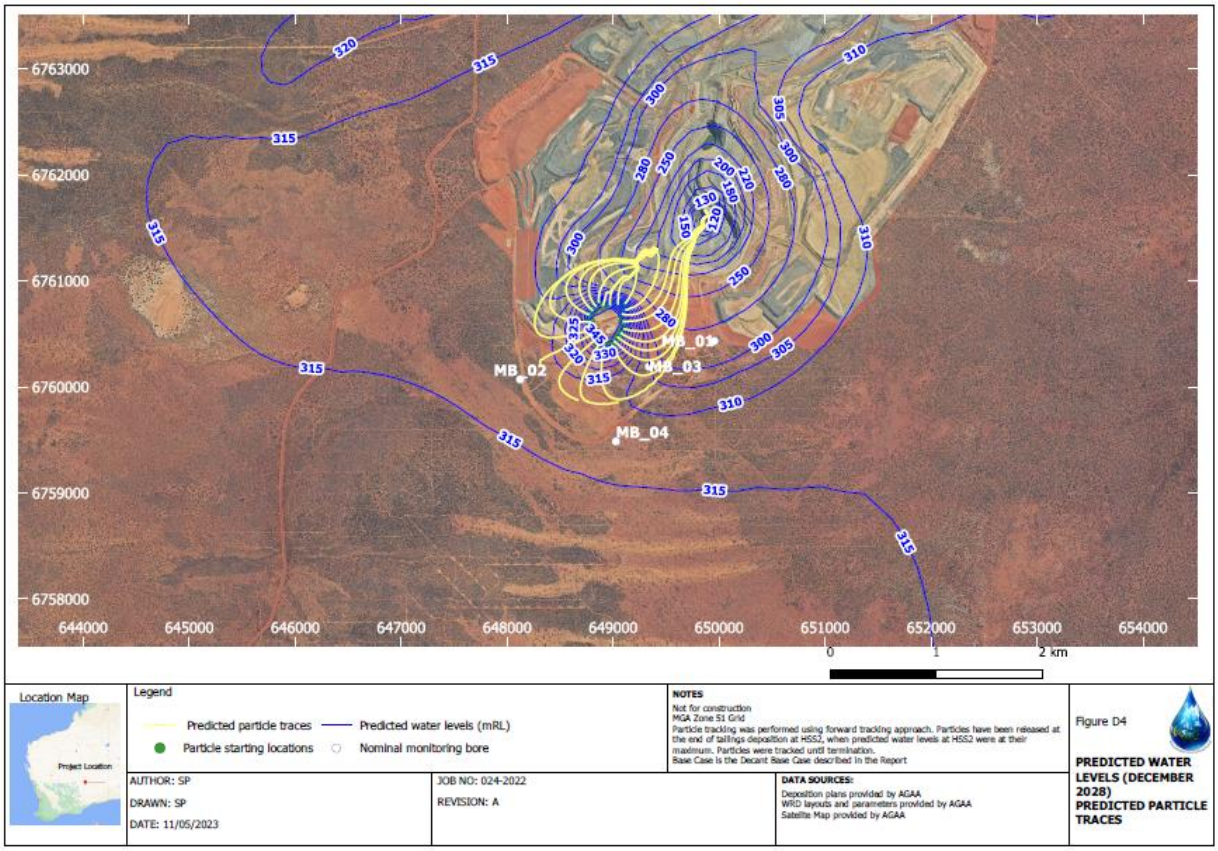

Figure 4: Predicted water levels (December 2028) ***Source: Groundwater Consulting Pty Ltd 2023***

3.3.4 Risk rating and regulatory controls

If mounding of the groundwater table around the in-pit HSS2 TSF occurs to an extent where the groundwater table reached the root zone of native vegetation at the surface it has been determined that mid-level impacts (vegetation stress/death) could occur. Therefore, the Delegated Officer considers the consequence of this risk event to be **Moderate.**

However, based on the findings of the groundwater modelling provided (and notwithstanding the uncertainties around the level of mounding predicted to occur) it has been determined that the likelihood of groundwater table mounding impacting receptors will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of this risk event to be **Unlikely**.

An overall risk rating of **Medium** is applied for this event. As a result of this risk rating, conditions will be placed on the licence to manage this risk. These conditions are outlined in Table 4.

Table 4: Regulatory Controls for HSS2 Seepage Management

Condition/control	Justification
Condition 20 – Groundwater monitoring and SWL limit	The Licence Holder's existing groundwater monitoring bores around the in-pit TSF have been added to condition 21 so that quarterly monitoring of groundwater levels and water quality can occur. A standing water level (SWL) limit of 4 metres below ground level (mbgl) has been applied to these bores to ensure any groundwater mounding does not impact native vegetation.
Minimise decant pond	As groundwater modelling assumed active decant recovery with a decant pond depth maintained at no more than 2 meters deep. A requirement has therefore

	been conditioned on the works approval that requires the decant pond to be kept as small as practicable to minimise seepage.

3.4 Detailed risk assessment for seepage from HSS2 in-pit TSF causing groundwater contamination.

3.4.1 Description of risk event

Tailings at the premises has been classified as potentially acid forming (PAF) based on tailings characterisation studies that has been undertaken to determine the acid generating properties of the tailings. This may result in the generation of acid within the HSS2 in-pit TSF and the mobilisation of metals and metalloids withing pore water and ultimately within seepage leaving the facility into groundwater. Consequently, groundwater contamination could occur.

3.4.2 Receptors

The premises is located within the Goldfields proclaimed groundwater area with groundwater flow from southwest to northeast with eventual discharge to the saline playas of the Lake Rason/Gwynne Creek palaeodrainage approximately 12 km north of the HSS2 pit.

Groundwater in the area is naturally saline. There are no groundwater users in the area as the premises is isolated, with the closest town being more than 200 km away and the closest pastoral station (Mt Weld Station) approximately 150 km away.

The only potential groundwater dependent vegetation close to the premises is the saline vegetation associated with the Lake Rason/Gwynne Creek palaeodrainage approximately 12 km northeast of HSS2 open pit. This is well beyond the influence of the HSS2 In-pit TSF.

It is expected that groundwater over the operational period of the HSS2 in-pit TSF will be predominantly influenced by the ongoing Havana open pit mining and dewatering activities, which will create a drawdown effect resulting in seepage/ groundwater to migrate towards Havana open pit. Havana open pit is predicted to act as groundwater sink in the long-term.

3.4.3 Licence Holder Proposed controls.

The Licence Holder has stated in their supporting documents that there would only be a low risk that seepage from the TSF in HSS2 would contain elevated concentrations of metals and metalloids, as the saturated conditions in the facility would limit oxygen ingress and the oxidation of pyrite.

The Licence Holder has outlined that oxidation of tailings is restricted at the proposed in-pit TSF because the tailings will be deposited and stored at field capacity, providing an environment deprived of oxygen except at the very surface where evaporation may reduce saturation. Also based on column test work, there is at least a 20-week lag time prior to acid generation occurring. In HSS2 in-pit TSF, spigotting will be limited to a primary spigot with secondary deposition points as required, resulting in tailings being continuously covered by tailings.

The licence holder has stated in their application that the existing above ground paddock style TSF has been in operation for approximately 10 years, without any indication of seepage (measured at the underdrainage sump) of being acidic. Groundwater quality within the monitoring bores surrounding the TSF have also shown a steady neutral pH and benign concentrations of acid mobile metals supporting the view that acid generation is not occurring within the above-ground TSF.

The licence holder has installed four pairs of monitoring bores (deep and shallow) around HSS2 open pit and has proposed to monitor these bores for groundwater level and water quality consistent with existing conditions applicable to Table 6 of Licence L8676/2012/1.

3.4.4 Risk assessment

The Licence Holder has outlined that there would only be a low risk that seepage from the TSF in HSS2 would contain elevated concentrations of metals and metalloids, as the saturated conditions in the facility would limit oxygen ingress and the oxidation of pyrite. Although this assessment would be true at many mine sites, this may not be the case at the Tropicana mine site for the following reasons:

- The Tropicana mine site lies within an arid region, where nitrate concentrations in groundwater are often very high due to the effects of termite activity and the growth of cyanobacterial mats within soil profiles in the region (Barnes *et al*., 1992). Nitrate is known to be a strong oxidant that has the ability to oxidise pyrite under anaerobic conditions (Jørgensen *et al*., 2009). Consequently, if the mine process water (which is obtained from a local groundwater supply) were to contain elevated nitrate concentrations, there would be a risk that PAF tailings in the TSF would be oxidised, even in the absence of dissolved oxygen in the TSF pore-water.

  Insufficient information has been provided in order to assess whether the groundwater source for process-water at the premises contains elevated nitrate concentrations. However, if this is the case, there would be a risk that metals and metalloids would be released from tailings that are deposited in the proposed HSS2 TSF, even in the absence of significant levels of dissolved oxygen in the tailings pore-water.

- In addition to leaching gold from crushed ore, process-water containing cyanide ions can leach metals and metalloids from this material (Kyle *et al*., 2012; Cánovas *et al*., 2023). As many metals and metalloids can form highly soluble complexes with cyanide, these chemical constituents can accumulate in tailings pore-water on discharge to a TSF, and may be transported in seepage into groundwater. The leaching and transport of metals and metalloids by this process can take place under alkaline conditions in the absence of oxygen.

Therefore, it is possible that metals and metals could still be released into tailings pore-water through chemical reactions between cyanide ions and minerals in tailings particles. Additionally, if the process water contains elevated concentrations of nitrate ions, there could be a risk that pyrite in PAF tailings materials would be oxidised, releasing some metals and metalloids, even under anaerobic conditions within the TSF.

However, seepage modelling has indicated that ongoing dewatering of the neighboring Havana open pit will create a drawdown effect resulting in any seepage migrating towards and being captured by Havana open pit (Figure 4). It is also predicted that the Havana open pit will remain as a groundwater sink in the long term.

Groundwater monitoring around the existing paddock style TSF at the premises has also indicated no increasing trends for metals or metalloids within the groundwater. pH within the groundwater and also within captured seepage has also remained neutral over time. Indicating that acidification of the tailings is not occurring. This further supports the licence holder's statements that it is unlikely that acidic or metalliferous seepage will be released from the HSS2 in-pit TSF.

3.4.5 Risk rating and regulatory controls

If metalliferous seepage into groundwater resulting in groundwater contamination was to occur it will result in mid-level impacts to groundwater quality. However, as there are no groundwater users or groundwater dependent receptors in the area it has been determined that the consequence of this risk event is '**minor**'.

The likelihood of metalliferous seepage occurring from the in-pit TSF has been determined to be 'possible' (could occur at some time) based on the fact that metals could be mobilized into seepage even in the absence of oxygen due to the presence of cyanide and possibly nitrate

concentrations. However, this is **unlikely** to have a significant impact on the receiving environment due to neighboring Havana open pit acting as a groundwater sink resulting in any seepage being captured and retained within the premises footprint.

An overall risk rating of **Medium** is therefore applied for this risk event. The licence holder's proposed monitoring program (Table 5) have been deemed to be sufficient in managing this risk and will be conditioned within the licence.

Table 5: Regulatory Controls

Condition/control	Justification
Condition 20: Quarterly Groundwater Monitoring	The existing monitoring condition is detailed in Condition 21 (Table 6) the licence will be expanded to include the monitoring bores associated with TSF HSS2. This condition requires quarterly groundwater monitoring and annual reporting on groundwater quality. This provision of this condition allows the Department to monitor trends in the groundwater quality and take action if environmental harm is occurring.

4. Consultation

Table 6 provides a summary of the consultation undertaken by the department.

Table 6: Consultation

Consultation method	Comments received	Department response
Local Government Authority advised of proposal on 15 December 2023.	No comments were received from the Shire of Menzies.	N/A
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) advised of proposal 15 December 2023.	DEMIRS have assessed the related Mining Proposal and have no concerns regarding the proposed in-pit TSF. They are looking to approve the mining proposal soon and will review content of Works Approval to minimise potential for duplication of conditions.	Noted.
Licence Holder was provided with draft amendment on 8 May 2024	Refer to Appendix 1	Refer to Appendix 1

5. Conclusion

Based on the assessment in this Amendment Report, the Delegated Officer has determined that a Revised Licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

5.1 Summary of amendments

Table 7 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

Table 7: Summary of licence amendments

Condition no.	Proposed amendments
Condition 9 Table 3	HSS2 in-pit TSF has been added to Table 3 with operational requirements for freeboard and decant pond management added.
Condition 14 added	Condition 14 missing (numbering jumped from condition 13 to condition 15. Condition numbering corrected to include a condition 14, this impacts the numbering from condition 13-31.
Condition 20 Table 6	Additional monitoring bore locations added. SWL limit has also been applied to the new bores surrounding the HSS2 in-pit TSF
Condition 29 Table 9	HSS2 in-pit TSF construction requirements have been added to the licence Redundant construction requirements for items of infrastructure have been removed – infrastructure has been constructed and compliance documentation has been supplied to the department.
Condition 30	Condition has been deleted. Condition such as this is no longer supported by the department based on recent legal advice. To bring the licence into line with current approved wording and structure of construction compliance conditions this condition has been deleted.
Condition 30	Wording has been updated to reflect approved condition wording
Condition 31	Wording has been updated to reflect approved condition wording
Condition 33	Condition deleted as item 7 has been deleted from Table 9 and therefore this condition is no longer required.
Condition 34	Condition deleted as power station has been constructed and compliance documentation has been submitted in accordance with condition 30.

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Appendix 1: Summary of Licence Holder's comments on risk assessment and draft conditions

Condition	Summary of Licence Holder's comment	Department's response
Condition 9 – Table 3 – 'HSS2 inpit TSF'	DWER has proposed 'Infrastructure Requirements' for the HSS2 in-pit TSF to include the requirement for the decant pond to be "maintained at a depth of no more than 2 meters deep". The requirement of this specific condition to pond depth is impractical for the following reasons: • As operation of the in-pit TSF progresses, safe access to the decant pond will not be possible. • The operation and behaviour of an in-pit TSF will result in a mobile decant pond (both vertically and horizontally), making measurement of the pond depth extremely challenging. • Variable tailings settlement and consolidation within the in-pit TSF will make it make it particularly difficult to determine the tailings level from which to measure pond depth. AGAA propose that the wording of 'Infrastructure requirements' for HSS2 in-pit TSF be amended to "Decant recovery system to be operated within 12 months of tailings deposition commencing. Decant pond size is to be maintained as small as practicable".	In recognition of the impracticalities of this condition, and acceptable risk profile, condition 9 has been updated.
Condition 11 – free board requirements	Condition 11 requires a minimum freeboard of 300mm for tailings storage facilities, which would include HSS2 In-pit TSF. This is inconsistent with Condition 9, Table 3, which establishes a minimum freeboard for the HSS2 In-pit TSF of 0.5 metres below pit crest (in accordance with In-pit TSF Design).	Condition 11 has been amended to exclude HSS2 In-pit TSF
Condition 29 – Table 9 relating to "landfill expansion"	DWER listed the Landfill Expansion as 'Partially Complete' in Construction Compliance correspondence in June 2023 (DWER ref: 2012/002666-3) and removed construction requirement condition.	In recognition that future landfill trenches are proposed, the construction condition has been reinstated.

Condition	Summary of Licence Holder's comment	Department's response
	TGM note that Landfill Expansion remains active, with future landfill trenches to be constructed within the authorised area.	
Condition 29 – Table 9, New Item 2	AGAA propose that the term "floating" be removed from the "floating decant recovery pump system to be installed within 12 months of tailings deposition commencing into HSS2 in-pit TSF" to allow for the potential for decant recovery to occur by a pump system that does not 'float' on the decant pond.	The department notes that AGAA propose to utilise either a floating turret and skid/barge mounted pump arrangement or a highwall pump to undertake decant recovery, and have removed the "floating" requirement for the condition to provide AGAA the required flexibility.
Condition 31 (b)	Typing error identified "plant" instead of "plan".	Condition amended to read "plan"