Government of Western Australia
Department of Water and Environmental Regulation

Amendment Notice #8

Licence Number	L8621/2011/1
Licence Holder	Roy Hill Iron Ore Pty Ltd
ACN	123 722 038
File Number:	2011/009784
Premises	Roy Hill Iron Ore Mine M46/518 and M46/519 NEWMAN WA 6753
Date of Amendment	**18/10/2019**

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
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Alana Kidd

Manager, Resource Industries

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

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1.0 Definitions and interpretation

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

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
Amendment Notice	refers to this document
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 *Environmental Protection Act 1986* Locked Bag 10, Joondalup DC JOONDALUP WA 6919 info@dwer.wa.gov.au
CS Act	*Contaminated Sites Act 2003* (WA)
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.
DWER	Department of Water and Environmental Regulation
EC	Electrical Conductivity
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
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
Licence Holder	Roy Hill Iron Ore Pty Ltd
Licensee	Roy Hill Iron Ore Pty Ltd
LV	Light Vehicle

MAR	Managed Aquifer Recharge
m	metres
mbgl	metres below ground level
mg/L	milligram per litre
mm	millilitre
Minister	the Minister responsible for the EP Act and associated regulations
ML	megalitre
MS	Ministerial Statement
Mtpa	million tonnes per annum
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
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.
ROM	Run of Mine
Roy Hill	Roy Hill Iron Ore Pty Ltd
RHIO	Roy Hill Iron Ore Pty Ltd
Risk Event	as described in *Guidance Statement: Risk Assessment*
RIWI Act	Rights in Water and Irrigation Act 1914
SWIB	South West Injection Borefield
TDS	Total Dissolved Solids
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
uS/cm	Micro Siemens per centimetre

2.0 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 amendments relating to Category 5, 6 and 64. No changes to the aspects of the existing Licence relating to Categories 12, 52, 54, 57, 73 or 85B have been requested by the Licence Holder.

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

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Environmental Siting (November 2016)*
- *Guidance Statement: Risk Assessment (February 2017)*
- *Guideline: Decision Making (June 2019)*
- *Guideline: Industry Regulation Guide to Licensing (June 2019)*

The Guidance documents are published on the DWER website.

3.0 Amendment Application

On 23 May 2019, Roy Hill Iron Ore Pty Ltd (Roy Hill) (Licence Holder) (Licensee) submitted an application to amend the Roy Hill Mine operating Licence L8621/2011/1. The Licence Holder applied for the following:

- Construction and operation of a 25 million tonnes per annum (Mtpa) crusher and sizer at ROM 3, and an overland conveyor;
- Changes to the frequency of sampling at the Northern and Southern Recharge Basins;
- Approval for light vehicle tyre disposal at Mine Landfill 2;
- Removal of all reference in the Licence to creek discharges for dewater; and
- Administrative corrections.

On 20 June 2019, Roy Hill submitted a further application to amend the Licence. The Licence Holder applied for:

- The discharge of decant water from the Tailings Storage Facilities (TSF) into the existing Managed Aquifer Recharge (MAR) system in the South West Injection Borefield (SWIB); and
- Two additional 100 ML capacity decant Transfer Ponds.

The two Applications are combined into this one Amendment Notice #8.

4.0 Background

The following information is sourced from the Application as referenced in Appendix 1.

4.1 Category 5 - Crushing plant

Installation of a 25 Mtpa crusher and sizer at ROM 3, and an overland conveyor is proposed. The Licence Holder is not seeking an increase in tonnage for Category 5. Whilst there will be additional crushing capacity available, this will not represent an increase in overall capacity of processing. The additional crusher and sizer enables efficient mining from pits further south of the Roy Hill tenure. As the production through ROM 3 increases, the existing crushers will be utilised less to maintain a maximum of 65 Mtpa ore production.

The crushing plant at ROM 3 will consist of:

- gyratory crusher;
- ROM bin;
- conveyor;
- control room; and
- water sprays and chutes for dust suppression.
- An overland conveyor from ROM 3 connecting to the existing conveyor at ROM 2.

The location of the crusher at ROM 3 and overland conveyor is shown in Figure 1 below. The crusher will be located on land already cleared.

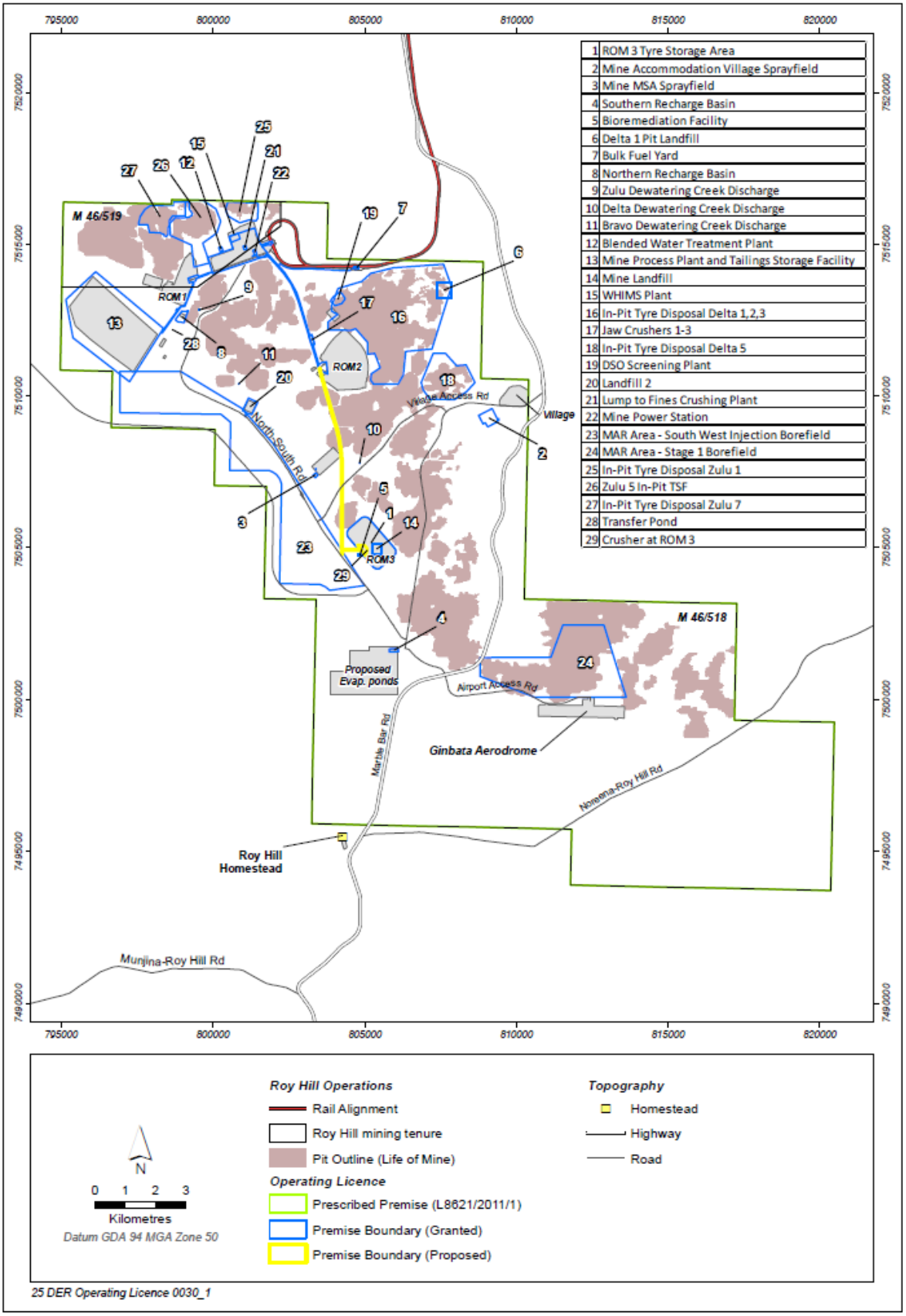
Water for the construction and operation of the crusher will be supplied from the existing production and dewater borefields.

Power will be supplied by the Alinta Power Station in Newman.

4.2 Tyre Disposal

During an inspection by DWER, it was discovered that between amendments of the Licences and the move to operations at Mine Landfill 2, Light Vehicle (LV) tyre disposal into the landfill is no longer permitted. Roy Hill currently have LV tyres stored at Landfill 2 which require disposal. Roy Hill have requested that Table 1.2.2 of the existing Licence is updated to allow tyre disposal into the Mine Landfill 2.

Figure 1: Site Plan



4.3 Monitoring at Northern and Southern Recharge Basins

Roy Hill requested the frequency of sampling required by condition 3.2.1 and Table 3.2.1 be amended from "quarterly" to "quarterly (unless there is no discharge during the quarter)" for the Southern Recharge Basin, Northern Recharge Basin, and Stage 1 and 2 Recharge Basins (not yet constructed). The change would be consistent with existing monitoring conditions for the oily water separators on the Licence.

Roy Hill also requested that monitoring of the flowmeters be changed from flow rates to volumes because the current flowmeters installed on the recharge basins are manual flowmeters that record volumes, but not flow rates.

4.4 Administrative corrections

Dewater discharge

The existing licence includes condition 2.5.1 to approve *Creek discharge from Zulu, Bravo and Delta dewatering areas for a maximum period of 12 months, or when subsequent site-water management strategies have been approved under the Environmental Protection Act 1986, or whichever date comes first.*

Subsequent site-water-management strategies (Managed Aquifer Recharge/reinjection) have been approved through Amendment 6 of the Operating Licence. The amendment application requested that that all reference to creek discharges for dewater is removed from the Licence to reduce possibility of confusion.

Sampling

Roy Hill notes that under Condition 3.6.1 of the existing licence, Total Hardness is required to sample for RHPZ0091 and RHPZ0092. However this is not reflected in reporting in form AGW1. RHIO have requested that AGW1 is updated to include total hardness.

4.5 Decant disposal by MAR

Roy Hill is proposing to dispose of TSF decant water via reinjection into the existing Managed Aquifer Recharge (MAR) system. This will occur via the existing reinjection network into the South West Injection Borefield (SWIB).

Decant water will only be reinjected if it meets the water quality requirements under the existing operating Licence conditions for the SWIB (less than 30,000 mg/L for total dissolved solids (TDS) and less than 40,000 uS/cm for electrical conductivity (EC)).

Decant water chemistry

Roy Hill commissioned GHD to undertake a risk assessment of the impacts from TSF decant water disposal into the existing MAR system for the life of mine at up to 20ML/day (GHD, 2019).

A comparison of samples taken from the existing above ground TSF decant and selected bores in the injection system was undertaken. GHD (2019) determined the following:

- The majority of recorded groundwater pH levels are similar to the TSF decant water median pH (7.50);
- The EC of the decant (1,886 uS/cm) is an order of magnitude lower than receiving aquifer (18,500 uS/cm);
- Concentrations of major cations and anions are generally lower in the decant compared to the groundwater. For instance maximum decant sodium concentration (610 mg/L) is orders of magnitude lower than the maximum groundwater concentration (45,000 mg/L); and

- Concentrations of trace elements in the decant, with exception of selenium and chromium, are generally lower than in groundwater in the SWIB area, with a number of measured trace metals consistently below the detection limit; and
- Nitrate nitrogen median concentration exceeds groundwater concentrations.

GHD predicted contamination plume

Transportation of contaminates of concern (chromium, selenium and nitrate) was modelled by GHD using the MODFLOW model. The assessment suggested the plume of concentration will increase in these three contaminates over the life of mine and post closure, and will be contained within the mining tenement. GHD assessed risk to be of low or negligible to areas outside of the mining tenement.

GHD predicted maximum concentrations will be in the range of 0.005 mg/L to 0.01 mg/L of dissolved total selenium; 0.02 mg/L to 0.05 mg/L of dissolved total chromium and 20 mg/L to 50 mg/L of nitrate. For chromium and nitrate, this would represent an exceedance of ANZECC guidelines trigger values for health and stock watering purposes in parts of the plume during mining and up to 30 years after closure - largely confined to the mining tenement.

GHD (2019) predictive modelling indicated that the nitrate plume will remain within 1 km from the marsh for up to ten years post closure when assuming low attenuation rate. After that, the plume will dissipate until the concentrations become negligible 40 years post closure.

This model has been technically reviewed as part of the assessment of this application (Section 8).

Mounding

RHIO is not seeking an increase in capacity of water reinjected under this application, and therefore it is not considered that the reinjection of decant water will change the expected groundwater levels. Water level is predicted to rise over 10 m in the immediate vicinity of injected bores. Water levels will be maintained 5 m or deeper in the area of injection, considered below the root zone.

RHIO proposes that groundwater level and quality monitoring will continue as per the Mine Monitoring Manual (OP-MAN- 00007) and existing Operating Licence conditions.

4.6 Transfer Ponds

Decant water will be collected in the 60 ML Transfer Pond currently approved on the existing licence for storage of decant water and reject water from the water blending plant for short term purpose of dust suppression.

RHIO is proposing to construct two additional 100 ML ponds located adjacent to the 60 ML pond (located near ROM1). Whilst the 60 ML pond will be the primary discharge of the decant and reject water to MAR, there may be occasions for operational reasons that the 100 ML ponds will be utilised.

The 100 ML ponds will be lined with 1.5 mm of HDPE. A freeboard of 500 mm will be maintained and water levels will be managed with level trips connected to the SCADA system; and ponds will be inspected weekly.

The transfer pipeline will tie into the existing MAR feed approximately 1.2 km from the pumps.

5.0 Other approvals

The Licence Holder has provided the following information relating to other approvals applicable to this amendment as outlined in Table 2.

Table 2: Relevant approvals

Legislation	Number	Approval
Environment Protection and Biodiversity Conservation Act 1999	EPBC No: 2008/4624	Notification of Referral Decision – Not a Controlled Action
Environmental Protection Act 1986 - Part IV	Ministerial Statement (MS) 824 (Stage 1)	Approved 23 December 2009 with subsequent amendments
	MS 829 (Stage 2)	Approved 31 March 2010 with subsequent amendments
Mining Act 1978	Mining Proposal for M46/518 and M46/519 Reg ID 76733 MP Reg ID 78415	Determined 07/12/2018 Approval will be sought for the crusher in an updated Mining Proposal.
Dangerous Goods Safety Act 2004	DGS021489	Dangerous Goods Site Licence
Rights in Water and Irrigation Act 1914 (RIWI Act)	GWL172642(3)	17,000,000 kilolitres per annum approved allocation, 'Licence to Take Groundwater (s5C)' in accordance with the RIWI Act provides authorisation for the ability to: • abstract for the purpose of dewatering; • dust suppression for earthworks and construction purposes; • earthwork and construction purposes; and • mineral ore processing and other mining purposes.
	Amendment to GWL172642 (still under assessment at the time of this amendment)	Online Application submitted 20 June 2018 by Licensee for '*Additional 53 GL/a (total 70 GL/a) annual allocation to meet dewatering demands.'* Updated Groundwater Operating Strategy provided in support of the increased allocation application. Not yet determined at the time of this amendment.

EP Act Part IV – further detail

The Roy Hill Iron Ore Mining Project was approved by MS 824 for Stage 1 on 23 December 2009 and MS 829 for Stage 2 on 31 March 2010.

MS 824 for Stage 1 is to mine iron ore from the Stage 1 project area on the southern slopes of the Chichester Range and develop associated mining infrastructure.

MS 829 for Stage 2 is to mine iron ore from the Stage 2 project area on the southern slopes of the Chichester Range and develop a remote borefield.

MS 824 and MS 829 provide conditions for the management of groundwater drawdown, and groundwater dependent vegetation (from groundwater abstraction):

- Condition 8 of MS 824 and Condition 10 of MS 829 pertain to the protection and management of surface water and groundwater quality in the context of run-off and seepage from waste facilities, evaporation ponds and locations where salt is encapsulated. Monitoring of the surface water and groundwater around the waste fines and evaporation pond storage facilities and locations where the salt is encapsulated is required.
- Several changes to the Key Characteristics Tables of both MS 824 and MS 829 have been approved under section 45C of the EP Act. The authorised Key Characteristics of MS 824 and MS 829 as listed in Attachment 7 and which are relevant to this amendment are:

Element	Authorised Extent
Mine Life	20 years (Stage 1 and Stage 2).
Processing Rate	Removed as regulated under Part V of the *Environmental Protection Act 1986.*
Mine Dewatering	Up to 396 GL total for Stage 1 and Stage 2.
Dewatered Saline Groundwater to be disposed of to Evaporation Ponds	36 GL total for Stage 1 and 2.
Dewatered Saline Groundwater to be used for dust suppression	Up to 3.7 GL/annum for Stage 1 and Stage 2.
Dewatered Saline Groundwater (up to 30,000 mg/L TDS) and RO Plant reject water to be disposed to recharge basins and/or reinjection bores	Up to 55 GL per annum for a period of up to 2 years.

Roy Hill has submitted an EP Act Part IV s38 application for approval for life of mine operations, including for dewatered Saline Groundwater (up to 30,000 mg/L TDS) and RO Plant reject water to be disposed to recharge basins and/or reinjection bores for the life of mine, and for tailings decant water to additionally be disposed to recharge basins and used for dust suppression, for the life of the mine.

The s38 is in the process of assessment at the time of this amendment.

6.0 Amendment history

Table 3 provides the amendment history for the Licence.

Table 3: Licence amendments

Instrument	Issued	Amendment
L8621/2011/1	22/03/2012	New Licence issued approving operation of category 85 (WWTP).
L8621/2011/1	30/05/2013	Amendment to include category 89 (putrescible landfill).
L8621/2011/1	19/09/2013	Amendment to include category 12 (screening of material) and upgrade from category 85 to category 54 (WWTP).
L8621/2011/1	8/5/2014	Amendment to incorporate expansion to the landfill (category 89).
L8621/2011/1	5/2/2015	Amendment to add category 57 (used tyre storage), increase category 64 landfill design capacity and excise land for a small WWTP.
L8621/2011/1	9/4/2015	Administrative amendment
L8621/2011/1	5/11/2015	Amendment to include the Mine Services Area WWTP and update licence template.
L8621/2011/1	7/4/2016	Amendment to include category 6 (dewatering) and 73 (bulk storage of chemicals), construction of northern recharge basin and southern and northern discharge locations to No-name Creek. Removal of Mankarlyikkakurra Exploration Camp.
L8621/2011/1	29/04/2016	Amendment by Notice to extend Licence expiry date to 25/03/2034.
L8621/2011/1	24/11/2016	Amendment to include category 5 operations including ore processing plant (Process Plant) and TSF, the operation of the Mine Process Plant WWTP constructed under W5732/2014/1 (as amended) including an increased WWTP irrigation area of 15,000 m^2, operation and construction of Class II landfill and operation dewatering recharge basins. Removal of conditions related to the discharge of dewatering effluent to the southern and northern discharge locations to No Name Creek, and the monitoring of those emissions, due to expiry of the Office of the EPA temporary authorisation to discharge.
L8621/2011/1	13/1/2017	Amendment Notice 1 - approved operation of TSF evaporators to enhance water evaporation within TSF.
L8621/2011/1	16/11/2017	Amendment Notice 2 –approved changes to the design and construction of the stage 2 raise of the TSF; addition of groundwater monitoring conditions around TSF, administrative changes.
L8621/2011/1	17/11/2017	Amendment Notice 3 – approved construction and operation of a new diesel fired power station, in-pit tyre disposal areas and additional crushing/screening facilities.
L8621/2011/1	29/05/2018	Amendment Notice 4– addition of three creek discharge points for the purpose of scheduled and unscheduled water dewatering water and Process Dam discharge. Addition of category 52 to the front page of this Amendment Notice (administrative only as previously assessed under Amendment Notice 3).

Instrument	Issued	Amendment
L8621/2011/1	31/05/2018	Amendment Notice 5 – addition of 7 new 90 kilowatt (kW) TSF evaporators to increase water evaporation volumes within the TSF.
L8621/2011/1	05/10/2018	Amendment Notice 6 – increase of (category 5) ore processing throughput to 86 Mtpa (wet); construction and operation of 4 Mtpa MSP; increase of (category 6) dewatering disposal volume to 55 GL/a for a period of two years following submission of the construction compliance report for the MAR System; and movement of the (category 54) Mine Process Plant Irrigation Area immediately north of where it currently exists.
L8621/2011/1	13/06/2019	Amendment Notice 7 – Addition of the Zulu 5 In-Pit Tailings Storage Facility; removal of TSF groundwater monitoring bore TSFMW08; addition of Category 85B by a 15 GL/annum Water Blending Plant which incorporates a 14.6 GL/annum Brackish Water Reverse Osmosis Plant; increase the proposed capacity of the approved Mine Power Station; and increase the tyre disposal area.
L8621/2011/1	18/10/2019	Amendment Notice 8 – Approval for Cat 5 crusher, short term discharge of decant to MAR.

7.0 Location and receptors

The Roy Hill Mine is located on mining tenements M46/518 and M46/519, approximately 280km south of Port Hedland and 110km north of Newman.

7.1 Sensitive land uses

The Mine sits wholly within the Roy Hill Pastoral Station, which is currently used for low intensity cattle grazing.

The nearest residence is Roy Hill Station homestead located approximately 9.5 km south of the crusher at ROM 3.

The Fortescue Metals Christmas Creek mining operation is located approximately 20 km to the northwest of the Roy Hill Mining Leases.

The Roy Hill Accommodation Village located within M46/518 adjacent to the eastern boundary of the premises is not considered a sensitive land use for purposes of this assessment, in accordance with *Guidance Statement Risk Assessments.*

7.2 Environmental receptors

The Mine is located within the Fortescue Plains subregion, which comprises extensive salt marsh, mulgabunch grass, and short grass communities on alluvial plains in the east and deeply incised gorge systems in the western (lower) part of the drainage. River gum woodlands fringe the drainage lines and the subregion also supports the northern limit of Mulga (*Acacia aneura*).

An extensive calcrete aquifer (originating within a palaeo-drainage valley) feeds numerous permanent springs in the central Fortescue, supporting large permanent wetlands with extensive stands of river gum and cadjeput *Melaleuca* woodlands (Application 2019a referenced Kendrick, 2001).

Table 4 below lists the specified environmental receptors (Guidance Statement: Environmental Siting) in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

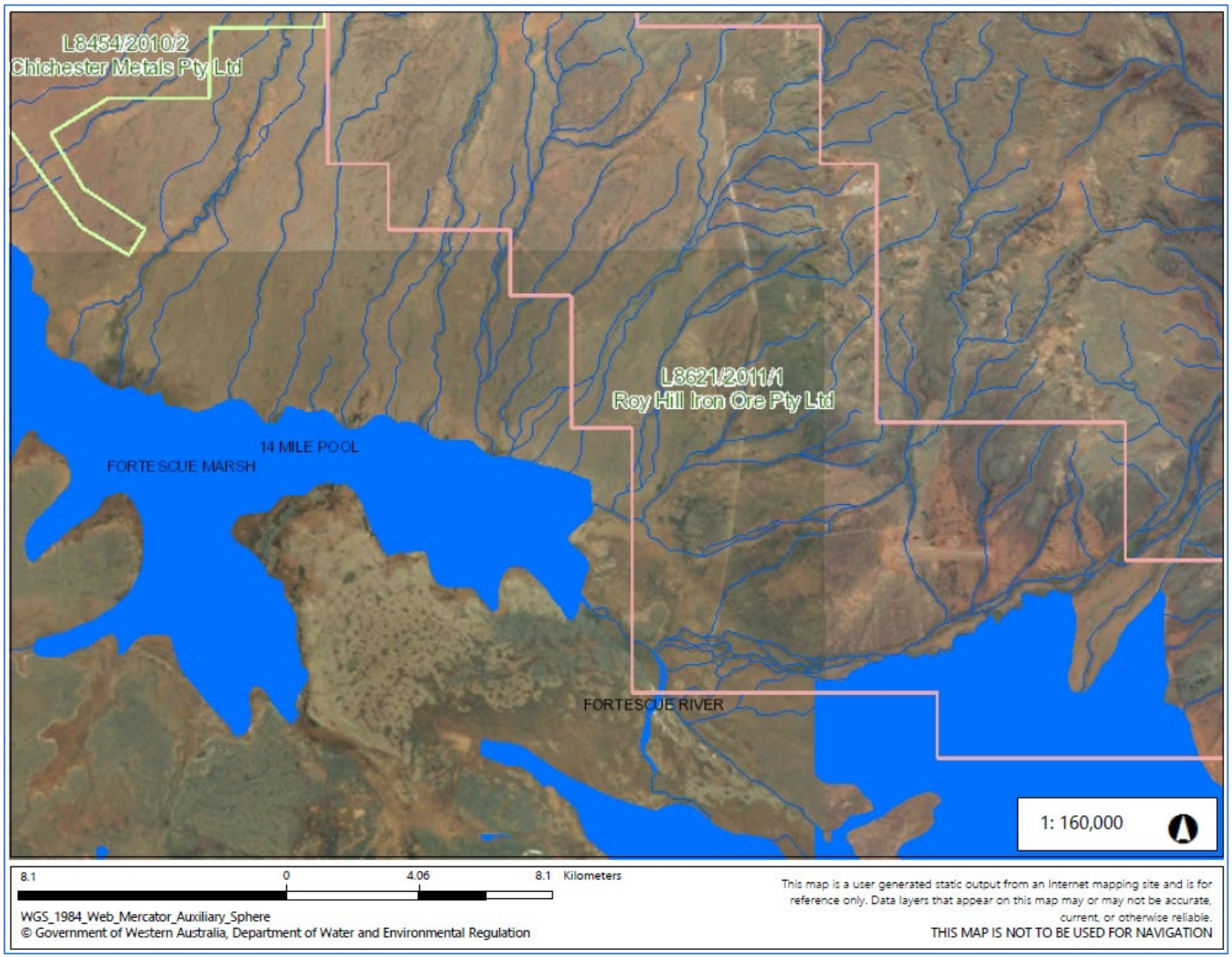
Table 4: Environmental receptors and distance from activity boundary

Environmental receptors	Distance from proposed activities
Fortescue River and Marsh - Priority 1 Ecological Community (PEC), a wetland of national significance and proposed Ramsar Area.	Fortescue Marsh Management Zone approximately 4 km from the crusher, as shown in Figure 2. Dependent on sheet flow and drainage from Kulbee Creek, Kulkinbah Creek and minor creek lines that drain through the mine footprint.
Ephemeral Creeks	The Mine area is drained by several ephemeral creeks that generally flow in a south westerly direction towards the Fortescue River and Marsh as shown in Figure 2. There are no permanent creeks, surface water pools or wetlands within the mine area.
Vegetation	Groundwater dependent and surface water vegetation communities have been identified within the boundaries of the Premises. Five priority flora species have been recorded on the premises. *Rhagodia sp. Hamersley* (Priority 3) has been recorded approximately 800 metres from the crusher. The Crusher will be located within an area described as tall open shrubland over sparse to open shrubs over open grassland.
Groundwater	There are no Public Drinking Water Supply Areas within or adjacent to the RHIO prescribed premises. Salinity of groundwater beneath the project site ranges from 600 to 100,000 mg/L Total Dissolved Solids (TDS). Under natural conditions, depth to natural groundwater at the premises decreases towards the south in the direction of the Fortescue Marsh and is more than 20 mbgl at ROM 3. Under natural conditions, groundwater flows in the south westerly direction towards the Fortescue Marsh, at relatively flat flow gradients with depth decreasing in the direction of the Marsh. Dewatering from the open mine pits will create a large area of depressed groundwater levels with reversed flow gradients. The water levels will be depressed by up to 50 – 70 m below the natural groundwater level. Reinjection of dewater is currently approved for two years, but is currently being assessed under EP Act Part IV s38 for Life of Mine duration. Sustained re-injection of is expected to result in formation of a localised groundwater mound predicted to rise by up to 10 m above natural groundwater level. After dewatering and re-injection ceases, groundwater levels will slowly recover. The recovery of drawdown created by dewatering is predicted to be relatively long-term.

7.3 Surface water runoff

Regional rainfall and runoff is highly variable. Local data indicates that surface flows within drainage lines only occurs during, and for relatively short periods after, significant rainfall. Under these conditions flow response and subsequent recession is typically rapid (Application, 2019).

Figure 2: Surface water features



8 Technical review of forecast impact from decant discharge into MAR (solute transport model)

As discussed earlier, GHD produced a solute transport model to assess the potential impacts of the discharge of the TSF decant water into the surficial aquifer beneath the RHIO mine site using recharge bores.

The model has not considered the chemical reactions that are likely to take place between the high nitrate concentrations in the TSF water and sulfide minerals that are present in the aquifer. Although nitrate concentrations are known to be naturally elevated in groundwater in the area, naturally high NO_3- concentrations probably only occur at the water table and not at the depths where water will be injected in the proposed MAR scheme at the site. At these depths, nitrate will act as a strong oxidising agent that will react with sulfide minerals (mostly pyrite) to release metals and sulfate ions into groundwater.

Consequently, although it is likely that nitrate concentrations in groundwater and the extent of the nitrate plume from the injection site will be much lower than predicted by the GHD model, concentrations of some metals and metalloids in groundwater will be much higher and more extensive than predicted by the model. Additionally, the degree to which concentrations of some metals and metalloids may be attenuated by sorption by aquifer sediments is likely to be lower than predicted near the MAR injection zone.

It is considered that although these differences in concentrations are unlikely to lead to significant environmental impacts in the short to medium-term, the long-term fate of chemical constituents that would be released into groundwater as a result of the discharge of TSF decant water is not known with a high degree of certainty. However, it is considered to be unlikely that concentrations of metals, metalloids and nitrate would be at environmentally significant concentrations when groundwater flow from the MAR injection sites reaches the Fortescue Marsh due to the long travel distance and the large amount of hydrodynamic dispersion and sorption by sediments that would take place in the surficial aquifer over this distance.

Based on this assessment, it is recommended that the Licence Holder should undertake further laboratory- and field-based geochemical studies to characterise the chemical reactions that will take place between the blended MAR water and aquifer sediments. The information obtained from these studies should then be used to develop and calibrate a suitable reactive-transport model to predict the long-term fate and transport of chemical constituents in groundwater from the MAR injection sites.

Total Suspended Solids

The most critical parameter that is likely to affect the operation of the scheme is likely to be the total suspended solids (TSS) content of the water that is injected into the aquifer. This is because water with a high TSS content increases the risk that the aquifer in the vicinity of the recharge area will become physically clogged with fine particles, which would greatly reduce the rate at which recharge could take place.

The clogging can take place by: “surface clogging”, where the particle-size is greater than the size of the pore-spaces in the aquifer; “inner clogging” where the particles can penetrate some distance into the aquifer before clogging pore-spaces; or a combination of these two processes (Du et al., 2014). The extent to which this problem will take place will depend on the physical characteristics of the aquifer, the particle-size distribution of suspended solids in the recharge water and, in particular, the salinity of the recharge water (Du et al., 2019). In the case of fresh water being injected an aquifer, it may be possible to recharge water with a TSS of 100 mg/L on a sustainable basis (Du et al., 2014). However, this may not be possible with the injection of saline water into a saline aquifer as recent research (Du et al., 2019) has found that clogging problems may occur at much lower TSS contents in saline water systems.

This is because fine colloids in saline recharge water can precipitate out in pore-spaces some distance into the aquifer (i.e. this is an “inner clogging” issue) as changes in salinity cause them to precipitate from suspension. This means that the threshold TSS level of concern in saline MAR schemes should be much lower than 100 mg/L, and possibly as low as 25 mg/L, although this value would have to be determined from site-specific investigations.

A plan should be developed to indicate what measures will be implemented in the event that TSS levels in the water discharged to ground consistently exceed this threshold value.

References

Du, X., Fang, Y., Wang, Z., Hou, J. and Je, X., 2014. The prediction method for potential suspended solids clogging types during managed aquifer recharge. Water, 6, 961-975. The paper is available from web site www.mdpi.com.

Du, X., Yalin, S., Xueyan, Y. and Ran, L., 2019. Colloid clogging of saturate porous media under varying ionic strength and roughness during managed aquifer recharge. Journal of Water Reuse and Desalination, 9. The paper is available from web site https://iwaponline.com/jwrd/article/9/3/225/66101/Colloid-clogging-of-saturated-porous-media-under.

9 Risk assessment

Tables 5 and 6 below describe the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments.* Sensitive environmental receptors are defined in *Guidance Statement: Environmental Siting*. Both tables identify whether the emissions present a material risk to public health or the environment, and regulatory controls.

Table 5: Risk assessment for proposed amendments during construction

Source/Activities	Potential emissions	Potential receptors	Potential pathway	Impact	Consequence rating	Likelihood rating	Risk	Reasoning	Regulatory controls
Category 5: Construction of ROM 3 process plant and overland conveyor, and Transfer ponds.	Noise	Closest sensitive land use is Roy Hill Station homestead - 9.5 km south.	Air (wind borne)	Amenity	N/A	N/A	N/A	Distance to closest sensitive land use is sufficient to inform the risk of dust and noise emissions as not foreseeable.	None specified in the Amendment. The *Environmental Protection (Noise) Regulations 1997* are applicable. The general provisions of the EP Act with respect to the causing of pollution and environmental harm apply.
	Dust		Air (wind borne)	Health and amenity	N/A	N/A	N/A		
	Dust	Uncleared vegetation in the vicinity of construction. Five priority flora species have been recorded on the premises. The closest priority species has been recorded approximately 800 metres from the crusher.	Air (wind borne)	Reduced health and viability of vegetation.	Slight	Unlikely	Low	Dust producing activities during construction short term. Distance to sensitive receptors. The Licence Holder proposes to manage dust by using water on access roads during construction.	
	Hydrocarbon spills Stormwater containing hydrocarbons by spills and leaks, from machinery, and sediment from earth moving activities.	Soils The closest Ephemeral creek tributary of the Fortescue Marsh is located 600 m from ROM 3 and the crusher. The Fortescue Marsh is 4 km away.	Direct discharge and along stormwater flow path	Contamination of soils and ephemeral creeks with hydrocarbons. Sedimentation of ephemeral creeks.	Minor	Unlikely	Medium	Construction activities are short term. Distance to sensitive receptors. <u>Licence Holder controls</u> • Spills are managed under the Roy Hill Spill Response Procedure (OP-PRO-00275). • Soil contaminated with hydrocarbon will be taken to the bioremediation facility for treatment. • Stormwater is managed under the Roy Hill Surface Water Management Procedure (OP-PRP-00035). • Locating infrastructure on or in close proximity to major Fortescue March tributaries is avoided.	The amendment will include location of ROM 3 and the crusher. The *Environmental Protection (Unauthorised Discharges) Regulations 2004* will apply. The general provisions of the EP Act with respect to the causing of pollution and environmental harm will apply.

Table 6: Risk assessment for proposed amendments during operation

Source/Activities	Potential emissions	Potential receptors	Potential pathway	Impact	Consequence rating	Likelihood rating	Risk	Reasoning	Regulatory controls
Category 5: Operation of a 25 Mtpa crusher and sizer process plant and overland conveyor.	Noise	Closest sensitive land use is Roy Hill Station homestead - 9.5 km south.	Air (wind borne)	Amenity	N/A	N/A	N/A	Distance to closest sensitive land use is sufficient to inform the risk of dust and noise emissions as not foreseeable.	None specified in the Amendment. The *Environmental Protection (Noise) Regulations 1997* are applicable. The general provisions of the EP Act with respect to the causing of pollution and environmental harm apply
	Dust			Health and amenity	N/A	N/A	N/A		

Source/Activities	Potential emissions	Potential receptors	Potential pathway	Impact	Consequence rating	Likelihood rating	Risk	Reasoning	Regulatory controls
	Dust	Vegetation in the vicinity. Five priority flora species have been recorded on the premises. The closest has been recorded as approximately 800 metres from the crusher.	Air (wind borne)	Reduced health and viability of vegetation.	Slight	Unlikely	Low	Distance to sensitive receptors. <u>Licence Holder controls</u> • Conveyors and loading bin fitted with dust control features – skirt module, internal and external dust curtains, primary and secondary scrapers, wind guards, surge bins, water sprayers and dust collectors. • The overland conveyor is uncovered, but spray bars will be installed at the discharge onto the overland conveyor. • Daily visual inspections	The Licence Holder's infrastructure controls will be conditioned in the amendment as infrastructure construction requirements for the crusher.
	Stormwater containing hydrocarbons by spills and leaks from machinery, and sediment.	Soils and terrestrial vegetation Ephemeral creek lines and riparian vegetation Fortescue Marsh is 4 km away.	Direct discharge and along stormwater flow path	Contamination of soils and ephemeral creeks with hydrocarbons. Erosion and sedimentation impacting terrestrial and riparian vegetation.	Moderate	Unlikely	Medium	ROM 3 and the process plant is located 600 m from the closest ephemeral creek tributary of the Fortescue Marsh. The Fortescue Marsh is 4 km away. <u>Licence Holder controls</u> • Processing plant will be constructed so that surface water will be diverted away from the crusher. • The overland conveyor will be designed to maintain existing surface water flows. • Spills are managed under the Roy Hill Spill Response Procedure (OP-PRO-00275). • Soil contaminated with hydrocarbon will be taken to the bioremediation facility for treatment. • Stormwater is managed under the Roy Hill Surface Water Management Procedure (OP-PRP-00035).	The Licence Holder's infrastructure controls will be conditioned in the amendment as infrastructure construction requirements. The *Environmental Protection (Unauthorised Discharges) Regulations 2004* will apply.
Category 5: Discharge of TSF decant to the SWIB MAR system.	Injection of tailings decant water containing elevated levels of chromium, selenium and nitrate	Groundwater Groundwater dependent vegetation (including Mulga) communities Fortescue Marsh PEC	Direct discharge	Potential increase in concentrations of metals in groundwater with impacts to groundwater dependent vegetation and Fortescue Marsh Potential for water with a high TSS content to clog the aquifer in the vicinity of the recharge area with fine particles, reducing the rate at which recharge could take place.	Moderate - in the short term. Unknown - in the long term	Unlikely - in the short term	Medium - in the short term Unknown - in the long term	Some phreatophytes may opportunistically use groundwater deeper than 5mbgl concentrations. Se, Cr and nitrate concentrations will increase in groundwater during injection. Water with a high TSS content increases the risk that the aquifer in the vicinity of the recharge area will become physically clogged with fine particles, which would greatly reduce the rate at which recharge could take place. The proposal to discharge decant to the MAR system is unlikely to lead to significant environmental impacts in the short to medium-term, however the longer term impact is uncertain. Further geochemical investigations are required. <u>Licence Holder controls</u> • Decant water will be reinjected only if it meets the water quality requirements under the existing operating Licence conditions which for the South West Injection Borefield is less than 30,000 mg/L TDS and less than 40,000 uS/cm for EC. • Water levels will be maintained 5 m or deeper in the area of injection.	Long term approval for disposal of decant to the MAR system is currently being assessed as part of an EP Act Part IV s38 application to amend MS 824 and MS 829. The licence will be amended to approve short term discharge of TSF decant to the SWIB MAR system. Monitoring is required to assess whether the scheme is functioning effectively and evaluate impacts to groundwater quality. Chromium and selenium will be added to parameters monitored in the injection water, as measured on a quarterly basis, due to elevated concentrations in the decant water and their high mobility in under near neutral to alkaline pH values when present in their hexavalent oxidation states. TSS will be added to the suite of parameters that are measured in water that is discharged through MAR, measured on a monthly basis. The Applicant proposed (by comments on the draft amendment in Schedule 2) a trigger level of 25 mg/L with management actions on exceedance of the trigger level

Source/Activities	Potential emissions	Potential receptors	Potential pathway	Impact	Consequence rating	Likelihood rating	Risk	Reasoning	Regulatory controls
									in place of a 25 mg/L limit proposed by the Delegated Officer. The trigger level and management actions is considered adequate to manage risk in the short term, and monitoring will contribute to better background information for longer term discharge. The Licence Holder will also be required to undertake further laboratory and field geochemical studies to characterise the chemical reactions between decant water discharged to the MAR and aquifer sediments. Initially a scope of work will be required to be submitted for the CEO review prior to conditioning the studies. The suite of chemical parameters for monitoring groundwater remains adequate for short term use.
Category 5: Transportation of TSF decant water to the SWIB MAR recharge system – approximately 1.2 km.	Rupture/Spills - Decant water containing elevated nitrate concentration and metalloid contaminants.	Soils and terrestrial and riparian vegetation. Five priority flora species have been recorded on the premises. Ephemeral creeks draining to Fortescue Marsh PEC	Direct discharge to ground and spill flow path	Inundation of vegetation, and soil contamination inhibiting vegetation growth by accumulation of salts and some elevated metals	Moderate	Unlikely	Medium	There are no permanent creeks, surface water pools or wetlands within the mine area. The premises is drained by several ephemeral creeks that generally flow towards the Fortescue River and Marsh - 4 km away. Decant water pipeline will travel 1.2 km to the existing MAR feed. <u>Licence Holder Controls</u> • Pipeline/pumps will be fitted with pressure transducers which will be fully visible on the water SCADA system, which notes flows, pressures and triggers alarms when readings are too high or low. • The pipelines will be visually inspected weekly.	Licence Holder controls will be included in the licence as construction and inspection requirements.
Category 5: Storage of decant and reject water in 2 x 100 ML transfer ponds.	Overflow and seepage of decant and reject water, with nitrate, metalloids and salinity.	Soils, vegetation, surface water and riparian vegetation in the path of overflow. Groundwater approximately 40 mbgl at ROM 1 (pre mining)	Direct discharge to ground and spill flow path Infiltration of seepage through ground	Inundation of vegetation, and soil contamination inhibiting vegetation growth by accumulation of salts and some elevated metals.	Minor	Unlikely	Medium	There are no permanent creeks, surface water pools or wetlands within the mine area. The premises is drained by several ephemeral creeks that generally flow towards the Fortescue River and Marsh - 4 km away. <u>Licence Holder controls</u> • Each pond will be lined with 1.5 mm thick HDPE; • 500 mm freeboard and water levels will be managed with level trips connected to the SCADA system; and • Ponds inspected weekly.	Licence Holder controls will be included in the licence as construction and inspection requirements for the ponds.
Category 64: landfilling of tyres at Landfill 2.	Fire and smoke with toxic chemicals.	Terrestrial and riparian vegetation. Five priority flora species have been recorded on the premises Fauna	Airborne and fuel path.	Fire damage to vegetation, and death of fauna - may be extensive dependent on conditions at the time of a fire.	Moderate	Unlikely	Medium	A tyre fire may be difficult to extinguish and contain toxic chemicals. However, the mine site is remote and not generally accessible to the public. Existing conditions require disposal of tyres to be more than 3 metres above original groundwater level and covering of 1,000 mm of soil as soon as practical following final waste levels in the areas tyres are deposited.	The existing conditions remain applicable and tyre disposal to Landfill 2 will be added to the Licence. Requirements for landfilling tyres are set out in Part 6 of the *Environmental Protection Regulations 1987*. Additional requirements for the acceptance and landfilling of controlled waste (including asbestos and tyres) are set out in the *Environmental Protection (Controlled Waste) Regulations 2004*.

10 Decision

As outlined in Tables 5 and 6, the Delegated Officer has determined to grant the amendment for construction and operation of a 25 Mtpa crusher and sizer at ROM 3, overland conveyor, and two 100 ML decant transfer ponds. Disposal of tyres to Mine Landfill 2 and short term discharge of tailings decant to the MAR system is also approved.

Conditions are amended in accordance with the assessment of risk, and as described in Tables 5 and 6.

10.1 Amendments

Condition 1.2.4, Table 1.2.2 is amended to allow tyre disposal into the Landfill 2 and formatting corrections made to the Table.

Condition 1.2.11, Table 1.2.4 is amended to include the operational storage requirements of the additional two x 100 ML transfer ponds, and for storage of decant for discharge to the SWIB MAR system for two years.

Condition 1.2.12, Table 1.2.5 is amended to include inspection of the pipelines transporting decant water and reject water from the Transfer Ponds.

Condition 1.2.14, Table 1.2.6 is amended to include works specifications of the crusher at ROM 3, overland conveyor, two x 100 ML transfer ponds, and transfer pipeline infrastructure. Submission of construction compliance documentation is required by conditions of the existing licence.

Condition 2.2.1, Table 2.2.1 is amended to include disposal of decant to SWIB Injection Bores for a two year period.

Condition 3.2.1, Table 3.2.1 for monitoring of point source emissions to groundwater is amended to include parameters Total Suspended Solids (sampled monthly) and chromium and selenium (sampled quarterly) for the SWIB injection bores.

New condition 3.2.2 is added for further investigations to characterise the chemical reactions between blended MAR water and aquifer sediments.

New condition 3.2.3 is added for a trigger level of 75 mg/L with management actions for Total Suspended Solids, with reference to monitoring required by condition 3.2.1. Trigger level exceedences and management actions undertaken are added to AER reporting requirements.

10.2 Minor/administrative amendments

Condition 2.5.1 is removed because discharged of dewater to the MAR system was approved by Amendment 6 and the option to discharge dewater to the creek is no longer required. Conditions 1.2.14, 2.5.1, 2.5.2, 2.5.4, 3.6.1, 3.6.2, 3.6.3 and reporting conditions are amended to account for removal of creek discharge for dewater conditions.

Condition 3.2.1, Table 3.2.1 is amended for frequency of sampling at the Southern Recharge Basin, Northern Recharge Basin, and Stage 1 and 2 Recharge Basins from *"quarterly"* to *"quarterly (unless there is no discharge during the quarter)"*, and recording of total volume of discharge rather than flow rates. The Delegated Officer considers that risk is not increased by the changes.

Condition 4.2.1, Table 4.2.1 and Form AGW1 are amended to include reporting of the Table 3.6.1 monitoring parameter Total Hardness.

11 Licence Holder's comments

The Licence Holder was provided with the draft Amendment Notice on 17 September 2019.

Comments received from the Licence Holder have been considered by the Delegated Officer as shown in Appendix 2.

12 Amendment

1. Condition 1.2.4, Table 1.2.2 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

1.2.4 The Licensee shall ensure that wastes accepted onto the Premises are only subjected to the process(es) set out in Table 1.2.2 and in accordance with any process limits described in that Table.

Table 1.2.2: Waste processing		
Waste type	**Process(es)**	**Process limits[1,2]**
Inert Waste Type 1 Putrescible Waste	Receipt, handling and disposal of waste by landfilling	Disposal of waste by landfilling shall only take place within the Landfill, Landfill 2 and Delta 1 Pit Landfill shown on the Premises map in Schedule 1. The separation distance between the base of the landfill and the highest groundwater level shall be greater than 3 m. Disposal of waste shall not exceed 3,000 tonnes per annual period. The size of the tipping face is kept to a minimum and not larger than 30 m in length. Must meet the acceptance criteria for a Class II landfill[3].
Clean Fill		
Inert Waste Type 2[1]	Receipt, handling and ~~disposal~~ **landfilling or storage** of waste ~~by landfilling~~	Disposal of Inert Waste Type 2 shall not exceed 5,000 tonnes per annual period and shall only include tyres, conveyors and HDPE pipe. Tyre disposal shall only occur **at Landfill 2 and the** in-pit Tyre Disposal areas within the Delta pit (Delta 1, 2, 3 & 5) and Zulu mine pit (Zulu 1 and 7) and ROM 3 Tyre Storage Area identified on the Premises maps in Schedule 1. Base of In-pit Tyre Disposal areas shall be greater than 3 m above original groundwater level. Not more than 5,000 used tyres shall be stored at the Premises at any one time. Storage of used tyres in the ROM 3 Tyre Storage Area shown on the Premises map in Schedule 1 shall only occur in units not more than 100 tyres. Used tyres must be stacked on their side walls or if stored on treads, the area shall be baled with a securing device made of non-combustible material. A separation distance of 6 m must be maintained between units.

Table 1.2.2: Waste processing		
Waste type	**Process(es)**	**Process limits[1,2]**
Sewage	Biological, physical and chemical treatment	Treatment of sewage waste at the MSA and Mine process Plant WWTP shall be at or below the treatment capacity of 48 m^3/day and 35 m^3/day respectively.
Sewage	Biological, physical and chemical treatment	Treatment of sewage waste at the Accommodation Village WWTP shall be at or below the treatment capacity of 510 m^3/day

Note 1: Requirements for landfilling tyres are set out in Part 6 of the *Environmental Protection Regulations 1987*.
Note 2: Additional requirements for the acceptance and landfilling of controlled waste (including asbestos and tyres) are set out in the *Environmental Protection (Controlled Waste) Regulations 2004*.
Note 3: Defined in the Landfill Definitions.

2. Condition 1.2.11, Table 1.2.4 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

1.2.11 The Licensee shall ensure that tailings material, dewatering water, blended water, **reject water, decant water** and hydrocarbons are only stored and/or treated within vessels or compounds provided with the infrastructure requirements specified in Table 1.2.4 and identified in Schedule 1.

Table 1.2.4: Containment infrastructure		
Containment cell or dam number(s) as depicted in Schedule 1	**Material**	**Infrastructure requirements**
TSF	Tailings	A minimum top of embankment freeboard of 1,200mm[1] is maintained. Methods of operation minimise the likelihood of erosion of the embankments by wave action. The supernatant pond on the TSF is minimised as far as possible. Final perimeter embankment height of 456 m RL.
Z5 IPTSF	Tailings	Maximum pond elevation of 442.2 mRL with emergency overflow invert level of 444.0 mRL. The supernatant pond on the TSF is minimised as far as possible.
Process Water Dam	Mine dewatering water, tailings return water and water from the Stage 1 borefield.	HDPE lined (1.5 mm thickness) dam, which stores water prior to use in the mine process plant.
Three Transfer Pond**s**	Reject water from the Water Blending Plant. Tailings decant water. (Storage for purposes of dust suppression **or for discharge to the SWIB MAR system.** ~~for up to two years from date of issue of Amendment Notice 7~~	**Three ponds: one** 60 ML capacity**; and two 100 ML capacity** HDPE lined (1.5 mm thickness) Freeboard of 500 mm maintained

Table 1.2.4: Containment infrastructure		
Containment cell or dam number(s) as depicted in Schedule 1	**Material**	**Infrastructure requirements**
Bulk Fuel Yard	C1 Combustible Liquid (diesel)	Two 2,765,000 litre storage tanks situated inside a HDPE lined bund, with bund permeability no less than 10^{-9} metres per second. Bund height sufficient to prevent surface water ingress up to 500 mm deep. Bund floor with both mechanical and fire protection in the form of clean fill and sloped and graded to allow drainage to sump. Ring beam has floor leak detection indicators.
Southern Recharge Basin Northern Recharge Basin	Mine dewatering water	Discharge controlled over a rock lined surface to the base of the basin to reduce erosion. Diversion drains installed to divert stormwater around the basins. Basins are fully fenced.
Stage 1 Recharge Basin Stage 2 Recharge Basin	Mine dewatering water	Minimum 2.25 m deep. Spoil material to be stockpiled on the upslope side to prevent surface water runoff entering the basins. Minimum operational freeboard of 0.25m. Basins are fully fenced.

3. Condition 1.2.12, Table 1.2.5 of the Licence is amended by the insertion of the bold text shown in underline below:

1.2.12 The Licensee shall:

(a) undertake inspections as detailed in Table 1.2.5;

(b) where any inspection identifies that an appropriate level of environmental protection is not being maintained, take corrective action to mitigate adverse environmental consequences as soon as practicable; and

(c) maintain a record of all inspections undertaken.

Table 1.2.5: Inspection of infrastructure		
Scope of inspection	**Type of inspection**	**Frequency of inspection**
Tailings delivery pipelines	Visual integrity	Daily
Tailings return pipelines	Visual integrity	Daily
Z5 IPTSF and TSF Embankment freeboard	Visual to confirm required freeboard capacity is available	Daily
Transfer Pond**s**	Visual to confirm required freeboard capacity is available	Weekly
WBP reject water pipelines	Visual integrity	Weekly
Pipelines from the Transfer Ponds	**Visual integrity**	**Weekly**

Mine dewater pipelines	Visual integrity	Weekly
Tailings facility evaporators	Visual integrity	Daily
Weather Station	Functionality and calibration	Monthly
Automated Programmable Logic Control (PLC) system	Calibration	Annually
	Functionality	Monthly

4. Condition 1.2.14, Table 1.2.6 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

1.2.14 The Licensee must not depart from the specifications in Table 1.2.6 except:

(a) where such departure is minor in nature and does not materially change or affect the infrastructure; or

(b) where such departure improves the functionality of the infrastructure and does not increase risks to public health, public amenity or the environment; and

(c) all other Conditions in this Licence are still satisfied.

Table 1.2.6: Works specifications	
Column 1	**Column 2**
~~Bravo Dewatering Creek Discharge location~~	~~1. Construction and placement of rock rip-rap in the defined creek bed/channel (at 'Bravo Dewatering Creek Discharge' as shown on the Map of dewatering bore areas and creek discharge points in Schedule 1) to minimise erosion and vegetation disturbance~~ ~~2. Spreader pipe to disperse flow across the rip-rap area.~~ ~~3. Flow meter near the discharge point to record discharge volumes.~~ ~~4. Pipelines are/will be buried beneath road and creek lines.~~ ~~The length (to nearest bore of the pipeline to the discharge point) will be approximately 7.5km.~~
Mine Power Station	1. Comprised of: • 56 x Caterpillar 3516B (XQ2000) diesel generators; • 2 x 110,000L double skinned diesel storage tanks; 28 x transformers in self-bunded modules; • 1 x 27,000L self-bunded lube storage tank; and • 1 x (OWS) system, designed to treat stormwater to less than 15mg/L total petroleum hydrocarbon; 2. Constructed as the map of the Mine Power Station shown in Schedule 1; and 3. Exhaust emissions from each generator via two 0.45m diameter stacks at a height of 2.9m above ground level at a velocity of 34.6m/s
Cell 2 TSF evaporators	1. Installation of seven Minetek 90kW evaporators on Cell 2 decant Causeway. 2. Automated PLC System. 3. Diesel generators that: • have 110% tank capacity spill protection, including a double bunded base; • have hydrocarbon fill-points with adequate spill-collection installed to prevent spills on the decant causeway and into the TSF; • are safely accessible for refuelling;

Table 1.2.6: Works specifications	
Column 1	**Column 2**
	• spill kits available at each (generator) location.
MSP	1. Switch rooms. 2. Scrubber. 3. Reagent Storage Area. 4. Concentrate Thickener. 5. Tailings Thickener. 6. Water Services Area (Water Storage tanks for MSP operation). 7. De-slime cyclone. 8. Hydro-separators. 9. Concentrate Storage Tank. 10. Return water pipeline (directed to Process Water Dam). 11. Earthen bunding to separate MSP area from Mine Process Plant Irrigation Area, functional to retain surface water flow
MAR System – reinjection bores	1. Install monitoring equipment on up to 50 reinjection bores (located within SWIB and Stage 1 Borefield as shown on the MAR Trial areas map in Schedule 1). 2. Each reinjection bore to be equipped with flow meter, Electrical Conductivity sensor, water level sensor and sample tap.
MAR System – recharge basins	1. Install two unlined recharge basins (Stage 1 and Stage 2 recharge basins as depicted on the maps in Schedule 1) to be located outside flood channels to dispose of excess dewatering water, to the following dimensions and characteristics: • Each basin is to be a minimum 2.25 m deep; • Spoil material from the basin construction to be stockpiled on the upslope side of the construction to prevent surface water runoff entering the basin; • Basins to be located outside of flood channels and surface water runoff areas to prevent groundwater egress or surface water ingress; and • Constructed for minimum operational freeboard of 0.25m. 2. Pipework to the basins to be connected to the higher quality dewatering network only via direct feed HDPE pipelines. 3. Feed lines to contain: • Isolation valves; • Magnetic flow meter; and • Electrical conductivity sensor. 4. Float valves to be installed: • One solenoid control (acting as the primary control); and • One mechanical control (acting as the secondary control) to allow for maintenance of freeboard. 5. Level transmitter to manage water level and primary solenoid control.

Table 1.2.6: Works specifications	
Column 1	**Column 2**
	6. All instrumentation connected to a telemetry panel which will transfer data back to a centralised Supervisory Control and Data Acquisition screen. 7. Ability for manual shutdown of feed water delivery. 8. Stock exclusion fencing and human exclusion signage erected.
Z5 IPTSF	1. Construction of Embankments 1 and 2 to complete the perimeter of the TSF and to isolate the TSF from the ongoing mining activities. 2. Embankment 1 constructed by the backfilling of pit Z601 with mine waste and Embankment 2 constructed by mining and partial backfilling of pit Z7 with mine waste. 3. A 20m wide channel constructed at an inlet level of 444.0mRL to direct flood contingency discharge into No Name Creek downstream. 4. Located and constructed as shown on the maps in Schedule 1, titled *Premises map* and *Map of Zulu 5 IPTSF - general arrangement.*
Z5 IPTSF tailing delivery system	1. The tailings delivery system to utilise the existing Tailings Pump Station (TPS) at the Process Plant. Downstream of the existing magflow and density meters, a new tie-in to be installed to connect to the new tailings delivery pipelines. 2. The new pipelines will utilise the same materials, sizes and pressure classes as the existing lines where feasible. The tie-in will occur in the DN450 High Density Polyethylene (HDPE) lined carbon steel portion of the lines. The new lines will continue with this material until the design pipeline pressure reduces sufficiently to safely allow the use of HDPE piping. 3. The transition from steel to HDPE to occur approximately at the base of Levee 7. A silt trap constructed at this location to contain any potential leaks from the change in pressure rating. Each line to have a burst disc installed near this location and be installed such that pipes will discharge into the Z5 IPTSF directly. 4. Magflow meters to be installed at Levee 7 to enable automated fast shutdown sequence. 5. A pressure switch directly downstream of the burst disc to automatically detect rupture of a burst disc to start fast shutdown sequence. 6. Pipe alignment will be parallel to roads where practicable and will be protected from vehicle interactions by windrows and culverts at road intersections 7. Located as shown on the map in Schedule 1, titled *Map of Zulu 5 IPTSF general arrangement*.
Z5 IPTSF Tailings deposition ring main and spigots	1. The deposition ring mains to be installed in two branches around the perimeter of the Z5 IPTSF, with 3 deposition spigots on each branch. 2. The ring mains to be installed with a 30m setback from the edge of the pit or mine waste backfill. 3. The deposition spigots to be DN450 PN16 HDPE pipe. The pipe will not be slotted for approximately the first 2 m after the turn-down elbow, to prevent any early release of tailings from the top of the spigot. 4. The spigots will extend down between 20 to 40m to ensure discharge is beyond the erodible zones.

Table 1.2.6: Works specifications	
Column 1	**Column 2**
	5. Located as shown on the map in Schedule 1, titled Map of Zulu 5 IPTSF - general arrangement
Z5 IPTSF Return water system	1. Three skid mounted pumps and dual HDPE return water lines located on an access ramp. 2. Return water line to tie into the existing return water line via manually operated valves. 3. Each return water pump skid controlled remotely via telemetry. 4. A flow meter to be installed at the tie in location to monitor flow rates. 5. Where vehicular crossings are required, the pipeline will be direct buried. Light Vehicle crossings will have a minimum of 1000mm cover, and Heavy Vehicle crossings will have a minimum of 1500mm cover. 6. All buried pipe will be a minimum pressure rating of PN10. 7. Decant to discharge to the Mine Process Plant and Transfer Pond. 8. Located as shown on the map in Schedule 1, titled *Map of Zulu 5 IPTSF - general arrangement*
Water Blending Plant (WBP)	1. Stage 1 - capacity of 20.5ML/day (7.5 GL/annum) incorporating a 7.3 GL/annum Brackish Water Reverse Osmosis (BWRO) Plant. 2. Stage 2 - upscaling by replicating Stage 1 for total capacity of 41 ML/day (15 GL/annum) (Stage 2). 3. Located on the western end of the Mine Process Plant area as shown on the Premises map in Schedule 1. 4. Constructed with a bunded concrete floor with drains - to contain and collect spills. 5. The Stage 1 WBP will consist of the following plant and equipment: • Feed water Tank (2ML); • 7 Multimedia filtration (MMF) units and MMF backwash system; • 5µm cartridge filtration; • RO - 4 x 5ML/day units; • Permeate water blending tank (1ML); • Blended Water Tank (2ML); • Waste Water Storage Tank (1ML); • Transfer and pumping systems; • Chemical dosing system; and • Chemical storage. 6. Chemicals delivered in 1kL Intermediate Bulk Containers (IBC) and stored in double skin chemical containers. 7. IBC bulk containers drain to a containment tank in the chemical storage unit. 8. Pipework is run within the confines of the bunded concrete floor of the WBP.

Table 1.2.6: Works specifications	
Column 1	**Column 2**
	9. Saline reject water collected in the waste water tank pumped to the Dust Suppression Pond, or pumped direct to the Managed Aquifer Recharge (MAR) system.
Transfer Pond**s**	1. **One** pond **with** capacity of 60 ML; and two ponds each with capacity of 100 ML 2. **All ponds** lined with 1.5 mm **thick** HDPE. 3. Freeboard and water levels managed with level trips connected to the SCADA system. 4. Located as shown on the as shown on the Premises map in Schedule 1.
Pipelines from Transfer Ponds to the SWIB MAR system and dust suppression storage	**1. Constructed in cleared areas, and buried beneath road crossings and buried through creek crossings to maintain surface water flow.** **2. Pipelines fitted with pressure transducers and connected to the SCADA system (for detection of flow or pressure anomalies, and alarms).**
Z5IPTSF Groundwater monitoring bores	1. Monitoring network established, designed to enable mounding from the TSF to be detected by standing water level. 2. Installed prior to deposition of tailings. 3. Final siting of monitoring wells determined under advice by an experienced hydrogeologist. 4. Bore logs submitted to the CEO.
25 Mtpa capacity Crushing plant (gyratory crusher and ROM bin) at ROM 3	**1. Located as shown on the as shown on the Premises map in Schedule 1.** **2. Constructed so that surface water will be diverted away from the crusher and processing areas.** **3. Conveyors and loading bin fitted with dust control features – skirt module, internal and external dust curtains, primary and secondary scrapers, wind guards, surge bins, water sprayers and dust collectors.**
Overland Conveyor (Rom 3 to ROM 2)	**1. Designed and constructed to maintain existing surface water flows.** **2. Spray bars installed at the discharge onto the overland conveyor.**

5. Condition 2.2.1, Table 2.2.1 of the Licence is amended by the insertion of the bold text shown in underline below:

2.2.1 The Licensee shall ensure that where waste is emitted to groundwater from the emission points in Table 2.2.1 and identified on the map of emission points in Schedule 1 it is done so in accordance with the conditions of this Licence.

Table 2.2.1: Emission points to groundwater		
Emission point reference and location on Map of emission points	**Description**	**Source including abatement**
Southern Recharge Basin Northern Recharge Basin	Disposal of excess water where dewatering production exceeds other mine site demands for dust suppression and construction and when the mine process plant is shut-down for maintenance	Water from mine dewatering
Stage 1 recharge Basin Stage 2 Recharge Basin	Disposal of excess mine pit dewatering water	Water from mine dewatering
SWIB Injection Bores *Installed* RHIB0128, RHIB0129, RHIB0130, RHIB0131A, RHIB0230, RHIB0231, RHIB0232, RHIB0233, RHIB0236, RHIB0238, RHIB0239, RHIB0249, RHIB0250, RHIB0251, RHIB0235, RHIB0252, RHIB0254, RHIB0255, RHIB0258, RHIB0260, RHIB0261, RHIB0262, RHIB0263, RHIB0264, RHIB0266, RHIB0267, RHIB0268, *Proposed* RHIB0235, RHIB0237, RHIB0253, RHIB0265, RHIB0257, RHIB0259	Disposal of excess mine pit dewatering water **Disposal of tailings decant water and/or WBP reject water for a period of up to two years (following submission of the construction compliance report required under condition 1.2.16 for the MAR System).**	Water from mine dewatering **Decant water from Tailings Storage Facilities and/or from the WBP via Transfer Pond/s.**
Stage 1 Borefield Injection Bores *Installed* RHIB0188, RHIB0189, RHIB0190, RHIB0191, RHIB0193, RHIB0194, RHIB0196, RHIB0009, RHIB0275, RHIB0276, RHIB0279 *Proposed* RHIB0023, RHIB0024, RHIB0027, RHIB0030, RHIB0036, RHIB0039, RHIB0277	Disposal of excess mine pit dewatering water	Water from mine dewatering

6. Condition 2.5.1 of the Licence is deleted as shown by the deletion of the text shown in strikethrough below:

~~**2.5.1** Creek discharge from Zulu, Bravo and Delta dewatering areas is to occur for a maximum period of 12 months, or when subsequent site-water management strategies have been approved under the *Environmental Protection Act 1986*, or whichever date comes first.~~

7. Conditions 2.5.2 to 2.5.4 are consequently renumbered to conditions 2.5.1 to 2.5.3.

8. Renumbered Condition 2.5.1, Table 2.5.1 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

~~2.5.2.~~ **2.5.1** The Licensee shall ensure that where waste is emitted to surface water from the emission points in Table 2.5.1 and identified on the map of surface water emission points in Schedule 1, it is done in accordance with the conditions of this Licence.

Table 2.5.1: Point source emissions to surface water		
Emission point reference	**Description**	**Source including abatement**
Zulu Dewatering Creek Discharge location	~~Discharge to No Name Creek~~	~~Water from dewatering of Zulu pit~~ **Process Water Dam discharge**
~~Bravo Dewatering Creek Discharge location~~	~~Discharge to West Kulbee Creek~~	~~Water from dewatering of Bravo pit~~
~~Delta Dewatering Creek Discharge location~~	~~Discharge to Kulbee Creek~~	~~Water from dewatering of Delta pit~~

9. Condition 2.5.4, Table 2.5.2 of the Licence is amended by the deletion of the text shown in strikethrough below:

~~2.5.4~~ **2.5.3** The Licensee shall not cause or allow point source emissions to surface water greater than the limits listed in Table 2.5.2.

Table 2.5.2: Point source emissions limit to surface water			
Emission point reference	**Parameter**	**Limit (including units)**	**Averaging period**
~~Zulu, Bravo and Delta Dewatering Creek Discharge locations~~	~~Total Dissolved Solids (mg/L)~~	~~2, 000 mg/L~~	~~Continuous during discharge for the approved period of up to 31 days per annum with a maximum of 7 days for each scheduled event.~~
	~~Electrical Conductivity (EC) (µS/cm)~~	~~3, 000 µS/cm~~	
Zulu Dewatering Creek Discharge location	Total Dissolved Solids	6, 000 mg/L	Continuous over 4 days of unscheduled process dam water discharge, once every 5 years.
	Electrical Conductivity (EC) (µS/cm)	8, 759 µS/cm	

10. Condition 3.2.1, Table 3.2.1 of the Licence is amended by the insertion of the bold text shown in underline below:

3.2.1 The Licensee shall undertake the monitoring in Table 3.2.1 according to the specifications in that table.

Table 3.2.1: Monitoring of point source emissions to groundwater			
Emission point reference as depicted in Schedule 1	**Parameter**	**Units**	**Frequency**
Southern Recharge Basin and Northern Recharge Basin	~~Volumetric flow rate~~[1] **Total volume**	m^3/day	Continuous
	Duration of discharge	Dates/days	quarterly **(unless there is no discharge during the quarter)**
	Electrical Conductivity[1]	µS/cm	
	Total Dissolved Solids[1]	mg/L	
Stage 1 Recharge Basin	~~Volumetric flow rate~~[1] **Total volume**	m^3/day	Continuous (cumulative)

Table 3.2.1: Monitoring of point source emissions to groundwater			
Emission point reference as depicted in Schedule 1	**Parameter**	**Units**	**Frequency**
Stage 2 Recharge Basin	Duration of discharge	Dates/days	Daily
	Electrical Conductivity[1]	µS/cm	Continuous during discharge
	Total Dissolved Solids[1, 2]	mg/L	
	Total Dissolved Solids[1]	mg/L	Quarterly **(unless there is no discharge during the quarter)**
SWIB Injection Bores *Installed* RHIB0128, RHIB0129, RHIB0130, RHIB0131A, RHIB0230, RHIB0231, RHIB0232, RHIB0233, RHIB0236, RHIB0238, RHIB0239, RHIB0249, RHIB0250, RHIB0251, RHIB0235, RHIB0252, RHIB0254, RHIB0255, RHIB0258, RHIB0260, RHIB0261, RHIB0262, RHIB0263, RHIB0264, RHIB0266, RHIB0267, RHIB0268, *Proposed* RHIB0235, RHIB0237, RHIB0253, RHIB0265, RHIB0257, RHIB0259	Volumetric flow rate[1]	Litres	Continuous (cumulative)
	Duration of discharge	Dates/days	Daily
	Electrical Conductivity[1]	µS/cm	Continuous during discharge
	Total Dissolved Solids[1, 2]	mg/L	
	Total Dissolved Solids[1]	mg/L	Quarterly
	Chromium	**mg/L**	**Quarterly**
	Selenium	**mg/L**	**Quarterly**
	Total Suspended Solids	**mg/L**	**Monthly**
Stage 1 Borefield Injection Bores *Installed* RHIB0188, RHIB0189, RHIB0190, RHIB0191, RHIB0193, RHIB0194, RHIB0196, RHIB0009, RHIB0275, RHIB0276, RHIB0279 *Proposed* RHIB0023, RHIB0024, RHIB0027, RHIB0030, RHIB0036, RHIB0039, RHIB0277	Volumetric flow rate[1]	Litres	Continuous (cumulative)
	Duration of discharge	Dates/days	Daily
	Electrical Conductivity[1]	µS/cm	Continuous during discharge
	Total Dissolved Solids[1, 2]	mg/L	
	Total Dissolved Solids[1]	mg/L	Quarterly

Note 1: In field non-NATA accredited analysis permitted.
Note 2: Calculation from Electrical Conductivity

11. The Licence is amended by the addition of new Condition 3.2.2 as shown below:

3.2.2 Within three months of the date of amendment of Amendment Notice 8 the Licensee shall submit to the CEO a scope of work to conduct laboratory and/or field based investigations to characterise the chemical reactions between blended MAR water and aquifer sediments, in particular to assess extent of reactions between decant water with

elevated nitrate concentrations and potential sulfide minerals present in the receiving aquifer sediments. The scope shall address expected outcomes of the investigations, timeframes to conduct the investigations and the expertise of those conducting the investigations. The results of the investigations shall be suitable to be used to develop and calibrate a reactive transport model to predict the long-term fate and transport of chemical constituents in groundwater at MAR injection sites.

12. The Licence is amended by the addition of Condition 3.2.3 as shown in the bold text in underline below:

3.2.3 The Licensee shall take the relevant management action in the case of a trigger level event in Table 3.2.2.

Table 3.2.2: Management actions

Emission Point reference	Event reference	Trigger Level	Management action
SWIB Injection Bores ***Installed*** **RHIB0128, RHIB0129, RHIB0130, RHIB0131A, RHIB0230, RHIB0231, RHIB0232, RHIB0233, RHIB0236, RHIB0238, RHIB0239, RHIB0249, RHIB0250, RHIB0251, RHIB0235, RHIB0252, RHIB0254, RHIB0255, RHIB0258, RHIB0260, RHIB0261, RHIB0262, RHIB0263, RHIB0264, RHIB0266, RHIB0267, RHIB0268,** ***Proposed*** **RHIB0235, RHIB0237, RHIB0253, RHIB0265, RHIB0257, RHIB0259**	**Monitoring required by Condition 3.2.1, Table 3.2.1 - results for Total Suspended Solids**	**Total Suspended Solids > 75 mg/L**	**Immediately upon identification of an exceedance of the trigger level, the Licence Holder shall undertake an assessment of the reinjection capacity to confirm there is reinjection capacity greater than planned demand. Should the assessment confirm reinjection capacity is not greater than planned demand, the Licence Holder shall undertake contingency actions that will involve but not be limited to undertaking bore rehabilitation or bore replacement.**

13. Condition 3.6.1, Table 3.6.1of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

3.6.1 The Licensee shall undertake the monitoring in Tables 3.6.1 and 3.6.2 according to the specifications in that table.

Table 3.6.1: Monitoring of ambient groundwater quality

Monitoring point reference as depicted in Schedule 1	Parameter	Units	Averaging period	Frequency
RHPZ0091 and RHPZ0092	Standing Water Level	m(AHD)	Spot sample	Quarterly
	pH[1]	pH units		
	Electrical Conductivity	µS/cm		
	Total Dissolved Solids	mg/L		
	Total Hardness			

Table 3.6.1: Monitoring of ambient groundwater quality				
Monitoring point reference as depicted in Schedule 1	**Parameter**	**Units**	**Averaging period**	**Frequency**
	Aluminium (Al), Arsenic (As), Barium (Ba), Boron (B), Cadmium (Cd), Chloride (Cl), Chromium (Cr), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), Sodium (Na) and Zinc (Zn)			
RHZ0091, RHPZ0092 and RHPZ0035	Total Recoverable Hydrocarbons	mg/L		
TSFMW01, TSFMW02, TSFMW03, TSFMW04, TSFMW05, TSFMW06, and TSFMW07	Standing Water Level[1]	m(AHD) metres below ground level	Spot sample	Monthly
Z5 IPTSF[2] monitoring bores located as required by condition 1.2.14	Standing Water Level[1]	m(AHD) metres below ground level	Spot sample	Monthly
~~Bores providing water to the creek discharge points from the Zulu, Bravo and Delta Dewatering Bore Areas~~	~~Electrical Conductivity~~	~~µS/cm~~	~~Daily~~	~~Continuous during discharge~~
	~~Volumetric flow rate [1]~~	~~m^3/day~~		
	~~Total Dissolved Solids Other parameters: Alkalinity ($CaCO_3$), Total Hardness ($mgCaCO_3$), Calcium (Ca), Chloride (Cl), Sulfate (SO_4), Bicarbonate (HCO_3), Carbonate (CO_3), Aluminium (Al), Silver (Ag), Arsenic (As), Boron (B), Barium (Ba), Beryllium (Be), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe),~~	~~mg/L~~	~~Spot sample~~	~~Once, at the commencement of each discharge event~~

Table 3.6.1: Monitoring of ambient groundwater quality				
Monitoring point reference as depicted in Schedule 1	**Parameter**	**Units**	**Averaging period**	**Frequency**
	~~Mercury (Hg), Potassium (K), Magnesium (Mg), Manganese (Mn), Molybdenum (Mo), Sodium (Na), Nickel (Ni), Lead (Pb), Sulfur (S), Selenium (Se), Silicon (Si), Tin (Sn), Strontium (Sr), Titanium (Ti), Thallium (Tl), Uranium (U), V (Vanadium), Zinc (Zn), Nitrite as NO_2, Nitrate as NO_3, Ammonium (NH_4), Total Nitrogen, Total Phosphorus and Total Suspended Solids.~~			
Groundwater monitoring bores regional **Installed** RHPZ0186s, RHPZ0083, RHPZ0088, RHPZ0075, RHPZ0184, RHPZ0185 RHPZ0281S, RHPZ0283S, RHPZ0285S, RHPZ0286S, RHPZ0287S, RHPZ0288S, RHPZ0289S, RHPZ0293S, RHPZ0292S, RHPZ0299S, RHPZ0300S, RHPZ0301S **Proposed** RHPZ0312 **Groundwater monitoring bores adjacent to injection bores:** *Installed* RHPZ0139s, RHPZ0140s, RHPZ0141s, RHPZ0142s,	Standing Water Level[1]	mAHD	Spot samples	Monthly for the first twelve months, then Quarterly
	pH[1]	pH units		
	Oxidation-reduction potential)calibration using Zobell's solution)	Millivolts (mV)		
	Total Hardness Nitrite as NO_2 Nitrate as NO_3 Aluminium (Al), Arsenic (As), Barium (Ba), Bicarbonate (HCO_{3-}), Boron (B), Cadmium (Cd), Calcium (Ca), Chloride (Cl), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Magnesium (M), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Potassium (K), Selenium (Se), Silver (Ag), Silica, (SiO_2), Sodium (Na),	mg/L	Spot sample	Quarterly

Table 3.6.1: Monitoring of ambient groundwater quality				
Monitoring point reference as depicted in Schedule 1	**Parameter**	**Units**	**Averaging period**	**Frequency**
RHPZ0216, RHPZ0128, RHPZ0222, RHPZ0223, RHPZ0240, RHPZ0238, RHPZ0239, RHPZ0217, RHPZ0032, RHPZ0255, RHPZ0256, RHPZ0262, RHPZ0259, RHPZ0264, RHPZ0263, RHPZ0260, RHPZ0277, RHPZ0278, RHPZ0280A, RHPZ0226S, RHPZ0229S, RHPZ0241S, RPHZ0265S, RHPZ0266S, RHPZ0276S, RHPZ0267S, RHPZ0268S, RHPZ0269S, RHPZ0270S, RHPZ0271S, RHPZ0272S, RHPZ0273S, RHPZ0219S, RHPZ0221S, RHPZ0274S, RHPZ0218S, RHPZ0275S, RHPZ0279 *Proposed* RHPZ0306, RHPZ0307, RHPZ0308, RHPZ0309, RHPZ0310, RHPZ0315	Sulfate (SO_4^{2-}), Thallium (Tl), Uranium (U), Vanadium(V) and Zinc (Zn)			

Note 1: In field non-NATA accredited analysis permitted.
Note 2: Sampling and analysis of Zulu5 IPTSF monitoring bores to commence immediately following installation.

14. Condition 3.6.2 is added and Table 3.6.2 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

3.6.2 The Licensee shall undertake the monitoring in Table 3.6.1 according to the specifications in that table.

Table 3.6.2: Monitoring of receiving environment			
Monitoring point reference	**Parameter**	**Details**	**Frequency**
~~Zulu, Bravo and Delta Dewatering Creek Discharge locations~~ **Zulu Creek Discharge point receiving Process Water Dam discharge as specified in Schedule 1 (Map of dewatering**	Establishment, GPS record and operation of permanent photo monitoring points at each emission point to determine vegetation and ecosystem condition	Establishment of fixed focal length - photo points at the following locations to enable capture of a representative picture of vegetation condition: • The discharge location • 150m downstream from discharge location • ~300m downstream from discharge location	First photo to be taken at each fixed location prior to commencement of initial discharge at each emission point and thereafter quarterly from each photo point

Table 3.6.2: Monitoring of receiving environment			
Monitoring point reference	**Parameter**	**Details**	**Frequency**
bore areas and discharge locations)	Distance (m) of (wetting front) flow travelled down creek line.	GPS record of furthest wetting front distance within creek line during each discharge event. To occur when creek is not flowing as a result of a rainfall event.	Within 24 hours of the cessation of every discharge event

15. Table 3.7.1 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

Table 3.7.1: Monitoring of point source emissions to surface water			
Emission point reference	**Parameter**	**Units**	**Frequency**
~~Zulu, Bravo and Delta Dewatering Creek Discharge points as specified in Schedule 1 (Map of dewatering bore areas and discharge locations)~~ Zulu Creek Discharge point receiving Process Water Dam discharge as specified in Schedule 1 (Map of dewatering bore areas and discharge locations)	~~pH[2]~~	~~pH units~~	Continuous during discharge
	~~Volumetric flow rate[1]~~	m^3/day	
	Volume of discharge	**m^3/day**	
	Duration of discharge	Dates/days	
	~~Electrical Conductivity[2]~~	~~µS/cm~~	
	~~Total Dissolved Solids[2]~~	~~mg/L~~	
	pH[2]	pH units	Spot sample at the commencement of each discharge event
	Temperature[2]	°C	
	Dissolved oxygen[2]	mg/L and %	
	Electrical Conductivity[2]	µS/cm	
	Total Dissolved Solids[2]	mg/L	
	Other parameters (mg/L): Alkalinity ($CaCO_3$), Total Hardness (mg$CaCO_3$), Ca, Cl, SO_4, HCO_3, CO_3, Al, Ag, As, B, Ba, Be, Ca, Cl, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, S, Se, Si, Sn, Sr, Ti, Tl, U, V, Zn, NO_2, NO_3, NH_4, Total Nitrogen, Total Phosphorus, TSS.		
	Al, As, Cd, Co, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Zn, V	mg/L[3]	Twice daily during Process Water Dam discharge[3]

Note 1: Flow meter must be operational and calibrated in accordance with the manufacturer's specifications and relevant Australian Standard.
Note 2: In field non-NATA accredited analysis permitted.
Note 3: Twice daily samples are to be used as representative samples to determine EP Regs, Schedule 4, Part 3, Table 2, point: 'Waste that can potentially accumulate in the environment or living tissue (for each kilogram discharged per day)'. Flow rate from Process Water Dam will need to be used to determine volume discharged per day, multiplied by quantity present in representative samples. This information will be required to be presented in Annual Fee calculations, when Process Water Dam is emptied.

16. Condition 4.2.1, Table 4.2.1 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

4.2.1 The Licensee shall submit to the CEO an Annual Environmental Report within 90 calendar days after the end of the anniversary date. The report shall contain the information listed in Table 4.2.1 in the format or form specified in that table.

Table 4.2.1: Annual Environmental Report		
Condition or Table (if relevant)	**Parameter**	**Format or Form[1]**
--	Summary of any failure or malfunction of any pollution control equipment and any environmental incidents that have occurred during the annual period and any action taken	None specified
--	Summary of results from the TSF evaporator vegetation health/soil monitoring program for that annual period, including any exceedance of triggers and management responses, as described within RHIO's Saline Water Disposal Vegetation Management Plan (OP-PLN-00072).	None specified
Tables 1.2.1 and 1.2.7	Actual throughput for the reporting period for approved categories under Schedule 1 of the *Environmental Protection Regulations 1987*, including individual throughput values for the MSP	None specified
Condition 1.2.12	Summary of any failure or malfunction of any infrastructure listed in Table 1.2.5 and any action taken post inspection.	None specified
Table 2.3.1	An updated description of the irrigation area(s) reporting any decline in health, against previous years, and corrective actions	None specified
Condition 2.4.1	Compliance	TSF evaporator hours of use
Table 2.5.2	Compliance	Table demonstrating daily averaged TDS values (using the hourly data) as recorded during creek discharge events.
Condition 2.5.3	Annual water balance of TSF and Z5 IPTSF. Summary of reports detailing the reason for discharge – timing of discharge, volume discharged, water quality and comparison to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality with discussion on elevated results.	None specified
Table 3.2.1	All parameters listed in the Table, and management actions undertaken if trigger level exceeded.	GR1
Condition 3.2.3	**Management actions undertaken if trigger level exceeded, and outcome.**	**None specified**
Table 3.3.1	Monthly records and cumulative volume for each WWTP	None specified

Table 4.2.1: Annual Environmental Report		
Condition or Table (if relevant)	**Parameter**	**Format or Form[1]**
	Biochemical Oxygen Demand, Total Suspended Solids, pH, Total Nitrogen, Total Phosphorus, *E.coli*, Total Dissolved Solids, Total Recoverable Hydrocarbons	LR1
Table 3.5.1	Tailings Storage Facility: volume (m^3) of tailings deposited and volume (m^3) of water recovered.	None specified
Condition 3.5.2	Annual water balance of TSF**s**	None specified
Table 3.6.1	RHPZ0092, RHPZ0091 for the following parameters: Standing Water Level, pH **Total Hardness** Electrical Conductivity, Total Dissolved Solids, Aluminium (Al), Arsenic (As), Barium (Ba), Boron (B), Cadmium (Cd), Chromium (Cr), Chloride (Cl), Copper (Cu), Iron (Fe) Lead (Pb), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), Sodium (Na), Zinc (Zn), Total Recoverable Hydrocarbons. for RHPZ0092, RHPZ0091 and RHPZ0035	AGW1
	TSFMW01, TSFMW02, TSFMW03, TSFMW04, TSFMW05, TSFMW06, TSFMW07 and TSFMW08 standing water level data	Table format providing: monthly Standing water level data
	Z5 IPTSF standing water level data	

Table 4.2.1: Annual Environmental Report		
Condition or Table (if relevant)	**Parameter**	**Format or Form[1]**
Table 3.6.2	Demonstration of vegetation and stream ecosystem condition	**Report providing**: • GPS location, photographic information and comparison of vegetation and stream ecosystem condition between established photographic points; • Information on annual assessment of vegetation health as per the Roy Hill Vegetation Health Monitoring Program. Specifically: - General site condition - Soil surface states - Projected Foliar Cover (PFC), stratum cover dominance and weeds - Recruitment - ample plants - Quantitative parameters. • Discussion on the findings of the vegetation assessment in comparison with the Management objectives and strategies found in EPA, 2013 (for 'Zone 3a – Kulbee Alluvial Flank – Natural water regimes).
Table 3.6.2 and Table 3.6.3	Record of flow distance	Table providing comparison of flow volumes and maximum distance flow has travelled down each creek line for each discharge event.
Table 3.6.1 and Table 3.6.3	~~Monitoring associated with the Bores providing water to the creek discharge points from the Zulu, Bravo and Delta Dewatering Bore Areas; and~~ Monitoring of point source emissions to surface water.	Table format providing dates of creek discharge duration and results ~~and comparison of results between groundwater samples from bores providing water to the discharge points from the Zulu, Bravo and Delta Dewatering Bore Areas (data required in Table 3.6.1)~~ and results from Table 3.6.3.
Table 3.6.1	Monitoring of the groundwater monitoring bores regional and groundwater monitoring bores adjacent to the production injection wells	All data provided in a tabular format within a report.
Condition 4.1.2	Compliance	AACR form (a template of which available on department's website)
Condition 4.1.3	Complaints summary	None specified
Condition 4.1.4	Records of waste types and quantities received at the site and disposed of at the site	None specified

17. Schedule 1 of the Licence is amended by the deletion of the existing *Premises map* and the insertion of the Premises map bounded by red below.

18. Schedule 1 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below.

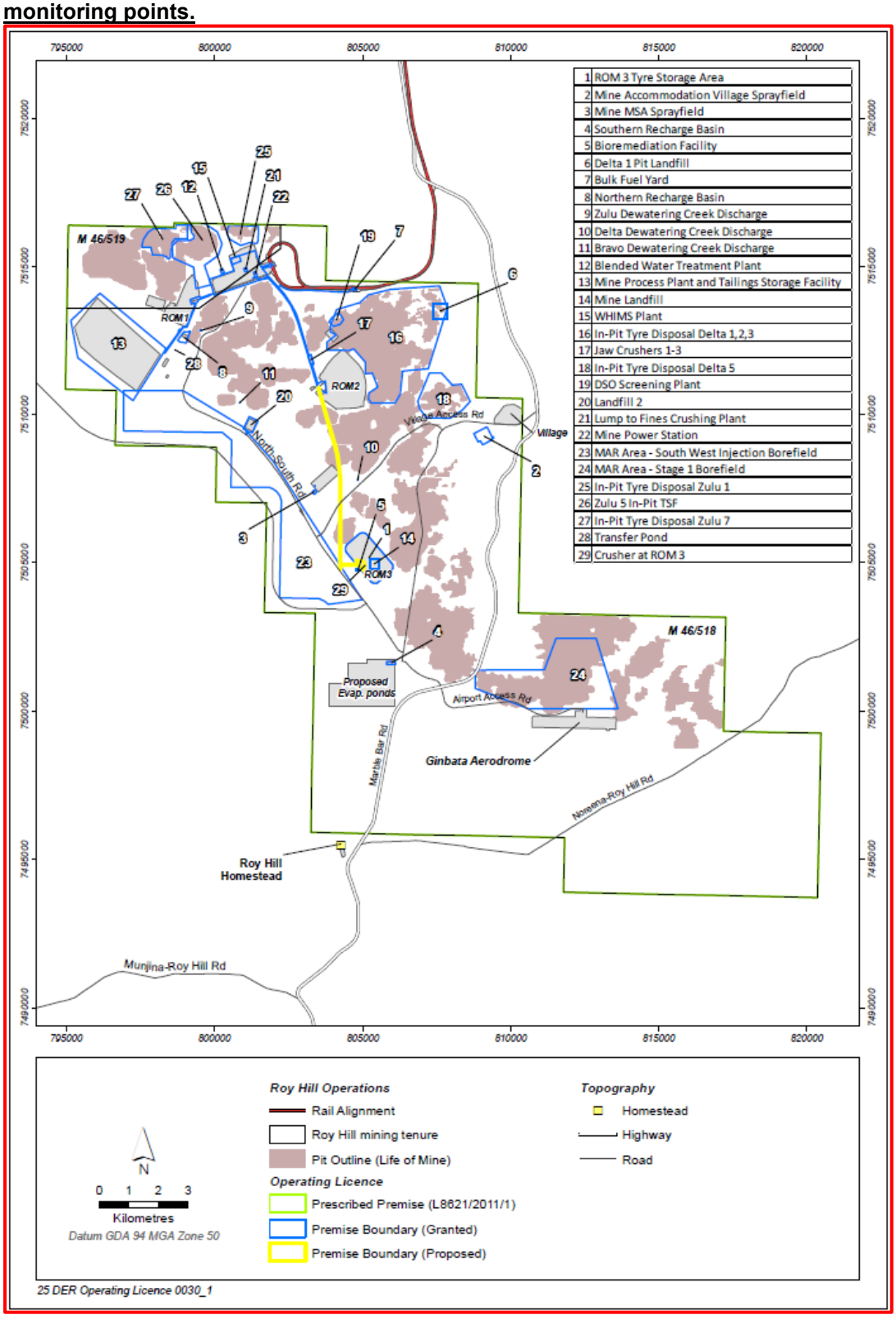
The ~~dewatering bores, pipeline corridors and~~ **Zulu** creek discharge point~~s~~ defined in Tables 3.6.1, 3.6.2 and 3.7.1 ~~are~~ **is** shown in the map below~~. All areas on this map are within the Premises boundary. The bores within the polygons will feed the three corresponding discharge points located within this Map.~~

19. Schedule 3 GR 1 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below.

20. Schedule 3 AGW1 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below.

Premises map

Premises map including waste processing locations, containment infrastructure, emission and monitoring points.



Licence: L8621/2011/1 Licensee: Roy Hill Iron Ore Pty Ltd
Form: GR1 Period:
Name: Monitoring of point source emissions to groundwater

Form GR1: Monitoring of point source emissions to groundwater					
Emission point	**Parameter**	**Result**	**Averaging Period**	**Method**	**Sample date & Times**
Southern Recharge Basin and Northern Recharge Basin	Volumetric flow rate		Continuous		
	Duration of discharge		Days		
	Electrical Conductivity		Spot Sample		
	Total Dissolved Solids				
Stage 1 Recharge Basin	Volumetric flow rate		Continuous (cumulative)		
	Duration of discharge		Daily		
	Total Dissolved Solids		Spot Sample		
Stage 2 Recharge Basin	Volumetric flow rate		Continuous (cumulative)		
	Duration of discharge		Daily		
	Total Dissolved Solids		Spot Sample		
SWIB Injection Bores Installed RHIB0128, RHIB0129, RHIB0130, RHIB0131, RHIB0230, RHIB0232, RHIB0233, RHIB0235, RHIB0252, RHIB0253, RHIB0265, RHIB0267, RHIB0268 Proposed RHIB0231A, RHIB0233,	Volumetric flow rate		Continuous (cumulative)		
	Duration of discharge		Daily		
	Total Dissolved Solids		Spot Sample		
	Total Suspended Solids		**Spot sample**		
	Chromium		**Spot sample**		
	Selenium		**Spot sample**		

Form GR1: Monitoring of point source emissions to groundwater					
Emission point	**Parameter**	**Result**	**Averaging Period**	**Method**	**Sample date & Times**
RHIB0236, RHIB0237, RHIB0238, RHIB0239, RHIB0249, RHIB0250, RHIB0251, RHIB0254, RHIB0255, RHIB0257, RHIB0258, RHIB0259, RHIB0260, RHIB0261, RHIB0262, RHIB0263, RHIB0264, RHIB0266					
Stage 1 Borefield Injection Bores <u>Installed</u> RHIB0188, RHIB0189, RHIB0190, RHIB0191, RHIB0193, RHIB0194, RHIB0196, RHIB009, RHIB0023, RHIB0024, RHIB0027, RHIB0030, RHIB0036,	Volumetric flow rate		Continuous (cumulative)		
	Duration of discharge		Daily		
	Total Dissolved Solids		Spot Sample		

Form GR1: Monitoring of point source emissions to groundwater					
Emission point	**Parameter**	**Result**	**Averaging Period**	**Method**	**Sample date & Times**
RHIB0039, RHIB0275, RHIB0276, RHIB0277, RHIB0279					

Licence: L8621/2011/1 Licensee: Roy Hill Iron Ore Pty Ltd
Form: AGW1 Period:
Name: Monitoring of ambient groundwater quality

Form AGW1: Monitoring of ambient groundwater quality						
Emission point	**Parameter**	**Unit**	**Result**	**Averaging Period**	**Method**	**Sample date & Times**
RHPZ0092 and RHPZ0091	Standing Water Level	m(AHD)		Spot Sample		
	pH	pH units				
	Electrical Conductivity	µS/cm				
	Total Hardness	**mg/L**				
	Total Dissolved Solids	mg/L				
	Chloride	mg/L				
	Sodium	mg/L				
	Aluminium (Al)	mg/L				
	Arsenic (As)	mg/L				
	Barium (Ba)	mg/L				
	Boron (B)	mg/L				
	Cadmium (Cd)	mg/L				
	Chromium (Cr)	mg/L				
	Copper (Cu)	mg/L				
	Iron (Fe)	mg/L				
	Lead (Pb)	mg/L				
	Manganese (Mn)	mg/L				
	Mercury (Hg)	mg/L				
	Molybdenum (Mo)	mg/L				
	Nickel (Ni)	mg/L				
	Selenium (Se)	mg/L				
	Silver (Ag)	mg/L				
	Zinc (Zn)	mg/L				
RHPZ0092, RHPZ0091 and RHPZ0035	Total Recoverable Hydrocarbons	mg/L				

13 Appendix 1: Key documents

	Document title	In text ref	Availability
1	Application Form dated 23 May 2019 and supporting document *Operating Licence Amendment Application – Crusher Installation, OP-APP-0063.* Roy Hill, 21 May 2019	Application	DWER records (DWERDT161929)
2	Application Form dated 6 June 2019 and supporting document *Operating Licence Amendment Application – Decant Water to MAR, OP-APP-00065.* Roy Hill, 20 June 2019		DWER records (A1798823)
3	Email: *RE: L8621/2011/1 Roy Hill amendment notice 8 clarifications and map request*. Sent by Vlad Rios Vera, Roy Hill, 6 September 2019 2:55PM		DWER records (A1821305)
4	Australian and New Zealand Environment Conservation Council (ANZECC) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.	ANZECC guidelines	Accessed at www.waterquality.gov.au/anz-guidelines
	Ministerial Statement 824	MS 824	accessed at www.epa.wa.gov.au
5	Ministerial Statement 829	MS 829	
6	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.	-	accessed at www.dwer.wa.gov.au
7	DER, February 2017. *Guideline Statement: Risk Assessments*. Department of Environment Regulation, Perth.		
8	DWER, June 2019. *Guidance: Decision Making*. Department of Environment Regulation, Perth.		
9	DER, November 2016. *Guidance Statement: Environmental Siting*. Department of Environment Regulation, Perth.		
10	DWER, June 2019. *Guideline: Industry Regulation Guide to Licensing*		
11	Licence L8621/2011/1 – Roy Hill Iron Ore Mine	L8621/2011/1	accessed at www.dwer.wa.gov.au
12	*Roy Hill Spill Response Procedure (OP-PRO-00275)*	-	DWER records (A1821305)
13	*Roy Hill Surface Water Management Procedure (OP-PRP-00035)*	-	DWER records (A1821305)
14	GHD, January 2019. *Roy Hill Iron Ore Pty Ltd TSF Decant Water Disposal Risk Assessment*	GHD, 2019	

14 Appendix 2: Summary of Licence Holder comments

The Licence Holder was provided with the draft Amendment Notice on 17 September 2019 for review and comment. The Licence Holder responded on 14 October 2019, with comments and waiving the remaining comment period. The following comments were received on the draft Amendment Notice.

Condition	Summary of Licence Holder comment	DWER response
1.2.14 (Table 1.2.6)	Roy Hill requests that DWER please remove Bravo Dewatering Creek Discharge location from Table 1.2.6 as creek discharge from Bravo is no longer permitted.	Agreed, final document updated.
	Following additional design requirements of the crusher at ROM 3 it has been determined that the crusher will be a gyratory crusher instead of a jaw crusher. The gyratory crusher will also not have any wind guards. Roy Hill considers that these changes are unlikely to cause any additional environmental impacts and requests that Table 1.2.6 and Section 4.1 are updated to reflect these changes.	Agreed unlikely to cause additional environmental impacts, risk remains the same. Table 1.2.6 and relevant sections edited for the final document
2.2.1 (Table 2.2.1)	Roy Hill notes that under Amendment 8, the timeframe for reinjection of Water Blending Plant (WBP) reject water and decant water is permitted for a period no longer than 2 years from the issue of Amendment Notice 8. Under Amendment 6, as outlined in Table 1.2.7 of the Operating Licence, Roy Hill is only permitted to reinject for a period of up to two years following the submission of the construction compliance report required for the MAR system. Roy Hill suggests that the cease date for reinjection of reject or decant water should potentially be aligned to Table 1.2.7.	Suggestion agreed, and Table 2.2.1 final document is edited.
2.2.2 (Table 2.2.2)	Table 2.2.2 currently reads Total Suspended Solids (TSS) will be monitored continuously during discharge. Elsewhere in the document, it requires TSS to be sampled monthly. Can this Table please be updated to reflect that TSS will be sampled via spot sampling?	TSS is removed from the Table as a trigger level with management actions will apply.
3.2.1 (Table 3.2.1)	Roy Hill would request that TSS sampling is undertaken quarterly. This is consistent with other required sampling for the injection bores and it is believed this would provide adequate data.	Requirement for monthly sampling remains. Monthly monitoring will provide more accurate TSS information being collected for management in potentially the longer term.
3.2.2	Section 8 assumes that there are sulphide minerals in the receiving aquifer. It is also assumed that there is oxidising potential in the aquifer. Roy Hill proposes as a first step to	It is agreed to extend the submission date and include the word “potential” and the final document is updated accordingly.

Condition	Summary of Licence Holder comment	DWER response
	assess oxidising conditions of the aquifer and likelihood of presence of sulphide minerals by amending this condition as follows: *Within ~~two~~ **three** months of the date of amendment of Amendment Notice 8 the Licensee shall submit to the CEO a scope of work to conduct laboratory and/or field based investigations to characterise the chemical reactions between blended MAR water and aquifer sediments, in particular to assess extent of reactions between decant water with elevated nitrate concentrations and **potential** sulfide minerals present in the receiving aquifer sediments. The scope shall address expected outcomes of the investigations, timeframes to conduct the investigations and the expertise of those conducting the investigations. ~~The results of the investigations shall be suitable to be used to develop and calibrate a reactive transport model to predict the long –term fate and transport of chemical constituents in groundwater at MAR injection sites.~~*	The results of the investigation should still be suitable to be used to develop and calibrate a reactive transport model predict the long-term fate and transport of chemical constituents in groundwater at MAR injection sites, in case this is required at a later date
18	It notes Bravo creek discharge points however this should be Zulu.	Typo corrected for the final document
2.2.2 (Table 2.2.2)	Following consultation with Alana Kidd, Lindy Twycross and Steve Apleyard on 7th October and subsequent email from Lindy Twycross on 11th October, Roy Hill proposes the removal of the TSS limit from condition 2.2.2 and instead the addition of a new condition for a management trigger level for TSS. Based on preliminary water quality data available from dewatered groundwater disposed into MAR at the Roy Hill mine, Roy Hill proposes a TSS management trigger level of 75 mg/L. Immediately upon identification of an exceedance of the proposed management trigger level, Roy Hill proposes to undertake an assessment of the reinjection capacity to confirm there is reinjection capacity greater than planned demand. Should the assessment confirm reinjection capacity is not greater than planned demand, Roy Hill would undertake contingency actions that will involve but not be limited to undertaking bore rehabilitation or bore replacement.	With consideration of approval for disposal of water to the MAR system being short term, and the management options proposed, the Limit is removed, and trigger level of 75 mg/L with management actions is applied. Also, additional information regarding TSS and rationale for application of a trigger level included in Section 8 as this was accidentally removed during review of the draft prior to sending to Roy Hill.