Application for Licence

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	L9056/2017/1
Licence Holder	Pilgangoora Operations Pty Ltd
ACN	616 560 395
File Number	DER2017/000318
Premises	Pilgangoora Lithium-Tantalum Project Mining Tenement M45/1256 and L45/417 MARBLE BAR WA 6760
Date of Report	24 July 2019
Status of Report	Final

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1. Definitions of terms and acronyms

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

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AER	Annual Environment Report
Annual Audit Compliance Report (AACR)	means a report in a format approved by the CEO as presented by the Licence Holder or as specified by the CEO (guidelines and templates may be available on the Department's website).
ANZECC/ARMCANZ,	Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australia and New Zealand Environment and Conservation Council and the Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ). Available at http://www.waterquality.gov.au/anz-guidelines/guideline-values/default/primary-industries
Application	The inclusion of all applications, including revised applications and additional information provided in Licence Holder responses to requests for information
ARI	Annual Recurrence Interval
ASC NEPM	*National Environment Protection (Assessment of Site Contamination) Measure 1999.* Available at https://www.der.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/Assessment_and_management_of_contaminated_sites.pdf
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
Decision Report	refers to this document.
Delegated Officer	an officer under section 20 of the EP Act.
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
Discharge	has the same meaning given to that term under the EP Act.
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation.
Effluent	means treated sewage
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
HDPE	High Density Polyethylene
Influent	means un-treated sewage
m^3	cubic metres
Licence Holder	refers to the occupier of the premises being the person to whom this Licence has been granted, as specified at the front of this Decision Report.
mbgl	metres below ground level
Minister	the Minister responsible for the EP Act and associated regulations
mtpa	million tonnes per annum
MW	mega watt
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
Primary Activities	as defined in Schedule 2 of the Revised Licence
Risk Event	As described in *Guidance Statement: Risk Assessment*
RO	Reverse Osmosis
ROM	Run of Mine
tpa	tonnes per annum
TMF	Tailings Management Facility
TMF Cell 1	Cell 1 of the Tailings Management Facility
TMF Cell 2	Cell 2 of the Tailings Management Facility
TMF 1 Stage 1A	Tailings Management Facility Cell 1, Stage 1A to final RL of 185.3 m
TMF 1 Stage 1B	Tailings Management Facility Cell 1, Stage 1B to final RL of 189.3 m
TMF 2 Stage 1A	Tailings Management Facility Cell 2, Stage 1A to final RL of 185.3 m
TMF 2 Stage 1B	Tailings Management Facility Cell 2, Stage 1B to final RL of 189.3 m
TRH	Total Recoverable Hydrocarbons
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004*

	(WA)
µg/L	micrograms per litre
USEPA LEAF 1313	United States Environmental Protection Agency, Leaching Environmental Assessment Framework Method 1313 – *Liquid-solid Partitioning as a function of extract pH using a parallel batch extraction procedure*

2. Purpose and scope of assessment

A concurrent application was received by DWER on 20 January 2017 for a Works Approval and Licence for the Pilgangoora Lithium-Tantalum Project (Premises). The Premises consists of a Processing Plant and Tailings Management Facility (TMF), and support infrastructure including sewage treatment, power generation, fuel storage and a landfill.

The Licence Holder holds Works Approval W6051/2017/1 for construction and commissioning of these facilities that was issued 28 September 2017 and has been subject to three amendments and a transfer, as documented in Section 5.3.

This application seeks a Licence to operate the facilities. This Decision Report documents the risk assessment of emissions and discharges and determination of the application consistent with DWER's *Guidance Statement: Risks Assessment and Guidance Statement: Decision Making* respectively.

2.1 Application details

Table 2 lists the documents submitted during the assessment process.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received	DWER document reference
Application form: Works Approval / Licence / Renewal Amendment / Registration PILGANGOORA WORKS APPROVAL AND LICENCE APPLICATION supporting documentation	20 January 2017	A1770076
Additional appendices	23 January 2017	A177077
Email RE: PILGANGOORA WORKS APPROVAL AND LICENCE APPLICATION	5 May 2017	A1424492
Email: RE: Pilgangoora documentation	20 June 2017	A1459267
Additional information for inclusion in PML Works Approval and Licence Application currently under assessment	19 July 2017	A1483348
Tailings Management Facility Technical Specification for Cell 1 Stage 1A Construction prepared by ATC Williams August 2017 (115275.04 SP01 Rev0)	August 2017	A1567040
Email WA_OL 2017-00317 Additional information	8 August 2017	A1500986
Email: RE: Conversion from Works Approval to Licence - PML W6051, RO Plants query	5 June 2018	A1686523
Completion Report for Oily Water Separator Completion Report for Oily Water Separator at the Truck washdown bay	5 April 2018	A1771151 A1740815

	19 November 2018	
Completion Report for the Power Station: Re: Applicant Notification – W6051/2017/1 – Request for Further Information	18 April 2018	A1656471
Completion Report for the WWTP: W6051/2017-1 Pilgangoora Lithium Project - WWTP Completion Report	30 May 2018	A1684072
Completion Report for the Process Plant: W6051/2017/1 - Process Plant Completion Report	8 June 2018	A1688546
Completion for TMF Cell 1: Pilbara Minerals - Pilgangoora Operations - TMF 1 completion report PILBARA MINERALS LIMITED, Pilgangoora Lithium-Tantalum Project, Western Australia, Tailings Management Facility, Cell 1 Stage 1A, Construction Report	5 July 2018 July 2018	A1701944 A1703062
Completion Report for W6051/2017/1 Condition 16 and 17: W6051/2017/1 - Condition 16 and 17 report	27 July 2018	A1707078
Completion Report for W6051/2017/1 Condition 18: Pilgangoora Operations - W6051/2017/1 - Condition 18 Report	27 August 2018	A1714659
Completion Reports for the Process Water Pond: Completion Report - Pilgangoora Operations Process pond	5 February 2019	A1765498
Pilgangoora Lithium-Tantalum Project, W6051/2017/1, REPORT, Works Approval Condition 2	14 February 2019	A1769120
W6051/2017/1 – Condition 19 and 20 Monitoring Data	14 February 2019	A1769120
Email: RE: L9056 Pilgangoora Licence Queries	12 March 2019	A1771596
Email: RE: L9056 Pilgangoora Licence Queries	13 March 2019	A1771813
Email: RE: L9056 Pilgangoora Licence Queries	13 March 2019	A1771894
Completion Report for TMF Cell 2: Pilgangoora TMF Cell 2 Stage 1A Completion Report	12 May 2019	A1789745

3. Background

The Premises is operated by the Licence Holder, Pilgangoora Operations Pty Ltd (POPL). Construction of the Premises commenced in 2017. Previously the occupier was Pilbara Minerals Pty Ltd (PML), however, ownership of the project was handed over to POPL on 16 October 2018.

Completion Reports as required by condition 5 of Works Approval W6051/2017/1 were received for prescribed infrastructure as follows:

- The Bulk Fuel Storage Facility and refuelling area completion report was provided 5 April 2018;
- The Process Water Pond Cell 1 completion report was provided on 5 April 2018 and Process Water Pond Cell 2 completion report on 5 February 2019;
- The Power Station completion report was provided 18 April 2018;
- The WWTP and irrigation field completion report was provided 30 May 2018. A second irrigation field is yet to be constructed;
- The Processing Plant, Stage 1 completion report was provided 7 June 2018;

- The TMF Cell 1 completion report was provided 5 July 2018. The TMF Cell 2 construction report was provided 12 May 2019;
- The TMF groundwater monitoring bores completion report was provided 27 August 2018;
- The West Waste Dump landfill completion report was provided 5 November 2018. The Monster South Waste Rock Landform is yet to be constructed;
- Each facility was subject to completion reports following the construction of the Processing Plant, Power Station, Landfill, Mobile Crushing and Screening Plant, Bulk Diesel Fuel Facility and TMF Cell 1 and the WWTP; and
- A Mobile Crushing and Screening Plant for use during construction and a Mobile Crushing and Screening Plant for operations are authorised via the Works Approval, but completion reports are yet to be received for this infrastructure.

Table 3 lists the prescribed premises categories and applicable production or design capacities for the Premises that have been applied for.

Table 3: Prescribed premises categories

Category	Description	Approved Premises production or design capacity or throughput
5	Processing or beneficiation of metallic or non-metallic ore	2,000,000 tonnes per annum
52	Electric power generation	15.7 MW
54	Sewage facility	125 m^3/day
64	Putrescible landfill	5,000 tonnes per annum
73	Bulk storage of chemicals	1,036 m^3 in aggregate

3.1 Exclusions to the premises

The Licence Holder will also be operating the following infrastructure which is not within the scope of this assessment:

- Bioremediation facility - as the facility does not receive liquid waste from other Premises, it does not trigger category 61 under the EP Regulations. The Licence Holder should note that the discharge of hydrocarbons to the environment is an unauthorised discharge under the *Environmental Protection (Unauthorised Discharges) Regulations 2004* and the facility should be operated to comply with the Assessment and management of contaminated sites and the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM);
- TMF exclusions - The supporting documentation (PML, 2017a) contains information on the entire TMF (TMF Cell 1, TMF Cell 2 and TMF Cell 3) however the Licence Holder has approval via Works Approval W6051/2017/1 to construct TMF Cell 1 Stage 1A (185.3m RL) and Stage 1B (189.3m RL), hereafter named TMF1 to the final height of 189.3m RL and TMF Cell 2. TMF Cell 1 and TMF Cell 2 have been constructed and this Licence gives approval to operate these. The Licence Holder has indicated that in the future TMF construction stages (TMF Cell 3), the diversion of Pilgangoora Creek, via construction of a diversion berm will be required. It is understood that the construction of this diversion berm will not be required until some 20 years into mine operation life. As such, given that further site geotechnical assessment and engineering design is required for TMF Cell 3 and the Pilgangoora Creek diversion, the construction of TMF Cell 3 and associated Pilgangoora Creek diversion is not authorised or included within the scope of this assessment;

- Wastewater treatment at the mine office, workshop and plant complexes are serviced by septic tanks and leach drains for the treatment of wastewater. The treatment capacities of these wastewater facilities do not exceed requirements for category 85 and DWER does not regulate septic tanks. The Licence Holder advised that approvals will be obtained from the Department of Health and the Shire of East Pilbara; and
- Pit dewatering infrastructure and in-pit sumps – dewatering discharge from the in-pit sumps are directed to a number of 1.5mm thick HDPE lined turkey nests located throughout the project area and used for dust suppression across the site. As all abstracted water is used on site, and not discharged to the environment for the purpose of accessing ore for mining purposes, category 6 is deemed not to be triggered. Predicted abstraction rates for pit dewatering are shown in Table 4:

Table 4: Predicted pit dewatering rates in tonnes

Type	Location	Method	Average Simulated Abstraction Rate (tonnes/year)						
			Year 1-4	Year 5-8	Year 9-12	Year 13-16	Year 16-20	Year 21-24	Year 25-28
Dewatering	Monster	Sump	63,072	31,536	63,072	63,072	63,072	63,072	63,072
	Eastern	Sump	63,072	63,072	157,680	220,752	189,216	220,752	283,824
	Central	Bores	189,216	189,216	126,144	63,072	-	-	-
		Sump	63,072	94,608	189,216	220,752	220,752	220,752	346,896
	Southern	Sump	-	31,536	63,072	63,072	94,608	94,608	157,680
	South	Sump	<31,536	31,536	63,072	63,072	63,072	63,072	126,144
		Total	**409,968**	**441,504**	**662,256**	**693,792**	**630,720**	**630,720**	**977,616**

Note 1: predicted dewatering rates for years 28-35 years (to end of expected mine life) not provided by the Licence Holder at the time of assessment.

- Haul roads and access roads;
- 500 person accommodation village (640 manning rate on roster rotation) (not including the WWTP);
- Borrow pits and stockpiles;
- Workshops and offices;
- Plant stores;
- Laboratory;
- Laydown area; and
- Borefield.

4. Overview of Premises

4.1 Operational aspects

The process will result in the production of lithium and tantalum concentrate as shown in Figure 1, which is to be transported by road in trucks to Port Hedland. The proposed site layout is shown in Figure 2.

4.1.1 Train 1 Processing Plant

Ore is fed through three stages of crushing, multiple screening processes, dense media separation, high pressure grinding, gravity concentrators, cyclones, cleaner spirals, cleaner scavenger spirals, low intensity magnetic separation, hydrocylones, ball mill, flotation, mill and concentrate thickener to produce lithium and tantalum concentrate.

Crushing and Dry Screening

A front end loader feeds ore to the crushing plant via the ROM bin to commence primary then secondary crushing of the ore. The ore is then screened and oversized ore is re-crushed to achieve the desired size for stockpiling prior to tertiary crushing.

A reinforced tunnel sits centrally under the stockpile and houses the four vibrating feeders which are open to the stockpile located above the feeders. Ore is then withdrawn from the coarse ore stockpile via the vibratory feeders. The vibrating feeders transport crushed ore from the stockpile above, through the passive slot feeders and onto a conveyor at a tertiary crusher feed conveyor.

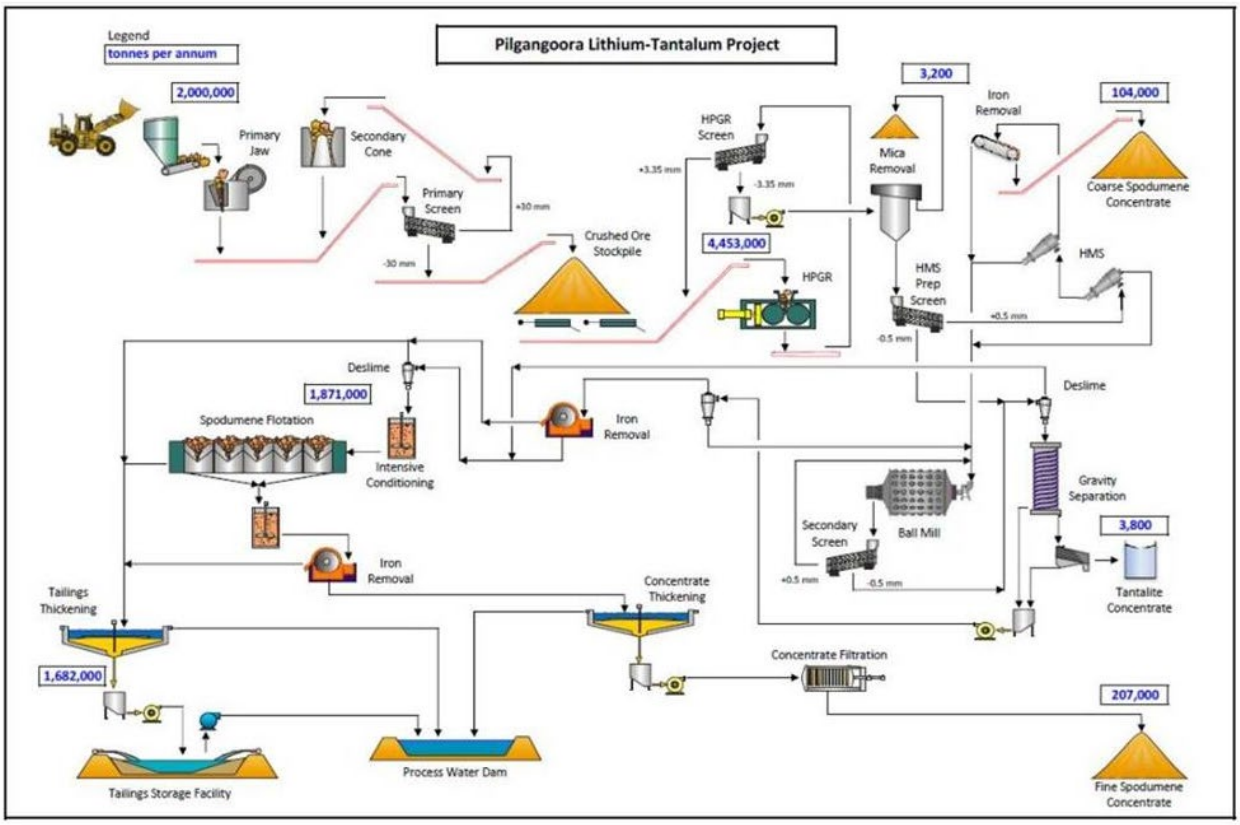

Figure 1: Process flow diagram

High Pressure Grinding Rolls (HPGR)

Tertiary crushing of the dry ore is conducted using a High Pressure Grinding Roller (HPGR). The grinding elements of the HPGR are two counter-rotating rolls, between which the material is crushed. One roll is designed as a fixed roll and the other one as a floating roll.

Screening

Undersize HPGR screens are diverted to the Heavy Media Separator (HMS) Stage 1 Feed Preparation screen which screens the ore particles into plus and minus streams. The minus stream is pumped from the screen underflow hopper to the spiral gravity circuit to recover tantalum minerals.

The Process Plant area general layout has been provided in Figure 3.

Milling and Flotation

The plus particles are re-pulped with ferrosilicon slurry and pumped through HMS Stage 1 cyclones. The cyclones separate the particles into light particles (floats) and heavy particles (sinks). The heavy particles contain substantially liberated spodumene particles and tantalum minerals (and other heavy minerals present in the ore).

These Stage 1 floats containing partially liberated spodumene particles and waste minerals are conveyed to the grinding mill, whereas the sinks are transferred to the Stage 2 HMS Circuit. The Stage 1 sinks are re-pulped with a higher density mix of ferrosilicon slurry than used in Stage 1

and are passed through a single HMS cyclone. The floats from this cyclone contain the majority of spodumene minerals, and the sinks contain the tantalum (and other heavy minerals).

Each floats and sinks stream is thoroughly washed on the respective product screens to recover ferrosilicon for re-use in the circuit. New ferrosilicon is intermittently added to the circuit to replenish any losses.

The gravity tails (from the spiral circuit) are classified via a cluster of Primary Hydrocyclones. The underflow contains coarse particles which then report to the ball mill feed for further size reduction. The primary hydrocyclone overflow proceeds to the flotation circuit after intensive conditioning with sodium lignosulphonate, and desliming by cyclones. The slimes report to the tailings thickener and the rest of the slurry (cyclone underflow) reports to flotation.

The HMS Stage 1 floats and HMS Stage 2 sinks streams are also fed to the ball mill to liberate and enable recovery (after further size reduction) of additional spodumene and tantalum minerals contained within these streams. After intensive conditioning and desliming, the flotation feed is first conditioned with sodium silicate solution and adjusted to pH 8 with sodium hydroxide prior to the addition of the flotation collector. The slurry passes through the first bank of Rougher Flotation cells after which additional collector is added and then further flotation recovery takes place in a second bank of Rougher flotation cells. The tails from the 1st Cleaner cells proceeds to Cleaner Scavenger flotation cells to recover additional spodumene, after which the Cleaner Scavenger tails are pumped to the tailings thickener.

Concentrators

The HMS Stage 1 Feed Preparation screen undersize material contains valuable tantalum minerals which are recoverable using conventional wet spiral concentrators. Accordingly, this is pumped to banks of Rougher Spirals which are designed to recover the maximum amount of heavy minerals into a low grade concentrate. The Rougher Spiral concentrate is then pumped to a bank of Cleaner Spirals which recover a high grade concentrate at lower recovery rates. The Cleaner Tails then returns to a bank of Cleaner Scavenger Spirals which scavenges heavy minerals from the Cleaner Tails into a lower grade concentrate which returns to the Cleaner Spirals to recover these minerals.

The concentrate from the Cleaner Spirals is passed through a Low Intensity Magnetic Separator to remove iron contaminants from the concentrate.

The flotation Spodumene (concentrate) stream is attritioned and then processed via magnetic separation to remove contaminant iron (grinding media and iron staining) after which it is pumped to the Spodumene Concentrate thickener where it is thickened to approximately 70% w/w solids prior to being pumped to a pressure filter.

Final Product Processing

The tantalum concentrate is then processed over Rougher and Cleaner wet shaking tables to upgrade the tantalite into a concentrate of approximately 25% Ta_2O_5. This is packaged into bulka-bags and shipped off site for sale or further upgrading.

Following pumping from the Spodumene Concentrate thickener, the pressure filter dewaters the Spodumene concentrate to less than 7% moisture, after which it is stacked on the Spodumene Flotation Concentrate stockpile within the concentrate storage shed prior to transport off site. Some spodumene concentrate is to be stored outside as shown in Figure 4. This spodumene concentrate does not meet the shipping specifications and will be blended with product to be exported. While stored, the product moisture will be maintained to prevent dust lift off. It is anticipated that this storage is temporary as once the plant is at steady production, off spec product will be minimal.

Fines Tailings Handling

The tailings stream comprises the deslime cyclone overflow, the flotation tailings and minor process streams. Waste streams are mixed prior to sending to the Tailings Management Facility. Tailings density is a reflection of the collective waste stream. Excess water from the thickening process and decant water is delivered to the Process Water Pond for recycling through the Processing Plant.

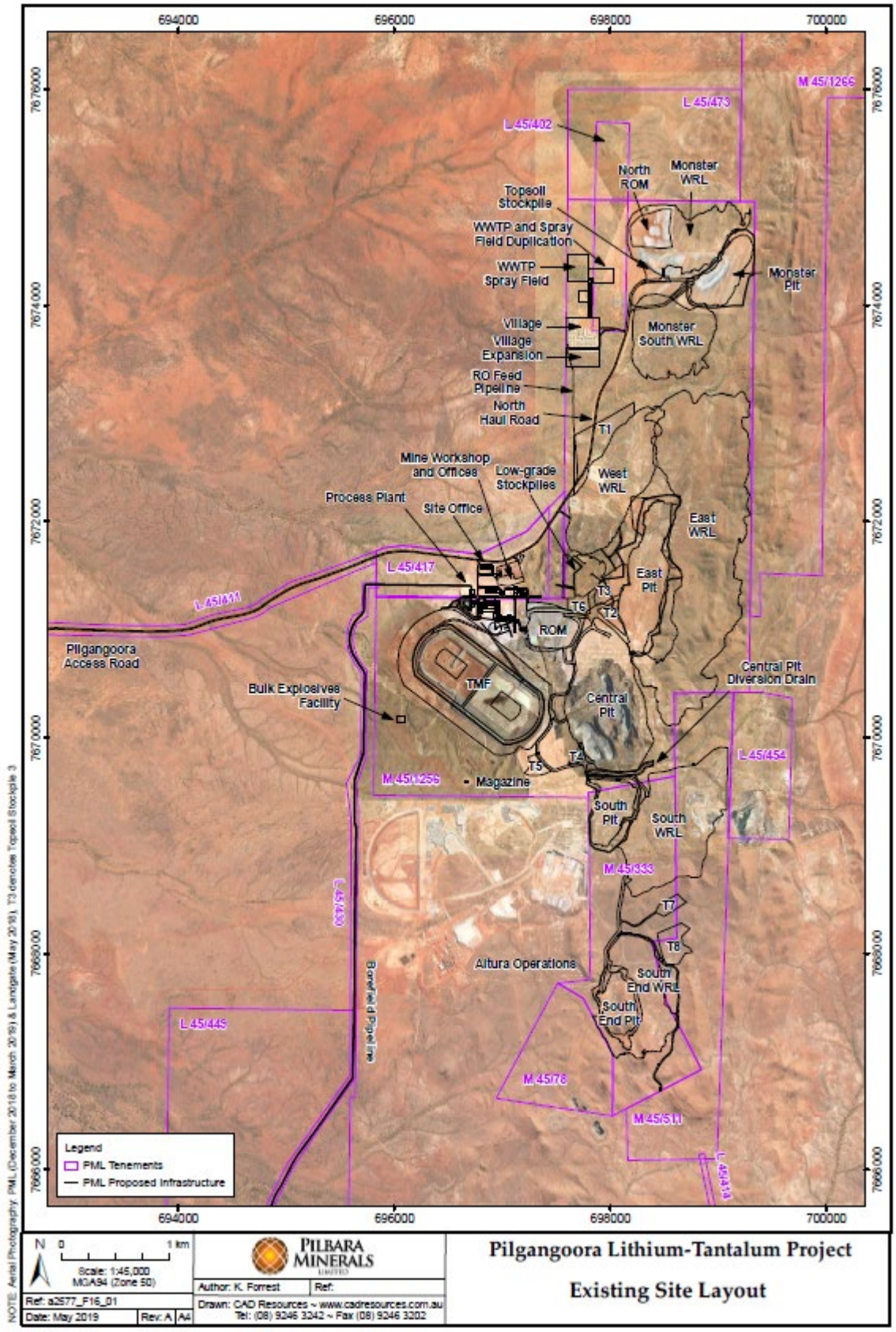

Figure 2: Premises site layout

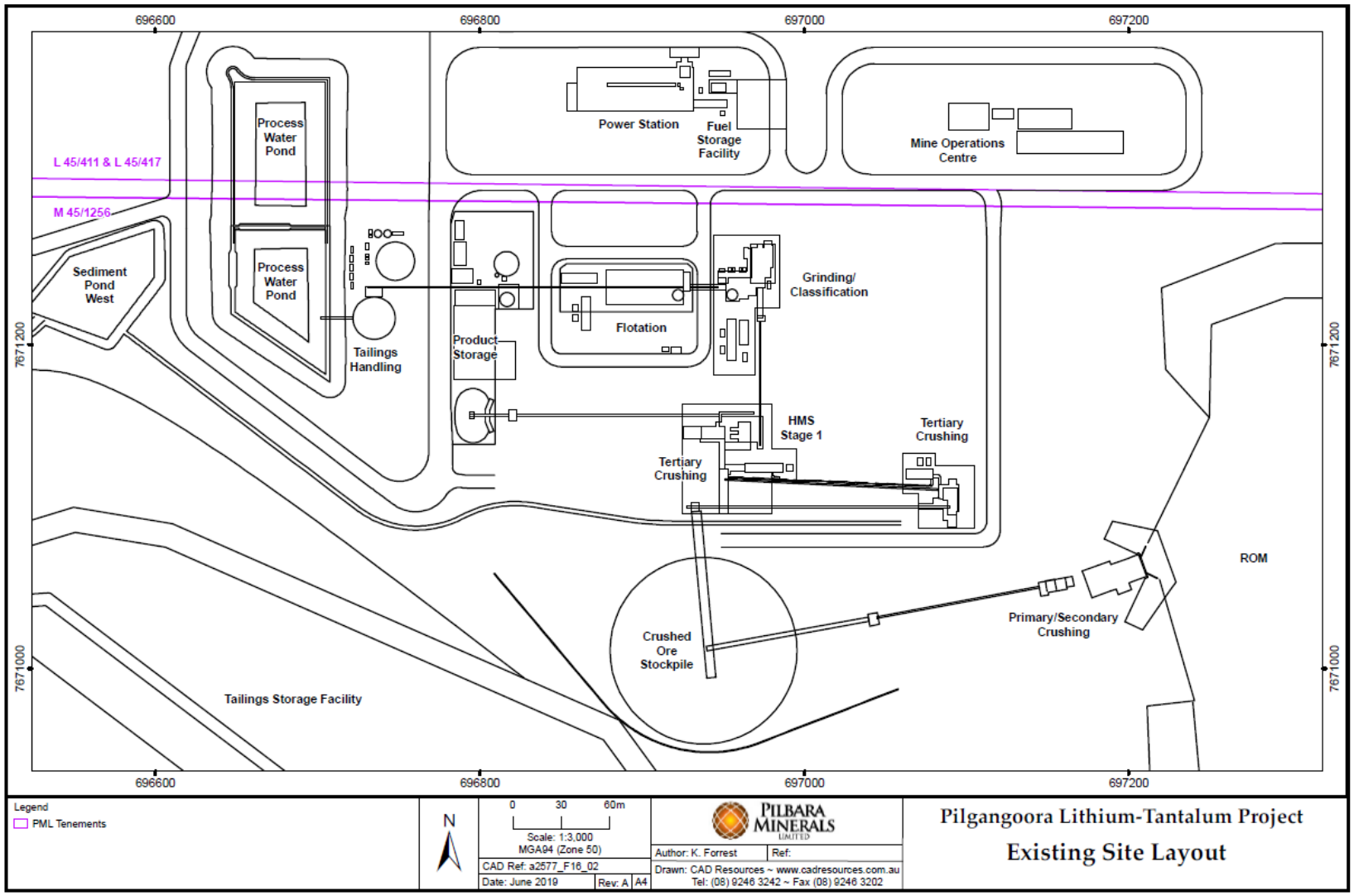

Figure 3: Process Plant area general layout

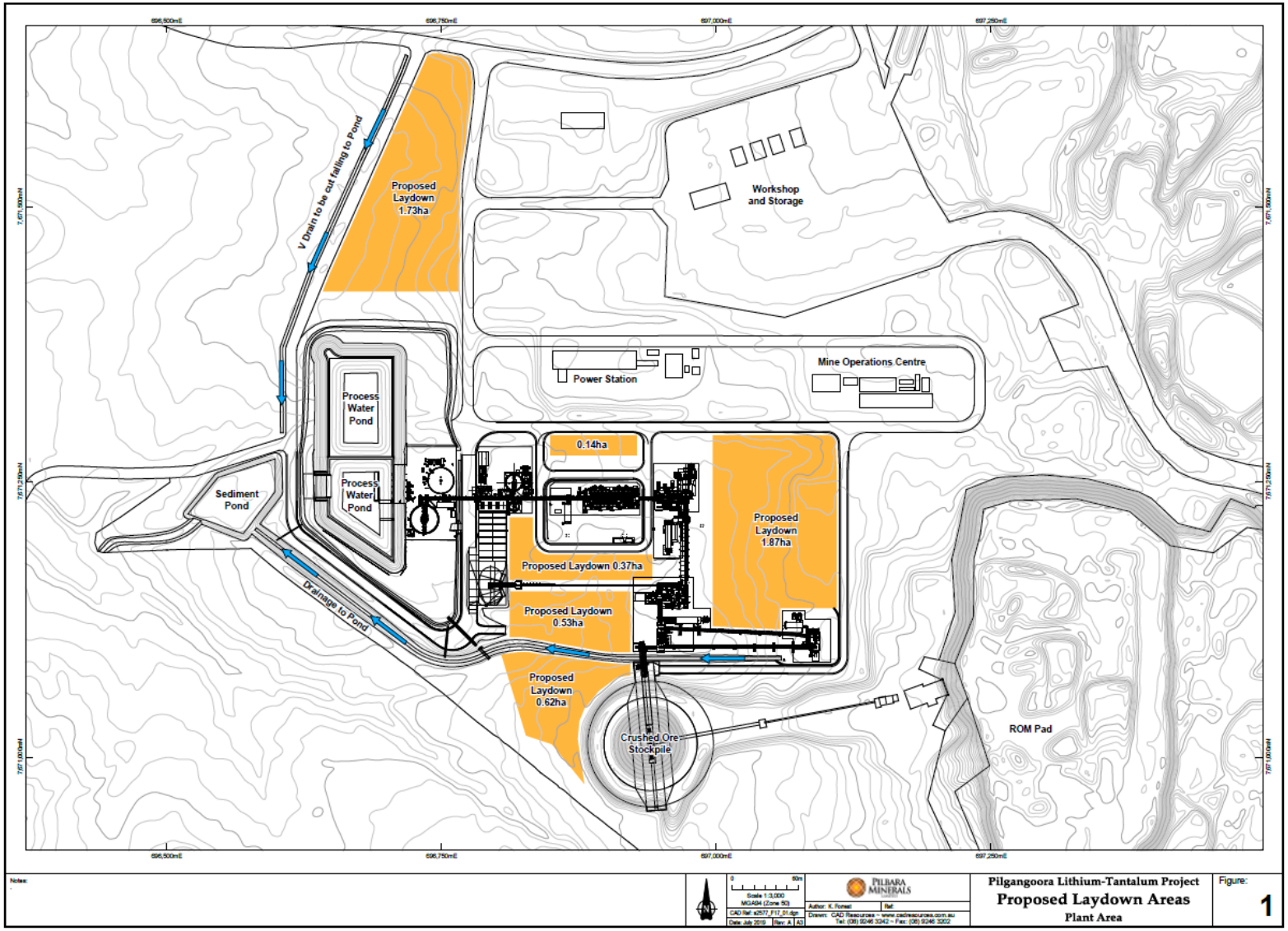

Figure 4: Spodumene concentrate storage (yellow) with drainage to Sediment Pond

4.1.2 Tailings Management Facilities

The Licence Holder is operating TMF Cell 1 and the construction report has been received for TMF Cell 2. Details are shown in Table 5. The footprint and layout are shown in Figure 5, Figure 6 and Figure 7.

Table 5: TMF design criteria and specifications

	TMF 1 Stage 1A	TMF 1 Stage 1B	TMF 2 Stage 1A	TMF 2 Stage 1B
Type	Integrated waste landform			
Footprint	19.9 ha		20.5 ha	
Height	9.3m (RL 185.3 m)	13.3 m (RL 189.3m)	9.3m (RL 185.3 m)	13.3 m (RL 189.3m)
Storage capacity	1.9 Mtpa		2.7 Mtpa	
	Storage for 35.1 Mt of tailings and 29.4 Mm^3 of waste rock (over a period of 21 years at 2 Mtpa ore throughput). Rate of 1.68 Mtpa, operated for about 21 years.			
Stormwater storage	1:100 AEP, 72 hr run-off superimposed on normal operating pond plus 500mm total freeboard and 300mm operational freeboard.		1:100 AEP, 72 hr run-off superimposed on normal operating pond plus 500mm total freeboard and 300mm operational freeboard.	
Tailings Density	Thickened slurry consisting of 65% to 68% solids concentration Settling to a stored density of 1.4 t/m^3		52% to 68% solids concentration Settling to a stored density of 1.2 - 1.4t/m^3	
Pipelines	Audible alarms fitted to record pressure changes fitted to all pipelines and monitored in the control room. Tailings delivery line and return water line above ground within bunds with spill catch pits of 12 hours containment.			
Tailings Deposition Method	Multiple rotating spigots (ring main) on a cyclic (rotating) basis		Multiple rotating spigots (ring main) on a cyclic (rotating) basis	
	Deposition of tailings will alternate between TMF Cell 1 and TMF Cell 2 up to year 21 of plant operation			
Permeability	Not less than 0.3m clay material Impoundment area proof compacted to between 2.48 x 10^{-6} m/s and 27.40 x 10^{-6} m/s Facility is unlined	Impoundment area permeability dependent on the tailings settling density from within TMF 1 Stage 1A	Permeability ranges across the embankments zones from 2.4 x 10^{-9} to 9.5 x 10^{-9} m/s Maximum hydraulic conductivity at the base (impoundment area) of the TMF has been measured at 7.45 x 10^{-6} m/s in extremely weathered granite Facility is unlined	Impoundment area permeability dependent on the tailings settling density from within TMF 2 Stage 1A

	TMF 1 Stage 1A	TMF 1 Stage 1B	TMF 2 Stage 1A	TMF 2 Stage 1B
Vertical seepage	1000m^3/day	1000m^3/day	1000m^3/day	1000m^3/day
Embankment Zone construction	Width of Zone 1 to 4 m to facilitate safe construction access for machinery.			
Water Management System	Central decant system decant access causeway, decant comprising of 2.8m wide concrete base footing and 8 slot 1800 dia x 89 wall x 1220 high rings	Addition of concrete rings to an adequate height for decant management post decant causeway raise	Central decant system decant access causeway, decant comprising of 2.8m wide concrete base footing and 8 slot 1800 dia x 89 wall x 1220 high rings	Addition of concrete rings to an adequate height for decant management post decant causeway raise
	Decant removed via submersible pumps within decant tower. Decant access causeways are raised by the application of waste rock on both sides of the causeway.			
	Cut off trench (to a depth of 1.5m and width of 3.0m through superficial materials) constructed through the surficial deposits on the upstream side of the starter embankments (constructed from pre-strip mine waste rock materials with low permeability upstream zone formed from clayey sand materials excavated from the vicinity of the TMF footprint) and extended around the full TMF perimeter. A sandy filter zone separates the low-permeability zone from the waste rock zone. Subsequent raises are to utilize proximal beach tailings. In-situ density testing has been conducted. Underdrainage was provided at the low point of the Cell 1 Stage 1A perimeter (northern corner) to minimize water accumulation. Underdrainage pipe is pre-slotted and comprises of: • "HDPE PE100 PN16 DN200 mm, • PVC-U PN16 DN200, or • SRP Rocla Plastream DN225" (115275.04 SP01 Rev0) This pipe was placed in the existing drainage line and extends 60 m towards the upstream side of the embankment and is covered by 0.5 m of gravel material which is extended until the gravel packing meets the natural ground surface.		Cut off trench constructed through the surficial deposits on the upstream side of the starter embankments and extended around the full TMF perimeter.	
Monitoring bores	Six groundwater monitoring bores installed around the perimeter of the TMF (TMF TMFMB01- TMFMB06). If there is a rise in groundwater level in any monitoring bore to 5 mbgl, the Licence			

	TMF 1 Stage 1A	TMF 1 Stage 1B	TMF 2 Stage 1A	TMF 2 Stage 1B
	Holder commits to installing recovery bores (or trenches) to collect seepage and return the seepage water to the TMF decant pond, except if the breach is a result of natural extreme rainfall events. A network of 10 monitoring bores installed at the Premises to provide background data, and, allow the assessment of groundwater during operations.			
Monitoring of porewater in embankment	Four Vibrating Wire Piezometers (VWP) installed in the embankment foundation	Four Standpipe Piezometers to be installed (Total of 8 Piezometers installed)	Four VWP installed in the embankment foundation	Six Standpipe Piezometers to be installed (Total of 10 Piezometers installed)
Earthquake Loading	Operating: Operating Basis Earthquake[1] Final Landform: Maximum Design Earthquake[1] Post Closure: Maximum Credible Earthquake [1]			
Tailings monitoring parameters (Licence Holder controls)	Feed rate Slurry densities pH TDS and Electrical Conductivity (analyses at a laboratory) Radiation levels (Th and U)			
Surface water interfaces	Rock armouring to provide protection against flooding of Pilgangoora Creek. Drainage installed to divert runoff around the TMF to Pilgangoora Creek.			

1 ATC Williams, 2016

Geotechnical investigations were conducted by ATC Williams (ATC Williams 2017a). The following information was presented in their 2017 report (115275.03R02).

Superficial deposits in the TMF area typically comprised very dense, fine to coarse, red brown or brown sandy clayey gravel with occasional cobbles to depths of less than 1 m. At Pilgangoora Creek, geotechnical investigations encountered clayey gravel to 3.3 m depth.

Adjacent to minor drainage lines, medium dense to very dense, fine to coarse, red brown or pale brown or orange brown clayey sand was also identified to shallow depths (<1 m).

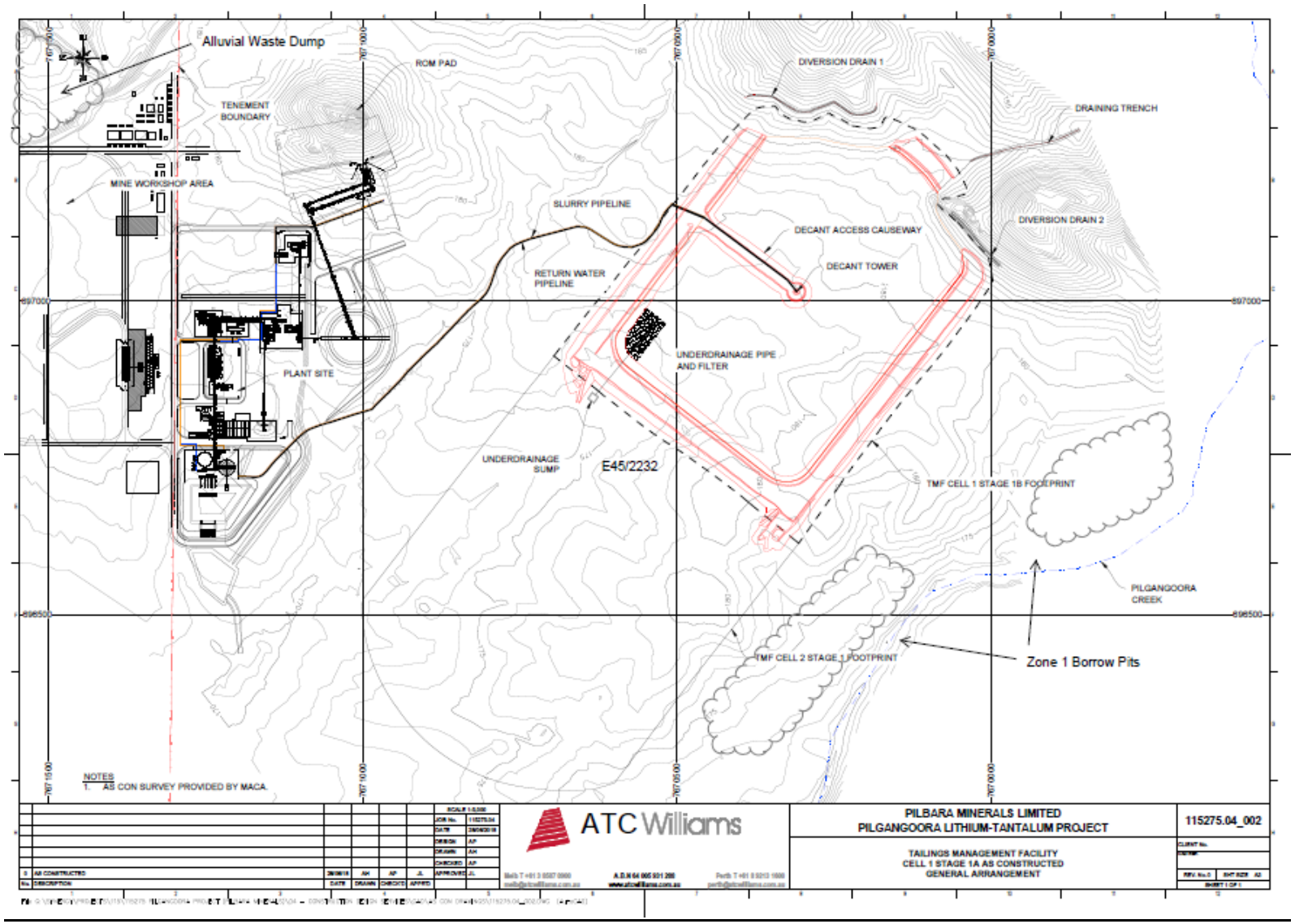

Figure 5: TMF Cell 1 footprint and location of other site infrastructure.

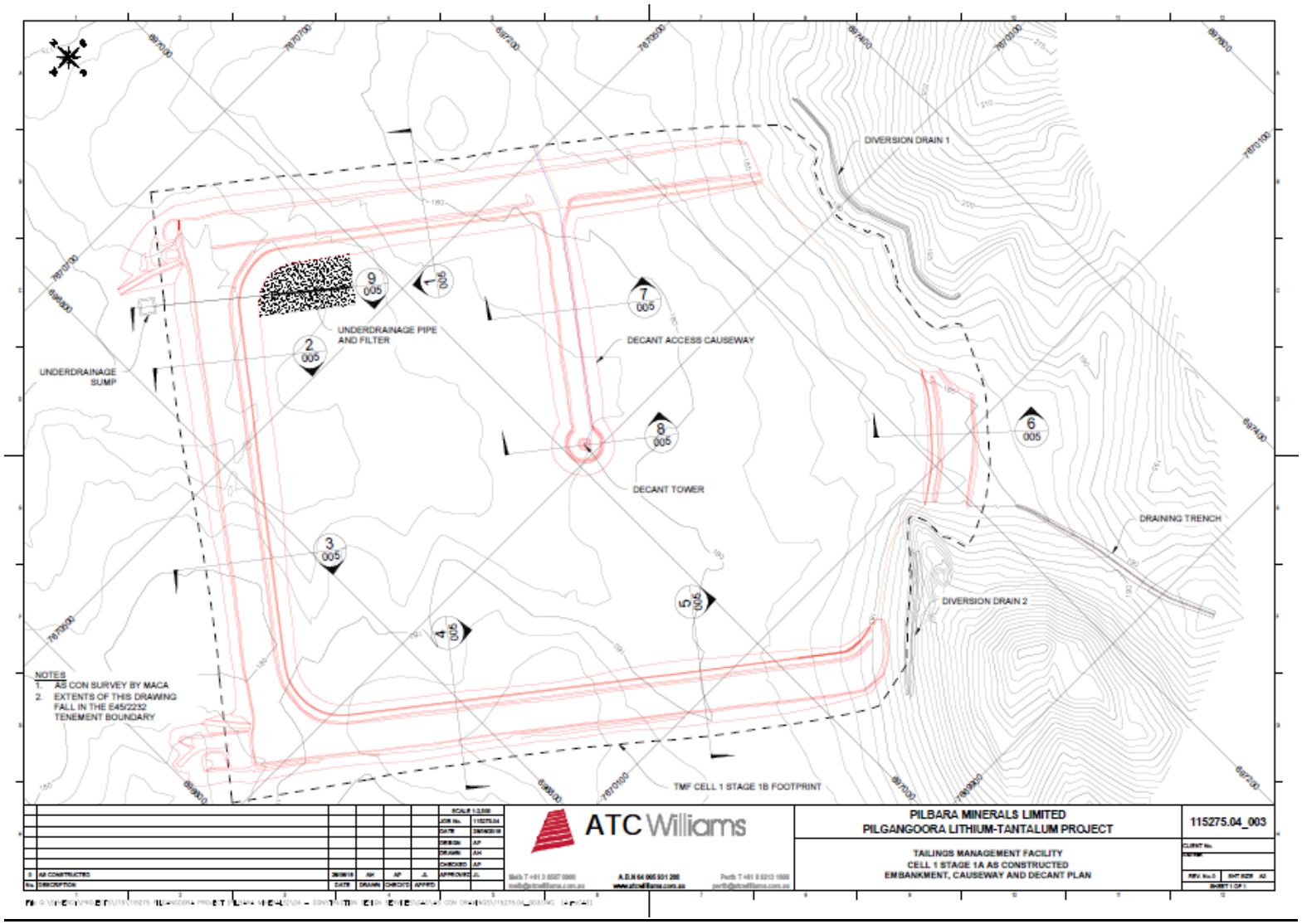

Figure 6: TMF Cell 1 General Arrangement.

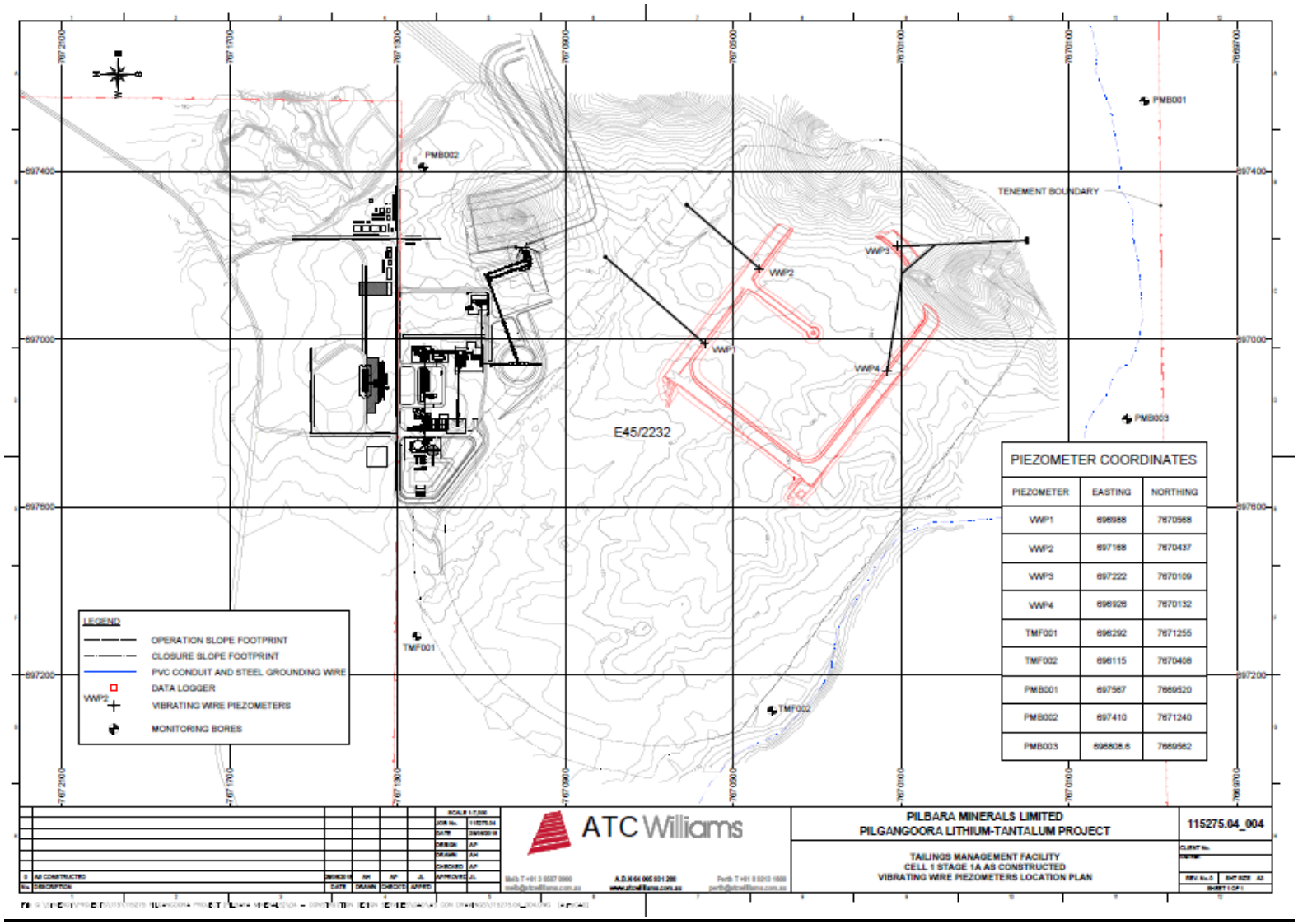

Figure 7: TMF Cell 1 Vibrating Wire Piezometers Locations

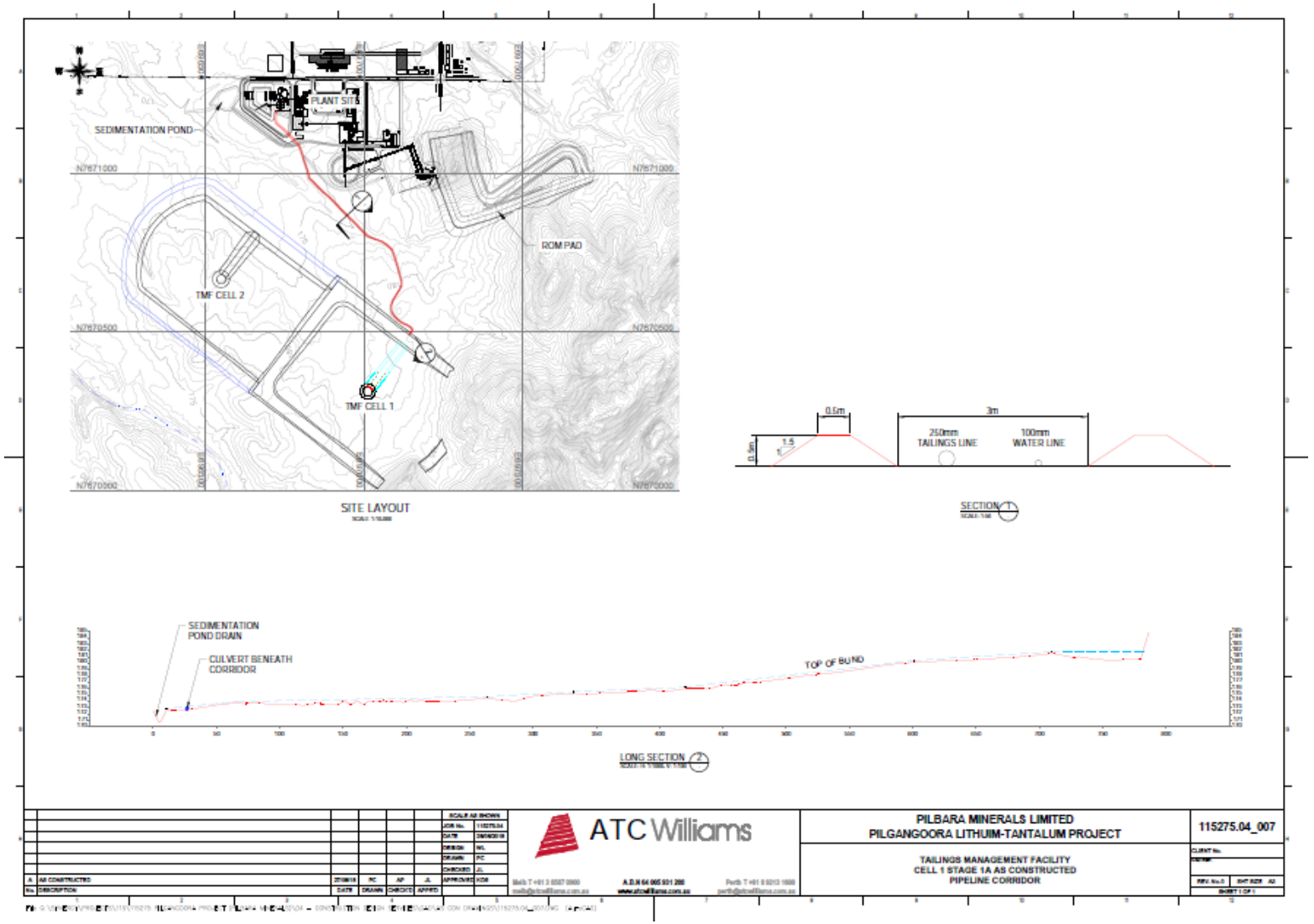

Figure 8: TMF Cell 1 Pipeline Corridor (TMF Cell 2 utilises the same tailings pipeline corridor as TMF Cell 1)

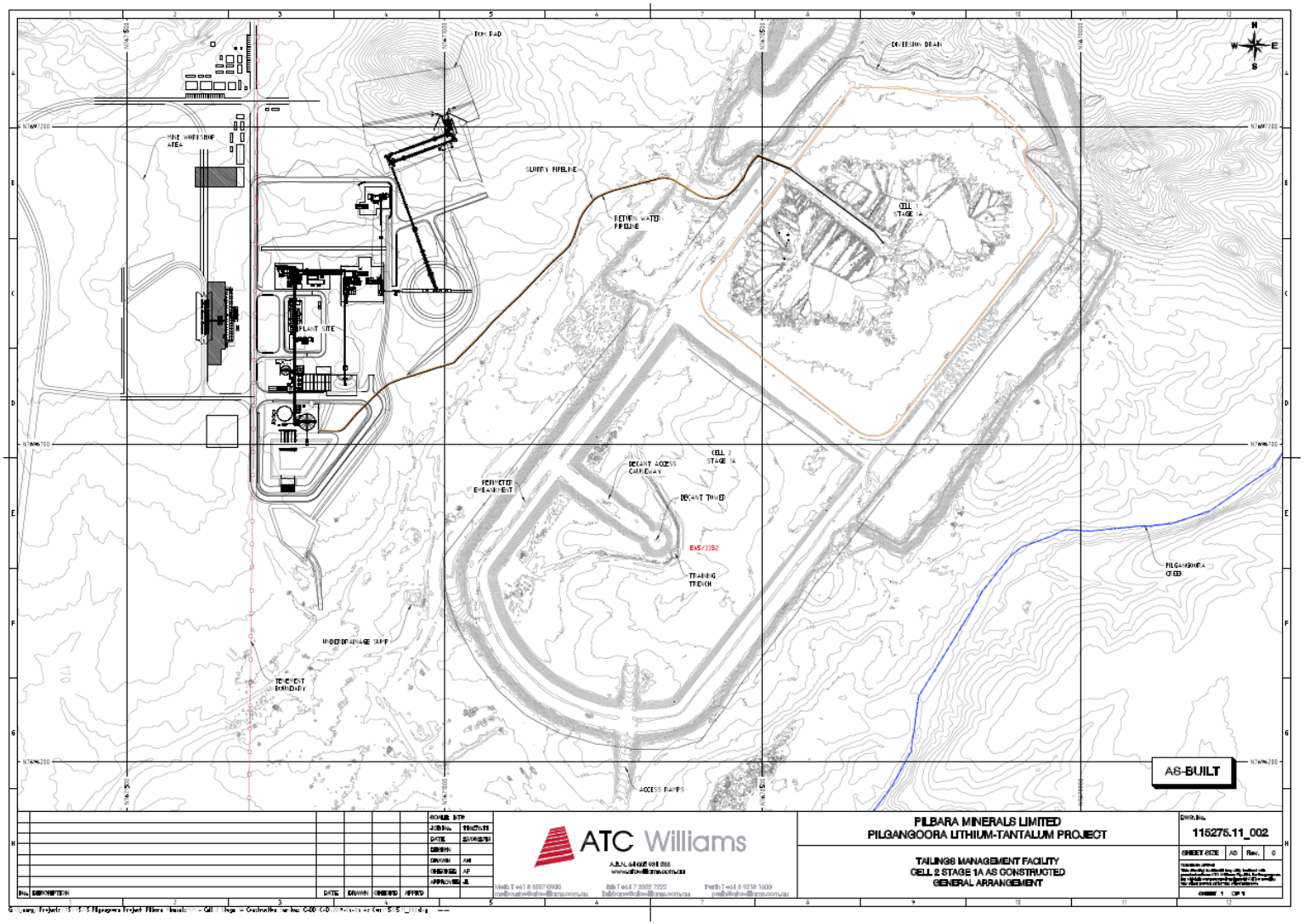

Figure 9: TMF Cell 2 footprint and location of other site infrastructure

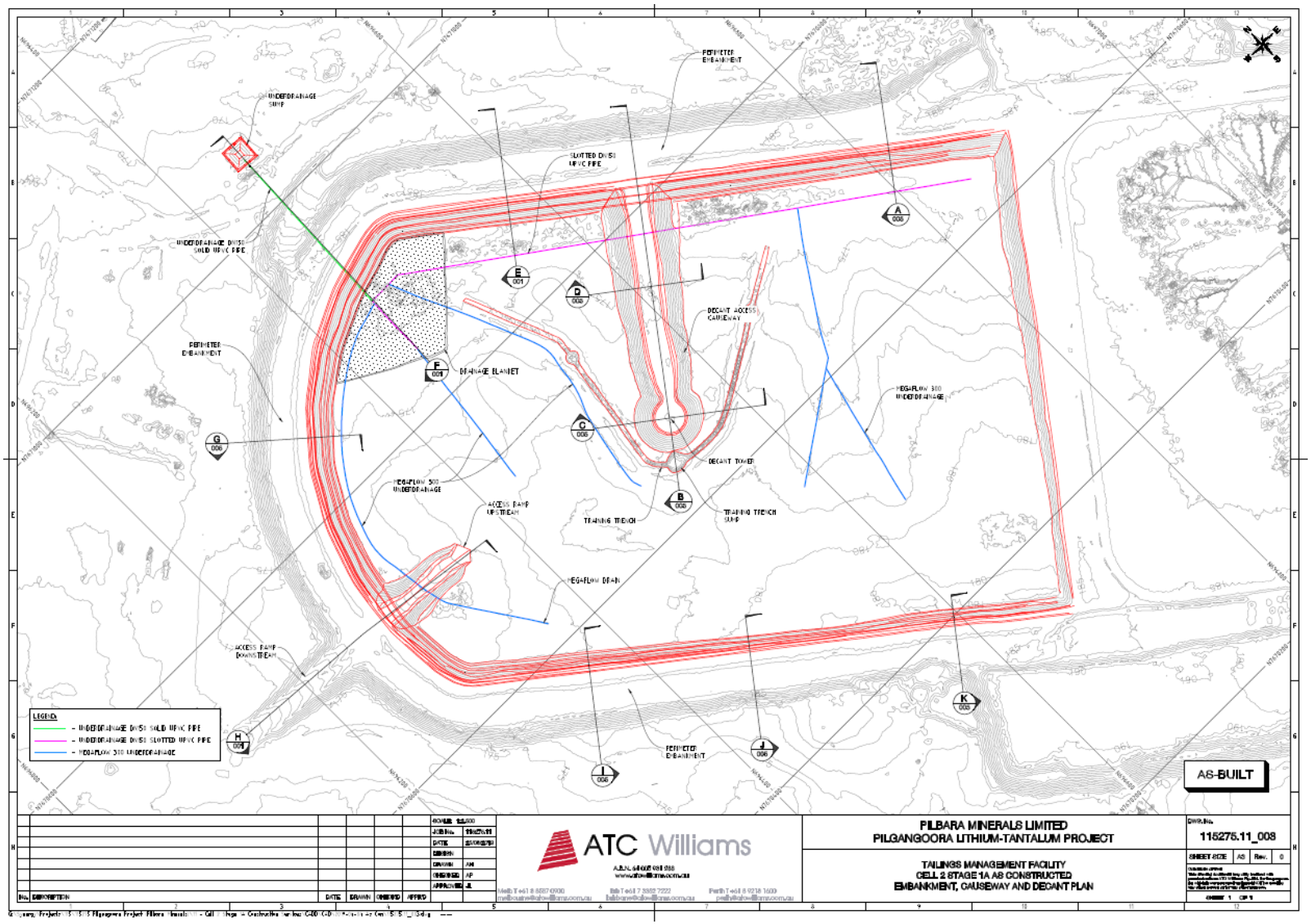

Figure 10: TMF Cell 2 General Arrangement

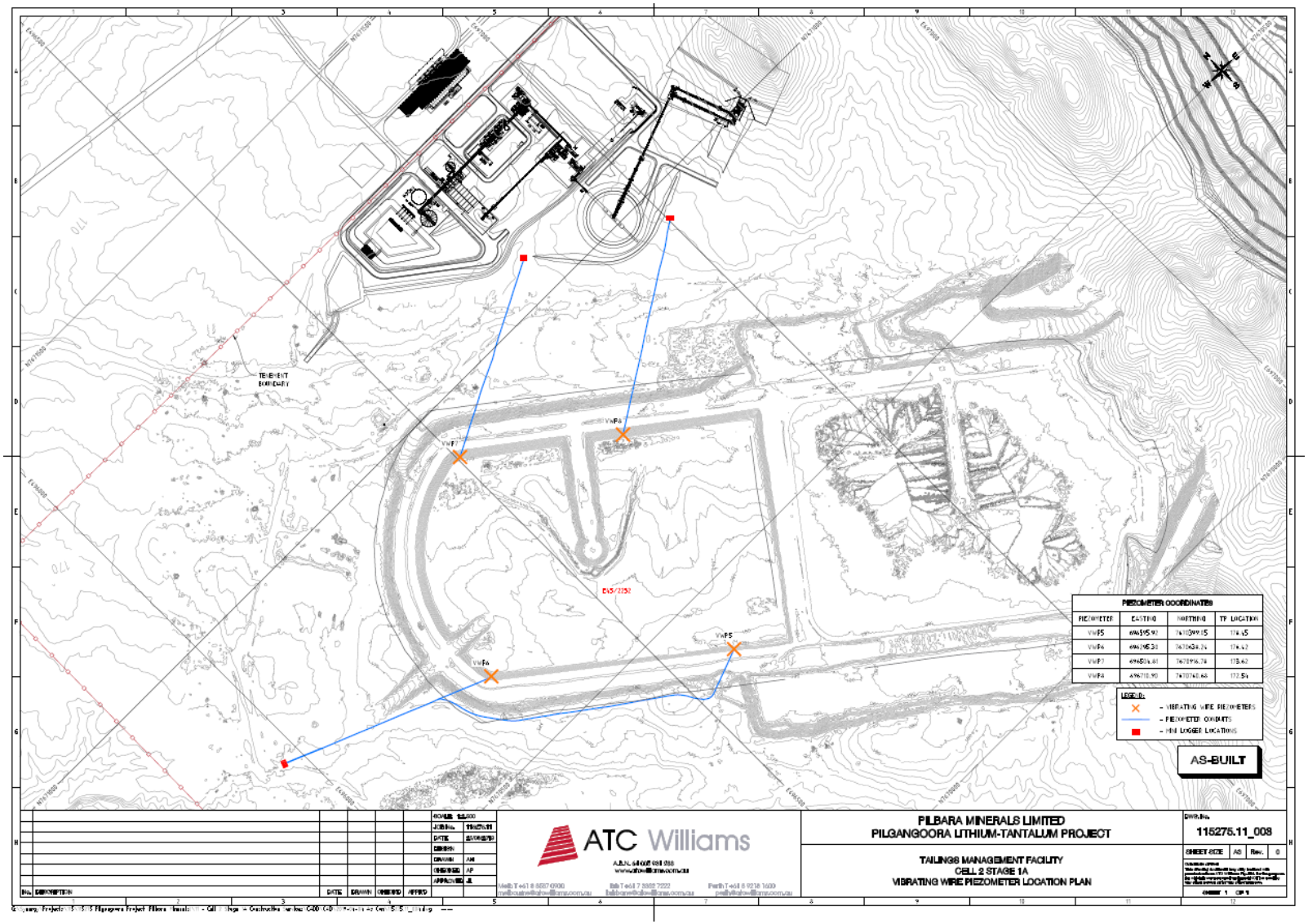

Figure 11: TMF Cell 2 Vibrating Wire Piezometers Locations

Tailings Characterization

Original Leachate testing was undertaken on the waste materials using “static testing” and “kinetic testing” using humidity cells. The conclusion of this report was that the waste materials are “inert with near-zero risk for water quality impacts when left in a free-draining state.” Furthermore, the report states that “in terms of drinking-water quality, the leachates are essentially potable” (Campbell and Associates Pty Ltd, September 2016).

This report suggests that static testing was undertaken in an appropriate manner, however, there are a number of factors that may limit the usefulness of the results. These include:

Duration of kinetic testing

The kinetic testing was only undertaken for a six week period whereas this testing is required to be undertaken for a minimum of twenty-weeks and may be required to exceed one year for some materials (Maest et al., 2005).

Heterogeneity and surface area effect

Rare-element pegmatite ore bodies are extremely coarse-grained and typically contain a large suite of minerals that have a highly heterogeneous distribution within the ore body (Bradley et al., 2010). Therefore, it is important that sufficient samples are collected and tested to assess the geochemistry of these materials, and kinetic testing must consider the available surface area of the material so that results can be scaled up from the laboratory to field scale (Maest et al, 2005).

Furthermore, the geochemical testing has not considered the possibility that tailings materials could be the subject to biologically-enhanced weathering. This type of weathering is caused by a range of fungal communities and microorganisms in the soil profile that produce organic acids to leach nutrients (particularly potassium and phosphorus).

USEPA LEAF 1313 testing at other sites with a similar ore body have indicated tailings leachate containing fluoride, lithium and thallium at levels of environmental concern.

Conditions 1 and 2 of Works Approval W6051/2017/1, therefore, required additional tailings leachate testing using the USEPA LEAF 1313 testing methodology (Conditions 1 and 2 Report and Radionuclides Characterisation, February 2019). The results of this testing were reviewed by DWER and it has been confirmed that the tests were carried out appropriately and the leachate is unlikely to cause significant environmental impacts.

4.1.3 Electric Power Generation (Power Station)

This facility was assessed and approved to be constructed within M45/1256 as per the Works Approval W6051/2017/1. In April 2018 it was identified that the Power Station and Fuel Farm had not been constructed in its approved location but had been constructed on PML tenure, Miscellaneous Licence L45/417. L45/417 is situated immediately north of the western portion of M45/1256 so the Power Station and Fuel Farm have been constructed approximately 100m away from the (original) approved location.

The Licence Holder stated on 18 April 2018 that the Power Station and Fuel Farm have been constructed in accordance with the requirements of Schedule 3 (Table 3) of the original Works Approval with the exception of the diesel generators that were intended to supply power to the Power Station. The Licence Holder has installed 10 x diesel generators with capacities ranging from 1300 kVA to 3100 kVA in place of the originally proposed 16 x 1400 kVA diesel generators. The Licence Holder advised that the reconfiguration of genset sizing was a requirement of the availability of units for purchase within the timeframe of construction. The Licence Holder also advised that the installed fewer generators with higher load capacities are expected to have fuel consumption and emissions similar to original estimates.

A duel fuel natural gas/diesel Power Station consisting of generators and a Compressed Natural

Gas (CNG) daughter station was originally approved. The CNG daughter station is yet to be installed.

The Power Station will operate on diesel generators during the commissioning period, with diesel trucked to the Premises during the first five years. The CNG supply will be trucked to site as trailer mounted self-contained 350m^3 gas in bullet type vessels. A permanent natural gas supply may be installed in the future and diesel supply will then be used as backup.

The generators are operated at 75-100% capacity and monitored via the control system based on fuel consumption and routine emissions sampling. Optimal fuel burn has been identified for these gensets as being between 80 and 90%. Stack sampling locations will comply with Australian Standard AS4323.1 Stationary source emissions.

Table 6 outlines the expected air quality concentrations emitted from the stacks as provided by the Licence Holder.

Table 6: Expected air quality concentrations emitted from the stacks

Test Criteria	**Emission Limits**	**Standard of Concentration (Group 6)[1]**
<u>Diesel emissions</u>		
NO_x	Less than 2880 ppm	N.A. (system capacity less than 30 MW)
CO	Less than 1060 ppm	N.A. (not listed)[2]
Particulates	Less than 55 ppm	Less than 50 mg/m^3
SO_2	Less than 28 ppm	N.A. (not listed)[2]
Non-Methane Hydrocarbons (NMHC)	Less than 110 ppm	N.A. (not listed)[2]
Volatile Organic Compounds	Less than 6.48 g/min	N.A. (using standard fuel)[2]
<u>Gas Emissions</u>		
NO_x	NOx Less than 189 ppm	N.A. (system capacity less than 30 MW)
CO	CO Less than 623 ppm	N.A. (not listed)[2]
Particulates	NA	Less than 50 mg/m^3
SO_2	Less than 565 ppm	N.A. (not listed)[2]
NMHC	Less than 141.88 g/min	N.A. (using standard fuel)[2]

1 Based on NSW Protection of the Environment Operations (Clean Air) Regulation 2010 (Division 2, Clause 32).

2. Based on NSW Protection of the Environment Operations (Clean Air) Regulation 2010 (Schedule 3, Electricity Generation).

4.1.4 Bulk storage of chemicals and treatment of hydrocarbon contaminated water (Fuel Farm)

In the issue of the original Works Approval in September 2017, DWER had incorrectly stated within the Decision Report that the bulk chemical capacity within the Premises was 1,032 m^3 in aggregate. This value was supposed to read 1,036m^3 in aggregate. DWER consider that the risk profile between 1,032m^3 and 1,036m^3 is not significant. The correct value has now been updated.

Diesel fuel is delivered by road trains and stored in above ground self-bunded fuel storage tanks within the bulk fuel facility area (fuel farm). This consists of a bunded concrete pad with a drain at the tanks for both fast-fill (haul packs) and light vehicle refuelling. The pad is also the location for refuelling the tanks from fuel tanker road trains. The drain from this bunded concrete pad drains from below the refuelling grates and the self-bunded tank sumps to a local sump. The local sump contents are then pumped to the Power Station Oily Water Separator (diesel fuel farm).

There are two Oily Water Separators operational on site (to enable wastewater reuse or for dust suppression). One is designated for the truck wash and is located at the workshop. The second is located at the Power Station in the diesel fuel farm area. Both Oily Water Separators treat hydrocarbon waste to a maximum TRH concentration of <15mg/L which is monitored monthly. The treated oily water from both Oily Water Separator systems are pumped to a holding tank, collected by truck and unloaded into the vehicle wash water area / sump or dust suppression raw water tank.

Equipment wash down areas are contained on an impervious pad, such as reinforced concrete or plastic liner (for temporary facilities), with a perimeter kerb or bund wall.

Washdown from hardstand areas (e.g. workshop area floors) is directed to the truck wash Oily Water Separator for treatment. Collected sludge is removed from the settling sump and transported to the bioremediation pad on-site.

Coolants, lubrication and hydraulic oils for servicing the mobile fleet is stored within workshop, maintenance and reagent areas. All fuel storage and dispensing facilities are constructed and managed in accordance with the '*Australian Standard for Storage and Handling of Flammable and Combustible Liquids*' (AS 1940-2004). All of these materials are stored on drip trays or within steel or concrete bunded areas.

The site contains two secondary containment systems by way of sedimentation traps, one at the Processing Plant area and a second at the mining contractor's area. Hydrocarbon and chemical waste not contained in large stormwater events is captured in either sediment trap systems. Both sediment trap systems overflow to natural tributaries. These sediment basins are inspected as required, and before known significant rainfall events to ensure they are capable of functioning to remove sediment during high-rainfall events. PML established surface water monitoring sites, prior to the construction of the basin structures which include sites upstream and downstream of the (entire) operation.

4.1.5 Wastewater Treatment Plant

The WWTP is a Moving Bed Bioreactor system designed to treat up to 125 m^3 of effluent per day. The WWTP came to the Premises fully assembled, factory tested and water treatment cultures generated off site with the suppliers having commissioned it ready for operations.

Throughput is based on the 300 room camp at full occupancy with an input rate of 250 litres per person per day (taking into account camp ablutions, kitchen and washing facilities, as well as ablutions at the mine site) for a maximum output of 75 m^3 per day expected.

Brine from the Camp RO Plant is sent to the irrigation tank at the WWTP and mixed with treated effluent prior to discharge to the spray field, which is located north of the village. The Licence

Holder also has DWER approval to increase the irrigation field from 3.04 ha to 4.72 ha (Works Approval W6051/2017/1). The irrigation area expansion is yet to be constructed.

The spray field is located within the Macroy Land System, described as “comprising stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands”. The soils in the area of the spray field are red sandy loam with fine gravel throughout. The high loam content of the soil places it in the “Fine grained soils” category as defined by Table 1 of *Department of Environment 2004 Water Quality Protection Note Irrigation with nutrient-rich wastewater* (WQPN 22).

Coordinates for the existing and proposed extension to the irrigation field are shown in Table 7 and the WWTP layout is shown in Figure 12.

Table 7: Coordinates for the existing and proposed extension to the irrigation field

Spray field section	Coordinates	
Existing spray field (3.04 ha)	697606.0 mE 76743779.9 mN	697795.5 mE 7674377.9 mN
	697606.2 mE 7674217.7 mN	697795.7 mE 7674217.9 mN
Proposed extension (1.69 ha)	697606.0 mE 7674467.3 mN	697795.5 mE 7674467.3 mN
	697606.0 mE 76743779.9 mN	697795.5 mE 7674377.9 mN

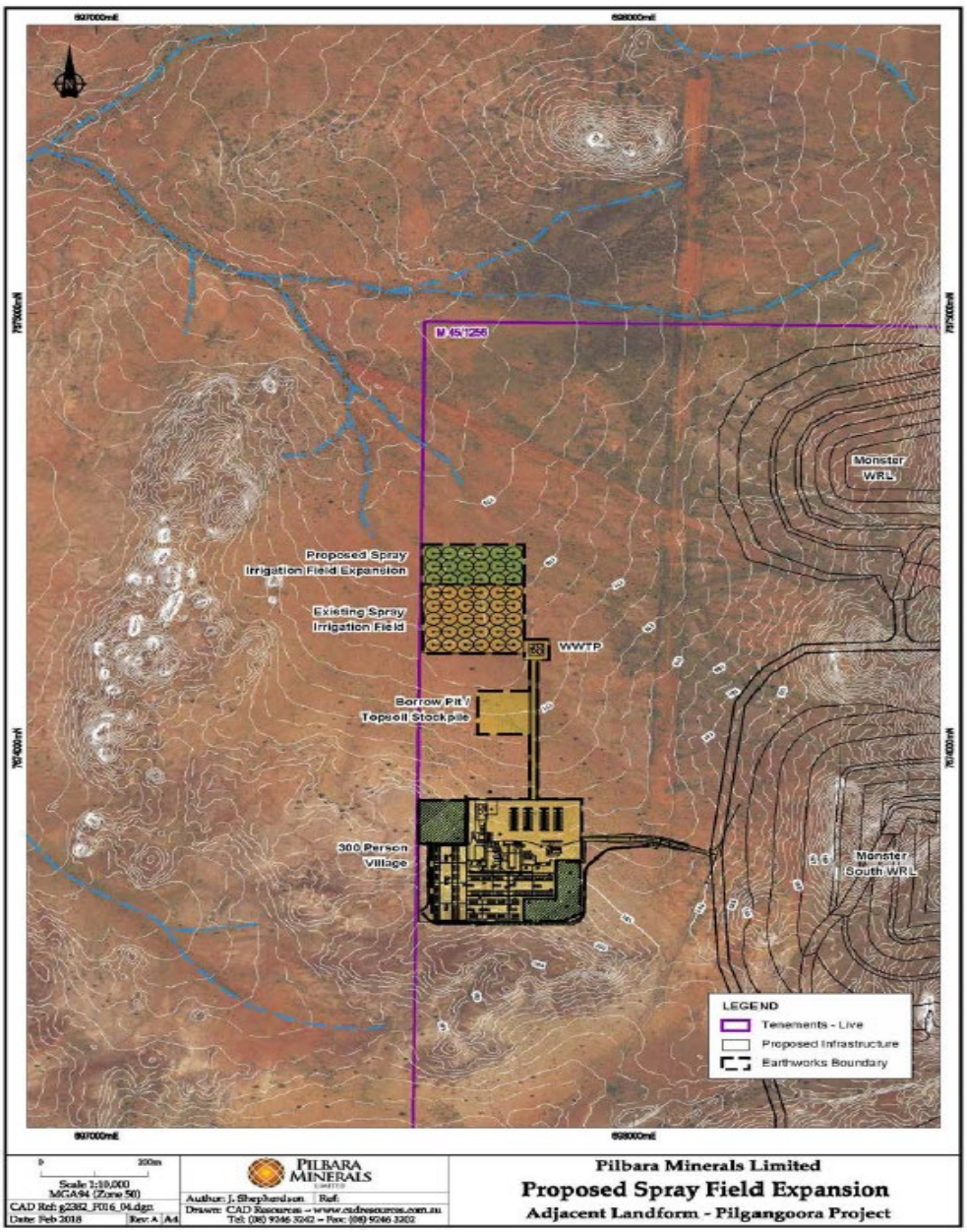

Figure 12: WWTP location, current irrigation field and irrigation field expansion (expansion yet to be constructed)

4.1.6 RO Processes on site

Two RO Plants are operated on site. One is located at the camp and the other one at the Processing Plant. Information on water quality of the RO plant brine is shown in Table 11.

The combined total throughput of both RO Plants is 0.082GL/annum, less than the category 85B prescribed premise throughput of 0.50GL or more per year.

Camp RO Plant

The RO brine emission has been assessed as part of the WWTP disposal due to the mixing of this with the WWTP effluent and disposal to the irrigation area. The Camp RO Plant is supplied with raw water from production bore PWB005. The Licence Holder has advised that water treated through the RO process for use at the accommodation camp will have contaminants from the source groundwater removed such that it will reach potable water quality and meet the Australian Drinking Water Guideline requirements.

The Camp RO Plant has an estimated throughput/production capacity of 0.0638 GL/annum. The volume of wastewater is 50% of raw water input, 0.0319 GL/annum.

The waste brine from the Camp RO Plant is sent to the irrigation tank at the WWTP and mixed with treated effluent prior to discharge to the sprayfield.

Processing Plant RO Plant

The Processing Plant RO Plant is supplied with raw water from production bore PWB005. The processing plant RO Plant has an estimated throughput of 0.0182 GL/annum and the waste brine is 0.0091 GL/annum.

Brine from the RO Plant at the Processing Plant is mixed with dewatering effluent prior to it being recirculated back into the Process Water Dam for use within the plant process.

4.1.7 Inert and Putrescible landfill

The Licence Holder has constructed an inert and putrescible landfill within the West Waste Dump as shown in Figure 2. The Monster Waste Dump has not yet been constructed.

The landfill currently consists of five trenches, each with a capacity of 720m^3 (3,600m^3 total), where putrescible and inert waste is disposed of separately. More trenches will be implemented as required. The layout is shown in Figure 13.

Figure 13: Landfill Trenches Layout

A maximum of 5,000 tonnes per annual period of waste is to be disposed. The waste types consist of:

- Inert Waste Type 1;
- Inert Waste Type 2;
- Contaminated solid waste meeting waste acceptance criteria specified for class I or II landfills; and
- Putrescible Waste.

Contaminated solid waste may be disposed of to the landfill if it meets the guideline values in the Class I or II Landfill criteria listed in Landfill Waste Classification and Waste Definitions 1996 (As amended December 2009), after treatment at the bioremediation facility.

4.2 All Infrastructure

The Pilgangoora facility infrastructure, as it relates to Categories 5, 52, 54, 64, 70 and 73 activities, is detailed in Table 8 and with reference to the proposed site layout as shown in Figure 2.

Table 8: Pilgangoora facility Category 5, 12, 52, 54, 64, 70 and 73 infrastructure

Infrastructure	
Prescribed Activity Category 5	
Lithium and tantalum bearing ore is processed to produce lithium and tantalum-niobium concentrate fines for the chemical and technical grade markets. Tantalum concentrate is shipped offsite in bulka bags and spodumene (lithium) is trucked offsite as a concentrate. Tailings is thickened and disposed of to an integrated waste landform TMF.	
1	Processing Plant designed to process 2 Mtpa, beneficiating run-of-mine ore to a 6% lithium concentrates fines and a tantalum-niobium concentrate fines: •Concrete pad bunded with containment capacity equivalent to 110% of the capacity of all tanks; •Electric sump pumps; •Primary/Secondary/Tertiary crushers; •Wet screener; •Two stages of Dense Media Separation; •Wet spiral concentrators; •Four vibrating feeders; •High Pressure Grinding Roll; •Stage 1 Feed Preparation screener; •Four Stage 1 Cyclones; •Grinding Mill; •One Stage 2 Cyclone; •Wet spiral concentrators; •Cleaner spirals; •Cleaner scavenger spirals; •Low intensity magnetic separator; •Rougher and cleaner wet shaking tables; •Primary hydrocyclones; •Floatation circuit; •Tailings thickener; •Ball mill; •Spodumene concentrate thickener; •Pressure filter; •Spray/ sprinkler systems; •Stockpiles; •Tantalum concentrate bulka bag storage area. •Spodumene (lithium) concentrate storage shed.
2	Tailings Management Facility: •Cell 1, Stages 1A and 1B; •Cell 2, Stages 1A and 1B; •Minimum crest width of 40m; •Waste landform type facility; •Central decant water pond; and •Associated pumps/piping (including tailings line and water line) with pressure transmitters.
3	Control System.
4	Process Water Pond consisting of two Cells (Cell 1 and Cell 2) lined with minimum 1.8 mm thick HDPE liner.
5	Sedimentation Pond.
6	Chemical storage within the workshop area: •Concrete bunded area containing plinths for the location of isotainers, mixing tanks and storage

Infrastructure	
	tanks located within the Processing Plant area; • Transfer pumps/pipelines fitted with pressure transmitters; • Isotainers will contain the following liquids: ➢ 28kL Sodium hydroxide (50% w/w) (33m^3 per month); ➢ 28kL Sodium silicate (43% w/w) (26m^3 per month); ➢ 28kL Flotinor 7179 (as supplied) (300m^3/month); ➢ 1000L IBC sulphuric acid (98% w/w) (estimate 20m^3/ month, if required); ➢ 50m^3 sodium lignosulphonate mixing tank (25% w/v sodium lignosulphonate); and ➢ 50m^3 sodium lignosulphonate solution storage tank (25% w/v sodium lignosulphonate). • Dry reagents stored in a storage shed: ➢ Sodium lignosulphonate (1000kg bags) (40 tonnes per month); ➢ Magnafloc 333 flocculant (3 tonnes per month); and ➢ Ferrosilican in bulka-bags (35 tonnes per month).
Prescribed Activity Category 52	
Dual fuel natural gas/diesel power plant of 15.7 MW and 2.9 MW standby.	
1	7 x 2500 kVA, 2 x 1300 kVA and 1 x 3100 KvA generators giving a capacity of 23,200 kVA. Particulate Matter (PM). QSK78-G9: 0.1 g/bhp-h or 0.46 g/min. QSV91G: n/a. HSK78G: n/a. VOC. QSK78-G9: 0.14 g/bhp-h or 6.48 g/min. QSV91G: 3.04 g/bhp-h or 141.88 g/min. HSK78G: 2.7 g/bhp-h or 126.09 g/min. Data offered for QSK 78 Diesel Genset, data is based on Tier-1 Emissions. FROM A111380. ('n/a' means the concentration is insignificant and hence not measured).
2	Compressed natural gas daughter station (not yet installed).
3	Control System to monitor efficiency of the system.
4	Trailer mounted self-contained 350 m^3 gas in bullet type vessels (18 hour supply of gas).
5	Oil tanks within concrete bunded areas.
6	Waste oil storage tank.
7	Used oil contaminated parts fully enclosed metal bin storage.
8	Oily Water Separator.
9	Sedimentation Pond.
Prescribed Activity Category 54	
Moving sequence batch reactor (SBR) less than 125 m^3/day treatment capacity WWTP, fully assembled and factory tested.	
1	Sequence Batch Reactor treatment facility.
2	Five packaged sewage pump stations.
3	200 kL Balance Tank.
4	300 kL Treated Effluent/Irrigation Tank.
5	Sludge thickening tank.

Infrastructure	
6	Associated tanks and equipment.
7	High level alarms wired to visual strobe light and sounder to alert of overflows.
8	WWTP inlet and outlet flow meters.
9	Capacity for two and a half days of contingency storage at full camp occupancy in the event of WWTP malfunction.
10	3.04ha spray irrigation area (approved up to 4.73ha) with 30 irrigation impact sprinkler heads and HDPE pipeline PN12.5.
11	Three strand perimeter fencing around the spray irrigation area.
12	Tie-in with Camp RO brine stream at the treated effluent irrigation tank.
13	The WWTP is designed to achieve the following water quality standards: • Biochemical Oxygen Demand <20mg/L; • Total Suspended Solids <30mg/L; • Total Nitrogen <30mg/L; • Total Phosphorus <7.5mg/L; • Chlorine Residual >0.2-2mg/L; • pH 6.5-8.5; and • E.coli <1000cfu/100mL.
Prescribed Activity Category 64	
Putrescible, inert and contaminated solid waste 5,000 tpa landfill facilities incorporated within West Waste Dump includes the disposal of unserviceable tyres.	
1	Putrescible, inert and contaminated solid waste segregated trenches to maximum depth of 4mbgl.
2	Each cell rock-bunded to prevent wind-blown rubbish from escaping across site.
Prescribed Activity Category 73	
Above ground self bunded fuel storage tanks to a total capacity of 1,036 m^3 of diesel (in aggregate).	
1	440 kL (4 x 110kL) self bunded diesel tanks for mining fleet, located at the mining contractors yard.
2	26 kL (1 x 26kL) self bunded diesel tank for camp diesel supply, located at the camp.
3	550 kL (5 x 110kL) self bunded diesel tanks for power plant, located at the bulk fuel facility.
4	20kL (1 x 20kL, the “day tank”) for the Power Station will be located in a concrete bund at the bulk fuel facility.
Other activities	
1	Office.
2	Workshop and laydown areas.
3	Laboratory.
4	Plant complexes.
5	A 500 person accommodation village and associated infrastructure.

Infrastructure	
6	2 Reverse Osmosis Plants: 1 to facilitate the accommodation camp and 1 to facilitate the Process Plant with a combined throughput of less than 0.50GL or more per year.

5. Legislative context

The following Table 9 outlines the known legislative context for this project in relation to this works approval amendment.

Table 9: Pilgangoora Project Legislative context.

Legislation	Number	Subsidiary	Approval
Mining Act (WA) 1978	Mining Proposal (with Closure Plan) (Reg ID 63791) 9 May 2017	PML	Pilgangoora Lithium Tantalum Project - Version 3 on M 4500333; M 4500078; M 4501256; M 4500511; L 4500388; L 4500413; L 4500414
	Mining Proposal amendment (Revised) (Reg ID 68032) 22 August 2017		Pilgangoora Lithium-Tantalum Project, Version 4 on M 4501256; M 4500333; M 4500511; M 4500078; L 4500388; L 4500413; L 4500414; L 4500417. (NB: the Closure Plan did not change between Versions 3 and 4).
	Mining Proposal (Reg ID 70524) 28 February 2018.		This Mining Proposal approval includes TMF cell 1 and TMF cell 2. Fixed plant crushing and screening of ore material has been approved however, mobile crushing and screening is yet to be approved. The proposed increase in the disturbance footprint for the spray irrigation field expansion is currently approved under the Mining Act. The current Mining Proposal does not include a landfill in either the Monster Waste Dump (already approved under W6051/2017/1) or the landfill within the West Waste Dump. Department of Mines, Industry Regulation and Safety (DMIRS) does not have any concerns with any aspect of the proposed works approval amendment (DMIRS, 2018).
	Mining Proposal (Reg ID 76718)	POPL	DMIRS considered the Licence Holder's proposal to amend the TMF design, which is not supported by adequate geochemical testwork or a detailed seepage assessment (both required under Condition 1 and Condition 2 of the Works Approval W605/2017/1) and DMIRS requested the Licence Holder remove the TMF design amendment from Mining Proposal (Reg ID 76718). The Mining Proposal was then approved in December 2018.
	Mining Proposal (Reg ID 78129)	POPL	Mining Proposal for optimisation of the project and increased processing rate which will result in a shorter LOM. The changes proposed are: • Construction of a second processing circuit (Train 2) with capacity of 3 Mtpa, to run in tandem with the existing (Train 1) 2 Mtpa processing circuit. A tantalite dressing plant will be also added and expansion of the process water pond; • Expansion of the existing power station to provide an additional 16.3 MW with an overall total capacity of 32 MW. Expansion of the bulk diesel storage area to supply mining fleet and the power station; • LOM will reduce from ~ 35 years to 17 years; • Increased rate of tailings deposition and rate of embankment construction for TMF Cell 1 and Cell 2. No footprint or height change proposed in this MP; • Increased LOM tailings volume from 58.8 Mt to 68.3 Mt due to

			the changes proposed to the Central Pit and processing increase; • Low grade ore stockpile and new WRL (West WRL) both predominately located within areas previously approved for topsoil stockpiling or disturbed by historical mining activity. Additional clearing of 21.74 Ha and reallocation of 54.53 Ha approved topsoil stockpile area will be re-assigned (POPL state that topsoil stockpiling within future footprint of TMF cell 3 and direct spreading will address this loss of area); • Extension of the Central Pit to include Stage 5 cutback and Pilgangoora Creek diversion. 11.8 Ha disturbance increase; • Reallocation of land use between the Monster WRL, North ROM, topsoil stockpile area and Main ROM to increase ROM capacity and topsoil area; • New explosives storage facility and magazine in M45/473 to offer flexibility due to the moving nature of mining activity across the Project; • Expansion of the Accommodation village to 750 rooms to accommodate the construction work force. Duplication of the WWTP. Disturbance increase of 5 Ha; • New tenements for the "Western Borefields"; and • Overall increase in disturbance is 44.83 Ha (disturbance covered under the existing NVCP and 10 Ha exemption for some tenements). Change in environmental risks / impacts of the proposed Project amendments under a 5 MTPA processing throughput (Reg ID 78129) include: • Project drawdown impacts will significantly increase due to the higher rate of dewatering associated with an increased mining rate and processing throughput. Some of these increased impacts are also attributed to a better understanding of the fractured rock aquifer geometry and hydraulic conductivity; and • The LOM will halve, with associated implications on closure planning (assessed under the MCP in this assessment report). RMP and PMP to be updated with inclusion of the tantalite dressing plant. No environmental risks associated with this, as waste rock and tailings remain below 1 Bq/g.
Granted under section 51E of the EP Act	Clearing Permit CPS 7449-1 23 March 2017	PML	Clearing limited to 1,217 ha on Mining Lease 45/78, Mining Lease 45/333, Mining Lease 45/511, Mining Lease 45/1256, Miscellaneous Licence 45/388, Miscellaneous Licence 45/413, Miscellaneous Licence 45/414
	Clearing Permit amendment CPS 7449-2 3 August 2017		Clearing limited to 1,330 ha on Mining Lease 45/78, Mining Lease 45/333, Mining Lease 45/511, Mining Lease 45/1256, Miscellaneous Licence 45/388, Miscellaneous Licence 45/413, Miscellaneous Licence 45/414, Miscellaneous Licence 45/417
	Clearing Permit CPS 8175/1 October 2018	POPL	Clearing limited to 1,330.1 ha on Mining Lease 45/78, Mining Lease 45/333, Mining Lease 45/511, Mining Lease 45/1256, Miscellaneous Licence 45/388, Miscellaneous Licence 45/402, Miscellaneous Licence 45/411, Miscellaneous Licence 45/413, Miscellaneous Licence 45/414, Miscellaneous Licence 45/417, Miscellaneous Licence 45/426, Miscellaneous Licence 45/430
Rights in Water and Irrigation Act 1914	GWL183594 (2)	PML	The annual entitlement for the licence is 1,000,000kL from Southern Borefield on L45/413. This water is for dust suppression and processing. This lease is outside the current approved Premises boundary of Mining Tenement M45/1256.

	GWL183354 (1) 3 March 2017)	PML	The annual entitlement for the licence is 1,250,000 kL from bores located across the mining tenements M45/78, M45/333, M45/511 and M45/1256 for dust suppression, earthworks and construction, camp requirements and road construction purposes. This licence expired on 2 March 2018, however PML applied for a renewal of this licence on 14 February 2018. This licence remains valid until the next version of the licence has been issued by DWER.

5.1 Part IV of the EP Act

The Licence Holder has stated that the project has not been referred to Part IV of the EP Act for assessment under s38 of the EP Act as the Premises was not considered to have a significant impact on the environment.

5.2 Other relevant approvals

5.2.1 Radiation management

In Western Australia the primary legislation relating to radiation management is the *Radiation Safety Act 1975* and subsidiary legislation. In general, mining operations are mandated to comply with the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Code of Practice & Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing – Radiation Protection Series No. 9 (the Radiation Code).

Within the Radiation Code it is stated that the International Atomic Energy Agency (IAEA, RS-G-1.7) sets exclusion levels for naturally occurring radioactivity in bulk materials at 1 Becquerel per gram (Bq/g) head-of-chain activity for the uranium and thorium decay chain radionuclides. The activity concentration of 1 Bq/g is currently the internationally-accepted level for defining the scope of regulation for naturally occurring materials containing uranium or thorium.

The Licence Holder advised that as part of the tailings test work, a subsample of tailings was assayed by ALS in June 2016. Thorium and Uranium concentrations were 2.6 mg/kg and 3.2 mg/kg respectively. At these concentrations, the combined activity concentration of Thorium and Uranium is approximately 0.05 Bq/g which is an order of magnitude lower than the internationally adopted radiation management trigger value of 1 Bq/g.

Transport of radioactive material in Western Australia is legislated by the *Radiation Safety (Transport of Radioactive Substances) Regulations 2002*, made under the *Radiation Safety Act 1975*. The regulations commit Western Australia to regulating the transport of radioactive materials as per the requirements of the ARPANSA Code of Practice for the Safe Transport of Radioactive Material – Radiation Protection Series No. 2 (Transport Code). Under the Transport Code (Section IV, Table 1. *Basic Radionuclide Values)* the exemption limit for materials or ores containing natural uranium and thorium is 1 (1×10^0) Bq/g head-of-chain. However, under an additional clause, paragraph 107(e) of the Transport Code states, "natural material and ores containing naturally occurring radionuclides that are either in their natural state, or have been processed only for purposes other than for the extraction of the radionuclides, and that are not intended to be processed for use of these radionuclides, provided that the activity concentration of the material does not exceed 10 times the values specified in para. 401(b), or calculated in accordance with paras 402-406".

Based on the additional clause, paragraph 107(e) of the Transport Code, the limit for transport of materials or ores containing natural uranium and thorium is 10 Bq/g head-of-chain.

Due to the overall low uranium and thorium level details as provided in the Licence Holder's supporting documentation, the requirements of the Radiation Code "are not applicable" to the Premises. "It is not anticipated that any pre-operational baseline or radiation management actions is needed".

Radiation Management Plan

DMIRS has required the Licence Holder to have a Radiation Management Plan for the site in accordance with the requirements of the regulation 16.7 of the *Western Australian Mines Safety and Inspection Regulations 1995.*

The current version of this plan is dated November 2017, however, is in need of update as it states that no elevations of radionuclides are present. Elevations of Gross Alpha, with increasing trends, have been noted in both the wastewater and groundwater, which exceed the trigger level of 0.5 Bq/L as listed in the ANZECC/ARMCANZ water quality guidelines. This data is required to be monitored for wastewater and groundwater data, respectively.

DWER has advised DMIRS of this data and sent a formal advice request on 23 January 2019 to advise of any concerns or recommendations as a result of this data. DMIRS provided a response with recommendations for Radionuclides Characterisation, which has since been provided by the Licence Holder and detailed in Section 6.4.

This Radiation Management Plan undergoes standard updates as required by DMIRS. An updated Radiation Management Plan has recently been submitted to DMIRS, which includes the last two years of groundwater radiation monitoring results.

5.2.2 Planning approvals

The Licence Holder has the required planning approvals for this stage of operations

5.2.3 Department of Jobs, Tourism, Science and Innovation

This project has not been listed as having an Agreement Act administered by the department.

5.2.4 *Environment Protection and Biodiversity Conservation Act 1999* (Cth)

The Project was not referred to the Commonwealth Department of Environment and Energy.

5.3 Part V of the EP Act

5.3.1 Applicable regulations, standards and guidelines

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

The guidance statements which inform this assessment are:

- *Guidance Statement: Regulatory Principles (July 2015);*
- *Guidance Statement: Setting Conditions (October 2015);*
- *Guidance Statement: Decision Making (February 2017);*
- *Guidance Statement: Risk Assessments (February 2017);*
- *Guidance Statement: Environmental Siting (November 2016);* and
- Guidance Statement: Licence duration (August 2016).

5.3.2 Works approval and licence history

Table 10 outlines the works approval and licence history for the premises.

Table 10: Instruments issued for the Premises since 28 September 2017

Instrument	Issued	Description
W6051/2017/1	28/09/2017	Original approval to construct: • Category 5: max. 2mtpa capacity Processing Plant including Tailings Management Facility (TMF) Cell 2, Stage 1 only to 13.3m RL and tailings pipeline infrastructure; • Category 52: 15.7 MW (plus 2.2 MW standby) capacity Power Station; • Category 64: 5,000 tpa capacity putrescible and inert landfill facility; • Category 70: Crushing and Screening Facility, limited to 50,000 tpa during construction; • Category 73: 1,036 m^3 in aggregate Bulk fuel and chemical storage; and • Category 85: 50 m^3/day throughput Wastewater Treatment Plant.
W6051/2017/1	06/11/2017	Amendment 1 – DWER initiated amendment of Condition 6 to authorise the commissioning of the Process Plant and Power Station for a period no longer than 2 months
W6051/2017/1	29/06/2018	Amendment 2 – allows the following Approval to construct: • TMF Cell 1 Stage 1 (TMF 1), stages 1A and 1B; • TMF Cell 2 Stage 1 (TMF 2), in stages 1A and 1B; • Modifications of the existing WWTP to allow for an increase in throughput (from 100 to 125m^3/day) and associated irrigation field expansion; • Category 64 landfill within the West Waste Dump; and • Mobile crushing and screening plant (max capacity 1,000,000 tpa) for ore production. Amendment to: • Change Prescribed Premises Category 5 to allow for the construction of a facility that allows for an increased processing throughput of (max) 1 Mtpa, taking the Premises total processing capacity to 3 Mtpa; • Change Prescribed Premises Category 85 to Category 54 to allow for the increased throughput and discharge from the WWTP; • Add a new landfill location within the Premises; • Prescribed premises boundary to include L45/417 tenure; and • Alter the location of the Category 52 Power Station and Category 73 fuel farm locations.
W6051/2017/1	16/10/2018	Transfer from PML to POPL. On 6 August 2018, PML implemented an internal restructure with assets (mining tenements, contracts, plant, equipment, permits and licenses) relating to the Pilgangoora Lithium-Tantalum Project transferred to POPL.
W6051/2017/1	25/02/2019	Amendment 3 – extended the commissioning periods until 30 September 2019.

5.3.3 Clearing

The clearing of native vegetation is not approved under the Licence. Refer to Table 9 for information on known clearing approvals for this project.

6. Modelling and monitoring data

6.1 Monitoring of discharges to land

Fortnightly monitoring of RO brine and RO brine mixed with WWTP effluent had been required under Works Approval W6051/2017/1. The results are provided in Table 11 below. It should be noted that elevations in fluoride and Gross Alpha are present above the ANZECC/ARMCANZ guidelines, Short-term trigger values for irrigation (recommended relevant guideline by DWER's Contaminated Sites Branch). It would be expected that the Processing Plant RO Plant would have similar brine water quality.

There is unlikely to be significant impacts on vegetation and soil fauna from the use of water that contains about 2.9 mg/L of fluoride as this concentration is only marginally above the short-term irrigation value of 2 mg/L. DWER's Contaminated Sites Branch has advised that it is likely that the ongoing use of water with this fluoride concentration will cause concentrations of this anion to progressively increase in groundwater beneath the site due to the effects of evaporative concentration and due to physical and chemical processes that will allow fluoride to have high mobility soils beneath the irrigation area.

Table 11: Camp RO Brine and WWTP Discharge Data

	RO Brine									RO brine and WWTP effluent									
Parameter (mg/L)	31/07/18	14/08/18	29/08/18	12/09/18	25/09/18	10/10/18	24/10/18	07/11/18	21/11/18	31/07/18	14/08/18	29/08/18	12/09/18	25/09/18	10/10/18	24/10/18	07/11/18	21/11/18	ANZECC irrigation[1]
Volume	-	797	1010	918	497	828	705	793	465	1974	882	1483	1527	997	1233	912	1189	1508	-
TDS	2100	3000	2900	2700	3300	1700	3200	3000	2400	700	1700	2100	1300	1500	1200	1200	2100	2200	<4,000
TSS	-	-	-	-	-	-	-	-	-	11	6	28	34	6	-	-	-	-	<30
E.coli	-	-	-	-	-	-	-	-	-	<10	<1	<1	<1	22	-	-	-	-	<1,000
pH (pH units)	8	8.1	8.1	8.3	8.1	8.1	8.3	8	8.3	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.3	6.5-8.5
BOD	-	-	-	-	-	-	-	-	-	13	<5	13	13	10	<5	<5	<5	<5	<20
Total P	0.13	0.09	1	0.12	0.45	0.05	0.04	0.09	0.06	0.55	0.46	1.2	2	0.61	0.68	0.66	0.74	1.1	<7.5
Total N	5.5	6.6	4.9	2.6	6.9	3.2	6.6	5.6	4.5	44	22	10	14	7.6	6.3	9.7	15	7.8	<30
Al	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.079	0.066	0.17	0.12	0.086	0.094	0.11	0.069	0.057	<20
As	0.041	0.058	0.058	0.05	0.054	0.032	0.058	0.058	0.042	0.005	0.032	0.039	0.021	0.022	0.017	0.019	0.036	0.039	<2.0
Bi	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Br	4.2	4.8	3.8	4	5	2.4	5.4	4.8	3.9	5.4	1.9	2.6	1.5	1.8	1.4	1.4	2.6	3.5	-
Cd	0.0003	0.0002	0.0003	0.0002	0.0003	0.0002	<0.0001	0.0003	0.0002	<0.0001	<0.0002	<0.0001	0.0001	0.0001	<0.0001	<0.0001	0.0002	0.0002	<0.05
Cs	0.033	0.058	0.053	0.052	0.064	0.030	0.060	0.062	0.045	0.009	0.030	0.040	0.023	0.026	0.018	0.020	0.037	0.04	-
Ca	120	170	160	150	170	96	130	170	130	25	94	110	66	74	56	69	110	120	-
Total hardness as $CaCO_3$	1000	1400	1500	1300	1500	880	1500	1500	1200	180	770	1000	550	640	500	570	940	1000	-
Cl	610	980	820	850	1100	570	1100	1100	820	280	660	820	420	540	380	500	720	760	-
Cr	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<1
Co	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.1
Cu	0.017	0.007	0.006	0.006	0.006	0.004	0.001	0.007	0.004	0.010	0.017	0.024	0.015	0.007	0.006	0.011	0.023	0.002	<5
F	2.8	3.8	3.8	3.2	3.9	2.2	3.5	4.1	2.9	0.6	2.1	2.9	1.4	1.7	1.2	1.3	2.6	2.7	<2
Gross Beta	0.077	0.122	0.177	0.206	0.095	0.066	0.058	0.068	-	<0.063	0.077	0.050	0.071	-	0.059	0.045	0.096	-	0.5
Gross Alpha	0.443	0.714	0.783	0.829	1.190	0.387	0.728	1.230	-	0.044	0.325	0.224	0.161	-	0.159	0.145	0.144	-	0.5
Cr^{6+}	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.019	<0.004	<0.004	<0.004	<0.004	<0.004	0.026	0.025	<0.004	<1
Fe	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.071	0.006	0.008	0.015	0.026	0.009	0.024	0.0042	<0.005	<10
Pb	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<5
Li	1.4	2.0	1.8	1.4	1.9	1.1	2.0	1.9	1.4	0.24	0.86	1.60	0.59	0.84	0.66	0.72	1.20	1.30	<2.5
Mg	180	240	250	230	270	150	290	260	210	30	130	180	94	110	87	96	160	180	-
Mn	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.015	0.01	0.004	0.014	0.017	0.013	0.013	0.012	0.004	<10
Hg	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.002
Ni	0.008	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.002	0.006	0.006	0.008	0.006	0.006	0.006	0.001	0.006	0.003	<2
Nb	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
K	2.2	3.1	3.1	2.7	2.5	1.8	3.7	3.3	2.5	12	8.1	5.3	9.7	8.9	7.8	10	7.0	3.9	-
Rb	0.012	0.021	0.020	0.018	0.022	0.011	0.022	0.022	0.016	0.016	0.019	0.02	0.018	0.019	0.015	0.020	0.021	0.017	-
Se	0.006	0.007	0.009	0.007	0.008	0.005	0.009	0.008	0.007	0.001	0.004	0.006	0.003	0.003	0.003	0.003	0.005	0.006	<0.05
Radium 226	0.024	0.038	0.028	0.034	<0.44	-	-	-	-	<0.051	<0.059	0.055	<0.056	-	-	-	-	-	5
Radium 228	<0.120	<0.098	<0.130	0.077	<0.095	-	-	-	-	<0.150	<0.110	0.053	<0.170	-	-	-	-	-	2
Si	45	66	54	48	55	30	58	56	42	29	40	20	30	39	18	18	33	36	-
Na	370	610	570	470	600	340	590	590	470	170	310	470	250	300	230	270	390	430	-
SO_4	190	270	270	260	300	180	300	320	260	44	140	200	110	140	100	120	200	240	-
Ta	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
Tl	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
U	0.011	0.014	0.014	0.014	0.015	0.008	0.013	0.015	0.011	0.001	0.007	0.010	0.006	0.007	0.004	0.004	0.009	0.010	<0.1
Zn	0.021	0.010	0.008	0.009	0.010	0.006	<0.005	0.007	0.006	0.035	0.041	0.021	0.031	<0.001	0.050	0.028	0.063	0.007	<5

Note 1: Derived from the ANZECC/ARMCANZ guidelines, Short-term trigger values for irrigation

Note 2: Orange text indicates where trigger levels have been exceeded in the mixed RO brine and WWTP effluent as this is what is discharged to the irrigation area

6.2 Modelling of TMF seepage

Condition 2 of Works Approval W6051/2017/1 required a seepage model for TMF Cell 1 and TMF Cell 2 be provided that:

- Estimates the total seepage magnitude;
- Shows seepage flow direction from TMF Cell 1 and TMF Cell 2;
- Includes a site specific risk assessment for seepage from TMF Cell 1 and TMF Cell 2, identifying potential pathways and impacts on receptors including potential impacts to the hyporheic zone of Pilgangoora Creek; and
- Any additional controls required to manage seepage in the event that testing undertaken indicates that contaminants are at levels of environmental concern.

Two scenarios were modelled:

- Scenario 1 uses extremely low rock permeability, forcing seepage to propagate laterally and thus groundwater intersects Pilgangoora Creek by year 6 at very low rates; and
- Scenario 2 uses measured rock permeability from geotechnical investigations and this higher permeability allows seepage to propagate vertically, remaining at 40 metres below the creek level, thus not impacting on Pilgangoora Creek.

The outcome will likely be somewhere between these two scenarios, with mine dewatering activities influencing the seepage. An average of the two models results in groundwater remaining approximately 20 metres below the creek level.

DWER has verified that the modelling of seepage from the TMFs has been undertaken in an appropriate manner using a suitable finite-element modelling code, and the conclusions of the modelling are supported as are the proposed control measures to further reduce the seepage risk from the facility.

6.3 Monitoring of ambient groundwater

Works Approval W6051/2017/1 Condition 15 required a report providing all baseline water quality sampled for the groundwater monitoring bores listed in Schedule 1 of the Works Approval.

Condition 16 required a report be submitted containing groundwater monitoring results from the following bores:

- TMFMB01;
- TMFMB02;
- PWB005;
- PMB001;
- PMB002; and
- PWB004.

Condition 17 required that the following groundwater monitoring bores be constructed that are in the vicinity of TMF Cell 1:

- TMFMB3: 697575E 7669675N;
- TMFMB4: 696457E 7670088N;
- TMFMB5: 695880E 7670579N;
- TMFMB6: 696165E 7669570N; and
- New shallow (50m) monitoring bore adjacent to PWB004: 696609E 7670135N.

Condition 18 required that the results from the bores constructed via condition 17 be provided in a report.

These reports have been received, reviewed and accepted by DWER.

6.3.1 Groundwater Chemistry

The Licence Holder provided groundwater quality information from bores sampled across the project area in early April 2018. The locations of the groundwater monitoring bores are shown in Figure 2. Some bores were not able to be sampled due to access issues at the time of sampling. This information is combined with data presented in the original (September 2017) Decision Report and is shown in Table 12. A comparison of data against ANZECC/ARMCANZ Livestock watering guidelines trigger exceedance and ANZECC/ARMCANZ Freshwater guidelines 95% protection limit exceedance is also provided within Table 12 for the purpose of the risk assessment review.

The average water depth of the bores able to be sampled across the project area was 13.8mbgl. Groundwater was observed to be fresh to brackish with EC values ranging from 714 - 2350 µS/cm, while TDS ranged from 472 - 2,120 mg/L. pH values observed across the project area ranged from 7.59 - 7.99. These results infer that pH is slightly basic and water quality (TDS) is fresh to slightly brackish.

With the exception of elevated levels of Aluminium in PMB009 and PMB010, Fluoride in PMB002 and sulphate in PB5, all baseline water quality levels provided by the Licence Holder are below the recommended levels for livestock drinking water ANZECC/ARMCANZ Livestock watering guidelines health trigger exceedance values. Aluminium, Cadmium, Copper, Boron, Nickel, Zinc and Chromium displayed water quality values higher than ANZECC/ARMCANZ Freshwater guidelines 95% protection value for freshwater ecosystems. More groundwater monitoring data is available within DWER records, but was too extensive to provide in this report.

Gross Alpha elevations over the ANZECC/ARMCANZ trigger values for radioactive contaminants in irrigation water guidelines are shown in Table 13 for TMFMB01.

Table 12: Groundwater Monitoring Summary

Analyte	Units	ANZECC Livestock	ANZECC Freshwater (mg/L)	PWB001 [3]	PWB002 [3]	PWB004 [11]	PWB005 [11]	PB5 [3]	PMB001 [11]	PMB002 [4]	PMB003 [4]	PMB004 [3]	PMB005 [4]	PMB006 [4]	PMB007 [4]	PMB008 [3]	PMB009 [3]	PMB010 [3]	TMFMB01 [4]	TMFMB02 [4]	TMFMB03 [10]	TMFMB04 [10]	TMFMB05 [10]	TMFMB06 [10]	New shallow bore near PWB004 (PWBMB004) [10]	SWB1 [3]	MRLPB3 [3]	SBM01 [3]	SBM033
pH	pH Units	NE	6.5 to 8.5	8.3	8.4	8.1	7.9	8.2	8	7.84	7.71	7.99	7.72	7.71	7.68	7.59	7.74	7.79	7.9	7.77	8	7.9	7.9	8.1	8	7.66	8.52	7.24	7.28
Conductivity	@ 25 C µS/cm	NE	NE	1600	2500	/	/	4700	/	2350	1360	2180	1560	1100	970	1330	783	898	714	1460	/	/	/	/	/	2230	1450	685	547
Total Dissolved Solids	mg/L	4000	NE	950	1500	/	/	3500	/	1360	996	2120	1060	736	640	868	581	653	472	1090	/	/	/	/	/	1610	925	502	450
Bicarbonate Alkalinity as HCO_3	mg/L	NE	NE	580	610	/	/	470	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Carbonate Alkalinity as CO_3	mg/L	NE	NE	2	8	/	/	<1	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Total Alkalinity as $CaCO_3$	mg/L	NE	NE	480	510	390	470	380	430	494	437	423	393	412	478	518	338	321	367	407	360	390	280	470	330	450	340	303	228
Total Hardness by Calculation	mg $CaCO_3$/L	NE	NE	510	500	/	/	2,000	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Fluoride by ISE	mg/L	2	NE	0.8	2.1	/	/	0.3	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Fluoride by PC Titrator	mg/L	2	NE	/	/	0.3	1.4	/	0.7	2.2	0.8	0.6	1.4	0.6	0.7	0.4	0.2	0.4	0.6	0.6	0.5	0.2	0.3	0.5	0.3	0.7	0.2	0.3	0.3
Gross Alpha	Bq/L	/	0.5	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0.3	0.27	0.55	0.706	0.476	/	/	/	/
Gross Beta	Bq/L	/	0.5	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0.08	0.081	0.088	<0.07	0.135	/	/	/	/
Nitrite, NO_2 as NO_2	mg/L	30	NE	<0.2	0.8	<0.2	<0.2	/	<0.2	/	/	/	/	/	/	/	/	/	/	/	0.6	<0.2	<0.2	<0.2	<0.2	/	/	/	/
Nitrate, NO_3 as NO_3	mg/L	400	0.7	11	34	2.9	3.9	100	10	/	/	/	/	/	/	/	/	/	/	/	3.6	4.3	<0.2	3.2	0.2	/	/	/	/
Sulfate, SO_4	mg/L	1000	NE	58	170	45	100	1300	92	135	50	421	67	36	19	42	85	66	32	68	140	31	16	64	50	205	133	48	44
Aluminum, Al	mg/L	5	0.055	0.007	0.037	0.017	0.025	/	0.25	0.02	0.83	0.001	0.09	0.06	0.04	0.36	7.6	5.55	0.13	0.02	<0.005	<0.005	0.009	0.009	0.006	0.04	0.02	0.27	3.88
Antimony, Sb	mg/L	NE	ND	<0.001	<0.001			/		<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	0.003	<0.01	<0.001	<0.001	/	/	/	/	/	<0.001	<0.001	<0.01	<0.01
Arsenic, As	mg/L	0.5	0.013 AsV, 0.024 AsIII	0.027	0.016	0.014	0.26	/	0.023	0.023	0.02	0.034	0.018	0.0002	0.038	0.044	0.003	0.003	0.001	0.008	0.005	0.004	0.002	0.009	0.005	0.068	<0.001	0.004	0.012
Barium, Ba	mg/L	NE	NE	0.029	0.066	/	/	/	/	0.069	0.089	0.099	0.039	0.226	0.016	0.024	0.319	0.16	0.137	0.154	/	/	/	/	/	0.025	0.001	0.108	0.057
Bismuth, Bi	mg/L	NE	ID	<0.001	<0.001	<0.001	<0.001	/	<0.001	/	/	/	/	/	/	/	/	/	/	/	<0.001	<0.001	<0.001	<0.001	<0.001	/	/	/	/
Boron, B	mg/L	5	0.37	0.6	1.10	/	/	/	/	0.79	0.36	0.64	0.44	0.17	0.32	0.5	0.35	0.4	0.24	0.79	/	/	/	/	/	0.83	0.48	0.22	0.21
Cadmium, Cd	mg/L	0.01	0.0002	<0.0001	<0.0001	0.0001	0.0002	/	0.0001	<0.0001	0.0003	0.003	0.002	<0.00001	<0.0001	<0.0001	0.001	<0.0001	<0.00001	0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.0001
Calcium, Ca	mg/L	1000	NE	59	61	80	70	71	62	57	90	106	73	100	65	56	74	62	52	94	75	82	65	39	73	26	6	39	29
Chloride, Cl	mg/L	NE	NE	230	410	220	350	690	240	440	240	504	314	141	78	193	55	119	45	321	320	190	35	190	230	530	301	76	63
Chromium,	mg/L	1	0.001 CrVI	<0.001	<0.001	<0.004	<0.004	/	<0.004	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.006	0.31	0.024	<0.001	0.002	<0.004	<0.004	<0.004	<0.004	<0.004	0.008	<0.001	0.002	0.032
Cobalt, Co	mg/L	1	ID	<0.001	<0.001	<0.001	<0.001	/	0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.007	0.005	0.002	<0.001	0.002	<0.001	0.001	<0.001	0.002	0.039	<0.001	0.004	0.003
Copper, Cu	mg/L	1	0.0014	0.001	0.002	0.02	0.009	/	0.002	<0.001	0.002	0.004	<0.001	<0.001	<0.001	0.002	0.016	0.012	0.001	0.001	<0.001	0.002	<0.001	0.002	<0.001	0.003	<0.001	0.002	0.004
Iron, Fe	mg/L	NE	ID	0.01	0.011	0.02	0.029	0.02	0.19	<0.05	0.87	<0.05	0.12	0.74	<0.05	0.35	8.01	6.11	0.49	<0.05	<0.005	<0.005	0.014	<0.005	<0.005	0.05	1.1	0.56	5.64
Potassium, K	mg/L	NE	NE	1.6	4.1	1.7	1.3	6.1	1.7	3	3	4	1	2	<1	1	11	10	11	4	8	1.8	3.9	2.7	8	14	7	5	4
Lead, Pb	mg/L	0.1	0.0034	<0.001	<0.001	0.005	<0.001	/	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Lithium, Li	mg/L	NE	NE	1.70	1.10	0.36	0.62	/	1.1	/	/	/	/	/	/	/	/	/	/	/	1.1	0.2	0.0	0.3	0.3	/	/	/	/
Magnesium, Mg	mg/L	600	NE	88	85	100	100	440	95	95	102	225	104	79	83	107	41	45	33	105	100	89	25	62	79	148	110	58	43

Analyte	Units	ANZECC Livestock	ANZECC Freshwater (mg/L)	PWB001 [3]	PWB002 [3]	PWB004 [11]	PWB005 [11]	PB5 [3]	PMB001 [11]	PMB002 [4]	PMB003 [4]	PMB004 [3]	PMB005 [4]	PMB006 [4]	PMB007 [4]	PMB008 [3]	PMB009 [3]	PMB010 [3]	TMFMB01 [4]	TMFMB02 [4]	TMFMB03 [10]	TMFMB04 [10]	TMFMB05 [10]	TMFMB06 [10]	New shallow bore near PWB004 (PWBMB004) [10]	SWB1 [3]	MRLPB3 [3]	SBM01 [3]	SBM033
Manganese, Mn	mg/L	NE	0.0019	0.025	0.037	0.0	0.001	0.006	0.036	/	/	/	/	/	/	/	/	/	/	/	0.29	0.002	0.49	0.017	0.74	/	/	/	/
Mercury, Hg	mg/L	0.02	0.006 (inorganic)	/	/	<0.00005	<0.00005	/	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, Mo	mg/L	0.15	ID	0.003	0.01	0.001	0.003	/	0.007	0.005	0.001	<0.001	0.002	0.003	<0.001	<0.001	0.006	0.006	0.019	0.003	0.01	<0.001	0.006	0.006	0.008	0.001	<0.001	0.002	0.001
Nickel, Ni	mg/L	1	0.011	0.001	0.002	0.005	0.002	/	0.002	<0.001	<0.001	0.003	<0.001	0.001	<0.001	0.004	0.015	0.013	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.002	0.002	<0.001	0.017	0.024
Niobium, Nb	mg/L	NE	NE	<0.005	<0.005	<0.005	<0.005	/	<0.005	/	/	/	/	/	/	/	/	/	/	/	<0.005	<0.005	<0.005	<0.005	<0.005	/	/	/	/
Total N	mg/L	NE	NE	/	/	0.72	0.96	/	2.4	4.2	1.7	23.3	2.1	0.5	1.2	1.1	0.2	0.3	0.3	1.1	1.6	0.98	0.11	0.8	0.22	1.6	0.2	0.2	<0.1
Total P	mg/L	NE	NE	/	/	0.03	<0.02	/	0.03	<0.01	0.04	<0.05	0.01	0.08	<0.01	0.03	0.08	0.11	0.06	0.02	0.3	0.03	0.04	0.09	0.08	0.02	<0.01	0.06	0.04
Phosphorus, P	mg/L	NE	NE	<0.05	0.32	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Radium-226	Bq/L	5	5	0.075	<0.043	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Radium-228	Bq/L	2	2	<0.099	0.048	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Selenium, Se	mg/L	0.02	0.011	0.004	0.011	0.002	0.003	/	0.003	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.002	<0.001	<0.001	0.003	<0.001	<0.01	<0.01	<0.01	<0.01
Silica, Soluble	mg/L	NE	NE	/	/	26	24	0.081	28	/	/	/	/	/	/	/	/	/	/	/	19	25	14	22	17	/	/	/	/
Sodium, Na	mg/L	NE	NE	160	370	67	230	330	130	299	85	179	147	69	79	111	74	102	86	133	150	44	34	190	50	295	173	60	68
Thallium, Tl	mg/L	NE	ID	<0.001	<0.001	<0.001	/	/	<0.001	/	/	/	/	/	/	/	/	/	/	/	<0.001	<0.001	<0.001	<0.001	<0.001	/	/	/	/
Thorium, Th	mg/L	NE	NE	<0.001	0.001	<0.001	<0.001	/	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Tin, Sn	mg/L	NE	ID	<0.001	0.001	<0.001	<0.001	/	<0.001	<0.01	0.003	<0.001	0.003	0.004	0.005	0.004	0.011	0.108	0.003	0.001	<0.001	0.004	0.015	0.009	<0.001	0.002	0.058	0.058	0.038
Uranium, U	mg/L	0.2	ID	0.006	0.007	0.005	0.005	/	0.005	0.006	0.004	0.004	0.006	0.016	0.002	0.002	0.01	0.025	0.03	0.013	0.008	0.004	0.015	0.01	0.01	0.002	<0.001	0.008	0.001
Vanadium, V	mg/L	0.1	ID	0.11	0.096	/	/	/	/	0.13	0.03	0.05	0.07	<0.01	0.08	0.09	0.02	0.02	<0.01	0.03	/	/	/	/	/	0.02	<0.01	<0.01	<0.01
Zinc, Zn	mg/L	20	0.008	<0.005	<0.005	0.110	0.21	/	0.006	<0.005	<0.005	0.041	<0.005	<0.005	<0.005	0.013	0.019	0.03	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.022

1. The following codes are from ANZECC/ARMCANZ Livestock watering criteria:
ND = Not determined. Insufficient background data to calculate.
NT = Not sufficiently toxic
NE = Not established
2. Sampled in 2017
3. Sampled 28/3/18
4. Sampled 4/4/18
5. ID = Insufficient data to derive a reliable trigger value ANZECC/ARMCANZ Freshwater guidelines.
6. / = not analysed, no data provided
7. Note: Rubidium not tested for in analytical suites
8. Red text indicates ANZECC/ARMCANZ Livestock watering guidelines, health trigger exceedance values exceeded
9. Orange text indicates ANZECC/ARMCANZ Freshwater guidelines 95% protection guideline value for freshwater ecosystems exceeded
10. Sampled 14/8/18
11. Sampled July 2018

Accessibility for sampling: No Sample provided for PMB001 previous to July 2018 (too deep +40m), MRLMB3 and MRLMB4 not accessible at the time of sampling (April 2018), SBM02 was blocked.

Table 13: Radionuclide groundwater monitoring at TMFMB01

	TMFMB01							
	18/07/18	**31/07/18**	**14/08/18**	**29/08/18**	**12/09/18**	**25/09/18**	**10/10/18**	**24/10/18**
Gross Alpha	1.77	1.70	2.18	1.79	3.04	2.42	3.78	3.19
Gross Beta	0.08	0.08	0.08	0.07	0.26	0.13	<0.390	<0.330
Radium 226	0.07	0.05	0.05	0.03	0.05	0.05	-	-
Radium 228	<0.140	0.04	<0.130	<0.100	<0.130	<0.095	-	-

1. - = not analysed, no data provided

2. Red text indicates ANZECC/ARMCANZ Trigger values for radioactive contaminants for irrigation water exceeded.

6.4 Conditions 1 and 2 Report from Works Approval W6051/2017/1 and Radionuclides Characterisation

6.4.1 Conditions 1 and 2 Report

The Applicant provided the Conditions 1 and 2 report to DWER that addressed:

- Additional tailings leachate testing using USEPA LEAF test 1313 and ASLP testing methodology;
- Information on the radial extent of the cone of depression around pit dewatering infrastructure to determine whether TMF Cell 1 is within the dewatering capture zone. Information must include dewatering contours on a local scale to determine if the footprint of TMF Cell 1 is within the capture zone. Drawdown contours must be provided on a map at 50m, 10m, 5m and 1m intervals;
- A seepage model for TMF Cell 1 and TMF Cell 2 for the life of mine which must:
    - Estimate the total seepage magnitude;
    - Shows seepage flow direction from TMF Cell 1 and TMF Cell 2;
    - Includes a site specific risk assessment for seepage from TMF Cell 1 and TMF Cell 2, identifying potential pathways and impacts on receptors including potential impacts to the hyporheic zone of Pilgangoora Creek; and
- Any additional controls required to manage seepage in the event that testing undertaken in indicates that contaminants are at levels of environmental concern.

6.4.2 Radionuclides Characterisation

Conditions 19 and 20 of the Works Approval W6051/2017/1 require regular wastewater and groundwater monitoring, including Gross Alpha, Gross Beta, Radium 226 and Radium 228. Results have shown some samples exceed the Gross Alpha screening level of 0.5 Bq/L within the ANZECC/ARMCANZ Livestock Watering Guidelines.

DWER consulted DMIRS Mines Safety Directorate and a request for further information provided to Pilgangoora Operations Pty Ltd. The request included the alpha-emitting nuclides concentrations be provided, that are contributing to these elevations in Gross Alpha. A risk assessment was also requested to be conducted to identify the sources of and receptors for the radionuclides. In situations where groundwater containing elevated Gross Alpha levels is located near sensitive receptors, additional water quality investigations were required to identify which particular radionuclides have elevated concentrations and to more fully evaluate the magnitude of the risk they pose to receptors. Results indicate that it is likely that the leaching of uranium from host rocks under oxidising conditions is the source of the elevated gross-alpha levels measured in groundwater in the area. Sensitive receptors are livestock, wildlife and potable water use in the camp.

6.4.3 DWER Technical Advice

DWER has reviewed the above reports and documented the following:

- The short-term leaching tests have been carried out appropriately, and the conclusion that leachate from these materials is unlikely to cause significant environmental impacts during the life of the mine is generally supported;
- The predicted extent and depth of the cone-of-depression of the water table predicted by numerical modelling is likely to be valid based on an assessment of mine-dewatering using simplified analytical solutions;
- The modelling of seepage from the TSF has been undertaken in an appropriate manner using a suitable finite-element modelling code, and the conclusions of the modelling are supported as are the proposed control measures to further reduce the seepage risk from the facility;
- The proposed groundwater monitoring program is supported;
- It is likely that the combined effects of mine-dewatering and the deposition of mine-wastes in surface repositories have contributed to increased concentrations of uranium in groundwater at the Pilgangoora mine site; and
- It is likely that the leaching of uranium from host rocks under oxidising conditions is the source of the elevated gross-alpha levels measured in groundwater in the area.

DWER's Contaminated Sites Branch has also confirmed that groundwater results are filtered metals (with Al and Fe filtered and total as if there is a large difference between the results, there is a problem with the sampling method and all the metal results will be questionable) and the tailings slurry water and WWTP/RO brine wastewater are total metals.

Key findings:

1. **The average water depth of the bores able to be sampled across the project area is 13.8mbgl.**
2. **Groundwater was observed to be fresh to brackish.**
3. **The majority of parameters showed baseline water quality levels below the recommended levels for livestock drinking water ANZECC/ARMCANZ Livestock guidelines, health trigger exceedance values.**
4. **Gross Alpha is elevated above the ANZECC/ARMCANZ trigger values for radioactive contaminants in irrigation water guidelines.**
5. **The Conditions 1 and 2 report and Radionuclides Characterisation have been reviewed by DWER and deemed appropriate.**
6. **A reduction in frequency of monitoring from fortnightly has been endorsed as suitable by DWER.**

7. Assessment of operator

On 6 August 2018 PML implemented an internal restructure, pursuant to which all assets relating to the Pilgangoora Lithium – Tantalum Project were transferred to, or otherwise issued to the wholly-owned subsidiary, POPL. In September 2018 the works approval was transferred from PML to POPL. The Licence, therefore, has POPL listed as the Licence Holder.

POPL registered via Australian Securities & Investments Commission (ASIC) on 21 December 2016 and has been deemed to be a fit and competent operator. No records of the following have been found by DWER:

- Infringement notices or environmental field notices;

- Closure notices, stop work orders or environmental protection notices (although on 18 May 2018, DWER advised 'that in order to comply with W6051/2017/1 PML should cease work on Cell 1';
- Non-compliance history with controlled waste obligations and payment of fees;
- Parliamentary questions or briefing notes that the Department has had to respond to in relation to the applicant;
- History of complaints received about the applicant or any other activities they have been involved with; and
- Past history of being unable to meet their financial obligations, for example unpaid licencing fees, current or past insolvency and bankruptcy proceedings.

However, PML has been issued with two modified penalty notices and letters of warning for the following issues outlined below.
PML has some non compliances with regards to not meeting works approval or licence obligations, as they have previously been deemed non-compliant with Works Approval W6051/2017/1, including:

- Construction and/or installation of TMF Cell 1, as opposed to TMF Cell 2, which resulted in DWER advising 'that in order to comply with their WA they should cease work on Cell 1' on 18 May 2018;
- Alteration of the location of the Category 52 Power Station and Category 73 fuel farm locations, including an extension of the Prescribed Premises boundary to include L45/417;
- Use of unauthorised landfill (West Waste Dump);
- Commissioning the WWTP over the specified timeframe; and
- Not providing groundwater monitoring data by the specified timeframe.

The modified penalty notices were issued for the following:

- Pilbara Minerals Limited contravened a condition of its works approval at its Pilgangoora Lithium – Tantalum Project in Marble Bar in November 2017 by constructing a landfill at an alternate location without approval, which is an offence under section 55(1) of the Environmental Protection Act 1986. Penalty paid: $12,500; and
- Pilbara Minerals Limited caused an emission from a prescribed premises without a licence at its Pilgangoora Lithium – Tantalum Project in Marble Bar between November 2017 and May 2018 by operating a landfill without approval, which is an offence under section 56(1) of the Environmental Protection Act 1986. Penalty paid: $10,000.

It should be noted, the Licence Holder has taken numerous improvement actions to ensure that a recurrence of non-compliance actions is prevented, including, investing in information management systems and online software, such as, new compliance system, new human resources system and obligations register.

Key finding: Based on the improvements made, the Licence Holder has been deemed to be a fit and competent operator.

8. Consultation

8.1 Recent consultation

Decision to grant letters will be provided to the interested parties upon issue of the Licence.

8.2 Previous consultation

Original Works Approval and Licence Application

The concurrent Works Approval and Licence Application was advertised in the West Australian on 26 June 2017 for a comment period ending on 17 July 2017. A letter inviting comment was

sent to the Shire of East Pilbara on 26 June 2017. No comments were received from the Shire of East Pilbara.

A letter of referral was sent to the Department of Parks and Wildlife (now Department of Biodiversity, Conservation and Attractions [DBCA]), Department of Water (DoW) (now DWER), DMP (now Department of Mines, Industry Regulation and Safety [DMIRS]) and an external party on 26 June 2017. The comments received are outlined below.

The following comments were received from DMIRS on 11 July 2017 (DMIRS, 2017) regarding the Application:

- DMIRS recently approved a Mining Proposal and Mine Closure Plan (REG ID 63791) on M45/1256;
- The Mining Proposal and associated Mine Closure Plan were referred to the Department of Water (DoW) who provided comments on the proposal and raised no significant concerns with the activities as proposed, or management strategies as suggested; and
- As part of the assessment process, the TMF design was again submitted to DMIRS Resources Safety Division for assessment. No significant issues were raised in relation to the geotechnical design of the facility.

The following comments were received from DWER – Land Use Planning/Approvals (Water), on 11 July 2017 (DWER Water, 2017) regarding the Application:

- Regulatory Services (Water) recently reviewed the mine proposal and mine closure plan (MPMCP) for the PML Pilgangoora project (REG ID63791) and provided comment to the former DMP. The region has also received a groundwater licence and supporting groundwater operating strategy (GWOS) for the project, and this is currently under assessment (*at the time of submission of these comments);*
- Comments were provided for the assessment of *Category 05 - Processing or beneficiation of metallic or non-metallic ore;*
- The departments review of the proposed groundwater monitoring, impact management measures and contingency plans presented in the GWOS found them to be reasonable and acceptable, and well designed to protect other users; potential groundwater dependent ecosystems (GDEs); and the nearby Breccia borefield;
- The GWOS has a more detailed monitoring program than was presented in the (*Part V*) application supporting document (*for this assessment*), and also includes five regional monitoring bores (ISCB, Strelley1, Strelley2, GDE_Mon_1 and GDE_Mon_2) to assess mine related drawdown. Regulatory Services (Water) suggested that it may be useful for these additional monitoring bores to be referenced in the Part V assessment for this project;
- PML and adjacent landholders Altura Mining / Altura Lithium Operations Pty Ltd have collaboratively/ collectively:
    - Approached Strelley Station to access existing monitoring bores Strelley1 and Strelley2 to facilitate early detection of any potential impacts to the groundwater environment, and if required, install further monitoring bores east of Pilbara Mineral's operation;
    - Approached Wallareenya Station with respect to groundwater monitoring and data sharing; and
    - Agreed to install two additional monitoring bores on the northern bank of Chinnamon Creek, GDE_Mon_1 and GDE_Mon_2 to facilitate early detection of potential impact to the GDE associated with Chinnamon Creek, and also Mineral Resource's Breccia Borefield.

The DBCA responded on 3 July 2017 (DBCA, 2017). Noting the *Wildlife Conservation and Land Management Act 1984* and the *Wildlife Conservation Act 1950,* the department did not have comment to add in relation to the proposal.

Works Approval Amendment

A letter of referral was sent to the DMIRS on 27 February 2018 requesting advice on the works

approval amendment. The following comments were received from DMIRS on 16 March 2018 regarding the amendment application:

- Approvals under the *Mining Act 1978* have been obtained for M45/1256, and associated tenements, under Mining Proposal Registration ID 70524, approved 28 February 2018;
- The footprint and geotechnical design of the TMF has been approved by the Resources Safety Division and the Environmental Compliance Branch of DMIRS. No concerns with this amendment relating to the TMF were raised;
- Fixed plant crushing and screening of ore material has been approved for M45/1256, however, mobile crushing and screening has not been approved under the *Mining Act 1978*. DMIRS noted that this change can be managed via the 2016 Mining Proposal Guidelines *"Proforma for Notification of Minor Changes to a Mining Proposal".*
- No issues were raised in relation to the expansion of the Category 54 WWTP and associated spray field; and
- The current Mining Proposal does not include a landfill in either the Monster Waste Dump or the West Waste Dump. Additionally, the "West Waste Dump" has not been approved by DMIRS, and the (DMIRS) approved site layout differs to that presented in the PML letter (to DWER) dated 19 December 2017. DMIRS has no concerns with the proposed works approval amendment for an additional landfill area, but this will require clarification from PML as to the discrepancies between site plans, as well as management of this change via the 2016 Mining Proposal Guidelines *"Proforma for Notification of Minor Changes to a Mining Proposal".*

9. Location and siting

9.1 Siting context

The project is located on mining tenement M45/1256 and L45/417 on Wallareenya Pastoral Station, located approximately 90 km south-southeast of the town of Port Hedland and 30 km northeast of the Wodgina Mine in the Pilbara Region as shown in Figure 14. The site is located on Wallareenya Station pastoral lease, an active cattle grazing station and cattle are anticipated to occur within the mining operations area during the life of the Project.

The workforce for the Premises is accommodated on site, with the accommodation village location presented in Figure 2. In accordance with the DWER Guidance Statement: Risk Assessments, the Camp is not considered a sensitive receptor for the purposes of this assessment.

Altura Lithium Operations Pty Ltd (mine) is located approximately 3km southwest of the Premises. The accommodation facility for the (Altura) Pilgangoora Lithium Project is not within Altura's Premises and has not been considered as a sensitive receptor within this assessment due to the extended distance this accommodation facility is away from the Premises.

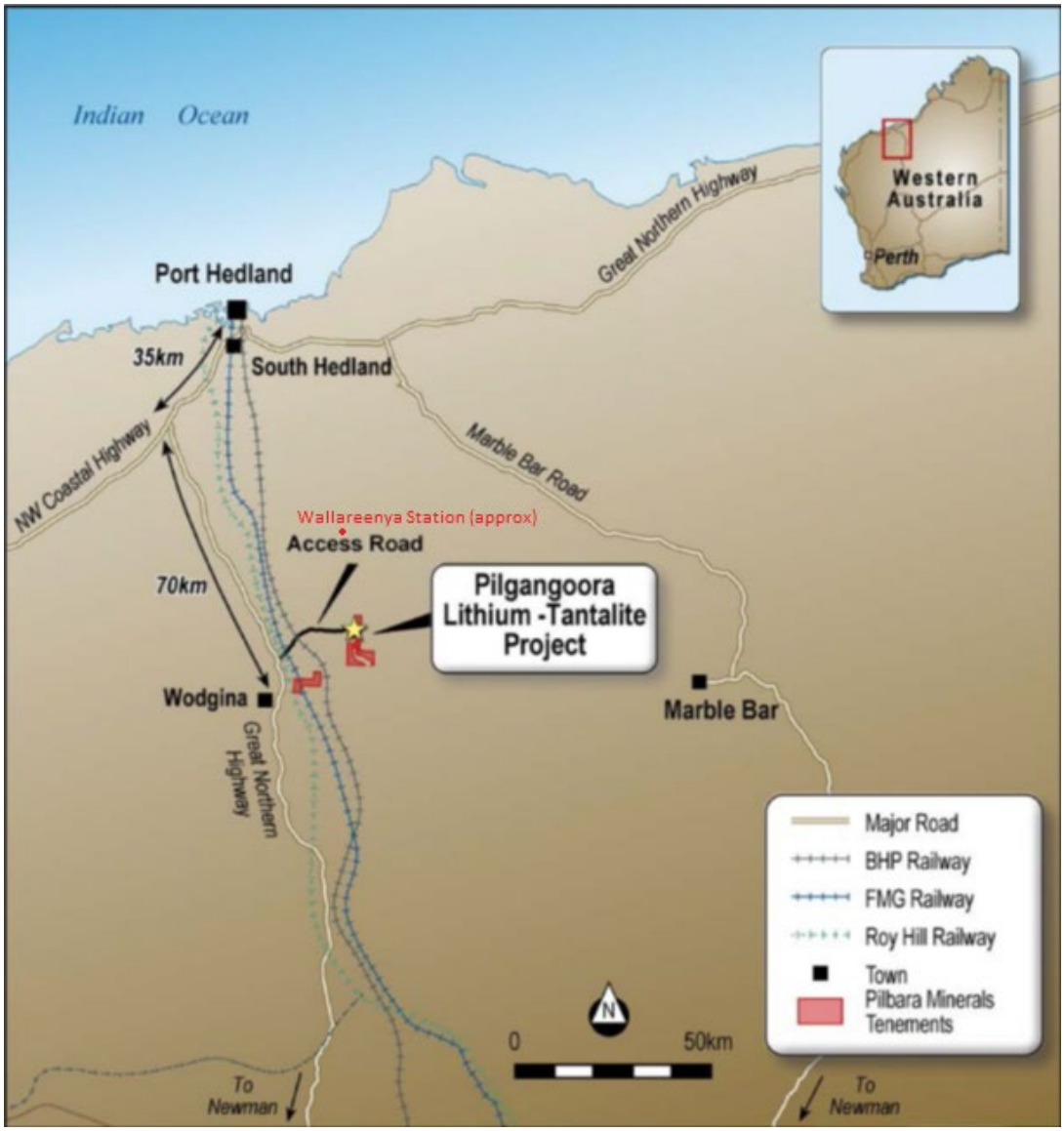

Figure 14: Regional Location

9.2 Residential and sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 14.

Table 14: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Residential Premises	Wallareenya Homestead more than 30 km north of the Premises. Indee Station more than 30 km northwest of the Premises. South Hedland more than 75 km north of the Premises.
Altura Lithium Operations Pty Ltd Accommodation Camp (ex-Roy Hill Infrastructure Rail Construction Camp 2)	More than 20 km from the Premises.
Wodgina Mine Camp	More than 30 km southwest of the Premises.
Industrial receptors	Altura Pilgangoora Project adjacent tenements (M45/1230 and M45/1231). Wodgina Mine 60 km southwest of the Premises. Altura Lithium Operation (under construction) approximately 3 km southwest of the Premises.

9.3 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at or Emissions and Discharges from the Premises. The distances to specified ecosystems are shown in Table 15. Table 15 also identifies the distances to other relevant ecosystem values which do not fit the definition of a specified ecosystem.

The table has also been modified to align with the *Guidance Statement: Environmental Siting.*

Table 15: Environmental values

Specified ecosystems - Biological component	Distance from the Premises
Threatened/Priority Flora	*No threatened or priority flora has been identified using publicly available GIS datasets.* A study conducted by MMWC Environmental has identified the presence of *"one species listed as Threatened Flora under the Wildlife Conservation Act 1050 (WA) is considered as Possible to occur in the survey area: Pityrodia sp. Marble Bar" (MMWC, July 2016).* There are no Declared Rare Flora within the Premises. The Licence Holders's database search indicated 16 species of Threatened and Priority listed flora occur within the vicinity of the project. Priority species *Heliotropium muticum* was recorded during the July 2016 survey conducted by the Licence Holder.
Threatened/Priority Fauna	Conservation significant species have been recorded in the survey area. These include the Rainbow Bee-eater listed under the EPBC Act, the Pilbara Leaf-nosed bat listed under the EPBC Act and the Western Pebble-mouse listed under the Wildlife Conservation Act 1950 (WA) (360 Environmental, 2016) . Threatened species Pityrodia sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4) is considered possible to occur in the survey area.
Threatened Ecological Communities and Priority	There are no Threatened Ecological Communities or Priority Ecological

Ecological Communities	Communities within or in a 30 km radius of the Premises.
Groundwater Dependent Ecosystems (GDE)	The nearest significant GDE (i.e. a GDE with moderate or higher potential for interaction with subsurface groundwater) to the Pilgangoora project, as identified in the GDE Atlas, is the Chinnamon Creek system (GRM, 2017). The Chinnamon Creek system is classified as having moderate potential for interaction. This ecosystem is located approximately 2 km south of project (and 3 km south of any dewatering activities).
Department of Biodiversity, Conservation and Attractions - Managed Lands and Waters	Mungaroona Range Nature Reserve boundary is located approximately 82 km south-west of the Premises.
Public Drinking Water Sources Area (PDWSA)	There are no PDWSA within the Premises.
RAMSAR wetland	No RAMSAR wetlands within 30 km radius of the Premises.

9.4 Surface water

The project is located within the eastern portion of the Turner River catchment (within the Port Hedland Coast Basin) to the west of the watershed with the Strelley River (within the De Grey River Basin).

Two primary drainage lines dissect the Premises, with the Houston Creek flowing from east to west through the northern half of M45/1256 and the Pilgangoora Creek (the larger of the two drainage lines) flowing from east to west near the southern boundary of M45/1256 (Figure 4). Both of the two primary drainage lines intersect approximately 4km west of M45/1256, reporting to Chinnamon Creek about 11km west of the Project site before discharging into the Turner River some 13km to the north-west. None of the rivers or creeks in the immediate vicinity of the Project site are perennial and only carry runoff following significant rainfall events (Significant Env, 2016).

A surface water study was undertaken by Groundwater Resource Management (GRM) in 2016 to determine the risks associated with the then proposed locations of mine site infrastructure. The study found that the camp, spray field and nearby abandoned airstrip are situated within the small Northern Creek catchment. The area has a negligible upstream catchment area and is not considered to be at any significant risk of flooding (GRM, 2017, Attachment 2). Northern Creeks' upper reaches are located between 250 m and 500 m to the north-west of the spray field. Northern Creek flows for short durations following rainfall events with extremely variable flow rates (GRM, 2017), which is typical of minor creek lines in the region. Northern Creek flows into Chinnamon Creek approximately 6.5 km south-west of the WWTP spray field. There are no permanent or semi-permanent pools between the Premises and prior to Chinnamon Creek.

9.5 Groundwater

The groundwater licence (GWL183354 (1)) for the project indicates that the Project is located above, and is abstracting from, the Pilbara fractured rock aquifer.

The hydrogeology of the area is characterised by an easterly draining system, with the groundwater divide immediately to the west of the Project. Alluvial cover is typically thin or absent in the area and mostly confined to the creek beds and minor drainage systems. The weathering profile in the region is also thin, typically less than 20m in depth (GRM,2016).

Groundwater occurrences in the area predominantly occur as fractured bedrock aquifers, whereby permeability in the natural rock is enhanced by fracturing, dissolution and chemical weathering. Away from the fractures, permeability in the bedrock is low.

Groundwater levels along the deposits typically range between 170-190mRL. Groundwater flow

direction is towards the west, away from the groundwater divide and locally towards Pilgangoora Creek.

In the geotechnical investigations conducted by ATC Williams (ATC Williams 2017a) groundwater was not encountered in any of the test pits but was intersected in each of the boreholes at the TMF site location (and two boreholes at the plant site) between depths of 9.75 m and 13.7 m bgl. Inferred groundwater elevation ranges from RL 159.4 m to 166.2 m in this area with an inferred hydraulic gradient of approximately 1:250 towards the North West.

Groundwater salinities in the area are typically fresh to slightly brackish, ranging from about 600 to 3,000mg/L TDS This low salinity groundwater is typical of areas most affected by direct rainfall recharge, e.g. near catchment divides and within shallow alluvium. Higher salinity groundwater typically occurs lower down in catchments and possibly also within deeper fractured rock aquifers (GRM, 2016).

The distances to surface and groundwater sources are shown in Table 16. Groundwater monitoring bore locations are shown in Figure 15.

Table 16: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental Value
Major watercourses/waterbodies	Pilgangoora Creek located in close proximity (southwest) to the TMF (Figure 4). Northern Creek located approximately 125 m from the expanded irrigation field. Houston Creek crosses the premises boundary near the east pit. Other unnamed ephemeral creeks systems are located on the Premises.	Water is used for livestock watering and industrial use.
Groundwater Groundwater is considered fresh to slightly brackish (600 – 3,000 mg/L TDS)	Depth to groundwater is approximately 9.5mbgl. There are no known operational stock watering bores within 5 km of the project. The nearest known operational stock watering bore is on Strelley Station, approximately 45 km east of the project. The WIR data shows there are 27 registered bores within 5 km of the project tenements. The WIR data identified the following bores within 5 km of the project: • Two bores are located to the east of the project (ISDB and ISCB) associated with the disused Lynas Find mine. It is understood these bores are no longer in operation. • Two bores to the west of the project (ISCWB and Coffins Bore), located within the Altura Mining tenement. Bore ISCWB was also installed for the Lynas Find mine and according to the database is of unknown type, although a site observation indicates the bore is a currently un-used production bore. Coffin Bore (which is locally called Coppin Bore) is listed as a domestic bore and discussions with Altura Mining indicate the bore has been decommissioned. The remaining 23 bores are all located along Chinnamon Creek, targeting a known high yielding fractured rock aquifer in the region. These bores are at least 2 km from the Pilgangoora project and include Mineral Resource's Breccia Borefield.	

9.6 Geology and Soils

9.6.1 Site Overview

The project is within the East Strelley Greenstone Belt of the Archean North Pilbara Craton, in the western part of the well exposed East Pilbara Granite Greenstone Terrane.

The region is underlain by Archean rocks comprising volcanic, sedimentary, mafic and ultramafic rocks. The mineralised zones contain varying amounts of lepidolite (lithium rich mica), spodumene (primary lithium ore), tantalite (primary tantalum ore), cassiterite (tin ore) and minor tapiolite (niobium and tantalum ore).

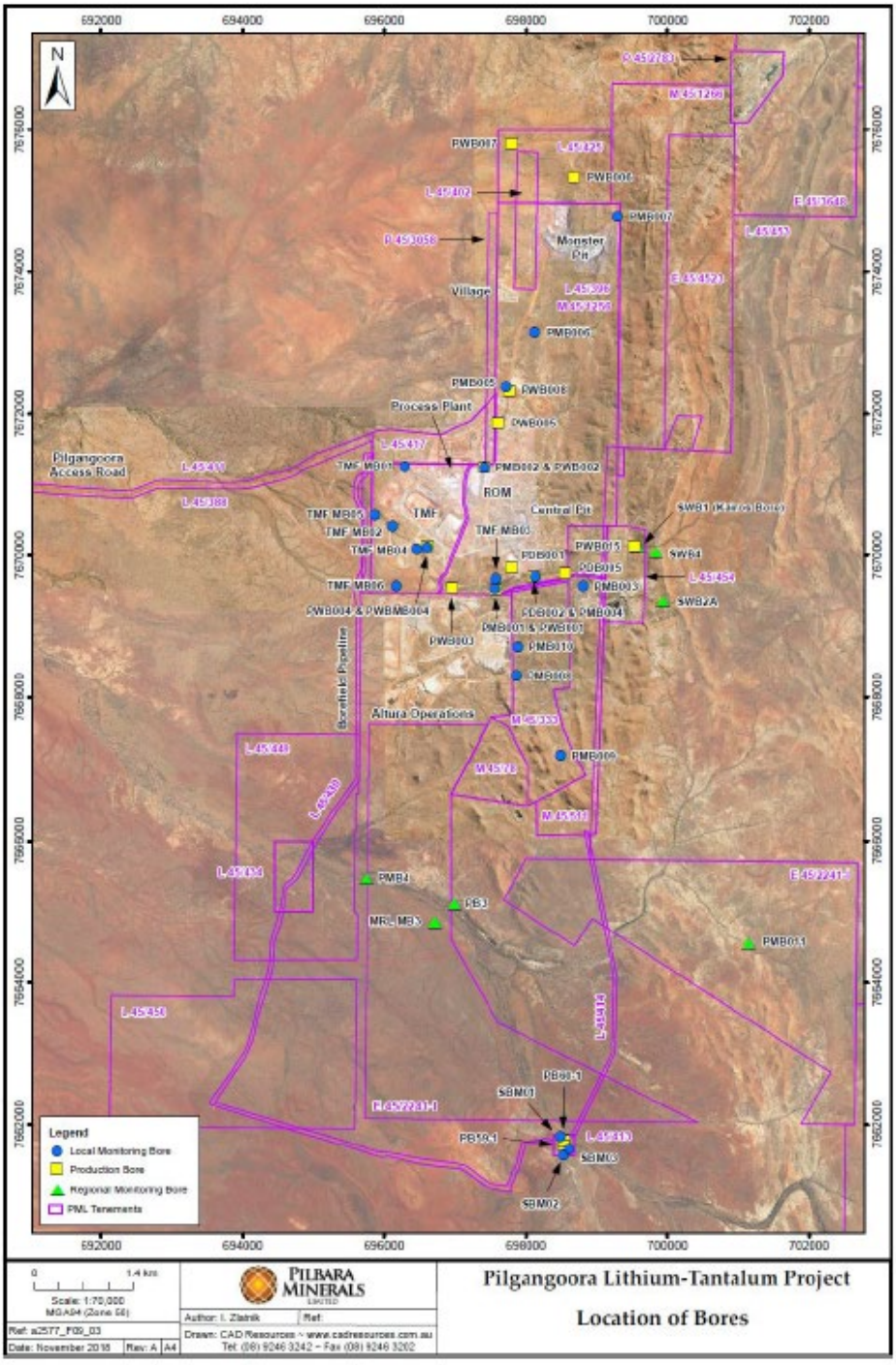

Figure 15: Current Monitoring Bore Locations

10. Risk assessment

10.1 Determination of emission, pathway and receptor

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

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 17.

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

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

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**		
Processing or beneficiation of metallic or non-metallic ore	Operation of Process Plant, movement of ore product through stockpiles, conveyors and bagging / loading ore	Dust associated with ore processing, ROM pad, crushing circuit, stockpiles, conveyors, bagging tantalum concentrate, loading spodumene (lithium) concentrate and outside storage of spodumene (lithium) concentrate	Residences (pastoral stations), other sensitive receptors (mine camps) and flora and vegetation	Air / wind dispersion	Health and amenity Potential to be deposited on vegetation and may prevent photosynthesis and plant respiration	No	No residences or sensitive land uses within 20 km of the Premises. The Delegated Officer considers that the provisions of the *Environmental Protection (Noise) Regulations 1997* and section 49 of the EP Act are sufficient to regulate noise and dust emissions during operation of the Process Plant. The Process Plant contains: • Dust extraction system and baghouse; • Spray/sprinkler systems installed at the crusher conveyor transfer points; • Dust will be managed daily with the use of mobile on site water carts which can be focused on any area generating dust; • Tantalum concentrate is enclosed in bulka bags so dust generation is not an issue. The tantalum concentrate is placed directly into the bulka bags from a wet gravity circuit processing pipe. The moisture content of the tantalum product is sufficiently high that dust is not generated during filling of the bulka bags. The larger particle size of the tantalum concentrate is also not conducive to
		Noise	Residences (pastoral stations) and other sensitive receptors (mine camps)	Air / wind dispersion	Amenity	No	

							dust generation. There is also dedicated, daily, site wide dust suppression through the use of water carts which can respond to any identified dust issue promptly; • Spodumene concentrate is generally enclosed in the concentrate storage shed and therefore doesn't generate dust. The spodumene concentrate falls directly off the filter press plates within the confines of the concentrate storage shed. The moisture concentrate of the spodumene concentrate is sufficiently high that dust is not generated. The spodumene concentrate also has a moisture content of approximately 11% which is rigorously maintained for commercial and shipping reasons. 3% moisture and above is the generally accepted level at which dust is not generated; • Spodumene concentrate stored outside has a moisture content of approximately 11% which is rigorously maintained for commercial and shipping reasons. 3% moisture and above is the generally accepted level at which dust is not generated.
		Leaks and spills of hydrocarbons and/or chemicals from processing and ore handling equipment	Terrestrial ecosystems adjacent to where the spillage has occurred	Direct discharges to land and infiltration to soils	Potential contamination of soil due to presence of hydrocarbons / chemicals and heavy metals Temporary loss of habitat	Yes	See detailed risk asses in section 10.4.
		Contaminated stormwater runoff	Soil, vegetation and surface water adjacent to storage or transfer areas (noting lithium is highly soluble)	Direct discharges to land Stormwater runoff from cleared and operational areas	Sedimentation of surface water systems Soil contamination inhibiting vegetation growth and survival and health impacts to fauna	Yes	See detailed risk assessment in section 10.4.

	Raw Water Tank and Process Water Pond	Overflow or seepage of raw and contaminated water including TMF decant water and excess water from the tailings thickner process	Terrestrial ecosystems and groundwater adjacent to the ponds	Direct discharge to land and infiltration into soil	Potential contamination of soil and groundwater due to presence of chemicals and heavy metals Temporary loss of habitat	Yes	See detailed risk assessment in section 10.5.
Operation of Power Station	Operation of Power Station	Air emissions of nitrogen oxides, sulfur oxides, carbon monoxide and volatile organic compounds	No residences or other sensitive receptors in proximity	Air / wind dispersion	Health and amenity	No	No sensitive receptors present at the constructed location within L45/417. The Delegated Officer considers 5km to be a sufficient separation distance for emissions generated by Power Stations. The risk associated with point source air emissions has been assessed as not required to continue to detailed risk assessment, therefore, no further regulatory controls are being applied to the Licence. Stack sampling points installed on each stack compliant with Australian Standard AS4323.1 Stationary source emissions; The Licence Holder is required to report air emissions to DWER annually through the annual fee application process. The Licensee will be required to include the air emission calculations as part of the annual fee submission, based on an appropriate emission estimation technique, for example monitoring data, National Pollution Inventory guides or emission factors.
		Noise	No residences or other sensitive receptors in proximity.	Air / wind dispersion	Amenity	No	No sensitive receptors present at the constructed location within L45/417.
Operation of fuel farm	Bulk storage and use of hydrocarbons	Spills of diesel and breach of containment	Soil and vegetation adjacent to areas of spill or breach	Direct discharges to land	Soil contamination inhibiting vegetation growth and survival and health impacts to fauna	Yes	See detailed risk assessment in section 10.4.
Dust Suppression	Use of water containing elevated levels of aluminium, arsenic, boron,	Elevated levels of aluminium, arsenic, boron, chromium,	Localised environment receiving runoff and road-side vegetation	Accumulation through soil profile	Accumulation of aluminium, arsenic, boron, chromium, copper, fluoride,	No	The use of groundwater for dust suppression purposes was not risk assessed for the original works approval.

	chromium, copper, fluoride, lithium, zinc and nitrate on roads, stockpiles and infrastructure	copper, fluoride, lithium, zinc and nitrate into the environment			lithium, zinc and nitrate in the localised environment		
TMF	Tailings surface	Dust lift off	Residences (pastoral stations), other sensitive receptors (mine camps) and flora and vegetation	Air / wind dispersion	Health and amenity Potential suppression of photosynthetic and respiratory functions	No	Tailings dust could contain elevated levels of metals. The material is enriched in lithium, thallium, bismuth and tantalum (Campbell and Associates, September 2016). Noting that the slurry consists of approximately 60% solids to 40% water and that there are no residences or priority flora within the vicinity of the premises, the risk is considered to be ***low***.
	Tailings pipeline and water return line	Rupture of pipeline causing tailings discharge to land	Vegetation adjacent to tailings pipeline alignment. On site surface water systems	Direct discharge	Soil contamination inhibiting vegetation growth and survival	Yes	See detailed risk assessment in section 10.6.
	Overtopping of tailings	Tailings discharge to land	Vegetation adjacent to the TMF. On site surface water systems	Direct discharge	Soil contamination inhibiting vegetation growth and survival	Yes	See detailed risk assessment in section 10.6.
	Seepage	Leachate to groundwater	Underlying groundwater and Pilgangoora Creek system.	Infiltration to groundwater Hydraulic connection between groundwater and the Pilgangoora Creek	Groundwater mounding Groundwater contamination and surface water contamination	Yes	See detailed risk assessment in section 10.7.
Waste Water Treatment Plant and current irrigation field (including irrigation field expansion)	Treatment of sewage	Odour	No residences or other sensitive receptors in proximity	Air / wind dispersion	None	No	The closest residential receptor is more than 30 km from the premises. The Altura mine site is located approximately 5 km from the wastewater treatment plant. The risk is considered to be ***low***.
	Sewage pipes and holding tanks	Failure of pipes / overtopping of holding tanks resulting in sewage discharge to land	Vegetation adjacent to discharge area	Direct discharge	Soil contamination inhibiting vegetation growth and survival	Yes	See detailed risk assessment in section 10.8.
	Irrigation of treated wastewater/ RO	Treated effluent mixed with RO brine waste from	Soils and vegetation within the irrigation	Direct discharge Spray drift or	Degradation of the soil profile.	Yes	See detailed risk assessment in section 10.9.

	brine	the camp	field. Soils and vegetation within the neighbouring tenement to the west. The downstream Northern Creek	run-off during a rainfall event.	Elevated contaminants within soils causing an impact to vegetation. Impacts to the neighbouring tenement (E45/2287 held by Altura Lithium) Elevated contaminants in soils being washed off during a rainfall event.		
		Elevated levels of aluminium, arsenic, boron, chromium, copper, fluoride, lithium, zinc and nitrate into the environment				Yes	See detailed risk assessment in section 10.9.
		Wind-blown treated effluent mixed with RO brine waste from the camp RO Plant		Spray drift		Yes	See detailed risk assessment in section 10.9.
(New) Landfill location in West Waste Dump	Active trench/cell	Dust	No residences or other sensitive receptors in proximity	Air / wind dispersion	Amenity	No	No residences or sensitive land uses within 20 km of the Premises. The Delegated Officer considers that the provisions of the *Environmental Protection (Noise) Regulations 1997* and section 49 of the EP Act are sufficient to regulate noise and dust emissions during operation of the Landfill.
		Noise	No residences or other sensitive receptors in proximity	Air / wind dispersion	Amenity	No	
		Odour	No residences or other sensitive receptors in proximity Fauna attractant	Air / wind dispersion	Amenity and fauna entrapment/death	No	Landfill is fenced with a 1.8 m high ring lock fence with double lockable gates that will be an effective barrier to fauna.
		Wind-blown waste	Terrestrial ecosystems	Discharges to land from waste disposal, air/wind dispersion	Ingestion by fauna Soil contamination	Yes	See detailed risk assessment in section 10.10.
		Leachate to groundwater	Groundwater dependent ecosystems, subterranean fauna	Direct discharge through the base of the landfill cells	Groundwater contamination	Yes	See detailed risk assessment in section 10.10.

10.2 Consequence and likelihood of risk events

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

Table 18: Risk rating matrix

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

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

Table 19: Risk criteria table

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

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

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

"onsite" means within the Prescribed Premises boundary.

10.3 Acceptability and treatment of risk event

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

Table 20: Risk treatment table

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

10.4 Risk Assessment – Leaks, spills and stormwater runoff from processing

10.4.1 Description of Leaks, spills and stormwater runoff

Stormwater at the Premises has the potential to become contaminated with sediments from processing, hydrocarbons, heavy metals, metalloids and hazardous chemicals and wastes, leading to contamination of land through direct contact or infiltration into soils.

Similar impacts may be caused from spills or leaks of hydrocarbons, chemicals and wastes stored at the Premises.

10.4.2 Identification and general characterisation of emission

Rainfall events at the Premises are likely to be of short duration and high intensity, and large volume events can be experienced. Any spillage not cleaned up may end up in stormwater during rainfall events and be mobilised and transported within minor drainage systems on the Premises.

The Processing Plant is located west of Central open pit and northeast of the TMF with these two large structures protecting the plant from rainfall ingress. The only surface water that may impact the plant is generated by the small catchment between Central pit, the TMF and the Processing Plant area.

Hydrocarbons and chemicals stored onsite have the potential to leak and spill, though it is not expected that large volumes of these would be able to gain access to the environment.

Spodumene concentrate stored outside of the storage shed could also result in stormwater contaminated with lithium.

10.4.3 Description of potential adverse impact from the emission

Stormwater contamination may potentially lead to localised or off-site impacts to sensitive ecosystems. Stormwater runoff may pick up sediment from cleared areas and result in smothering of nearby vegetation, impacting growth and survival. Soil contamination may also inhibit vegetation growth and cause health impacts to fauna.

Contamination of groundwater is possible from leaks and spills because depth to groundwater at the Premises is relatively shallow at approximately 9 to 12 mbgl and is fresh to brackish at 600 to 3,000mg/L TDS.

10.4.4 Criteria for assessment

ANZECC/ARMCANZ provide recommended trigger values for freshwater quality and DER's Guideline *Assessment and management of contaminated sites* provides ecological and human health assessment levels for soil.

Australian Standard 1940-2004 The storage and handling of flammable and combustible liquids and Australian Standard 3780 The storage and handling of corrosive substances set guidelines for design criteria for hydrocarbon and chemical storage areas.

10.4.5 Licence Holder controls

The Licence Holder controls in place to reduce and manage stormwater and leaks and spills of hydrocarbons, chemicals and waste are outlined in Table 21 and 22 below. These controls have been reviewed as part of this assessment.

Table 21: Licence Holder's proposed controls for stormwater runoff

Site infrastructure	Design details	Operation
Processing Plant	• Diversions around facility to separate clean and potentially contaminated water; • The Processing Plant is on a concrete pad. The area is bunded with a containment capacity equivalent to 110% of the capacity of all tanks; and • Electric sump pumps are installed in the concrete flooring at the Processing Plant to collect and pump any spilled material back into the process stream. • The plant is constructed on a raised pad and is on the side of a small hill, runoff is diverted around the plant (structurally engineered).	• Where stormwater is likely to be contaminated with hydrocarbons, water is directed to Oily Water Separators prior to discharge to the environment or re-use on-site.
Spodumene concentrate outside	• Stormwater run-off will be managed with drains that ultimately report to the Sediment Pond. Site topography and drainage is shown in Figure 4.	• Storm water is directed to the infrastructure Sedimentation Ponds
Sedimentation Ponds	• Clay lined; • General collector drains to direct rainfall runoff to Sedimentation Pond (basin) across the Premises; • Capture sediment – laden surface runoff prior to water exiting the Premises;	• Storm water from site is directed to the infrastructure Sedimentation Ponds; • Receives overflow from the Process Water Ponds in the event of extreme rainfall events; and • Minimum freeboard of 300mm is maintained in the pond.

Site infrastructure	Design details	Operation
	• Fitted with a control outlet to allow stored water to slowly continue downstream; • Sediment Pond downstream (southwest) of the Processing Plant area to capture storm water in the plant/workshop and Power Station area not contained by bunding; • Sediment Pond located northeast of the mining contractors area to capture run off from the contractors laydown area; and • Both ponds are designed to retain a 1 in 100 year ARI return period, 72 hour rainfall event.	
Raw Water Tank	• HDPE lined steel impermeable tank • 1.833 ML capacity (with 288 kL reserved for fire water capacity) • Fully covered • Water cannot ingress the tank during rainfall events.	• Not affected by rainfall events as fully covered tank. • No operational requirements necessary.
Process Water Pond	• The Process Water Pond has a thicker liner to a minimum of 1.8mm thickness; • Designed for 1:100 yr, 72 hr storm event; and • Freeboard markers installed.	• Minimum freeboard of 300mm is maintained in the ponds; • Water collected in the ponds is reused in processing; and • Twice daily inspections of the Process Water Pond during operation.
TMF	• 500mm total freeboard; • Freeboard indication markers are installed on the water storage ponds and TMF; • Designed to contain rainfall associated with a 1 in 100 year, 72 hour average recurrence interval event; • Cut off trench is constructed through the surficial deposits on the upstream side of the starter embankments and extended around the full TMF perimeter; • Constructed to manage a design capacity of 2 Mtpa; • The TMF is constructed maximum height of 13.3m (RL 189.3m) each; and • Central decant system.	• TMF Operating Manual developed and implemented to provide direction on the appropriate operation of the TMF; • Operated to manage design capacity of 2 Mtpa from the Processing Plant; • Decant removed via submersible pumps within decant tower; • Minimisation of the surface area of the decant pond during operations; and • Return of water to the plant is maximised.
All	• Diversions around facility to separate clean and potentially contaminated water.	• A Surface Water Management Plan is employed on site; and • During periods of flow in the four creeks (Northern, Houston, Pilgangoora, Southern) at a minimum of once annually (where it is accessible to do so), surface water samples are collected at one site upstream of the project and one site downstream of the

Site infrastructure	Design details	Operation
		Project with laboratory analyses for pH, TDS, TSS, electrical conductivity and the major cations and anions (including soluble lithium).

Table 22: Licence Holder controls for hydrocarbons, chemicals and waste (including leaks and spills)

Site infrastructure	Design details	Operation
Hydrocarbons, chemicals and reagents storage areas The Processing Plant chemical and regent dosing is automated using set dosing rates through the SCADA system. The SCADA system is continuously monitored by processing staff. Chemical and reagent areas are bunded and any spills are returned into the processing circuit.	• *Australian Standard 1940-2004 The storage and handling of flammable and combustible liquids*; • *Australian Standard 3780 The storage and handling of corrosive substances*; • *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*; and • Diesel pipelines are fitted with pressure transmitters at both ends of pipelines with alarms to indicate variation in flow pressure.	• Stored and handled in accordance with the requirements of the: ➢ *Dangerous Goods Safety Act 2004*; ➢ *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*; ➢ *Australian Standard 1940-2004 The storage and handling of flammable and combustible liquids*; and ➢ *Australian Standard 3780 The storage and handling of corrosive substances*.
All	• Spill kits are made available for use to contain hydrocarbon spills. In the event of a spill the contaminated soil are collected and disposed of in accordance with the site procedures; • Oily Water Separators for the treatment of hydrocarbon contaminated liquid; • Fuel and chemical handling are in accordance with the current Australian Standards for the storage and handling of flammable and combustible liquids under the *Dangerous Goods Safety Act 2004* and associated *Dangerous Goods Safety Regulations 2007*; and • Storage and refuelling of vehicles will occur on concreted areas.	• All washdown water/spillages generated from within storage areas are channelled to Oily Water Separators that will treat the site hydrocarbon waste to a maximum TRH of <15mg/L. The sampling point is the discharge outlet from the Oily Water Separators, located at the site wash down facility and monitored monthly; • Spill kits are available for use to contain hydrocarbon spills. In the event of a spill the contaminated soil is collected and disposed of in accordance with the site procedures; • Power Station self-contained day tank (20 kL) and waste oil tank and lubricants is located in a concrete bund and comply with *Australian Standard 1940-2004 The storage and handling of flammable and combustible liquids*; • Waste oil is stored in a bunded storage tank and disposed of by a licensed waste contractor. Used oil contaminated parts such as oil filters and oily rags are stored in fully enclosed metal bins in existing bunded areas at the Power Station. These are removed by a licensed recycling contractor; • Hydrocarbon and other chemical contaminated wastes are stored in bins

Site infrastructure	Design details	Operation
		or drums and removed off-site by a licenced contractor for recycling or disposal; • Fuel and chemical handling is in accordance with the current Australian Standards for the storage and handling of flammable and combustible liquids under the *Dangerous Goods Safety Act 2004* and associated Dangerous Goods Safety Regulations 2007; • Stored and handled in accordance with the requirements of the: ➢ *Dangerous Goods Safety Act 2004*; ➢ *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*; ➢ *Australian Standard 1940-2004 The storage and handling of flammable and combustible liquids*; and ➢ *Australian Standard 3780 The storage and handling of corrosive substances*. • Storage and refuelling of vehicles will occur on concreted areas.

10.4.6 Key findings

The Delegated Officer has reviewed the information regarding hydrocarbons, chemicals and waste (including leaks and spills) and has found:

1. **The Surface Water Management Plan was provided with the Application and an updated version provided on 24 January 2019.**
2. **Infrastructure is constructed to separate clean and contaminated stormwater.**
3. **All potentially contaminated hydrocarbon/chemical water is directed to Oily Water Separators for treatment prior to discharge or reuse.**
4. **All water storage ponds are lined and have freeboard markers installed.**
5. **Hydrocarbon and chemical storage areas comply with relevant Australian Standards.**
6. **Groundwater monitoring bores in the vicinity of the Processing Plant.**

10.4.7 Consequence

The Delegated Officer has had regard to the nature and quantity of hazardous materials used on the Premises, the engineering / infrastructure controls in place and the distance to the nearest sensitive receptors (groundwater located approximately 9-11 mbgl) and has determined that the impact of stormwater runoff and leaks and spills of hydrocarbons, chemicals and waste will result in low level on-site impacts and minimal off-site impacts at a local scale. Therefore, the Delegated Officer considers the consequence to be **minor**.

10.4.8 Likelihood of consequence

Based upon the distance to nearest sensitive receptors and Licence Holder controls the Delegated Officer has determined that the likelihood of stormwater runoff and leaks and spills

of hydrocarbons, chemicals and waste impacting on soil, groundwater and surface water will probably not occur in most circumstances. Therefore, the Delegated Officer considers the consequence to be **unlikely**.

10.4.9 Overall rating

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of stormwater runoff and leaks and spills of hydrocarbons, chemicals and waste on sensitive receptors is **medium**.

10.5 Risk Assessment – Overflows from the Raw Water Tank and Process Water Pond

10.5.1 Description of overflows from the Raw Water Tank and Process Water Pond

The Raw Water Tank is located within the Processing Plant area over the life of the mine.

The Process Water Pond is located adjacent to the Processing Plant and TMF as shown in Figure 2. It consists of two cells (Cell 1 and Cell 2). Cell 2 (capacity 15 ML) is designed to operate at capacity, with overflow reporting to Cell 1 (capacity 9.2 ML).

Overflows of these systems could result following a stormwater event or instrument failure.

10.5.2 Identification and general characterisation of emission

Data provided by the Licence Holder has indicated that production bore water quality is slightly brackish, with salinity ranging from 950-3,500 mg/L TDS. The Licence Holder has identified that the water quality to be abstracted is of good quality. Background water quality data provided by the Licence Holder has identified that the quality of the water being pumped to the Raw Water Tank is of almost potable standard.

Raw water is obtained from production bores and will pass through one of two package reverse osmosis/UV treatment facilities at the camp or Processing Plant prior to distribution around site. The brine from the camp RO Plant is sent to the irrigation tank at the WWTP for mixing with the treated effluent prior to distribution at the spray field. The brine from the Processing Plant RO Plant is returned to the Process Water Pond.

The Process Water Pond receives water from mine dewatering bores, production bores, decant water from TMF and excess water from the tails thickener (during processing). Water from this pond is recycled through the Processing Plant. With respect to tailings decant, over time, analytes within the tailings may concentrate through evaporation, process-cycling or if tailings leachate chemistry is affected by changes in redox chemistry.

Excess water from the Processing Plant tails thickener is mixed with the abovementioned water sources and reused within the Processing Plant. Lithium is known to be highly soluble. Process Pond water is not sampled and monitored by the Licence Holder as it is fully contained and not part of standard operations for this wastewater to discharge, however, water quality sampling of this wastewater would be beneficial.

10.5.3 Description of potential adverse impact from the emission

Potential emissions of raw water may occur from overtopping of the Raw Water Tank and may inundate vegetation. Contamination of groundwater is not anticipated by the raw water as it has been identified as good quality.

Process Pond water discharged to ground may inundate vegetation and contaminate terrestrial, surface water and groundwater ecosystems. However, the Process Pond overflows to the

Sediment Pond in the event of extreme rainfall events where it can be recovered back into the processing circuit.

10.5.4 Criteria for assessment

ANZECC/ARMCANZ provide recommended trigger values for Livestock watering and freshwater quality, while DWER's Contaminated Sites Guidelines *Assessment and management of contaminated sites* provides ecological and human health assessment levels for soil and the ASC NEPM provides consistent guidance on site contamination assessments.

10.5.5 Licence Holder Controls

The Licence Holder controls for the Raw Water Tank and Process Water Pond are set out in Table 23 below.

Table 23: Licence Holder's proposed controls for the Raw Water Tank and Process Water Pond

Site infrastructure	Design Details	Operation
Raw Water Tank	• HDPE lined steel impermeable tank • 1.833 ML capacity (with 288 kL reserved for fire water capacity) • Fully covered • Water cannot ingress the tank during rainfall events.	• Not affected by rainfall events as fully covered tank. • No operational requirements necessary.
Process Water Pond	• Freeboard designed for 1:100 yr, 72 hr storm event; • Lined with a minimum 1.8 mm HDPE liner; • Minimum freeboard of 300mm to be maintained in the pond; and • Freeboard markers installed.	• Minimum freeboard of 300mm is maintained in the ponds; and • Visually monitored after each rainfall event to check for adequate freeboard being available and to initiate pumping of the retained water into the process circuit.

10.5.6 Key Findings

The Delegated Officer has reviewed the information regarding overflows from the Raw Water Tank and Process Water Pond and has found:

1. **Water from the Process Water Pond also contains decant and excess water from the tailings thickner.**
2. **The Process Water Pond and Raw Water Tank is not discharged to the environment as part of standard operations.**
3. **Monitoring of the Process Water Pond is not conducted by the Licence Holder so contaminant details are not available.**
4. **The Raw Water Tank is fully enclosed.**
5. **The Process Water Pond is lined and has freeboard markers installed.**
6. **Freeboard monitoring of the pond occurs after each rainfall event.**

10.5.7 Consequence

The Raw Water Tank water is near potable.

The Process Water Pond receives water from mine dewatering bores, production bores, decant

water from TMF and excess water from the tails thickener. Monitoring is not conducted of this water so it is unknown if ANZECC/ARMCANZ water quality criteria is met. The Delegated Officer therefore considers the consequence to be **moderate**. This consequence may be revised once the Licence Holder provides monitoring data in support of this.

10.5.8 Likelihood of consequence

Based upon the Licence Holder's proposed controls, the Delegated Officer has determined that the likelihood of overflows from the Raw Water Tank and Process Water Dam will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood to be **unlikely**.

10.5.9 Overall rating

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of overflows from the process water dam to be **medium**.

10.6 Risk Assessment – TMF pipeline failure and overtopping

10.6.1 Description of TMF pipeline failure and overtopping

There is the potential for discharges of tailings to the terrestrial environment through TMF pipelines (delivery and decant), or overtopping of the TMF embankments.

Table 5 outlines the TMF design criteria and specifications. TMF has been designed in accordance with DMP, 2013 and ANCOLD, 2012.

10.6.2 Identification and general characterisation of emission

All tailings produced from processing are stored within the purpose built TMF. The tailings solids are pumped to TMF Cell 1 as a slurry at 65% to 68% solids concentration (by weight) (i.e. 52 to 68% solids by weight) and TMF Cell 2 as a slurry at 52% to 68% solids concentration (by weight) (i.e. 52 to 68% solids by weight).

Tailings slurry and decant return water contains soluble metals and metalloids (and other chemicals). Tailings contaminants depend on the geochemical composition of the ore and the chemicals used in the process plant. Decant water is sent through the water line back to the Processing Plant for reuse.

Over time it is recognized that some tailings analytes may become present at concentrations that indicate potential for concern if tailings decant is concentrated through evaporation or process cycling, or if tailings chemistry is affected by changes in redox chemistry within the tailings mass.The Application, Appendix 7: Geochemical Characterisation of Flotation-Tailings Samples, Implications for Tailings Management (September 2016) by Graeme Campbell and Associates Pty Ltd (Graeme Campbell and Associates, 2016) states that samples of tailings (Floatation Tailings [FT]) were tested using a programme of static-testing and kinetic-testing and indicates that:

- All tailings samples were classified as Non Acid Forming (NAF) due to negligible amounts of sulphide minerals;
- There were recorded enrichments in Lithium, Thallium, Bismuth and Tantalum, however, these are biogeochemically fixed (i.e. incorporated within the crystal-lattices of silicates, oxides, etc.);
- In terms of drinking water quality, the tailings-solids-leachates were essentially potable (based on NHMRC, 2015), with Arsenic slightly exceeding the 10 µg/L guideline;
- Tailings stream is inert with 'near zero' risk for water quality impacts where left in a free-draining state;
- Tailings have nothing to give geochemically during weathering;

- No stringent measures (e.g. HDPE lining) should be required in the design of TMF; and
- Direct revegetation with endemic plant species is a sound option following TMF closure.

USEPA LEAF1313 testing has shown that leachate from the tailings is unlikely to cause significant environmental impacts. Zinc concentrations were present at concentrations of up to 240 µg/L, higher than the ANZECC/ARMCANZ criterion of 8 µg/L for the protection of freshwater ecosystems. Contaminates Sites Branch used the Domenico analytical solution to simulate the groundwater transport of leachate from mine wastes to the creeks and the assessment indicated that concentrations of zinc in groundwater would be much lower than the ANZECC/ARMCANZ aquatic criterion on discharge to the hyporheic ecosystem, therefore, unlikely to cause significant environmental impacts.

10.6.3 Description of potential adverse impact from the emission

Leaks/spills or overtopping of tailings may contaminate soils, smother vegetation and have toxic effects on terrestrial and freshwater ecosystems (Pilgangoora Creek). Infiltration of significant quantities of tailings decant water may result in soluble contaminants leaching through the soil profile to affect local groundwater quality and may impact on the beneficial use of groundwater.

10.6.4 Criteria for assessment

ANZECC/ARMCANZ provide recommended trigger values for Livestock watering and freshwater quality, while DWER's Contaminated Sites Guidelines Assessment and management of contaminated sites provides ecological and human health assessment levels for soil and the ASC NEPM provides consistent guidance on site contamination assessments.

10.6.5 Licence Holder controls

The Licence Holder controls for the TMF pipelines and overtopping are set out in Table 24 below.

Table 24: Licence Holder's proposed controls for the TMF pipelines

Site infrastructure	Design Details	Operation
TMF Pipelines	• Pipelines are fitted with pressure transmitters at both ends of the pipeline with alarms to indicate variation in flow pressure; • Flow meters installed at the start and end of the tailings delivery line; • The tailings delivery line from the process plant to the TMF and the return water line are situated above ground within bunds with spill catch pits (Figure 8); • Spill catch pits contain any spillage of materials resulting from leaks or lines that burst during operation for up to 12 hours of spillage; • HDPE; • Spigot off takes are connected into the main tailings distribution line with a HDPE offtake branch; and • Spigots constructed using HDPE.	• TMF Operating Manual developed and implemented to provide direction on the appropriate operation of the TMF; • Operated to managed to design capacity of 2 Mtpa; • Operational pipeline pressure transmitters at both ends of the pipeline with alarms to indicate variation in flow pressure; • Flows are monitored by flow meters positioned at the start and end of the tailings delivery line, with readouts displayed on the Control System; • In the event flow meter readings indicate pipeline failure, the affected pipeline is shut down; • Twice daily inspections of TMF inflow and decant pipelines during operation.

The Licence Holder controls for the overtopping of the TMF are set out in Table 25 below.

Table 25: Licence Holder's proposed controls for the TMF overtopping

Site infrastructure	Design Details	Operation
TMF	• Designed to contain rainfall associated with a 1 in 100 year, 72 hour average recurrence interval event; • Cut off trench implemented; • 500mm total freeboard • Manage a design capacity of 2 Mtpa; • Central decant system to remove water from TMF1 and reduce levels; • A temporary floating decant return pump has been installed at TMF Cell 2 to allow accelerated recovery of supernatant water during commissioning. The decant pump will be relocated to the decant tower once sufficient water is available for recovery; and • A single spigot has been installed to allow commencement of discharge into TMF Cell 2 and future additional spigots will be installed to allow deposition location rotation and even deposition of tailings across the entire TMF Cell 2, thus maximising TMF Cell 2 capacity and operational efficiency.	• TMF Operating Manual developed and implemented to provide direction on the appropriate operation of the TMF; • Decant removed via submersible pumps within decant tower; • Minimisation of the surface area of the decant pond during operations; and • Return of water to the plant is maximised. The site water balance is captured via site telemetry and SCADA software. This system provides instantaneous data feed, which is continuously monitored by processing personnel. This system currently captures tailings deposition rates and decant water return rates. This data, along with rainfall and PAN evaporation data, can be utilised to derive overall seepage loss. In addition, water balance data is captured daily by processing personnel via the Tailings Operation Manual TMF Inspection sheets. In general there is a site water deficit so opportunities for efficient water usage are proactively explored and taken, this includes the reuse of decant return water. The safe operation of TMFs also relies on minimising the volume of decant return water remaining on the TMF. This practice is consistent with DMIRS published advice.

10.6.6 Key findings

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

1. **Structural integrity of the TMF is regulated by DMIRS under the *Mining Act 1978.***
2. **Consultant information provided to the Licence Holder advised that tailings are benign and decant water quality comparable to groundwater quality.**
3. **The design of TMF incorporates measures to reduce the volume of water retained within the facility.**
4. **A freeboard of 500mm is maintained in TMF.**
5. **Pipelines are fitted with pressure transmitters at both ends of the pipeline with alarms to indicate variation in flow pressure.**

10.6.7 Consequence

The Delegated Officer has had regard to the information detailed above for tailings composition, Licence Holder controls, water quality information provided by the Licence Holder and the

distance to the nearest sensitive receptors (potable quality groundwater located approximately 9-11 mbgl) and has determined that the impact of overtopping events and pipeline joint failures could result in minimal off-site impacts. Therefore, the Delegated Officer considers the consequence to be **minor**.

10.6.8 Likelihood of consequence

Based upon the distance to nearest sensitive receptors and Licence Holder controls the Delegated Officer has determined that the likelihood of an environmental impact from TMF pipeline failures and overtopping will not occur in most circumstances. However, as the groundwater is relatively shallow, the Delegated Officer considers the consequence to be **possible**.

10.6.9 Overall rating

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

Despite the medium overall rating, over time (the life of mine is 35 years) it is recognized that some analytes may become present at concentrations that indicate potential for concern if tailings decant is concentrated through evaporation or process cycling, or if tailings chemistry is affected by changes in redox chemistry within the tailings mass. To monitor this, the following parameters in Table 26 are included within the licence (groundwater and wastewater quality monitoring) for the operation of this Premises:

Table 26: Parameters to be monitored in groundwater and wastewater

Parameters			
pH	Aluminium, Al	Fluoride, F	Silicon, Si
Electrical Conductivity, EC	Antimony, Sb	Hexavalent Chromium, Cr^{6+}	Silver, Ag
Ammonia, NH_3	Arsenic, As	Iron, Fe	Sodium, Na
Nitrate, NO_3	Boron, B	Potassium, K	Strontium, Sr
Nitrite, NO_2	Barium, Ba	Lead, Pb	Tantalum, Ta
Bicarbonate Alkalinity as HCO_3	Beryllium Be	Lithium, Li	Thallium, Tl
Calcium Carbonate $CaCO_3$	Bismuth, Bi	Magnesium, Mg	Thorium, Th
Carbonate Alkalinity as CO_3	Bromine, Br	Mercury, Hg	Tin, Sn
Total Dissolved Solids, TDS	Calcium, Ca	Molybdenum, Mo	Uranium, U
Nitrite, NO_2 as NO_2	Cadmium, Cd	Manganese, Mn	Vanadium, V
Nitrate, NO_3 as NO_3	Chlorine, Cl	Nickel, Ni	Zinc, Zn
Total Alkalinity as $CaCO_3$	Cobalt, Co	Niobium, Nb	Gross Alpha
Total Dissolved Solids, TDS	Chromium, Cr	Phosphorus, P	Gross Beta
Total Hardness by Calculation	Caesium, Cs	Rubidium, Rb	Radium-226
Sulfate, SO4	Copper, Cu	Selenium, Se	Radium-228

10.7 Risk Assessment – seepage from TMF

10.7.1 Description of seepage from the TMF

Seepage of tailings water may occur from the TMF to groundwater and potentially travel to Pilgangoora Creek.

10.7.2 Identification and general characterisation of emission

Tailings testing results provided in the application (Campbell and Associates, September 2016) indicated elevated levels of aluminium, arsenic, copper, zinc, lead and nickel when compared against the 95% (freshwater) protection levels in ANZECC/ARMCANZ.

DWER's Contaminated Sites Branch has stated that USEPA LEAF1313 testing has shown that leachate from the tailings is unlikely to cause significant environmental impacts. Zinc concentrations were present at concentrations of up to 240 µg/L, higher than the ANZECC/ARMCANZ criterion of 8 µg/L for the protection of freshwater ecosystems. DWER used the Domenico analytical solution to simulate the groundwater transport of leachate from mine wastes to the creeks and the assessment indicated that concentrations of zinc in groundwater would be much lower than the ANZECC/ARMCANZ aquatic criterion on discharge to the hyporheic ecosystem, therefore, unlikely to cause significant environmental impacts.

10.7.3 Description of potential adverse impact from the emission

The Licence Holder has advised that the depth to groundwater is between 9 to 12 mbgl at the TMF. Seepage contains elevated levels of contaminants that may impact on the quality of groundwater and potentially access Pilgarangoora Creek affecting vegetation and fauna.

10.7.4 Criteria for assessment

ANZECC/ARMCANZ provide recommended trigger values for freshwater quality, which is an appropriate comparison trigger value given that creeks located to the west of the deposit are likely to contain a sensitive macroinvertebrate fauna in saturated gravel below the creek beds (stygofauna) and this aquatic criteria would be required to protect this ecosystem.

The Livestock drinking water guidelines have been used also for comparison against both the floatation tailings slurry and the ambient groundwater quality.

The Average Crustal Abundance concentrations from the Pilgangoora Lithium-Tantalum Project Mining Proposal can be used to assess flotation tailings solids concentrations against.

DWER's Contaminated Sites Guidelines *Assessment and management of contaminated sites* provides ecological and human health assessment levels for soil and the ASC NEPM provides consistent guidance on site contamination assessments.

10.7.5 Licence Holder controls

The Licence Holder controls in place to reduce and manage seepage from the TMF are outlined in Table 27 below. These controls have been reviewed as part of this assessment.

Table 27: Licence Holder's proposed controls for seepage from the TMF Cell 1

Site infrastructure	Design Details	Operation
TMFCell 1	• Design capacity of 1.9 Mtpa; • Four Vibrating Wire Piezometers (VWP) installed in the embankment foundation; • Four Standpipe Piezometers installed; • Seepage monitoring bores -TMFMB3, TMFMB4, TMFMB5,TMFMB6, New shallow (50m) monitoring bore adjacent to PWB004, TMFMB1, TMFMB2, TMFMB3;TMFMB4, TMFMB5 andTMFMB6	• TMF Operating Manual developed and implemented to provide direction on the appropriate operation of the TMF; • Operated to managed to design capacity of 2 Mtpa; • Decant water returned to the Process Water Dam for reuse during ore Processing. Minimising water on TMF will reduce seepage; • A network of 10 monitoring bores installed at the Premises to provide background data, and, allow the assessment of groundwater during operations; • Six groundwater TMF monitoring bores installed around the perimeter of the TMF will monitor water quality; and • If there is a rise in groundwater level in any monitoring bore to 5 mbgl, the Licence Holder commits to installing recovery bores (or trenches) to collect seepage and return the seepage water to the TMF decant pond, except if the breach is a result of natural extreme rainfall events.
TMF Cell 1 base	• Hydraulic conductivity of the base of TMF Cell 1 has been compacted and material imported as required to ensure low hydraulic conductivity: ➢ Not less than 300mm clay material at the base of the impoundment area; ➢ TMF Cell 1 compacted to between 2.48 x 10^{-6} m/s and 27.40 x 10^{-6} m/s hydraulic conductivity; and ➢ Specific permeability testing has been provided to DWER to confirm that the compaction of the base of each cell is compacted to reduce the potential for TMF Cell 1 seepage (Results ranged from 2.48 – 27.40 x10^{-6} m/s.	-
Underdrainage system	• Cut off trench implemented through the surficial deposits on the upstream side of the starter embankments and extended around the full TMF perimeter to a nominal depth of 1.5 m or refusal on weathered rock.	-
Decant pond area	• Designed to receive tailings decant and rainwater accumulation and gravity feed the liquid to a pump system installed in the decant tower.	• Decant water returned to the Process Water Dam for reuse during ore processing; and • Regular tailings slurry water testing.

Site infrastructure	Design Details	Operation
Decant tower	• Central decant system.	• Decant water returned to the Process Water Dam for reuse during ore processing.

Table 28: Licence Holder's proposed controls for seepage from TMF Cell 2

Site infrastructure	Design Details	Operation
TMF Cell 2	• Design capacity of 2.7 Mtpa; • Four Vibrating Wire Piezometers (VWP) installed in the embankment foundation; • Six Standpipe Piezometers installed; • Seepage monitoring bores -TMFMB3, TMFMB4, TMFMB5,TMFMB6, New shallow (50m) monitoring bore adjacent to PWB004, TMFMB1, TMFMB2, TMFMB3;TMFMB4, TMFMB5 andTMFMB6	• TMF Operating Manual developed and implemented to provide direction on the appropriate operation of the TMF; • Operated to managed to design capacity of 2.7 Mtpa; • Decant water returned to the Process Water Dam for reuse during ore Processing. Minimising water on the TMF will reduce seepage; • A network of 10 monitoring bores installed at the Premises to provide background data, and, allow the assessment of groundwater during operations; • Six groundwater TMF monitoring bores installed around the perimeter of the TMF will monitor water quality; and • If there is a rise in groundwater level in any monitoring bore to 5 mbgl, the Licence Holder commits to installing recovery bores (or trenches) to collect seepage and return the seepage water to the TMF decant pond, except if the breach is a result of natural extreme rainfall events.
TMF Cell 2 base	• Hydraulic conductivity of the base of TMF Cell 2 has been compacted and material imported as required to ensure low hydraulic conductivity: ➢ Not less than 300mm clay material at the base of the impoundment area; ➢ TMF Cell 2 compacted to between 2.4 x 10^{-9} to 9.5 x 10^{-9} m/s ➢ hydraulic conductivity; and ➢ Specific permeability testing has been provided to DWER to confirm that the compaction of the base of each cell is compacted to reduce the potential for TMF1 seepage (Results ranged from 2.4 x 10^{-9} to 9.5 x 10^{-9} m/s.	-
Underdrainage	• Cut off trench implemented through the surficial deposits on the upstream side	-

Site infrastructure	Design Details	Operation
system	of the starter embankments and extended around the full TMF perimeter to a nominal depth of 1.5 m or refusal on weathered rock.	
Decant pond area	• Designed to receive tailings decant and rainwater accumulation and gravity feed the liquid to a pump system installed in the decant tower.	• Decant water returned to the Process Water Dam for reuse during ore processing; and • Regular tailings slurry water testing testing.
Decant tower	• A temporary floating decant return pump has been installed at TMF Cell 2 to allow accelerated recovery of supernatant water during commissioning. The decant pump will be relocated to the decant tower once sufficient water is available for recovery; and • A single spigot has been installed to allow commencement of discharge into TMF Cell 2 and future additional spigots will be installed to allow deposition location rotation and even deposition of tailings across the entire TMF Cell 2, thus maximising TMF Cell 2 capacity and operational efficiency.	• Decant water returned to the Process Water Dam for reuse during ore processing.

The proposed monitoring schedule during operations is shown in Table 29 below.

Table 29: Proposed Monitoring Schedule

Proposed Monitoring Schedule		
Locations	**Parameter**	**Frequency**
TMFMB01 TMFMB02 TMFMB03 TMFMB04 PWBMB004 TMFMB05 TMFMB06	Standing Water Level	Monthly
	Major Anion / Cation	Monthly
	Metals	Quarterly
	Radiation	Biannually
	Radium 226, 228	Biannually if triggered

10.7.6 Key findings

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

1. **Structural integrity of TMF is regulated by DMIRS under the *Mining Act 1978.***
2. **Modelling has been provided, which indicates that seepage is unlikely to reach more than 20 metres below the creek bed. DWER has endorsed this modelling.**
3. **Groundwater monitoring has shown elevated levels of Gross Alpha in the vicinity of the TMF, over ANZECC/ARMCANZ. This data has been referred to DMIRS for advice and guidance.**
4. **The design of the TMF incorporates measures to reduce the volume of water**

retained to reduce seepage, however seepage and groundwater mounding beneath the TMF is still anticipated.

5. **Six monitoring bores are established to monitor groundwater adjacent to the TMF to enable detection of seepage and groundwater mounding.**
6. **The Licence Holder will install recovery bores/trenches to collect seepage and return it to the decant pond pending a rise in groundwater to 5mbgl in or around the TMF.**

10.7.7 Consequence

The USEPA LEAF 1313 testing has indicated that leachate from these materials is unlikely to cause significant environmental impacts. If seepage from the TMF occurs, then the Delegated Officer has determined that the impact on the Pilgangoora Creek and the underlying groundwater may result in offsite impacts at a low level. Therefore, the Delegated Officer considers the consequence of seepage to be **moderate.**

10.7.8 Likelihood of Risk Event

Based on the modelling scenarios indicating that seepage would be more than 20 metres below the base of the creek bed and the siting of the TMF within the pit dewatering drawdown cone, the Delegated Office has determine the likelihood to be **unlikely.**

10.7.9 Overall rating

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

10.8 Risk Assessment – WWTP failure of pipes, storage tank failure

10.8.1 Description of WWTP failure of pipes, storage tank failure

Raw wastewater or treated wastewater may discharge to the environment due to failure of pipes, breakdown of pumps, overtopping of tanks etc.

10.8.2 Identification and general characterisation of emission

Treated wastewater may contain high levels of pathogens, TDS, nutrients and radionuclides. Monitoring or the treated effluent in the irrigation tank (sewage effluent and RO brine) has shown that Gross Alpha is elevated above the ANZECC/ARMCANZ guidelines. This has been referred to DMIRS for advice and recommendations. Fluoride has also been shown to be elevated above the short-term irrigation guidelines. See Table 11 for monitoring results.

10.8.3 Description of potential adverse impact from the emission

This may cause contamination of the surrounding soils resulting in vegetation decline or the high nutrient levels could result in weed growth.

Infiltration, contaminating groundwater, could potentially occur.

10.8.4 Criteria for assessment

The WWTP treated effluent meets Low Exposure Risk Level in accordance with DoH, 2011. Relevant land and groundwater quality criteria include ANZECC/ARMCANZ *National Water Quality Management Strategy, Australian Guidelines for Sewerage Systems, Effluent Management 1997* (NWQMS, 1997).

The ANZECC/ARMCANZ guidelines for short-term irrigation water are relevant.

DWER's Contaminated Sites Guidelines *Assessment and management of contaminated sites* provides ecological and human health assessment levels for soil and the ASC NEPM provides consistent guidance on site contamination assessments.

10.8.5 Licence Holder controls

The Licence Holder controls for sewage discharge from the failure of pipes, tank failure and disposal to the spray field are outlined in Table 30 below.

Table 30: Licence Holder's proposed controls for sewage discharge from the failure of pipes and tank failure

Site infrastructure	Design Details	Operation
WWTP	• There is no Sensitive Water Resource within 500m of the WWTP; • The WWTP is not within a Public Drinking Water Source Area, a wetland with defined conservation value, Environmental Protection Policy Lakes, Waterways Management Areas or other wetland; • MBBR WWTP fully assembled and factory tested prior to site transfer; • 1 x Sequence Batch Reactor (SBR) -0100-C-X-X-X with less than 125 m^3/day treatment capacity; • 5 x Collection pump stations (PSPS-02-2-X-C-X-X); • 1 x 200 kL Balance tank fitted with high level alarm wired to visual strobe light and sounder to alert of overflows; • 1 x 300 kL treated effluent / Irrigation tank fitted with high level alarm; • 1 x sludge thickening tank; • Water treatment cultures were generated off site and introduced into the plant; • Capacity to treat up to 125m^3/day of sewage; • The WWTP is containerized with external pump skids and tanks; • The WWTP has contingency storage capacity for up to two days of normal flow if discharge is suspended while any problems are fixed; • All tanks are fitted with high level alarms (for overflow); • Flow meter is installed between the WWTP outflow point and the spray field to record the spray field disposal rate; and • Tie-in with Camp RO brine stream at the treated effluent irrigation tank.	• Quarterly monitoring of Biochemical Oxygen Demand (BOD) mg/L, Total Suspended Solids (TSS) mg/L, Total Dissolved Solids (TDS) mg/L, pH, Total Nitrogen mg/L, Total Phosphorus mg/L, E. coli cfu/100mL conducted; • The WWTP is operated to meet the following emission standards: ➢ Biochemical Oxygen Demand <20mg/L; ➢ Total Suspended Solids <30mg/L; ➢ Total Nitrogen <30mg/L; ➢ Total Phosphorus <7.5mg/L; ➢ Chlorine Residual >0.2-2mg/L; ➢ pH 6.5-8.5; and ➢ *E.coli* <1000cfu/100mL. • The maximum TDS of the final effluent stream that is sent to the spray irrigation field for disposal is <1000 mg/L; • Sampling points installed at the mixing tank outlet prior to release of effluent via pipeline to the spray irrigation area; • The WWTP perimeter is fenced; • Monthly Cumulative flow rate and volume (m^3) is be recorded; and • Monitoring of the final effluent tank with RO brine is required with comparison to the short-term irrigation guidelines (ANZECC/ARMCANZ).

10.8.6 Key findings

The Delegated Officer has reviewed the information regarding the risk of sewage discharge from WWTP failure of pipes, storage tank failure and irrigation and has found:

1. **The WWTP has contingency storage capacity for up to 2 days of normal flow if discharge is suspended while any problems are fixed.**
2. **Treated effluent meets secondary treatment as per the *National Water Quality Management Strategy, Australian guidelines for sewerage systems: Effluent Management, 1997* (NWQMS, 1997).**
3. **There are no nearby receptors but groundwater has been determined to be good quality.**
4. **Monitoring of the final effluent tank with RO brine is required along with comparison to the short-term irrigation guidelines (ANZECC/ARMCANZ).**

10.8.7 Consequence

Based on the information detailed above and distance to the nearest sensitive receptors and that the wastewater will undergo treatment prior to discharge, the Delegated Officer has determined that the impact of WWTP pipe failure, tank failure and the disposal of treated effluent to the spray field will result in low level on-site impacts. Therefore, the Delegated Officer considers the consequence to be **moderate**.

10.8.8 Likelihood of consequence

Based upon the controls in place, particularly alarms, flow meters and the contingency storage available, the Delegated Officer has determined that the likelihood of an environmental impact from WWTP pipe failures, tank failures or overtopping will not occur in most circumstances. With the controls in place any leaks/spills that do occur, would be quickly attended to, so even with elevated contaminants present (such as Gross Alpha and fluoride elevations), the consequences would be unlikely. The Delegated Officer considers the consequence to be **unlikely**.

10.8.9 Overall rating

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

10.9 Risk Assessment – irrigation of treated effluent and RO brine waste to land

10.9.1 General hazard characterisation and impact of emission

Treated WWTP effluent and RO brine from the camp are to be disposed of to the 3.04ha irrigation area. The frequency and duration of the RO brine/treated effluent emission is anticipated to be daily and sporadic, however quantities will vary daily during operations.

It should also be noted that the Licence Holder plans to take some treated wastewater from the WWTP (Class C) and apply additional filtration and chlorination to attain Class A for use on camp reticulated gardens. This is in accordance with an approved Department of Health (DoH) Recycled Water Management Plan (use of recycled water for reticulation on gardens). This is not further risk assessed as it is regulated by DoH.

10.9.2 Identification and general characterisation of emission

Table 11 shows data collected of the RO brine and the RO brine mixed with WWTP effluent in the final irrigation tank for disposal to the irrigation spray field.

Elevations in fluoride and Gross Alpha are present above the ANZECC/ARMCANZ guidelines, short-term trigger values for irrigation.

10.9.3 Description of potential adverse impact from the emission

Whilst the deposition of the water for WWTP irrigation purposes is to be localised to the irrigation area, there is the potential for runoff from this area contaminating off-site areas and contaminating terrestrial, surface water and groundwater ecosystems.

It should also be noted that there are two freshwater creeks within the Premises boundary (Houston and Pilgangoora Creeks) that flow during high rainfall events and there is a creek line identified 120m to the west of the irrigation area as depicted in Figure 12.

The depth to groundwater within the vicinity of the WWTP area and spray field is approximately 15m. This has been measured from the closest bore.

10.9.4 Criteria for assessment

The WWTP treated effluent meets Low Exposure Risk Level in accordance with DoH, 2011. Relevant land and groundwater quality criteria include ANZECC/ARMCANZ.

Data presented in Table 13 suggests that samples of groundwater abstracted for use on the Premises contain aluminium, arsenic, cadmium, copper, zinc, chromium, boron and nickel levels that exceed ANZECC/ARMCANZ recommended 95% trigger values for freshwater quality.

DWER has recommended that the short-term irrigation water guidelines (ANZECC/ARMCANZ) are the most relevant to use because the criterion is applicable for irrigation periods of up to 20 years, rather than the 100 year period allowed for the long-term irrigation water values.

Fortnightly monitoring of RO brine and RO brine mixed with WWTP effluent had been required under Works Approval W6051/2017/1. The results are provided in Table 11. It should be noted that elevations in fluoride and Gross Alpha are present above the ANZECC/ARMCANZ guidelines, short-term trigger values for irrigation. There is unlikely to be significant impacts on vegetation and soil fauna from the use of water that contains about 2.9 mg/L as this concentration is only marginally above the short-term irrigation value of 2 mg/L. It is likely that the ongoing use of water with this fluoride concentration will cause concentrations of this anion to progressively increase in groundwater beneath the site due to the effects of evaporative concentration and due to physical and chemical processes that will allow fluoride to have high mobility soils beneath the irrigation area. It is unlikely that there would be any significant impacts on vegetation or soil fauna from the Gross Alpha levels that occur in the wastewater stream that is used for irrigation.

The Licence Holder has provided nutrient loading calculations in accordance with Water Quality Protection Note 22. According to these calculations, the expected nutrient loading is 72.5 kg/ha/yr for phosphorus and 290 kg/ha/yr for nitrogen (PML, February 2018).

The Licence Holder has selected the lowest vulnerability category soils (D) from Table 2 of WQPN 22 due to the types of soils (high loam content) and due to the proximity of the irrigation field to the Northern Creek (between 250 m and 500 m).

10.9.5 Licence Holder controls

The Licence Holder controls for irrigation are set out in Table 31 below.

Table 31: Licence Holder's proposed controls for irrigation of effluent and RO brine to land

Site infrastructure	Design Details	Operation
Spray Field (3.04 ha irrigation area)	• The land is not permanently or seasonally inundated or waterlogged, needs no artificial drainage or requires natural watercourses to be diverted; • There is no Sensitive Water Resource within 500m of the spray field, however, a water course has been identified within 120m west of the irrigation field expansion area; • The spray field is not within a Public Drinking Water Source Area, a wetland with defined conservation value, Environmental Protection Policy Lakes, Waterways Management Areas or other wetland; • Stock exclusion fence comprising star picket, 3 strand wire and corner strainer posts surrounding entire irrigation area; • Internal berm installed inside the fence line from excess soil to limit surface water runoff from the irrigation area; • Operational pipework constructed using HDPE with minimum pressure rating (PN) of 12.5; • Total minimum spray area of 3.04ha (expected nutrient loading of 290 kg/ha/yr of total nitrogen and 72.5 kg/ha/yr of total phosphorus. This is based on target discharge quality of <30 mg/L total nitrogen and <7.5 mg/L total phosphorus); • Minimum of 48 irrigation sprinklers; and • Sampling points installed at the RO brine outlet prior to the WWTP Mixing Tank.	• The spray field containing natural vegetation is managed to prevent waterlogging of the surface or ponding of water by alternating discharge between the three sets of sprinklers; • Daily inspections of the spray field are undertaken to ensure there is no waterlogging of soil or ponding, and to identify maintenance requirements; • Maintenance is undertaken as required to ensure correct operation of the system; and • The spray field area is monitored for the presence of weeds on at least a quarterly basis, with herbicide treatment being carried out as required.

10.9.6 Key findings

The Delegated Officer has reviewed the information regarding the risk of RO brine/treated effluent irrigation and has found:

1. **Treated effluent meets secondary treatment as per the National Water Quality Management Strategy, Australian guidelines for sewerage systems: Effluent Management, 1997 (NWQMS, 1997).**
2. **Monitoring results indicate that fluoride and Gross Alpha levels exceed the short-term irrigation levels as listed in the ANZECC/ARMCANZ water quality guidelines. DWER has advised that these elevations are unlikely to result in significant environmental impacts.**
3. **The irrigation area is suitably sized for the wastewater irrigation in accordance with soil nutrient loading WQPN 22.**
4. **There are no nearby significant receptors at the WWTP and a surface water drainage line has been identified within 120m of the irrigation area.**

10.9.7 Consequence

Based on the information detailed above and distance to the nearest sensitive receptor (Creek line 120m away), the Delegated Officer has determined that the impact of this discharge could result in low level on-site impacts and minimal local scale impacts offsite.

There is unlikely to be significant impacts on vegetation and soil fauna from the use of water that contains about 2.9 mg/L of fluoride as this concentration is only marginally above the short-term irrigation value of 2 mg/L. It is likely that the ongoing use of water with this fluoride concentration will cause concentrations of this anion to progressively increase in groundwater beneath the site due to the effects of evaporative concentration and due to physical and chemical processes that will allow fluoride to have high mobility soils beneath the irrigation area.

Therefore, the Delegated Officer considers the consequence to be **minor**.

10.9.8 Likelihood of consequence

Based upon the Licence Holder controls within the spray irrigation area, the Delegated Officer has determined that the likelihood of an environmental impact from the disposal of treated effluent to the spray field and off site impacts from this disposal will not occur in most circumstances. However, as the groundwater around the WWTP and irrigation area is relatively shallow, the Delegated Officer considers the consequence to be **possible**.

10.9.9 Overall rating

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of discharges to land from the mixed (RO brine and effluent) irrigation water on sensitive receptors during operation is **medium**.

10.10 Risk Assessment – Landfill waste disposal and leachate

10.10.1 General hazard characterisation and impact

A maximum of 5,000 tonnes of putrescible, inert waste types 1 and 2 and contaminated solid wastes can be disposed of into the West Waste Dump per annum. Five cells are currently developed that can hold 720m^3 of waste each (3,600m^3 total). Putrescible, inert and contaminated soild waste is placed in separate trenches within the landfill. More trenches will be implemented as required.

10.10.2 Identification and general characterisation of emission

The most significant impact of a landfill on the surrounding environment is from leachate as it can enter the environment through seepage and runoff of contaminated stormwater.

10.10.3 Description of potential adverse impact from the emission

Seepage can result in groundwater contamination that impacts on beneficial use. Groundwater monitoring bore PMB005 is located in the vicinity of the landfill and standing water level is >8mbgl.

Contaminated groundwater can impact on vegetation.

10.10.4 Criteria for assessment

Relevant land and groundwater quality criteria include the ANZECC/ARMCANZ for freshwater and marine waters, the *Landfill Waste Classification and Waste Definitions 1996.*

DWER's Contaminated Sites Guidelines *Assessment and management of contaminated sites* provides ecological and human health assessment levels for soil and the ASC NEPM provides

consistent guidance on site contamination assessments.

10.10.5 Licence Holder controls

The Licence Holder controls for waste disposal and leachate at the landfill are set out in Table 32 below.

Table 32: Applicant's proposed controls for the landfill

Site infrastructure	Design Details	Operation
Landfill within the West Waste Dump	• Meets the requirements of the *Environmental Protection (Rural Landfill) Regulations 2002,* although this landfill is a Category 64 landfill; • The location of the landfill has taken into consideration factors such as: ➢ Located more than 5m from groundwater (Groundwater is approximately 12 mbgl); and ➢ Located more than 250m from any watercourse (600m to Houston Creek). • Design capacity of 5,000 tonnes per year; and • Trench is excavated to a maximum depth of 4m; • The landfill is surrounded by an earthen bund at least 2 m tall on three sides to minimise wind-blown rubbish as well as to prevent surface water runoff entering the trench; • Trenches 30m long; • Windrow encircles the landfill to divert clean surface water runoff; and • Landfill is fenced with a 1.8 m high ring lock fence with double lockable gates	• Putrescible, inert and contaminated solid waste is disposed of in separate trenches; • Appropriate and adequate signage is erected around the West Waste Dump; • Place and compact waste to ensure that all faces are stable and capable of retaining restoration material; • Restore cells (trenches) within 6 months after disposal in that cell (trench) has been completed; • Store sufficient, dense, inert and incombustible material that is readily available at all times to cover the landfill tipping area; • The size of the tipping face is kept to a minimum, and not larger than 30 m in length or more than 2 m above ground level in height; • Waste is covered as required; • Waste is levelled and compacted (e.g. maximum 300 mm lifts, passed over at least 3 times by heavy earthmoving machinery) as soon as practicable after it has been placed within the cell (trench); • Wind-blown waste is returned to the landfill site on a regular and recurring basis, but at least on a monthly basis; • Weekly inspections will be undertaken of the landfill and any rubbish in the surrounding area will be collected at least on a monthly basis. • Only putrescible waste, inert types 1 and 2 and contaminated solid wastes are disposed of at the landfill; • Unserviceable tyres shall be transported to a designated area within the approved waste rock dump disturbance footprint. They shall be stacked appropriately and periodically buried in accordance with Regulation 14(2) of the EP Regs; • No hydrocarbons and / or chemicals are disposed of into the landfill facility; and • The volume of waste disposed of into the landfill is recorded based on an estimate of average weekly disposal.

10.10.6 Key findings

The Delegated Officer has reviewed the information regarding the landfill and has found:

1. **Only putrescible and inert waste types 1 and 2 in accordance with the *Landfill Waste Classification and Waste Definitions 1996 (as amended 2018)* are to be accepted at the landfill for disposal. The acceptance of waste for disposal not meeting the types permitted for disposal may result in a breach of section 53 of the EP Act.**
2. **The landfill is sited more than 5m from groundwater (approximately 12 mbgl) and more than 250m from any watercourse.**

10.10.7 Consequence

Based on the information detailed above, distance to the nearest sensitive receptors and the small scale of the landfill, the Delegated Officer has determined that the impact of waste disposal and leachate from the landfill will result in minimal off-site impacts on a local scale. Therefore, the Delegated Officer considers the consequence to be **slight**.

10.10.8 Likelihood of consequence

Based upon the distance to the nearest sensitive receptors and Applicant controls, the Delegated Officer has determined that the likelihood of an environmental impact from waste disposal and leachate associated with the landfill will not occur in most circumstances. However as the groundwater is relatively shallow, the Delegated Officer considers the consequence to be **possible**.

10.10.9 Overall rating

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

10.11 Summary of acceptability and treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the risk events set out above, with the appropriate treatment and control, are set out in Table 32 below. Controls are described further in section 12.

Table 33: Risk assessment summary

	Description of Risk Event			Licence Holder controls	Risk Rating	Acceptability with controls (conditions on instrument)
	Emission	Source	Pathway/ Receptor (Impact)			
1.	Leaks, spills and stormwater runoff	Ore processing and handling areas Breach of containment infrastructure and pipeline failures Washdown	Direct discharge to land and infiltration to soil	Infrastructure Design Requirements Management Plans Monitoring Requirement regarding Operation of Infrastructure	Minor consequence Unlikely **Medium risk**	Acceptable subject to regulatory controls Requirements regarding operation of infrastructure and monitoring requirements for

		water Stormwater runoff Spillage of ore				the licence
2.	Overflows from the Raw Water Tank and Process Water Pond	Raw water Process Water Pond (combined water from mine dewatering bores, production bores, decant water from the TMF and excess water from the tails thickener)	Direct discharge to land and infiltration to soil Potential contamination of soil due to presence of chemicals and heavy metals Temporary loss of habitat	HDPE lined steel tank 1.833 ML capacity (with 288 kL reserved for fire water capacity) Fully covered raw water tank Monitored after each runoff event to initiate pumping of the retained water into the process circuit Freeboard designed for 1:100 yr, 72 hr storm event Minimum freeboard of 300mm to be maintained in the ponds	Moderate consequence Unlikely **Medium risk**	Acceptable subject to regulatory controls Requirements regarding operation of infrastructure and monitoring requirements for the licence
3.	TMF pipeline failure, overtopping	Failure of pipelines (tailings and return water) Overflow of TMF tailings	Direct discharge to land and infiltration to soil	Operating Manual Monitoring Infrastructure Design Requirements Requirement regarding Operation of Infrastructure Restriction on Input	Minor consequence Possible **Medium risk**	Acceptable subject to regulatory controls Requirements regarding operation of infrastructure and monitoring requirements for the licence
4.	Seepage of tailings liquor/decant from TMF	Seepage from TMF	Discharges to land and water	Operating Manual Monitoring Infrastructure Design Requirements Requirement regarding Operation of Infrastructure Restriction on Input	Moderate consequence Unlikely **Medium risk**	Acceptable subject to regulatory controls Requirements regarding operation of infrastructure and monitoring requirements for the licence

5.	WWTP pipes and storage tank failure	Failure of pipes Overtopping of tanks due to failure of equipment Discharge of treated effluent land	Discharges to land	Siting of Infrastructure Infrastructure Design Requirements Requirements regarding Operation of Infrastructure Restriction on Input	Minor consequence Unlikely **Medium risk**	Acceptable subject to regulatory controls Requirements regarding operation of infrastructure and restriction of input for the licence
6.	Irrigation of treated effluent and RO brine to land	Treated effluent mixed with RO brine waste from the camp	Discharges to land and water	Surface Water Management Plan Siting of infrastructure and drainage control within the spray irrigation area	Moderate consequence Possible **Medium risk**	Acceptable subject to regulatory controls Requirements regarding operation of infrastructure and monitoring requirements for the licence
7.	Landfill waste disposal and leachate	Leaching of material below the facility Release of wind-blown waste	Discharges to land	Siting of Infrastructure Infrastructure Design Requirements Requirements regarding Operation of Infrastructure Restriction on Input	Slight consequence Possible **Low risk**	Acceptable subject to regulatory controls Requirements regarding operation of infrastructure and restriction of input for the licence

11. Regulatory controls

A summary of regulatory controls determined to be appropriate for the Risk Event is set out in Table 34. The risks are set out in the assessment in section 10 and the controls are detailed in this section. DWER will determine controls having regard to the adequacy of controls proposed by the Licence Holder. The conditions of the Licence will be set to give effect to the determined regulatory controls.

Table 34: Summary of regulatory controls to be applied

		Controls (references are to sections below, setting out details of controls)				
		Waste Acceptance	Emissions	Infrastructure and Equipment	Monitoring	Records / Reporting
Risk Items (see risk analysis in section 10)	12.1.1. Operational requirements for Leaks, spills and stormwater runoff			●		●
	12.1.2. Operational requirements for Overflows from the Raw Water Tank and Process Water Pond		●	●	●	●
	12.1.4 Operational requirements Seepage of tailings liquor/decant from the TMF		●	●	●	●
	12.1.5 Operational requirements for the TMF pipeline failure, overtopping		●	●	●	●
	12.1.6 Operational requirements for WWTP pipes and storage tank failure		●	●	●	●
	12.1.7 Operational requirements for the irrigation of treated effluent and RO brine to land		●	●	●	●
	12.1.8 Operational requirements for the Landfill waste disposal and leachate	●	●	●		●

12. Licence controls

The following controls have been imposed as conditions on the Licence to manage the risk of emissions during operation of the Premises.

12.1.1 Operational requirements for Leaks, spills and stormwater runoff

Site Infrastructure	Operational requirements
Processing Plant	• Process capacity of 2 Mtpa; • Ore is fed through three stages of crushing, multiple screening processes, dense media separation, high pressure grinding, gravity concentrators, cyclones, cleaner spirals, cleaner scavenger spirals, low intensity magnetic separation, hydrocylones, ball mill, flotation, mill and concentrate thickener to produce lithium and tantalum concentrate; • Plant is on a concrete pad and concrete bunded with a containment capacity equivalent to 110% of the capacity of largest tank and drainage to the Process Water Pond; • Electric sump pumps installed in the concrete flooring to collect and pump any spilled material back into the process stream; • Flow transmitter and magflow meter installed; and • Isotainers, mixing tanks and storage tanks are located on a concrete bunded area with plinths within the Processing Plant area.
Power Station	• Installed load capacity of 15.7 MW; • 10 x diesel generators with capacities ranging from 1300 kVA to 3100 kVA; • Drainage at the power station units graded such that spills and surface water flow enters a triple oil/water interceptor; • Sedimentation pond to receive surface water flow; • Automated Control System; • Waste oil tanks self-contained double skin design within concrete aprons; • Fully enclosed metal bin storage for used oil contaminated parts are collected for disposal offsite; and • Oily water separator, with oil from the separation process stored in a 1,000 L tank prior to disposal offsite.
Fuel storage facilities	• Complies with Australian Standard AS 1940-2004 The storage and handling of flammable and combustible liquids.
Sedimentation Ponds	• Receive site stormwater; • Minimum freeboard of 300mm is maintained in the ponds; • Inspected as required, and before known significant rainfall events to ensure they are capable of functioning to remove sediment during high-rainfall events; and • Surface water monitoring sites have been established, which include sites upstream and downstream of the (entire) operation.
Oily Water Separators	• Where water is likely to be contaminated with hydrocarbons and other contaminants, this water will be directed to an Oily Water Separator prior to discharge to the environment or re-use onsite; and • Oily Water Separators treat hydrocarbon waste to a maximum TRH concentration of <15mg/L which is monitored monthly.
All	• A Surface Water Management Plan is employed on site;

	• Where stormwater is likely to be contaminated with hydrocarbons and other contaminants, water will be directed to an oil water separation system prior to discharge to the environment or re-use onsite (with TPH less than 15mg/L). Initial sampling for other contaminants will be required prior to discharge; and • During periods of flow in the four creeks (Northern, Houston, Pilgangoora, Southern) at a minimum of once annually, surface water samples are collected at one site upstream of the project and one site downstream of the Project with laboratory analyses for pH, TDS, TSS, electrical conductivity, major cations and anions, and contaminants.

12.1.2 Operational requirements for Overflows from the Raw Water Tank and Process Water Pond

Site Infrastructure	Operational requirements
Raw Water Tank	• 1.833 ML capacity (with 288 kL reserved for fire water capacity); • HDPE lined steel impermeable tank; • Fully covered; and • Water cannot ingress the tank during rainfall events.
Process Water Pond	• Capacity of Cell 1 is 9.2 mL and capacity of Cell 2 is 15 mL; • Minimum freeboard of 300m maintained in the pond; • Freeboard markers visible; • Maintain 1.8 mm HDPE liner via regular inspections; • Float cut-off system maintained to prevent overflow; • Twice daily inspections of the pond during operation; • Monitored after each rainfall event to check for adequate freeboard being available and to initiate pumping of the retained water into the process circuit; • Water collected in the pond is reused in processing; and • Six monthly process water quality monitoring.

12.1.3 Operational requirements Seepage of tailings liquor/decant from the TMF

Site Infrastructure	Operational requirements
TMF Cell 1	<u>General:</u> • Operated to manage design capacity of 1.9 Mtpa; • Integrated waste landform over 19.9 ha • Embankment level: ➢ TMF 1, Stage 1A of 185.3mRL; ➢ TMF 1, Stage 1B of 189.3mRL; • Permeability of between 1 x 10^{-6} m/s and 47 x 10^{-6} m/s • Minimum freeboard of 500m maintained; • Contain rainfall of a 1 in 100 year, 72 hour ARI event; • Annual water balance calculated. <u>Underdrainage system:</u> • Underdrainage was provided at the low point of the Cell 1 Stage 1A perimeter (northern corner) to minimize water accumulation. • Underdrainage pipe is pre-slotted and comprises of:

	➢ "HDPE PE100 PN16 DN200 mm, ➢ PVC-U PN16 DN200, or ➢ SRP Rocla Plastream DN225" (115275.04 SP01 Rev0) • This pipe was placed in the existing drainage line and extends 60 m towards the upstream side of the embankment and is covered by 0.5 m of gravel material which is extended until the gravel packing meets the natural ground surface. <u>Cut-off trench:</u> • Cut off trench (to a depth of 1.5m and width of 3.0m through superficial materials) constructed through the surficial deposits on the upstream side of the starter embankments (constructed from pre-strip mine waste rock materials with low permeability upstream zone formed from clayey sand materials excavated from the vicinity of the TMF footprint) and extended around the full TMF perimeter. • A sandy filter zone separates the low-permeability zone from the waste rock zone. <u>Decant Pond:</u> • Decant removed to Process Water Dam via submersible pumps to minimize surface area of the decant pond; and • Return of water to the plant will be maximised and an annual water balance, calculated. <u>Deposition:</u> • Multiple rotating spigots (ring main) on a cyclic (rotating) basis. <u>Monitoring:</u> • Eight piezometers are monitored for determining phreatic surface within the tailings; • Groundwater monitoring is conducted at the six monitoring bores adjacent to the TMF to enable detection of seepage and groundwater mounding/quality, with targets and limits set; and • Maintain the groundwater level at greater than five (5) metres bgl in the TMF monitoring bores.
TMF Cell 2	<u>General:</u> • Operated to manage design capacity of 2.7 Mtpa; • Integrated waste landform over 19.9 ha • Embankment level: ➢ TMF 2, Stage 1A of 185.3mRL; ➢ TMF 2, Stage 1B of 189.3mRL; • Permeability of between 2.4 x 10^{-9} to 9.5 x 10^{-9} m/s • Minimum freeboard of 500m maintained; • Contain rainfall of a 1 in 100 year, 72 hour ARI event; • Annual water balance calculated. <u>Underdrainage system:</u> • Underdrainage was provided at the low point of the Cell 1 Stage 1A perimeter (northern corner) to minimize water accumulation. • Underdrainage pipe is pre-slotted and comprises of: ➢ "HDPE PE100 PN16 DN200 mm, ➢ PVC-U PN16 DN200, or

	➢ SRP Rocla Plastream DN225" (115275.04 SP01 Rev0) • This pipe was placed in the existing drainage line and extends 60 m towards the upstream side of the embankment and is covered by 0.5 m of gravel material which is extended until the gravel packing meets the natural ground surface. <u>Cut-off trench:</u> • Cut off trench (to a depth of 1.5m and width of 3.0m through superficial materials) constructed through the surficial deposits on the upstream side of the starter embankments (constructed from pre-strip mine waste rock materials with low permeability upstream zone formed from clayey sand materials excavated from the vicinity of the TMF footprint) and extended around the full TMF perimeter. • A sandy filter zone separates the low-permeability zone from the waste rock zone. <u>Decant Pond:</u> • A temporary floating decant return pump has been installed at TMF Cell 2 to allow accelerated recovery of supernatant water during commissioning. The decant pump will be relocated to the decant tower once sufficient water is available for recovery; and • Decant removed to Process Water Dam via submersible pumps to minimize surface area of the decant pond; and • Return of water to the plant will be maximised and an annual water balance, calculated. <u>Deposition:</u> • A single spigot has been installed to allow commencement of discharge into TMF Cell 2 and future additional spigots will be installed to allow deposition location rotation and even deposition of tailings across the entire TMF Cell 2, thus maximising TMF Cell 2 capacity and operational efficiency. • Multiple rotating spigots (ring main) on a cyclic (rotating) basis. <u>Monitoring:</u> • Ten piezometers are monitored for determining phreatic surface within the tailings; • Groundwater monitoring is conducted at the six monitoring bores adjacent to the TMF to enable detection of seepage and groundwater mounding/quality, with targets and limits set; and • Maintain the groundwater level at greater than five (5) metres bgl in the TMF monitoring bores.

12.1.4 Operational requirements for TMF pipeline failure, overtopping

Site Infrastructure	Operational requirements
Pipelines	• Audible alarms fitted to record pressure changes fitted to all pipelines and monitored in the control room; • Tailings delivery line and return water line above ground within bunds with spill catch pits of 12 hours containment; • Continuous process control monitoring (leak detection) and flow meters at either end of the tailings delivery lines; • Physical inspection of the pipeline corridors at least once per 12 hour shift (twice daily); and • In the event flow meter readings indicate pipeline failure, the affected pipeline will be shut down.

12.1.5 Operational requirements for WWTP pipes and storage tank failure

Site Infrastructure	Operational requirements
WWTP (Discharge point from effluent and RO Brine mixing tank)	• Moving Bed Bioreactor System with less than 125 m^3/day treatment capacity; • Balance tank fitted with high level alarm wired to visual strobe light and sounder to alert of overflows; • Treated effluent / Irrigation tank fitted with high level alarm; • Flow meters installed at influent inlet point and effluent egress point; • Stock exclusion fence surrounding entire WWTP facility. • Monitoring conditions are placed on the sampling and assessment of combined brine water from the Camp RO Plant and WWTP effluent. This is to monitor the levels of metals and non-metals of the effluent to determine the potential levels of contamination entering the spray irrigation area.

12.1.6 Operational requirements for the irrigation of treated effluent and RO brine to land

Site Infrastructure	Operational requirements
Spray field	• Irrigation sprayfield of 3.04 ha (authorized up to 4.73 ha); • Internal soil berm must be maintained inside the fence to prevent surface run off from the spray field during storm events; • The spray field is managed to prevent waterlogging of the surface or ponding of water by alternating discharge between the sprinklers; • No irrigation generated run-off, spray drift or discharge occurs beyond the boundary of the irrigation area; • Wastewater is evenly distributed over the irrigation area; • Soil erosion is prevented from occurring inside the irrigation area; • Healthy vegetation cover is maintained over the wastewater irrigation areas; • The spray field area is monitored for the presence of weeds on at least a quarterly basis, with herbicide treatment being carried out as required; • Daily inspections of the spray field are undertaken to ensure

	there is no waterlogging of soil or ponding, vegetation health is not declining and to identify maintenance requirements; • Maintain the fencing around the irrigation area that acts as an effective barrier to unauthorised persons, cattle, horses and other stock; • Undertake regular inspections of all fencing and repair damage as soon as practicable; • Maintenance is undertaken as required to ensure correct operation of the system; and • Effluent monitoring with limits based on Livestock drinking water quality in ANZECC/ARMCANZ Livestock Guidelines, and TDS for Beef Cattle.

12.1.7 Operational requirements for the Landfill waste disposal and leachate

Site Infrastructure	Operational requirements
Landfill	• Capacity of 5,000 tpa; • Only putrescible waste, inert wastes and tyres are disposed of at the landfill in separate trenches; • Trenches are covered a minimum of once per fortnight with soil material; • Appropriate and adequate signage is maintained around the landfill sites; • Place and compact waste to ensure that all faces are stable and capable of retaining restoration material; • Restore cells (trenches) within 6 months after disposal in that cell (trench) has been completed; • Store sufficient, dense, inert and incombustible material that is readily available at all times to cover the landfill tipping area; • The size of the tipping face is kept to a minimum, and not larger than 30 metres in length or more than 2 metres above ground level in height; • Waste is levelled and compacted (e.g. maximum 300 mm lifts, passed over at least 3 times by heavy earthmoving machinery) as soon as practicable after it has been placed within the cell (trench); • Cover landfilled waste with sufficient clean fill (e.g. 100 mm) at least weekly, to ensure that the waste is completely covered and that no waste is exposed; • Windblown waste is returned to the landfill site on a regular and recurring basis, at least monthly; • Unserviceable tyres shall be transported to a designated area within the approved waste rock dump disturbance footprint. They shall be stacked appropriately and periodically buried in accordance with Regulation 14(2) of the EP Regs; • No hydrocarbons and / or chemicals are disposed of into the landfill facility; and • The volume of waste disposed of into the landfill is recorded.

12.1.8 Licence reporting

An Annual Environmental Report and Annual Audit Compliance Report is required to be submitted as conditions of the Licence.

13. Determination of Licence conditions

The conditions in the issued Licence in Attachment 1 have been determined in accordance with the *Guidance Statement: Setting Conditions*.

The *Guidance Statement: Licence Duration* has been applied and the issued licence expires in 20 years from date of issue. Table 35 provides a summary of the conditions to be applied to this Licence.

Table 35: Summary of conditions to be applied

Condition Ref	Grounds
Emissions 1, 2 and 3	These conditions are valid, risk-based and consistent with the EP Act.
Waste Acceptance 4	These conditions are valid, risk-based and consistent with the EP Act.
Infrastructure and Equipment 5	These conditions are valid, risk-based and contain appropriate controls.
Monitoring 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	These conditions are valid, risk-based and consistent with the EP Act.
Records / Reporting 16, 17, 18, 19, 20 and 21	These conditions are valid and are necessary administration and reporting requirements to ensure compliance.

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

14. Licence Holder's comments

The Licence Holder was provided with copies of the draft Licence document and draft Decision Report on the following dates.

- Friday, 7 June 2019; and
- Thursday, 18 July 2019.

Where the Licence Holder has provided comment, these have been summarised, along with DWER's response, in Appendix 2.

15. Conclusion

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

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

Manager, Licensing - (Resource Industries)
Regulatory Services – Environment
Delegated Officer
under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key Documents

	Document details	In text ref	Availability
1.	Works Approval W6051/2017/1 – Pilgangoora Lithium-Tantalum Project	W6051/2017/1	Available at: www.dwer.wa.gov.au
2.	*ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*	ANZECC/ARMCANZ Freshwater guidelines	Available at: www.environment.gov.au
3.	*ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality - Livestock Guidelines* Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 3 Primary Industries — Rationale and Background Information *(Irrigation and general water uses, stock drinking water, aquaculture and human consumers of aquatic foods)* (Chapter 9)	ANZECC/ARMCANZ Livestock watering guidelines	Available at: http://www.environment.gov.au/water/policy-programs/nwqms
4.	Tailings Management Facility Feasibility Study Design prepared by ATC Williams November 2016 (115275.01R02 Rev 0)	ATC Williams, 2016	DWER records (A1567039)
5.	Geotechnical investigation for TMF (Tailings Management Facility) prepared by ATC Williams April 2017 (115275.03R02)	ATC Williams, 2017a	DWER records (A1567037)
6.	Bradley, D.C., McCauley, A.D. and Stillings, L.M., 2010. Mineral-Deposit Model for Lithium-Cesium-Tantalum Pegmatites. US Geological Survey, Scientific investigations Report 2010-50700-O.	Bradley et. Al, 2010	Available at: https://pubs.er.usgs.gov/publication/sir20105070O.
7.	Graeme Campbell and Associated Pty Ltd Pilgangoora Lithium-Tantalum Project Geochemical Characterisation of Flotation-	Campbell and Associates Pty Ltd, September	DWER records (A1363286)

	Tailings Samples, September 2016	2016	
8.	Stakeholder consultation response on proposed W6051/2017/1 and licence L9056/2017/1 from DBCA (Parks and Wildlife)	DBCA, 2017	DWER Records (A1469989)
9.	Stakeholder consultation response on proposed W6051/2017/1 and licence L9056/2017/1 from Land Use Planning/Approvals, (Water) DWER	DWER Water, 2017	DWER Records (A1471350)
10.	DMIRS comments on 2018 works approval amendment	DMIRS, 2018	DWER records (A1636358)
11.	Stakeholder consultation response on proposed W6051/2017/1 and licence L9056/2017/1 from DMIRS	DMIRS, 2017	DWER Records (A1471444)
12.	Code of Practice: Tailings storage facilities in Western Australia, Department of Mines and Petroleum, 2013	DMP, 2013	Available at: http://www.dmp.wa.gov.au
13.	DER, July 2015. Guidance Statement: Regulatory principles. Department of Environment Regulation, Perth.	Guidance Statement: *Regulatory principles*	Available at: www.dwer.wa.gov.au
14.	DER, October 2015. Guidance Statement: Setting conditions. Department of Environment Regulation, Perth.	Guidance Statement: *Setting Conditions*	
15.	DER, August 2016. Guidance Statement: Licence duration. Department of Environment Regulation, Perth.	Guidance Statement: *Licence duration*	
16.	DER, February 2017. Guidance Statement: Risk Assessments. Department of Environment Regulation, Perth.	Guidance Statement: Risk Assessments	
17.	DER, February 2017. Guidance Statement: Decision Making. Department of Environment	Guidance Statement: Decision Making	

	Regulation, Perth.		
18.	Groundwater Resource Management Dewatering Assessment Pilgangoora Lithium Tantalum Project, August 2016	GRM, 2016	DWER records (A1608188)
19.	Geochemical Characterisation of Flotation-Tailings Sample Graeme Campbell and Associates Pty Ltd September 2016 (Job No. 1520/2)	Graeme Campbell and Associates, 2016	DWER Records (A1363257)
20.	Groundwater Resource Management (Groundwater) Operating Strategy for Pilgangoora Project	GRM, 2017	Available from the Licence Holder
21.	IAEA Safety Standards Series, Application of the Concepts of Exclusion, Exemption and Clearance, Safety Guide No. RS-G-1.7, International Atomic Energy Agency, 2004	IAEA, RS-G-1.7	Available at: http://www-pub.iaea.org
22.	Maest, A.S., Kuipers, J.R., Travers, C.L. and Atkins, D.A., 2005. Predicting Water Quality at Hardrock Mines: Methods and Models, Uncertainties, and State-of-the-Art.	Maest, et al, 2005	Available at: http://pebblescience.org/Pebble-Mine/acid-drainage-pdfs/PredictionsReportFinal.pdf
23.	MMWC Environmental Pilgangoora Project Area Flora, Vegetation and Fauna Assessment V2 – July 2016	MMWC, July 2016	DWER records (A1363286)
24.	National Health and Medical Research Council (NHMRC), 2015, "Australian Drinking Water Guidelines 6, 2011", Version 3.1, Updated March 2015	NHMRC, 2015	Available at: https://www.nhmrc.gov.au/guidelines-publications/eh52
25.	National Water Quality Management Strategy, Australian guidelines for sewerage systems: Effluent Management, 1997	NWQMS, 1997	Available at: http://waterquality.gov.au/SiteCollectionDocuments/effluent-management.pdf
26.	WORKS APPROVAL AND OPERATING LICENCE APPLICATION SUPPORTING	PML, 2017a	DWER Records (A1363257)

	DOCUMENT Pilgangoora Lithium-Tantalum Project. Report Version/Date: Version 1 18 January 2017 – *original application*		
27.	Soil Characterisation Study (Significant Environmental Services, 2016).	Significant Environmental Services, 2016	DWER records (A1624424)
28.	Australian Radiation Protection and Nuclear Safety Agency, Code of Practice & Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing – Radiation Protection Series Publication No. 9, August 2005	Radiation Code	Available at: http://www.arpansa.gov.au
29.	Australian Radiation Protection and Nuclear Safety Agency, Code of Practice for Safe Transport of Radioactive Material – Radiation Protection Series, No. 2, 2008 Edition	Transport Code	Available at: http://www.arpansa.gov.au
30.	360 Environmental Pilgangoora Baseline Vertebrate Fauna Survey	360 Environmental, 2016	DWER records (A1363286)
31.	Department of Environment 2004 Water Quality Protection Note Irrigation with nutrient-rich wastewater (WQPN 22)	WQPN 22	Available at: https://www.water.wa.gov.au/__data/assets/pdf_file/0013/4045/82324.pdf
32.	Contaminated Sites Branch technical advice on Gross Alpha and Fluoride elevations in groundwater and wastewater	N/A	DWER records (A1769987)
33.	Email titled "RE: Pilgangoora Lithium-Tantalum Project Meeting 8 February 2019 – outcomes summary" dated 14/02/2019 2:43pm and authored by Pilbara Minerals Pty Ltd (includes Conditions 1 and 2 Report and Radionuclides Characterisation)	Conditions 1 and 2 Report and Radionuclides Characterisation, February 2019	DWER records (A1769120)

34.	Contaminated Sites Branch technical advice on Conditions 1 and 2 Report and Radionuclides Characterisation Reports	N/A	DWER records (A1769988)
35.	Radiation Management Plan	Radiation Management Plan	DWER records (A1754360)
36.	Email titled “RE: L9056 Pilgangoora Licence Queries” dated 13/03/2019 2:57pm and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1771894)
37.	Email titled “RE: L9056 Pilgangoora Licence Queries” dated 13/03/2019 11:52am and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1771813)
38.	Email titled “RE: L9056 Pilgangoora Licence Queries” dated 13/03/2019 2:54pm and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1771596)
39.	Emailed titled “RE: Updated maps” dated 29/05/2019 3:31pm and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1793179)
40.	Email titled “FW: L9056 Pilgangoora Queries” dated 30/05/2019 4:04pm and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1793181)
41.	Email titled “FW: L9056 Pilgangoora Queries” dated 31/05/2019 8:51am and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1793176)
42.	Email titled “RE: L9056 Pilgangoora Queries” dated 31/05/2019 2:36pm and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1793369)
43.	Email titled “Existing Site Layout” dated 5/06/2019 1:38pm and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1794148)

44.	Email titled “Pilgangoora Operations - draft licence review” dated 2/07/2019 12:19pm and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (DWERDT174612)
45.	Email titled “RE: Mining Proposal (Reg ID 78129)” dated 5/07/2018 1:40pm and authored by DMIRS	N/A	DWER records (A1803103)
46.	Email titled “RE: Mining Proposal (Reg ID 78129)” dated 9/07/2019 12:59pm and authored by DMIRS	N/A	DWER records (A1804221)
47.	Email titled “FW: spodumene concentrate storage” dated 11/07/2019 11:07am and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1804926)
48.	Email titled “FW: Process Water Pond to Sediment Pond” dated 10/07/2019 4:54pm and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1804927)
49.	Email titled “RE: Metals - Total V Filtered for baseline groundwater data analysis” dated 12/07/2019 2:05pm and authored by DWER	N/A	DWER records (A1805106)
50.	Email titled ”RE: Metals - Total V Filtered for baseline groundwater data analysis” dated 12/07/2019 2:03pm and authored by DWER	N/A	DWER records (A1805104)
51.	Email titled “RE: APPLICANT NOTIFICATION - L9056/2017/1 - APPLICATION FOR A LICENCE - DRAFT INSTRUMENT AND DECISION REPORT” dated 22/07/2019 11:02am and authored by Pilbara Minerals Pty Ltd	N/A	DWER records (A1807515)

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

Condition	Comments received	Suggested action by POPL	DWER response
DATE 02/07/2019			
Licence, Cover page	• L45/147 listed. This is not a POPL tenement	• Replace with L45/417	• Updated as requested
Licence, Table 1	• TPH noted as Total Petroleum Hydrocarbons. This naming convention is no longer used	• Replace with TRH – Total Reportable Hydrocarbons	• Updated as requested
Licence, Table 2	• Specified emissions does not include TMF 2 (TMF Cell 2 Stage 1A and 1B). A Completion Report for TMF Cell 2 was submitted to DWER on 12 May 2019. Throughout the document there is reference to TMF Cells 1 and 2 as TMF1 and TMF2. DWER have explained this in the definitions section of the document, however it may leave the reader with an impression that there are two separate facilities on site, not two cells of a single facility	• Include TMF 2 into Table 2. Consider change in naming convention from TMF1 and TMF2 to TMF Cell 1 and TMF Cell 2	• Updated as requested
Licence, Table 3	• Discharge Point does not include TMF 2 (TMF Cell 2 Stage 1A and 1B). A Completion Report for TMF	• Include TMF 2 into Table 3	• Updated as requested

Condition	Comments received	Suggested action by POPL	DWER response
	Cell 2 was submitted to DWER on 12 May 2019		
Licence, Table 4	• TPH is noted. This naming convention is no longer used	• Replace with TRH – Total Reportable Hydrocarbons.	• Updated to Total Recoverable Hydrocarbons
Licence, Table 4	• WWTP effluent TDS limit is set at <1,000 mg/L. This limit is unachievable. All results provided to DWER to date demonstrate that WWTP effluent is consistently above 1,200 mg/L	• Replace <1,000 mg/L with <5,000 mg/L (the ANZECC stockwater drinking limit)	• Updated to 4,000 mg/L for ANZECC stockwater drinking water guidelines for Beef Cattle
Licence, Table 5	• Types of waste accepted do not include Contaminated Solid Waste. This waste type is included in Decision Report Section 4.1.6	• Include Contaminated Solid Waste into Table 5	• Updated as requested
Licence, Table 6	• Table 6 includes out-of-date information that is not an operational requirement including: ➢ TMF Cell 1 (permeability, Underdrainage system, cut-off trench). ➢ Raw Water Tank (monitored after each rainfall event)	• Remove permeability, Underdrainage system, Cutoff trench from TMF Cell 1. • Remove the monitoring of the raw water tank	• This information is relevant as it relates to seepage during operations of the TMF • TMF Cell 2 has also been included • Updated Raw Water Tank monitoring to state that water cannot ingress the tank during rainfall events
Licence, Table 6	• Section “All” does not include product stockpiles. POPL require operational ability to maintain product stockpiles on site to ensure continuity of supply to shipping operations	• Include product stockpiles into Section “All” with requirement to ensure any contaminated runoff is directed to the site Sediment Ponds	• Updated to include product stockpiles in the Processing Plant section.

Condition	Comments received	Suggested action by POPL	DWER response
Licence, Condition 11(a)	• Reference to Monitoring and Process Water Bores map in Schedule 1 • The flotation tailings slurry water monitoring location is not specified within the Ambient Groundwater Monitoring Map	• Change reference to Ambient Groundwater Monitoring Map • Provide detail on the proposed monitoring location	• Updated as requested
Licence, Condition 11(g)	• Requirement to compare results to ANZECC Livestock drinking water guideline. Many of the listed analytes are not included in this guideline and therefore cannot be compared	• Include wording “where applicable”	• Updated as requested
Licence, Table 7	• Location listed as “TSF1 offtake” is not defined	• Provide detail on the proposed monitoring location	• Updated as requested
Licence, Table 7	• Calcium Carbonate CaCO3 and Total Dissolved Solids, TDS are listed twice	• Remove duplicate analytes	• Updated as requested
Licence, Table 7	• Analytes are not defined as either Total or Soluble	• Provide definition of whether analytes are Total or Soluble	• Updated to include a note that these are total metals
Licence, Condition 12(g)	• Requirement to compare results to ANZECC Fresh & Marine Water Quality water guideline. Many of the listed analytes are not included in this guideline and therefore cannot be compared	• Include wording “where applicable”	• Updated as requested
Licence, Table 8	• Column 8 specifies “Limits” based on ANZECC Livestock drinking water guidelines. No action has	• Specify what action must be undertaken if a limit is exceeded.	• Updated as requested to specifically refer to the triggers and limits • Updated Condition 14 to include all triggers

Condition	Comments received	Suggested action by POPL	DWER response
	been specified in relation to these limits	• Remove the SWL Limit as it is not referenced in the remainder of the document	• Condition 17 states the actions required by a limit exceedance
Licence, Table 8	• Column 8 includes SWL limits and references Note 3. Note 3 references the ANZECC Guidelines. SWL is not included in the ANZECC Guidelines	• Exclude SWL limits from the ANZECC note	• Updated as requested
Licence, Table 8	• Analytes are not defined as either Total or Soluble	• Provide definition of whether analytes are Total or Soluble	• Updated to include note that these are filtered metals, except for Al and Fe that are filtered and total metals
Licence, Table 8	• Limits have been selected based on based on ANZECC Livestock drinking water guidelines. Decision Report 6.3.1 outlines that some analytes already exceed these limits	• Amend or remove the Selenium and Fluoride limits from PMB002 recognition of existing baseline exceedance	• Selenium results are within the limits • Fluoride limits have been updated to: ➢ 2 mg/L (with the exception of PMB002) ➢ 2.5 mg/L for PMB002 (as exceedance have been noted in this groundwater monitoring bore)
Licence, Table 8	• Column 5 requires “immediate and then six monthly” monitoring for Gross Alpha / Beta. This extent of this timeframe is not clearly defined	• Change frequency to “as soon as practicable if Gross Alpha or Beta Trigger Levels are exceeded”	• Triggers have been modified for TMFMB05 and TMFMB06, where exceedances are noted
Licence, Condition 13	• Condition 13 requires the licence holder to implement measures if the standing water level trigger has been exceeded. Recent	• Change condition 13 to require action should the standing water level exceed the trigger level by three consecutive months	• Updated to exclude natural excessive rainfall events

Condition	Comments received	Suggested action by POPL	DWER response
	Cyclone Veronica (1:50 yr ARI) resulted in immediate response in all TMF bores with TMFMB01 and TMFMB02 exceeding the Trigger Level (7mbgl) and TMFMB05 exceeding the Limit Level (5mbgl). Levels are recovering to pre-event levels. Events such as these are outside the control of POPL and should not trigger management action		
Licence, Condition 14	• Condition requires immediate notification to CEO if Gross Alpha/Beta exceed trigger limits in Table 8. Decision Report 6.3.1 outlines that Gross Alpha values consistently exceed these trigger levels	• Remove the Gross Alpha Trigger reporting requirement from PMB002, PWBMB004, TMFMB01, TMFMB02, TMFMB03, TMFMB04, TMFMB05 and TMFMB06	• The trigger values in Table 8 for TMFMB05 and TMFMB06 have been updated so this Condition is now more appropriate
Licence, Condition 15(a)	• Reference to Monitoring and Process Water Bores map in Schedule 1. This map is incorrectly referenced	• Change reference to Ambient Groundwater Monitoring Map	• Updated as requested
Licence, Condition 15(g)	• Condition requires comparison of WWTP and OWS discharges to be compared to ANZECC Short-term irrigation values. • Comparison to the STV is not possible for the majority of parameters as they are not included in the ANZECC irrigation guideline.	• Remove reference to the ANZECC Short Term irrigation guideline	• DWER's Contaminated Sites Branch has recommended this guideline as applicable for comparison

Condition	Comments received	Suggested action by POPL	DWER response
	• NWQMS Paper 4, Volume 3 outlines the derivation of the Short Term Irrigation triggers. As outlined in this Paper, all triggers are related to plant productivity and crop yield. These guidelines are not relevant to the Pilgangoora WWTP or OWS discharge		
Licence, Table 9	• Column 1 (Location) does not adequately define the discharge point for the WWTP	• Include WWTP at start of location description	• Updated as requested
Licence, Table 9	• The table does not define whether metals analyses are to be Total or Dissolved	• Include definition of Total or Dissolved for all metals	• Updated to include note that these are total metals
Licence, Table 9	• The following are duplicated in Column 2 ➢ Calcium Carbonate CaCO3 ➢ Gross Alpha ➢ Gross B ➢ Rubidium, Rb ➢ Selenium, Se ➢ Silicon, Si ➢ Sodium, Na ➢ Sulphate, SO4 ➢ Tantalum, Ta ➢ Thallium, Tl ➢ Thorium, Th ➢ Tin, Sn ➢ Uranium, U ➢ Zinc, Zn	• Remove duplicates	• Updated as requested

Condition	Comments received	Suggested action by POPL	DWER response
Licence, Table 9	• Thallium has a note requiring level of detection sufficient to compare to ANZECC guidelines. Thallium in not contained within the Short Term Irrigation values	• Remove note	• Updated as requested. The Note 2 is listed next to Column 2, Parameter heading
Licence, Table 9	• Process Water Pond volume does not define whether it is input, output or total stored volume	• Defined intent of volume measurement. Suggest removal of volume as the process pond is designed as part of the process balance, not storage or disposal	• Updated to include input and output
Licence, Table 9	• Oily Water treatment systems list Total Petroleum Hydrocarbons as the parameter. This has been replaced by Total Recoverable Hydrocarbons (TRH)	• Change OWS parameter to Total Recoverable Hydrocarbons	• Updated as requested
Licence, Condition 19	• Condition requires the Licence Holder to comply with “Department Request”. The scope of this request is not defined	• Include scope of “Department Request” within this Condition	• “Department Request” is defined in the Definitions Table 1
Licence, Premises Boundary	• Premises boundary lists L45/147. This is not a POPL tenement	• Replace L45/147 with L45/417	• Updated as requested
Licence, Table 12	• Table does not include TMF2 (TMF Cell 2 Stage 1A and 1B). A Completion Report for TMF Cell 2 was submitted to DWER on 12 May 2019	• Include TMF Cell 2	• Updated as requested
Decision Report, Cover Page	• L45/147 listed. This is not a POPL tenement	• Replace with L45/417	• Updated as requested

Condition	Comments received	Suggested action by POPL	DWER response
Decision Report, Table 2	• Submission of TMF2 Completion Report no listed	• Include TMF2 Completion Report	• Updated as requested
Decision Report, Section 3	• Statement that TMF2 construction is not yet finalised is incorrect. Completion Report for TMF Cell 2 was submitted to DWER on 12 May 2019	• Include TMF2 Completion Report	• Updated as requested
Decision Report, Section 3.1	• Statement that a licence amendment is required for TMF2 as construction is not yet finalised is incorrect. Completion Report for TMF Cell 2 was submitted to DWER on 12 May 2019	• Include TMF2 Completion Report	• Updated as requested
Decision Report, Section 4.1.2	• Statement that a Completion Report is required for TMF2 as construction is not yet finalised is incorrect. Completion Report for TMF Cell 2 was submitted to DWER on 12 May 2019	• Include TMF2 Completion Report	• Updated as requested
Decision Report, Table 5	• Tailings Deposition Method for TMF Cell 1 and Cell 2 are noted as different. Deposition method will be the same	• Amend TMF Cell 2 to match TMF Cell 1	• Updated as requested
Decision Report, Table 5	• TMF Cell 1 and Cell 2 permeabilities are at variance to those within the respective Completion Reports	• Amend permeabilities to match Completion Reports	• Updated as requested
Decision Report, Table 5	• Monitoring section notes that “Licence holder commits to	• Remove text requiring management action without investigation and assessment	• Updated to include except if the breach is a result of natural extreme

Condition	Comments received	Suggested action by POPL	DWER response
	installing recovery bores to collect seepage" if there is a rise in groundwater in monitoring bores TMFMB01-06. • Recent Cyclone Veronica (1:50 yr ARI) resulted in immediate response in all TMF bores with TMFMB01 and TMFMB02 exceeding the Trigger Level (7mbgl) and TMFMB05 exceeding the Limit Level (5mbgl). Levels are recovering to pre-event levels. Events such as these are outside the control of POPL and should not trigger management action		rainfall events
Decision Report, Figures 4-7	• Figures do not include TMF2	• Replace Figures with those that include TMF1 and 2	• Updated as requested
Decision Report, Section 4.1.2	• Duration of kinetic testing references Maest et al 2005 in relation to kinetic testing inferring that the testwork completed for Pilgangoora is insufficient. It is important to note the proviso of "for some materials". • The Pilgangoora tailings materials have been sufficiently tested, and results provided within the Condition 2 report submitted to DWER in February 2019. This report has been reviewed by DWER to their satisfaction (Draft Decision Report Section 6.4.3)	• Remove text inferring kinetic testing is insufficient	• This text provides background

Condition	Comments received	Suggested action by POPL	DWER response
Decision Report, Section 4.1.2	• Heterogeneity and surface area effect discusses tailings geochemistry in context of Bradley et al (2010) and Maest et al (2005). The citations used are in relation to waste rock (ie surface area of coarse-grained ore and biological enhanced weathering) and not relevant in the context of tailings assessment	• Remove this text as not relevant to tailings characterisation	• This text provides background
Decision Report, Section 4.1.2	• Heterogeneity and surface area effect references USEPA 1313 testing “at other sites” citing “environmental concerns”. The Pilgangoora site has been subject to USEPA 1313 testing as referenced in the subsequent paragraph with no concerns raised	• Remove this text as not relevant to the Pilgangoora site	• This text provides background
Decision Report, Section 4.1.4	• The header Wastewater Treatment Plant appears to have been included as general text with no Section number	• Wastewater Treatment Plant should be highlighted as Section 4.1.5	• Updated as requested
Decision Report, Seciton 4.1.4	• Final paragraph describes the “Brine from the RO plant is sent to the irrigation tank….”. There are two RO plants at Pilgangoora	• Include the word “Camp” when referencing the RO plant	• Updated as requested
Decision Report, Table 8	• Prescribed Activity Category 64 describes the landfill as 100 TPA. Section 4.1.8 demonstrates capacity of 5,000 TPA. Accepted	• Amend Table 8 to reference 5,000 TPA capacity and include Contaminated Solid Waste	• Updated as requested

Condition	Comments received	Suggested action by POPL	DWER response
	wastes are listed as putrescible and inert. Draft Decision Report Section 4.1.6 allows for Contaminated Solid Waste		
Decision Report, Table 8	• Prescribed Activity Category 54 (item 10) describes the WWTP irrigation area as 3.04ha. Approved Pilgangoora WWTP irrigation area is 4.73ha as described in Draft Decision Report Section 4.1.4	• Update Table 8 with the correct WWTP irrigation area	• Updated as requested
Decision Report, Table 9	• Table does not include latest Mining Proposal and Mine Closure Plan (Reg ID 78129) or NVCP (CPS8175/1)	• Include reference to current Mining Proposal / MCP and Native Vegetation Clearing Permit	• Updated as requested
Decision Report, Section 6.1	• Statement “due to physical and chemical processes that will allow fluoride to have high mobility soils beneath the irrigation area”. There is no reference provided for this assertion	• Include appropriate references to support this statement	• Updated as requested
Decision Report, Section 6.3.1	• Reference is made to several ANZECC guidelines in this section. This introduces confusion as to which guideline DWER assert is suitable or appropriate for groundwater chemistry	• Restrict discussion to a single guideline appropriate to the issue in question	• ANZECC/ARMCANZ Freshwater guidelines 95% protection guideline value for freshwater ecosystems have been set as triggers to meet as they are more stringent, while ANZECC/ARMCANZ Livestock watering guidelines have been set as limits as they are more conservative

Condition	Comments received	Suggested action by POPL	DWER response
Decision Report, Section 6.4.2	• This Section discusses content of the Condition 19 and 20 Monitoring Report. A statement is made in relation to the results within the Condition 19 report that "sensitive receptors are livestock, wildlife and potable water use in the camp". This statement is not contained within or supported by the Condition 19 Report	• Remove this statement as it is not included in the Condition 19 Report	• These are the sensitive receptors. It doesn't state that these are documented within the report
Decision Report, Section 6.4.3	• Section 6.4.3 includes two bullet points (final two) that are attributed to the Condition 19 Report (dated 12 Feb 2019). Neither of these two statements are contained within that report	• Remove these two bullet points. Replace with the correct statement that "Naturally elevated concentrations of uranium in the ground water in the vicinity of the TMF are the result of weak uranium mineralisation in the area"	• This is DWER's Contaminated Sites technical advice so these two bullet points are relevant
Decision Report, Section 7	• Draft Decision Report includes reference to stop work orders, modified penalty notices and letters of warning that are not applicable to the Operator (Pilgangoora Operations Pty Ltd)	• Remove reference to events that relate to Pilbara Minerals Ltd	• These enforcement details are relevant to the project
Decision Report, Section 10.4.2	• Statement that "Lithium is highly soluble". This is incorrect in the context of a spodumene operation. Lithium in spodumene is insoluble and requires chemical conversion and calcining at over 1,000 degrees Celsius to be mobilised	• Correct statement and reconsider risk assessment in context of spodumene operation	• Updated as requested

Condition	Comments received	Suggested action by POPL	DWER response
Decision Report, Section 10.4.5	• Spelling error “waster”	• Correct spelling error	• Updated as requested
Decision Report, Table 21	• Raw Water Tank, Operation Column includes text referencing monitoring of the raw water tank. This tank has a roof and is not impacted by runoff events	• Remove raw water tank and related text from Table 21	• Updated to include: ➢ HDPE lined steel impermeable tank ➢ 1.833 ML capacity (with 288 kL reserved for fire water capacity) ➢ Fully covered ➢ Water cannot ingress the tank during rainfall events. ➢ Not affected by rainfall events as fully covered tank ➢ No operational requirements necessary
Decision Report, Table 21	• Statement that surface water will be sampled “minimum of once annually” may be outside of control of POPL depending on rainfall events	• Remove “minimum of once annually”	• Updated to state where it’s accessible
Decision Report, Table 22	• Row “All” references “triple oily-water interceptor”. The two OWS on site are both Coalescing Plate Separators (CPS)	• Remove text referencing “triple oily-water separator”	• Updated as requested
Decision Report, Section 10.5.2	• Statement that “Process water pond is not sampled and monitored by the Licence Holder” is misleading. It is more correct to state that “Process water pond	• Change text from “Process water pond is not sampled and monitored by the Licence Holder” to “Process water pond has no current DWER sampling or monitoring requirement”	• DWER recommended monitoring as part of the Works Approval assessment and also queried this again during the Licence assessment. As POPL is not

Condition	Comments received	Suggested action by POPL	DWER response
	has no current DWER sampling or monitoring requirement"		monitoring, DWER has included this as a Licence Condition to ensure the monitoring is conducted
Decision Report, Section 10.5.3	• Statement that process pond water discharge may inundate vegetation is incorrect. Process pond discharge reports directly to Sediment Pond where it can be recovered to process	• Remove text relating to inundation if vegetation	• Updated to state that the Process Water Pond overflow to the Sediment Pond in the event of extreme rainfall events.
Decision Report, Table 23	• Statement that Raw Water Tank is monitored after runoff events is incorrect. This tank has a roof and is not impacted by runoff events	• Remove text referencing monitoring of raw water tank in relation to runoff events	• Updated as requested
Decision Report, Section 10.5.7	• Statement that "raw water tank water is potable" is incorrect. The water is "near potable"	• Remove incorrect statement	• Updated as requested
Decision Report, Section 10.6.2	• Table 19 and Table 18 are referenced together	• Include "and" between Table 19 and Table 18	• Updated to refer to Table 18
Decision Report, Section 10.6.2	• Reference to tailings density is reversed in logic. Tailings density is % solids, not water	• Correct reference	• Updated as requested
Decision Report, Section 10.6.8	• Likelihood does not consider the siting of the TMF within the pit dewatering drawdown cone	• Consider siting of TMF in context of open pit drawdown	• Updated as requested in Section 10.7.8
Decision Report, Table 26	• CaCO3 is duplicated in table	• Remove duplicates	• Updated as requested

Condition	Comments received	Suggested action by POPL	DWER response
Decision Report, Section 10.7.2	• Criteria for assessment discusses impact to stygofauna. No reference to support statement is provided	• Provide appropriate reference to support statement	• Updated to include DWER's Contaminated Sites Branch technical advice
Decision Report, Section 10.7.2	• Spelling error "Floatation"	• Correct spelling to "Flotation"	• Spelling is correct either way
Decision Report, Section 10.7.4	• Point 6 states "rise in groundwater in or around the TMF1". There should be no requirement to manage groundwater levels "in" the TMF. • Point 6 states that "Licence holder commits to installing recovery bores… to collect seepage" if there is a rise in groundwater in monitoring bores TMFMB01-06. • Recent Cyclone Veronica (1:50 yr ARI) resulted in immediate response in all TMF bores with TMFMB01 and TMFMB02 exceeding the Trigger Level (7mbgl) and TMFMB05 exceeding the Limit Level (5mbgl). Levels are recovering to pre-event levels. Events such as these are outside the control of POPL and should not trigger management action	• Replace "in or around" with a list of specific monitoring bores. • Remove text requiring management action without investigation and assessment	• Updated to say except if the breach is a result of natural extreme rainfall events
Decision Report, Section 10.7.7	• Table 19 and Table 18 are referenced together	• Include "and" between Table 19 and Table 18	• Updated to refer to Table 18

Condition	Comments received	Suggested action by POPL	DWER response
Decision Report, Section 10.8.2	• Section states that the ANZECC guidelines for short-term irrigation water are relevant. • NWQMS Paper 4, Volume 3 outlines the derivation of the Short Term Irrigation triggers. As outlined in this Paper, all triggers are related to plant productivity and crop yield. These guidelines are not relevant to the Pilgangoora WWTP or OWS discharge	• Remove reference to the ANZECC Short Term irrigation guideline	• DWER's Contaminated Sites Branch has recommended this guideline as applicable for comparison
Decision Report, Section 10.9.7	• Table 19 and Table 18 are referenced together	• Include "and" between Table 19 and Table 18	• Updated to refer to Table 18
Decision Report, Section 10	• All subsections have the same header number (10.10.1)	• Update Header Numbers	• Updated as requested
Decision Report, Section 10.10.1	• Section references inert wastes types 1 and 2. Draft Decision Report Section 4.1.6 allows for Contaminated Solid Waste	• Include Contaminated Solid Waste	• Updated as requested
Decision Report, Section 10.10.1	• Section states that "contaminated stormwater can impact on vegetation". The Pilgangoora landfill has been constructed in accordance with Works Approval W6051/2017/1 such that stormwater cannot exit the waste storage areas	• Remove text as not relevant to landfill design	• Updated to state Contaminated groundwater can impact on vegetation
Decision Report, Table 31	• Section references inert wastes types 1 and 2. Draft Decision	• Include Contaminated Solid Waste	• Updated as requested

Condition	Comments received	Suggested action by POPL	DWER response
	Report Section 4.1.6 allows for Contaminated Solid Waste		
Decision Report, Section 10.10.4	• Section references inert wastes types 1 and 2. Draft Decision Report Section 4.1.6 allows for Contaminated Solid Waste	• Include Contaminated Solid Waste	• Updated as requested
Decision Report, Section 12.1.2	• Statement that Raw Water Tank is monitored after runoff events is incorrect. This tank has a roof and is not impacted by runoff events	• Remove text referencing monitoring of raw water tank in relation to runoff events	• Updated as requested
Decision Report, Section 12.1.2	• Process Water Pond monitoring uses the term “wastewater”. Should be “process water”	• Change Wastewater to process water	• Updated as requested
DATE 22/07/2019			
Licence, Table 8	• POPL are satisfied with the contents of the licence and Decision Report, with the exception of the Gross Alpha trigger values	• Gross Alpha trigger under Column 7 of Table 8, being 0.5Bq/L (with the exception of TMFMB05 and TMFMB06) and 1Bq/L for TMFMB05 and TMFMB06. Monitoring results to date indicate POPL routinely exceed this trigger level as indicated in the attached monitoring report and also in monitoring data previously provided to DWER. POPL propose a more appropriate Gross Alpha trigger level of 1.5Bq/L for TMFMB005, TMFMB06 and TMFMB02, 0.5Bq/L for PMB001 and 1Bq/L for all other ambient groundwater monitoring	• Updated as requested

Condition	Comments received	Suggested action by POPL	DWER response
		points • In addition, in column 1 of Table 8 PMB005 should read PWB005	

Attachment 1: Licence L9056/2017/1