Decision Report

Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Works Approval Number	W6132/2018/1
Works Approval Holder	Wodgina Lithium Pty Ltd.
ACN	611 488 932
File Number	DER2017/001949
Premises	Wodgina Operations Mining tenements M45/50, M45/381, M45/382, M45/923, M45/925 and M45/1252 MARBLE BAR WA 6760
Date of Report	17 May 2018
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
AEP	Annual Exceedance Probability
AER	Annual Environment Report
Applicant	Wodgina Lithium Pty Ltd
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CS Act	*Contaminated Sites Act 2003* (WA)
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.
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the *Public Sector Management Act 1994* and is responsible for the administration of the *Environmental Protection Act 1986* along with other legislation.
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
m^3	cubic metres
mg/L	milligrams per litre

mm	millimetres
mtpa	million tonnes per annum
Mm^3	million cubic metres
m/s	metres per second
mtpa	million tonnes per annum
MW	megawatts
NEPM	National Environmental Protection Measure
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*
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
mg/m^3	miligrams per cubic metre
Works Approval Holder	Wodgina Lithium Pty Ltd.

2. Purpose and scope of assessment

Wodgina Lithium Pty Ltd (Applicant) submitted an application on 12 February 2018 to the Department of Water and Environmental Regulation (DWER) for a works approval under Part V, Division 3 of the *Environmental Protection Act 1986* (EP Act). The application pertains to the construction of the following:

- Spodumene and tantalum beneficiation plant;
- TSF 3 expansion and pipeline/decant return infrastructure;
- Power station;
- Expansion of the existing wastewater treatment facility; and
- Expansion of the existing putrescible landfill and tyre storage area.

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
Application form and supporting documentation	12 February 2018
Wodgina Groundwater Operating Strategy October 2016	
Wodgina Fauna Gap Analysis 2017	
Wodgina DSO Terrestrial; Vertebrate Fauna Assessment 2009	
Wodgina DSO Terrestrial Vertebrate Fauna Survey 2012	
Bamford – Wodgina CS Report Update 2017	
Wodgina Triennial Aquifer Review 2015	
MBS Environmental February 2018. Wodgina Lithium Project Process Streams Geochemical Assessment (amended)[1].	15 February 2018
Further information provided on pipeline and levels of thallium, fluoride and lithium in tailings leachate.	04 April 2018

Note 1: Report supersedes version 1 of the report submitted on 12 February 2018 as supporting documentation.

The application relates to the prescribed Premises categories defined in Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) and listed in Table 3.

Table 3: Prescribed Premises Categories applied for

Classification of Premises	Description	Current Premises production design capacity or throughput	Premises production or design capacity or throughput
Category 5	Processing or beneficiation of metallic or non-metallic ore	8.75 million tonnes per annum	No change requested
Category 52	Electric power generation	N/A	64 megawatts
Category 54	Sewage facility	210 cubic metres per day	210 cubic metres per day
Category 89	Class II putrescible landfill site	3350 tonnes per annual period	4999 tonnes per year

Figure 1 depicts the Premises boundary and the location of the prescribed activities subject to this works approval.

3. Background

The Premises is located on the Kangan Pastoral Lease in the East Pilbara Shire, approximately 120 km from Port Hedland in Western Australia. The Premises is located on mining tenements M45/50, M45/353, M45/381, M45/382, M45/383, M45/886, M45/887, M45/923, M45/925, and M45/1252 in Marble Bar.

The Wodgina mine was established in 1989 and operations were expanded during the 1990s. A major expansion of the operation occurred in 2002.

In June 2016, Mineral Resources (MRL) through the controlled entity Wodgina Lithium Pty Ltd (Applicant), entered into an agreement with the then owner Global Advanced Metals (GAM), for the purchase of the mines assets and mineral rights. The tantalum rights have been retained by GAM.

A notification of the recommencement of mining was received in February 2017. The site currently processes ore for direct shipping off site. The Applicant now proposes to extract spodumene and tantalum from pegmatite ore on site and process through the proposed beneficiation plant, increasing the Lithium Oxide concentration in the spodumene concentrate from the current 1% in the direct shipped ore to 6%.

The pegmatite ore contains naturally occurring radioactive materials (NORMS). The pegmatites at the Wodgina Operations contain sufficient concentrations of NORMS such that management under a Radiation Management Plan is required, according to the *Mines Safety and Inspection Regulations 1995* and ARPANSA's *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing 2005*.

Radiological matters are primarily managed by the Department of Mines, Industry Regulation and Safety (DMIRS) on delegation from the Radiological Council (WA). Part V of the EP Act has a role in regard to the management of processing wastes (generally tailings) and any discharges that may impact on the environment arising from the storage of these wastes.

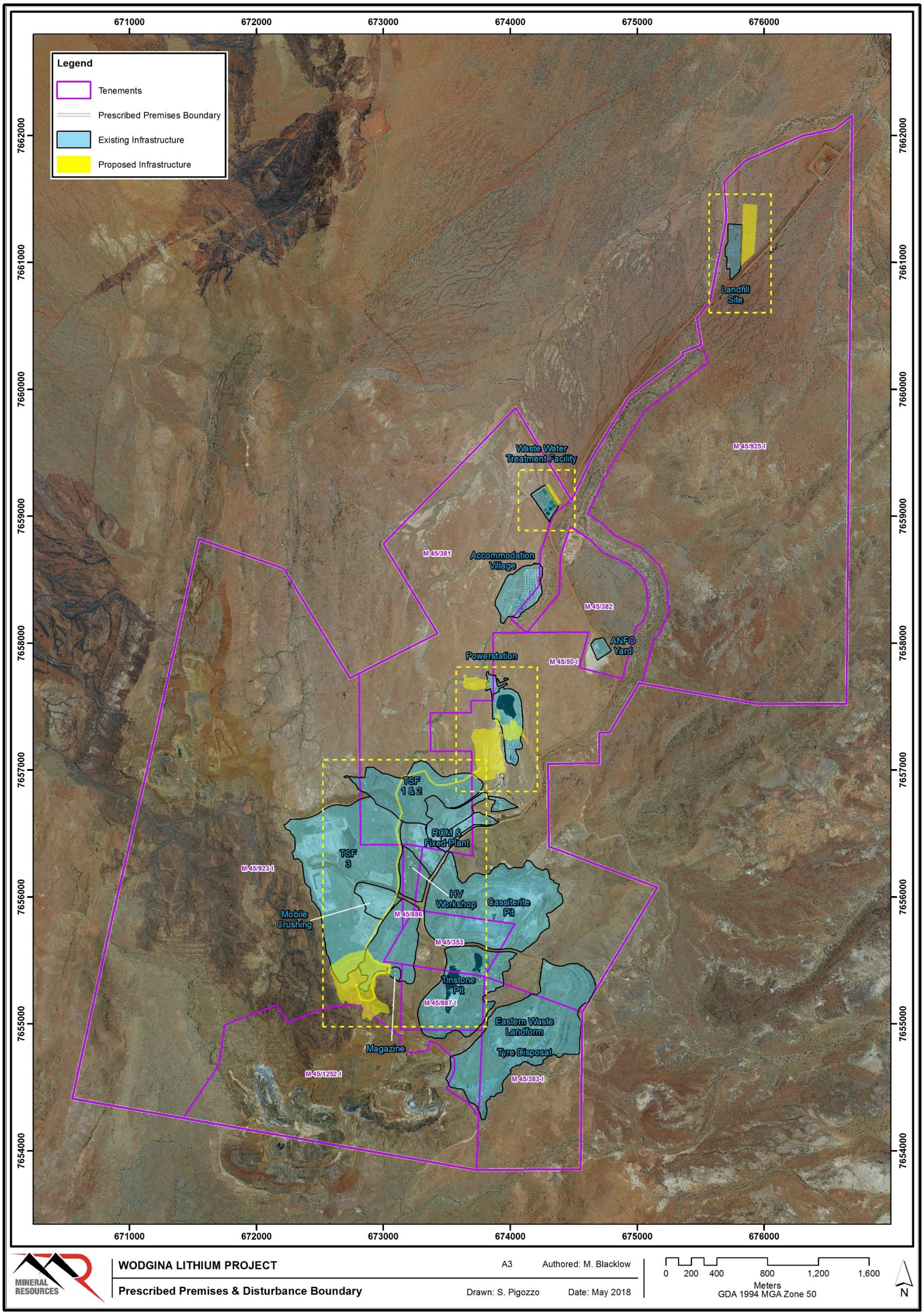


Figure 1: Premises boundary and prescribed activities that are subject of Works Approval W6132/2018/1. Overview of proposed changes to the Premises.

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

3.1.1

3.1.2 TSF3 expansion

The Applicant proposes to construct an expansion to the existing TSF3 to store tailings at the start-up of the new beneficiation plant. The TSF3 expansion has been designed to store 3.5 mt of tailings over a 10 month period. The tailings have an in situ dry density of 1.5 t/m^3 and are 60% solids. The TSF3 expansion is located in a steep sided valley upstream of the south of the existing TSF3. The southern embankment of the existing TSF3 forms the northern embankment (main embankment) of the TSF3 expansion. Figure 3 shows the general location of the TSF 3 expansion.

Figure 2: Process flow diagram (Wodgina, February 2018)

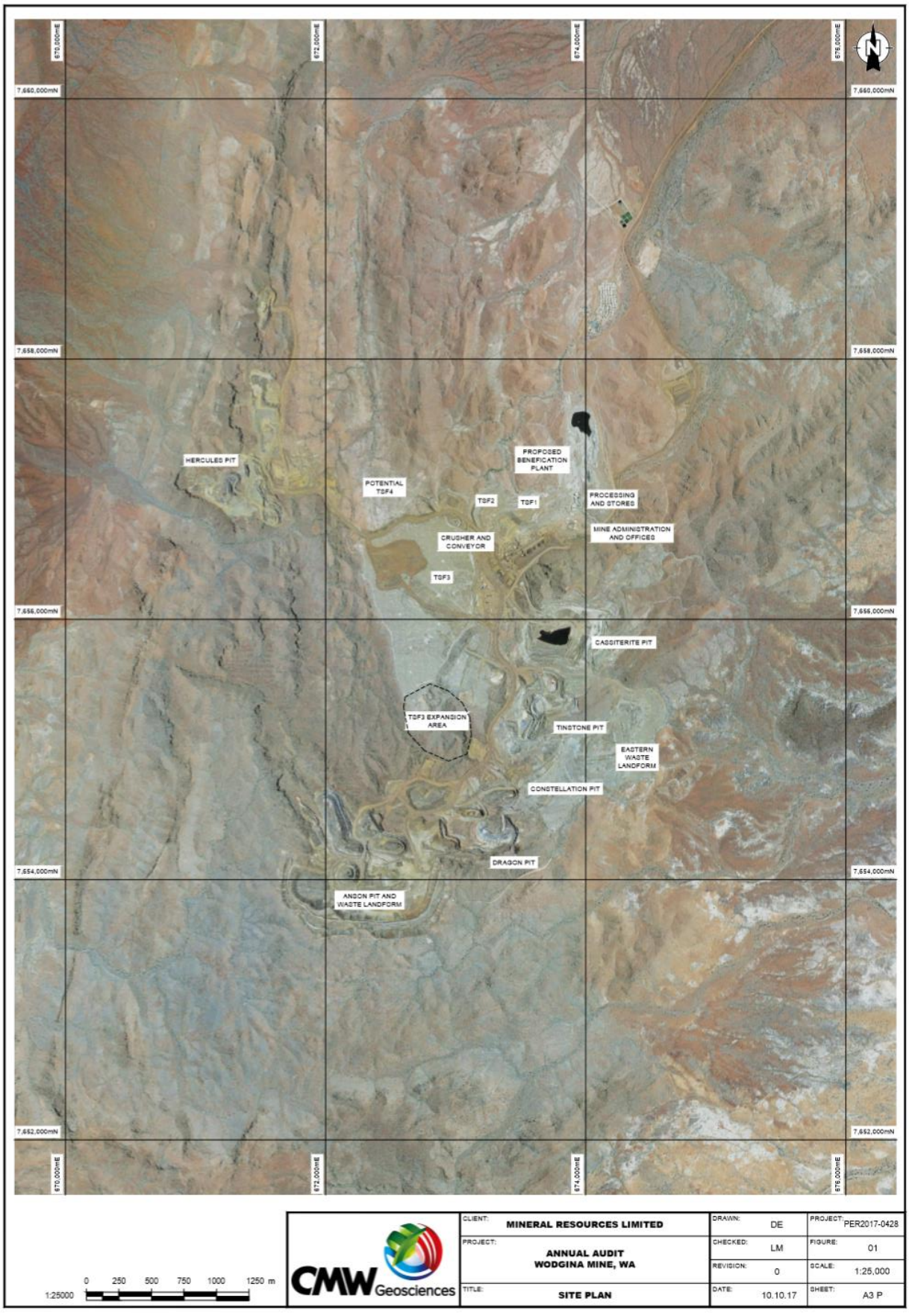


Figure 3: General location of proposed TSF3 expansion

TSF3 Construction (CMW, January 2018)

The existing southern embankment will be raised from an existing crest RL 260 m to a final crest of RL 275 m by the downstream construction techniques, necessitating removal of the tailings from the existing TSF3 that lie beneath the proposed embankment.

A compacted clayey zone is to be constructed along the waste dumps on the eastern side of the site and construction of a pipe bench along the eastern side of the valley.

The TSF embankment will be a zoned embankment comprising an upstream (expansion side) zone of low permeability, roller-compacted clayey mine waste and downstream (existing TSF3 side) zone of traffic compacted mine waste. Clayey mine waste and general mine waste have been utilised previously in the construction of the existing TSF3. The TSF3 expansion main embankment will be raised in stages:

Starter stage (as per Schedule 2: Figure 1 in the Works Approval):

- Construction of clayey mine waste zone (6 m) adjacent to the waste dump on the eastern side of the expansion area. This will include a cut-off trench excavated to 'rock' in order to reduce seepage losses into the dump.
- Establishment of a decant pump near the main embankment of the TSF3 expansion. Construction of the pipe bench along the eastern side of the expansion area.

Final stage (as per Schedule 2: Figure 2 in the Works Approval):

- Removal of tailings from beneath the raised embankment footprint.
- Downstream raising of the main embankment comprising an upstream clayey material compacted zone and downstream traffic compacted waste zone.
- Raising of the clayey mine waste zone adjacent to the waste dump on the eastern side of the expansion.
- Raising of the decant pump near the main embankment of the expansion area.
- Construction of closure spillway in the north eastern area of storage. The closure design for the TSF3 expansion area includes a closure spillway constructed at the north-eastern corner of the facility. The spillway will divert runoff from the top surface of the TSF3 expansion area to the north-east and adjacent pit area.

TSF3 Operation (CMW, January 2018)

The following operational considerations have been incorporated into the design:

- Tailings in the form of slurry will be discharged sub-aerially into the facility from several single point discharges located up the valley (locations depicted in Schedule 2: Figures 1 and 2 of the Works Approval). Tailings deposition will be in thin layers, not exceeding 300 mm thickness, in order to allow optimum density and strength gain by subjecting each layer to a drying cycle.
- Tailings deposition to be carried out such that the supernatant pond is maintained around the decant pump within the northern section of the facility near the main embankment of the TSF3 expansion.
- Water will be removed from the facility and pumped back to the process plant. This will continue for the life of mine, at which point the closure spillway will be constructed.
- The minimum operational freeboard for the TSF 3 expansion under normal operating conditions is 0.5 m, plus allowance for temporary storage of the 1% average exceedance probability (AEP) 72-hour storm event whilst maintaining required freeboard. Total freeboard of 1 m.

- On eventual decommissioning, the facility will remain as a permanent feature of the landscape and drain to an increasingly stable mass. The top surface will then be rehabilitated.
- Multiple discharge points along the eastern boundary into the TSF will be utilised to ensure level deposition of tailings into the facility.
- The tailings line itself will be located above ground within earthen bunding from the beneficiation plant through to the TSF and be inspected on a daily basis to ensure no wear or failures are apparent.
- Pipeline to be installed with instrumentation consisting of electromagnetic flow meters and pressure transmitter installed downstream of pump station and upstream of single point discharge providing constant monitoring of operation parameters of the tailings pipeline and provide shutdown of the system in the event of pipeline failure.
- There will be catch sumps installed at low points (4 locations) along the line each with a capacity to store sufficient volume of tailings in the event of a pipeline failure.
- The proposed tailings line location has now been amended to now run entirely within disturbed areas as depicted in Schedule 2: Figure 4 of the Works Approval.

It is expected that the life of the TSF expansion is 12 months, with a new TSF planned for the future. The new TSF will be subject to a separate approval application.

The details of the TSF3 expansion stages are summarised in Table 4.

Table 4: TSF3 expansion stages

Stage	Crest RL (m)	Area (ha)	Cumulative Volume (Mm^3)	Cumulative Storage Capacity (Mt)	Cumulative Storage Life (months)
Starter	260	8.4	0.73	1.1	3
Final	275	12.8	2.32	3.5	10

Tailings Seepage (CMW, January 2018)

Material properties used in seepage modelling are provided in Table 5.

Table 5: Permeability values for TSF3 expansion (CMW, January 2018)

Permeability values adopted	
Material Zone	**Permeability, K (m/s)**
Foundation (weathered basalt)	10^{-6}
Embankment (compacted clayey mine waste)	10^{-8}
Embankment (compacted mine waste)	10^{-6}
Tailings	10^{-7}

A water balance has been undertaken with total water inflows modelled at 7403.38 m^3/day. Total seepage outflow through the TSF floor has been predicted to be 130 m^3/day based on hydraulic conductivity of 1 x 10^{-7} m/s (CMW, January 2018). The water balance is at Figure 4. Initial seepage levels are expected to be greater as the hydraulic conductivity of the base materials is 1 x 10^{-6} m/s.

PROJECT	: EXPANSION TO TSF3
CLIENT	: MINERAL RESOURCES LIMITED
LOCATION	: WODGINA MINE, WA
SUBJECT	: PROJECTED WATER BALANCE - AVERAGE RAINFALL ABYDOS, AVERAGE EVAPORATION PORT HEDLAND

Date	20-Nov-17
Job No	
File	
Subject	Water Balance
Revision	A

		Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
INFLOWS		Days per month	31	28.25	31	30	31	30	31	31	30	31	30	31	
RAINFALL															
Rainfall (mm)			79.7	104.6	42.4	5.4	15.5	15.8	4.7	0.0	0.0	0.0	0.4	43.5	312.00
Average Daily Rainfall (mm)			2.57	3.70	1.37	0.18	0.50	0.53	0.15	0.00	0.00	0.00	0.01	1.40	
Tailings Dam Storage Area (m2)		change	128,000.00	128,000.00	128,000.00	128,000.00	128,000.00	128,000.00	128,000.00	128,000.00	128,000.00	128,000.00	128,000.00	128,000.00	
Runoff Coefficient Tailings			0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
Catchment Area above Storage (m2)		change	42,000.00	42,000.00	42,000.00	42,000.00	42,000.00	42,000.00	42,000.00	42,000.00	42,000.00	42,000.00	42,000.00	42,000.00	
Runoff Coefficient Catchment			0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	
Pool Area (m2)		change	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	
Running Beaches (m2)		change	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	
Rainfall Inflow Total Volume (m3/day)			234.93	338.57	125.09	16.55	45.77	48.08	13.73	0.00	0.00	0.00	1.18	128.14	
SLURRY WATER															
Tonnes per hour															
Operating hours per year															
Total tonnes per month			333,333.00	333,333.00	333,333.00	333,333.00	333,333.00	333,333.00	333,333.00	333,333.00	333,333.00	333,333.00	333,333.00	333,333.00	3,999,996.00
% Solids =	60		60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	
Tailings Output Solids (tpd)			10,752.68	11,799.40	10,752.68	11,111.10	10,752.68	11,111.10	10,752.68	10,752.68	11,111.10	10,752.68	11,111.10	10,752.68	
Volume of Water (m3/day)			7168.45	7866.27	7168.45	7407.40	7168.45	7407.40	7168.45	7168.45	7407.40	7168.45	7407.40	7168.45	2,666,664.00
OTHER WATER INFLOWS															
Pit Dewatering (m3/day)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Other (PARP) (m3/day)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Other Water Inflow Total (m3/day)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL INFLOW (m3/day)	**7168.4516**		**7403.38**	**8204.84**	**7293.55**	**7423.95**	**7214.22**	**7455.48**	**7182.18**	**7168.45**	**7407.40**	**7168.45**	**7408.58**	**7296.60**	

OUTFLOW-LOSSES FROM TAILINGS DAM		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
EVAPORATION (from pond and beaches)														
Evaporation Rate (mm)	OCT	364.00	320.00	317.00	271.00	246.00	197.00	219.00	246.00	329.00	321.00	374.00	386.00	3,590.00
Pan Factor		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
Monthly Dam Evaporation Rate (mm)		273.00	240.00	237.75	203.25	184.50	147.75	164.25	184.50	246.75	240.75	280.50	289.50	
Average Daily Evaporation Rate (mm)		8.81	8.50	7.67	6.78	5.95	4.93	5.30	5.95	8.23	7.77	9.35	9.34	
Pool Area & Running Beaches (m2)		25,000.00	25,000.00	25,000.00	25,000.00	25,000.00	25,000.00	25,000.00	25,000.00	25,000.00	25,000.00	25,000.00	25,000.00	
Daily Evaporation Loss/Outflow (m3/day)		220.16	212.39	191.73	169.38	148.79	123.13	132.46	148.79	205.63	194.15	233.75	233.47	
EVAPO-TRANSPIRATION (from drying tailings)														
Evaporation Rate (mm)		364.00	320.00	317.00	271.00	246.00	197.00	219.00	246.00	329.00	321.00	374.00	386.00	
Evapo-transpiration Rate (Pan/3)		121.33	106.67	105.67	90.33	82.00	65.67	73.00	82.00	109.67	107.00	124.67	128.67	
Average Daily Evapo-transpiration Rate (mm)		3.91	3.78	3.41	3.01	2.65	2.19	2.35	2.65	3.66	3.45	4.16	4.15	
Area Transpiring (m2)		34,333.33	34,333.33	34,333.33	34,333.33	34,333.33	34,333.33	34,333.33	34,333.33	34,333.33	34,333.33	34,333.33	34,333.33	
Daily transpiration Loss (m3/day)		134.38	129.64	117.03	103.38	90.82	75.15	80.85	90.82	125.51	118.51	142.67	142.50	
SEEPAGE														
Downstream Embankment (m3/day)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Upstream Embankment (m3/day)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Seepage Rate m/sec	1.00E-07													
Dam Floor (m3/day).		130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	
Total Seepage Outflow (m3/day)		130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	
RETENTION														
Tailings Output (tpd)		10,752.68	11,799.40	10,752.68	11,111.10	10,752.68	11,111.10	10,752.68	10,752.68	11,111.10	10,752.68	11,111.10	10,752.68	
Assumed Moisture Content of Tailings (average)	30%													
Volume Retained in Tailings (m3/day)		3,225.80	3,539.82	3,225.80	3,333.33	3,225.80	3,333.33	3,225.80	3,225.80	3,333.33	3,225.80	3,333.33	3,225.80	
TOTAL OUTFLOW-LOSSES FROM TAILINGS DAM		3,710.34	4,011.85	3,664.57	3,736.09	3,595.41	3,661.61	3,569.11	3,595.41	3,794.46	3,668.46	3,839.75	3,731.77	
BALANCE INFLOW-OUTFLOW/LOSSES (m3/day)		3,693.04	4,192.99	3,628.98	3,687.87	3,618.81	3,793.87	3,613.07	3,573.04	3,612.94	3,499.99	3,568.83	3,564.82	
BALANCE INFLOW-OUTFLOW/LOSSES (m3/month)		114,484.22	118,452.09	112,498.37	110,635.97	112,183.01	113,816.19	112,005.14	110,764.27	108,388.13	108,499.68	107,064.85	110,509.53	
RETURN WATER TO THE PLANT (if available)														
Total Water Return per month (assume 30%)		114,484	118,452	112,498	110,636	112,183	113,816	112,005	110,764	108,388	108,500	107,065	110,510	1339301
Volume of Water (m3/day),estimated at		3,693	4,193	3,629	3,688	3,619	3,794	3,613	3,573	3,613	3,500	3,569	3,565	
Average water return		52%	53%	51%	50%	50%	51%	50%	50%	49%	49%	48%	50%	

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Summary of Water Balance													
Water shortfall ( ) or excess of requirements (m3/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total water in excess of requirements (m3/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total water in excess of requirements (m3/year) =	0.00												50.2%

Figure 4: Water balance for TSF3 expansion (CWM, 2018)

A 2006 geotechnical audit of the existing TSF3 indicated that seepage was occurring from the floor of the facility and “travelling along steeply dipping north/south trending structures” (ENV-TS-RP-0079-Rev2). It is likely that some seepage from TFS3 contributes to this flow via the jointed rock under the TSF basin” (ENV-TS-RP-0079-Rev2).

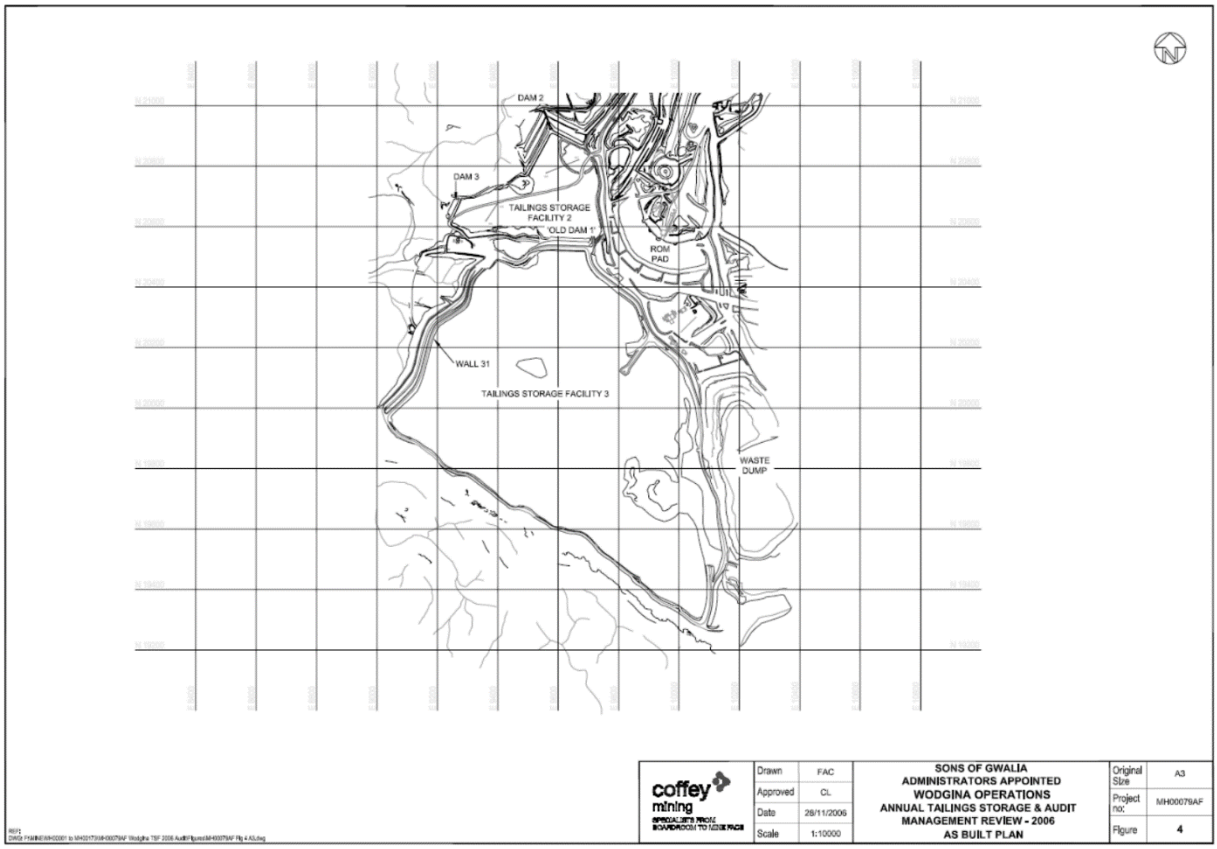
The 2006 audit report outlines that seepage was occurring through wall 31 and surface expression of seepage was occurring in a downstream watercourse. The report also documents that this has been rectified by the installation of seepage recovery bores and a sump (Coffey, 2007).

Information in the Mining Proposal also states that seepage from the area of the TSF 3 expansion will flow along the north/south trending structures as per the historical seepage “with some groundwater flow into the nearby pit area, associated with a fault."

The Applicant states that this historical seepage was noted in the creek system to the north of the existing TSF3 and was due to the decant pond being “directly linked by a geological structure to the seepage area”. The Applicant also states that the decant area of the TSF 3 expansion will be located around 1 km further to the south. (Wodgina, 8 May 2018).

The location of wall 31 is depicted in Figure 5.

Figure 5: TSF3 wall 31 (Coffey, 2007)



TSF3 Proposed Schedule of Inspections (CMW, January 2018)

The Applicant proposes to undertake routine inspection and maintenance procedures for all components of the tailings dam, including:

- pumps;
- valves;
- discharge locations;

- location and size of the decant pond;
- decant and return water pumps;
- the general integrity of the embankments (i.e. any new cracking);
- seepage downstream of the main embankment; and
- any changes to existing cracking or seepage.

In addition to routine inspection and maintenance, the stability of the embankment will be monitored through by survey prisms installed on the embankment crest between the expansion area and the existing TSF3. A piezometer will be installed in TSF3 immediately downstream of the TSF3 expansion area. This will enable the phreatic surface within the existing TSF3 to be monitored and stability analyses to be validated in future.

At a minimum:

- groundwater level readings will be taken monthly from TSF3 bores;
- groundwater samples for laboratory analyses will be taken quarterly from existing TSF3 bores;
- water level readings from the piezometers (3) will be undertaken monthly, with readings graphed so trends can be easily recognised; and
- information collected from the monitoring bores and piezometers will be reviewed regularly and reported in an annual audit.

3.2 Category 52 – Electric power generation

To accommodate the operational power requirements of the Premises during operation, the Applicant has applied to increase authorised power generation from 11 megawatts (MW) to 64 MW by constructing and operating 32 x 2MW natural gas generators. The proposed increase to the design capacity of power generating facilities at the Premises will result in trigger values listed in Schedule 1 of the EP Regulations being exceeded. Therefore the activity of power generation will become prescribed and a works approval is required for the power station's construction.

The Applicant proposes to construct and commission the power station to meet the air emission specifications provided in Table 6.

Table 6: Expected emissions from the 64 MW power station

Emissions (90% rated load at 5%O_2)	**Unit**	**Per generator**	**Total emissions from 32 operating generators (64 MW)**
Nitrogen oxides (NOx)	mg/Nm^3	500	16 000
Total hydrocarbon content		1,293	41 376
Methane (CH_4)		1,035	33 120
Non-methane hydrocarbons		215	6 880

Carbon monoxide (CO)		1,038	33 216
Carbon dioxide (CO_2)		178,169	2 701 408

The power plant will be constructed adjacent to the existing 11 MW plant. This existing power station will be phased out and decommissioned in 2019. The timing of this not yet know. The new power plant will be capable of generating 64 MW (with 32 units) to meet the power requirements of 3 x 250kT wet plants, dry crushing plant and associated non-process infrastructure.

The following infrastructure is to be constructed:

- Generators (maximum of 32)
- Oil make up tanks (24)
- 4,300 L self-bunded waste oil tank (1)
- 4,300 L self-bunded clean oil tank (1)
- Oily water separator (1)
- Perimeter drains
- 1.2m diameter x 120m long culverts along northern perimeter for surface water drainage (2)

3.3 Category 54 – Sewage facility

In the original application submitted, the Applicant applied to increase the throughput capacity of the WWTF from 210 m^3/day to 250 m^3/day to service a growing workforce that is expected to peak at 1,200 personnel (210 L/person/day). The application was later revised for the construction of one additional evaporation pond and no increase to the overall throughputs (175 L/person/day). The proposed layout of the WWTF is provided in Figure 6.

The existing WWTF accepts macerated sewage from the mine camp treating it using six 900 m^3 facultative ponds prior to discharging via gravity flow to three 3,000 m^3 ponds described as being evaporation ponds. The facultative ponds are designed to offer significant buffering capacity for the prevention of overflow during peak periods. In the event of large inflows, detention times will reduce from 30 days to 15 days to prevent overflow.

The facultative ponds conduct biological treatment of the waste water, by which aerobic microorganisms break down organics from the wastewater and anaerobic microorganisms break down organics in solids settling in the bottom of the ponds.

Sludge will continue to be regularly removed by an approved contractor and disposed offsite at a licensed waste disposal facility.

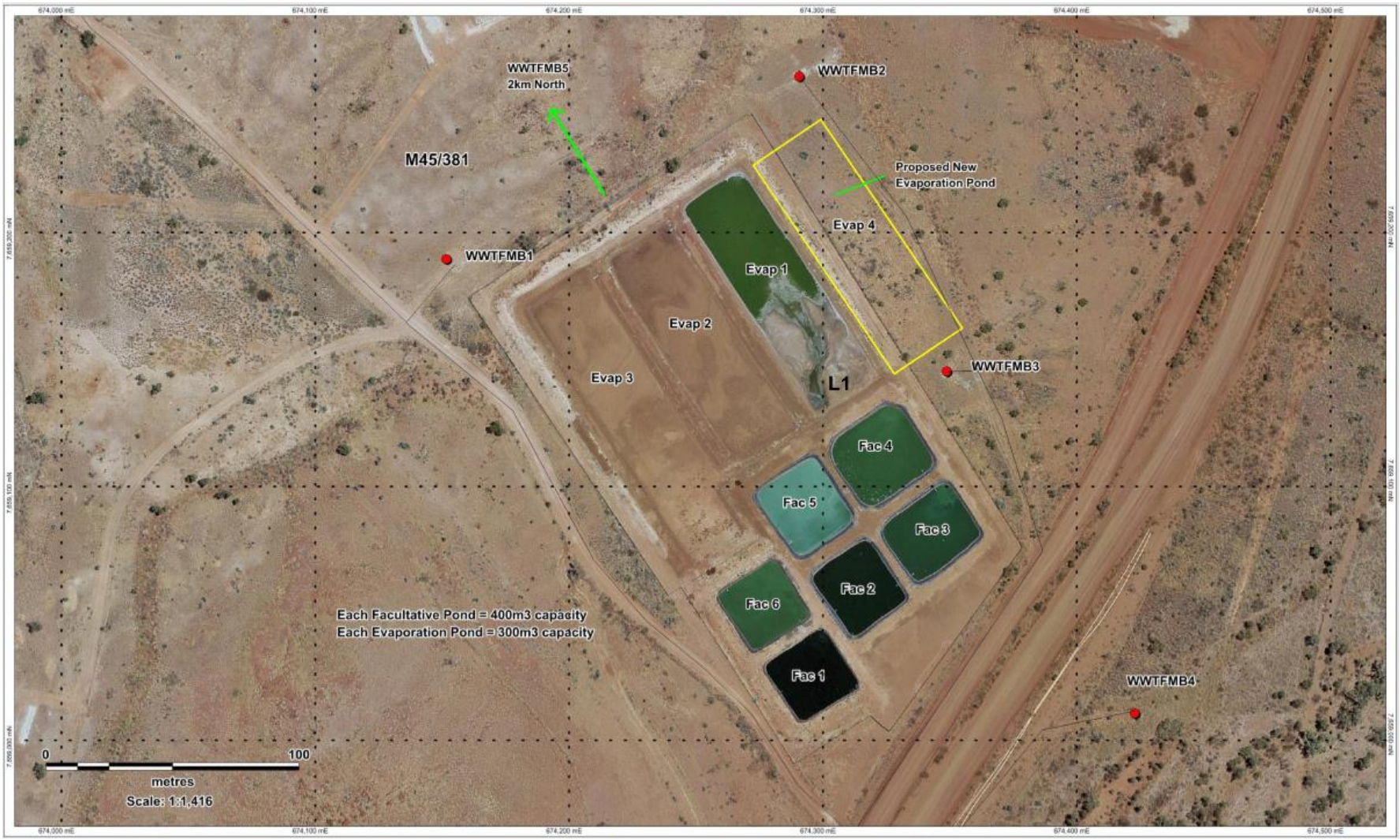


Figure 6: Design of the WWTF including Evap 4 (proposed)

3.4 Category 89

In hand with the increase in camp size, the landfill facility also requires an increase in its Category 89 allocation. The Applicant seeks to increase the capacity of its current landfills to 4999 tonnes per annum which is the maximum permissible within its current category limit (Category 89 - <5000 tonnes per annum). The Applicant seeks the following changes:

- Increase tyre disposal from 200 to 500 tpa (1500 tpa of inert type1 waste is also disposed at the tyre disposal area). As this does not require additional construction works, this increase in disposal will be address through a licence amendment.
- Increase the putrescible limit from 1650 to 2999 tpa.
- The location for the landfill expansion is shown in Figure 7. The Applicant proposes to manage and maintain the facility as per the *Environmental Protection (Rural Landfill) Regulations 2002*.
- Tyre disposal and the 1500 tpa of type 1 inert waste will remain at the Eastern Waste Landform as depicted in Figure 1.
- A putrescible landfill expansion is to be constructed adjacent to the current putrescible landfill area. The area subject to the expansion has the following coordinates are:

Point	Easting	Northing
1	675,833.34	7,661,463.87
2	675,946.73	7,661,455.58
3	675,924.60	7,661,073.93
4	675,811.21	7,660,971.60

- Trenches to be constructed (20 m length, by 3 m width by 4 m in depth)
- Landfill facility to be fenced to prevent fauna access
- Windrows of excavated material to be formed around three sides of each trench to prevent stormwater ingress
- Rollover bund to be constructed at entrance to facility to prevent stormwater ingress.

Figure 7: Location of putrescible landfill expansion in relation to existing putrescible landfill

4. Legislative context

Table 7 summarises approvals relevant to the assessment.

Table 7: Relevant approvals and tenure

Legislation	Number	Subsidiary	Approval
Mining Act 1978	Reg Id:71172	Wodgina Lithium Pty Ltd.	Approved mining proposal for power station, crushing and screening plants, beneficiation plant and tailings storage. Approved March 2018. A design report for the TSF3 expansion is currently being finalised which will form the basis of a DMIRS Letter of Intent. This is yet to be submitted. This pertains to excavation of in-situ tailings for the construction of the new embankment. A mining proposal is to be submitted to DMIRS for additional clearing for the WWTF and putrescible landfill expansion.
Part V, Division 2 of the *Environmental Protection Act 1986*	Purpose permit number - CPS 2951/1	Wodgina Lithium Pty Ltd (formerly Talison Minerals Pty Ltd.)	Permit to clear native vegetation granted under s.51E of the EP Act within mining tenement M45/923.
Rights in Water and Irrigation Act 1914	GWL154570(17)	Wodgina Lithium Pty Ltd	Covers North and Breccia borefields (annual entitlement 3,150,000 KL). Uses: dewatering, dust suppression, mineral ore processing and mining camp.
	GWL154596	Wodgina Lithium Pty Ltd	Covers old borefield (annual entitlement 365,000 kL) Uses: Dust suppression, mineral ore processing and mining cap.

4.1 Part IV of the EP Act

The proposal has not been referred to the Environmental Protection Authority.

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

The expansion of TSF3 was referred under the *Environmental Protection and Biodiversity Act 1999* (EPBC Act): EPBC 2008/4675 and was determined to not be a controlled action on 21 January 2009.

4.3 Part V of the EP Act

4.3.1 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)*

4.3.2 Works approval and licence history

Table 8 summarises the works approval and licence history for the Premises.

Table 8: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
L4328/1989/3	18 September 2008	Licence reissue
W4530/2009/1	12 November 2009	New works approval for tailings storage facility
W4594/2009/1	7 January 2010	New works approval for Category 89 landfill
W5036/2011/1	1 December 2011	New works approval for Category 54 sewage facility
W4992/2011/1	28 June 2012	New works approval for new crushing facilities
L4328/1989/10	26 September 2013	Licence reissue
L4328/1989/10	12 December 2013	Licence amendment to amend submission date for Annual Environmental Report L4328
L4328/1989/10	2 June 2016	Licence amendment for tyre disposal areas.
L4328/1989/10	7 February 2017	Licence transferred from Global Advanced Metals Wodgina Pty Ltd to Wodgina Lithium Pty Ltd. Director General's Instructions: Decision Document and Conditioning were implemented.
L4328/1989/10	18 August 2017	Amendment Notice 1 to relocate the disposal of Inert Waste Type 2 to the Eastern Waste Landform (EWL) and authorization to dispose of Inert Waste Type 1 as part of the construction of the 5 metre compacted base layer of the expanding EWL.
L4328/1989/10	12 March 2018	Amendment Notice 2 to install the secondary fixed processing plant adjacent to the existing fixed plant and 3 mobile crushing and screening plant atop TSF3.
W6132/2018/1	17 May 2018	Works Approval to construct a new beneficiation plant, expand TSF3, expand the wastewater treatment facility, construct a 64 MW power station and expand the putrescible landfill.

5. Consultation

The application was advertised in the West Australian newspaper on 9 April 2018 for a comment period ending on 1 May 2018. No comments were received.

A letter inviting comment was sent to the Shire of East Pilbara on 11 April 2018. No comments were received from the Shire of East Pilbara.

A letter of referral was sent to the Department of Biodiversity, Conservation and Attractions (DBCA), the Department of Mines, Industry Regulation and Safety (DMIRS) and DWER's Regulatory Services (Water) directorate on 11 April 2018.

5.1 DMIRS Environmental Branch

The following comments were received from DMIRS Environmental Branch on 13 April 2018:

- Existing approvals (Mining Proposal Reg ID 71172) have been obtained for Category 5 processing or beneficiation and Category 52 power generation activities on tenements M45/381 and M45/50.
- The expansion of TSF3 has been approved, however conditions are in place on tenement M45/923 prohibiting excavation of in-situ tailings for the construction of the new embankment and commencement of processing until further geotechnical and environmental details are assessed and approved by DMIRS.
- Additional clearing for the expansion of the Category 54 sewage facility and the Category 89 putrescible landfill has not been approved by DMIRS, and will require a Mining Proposal to be submitted by the Applicant.
- Clearing of the TSF3 expansion footprint is required under Mining Proposal Reg ID71172.

5.2 DMIRS Resources Safety

Information on the exemption levels for Rb-87 provided.

5.3 DBCA

The following comments were received from DBCA on 27 April 2018:

The proposed activities have the potential to impact on the threatened northern quoll (*Dasyurus hallucatus*) and the Pilbara Olive Python (*Liasis olivaceus barroni*) which are known to occur in the area. All activities should be undertaken in accordance with the relevant wildlife licensing approvals under the *Wildlife Conservation Act 1950*, should impacts on fauna be unavoidable.

Further clarification on the comments was sought with DBCA clarifying that the potential impacts relate to the clearing of vegetation and the taking of fauna incidental to clearing.

5.4 Regulatory Services (Water)

The following comments were received from Regulatory Services (Water) on 30 April 2018.

There are no mapped groundwater dependent ecosystems within close proximity to the TSF3 expansion (10km). The closest bore that is for camp use is under groundwater licence GWL184329 (Altura Mining Pty Ltd). This bore is located more than 3 km from the landfill, more than 6 km from the WWTF, more than 7km from the beneficiation plant and more than 9km from the TSF. An additional bore operated under GWL184329 is located in a similar location to the bore under GWL184329. The water from this bore is used for dust suppression, earthworks/construction purposes and railway construction and maintenance.

6. Location and siting

6.1 Siting context

The Premises is located within the Shire of East Pilbara within Marble Bar in Western Australia. Figure 8 following shows the regional location of the project.

6.2 Residential and sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 9.

Table 9: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Kangan Homestead	19 km west north-west
Yandeyarra Aboriginal Community	32 km west south-west
South Hedland	More than 80 km to the North
Pilgangoora Mine Site	35 km to the north-east
Altura Mine Site camp subject of licence L8610/2011/1)	Distance to the following site infrastructure: • Premises boundary – more than 800 m. • Putrescible landfill - more than 2 km. • WWTF – more than 4 km. • TSF3 expansion – more than 8 km. • Power station – more than 6 km.

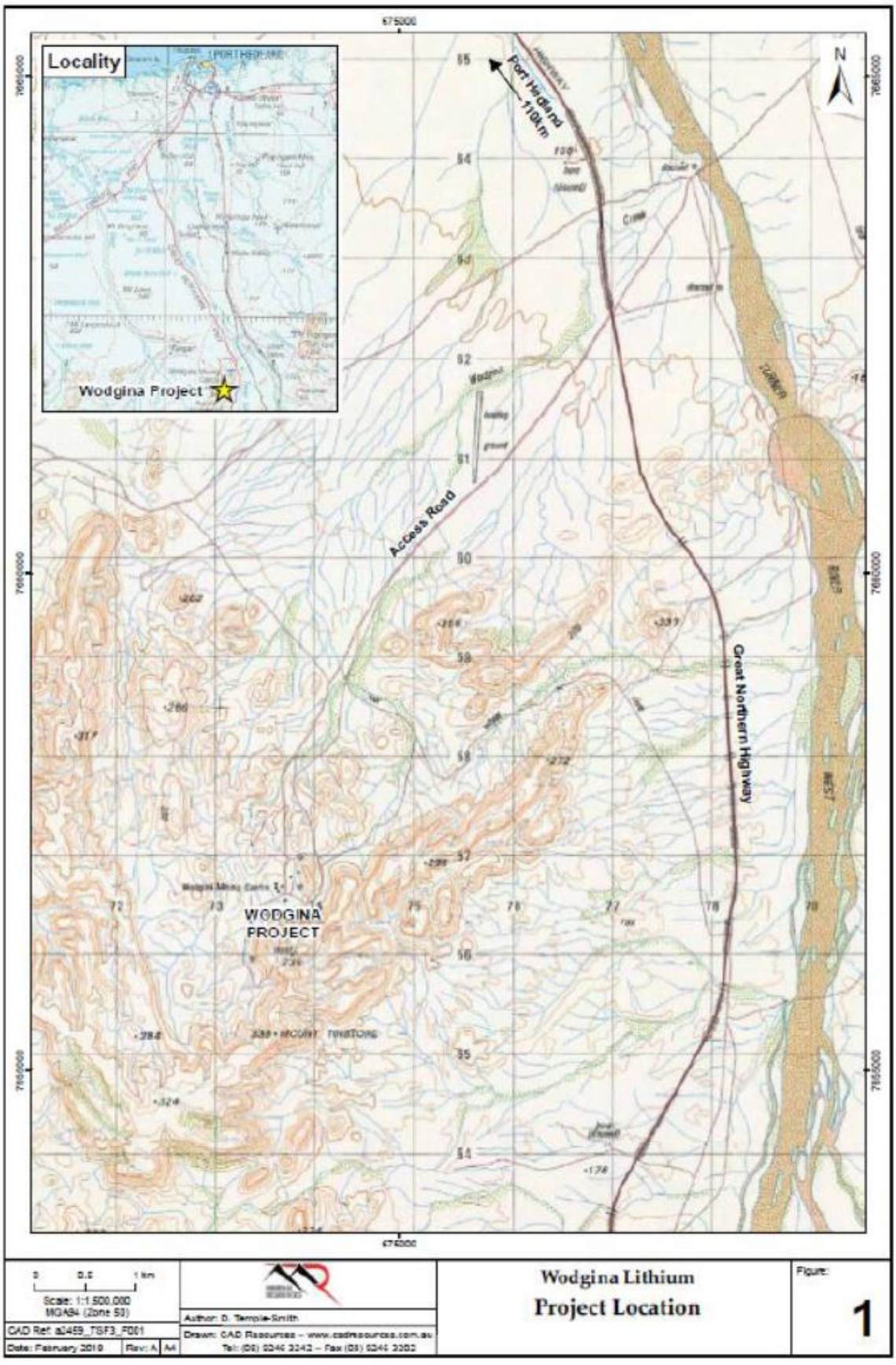


Figure 8: Wodgina Lithium project regional location

6.3 Specified ecosystems

Specified ecosystems are areas of conservation value that may be impacted by emissions and discharges from the Premises. The distances to specified ecosystems are shown in Table 10. Table 10 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 10: Environmental values

Specified ecosystems	**Distance from the Premises**
Ramsar Sites in Western Australia	The Fortescue Marshes are located more than 100 km from the Premises.
Threatened Ecological Communities and Priority Ecological Communities	There are no threatened Ecological Communities and Priority Ecological Communities within a 90 km radius of the Premises.
Biological component	**Distance from the Premises**
Threatened/Priority Flora	There is priority 2 flora located on M45/381 with one located approximately 230 m from the existing WWTF.
Threatened/Priority Fauna	There are numerous threatened and priority fauna located within the Premises boundary.

6.4 Groundwater and water sources

The distances to groundwater and water sources are shown in Table 11.

Table 11: Groundwater and water sources

Groundwater and water sources	**Distance from Premises**	**Environmental value**
Public drinking water source areas	There are no public drinking water source area within a 30 km radius of the Premises	NA
Major watercourses/ waterbodies	There are several ephemeral watercourses located within the Premises boundary	The Premises is located within the Pilbara Surface Water Irrigation Area proclaimed under the Rights in Water and Irrigation Act 1914. "There is no permanent surface water flow in the Wodgina area, although small pools may occur from time to time following periods of heavy rainfall" (ENV-TS-RP-0079-Rev2).
Groundwater	Depth to groundwater level is between 5 and 12 metres (CMW, 2018). Unconfined	The Premises is located within the Pilbara Groundwater area proclaimed under the Rights in Water and Irrigation Act 1914. The groundwater is fresh to brackish with total dissolved solids (TDS) concentration between 489 - 630 mg/L. The Applicant states that the on "review of available reports, it was suspected that groundwater mimics regional topography with

	fractured rock aquifer.	the likely flow direction towards the northeast" (Wodgina, February 2018.) Upon review of water levels in bores at the Premises, the groundwater flows generally in a northerly direction towards nearby creek systems. Groundwater bore locations are depicted in Figure 9. Interaction between groundwater and onsite creek systems in unknown. Due to its low salinity groundwater, the groundwater has beneficial use and is considered a receptor for the purposes of this assessment. No stock bores are in close proximity, the closest bore that is for camp use is under groundwater licence GWL184329 (Altura Mining Pty Ltd). This bore is located more than 3 km from the landfill, more than 6 km from the WWTF, more than 7km from the beneficiation plant and more than 9km from the TSF3 expansion.

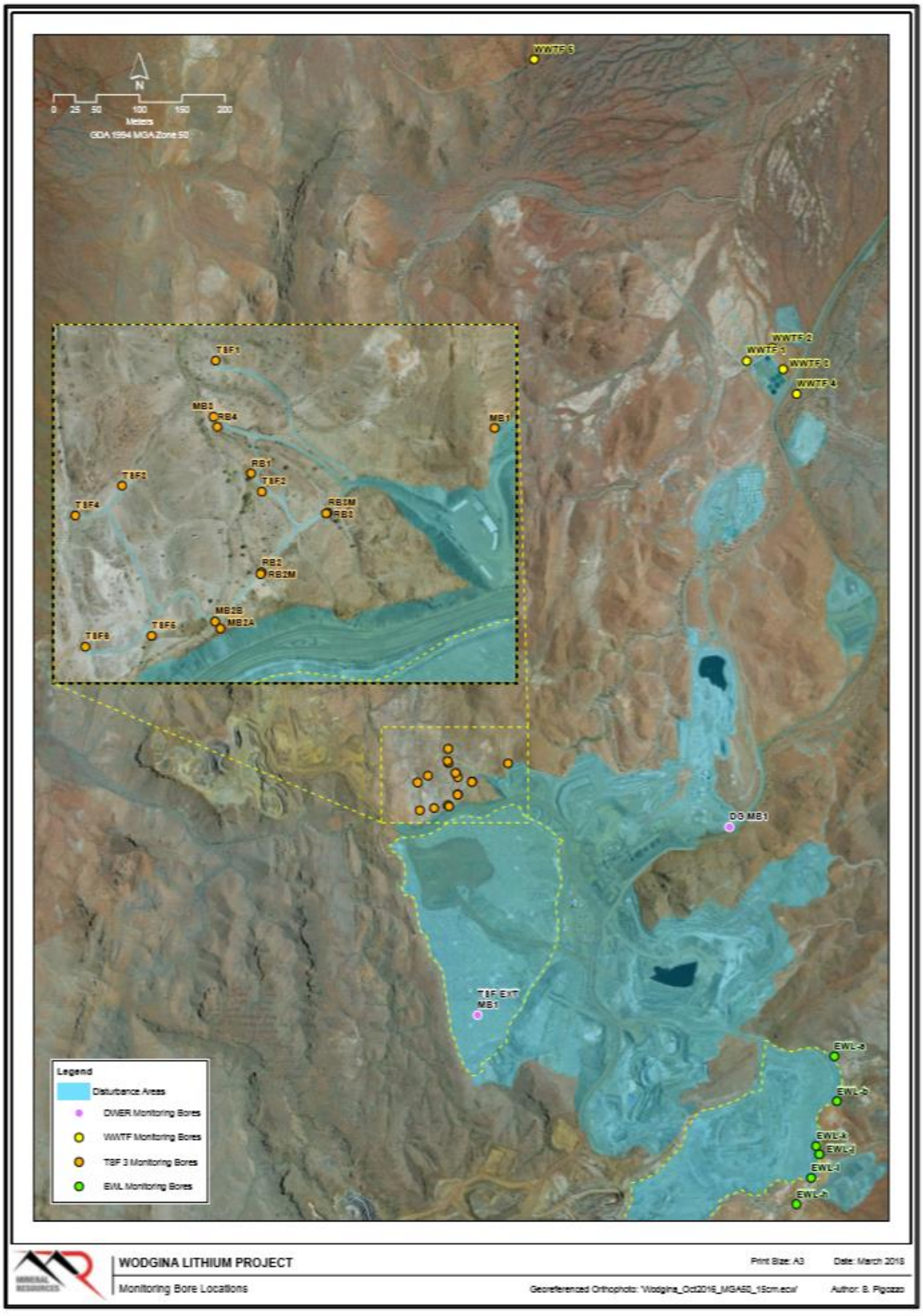


Figure 9: Current and proposed groundwater monitoring location

7. Tailings waste materials characterisation

7.1 Geochemical testing of tailings material from TSF3

The physical and chemical properties of one representative sample of spodumene tailings has been characterised by MBS Environmental in 2017. The water leachate pH of the tailings was very close to neutral (pH 6.76) (Wodgina, February 2018). These values have been compared to the trigger values in ANZECC/ARMCANZ 2000 in Table 12. Any exceedances of the trigger values are highlighted in red in Table 12.

The report submitted by the Applicant as amended on 14 February 2018 is summarised below:

- The measured sulphur concentration of the tailings was low (0.14%, 0.028% as sulphate sulphur). The measured ANC (2.1 kg H_2SO_4/t) of the material was extremely low and sufficient oxidisable sulphur was present to produce a marginally positive NAPP of 1.3 kg H_2SO_4/t and a NAG pH of 3.9 which classified the tailings as potentially acid forming (PAF) low capacity (low capacity because NAPP is less than 10 kg H_2SO_4/tonne (MBS, 14 February 2018).
- The tailings are significantly enriched in beryllium, bismuth, caesium, lithium, rubidium, antimony, molybdenum, tin, tantalum and thallium. Rubidium is a natural low level beta radiation emitter. The total radioactive activity for the process tailings is 3.36 Bq/g (MBS, 14 February 2018).
- ASLP leachate testing using de-ionised water indicates that aluminium (1.48 mg/L), cadmium (0.0002 mg/L), chromium (0.003 mg/L) and copper (0.009 mg/L) could leach from the tailings material.
- Leachate testing using the United States LEAF Testing 1313 method recorded elevated levels of aluminium (0.08 mg/L), nickel (0.03 mg/L), zinc (0.052 mg/L) and fluoride (3.8 mg/L) in tailings leachate, under neutral conditions.

Table 12: Comparison of ASLP and LEAF 1313 leachate testing results of the spodumene tailings against the trigger values in ANZECC/ARMCANZ 2000.

Parameter	ANZECC/ARMCANZ 95% protection of species in freshwater ecosystems trigger value (mg/L)	ANZECC/ARMCANZ livestock drinking water value (mg/L)	ASLP leachate results – de-ionised water (mg/L)	LEAF 1313 pH 7 result (mg/L)
Aluminium	0.055	5	1.48	0.08
Cadmium	0.0002	0.01	0.0002	0.0001
Chromium	0.001	1	0.003	<0.001
Copper	0.0014	0.4 (sheep) 1 (cattle)	0.009	0.001
Fluoride	N/A	2	1.9	3.8
Nickel	0.011	1	0.008	0.030
Zinc	0.008	20	0.06	0.052

7.2 Radioactivity of process streams

In Western Australia the primary legislation relating to radiation management is the *Radiation Safety Act 1975* and its subsidiary legislation. In general, mining operations mining or processing radioactive ores must comply with the Australian Radiation Protection and Nuclear Safety Agency's (ARPANSA) Radiation Protection Series Fundamentals, Codes and Standards; in particular the *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing 2005*. The calculated activity of process streams are detailed in Table 13.

Table 13: The calculated activity of process streams (MBS, 14 February 2018).

	Uranium		Thorium		Potassium		Rubidium		Total Activity
Units	mg/kg	Bq/g	mg/kg	Bq/g	mg/kg	Bq/g	mg/kg	Bq/g	Bq/g
Spodumene Process Tailings	3.1	0.039	5.1	0.021	20,400	0.630	3,980	2.67	3.36
Spodumene Concentrate	3.5	0.044	7.5	0.030	8,650	0.267	1,985	1.33	1.67
Tantalum Concentrate	195	2.43	123	0.499	2,225	0.069	612	0.41	3.40
Wodgina Ore	3.16	0.039	5.5	0.022	18,637	0.576	3,681	2.47	3.10

Note 1: Data from previous Global Advanced Metals operations of a tantalum concentrate were produced.

Note 2: Back calculated from Spodumene Tailings and Concentrate Results based on 85% tailings and 15% concentrate split.

The tailings are enriched in rubidium which is a natural low level beta radiation emitter with a half-life of 49 billion years, due to the RB-87 isotope. Thorium (Th-232) and uranium emit alpha, beta and high energy gamma radiation. The activity levels of thorium and uranium in tailings are 0.021 and 0.039 Bq/g respectively.

Matters relating to impacts to human health are managed by the Department of Mines, Industry Regulation and Safety on delegation from the Radiological Council (WA).

8. Risk assessment

8.1 Determination of emission, pathway and receptor

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

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 14 and Table 15.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Tables 14 and 15 below.

Table 14. Identification of emissions, pathway and receptors during construction

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Category 5, 52, 54 and 89	Leaks and spills of hydrocarbons	Hydrocarbons	Surrounding soils, surface water system and underlying groundwater	Direct discharge Stormwater runoff/ infiltration	Localised contamination of soils. Stormwater run-off to surface water systems. Infiltration to groundwater.	No	The fuel farm at the Power Station has a capacity of 110 KL, the light vehicle fuel farm is 207KL and the heavy vehicle fuel farm 237KL. Bulk Fuel Storage: Diesel stored in separate concrete bunded areas in accordance with Australian Standard 1940 or as double skinned tanks without bunding. Pipework constructed with steel and will all be above ground. Pipework will be protected from accidental vehicle contact where necessary using bollards and/or earthen bunds. Tank refuelling points will be located over an apron to provide containment of any spilled fuel. The collection points will be evacuated as necessary.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Vehicle movements on unsealed access roads	Noise	No residences or other sensitive receptors in close proximity	Air / wind dispersion	Amenity impacts	No	The closest sensitive receptor is the Altura mine camp, located more than 2 km from all construction activities. No sensitive receptor is likely to be impacted by construction activities.
	Construction of new beneficiation plant and pipeline infrastructure, TSF3 expansion WWTF expansion new pond constructed and new pipelines. Increase in putrescible landfill area.	Dust	No residences or other sensitive receptors in close proximity	Air/wind dispersion and then deposition			
			Priority (2) flora is located in the vicinity of the wastewater treatment facility.		Deposition on vegetation which may prevent photosynthesis and respiration	No	Vegetation in an arid environment may have natural dust tolerance which is likely to prevent vegetation impacts.

Table 15: 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**		
Category 5, 52, 54 and 89	Refuelling activities Leaks and spills of reagents/ hydrocarbons	Chemical reagents and hydrocarbons	Underlying soils, surface water systems and groundwater	Direct discharge Run off/ infiltration	Localised contamination of soils. Stormwater run-off to surface water systems. Infiltration to groundwater.	No	Fuel farm at the power station has a capacity of 110 KL, the light vehicle fuel farm is 207KL and the heavy vehicle fuel farm 237KL. Bulk Fuel Storage: Diesel stored in separate concrete bunded areas in accordance with Australian Standard 1940 or as double skinned tanks without bunding. Pipework constructed with steel and will all be above ground. Pipework will be protected from accidental vehicle contact where necessary using bollards and/or earthen bunds. Tank refuelling points will be located over an apron to provide containment of any spilled fuel. The collection points will be evacuated as necessary. Chemicals/Reagents: All chemical and reagents classed as dangerous goods stored in accordance with the requirements of the *Dangerous Goods Safety Act 2004* and the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*.
Category 5 – beneficiation plant and TSF 3 expansion	Tailings delivery (2) and return water pipelines (1)	Tailings slurry/tailings supernatant Return water	Localised soils and groundwater	Rupture of pipeline causing tailings discharge to land	Soil contamination through release of liquors with brackish salinity, low levels of radioactivity, elevated levels of contaminants including fluoride, aluminium and thallium.	Yes	See section 8.4.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Tailings deposition to expanded TSF3	Tailings seepage	Underlying soils and groundwater Ephemeral surface water systems and pools	Infiltration through underlying soils to groundwater. Potential hydraulic interactions between groundwater and surface water systems.	Contamination of groundwater capable of beneficial use Impacts to surface water quality and aquatic fauna	Yes	See section 8.5.
			Adjacent vegetation	Infiltration through underlying soils to groundwater.	Groundwater mounding inundating root zones of vegetation, resulting in poor vegetation health or death.	No	The TSF3 expansion is located within a valley. Surrounding vegetation is located in an elevated position above the footprint of the TSF3 expansion. The Delegated Officer has determined that surrounding vegetation is unlikely to be impacted by groundwater mounding.
		Overflow of tailings	Adjacent soils and vegetation Surface water and groundwater systems	Direct discharge and infiltration through soils to groundwater and adjacent surface water systems	Soil contamination through release of liquors with brackish salinity, low levels of radioactivity, elevated levels of contaminants including fluoride, lithium and thallium. Impact to vegetation health if inundated by tailings/supernatant.	No	The TSF design complies with the DMIRS requirement for storage of a 1% AEP rainfall event over 72 hours (383mm). "Provision of a minimum of 1 m total freeboard, plus an allowance for the 1%AEP 72 hour event of 383mm has been allowed above the normal decant pond" (CMW, January 2018). The risk of overtopping is considered to be low due to the Applicant's proposed controls. There is a requirement to construct the TSF with adequate capacity to provide a minimum 1 metre total. Freeboard will be conditioned in the Works Approval.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Tailings dust from TSF surface/ movement of ore through conveyors, train loadouts and at stockyards	Dust	Adjacent soils and vegetation Priority fauna	Air/wind dispersion Ingestion of dust deposited on vegetation	Dispersion of radioactive material and contaminants elevated in tailings material. Potential to be deposited on vegetation and/or uptake by plant root systems causing radionuclides to enter the food chain causing an impact to fauna.	No	Low levels of naturally occurring radioactivity in tailings (approximately 3.36 Bq/g). This is mostly associated with rubidium-87 which is a low beta emitter. Up to 30 bq/g of Rb-87 is exempt under the Radiation Safety (General) Regulations 1983. The Applicant is developing a radiation management plan which will also include waste management. Regulation of radiological impacts is the responsibility of the Department of Mines, Industry Regulation and Safety under the *Radiation Safety Act 1975*.
			No residences in proximity, vegetation including riparian vegetation adjacent to mine areas	Air/wind dispersion	Amenity impacts	No	The closest sensitive receptor is the Altura mine camp, which is located more than 8 km from processing areas. No sensitive receptors are likely to be impacted by operational activities.
	Beneficiation plant	Leaks and spills of process liquors and slurries Leaks and spills of chemical reagents.	Adjacent vegetation Soils and groundwater systems Birdlife	Overflowing bunds, tanks, pipeline failures direct to soils/contact with rainwater Infiltration through soil to groundwater. Discharge of overflow to abandoned Wodgina pit.	Reduction in groundwater quality impacting upon dependent vegetation. Accumulation of contaminants in the Wodgina pit could cause an impact to birdlife.	Yes	See section 8.6

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**		
		Noise	No residences in proximity. The closest sensitive receptor is a mine camp located 6 km to the northeast.	Air/wind dispersion	Amenity impacts	No	The closest sensitive receptor is the Altura mine camp, located more than 2 km from all construction activities. No sensitive receptor is likely to be impacted by operational activities.
Category 52 - Power station	Burning of gas for the generation of power	Air emissions	No residences in proximity. The closest sensitive receptor is a mine camp located 6 km to the northeast.	Air / wind dispersion	Health and amenity impacts	No	Impacts to the ambient air quality at the Altura Mine camp located 6 km to the northeast are not anticipated due to the significant distance from stack emission points. DWER notes that nitrogen oxides from the power station may not satisfy NEPM criteria at the Wodgina Camp located approximately 600 m away. However, onsite accommodation villages are not considered to be sensitive receptors for the purpose of a Part V risk assessment as they can be regulated under different legislation.
	Operation of generators Storage of hydrocarbons	Noise	No residences in proximity. The closest sensitive receptor is a mine camp located 6 km to the northeast.	Air / wind dispersion Stormwater runoff	Impacts to amenity	No	Noise from the power station is not expected to be detectable at the Altura Mine camp located 6 km to the northeast.
		Contaminated stormwater runoff	Surface water and riparian vegetation adjacent to the power station		Soil and groundwater contamination inhibiting vegetation growth and survival	Yes	Refer section 8.8.
Category 54 - Wastewater Treatment Plants	Treatment of sewage	Odour	No residences in proximity. The closest sensitive receptor is a mine camp located 6 km to the northeast.	Air / wind dispersion	Impacts to amenity	No	Odours from the WWTF are expected to dissipate to below detectable levels at the point of the Altura mine camp.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Storage of treated and untreated effluent within facultative or evaporation ponds	Seepage to groundwater and pond overflows	Vegetation adjacent to discharge area	Direct discharge	Soil and groundwater contamination inhibiting vegetation growth and survival	Yes	See section 8.7.
Category 89 - Landfill	Operation of expanded putrescible landfill	Dust/odour	No residences or other sensitive receptors in close proximity	Air/wind dispersion	Amenity impacts	No	The closest sensitive receptor is the Altura mine camp being located more than 2 km from the putrescible landfill. No sensitive receptor is likely to be impacted by landfilling activities.
		Noise	No residences or other sensitive receptors in close proximity	Air/wind dispersion	Amenity impacts	No	
		Seepage to groundwater Stormwater run-off	Underlying groundwater. Surface water systems and aquatic fauna	Infiltration through to groundwater Potential hydraulic interactions between groundwater and surface water systems	Degradation of groundwater quality limiting the beneficial uses. Potential hydraulic interactions between groundwater and surface water systems.	No	The Applicant proposes to increase the putrescible limit from 1650 to 2999 tpa. Due to the low potential for leachate generation, the increase in disposal at the putrescible landfill is considered to be low risk. Construction requirements will be conditioned in the Works Approval.

8.2 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 16 below.

Table 16: 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 17 below.

Table 17: Risk criteria table

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

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

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

"onsite" means within the Prescribed Premises boundary.

8.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment table 18 below:

Table 18: Risk treatment table

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

8.4 Risk Assessment – leaks and spills from tailings and return water pipelines

8.4.1 Description of Risk Event

Release of tailings slurry and/or supernatant to land and subsequent infiltration to groundwater, as a result of pipeline failures.

8.4.2 Identification and general characterisation of emission

The physical and chemical properties of tailings material proposed for discharge to TSF3 have been characterised by MBS Environmental (MBS, 14 February 2018). Refer to section 7 for more detail.

The tailings are significantly enriched in beryllium, bismuth, caesium, lithium, rubidium, antimony, molybdenum, tin, tantalum and thallium. Rubidium is a natural low level beta radiation emitter. The total radioactivity for the process tailings is calculated at 3.36 Bq/g (MBS, 14 February 2018).

8.4.3 Description of potential adverse impact from the emission

Schedule 2: Figure 4 depicts the pipeline location with the pipeline being approximately 3 km in length. The pipeline runs through already disturbed areas to the east of the existing TSF3.

8.4.4 Criteria for assessment

Relevant land and surface water quality criteria include:

- National Environment Protection (Assessment of Site Contamination) Measure 1999; and
- ANZECC & ARMCANZ (2000) – freshwater and marine waters criteria.
- ANZECC & ARMCANZ (2000) – livestock waters criteria.

8.4.5 Applicant controls

The tailings line from the beneficiation plant to the expanded TSF3 will be located above ground within earthen bunding. There will be catch sumps/scour pits installed at low points along the line as well as burst detection devices.

The Applicant has proposed the controls set out in Table 19. This assessment has reviewed the controls set out in Table 19 below.

Table 19: Applicant's proposed controls for tailings and return water pipeline failure

Site infrastructure	Construction
Tailings delivery pipelines (2) Decant return pipeline	• All pipelines to be 2915 m in total length. • Tailings pipelines to be constructed with 250 NB and 200 NB carbon steel pipelines from chainage 0 m through to chainage 2358 m. • Carbon steel piping to be supported above ground on precast concrete supports place on constructed access. • Mining hose used at changes in horizontal and vertical alignment. • Tailings pipelines to be constructed with DN250 and DN225 PN HDPE pipe from Chainage 2358m to chainage 2915m. • Decant return pipeline to be constructed with DN160 HDPE PN10. • All pipelines located above ground within earthen bunding where located outside the TSF embankment. • Bunded corridor must to be sized to contain at a minimum the equivalent volume to contain the maximum pipe volume. • Catch pits to be installed at chainage 850m, 950m, 1650m and 2220 m with a capacity to store 225 m^3 of tailings material in the event of pipeline failure. • Pipeline to be installed with instrumentation consisting of electromagnetic flow meters and pressure transmitter installed downstream of pump station and upstream of single point discharge providing constant monitoring of operation parameters of the tailings pipeline and provide shutdown of the system in the event of pipeline failure.

8.4.6 Key findings

The Delegated Officer has reviewed the information regarding spills and leaks from tailings and decant return pipelines and has found:

1. Only one sample of tailings material within the existing TSF has been characterised.
2. The tailings are significantly enriched in beryllium, bismuth, caesium, lithium, rubidium, antimony, molybdenum, tin, tantalum and thallium.
3. The total radioactivity for the process tailings is 3.36 Bq/g.
4. No information has been provided regarding groundwater and surface water

interactions.

5. All pipelines will be constructed of HDPE/carbon steel.
6. All pipelines will be contained within an earthen bunded corridor with catch sumps at low spots (4).
7. Instrumentation includes flow meters and pressure transmitter installed downstream of pump station and upstream of single point discharge providing constant monitoring of operation parameters of the tailings pipeline and provide shutdown of the system in the event of pipeline failure.

8.4.7 Consequence

If leaks and spills occur, low level impacts to localised soils are expected in already disturbed areas. Therefore, the consequence is ***slight***.

8.4.8 Likelihood of Risk Event

The likelihood of tailings being released to land from leaks and spills from pipelines is considered ***possible***.

8.4.9 Overall rating of leaks and spills from the pipelines.

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 16) and determined that the overall rating for the risk of leaks and spills from the pipelines is ***low.***

8.5 Risk Assessment – tailings seepage from TSF3 expansion impacting on groundwater quality

8.5.1 Description of tailings seepage from TSF3 expansion

Seepage from tailings stored in TSF3 expansion impacting groundwater quality within the unconfined fractured rock aquifer. Groundwater is fresh to brackish and therefore is suitable for beneficial use. A water balance model indicates that there may be 130 m^3/day of seepage through the base materials (based on hydraulic conductivity of 1 x 10^{-7} m/s) (CWM, 2018). Initial seepage is expected to be greater as the hydraulic conductivity of base materials proposed is to be 1 x 10^{-6} m/s.

8.5.2 Identification and general characterisation of emission

The tailings are significantly enriched in beryllium, bismuth, caesium, lithium, rubidium, antimony, molybdenum, tin, tantalum and thallium. Rubidium is a natural low level beta radiation emitter. The total radioactivity for the process tailings is 3.36 Bq/g (MBS, 14 February 2018). The activity for uranium and thorium in the tailings material is less than 1 Bq/g (0.039 and 0.021 Bq/g respectively).

The Applicant has provided a geochemical assessment of the process streams. ASLP (Australian Standard Leachate Procedure) leachate testing using de-ionised water indicates that aluminium (1.48 mg/L), cadmium (0.0002 mg/L), chromium (0.003 mg/L) and copper (0.009 mg/L) are contaminants of concern in tailings leachate.

Furthermore, leachate testing using the United States LEAF (Leaching Environmental Assessment Framework) Test Method 1313 indicates aluminium (0.08 mg/L), nickel (0.03 mg/L), zinc (0.052 mg/L) and fluoride (3.8 mg/L) are contaminants of concern in tailings leachate under neutral conditions. Further detail on tailings characterisation can be found at section 7.

Groundwater flow is to the north with water levels in on site bores indicating that groundwater flows towards creek systems.

The Applicant proposes to dispose of approximately 3.5 million tonnes of tailings.

8.5.3 Description of potential adverse impact from the emission

Seepage from the area of the TSF3 expansion will flow along the north/south trending structures as per the existing seepage from TSF3 "with some groundwater flow into the nearby pit area, associated with a fault" (ENV-TS-RP-0079-Rev2).

Seepage may contain radioactive material and elevated levels of contaminants such as aluminium, cadmium, nickel, zinc and fluoride, resulting in contamination of the underlying groundwater system. Alteration of the groundwater quality by tailings seepage may limit the current and future use of groundwater and impact on groundwater dependent ecosystems and vegetation.

8.5.4 Criteria for assessment

Relevant land and surface water quality criteria include:

- National Environment Protection (Assessment of Site Contamination) Measure 1999; and
- ANZECC & ARMCANZ (2000) – freshwater and marine waters criteria.
- ANZECC & ARMCANZ (2000) – livestock waters criteria

8.5.5 Applicant controls

This assessment has reviewed the controls set out in Table 20 below.

Table 20: Applicant's proposed controls for tailings seepage

Site infrastructure	Description
TSF3 expansion	No engineered liner - natural base materials have a permeability 1 x 10^{-6} m/s
	Seepage modelling indicates that there will be seepage of 130 m^3 per day (based on hydraulic conductivity of 1 x 10^{-7} m/s). Initial seepage is expected to be greater as base materials have a hydraulic conductivity of 1 x 10^{-6} m/s.
	Hydraulic conductivity of the tailings of 1 x 10^{-7} m/s to form a barrier once deposited.
	Existing embankment incorporates a cut-off trench excavated to 'rock' to reduce seepage losses through the embankment.
	Clayey zone constructed adjacent to the waste dump on the eastern side to reduce lateral seepage into the waste dump. Hydraulic conductivity of the clayey zone is 1 x 10^{-8} m/s. Cut off trench to be constructed under the compacted clayey zone along the waste dump.
	Decant pump near the main embankment to maintain the supernatant pond in the northern section of the facility near the main embankment. Water will be removed from the facility and pumped back to the process plant.
	Tailings material is expected to be 60% solids at point of discharge.

Site infrastructure	Description
	An additional bore is to be installed “downstream of the TSF expansion in the existing TSF3 (Wodgina, February 2018). The location of this bore is within the footprint of the existing TSF3.
	The Applicant proposes to treat the tailings with lime in the event of a “spike” in groundwater levels (Wodgina, April 2018).

8.5.6 Key findings

The Delegated Officer has reviewed the information regarding tailings seepage and has found:

1. Only one sample of representative spodumene tailings material has been characterised by geochemical testing.
2. Tailings leachate may contain elevated levels of aluminium, chromium, copper, nickel, zinc and fluoride.
3. Tailings leachate contains trace concentrations of radionuclides such as uranium, thorium, potassium and rubidium.
4. Approximately 3.5 million tonnes of tailings are to be disposed.
5. The downstream bore proposed is not within an un-impacted location.
6. The Applicant only proposes to add lime to the process to reduce fluoride concentrations if there is a spike in fluoride in groundwater levels. No fluoride trigger value has been provided.
7. Only desktop hydrogeological information has been provided, indicating groundwater flow is in the direction of topography.
8. Seepage from the area of the expansion will flow along the north/south trending structures as per the existing seepage from TSF3 “with some groundwater flow into the nearby pit area, associated with a fault” (ENV-TS-RP-0079-Rev2).
9. Historically, seepage intersected the natural surface within the creek channel some distance downstream of the existing TSF3.
10. The ephemeral watercourse to the north of the existing TSF3 is likely to be a receptor but it is located approximately 1 km from the TSF3 expansion. All other nearby watercourses are in an elevated position when compared to the TSF3 expansion.
11. There is no permanent surface water flow in the Wodgina area, although small pools may occur from time to time following periods of heavy rainfall.
12. Concentrations of contaminants in tailings water disposed and recycled from the TSF are likely to increase in concentration over time as these contaminants are not readily removed from solution.
13. Seepage modelling based on a hydraulic conductivity of 1×10^{-7} m/s has been modelled which indicates that seepage will occur at a rate of 130 m^3/day. However, the initial rate of seepage is likely to be greater as the base materials have a hydraulic conductivity of 1×10^{-6} m/s.

14. No information on interactions between groundwater and surface water systems has been provided.

8.5.7 Consequence

If seepage alters local groundwater quality, the ANZECC/ARMCANZ 2000 freshwater trigger values could be exceeded. Furthermore, the livestock drinking water limit for fluoride may be exceeded (expected fluoride concentration of 3.8 mg/L in leachate at pH 7 as compared to livestock limit of 2 mg/L). It is noted that this leachate concentration is derived from a single tailings sample. Therefore, the Delegated Officer has determined that the impact of seepage will be mid-level on site impacts on a local scale. Therefore, the Delegated Officer considers the consequence of seepage from the TSF3 expansion to be ***moderate*.**

8.5.8 Likelihood of Risk Event

Based on the geochemical testing of existing tailings material and that historically seepage has intersected downstream creek systems, the Delegated Officer has determined that the likelihood of seepage resulting in elevated levels above ANZECC/ARMCANZ trigger values for freshwater and livestock water may occur at some time. Therefore, the Delegated Officer considers the likelihood of Risk Event 1 to be ***possible*.**

8.5.9 Overall rating of seepage from TSF3 expansion

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 16) and determined that the overall rating for the risk of seepage from TSF3 expansion is ***medium*.**

8.6 Risk Assessment – Spills of processing liquors and sediment laden stormwater runoff within the beneficiation plant

8.6.1 Description of spills of processing liquors within the beneficiation plant

Soil and groundwater contamination through a release of chemical reagents (oleic acid, xanthate and soda ash), spills of tantalum or spodumene concentrate and process fines outside of bunded areas within the processing plant, or through leaks and spills from the process water pipelines. Release or spills of processing liquors could contaminate stormwater runoff and/or cause localised contamination of soils and infiltrate to groundwater.

8.6.2 Identification and general characterisation of emission

Only one sample of tailings material has been characterised by geochemical testing. The process water may contain elevated levels of contaminants such as aluminium, cadmium, nickel, zinc and fluoride. The tantalum concentrate contains uranium-238 at 2.43 Bq/g. The total activity for the spodumene concentrate is 1.67 Bq/g and the Tantalum concentrate at 3.4 Bq/g. Chemical reagents that could spill include oleic acid, xanthate and soda ash.

Table 21: Volumes of reagents to be stored within the beneficiation plant area.

Reagent	Units	Rate	Daily	Annual	Storage (7 days)
Oleic Acid at 98% w/w (L)	L/h	724	47,565	17,361,112	332,953
Soda Ash (t)	g/t	735	10.5	3,827	79
Pine Oil (t)	g/t	20	0.3	104	3

SIBX (t)	g/t	100	1.4	521	13
Grinding Media (t)	kg/t	0.067	1.02	371	7
Oxidised Paraffin Wax (kg)	g/t	250	706.7	257,932	4,975
Flocculant - Conc (kg)	g/t	5	10.3	3,755	72
Flocculant - Tails (kg)	g/t	30	394.4	143,962	2,761

8.6.3 Description of potential adverse impact from the emission

Process liquors contain trace radionuclides and elevated levels of contaminants such as aluminium, cadmium, nickel, zinc and fluoride, oleic acid and xanthate. Releases of processing liquors may causing soil contamination, and possibly migrate to groundwater, limiting the current and future use of groundwater. If surface water systems are groundwater fed, degradation of surface water quality could occur resulting in impacts to aquatic fauna. Accumulation of contaminants due to the overflow from the retention basin could result in impacts to birdlife coming into contact with water within the pit.

8.6.4 Criteria for assessment

Relevant land and surface water quality criteria include:

- National Environment Protection (Assessment of Site Contamination) Measure 1999; and
- ANZECC & ARMCANZ (2000) – freshwater and marine waters criteria.
- ANZECC & ARMCANZ (2000) – livestock waters criteria.

8.6.5 Applicant controls

The beneficiation plant is located up gradient of the main local drainage system and therefore does not have a significant external catchment draining into the plant (2.8 ha). Potential external surface water risks associated with the beneficiation plant are limited to a small number of upslope contributing areas. Locations for minor drainage diversions to mitigate runoff impacts to the site and maintain natural runoff flow are shown in Schedule 2: Figure 7.

The 3 parallel trains are to be installed within a concrete, impervious hardstand compound with all spills and drainage directed to concrete lined sumps. Sump pumps to be installed to reinject water/spills from the 3 parallel trains back into the process water stream.

Concrete bund kerbs to be constructed to direct stormwater towards the retention sump for recycling back to the process circuit.

Retention sump adequately sized to maintain an operational freeboard of 300 mm. The retention sump is to be lined with HDPE and is to be sized so that there will be no overflow except in the event of a greater than 1% AEP 72 hour storm.

No information has been provided on the hydrogeological environment of the Wodgina pit.

This assessment has reviewed the controls set out in Table 22 below.

Table 22: Applicant's proposed controls for contaminated drainage from the beneficiation plant

Site infrastructure	Description
Beneficiation plant drainage	
Beneficiation Plant	• The 3 parallel trains to be installed within a concrete, impervious hardstand compound with all spills and drainage directed to concrete lined sumps. Sump pumps to be installed to reinject water/spills from the 3 parallel trains back into the process water stream. • Concrete bund kerbs to be constructed to direct stormwater towards the retention sump for recycling back to the process circuit. • The spodumene and tantalum storage areas will be within a purpose built shed.
Retention sump	• The retention basin has been designed using recommended International Erosion Control Association (IECA) guidelines, which uses a 10th percentile 5-day rainfall event to calculate the required volume. • This indicates that a total basin volume (settling and storage volume) of approximately 2,600 m^3 is required (approx. 3,000 m^3 including freeboard allowance). Any retained water will either be pumped back into the process system or left to evaporate. • To be constructed with a 2.5 mm HDPE lining system with a permeability of 1 x 10^{-9} m/s or less. • Retention sump sized to have a minimum capacity of 3100 m^3. • Retention sump is to be adequately sized to maintain an operational freeboard of 300 mm. • Retention sump is to be adequately sized so overflow to the Wodgina Pit only occurs in a greater than 1% AEP, 72-hour rainfall event.
Wodgina pit	• Overflow from the retention pond will be directed to the Wodgina pit. No information has been provided on the hydrogeology of the pit.
Process water pond	• The process water pond is to be constructed with a 2.5 mm HDPE lining system with a permeability of 1 x 10^{-9} m/s or less. • Process water pond is to be constructed with a minimum storage capacity of 5000 m^3. • The process water pond is to be adequately sized to maintain a minimum operational freeboard of 300 mm. • The process water pond is to be adequately sized so that there will be no overflow except in the event of a greater than 1% AEP 72 hour storm.
Fuels and Reagents Storage	• Chemicals/Reagents: All chemical and reagents classed as dangerous goods stored in accordance with the requirements of the *Dangerous Goods Safety Act 2004* and the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*.

8.6.6 Key findings

The Delegated Officer has reviewed the information regarding contaminated drainage and has found:

1. The 3 parallel trains to be installed within a concrete, impervious hardstand compound with all spills and drainage directed to concrete lined sumps. Sump pumps to be installed to reinject water/spills from the 3 parallel trains back into the

process water stream.

2. Concrete bund kerbs to be constructed to direct stormwater towards the retention sump for recycling back to the process circuit. Birdlife may be attracted to water accumulating within the Wodgina pit.
3. The process water pond and retention sump are to be lined with HDPE.
4. The process water pond and retention sump are to be adequately sized so overflow only occurs in a greater than 1% AEP, 72-hour rainfall event.
5. Chemicals/Reagents: All chemical and reagents classed as dangerous goods stored in accordance with the requirements of the Dangerous Goods Safety Act 2004 and the Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007.
6. No information on the hydrogeology of the Wodgina pit has been provided.

8.6.7 Consequence

Most areas are to be installed on a concrete, impervious hardstand area and the retention sump and process water pond are to be lined therefore seepage to groundwater from a release of liquor to ground is not expected. If a discharge of contaminated drainage to the Wodgina pit occurs, then the Delegated Officer has determined that the impact will be low-level on site impacts. Therefore, the Delegated Officer considers the consequence of the release of contaminated drainage to be ***minor***.

8.6.8 Likelihood of Risk Event

Based on the Applicants' controls in the beneficiation plant area and that there will be no overflow to the Wodgina Pit except in a greater than 1 in 100 year ARI event, the Delegated Officer considers the likelihood of Risk Event 1 to be ***unlikely***.

8.6.9 Overall rating of contaminated drainage

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 16) and determined that the overall rating for the risk of contaminated drainage is ***medium***.

8.7 Risk Event – WWTF Seepage and Overflows

8.7.1 Description of WWTF seepage and overflows

The proposed WWTF comprises a series of lined ponds which overflow into infiltration/ evaporation ponds. Wastewater may be discharged from facultative or evaporation ponds during upset conditions of high load or during extreme rainfall events, resulting in runoff toward ephemeral creeks. In addition, wastewater also has the potential to reach creek systems by seeping into groundwater that flows toward surface water bodies.

8.7.2 Identification and general characterisation of emission

The Applicant targets effluent quality to fall within the expected range for a secondary treatment facility as specified in the *Australian Guidelines for Sewerage Systems – Effluent Management* (NWQMS, 1997), which are set out in Table 23. As demonstrated in Table 23, the WWTF is not currently capable of treating effluent to a quality to Australian guidelines for Biochemical Oxygen Demand (BOD) and total suspended solids (TSS). A review of monitoring data provided in the 2015/16 Annual Environmental Report indicates that this is an ongoing issue at the WWTF (PMI, 2017; MRL, 2016).

Table 23: Expected effluent quality for a secondary treatment facility

Parameter	Measurement Unit	Australian Guidelines[1]	Average Wastewater Quality (Q3/4 2017)
Biological Oxygen Demand (BOD)	mg/L	20-30	108.25
Total Suspended Solids (TSS)	mg/L	25-45	146
Total Nitrogen (TN)	mg/L	20-50	32.5
Total Phosphorous (TP)	mg/L	6-12	8.075
Faecal Coliforms (E. Coli)	org/mL	10^5-10^6	232.5
Anionic Surfactants	mg/L	<5	Not analysed
Oil and Grease	mg/L	<10	Not analysed

[1] Source: NWQMS, 1997

Original supporting documentation for the construction of the existing WWTF indicated that evaporation being the primary disposal method. However, further information received from the Applicant has revealed that infiltration at a rate of up to 10 L/m^2/day occurs at the evaporation ponds.

Effluent quality monitoring is conducted quarterly in accordance with Licence condition 3.2.1. In addition to the analytes listed in Table 24, the operating licence (L4328/1989/10) also requires the monthly monitoring of standing water levels (SWL) and quarterly monitoring of Chemical Oxygen Demand (COD), Total Dissolved Solids (TDS), ammonia and nitrate/nitrite at five ambient groundwater monitoring bores (Table 24).

Table 24: Averaged ambient water quality at WWTF monitoring bores 2017 Q3/Q4 (PMI, 2017)

Parameter	Units	WWTF1	WWTF2	WWTF3	WWTF4	WWTF5
SWL	metres below ground level	5.3	6.6	Dry/10.9[2]	6.3	32.2
pH	N/A	7.7	7.5	7.5	7.7	7.4
BOD	mg/L	<5	<5	<5	<5	<5
COD	mg/L	<20	83	<20	46	240
TDS	mg/L	590	1,300	1,350	825	685
TSS	mg/L	130	210	68	90	2,230
E.coli	cfu/100mL	<10	<100	<10	650	<10
TN	mg/L	Not sampled – incorrect bottles used for sampling.				
TP	mg/L	Not sampled – incorrect bottles used for sampling.				
Ammonia	mg/L	Not sampled – incorrect bottles used for sampling.				

Nitrate/ Nitrite	mg/L	Not sampled – incorrect bottles used for sampling.

Note 1: Sampling undertaken in Q1/Q2 of the 2017 annual period has not been made available to DWER.
Note 2: WWTF3 was recorded as dry in February, March and May. SWL has been averaged over the April and June monitoring periods.

8.7.3 Description of potential adverse impact from the emission

The proposed increased rate of discharge of wastewater from sewage to ground at the mine camp has the potential to cause adverse impacts on vegetation health in the riparian zone adjacent to an ephemeral creek located about 200 metres from the wastewater evaporation ponds.

Depending on the nitrogen and BOD concentrations in groundwater on arrival at the riparian zone, significant impacts on vegetation health in this area are possible. High nitrogen concentrations in subsoil pore water and anaerobic conditions caused by high BOD levels could lead to the decline in health or even death of mature trees and encourage the growth of short-lived weedy vegetation species. The high BOD levels in groundwater could also lead to the release of iron-bound phosphorus in soil into soil pore water, which could exacerbate eutrophic conditions and local vegetation impacts in the riparian zone.

8.7.4 Criteria for assessment

Relevant land and surface water quality criteria include:

- National Environment Protection (Assessment of Site Contamination) Measure 1999; and
- ANZECC & ARMCANZ (2000) – freshwater and marine waters criteria.

8.7.5 Applicant controls

The Applicant proposes to an additional infiltration/evaporation pond.

8.7.6 Key findings

The Delegated Officer has reviewed the information regarding WWTF seepage and overflows and has found:

1. The current treatment methods do not satisfy Australian guidelines for effluent quality from secondary treatment.
2. Existing evaporation ponds rely on infiltration of partially treated effluent to groundwater as a means for disposal with evaporation also relied upon. Using conservative calculations, up to 30,000 L of this partially treated effluent is infiltrated from each pond when in use.
3. The presence of faecal coliforms in groundwater monitoring data indicates some interaction between ponds and groundwater.
4. Standing water levels in WWTF5 (background monitoring point) were too low to allow for groundwater bores to be purged prior to sampling resulting in elevated particulates. Therefore data may not be an accurate representation of background ambient groundwater quality.
5. Pond seepage and overflows have the potential to cause eutrophication and subsequently impact riparian vegetation.

8.7.7 Consequence

The Delegated Officer has determined that the event of an overflow of the WWTF ponds or

seepage reaching riparian vegetation may result in mid-level off-site impacts at a local scale. Therefore, the Delegated Officer considers the consequence of the Risk Event to be ***major*.**

8.7.8 Likelihood of Risk Event

There is a high potential for short term, high intensity rainfall events in the Pilbara Region. Based on the high level of uncertainty regarding the WWTF's capacity, the Delegated Officer has conservatively determined that overflows will probably occur during most rainfall events. In addition, the presence of faecal coliforms in groundwater monitoring data indicates some interaction between ponds and groundwater suggesting that the WWTF will have some impact on groundwater chemistry near to the ephemeral creek most of the time.

Therefore, the Delegated Officer considers the likelihood of Risk Event 1 to be ***likely***.

8.7.9 Overall rating of WWTF seepage and overflows

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 16) and determined that the overall rating for the risk of WWTF seepage and overflows is ***high***.

8.8 Risk Event – Stormwater discharges to surface waters

8.8.1 Description of stormwater discharges to surface waters

Stormwater has the potential to become contaminated with hydrocarbons used at the power station during operation. The power station is located within a local drainage and creek line creating the potential for hydrocarbon contaminated stormwater to reach surface waters.

8.8.2 Description of potential adverse impact from the emission

Vegetation growth and survival may be impacted following contamination of land through direct contact with hydrocarbon contaminated stormwater or from infiltration into soils and groundwater.

8.8.3 Criteria for assessment

Relevant land and surface water quality criteria include:

- National Environment Protection (Assessment of Site Contamination) Measure 1999; and
- ANZECC & ARMCANZ (2000) – freshwater and marine waters criteria.

8.8.4 Applicant controls

This assessment has reviewed the following infrastructure and equipment controls proposed by the Applicant:

- Self bunded oil and waste oil tanks;
- Power station to be built on a pad;
- Where stormwater is likely to be contaminated with hydrocarbons, water will be directed to an oily water separator;
- All treated water from the oily water separator will be captured in a holding tank and removed by a licensed controlled waste carrier as required
- Perimeter drains will be in place; and
- 2 x 1.2m diameter x 120m long culverts along the northern perimeter for surface water drainage as shown in Figure 10.

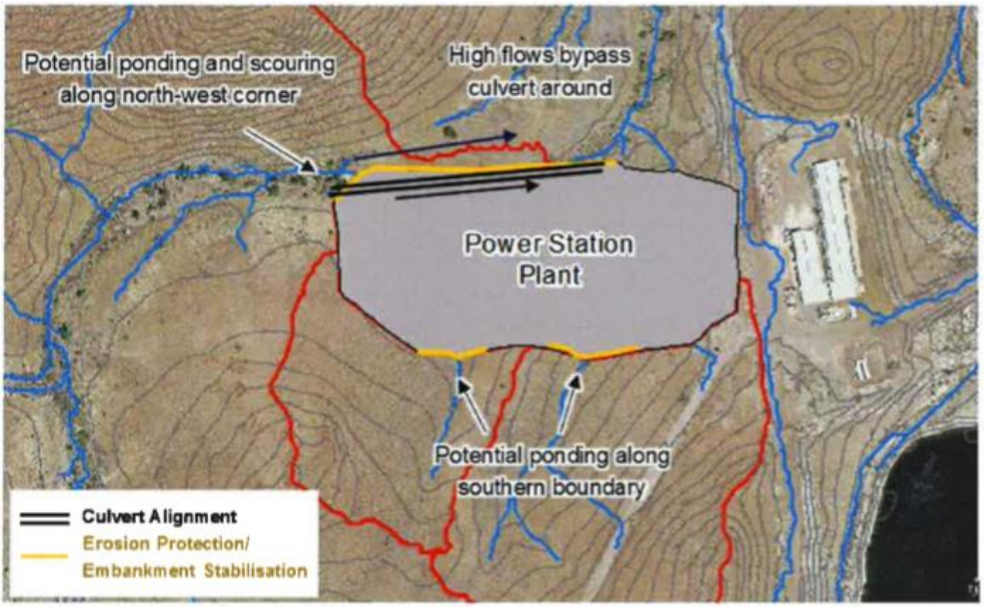


Figure 10: Proposed culverts along the northern perimeter of the power station

8.8.5 Key findings

The Delegated Officer has reviewed the information regarding stormwater discharges to surface waters and has found:

1. The power station is sited within local drainage and creek lines presenting a possible direct pathway to the environment.
2. Proposed culverts along the northern perimeter provide protection against a 1 in 5 year flood event. The culverts are expected to overflow in a northerly direction and away from the power station (Golder, 2018).
3. There will be no discharge of treated wastewater or potentially contaminated stormwater from the facility.

8.8.6 Consequence

The Delegated Officer has determined that discharge of hydrocarbon contaminated stormwater to surface waters occurring will result in low level impacts at a local scale. Therefore, the Delegated Officer considers the consequence of discharges to surface waters to be ***moderate***.

8.8.7 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of contaminated stormwater discharges to the creek occurring will may only occur in exceptional circumstances based on Applicant controls. Therefore, the Delegated Officer considers the likelihood of stormwater discharges from the power station to surface waters to be ***rare***.

8.8.8 Overall rating of stormwater discharges to surface waters

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 16) and determined that the overall rating for the risk of stormwater discharges to surface waters as ***medium***.

8.9 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 25 below. Controls are described further in sections 10 and 11.

Table 25: Risk assessment summary

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
1.	Release of tailings/super natant through rupture of pipeline	Tailings/ decant return pipeline	Direct discharge to land and seepage to groundwater. Contamination of groundwater and groundwater fed surface water systems impacting on groundwater	HDPE pipelines pipelines to be constructed in an earthen bunded corridor Catch sumps/scour pits to be constructed at low spots Flow control valves, pressure relief valves, pressure control valves, pressure sustaining valves and pressure reducing valves to be installed along the pipeline	Low	The Applicants controls will be conditioned in the works approval
2.	Tailings seepage	TSF3 expansion	Infiltration through underlying soils to groundwater. There may be interactions between groundwater and surface waters.	No engineered liner is proposed - natural base materials have a permeability 1 x 10-^{6} m/s Seepage modelling indicates that there will be seepage of 130m^{3} per day (based on hydraulic conductivity of 1 x 10 $^{-7}$ m/s). Hydraulic conductivity of the tailings of 1 x 10^{-7} m/s to form a barrier once deposited Existing embankment incorporates a cut-off trench excavated to 'rock' to reduce seepage losses Clayey zone constructed adjacent to the waste dump on the eastern side to reduce lateral seepage into the waste dump. Hydraulic conductivity of the clayey zone is 1 x 10 $^{-8}$ m/s. Cut off trench to be constructed under the compacted clayey zone along the waste dump. Decant pump near the main embankment to maintain the supernatant pond in the northern section of the facility near the main embankment. Water will be removed	Medium	Acceptable subject to further regulatory controls to reduce seepage. Treatment of tailings is required prior to discharge in the licence.

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
				from the facility and pumped back to the process plant. Tailings material is 60% solids. An additional bore is to be installed “downstream of the TSF expansion in the existingTSF3 (Wodgina, February 2018). The Applicant proposes to treat the tailings with lime in the event of a “spike” in groundwater levels (Wodgina, April 2018).		
5.	Leaks and spills and stormwater from beneficiation plant area	Beneficiation plant	Infiltration through soils to groundwater.	Drainage and bunding directed towards a retention basin. Process water pond Retention basin overflows to Wodgina pit.	Medium	The Applicant’s controls are to be conditioned in the works approval.
6.	WWTF seepage and overflows	WWTF	Overtopping of wastewater or groundwater seepage from WWTF ponds reaching nearby riparian vegetation.	None specified.	**High**	Acceptable subject to further regulatory controls.

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
7.	Stormwater discharges to surface waters	Power station hydrocarbon storage areas	Hydrocarbon-contaminated stormwater runoff into ephemeral surface water bodies	Concrete hardstands, bunding and stormwater diversion infrastructure.	**Medium**	Acceptable subject to Applicant controls conditioned.

9. Works Approval controls

9.1 Infrastructure and equipment

9.1.1 Tailings/return water pipelines infrastructure and equipment

The Applicant's controls are deemed acceptable to manage risks. Further information is required from the Applicant and will be conditioned in the Works Approval. The following infrastructure and equipment in Table 26 should be constructed to prevent impacts from pipeline ruptures.

Table 26: Tailings and return water pipelines requirements (design and construction)

Infrastructure	Requirements (Design and Construction)
Tailings deposition infrastructure	• End of pipe, (fixed),multi-spigots. • Tailings infrastructure installed in locations so that discharges occur in the locations specified for Stage 1 and Final Stage.
Pipeline corridor	• Pipeline corridor to be constructed in the location specified in Schedule 2: Figure 4. • Pipeline corridor graded so that spillage from the pipelines falls towards the TSF3 expansion.
Tailings delivery pipelines (2) from beneficiation plant to TSF3 expansion Return water pipeline (1) from TSF3 expansion to process water pond	• Pipelines constructed in the location specified in Schedule 2: Figure 4. • All pipelines to be 2915 m in total length. • Tailings pipelines to be constructed with 250 NB and 200 NB carbon steel pipelines from chainage 0 m through to chainage 2358 m. • Carbon steel piping to be supported above ground on precast concrete supports place on constructed access. • Mining hose used at changes in horizontal and vertical alignment. • Tailings pipelines to be constructed with DN250 and DN225 PN HDPE pipe from chainage 2358m to chainage 2915m. • Decant return pipeline to be constructed with DN160 HDPE PN10. • All pipelines located above ground within an earthen bunded corridor where located outside the TSF embankment. • Bunded corridor must to be sized to contain at a minimum the equivalent volume to contain the maximum pipe volume. • Catch pits to be installed at changes in direction or elevation (likely wear or failure points) with a capacity to store the expected volume of tailings that would be generated on that section of pipeline. • Pipelines to be installed with instrumentation consisting of electromagnetic flow meters and pressure transmitters installed downstream of pump station and upstream of single point discharge, providing constant monitoring of operation parameters of the tailings pipeline and activating shutdown of the system in the event of pipeline failure.

9.1.2 TSF3 expansion infrastructure and equipment

As seepage is likely to contain elevated levels of contaminants, further regulatory controls

have been applied to manage seepage at the TSF3 expansion. The following infrastructure and equipment in Table 27 should be constructed to prevent impacts from seepage.

Table 27: TSF3 expansion requirements (design and construction)

Infrastructure	Requirements (Design and Construction)

Decant infrastructure	• Installation of a pumped central decant, floating pump.
	• Starter stage:
	  ○ Decant pump installed near the main embankment area.
	• Final Stage:
	  ○ Raising of the decant pump near the main embankment of the expansion area.

TSF3 expansion	• TSF3 expansion constructed within M45/923.
	• Starter stage (current embankment height of RL 260 m:
	  ○ Storage capacity of 1.1 Mt (0.73 Mm^3) of tailings material.
	  ○ Storage area of 8.4 hectares.
	  ○ Construction of a compacted clayey mine waste zone with a permeability of 1 x 10^{-8} m/s or less and 6 m wide will be constructed along the eastern side of the TSF3 expansion at the site of the waste dump, to reduce seepage into the dump.
	  ○ Establishment of a decant pump near the main embankment of the TSF3 expansion.
	  ○ Construction of a pipe bench along the eastern side of TSF3 expansion.
	  ○ Constructed to provide a minimum 1 metre total freeboard (including an allowance for the 1% AEP 72 hour event of 383 mm) above the normal operating pond.
	• Regulatory controls:
	  ○ Constructed with a seepage recovery system comprising a recovery trench, sump pump and flowmeter established immediately downstream of the main embankment of the TSF3 expansion.
	  ○ Constructed with a compacted clay liner with a hydraulic conductivity of 1 x 10^{-8} m/s or less.
	• Construction of Final Stage (of TSF3 expansion):
	  ○ Storage capacity of 2.4 Mt (1.59 Mm^3)
	  ○ Storage area of 12.8 hectares.
	  ○ Downstream raising of the main embankment (existing TSF3 southern embankment) to 275 RL (m).
	  ○ Raising of the clayey mine waste zone with a permeability of 1 x 10^{-8} m/s or less constructed adjacent to the waste dump on the eastern side of the TSF3 expansion.
	  ○ Embankment sections constructed as per Figure 3 in Schedule 2.

9.1.3 Beneficiation plant infrastructure and equipment

The Applicant's controls have been conditioned in the works approval. The following infrastructure and equipment in Table 28 must be constructed to minimise emission of contaminants including radionuclides from the beneficiation plant area.

Table 28: Beneficiation plant requirements (design and construction)

Infrastructure	Requirements (Design and Construction)

Beneficiation plant area	• Design capacity of 4.6 Mtpa.
	• Installation of 3 parallel trains consisting of new:
	  ○ grinding circuits (ball mills), each with a nominal feed rate of 231 dry t/h.
	  ○ iron removal circuits consisting of low intensity magnetic separators followed by wet high intensity magnetic separators.
	  ○ tantalum recovery circuits.
	  ○ de-slime hydrocyclone circuits.
	  ○ sulphide pre-flotation circuits consisting of pre-flotation roughers and cleaner cells.
	  ○ flotation circuits consisting of rougher, scavenger, first cleaner, second cleaner and third cleaner stages to recover spodumene.
	  ○ Spodumene concentrate dewatering circuits consisting of a concentrate thickener, concentrate storage tank and a belt filter.
	• The 3 parallel trains to be installed within a raised concrete, impervious hardstand compound with all spills and drainage directed to concrete lined sumps. Sump pumps to be installed to reinject water/spills from the 3 parallel trains back into the process water stream.
	• Concrete bund kerbs to be constructed to direct stormwater towards the retention sump for recycling back to the process circuit.

Process water pond	• The process water pond must be constructed with a 2.5 mm HDPE lining system with a permeability of 1 x 10^{-9} m/s or less. • Process water pond to be constructed with a minimum storage capacity of 5000 m^3. • The process water pond must be adequately sized to maintain a minimum operational freeboard of 300 mm. • The process water pond must be adequately sized so that there will be no overflow except in the event of a greater than 1% AEP 72 hour storm.
Retention sump	• Must be constructed with a 2.5 mm HDPE lining system with a permeability of 1 x 10^{-9} m/s or less. • Retention sump sized to have a minimum capacity of 3100 m^3. • Retention sump adequately sized to maintain an operational freeboard of 300 mm. • Retention sump adequately sized so overflow to the Wodgina Pit only occurs in a greater than 1 in 100 year Annual Recurrence Interval, 72-hour rainfall event.
Fuels and reagent storage	• As per *Dangerous Goods Act 2004* requirements.

9.1.4 Power station infrastructure and equipment

The following infrastructure and equipment in Table 29 must be installed for the power station.

Table 29: Power station requirements (design and construction)

Infrastructure	Requirements (Design and Construction)

Power Station	• Power station to consist of a maximum of 32 engine gas trains (Cummins QSV91 – C2000N5CB) with a maximum design capacity of 64 megawatts
	• The power station must be built on a raised, impervious concrete pad designed to:
	  ○ Divert uncontaminated (no hydrocarbons) stormwater away from oil and waste oil storage areas.
	  ○ Not allow the runoff of potentially contaminated stormwater beyond the power station pad.
	• All oil and waste oil tanks must double skinned with self bunding (110% of the volume of the tank)
	Two 1.2m diameter x 120m long culverts must be constructed along the northern perimeter of the power station pad, as depicted in Figure 9, capable of preventing ingress of stormwater from a 1 in 5 year, 72 hour flood event.

9.1.5 Wastewater treatment facility infrastructure and equipment

The current performance of the wastewater is inadequate. As infiltration of wastewater is expected to have an impact on vegetation, the Delegated Officer has determined that it is not acceptable to allow further infiltration of wastewater.

Table 30: Wastewater treatment facility requirements (design and construction)

Infrastructure	Requirements (Design and Construction)
Wastewater evaporation pond 4	• Evaporation pond 4 to be constructed in the location depicted in Schedule 2: Figure 8. • Evaporation pond 4 must be constructed to contain rainfall associated with a 1 in 100 year, 72 hour average recurrence interval event. • Evaporation pond must be HDPE-lined with a permeability of 10^{-9} m/s or less.

9.1.6 Putrescible landfill area

The Applicant's proposed controls for the construction of the putrescible landfill expansion has been conditioned in the Works Approval.

Table 31: Putrescible landfill expansion (design and construction)

Infrastructure	Requirements (Design and Construction)
Landfill expansion	• Putrescible landfill expansion to be constructed within the following area: Point Eastings Northings 1 675,833.34 7,661,463.87 2 675,946.73 7,661,455.58 3 675,924.60 7,661,073.93 4 675,811.21 7,660,971.60 • Trenches to be constructed (20 m length, by 3 m width by 4 m in

	depth) • Landfill facility to be fenced to prevent fauna access • Windrows of excavated material to be formed around three sides of each trench to prevent stormwater ingress • Rollover bund to be constructed at entrance to facility to prevent stormwater ingress.

9.2 Specified actions

9.2.1 Groundwater and surface water

Further information is required to determine the risks of activities at the Premises. The information provided may result in additional controls being applied to the Works Approval.

Within 3 months of the issue of this Works Approval, the Works Approval Holder must provide to the CEO a report on the groundwater and surface water environment which must include:

(a) A hydrogeological characterisation of the groundwater environment beneath Tailings Storage Facility 3, Tailings Storage Facility 3 expansion, Wastewater Treatment Facility, beneficiation plant area and the Wodgina pit void.
(b) Detail any interactions between groundwater and surface water systems at the Premises.
(c) Determine and provide the baseline groundwater and surface water conditions. Please provide information on the groundwater levels and concentration of aluminium, arsenic, cadmium, chromium, copper, iron, lead, selenium, mercury, nickel, zinc, manganese, silicon, cobalt, potassium, magnesium, sodium, total nitrogen, calcium carbonate, calcium, lithium, caesium, rubidium, uranium, thorium, fluoride, thallium, chloride, bromide, sulphate, total phosphorus, total dissolved solids, pH, electrical conductivity, total recoverable hydrocarbons.
(d) Detail potential groundwater and surface water pathways from the Tailings Storage Facility 3 expansion, Wastewater Treatment Facility, beneficiation plant area, Wodgina pit void to determine risk to receptors.
(e) Presentation of a conceptual site model.
(f) Presentation of groundwater contours for the site.
(g) Review and propose groundwater monitoring locations in consultation with a qualified hydrogeologist.
(h) Propose an appropriate surface water monitoring program in consultation with a qualified hydrologist.

Within 12 months of the issue of the Works Approval, the Works Approval Holder must undertake a direct toxicity assessment (DTA) in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000). The DTA must:

(a) use local aquatic species found downstream of TSF3;
(b) determine the acute and/or chronic toxicity of fluoride, lithium and thallium in discharge from the TSF, including decant water, supernatant, pore water or seepage water;
(c) be used to derive a set of site specific trigger values for fluoride, lithium and thallium for protection of onsite aquatic ecosystems.

Following the DTA, the Works Approval Holder shall propose management actions to be undertaken in response to an exceedance of those trigger values.

9.2.2 Contaminants in Tailings

Within 4 months of the issue of the Works Approval, the Works Approval Holder must provide

to the CEO detail of proposed processes to reduce soluble concentrations of contaminants in tailings supernatant, such that downstream concentrations in any seepage expressed at the toe drain of the main embankment (wall31 of the existing TSF 3) meet the following contaminant levels:

(a) Aluminium 0.055 mg/L (ANZECC/ARMCANZ 2000 trigger value for protection of 95% of species in freshwater ecosystems);
(b) Fluoride 2 mg/L (ANZECC/ARMCANZ 2000 trigger value for livestock drinking water);
(c) Chromium 0.001 mg/L (ANZECC/ARMCANZ 2000 trigger value for protection of 95% of species in freshwater ecosystems);
(d) Copper 0.0014 mg/L(ANZECC/ARMCANZ 2000 trigger value for protection of 95% of species in freshwater ecosystems) ;
(e) Nickel 0.011 mg/L (ANZECC/ARMCANZ 2000 trigger value for protection of 95% of species in freshwater ecosystems);
(f) Zinc 0.008 mg/L (ANZECC/ARMCANZ 2000 trigger value for protection of 95% of species in freshwater ecosystems);
(g) Thallium 0.002 mg/L (USEPA maximum contaminant level goal for drinking water – adopted in lieu of an appropriate Australian standard); and
(h) Lithium 0.7 mg/L (proposed USEPA drinking water trigger value – adopted in lieu of an appropriate Australian standard).

9.2.3 Wastewater Disposal

Prior to construction of the evaporation pond, the Works Approval Holder must provide a water balance to demonstrate the WWTF provides adequate capacity to manage up to of 210 m^3 of effluent per day for a workforce of 1,200 personnel.

Within 3 months of the issue of the Works Approval, the Works Approval Holder must provide to the CEO an improvement plan for the Wastewater Treatment Facility. The improvement plant must include but is not limited to:

(a) Replacement of the Wastewater Treatment Facility; and/or

(b) A plan to line all existing evaporation/infiltration ponds.

9.3 Reporting

The Applicant will be required to submit compliance documentation providing evidence that the requirements detailed in Table 2 of the Works Approval have been satisfied to ensure regulatory oversight and outline what has been assessed under the Issued Works Approval.

The Works Approval will also require the submission of a commissioning report verifying the stack emissions at the power station are equivalent to that proposed and risk assessed in this Decision Report.

10. Licence controls

10.1.1 Tailings and return water pipelines

Existing licence conditions 1.3.8 and 1.3.9 provide adequate regulatory controls for the operation of the pipelines

10.1.2 TSF 3 expansion

Condition 1.3.6 of the current licence has freeboard/stormwater requirements.

Ambient monitoring with trigger values/limits will be applied to the licence to ensure that the ANZECC/ARMCANZ freshwater and livestock values will be met in the absence of site

specific values.

Additional groundwater monitoring bores identified through specified actions will be added to the licence.

10.1.3 Beneficiation plant process monitoring

Process monitoring for the treatment of elevated contaminants and radionuclides will be included in the licence. Sampling of the water quality within the Wodgina pit will be conditioned in the licence.

Limits for aluminium, (ANZECC freshwater) fluoride (livestock) and thallium (USEPA contaminant goal) within tailings supernatant will be applied through the licence. These limits are to be informed by the DTA required by condition 9 of the Works Approval.

10.1.4 WWTF

The Licence will continue to require quarterly monitoring of groundwater at monitoring points WWTF1 to WWTF5 (inclusive). Freeboard for the ponds is prescribed by existing condition 1.3.6.

Any changes resulting from the WWTF Improvement Plan (submitted as a condition of the Works Approval) will be assessed under the Licence. Further controls will be determined at the time of assessment.

10.1.5 Power station

Commissioning is not authorized under the Works Approval as a commissioning plan has not been submitted. Commissioning is to be undertaken under the Licence. If monitoring during commissioning verifies that the power station is operating in accordance with the specifications, no conditions will be added to the Licence apart from reporting on air emissions for fee purposes.

10.2 Commissioning

Commissioning is not authorized under the Works Approval as a commissioning plan has not been submitted. Commissioning is to be undertaken under the Licence.

10.2.1 TSF 3 expansion and beneficiation plant

Commissioning is not authorized under the Works Approval as a commissioning plan has not been submitted. Commissioning is to be undertaken under the Licence. Staged commissioning will be undertaken over a ten month period. This will be due to the stage construction. It is expected that each of the three trains will be commissioned over a 5 month period. This will start in September 2018 and conclude in June 2019.

Commissioning will be assessed under the Licence upon submission of a commissioning plan and compliance documentation in accordance with the Conditions of this Works Approval, following submission of the reports required by Conditions 3, 7, 8 and 9.

10.2.2 Power station

Commissioning is not authorized under the Works Approval as a commissioning plan has not been submitted. Commissioning is to be undertaken under the Licence. Commissioning will be assessed under the Licence upon submission of a commissioning plan and compliance documentation in accordance with the Conditions of this Works Approval, following submission of the reports required by Condition 3.

10.2.3 Wastewater treatment facility

Commissioning is not authorized under the Works Approval as a commissioning plan has not been submitted. Commissioning is to be undertaken under the Licence. Commissioning will be assessed under the Licence upon submission of a commissioning plan and compliance documentation in accordance with the Conditions of this Works Approval, following submission of the reports required by Conditions 3, 10 and 11.

10.2.4 Tailings Leachate Characterisation

As only one sample of representative spodumene tailings has been used to undertake a geochemical assessment, further testing is required to determine risks from the proposed operation. Testing is required to be undertaken on tailings material that is generated from the beneficiation plant during operation. Furthermore, additional acid mine drainage characterisation is also required.

Within 3 months of commencing operations of the beneficiation plant and TSF3 expansion, the Works Approval Holder must undertake further testing to determine the geochemical characteristics of tailings materials to be produced at the Premises in accordance with Table 32 below. The report must be submitted to the CEO within 30 days of completion.

Table 32: Geochemical testing of tailings material

Column 1	Column 2	Column 3
Minimum number of samples	**Testing methodology**	**Analytes[1] (mg/L unless otherwise stated)**
6	Australian Standard Leaching Procedure	Aluminum Arsenic Cadmium Chromium Copper Iron Lead Selenium Mercury Nickel Zinc Manganese Silicon Cobalt Potassium Magnesium Sodium Total nitrogen Calcium carbonate Calcium Lithium[2] Caesium Rubidium Uranium Thorium Fluoride Thallium[3] Chloride Bromide Sulphate Total phosphorus

Note 1: Analysis to be undertaken at a sufficient detection level to allow a comparison against the 95% protection trigger values for freshwater ecosystems in ANZECC/ARMCANZ Guidelines 2000. With the exception of gross-alpha, gross-beta values to be compared with ANZECC Guidelines drinking water values for livestock.

Note 2: Minimum detection level of 0.7 mg/L (Proposed USEPA drinking water guideline value).

Note 3: Minimum detection level of 0.002 mg/L (USEPA drinking water maximum contaminant level goal).

10.2.5 Gas Generators' Air Emission Testing

Within 60 days of completion of commissioning of the new gas generators, emission testing of the new units shall be completed in accordance with Table 33 below. The report shall be submitted to the CEO within 30 days of completion.

Table 33: Monitoring of point source emissions to air

Column 1	Column 2	Column 3	Column 4	Column 5
Emission point	**Parameter**	**Units**	**Minimum sampling time (minutes) per run**	**Method**
All gas generator exhausts	Carbon monoxide	mg/m^3 and g/sec	Minimum 60 minutes	USEPA Method 10
	Nitrogen oxides			USEPA Method 7D or USEPA Method 7E
	Volatile organic compounds			USEPA Method 18 or USEPA Method 25A

11. Determination of Works Approval conditions

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

The *Guidance Statement: Licence Duration* has been applied and the issued licence expires in 5 years from date of issue.

Table 34 provides a summary of the conditions to be applied to this works approval.

Table 34: Summary of conditions to be applied

Condition Ref	Grounds
Infrastructure and Equipment 1, 2, 3, 4 and 5	These conditions are valid, risk-based and contain appropriate controls.
Emissions 6	This condition is valid, risk-based and consistent with the EP Act.
Specified Actions 7,8,9,10 and 11	These conditions are valid, risk-based and consistent with the EP Act.
Information 12 and 13	These conditions are valid and are necessary administration and reporting requirements to ensure compliance.

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

12. Applicant's comments

The Applicant was provided with the draft Decision Report and draft issued Works Approval

on 11 May 2018. The Applicant/Licence Holder provided comments which are summarised, along with DWER's response, in Appendix 2.

13. 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).

SENIOR MANAGER

INDUSTRY REGULATION (RESOURCE INDUSTRIES)

Delegated Officer
under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Licence L4328/1989/1 – Wodgina Operations	L4328/1989/1	accessed at www.dwer.wa.gov.au
2.	Works Approval W6132/2018/1– Wodgina Operations	W6132/2018/1	Accessed at www.dwer.wa.gov.au
3.	Application form and supporting documentation	Wodgina, February 2018	DWER records (A1615930)
4.	CMW Geosciences. Tailings Storage Facility 3 Expansion	CMW, January 2018	DWER records (A1615930)
5.	Further information on pipeline and elevated contaminant levels provided by email received 5 April 2018 at 11:39 AM	Wodgina, April 2018	DWER records (A1647984)
6.	Process Minerals International. Wodgina Lithium Project Power Station, Crushing and Screening Plants, Beneficiation Plant and Tailings Storage Revised Mining Proposal 1 March 2018	ENV-TS-RP-0079-Rev2	DWER records (A1662366)
7.	Coffey Mining Pty Ltd. Tailings Storage Audit and management review 2006 tailings storage facilities 2 and 3 Wodgina Operations (MH00079AF-AA rep rev0)	Coffey, 2007	DWER records (A1669980)
8.	Referral decision: Expansion of the Talison Minerals Storage Facility Wodgina Mine, Pilbara Region, WA (EPBC 2008/4775)	EPBC 2008/4675	DWER records (A1669986)
9.	Wodgina queries. Email received 8 May 2018 10:41 AM	Wodgina, May 2018)	DWER records (A1669980)
10.	Wodgina Queries – Round 2. Email received 8 May 2018 7:08 AM.	Wodgina, 8 May 2018	DWER records (A1669984)

11.	Wodgina Queries – Round 3. Email received 9 May 2018 10:39 AM	Wodgina, 9 May 2018	DWER records (A1669986)
12.	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	-	accessed at www.dwer.wa.gov.au
13.	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.	-	
14.	DER, November 2016. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	-	
15.	DER, November 2016. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	-	
16.	Australian Government Bureau of Meteorology climate classification maps accessed 11 April 2018.	BOM, 2018	Accessed at www.bom.gov.au
17.	MBS Environmental. Wodgina Lithium Project Process Streams Geochemical Assessment prepared for Mineral Resources Limited (Amended 14 February 2018).	MBS, 14 February 2018	DWER records (A1620844)
18.	ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 1. National Water Quality Management Strategy.	ANZECC & ARMCANZ, 2000	Available at
19.	Department of Environment (1999) National Environment Protection (Assessment of Site Contamination) Measure 1999	NEPM, 1999	Available at
20.	Golder (2018) Wodgina Lithium Mine – Surface Water Assessment. On behalf of Mineral Resources Ltd	Golder, 2018	DWER records (A1615930)
21.	Mineral Resources Limited (2016) Annual Environmental Report to Department of Environment Regulation 2015/16, submitted 31 October 2016.	MRL, 2016	DWER records (A1173529)

22.	Process Minerals International (2017) Annual Audit Compliance Report & Annual Environmental Report, submitted November 2017.	PMI, 2017	DWER records (A1650830)

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

Condition	Summary of Licence Holder comment	DWER response
Condition 3	Please remove reference to 'Sequencing Batch Reactor' replace with pond or similar.	Removed and replaced with evaporation pond 4. Tailings and decant infrastructure included in Condition 3.
Condition 1, table 2	An underdrainage system connected to a decant will not work as the water head in the underdrainage will be at the bottom of the facility and the decant water head will be at the tailings surface. It is therefore recommended that an underdrainage is not pursued. MRL ask that DWER accept a seepage recovery system comprising a recovery trench and pump sump to be established immediately downstream of the main embankment of TSF3 Expansion instead	DWER notes this request and the requirement to construct an underdrainage system at the base of the facility has been replaced by a seepage recovery system comprising a recovery trench and pump sump immediately downstream of the main embankment of TSF3 Expansion. The requirement to install a flow meter has also been included.
	Mining hoses will be used at stress points intended to fail before the carbon steel pipe. Using specified failure points in conjunction with the flow metering instrumentation to detect leakage and limit discharge volumes, into specified containment areas, will ensure that any failures are contained	Noted, no changes.
	All tailings lines are above ground however not in V-drains. Mining hoses will be used on bends as stress points intended to fail before the carbon steel pipe. Using specified failure points in conjunction with the flow metering instrumentation to detect leakage and limit discharge volumes, into specified containment areas will ensure that failures are contained. Daily inspections of	Further discussions on pipeline controls were held on 16 May 2018. The v-drains are now to be replaced by earthen bund placed on either side of the pipelines. This requirement has been updated in Table 2.

Condition	Summary of Licence Holder comment	DWER response
	pipelines and the segregation of these pipelines from trafficable areas eliminates the need from full length “V” drains along the pipeline alignment. Based on the above, please remove reference to V-drains throughout document	
	Please remove: “All tailings delivery and return water pipelines to be constructed with flow control valves, pressure relief valves, pressure control valves, pressure sustaining valves and pressure reducing valves to enable the pipeline to be isolated and shut down in the event of pipeline failure.” Please remove all occurrences from the entire document. Superseded by point 12 in all cases.	DWER notes this request and has deleted this requirement from Table 2 of the Works Approval.
	Please amend reference to two (2) trains to three (3) trains throughout the document. The process flow diagram shows the flow of one of these trains, of which there will be three upon completion of construction	DWER notes this request and has amended Table 2 of the Works Approval.
Condition 9: Contaminants in tailings	MRL is concerned by the application of highly conservative freshwater aquatic ecosystem/human health drinking water guidelines at source (toe drain) to seepage water that, at this stage, have no identified receptor(s) for aquatic, ecological or human health concerns. In respect of recognised information gaps with respect to, for example, hydrology and groundwater chemistry, an appropriate approach would be gather this information and use it to undertake an environmental risk assessment for the site/tailings. This can be done prior to setting water criteria at source for the tailings seepage as proposed based on guidelines that may not be appropriate for the setting. In this regard, the mining operation’s location within a highly mineralised area already indicates naturally elevated levels of various metals including lithium in soils and rock –	Freshwater criteria has been applied due to the identification of a surface water receptor to the north of the existing TSF3. DWER agrees that information on hydrology and groundwater chemistry is an appropriate approach. This information is not currently available. The criteria specified in Condition 9 is in the absence of site specific values. These values can be amended at such a time that an appropriate site specific trigger value is developed through specified actions in conditions 7 and 8. No changes have been made to condition 9 at this time.

Condition	Summary of Licence Holder comment	DWER response
	the same is expected for any available groundwater at the site. Lithium and fluoride are considered overall to be the potentially key elements of interest in seepage from the tailings: • Fluoride is better understood as an environmental contaminant; however the potential pathway and receptor needs to be established. • Lithium toxicity in the environment is less well understood and requires further review on a site specific basis – MRL notes that despite the site's long history of mining in a naturally mineralised area (elevated lithium and fluoride), there are no indications of any particular detrimental effects on groundwater ecosystems or surface water systems. In addition, management actions to reduce concentrations of species (versus management by removal of pathways) will be limited for most of the species listed. Lithium, for example, is largely soluble and not readily removed. For the reasons outlined above, MRL therefore propose that site specific trigger values be developed for the tailings, noting that the application of the levels as proposed would result in immediate exceedances at commencement of operations. An Ecological Risk Assessment, groundwater monitoring and studies will be undertaken to better inform site specific trigger values for the tailings as noted in correspondence dated 3/4/2018 and as per Specified Action 7. MRL asks that the timeframe for supplying this information is amended to four (4) months rather than three (3) to ensure sufficient time to complete the necessary studies to inform appropriate trigger values for the Wodgina site.	The timeframe to provide processes to reduce contaminants in tailings has been changed to 4 months as requested.

Condition	Summary of Licence Holder comment	DWER response
Condition 11	MRL will produce a plan to improve the facility around a staged lining of the evaporation ponds. MRL will replace the facility, but will however ensure it complies with relevant legislation. Additional sampling completed is attached to show improving results from the surrounding bores in Q4 2017 and Q1 2018 (Attachment 2).	Noted. Condition 11 has been amended to include and/or.

Decision document section	Summary of Licence Holder comment	DWER response
Table 3- Category 54	The current premises production capacity is 210 m^3/day and the premises throughput is also 210 m3/day.	Table 3 of the decision report has been changed.
Table 3 – Category 89	The premises production design capacity is 4,999 tpa	Table 3 of the decision report has been changed.
Spodumene concentrate	The volume of spodumene being produced will be up to 750,000 tpa with each train producing 250,000 tpa.	Section 3.1.1 of the decision report has been updated.
Category 52	The existing power plant is 11MW. The existing power station will be phased out of use and decommissioned in 2019. The timing for this is not known at this time.	Section 52 of the decision report has been updated.
Category 89	The works approval is to cover the construction of a new putrescible landfill trench. The tyre allocation will be dealt with in a licence amendment application.	Table 2 includes construction requirements on the putrescible landfill. There are no construction requirement for the tyre disposal area included in the Works Approval.
Rights in Water and Irrigation Act 1914	GWL154570 (17) Wodgina Lithium Pty Ltd. Covers North and Breccia borefields (annual entitlement 3,150,000 kL) Uses: Dewatering for mining, dust suppression (mining	This information has been included in Table 7 of the decision report.

Decision document section	Summary of Licence Holder comment	DWER response
	and construction), mineral ore processing and mining camp. GWL154596 Wodgina Lithium Pty Ltd Covers Old borefield (annual entitlement 365,000 kL) Uses: Dust suppression, mineral ore processing and mining camp.	
Table 22: Beneficiation Plant	Storage of tantalum and spodumene concentrate will be in a purpose built shed	This information has been included in section 3.1.1 and has also been included in Table 2 of the Works Approval.
9.2.2	The main embankment is 31 of TSF3.	Noted and included in section 9.2.2 of the decision report and the specified action on contaminants in tailings (Condition 9 of the Works Approval).
9.2.3	The wording is different from that of condition 11 on page 16 (the use of and/or here but not previously). Please amend to say and/or at page 16 of the Works Approval.	Condition 11 has been amended to include and/or as below: *Within 3 months of the issue of the Works Approval, the Works Approval Holder must provide to the CEO an improvement plan for the Wastewater Treatment Facility. The improvement plant must include but is not limited to:* *(a) Replacement of the Wastewater Treatment Facility; and/or* *(b) A plan to line all existing evaporation/infiltration ponds.*
10.2.1	Staged commissioning will be undertaken over a ten month period. This will be due to the stage construction. It is expected that each of the three trains will be commissioned over a 5 month period. This will start in September 2018 and conclude in June 2019.	Commissioning is not authorised under the Works Approval. Commissioning will only be authorised upon receipt of a commissioning plan.

Attachment 1: Issued Works Approval W6132/2018/1