Decision Report

Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Works Approval Number	W6127/2018/1
Applicant	Rosslyn Hill Mining Pty Ltd
ACN	075 523 661
File Number	DER2018/000215
Premises	Paroo Station Mine Mining tenements M53/502, M53/503, M53/504, M53/1002
Date of Report	30 November 2018
Status of Report	Final

Table of Contents

1. Definitions of terms and acronyms

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

Table 1: Definitions

Term	Definition
AACR	Annual Audit Compliance Report
ACN	Australian Company Number
AER	Annual Environment Report
Applicant	Rosslyn Hill Mining Pty Ltd
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CCDs	Counter-current decant thickeners
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.
DeS (also DES)	Desulphurisation
Development Envelope	An area of land marked on a plan, in which land disturbance for a proposal under application of Part IV of the EP Act, is assessed by the EPA (WA).
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)
EW	Electrowinning
Existing Licence	The Licence issued under Part V, Division 3 of the EP Act and in force (L8493/2010/2)
IWL	Integrated Waste Landform
Licence Holder	Rosslyn Hill Mining Pty Ltd
m^3	cubic metres
Minister	the Minister responsible for the EP Act and associated regulations
MS	Ministerial Statement
MSA	Methanesulphonic acid
mtpa	million tonnes per annum
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.
OHS	Occupational health and safety
Pb	Lead
PE	Polyethylene
PM	Particulate Matter
PM_{10}	used to describe particulate matter that is smaller than 10 microns (µm) in diameter
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 Works Approval
RHM	Rosslyn Hill Mining
Risk Event	As described in *Guidance Statement: Risk Assessment*
tpa	tonnes per annum

UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
µg/m^3	micrograms per cubic metre
µg/L	micrograms per litre
UV	ultraviolet

2. Purpose and scope of assessment

Rosslyn Hill Mining Pty Ltd operates the Paroo Station lead carbonate mine and concentrator, approximately 34 km west of Wiluna. Rosslyn Hill Mining Pty Ltd is the Licence Holder of L8493/2010/2, authorised to conduct ore processing works, sewage treatment facility and a putrescible landfill, prescribed as categories 5, 85 and 89 respectively, according to Schedule 1 of the *Environmental Protection Regulations 1987*. Licence L8493/2010/2 is issued under Part V of the *Environmental Protection Act 1986* (EP Act).

On 31 January 2018 Rosslyn Hill Mining applied for a works approval to construct a lead hydrometallurgical facility, in order to upgrade the lead carbonate concentrate currently produced at the Premises to a lead ingot (final product) at a rate of 70 000 tpa. The application also seeks approval to make upgrades to the existing lead concentrator circuit and to install a gas fired power station.

The proposal to construct and operate a lead hydrometallurgical facility, in addition to further expansion of the mining area and tailings storage facility, was referred for assessment under Part IV of the EP Act. The proposal was approved by the Minister for Environment on 25 September 2018, as per Ministerial Statement 1083. Consequently, this Decision Report assesses the Works Approval application with consideration of Ministerial Statement 1083 and the accompanying EPA Report 1620, in accord with section 54(4)(b) of the EP Act.

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
Rosslyn Hill (2018) *DWER Works Approval Hydrometallurgical Facility Supplementary Information*, January 2018	31 January 2018
Strategen (2018) *Rosslyn Hill Mining Pty Ltd Paroo Station Lead Project Hydrometallurgical Facility and Mine Extension Proposal Environmental Review,* January 2018	31 January 2018
Email from B Corry, RHM, to DWER, Re: Works Approval application queries – Paroo Station Lead Hydrometallurgical Facility, sent 20 September 2018 11:57 AM	20 September 2018

3. Background

Table 3 lists the prescribed premises categories that have been applied for.

Table 3: Prescribed Premises Categories

Classification of Premises	Description	*Existing approved Premises production capacity*	*New production capacity applied for*
Category 5	Processing or beneficiation of metallic or non-metallic ore: premises on which — (a) metallic or non-metallic ore is crushed, ground, milled or otherwise processed; or	1.7 Mtpa	2.5 Mpta

	(b) tailings from metallic or non-metallic ore are reprocessed; or (c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam.		
Category 44	Metal smelting or refining: premises on which metal ore, metal ore concentrate or metal waste is smelted, fused, roasted, refined or processed	-	70 000 tpa

4. Overview of Premises

4.1 Operational aspects

The Paroo Station Mine (formerly known as Magellan Metals) currently produces a lead carbonate concentrate of approximately 65 – 70% lead concentration. The mine has been in a period of care and maintenance since 2015, as a result of a depressed lead market.

A new hydrometallurgical process as shown in the following figures (Figures 2 -4) has been developed to upgrade the lead carbonate concentrate to a final product lead ingot. The process uses methanesulphonic acid (MSA) as its leaching reagent to recover lead from the lead carbonate, with the process also removing impurities prior to producing a lead electrolyte. The lead is then plated into cathodes from the electrolyte (lead electrowinning) and finally cast into ingots. The hydromet plant has a design capacity of 80 000 tpa and a nominal capacity of 70 000 tpa.

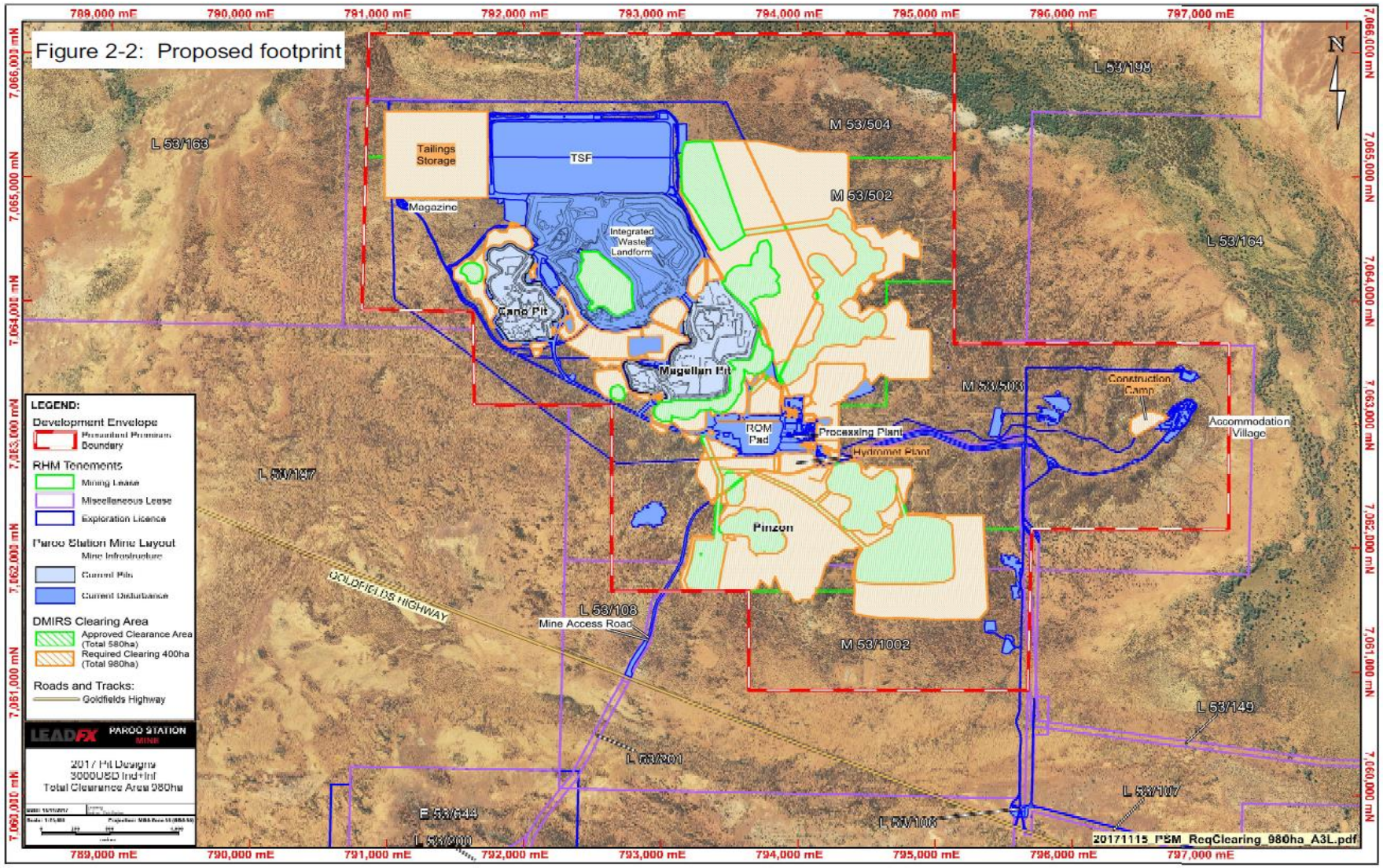

Figure 1: Rosslyn Hill Proposal, showing location of Hydromet Plant and the Prescribed Premises Boundary (Strategen 2018)

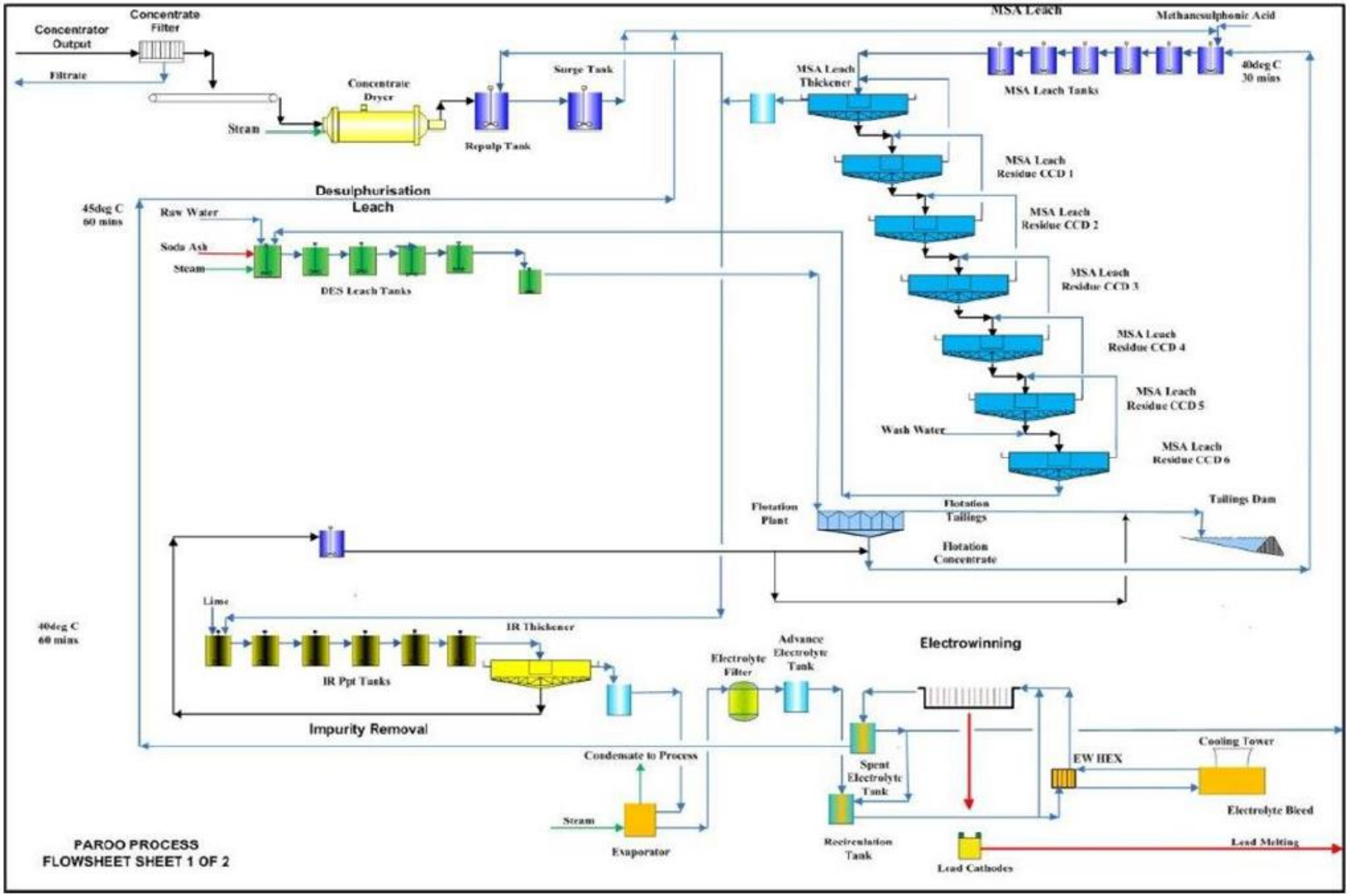

Figure 2: Hydrometallurgical facility flowsheet (1 of 2)

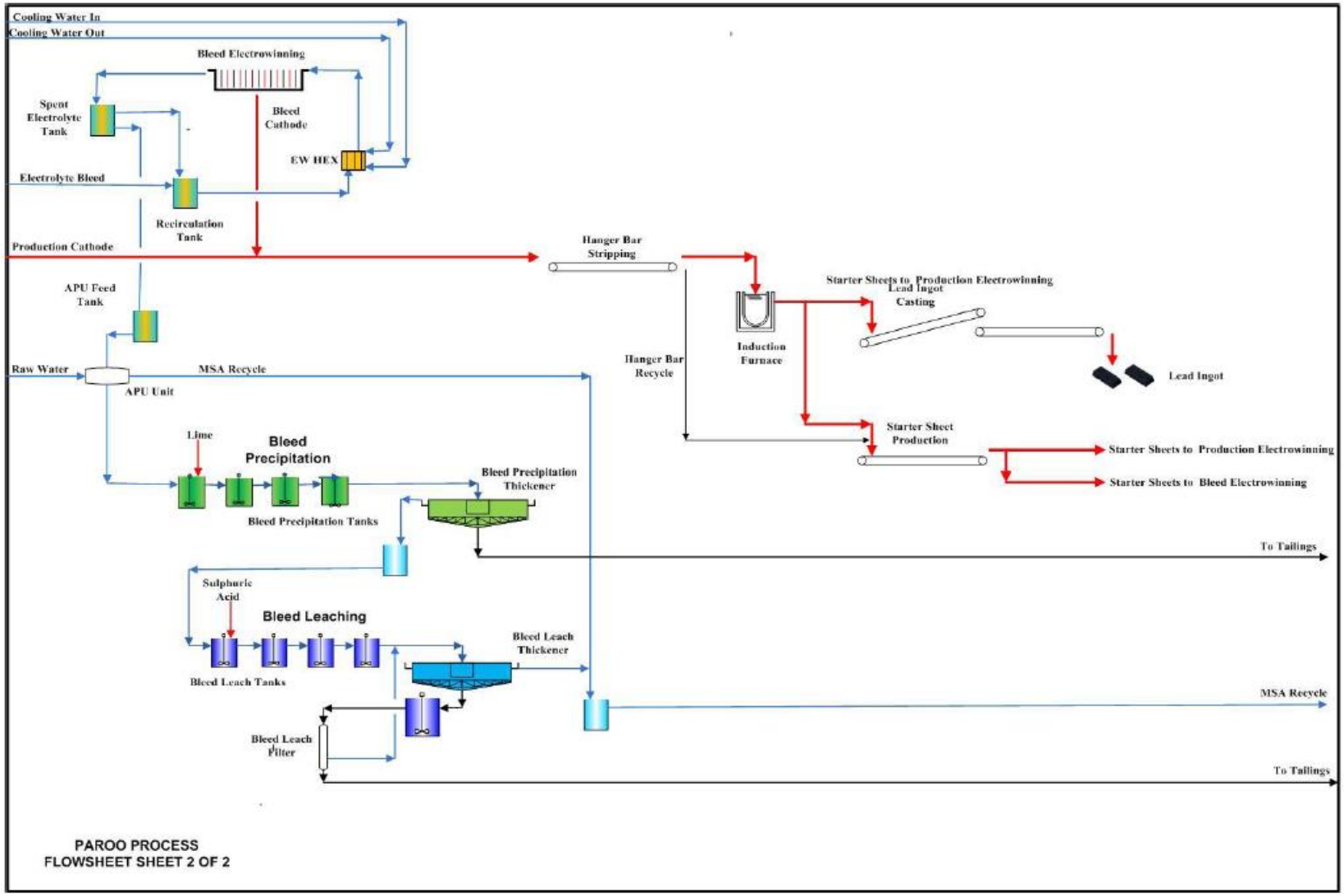

Figure 3: Hydrometallurgical Facility Flowsheet (2 of 2)

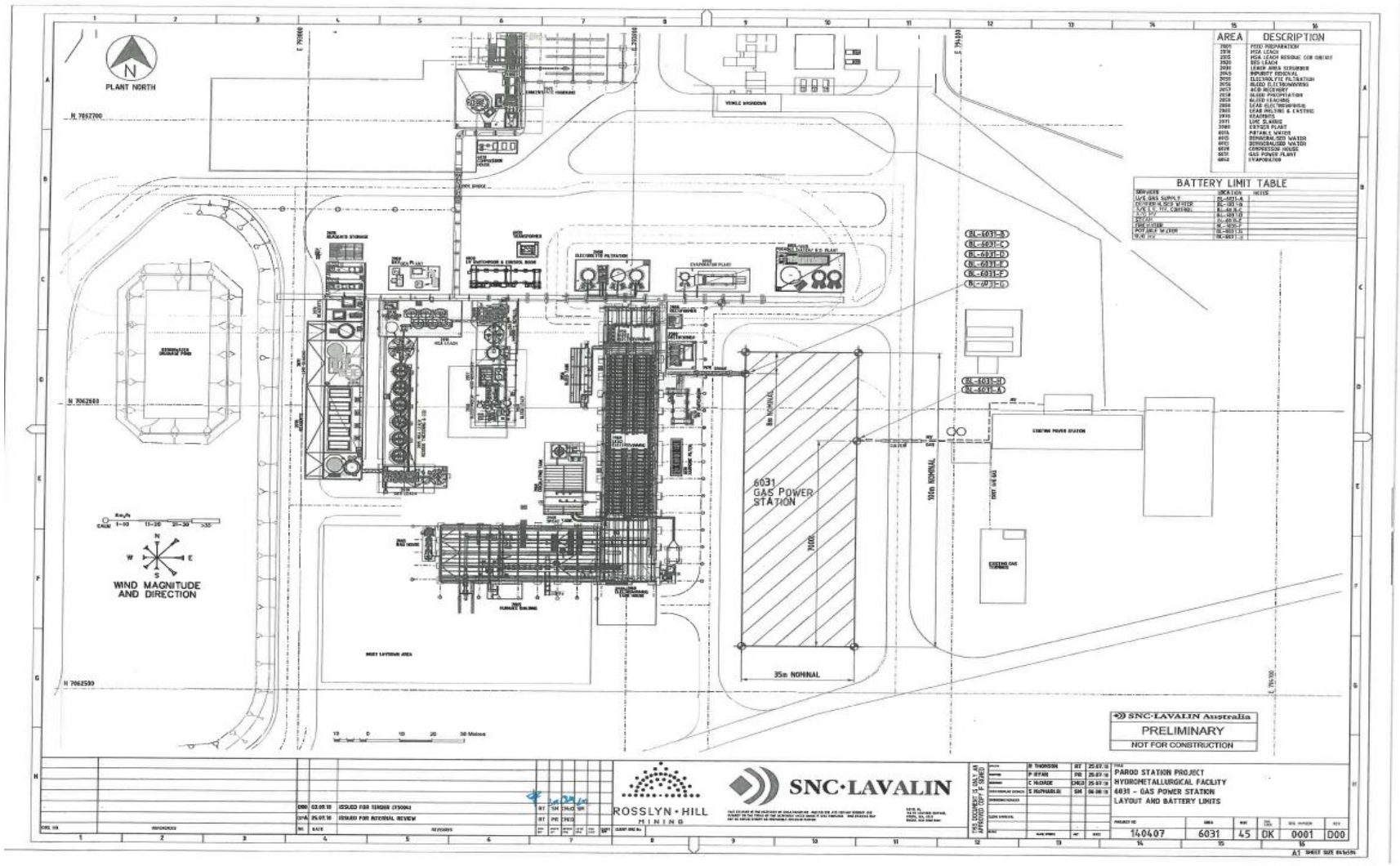

Figure 4: Hydrometallurgical Facility and Gas Power Station Site Layout

4.2 Infrastructure

The proposed Paroo Station Mine hydrometallurgical plant and associated infrastructure, as it relates to Category 5, and 44 activities, is detailed in Table 4 and with reference to the Site Plan (included previously as Figure 4; also attached in the Issued Works Approval).

Table 4 lists infrastructure associated with each prescribed premises category.

Table 4: Paroo Station Mine Category 5 and 44 infrastructure

	Area/ Activity	Infrastructure
	Prescribed Activity Category 5	
Processing of lead carbonate ore to produce a lead carbonate concentrate using milling and flotation.		
1	Upgrades to the milling circuit	Install a pebble crusher
2	Upgrades to existing flotation circuit	Remove the process cyclones and replace with sieves. Add two stage modification ahead of rougher flotation: • pH conditioning with sulphuric acid fed from the Hydromet plant; and • lime addition Cleaning circuit modifications Column flotation for slimes rejection
3	Concentrate thickening	Replace existing thickener/clarifier with new thickener
4	Concentrate storage	Reclaim system installed within existing concentrate storage shed plus concentrate storage capacity Surge tank capacity within the Hydrometallurgical Facility
	Prescribed Activity Category 44	
Processing of lead carbonate ore concentrate to produce a lead ingot via a hydrometallurgical plant including an acid leach and electrowinning refining.		
1	Concentrate (feed) preparation	Concentrate feeder storage tank Concentrate filter Concentrate dryer; dryer emissions treated in a two stage caustic pack bed scrubber, operating at 99% efficiency Concentrate repulp tank
2	Leaching and solids/liquid separation	MSA (Methanesulphonic acid) leach and CCDs (counter current decant thickeners): Six covered atmospheric MSA leach tanks sited within containment concrete bunding with polyurethane surface – capacity of 110% of the largest vessel within the compound. Fugitive carbon dioxide from leach tanks vented to vacuum de-aeration tower and scrubber. Six CCD thickeners with MSA leach residue feed tanks sited within containment concrete bunding with polyurethane surface – capacity of 110% of the largest vessel within the compound. Acid leach treating washed MSA leach residue with sulphuric acid – capacity of 110% of the largest vessel in the compound. DeS (Desulphurisation) leach: DeS repulp tank and four leach tanks with sodium

	Area/ Activity	Infrastructure
		carbonate addition. Sited within containment concrete bunding with polyurethane surface – capacity of 110% of the largest vessel within the compound. Offgas emissions from all leach circuits treated via the leach vent wet caustic scrubber with the scrubber bleed recirculated to the DeS repulp tank.
3	Impurity removal and electrolyte preparation	Impurity removal: Four atmospheric precipitation tanks and impurity removal thickener to neutralise and precipitate iron and aluminium from solution. Containment concrete bunding with polyurethane surface – capacity of 110% of the largest vessel within the compound. Oxygen Plant producing approximately 2 tonnes/hr Electrolyte filtration: Filtration
4	Lead electrowinning	Lead electrowinning tankhouse: Process filtered electrolyte into lead cathodes. Each cell fitted with 45 lead cathodes and 46 anodes. One electrical circuit powered by one 34 500 Ampere transformer-rectifier. Cathodes transferred via crane and conveyor to cathode handling line and then sent via conveyor to the furnace. EW cells fitted with brushes to suppress acid mist. Tank compound bunded with concrete with polyurethane surface – capacity of 110% of the largest vessel within the compound. Spent electrolyte directed to plate heat exchanger.
5	Bleed treatment	Remove impurities from spent electrolyte and regenerate MSA for reuse. Bleed electrowinning: Remove trace lead from spent electrolyte (bleed solution) via three tanks and 10 EW cells tankhouse. Containment concrete bunding for tanks compound with polyurethane surface – capacity of 110% of the largest vessel within the compound. Acid purification: Bleed solution is filtered, acid treated by ion exchange to regenerate to recovered MSA tank. By-product stream of metallic salts and small amount of MSA fed to bleed precipitation. Containment concrete bunding for tanks compound with polyurethane surface – capacity of 110% of the largest vessel within the compound. Bleed precipitation: Lime addition to precipitate metal hydroxides and soluble calcium methanesulphonates. Four atmospheric leach tanks and precipitation thickener, filtration, with filter cake sent to tailings. Containment concrete bunding for tanks compound with polyurethane surface – capacity of 110% of the largest vessel within the compound. Bleed treatment - leaching: Precip liquor (with calcium methanesulphonates) reacted with sulphuric acid to precipitate gypsum and regenerate MSA. Strontium is also precipitated. Filtered with solids sent to tailings and liquor recycled to MSA leach.
6	Lead melting, casting and load-out	One tonne lead induction furnace with a 600kW induction power unit. Cooling system. Molten lead is fed via heated launder to the star feeder at the start of the casting line. Lead is then poured into lead ingot moulds. Ingots transported via conveyor and released onto another conveyor to the stacking robot. Ingots stacked and strapped, stored ready for transport offsite. Lead starter sheets are also cast from the molten lead into the cathode mould with a copper hanger bar. Stacked for use in the lead refinery.
	Directly related activities	
Electric power generation using gas generators		

	Area/ Activity	Infrastructure
1	New power station installation	Gas generators (9 * 2MW units) 18 vent stacks to air (2 per generator)
Storage of reagents required for the hydromet plant		
2	Reagents storage and handling - Hydromet	- MSA (methanesulphonic acid) - Sodium carbonate - Lime - Flocculant 1 (25kg bags dosed into the small bin to the flocculant mixing tank) - Flocculant 2 (25kg bags dosed into the small bin to the flocculant mixing tank) - EW50 (polyacrylamide flocculant) - Orthophosphoric acid - Aloes - Sulphuric acid - Sodium hydroxide Total volume of approximately 660m^3.

4.3 Exclusions to the Premises

This assessment relates to the activities subject to the Part V Works Approval Application which concerns the following:

- Lead hydrometallurgical plant;
- Gas fired power station;
- Upgrades to the existing lead carbonate concentrator plant; and
- Associated reagent storage and handling facilities.

Other aspects of the Part IV proposal concerning expansion of mining areas and the tailings storage facility are not within the scope of this Works Approval application. Further, mining activities of metallic and non-metallic ores are not prescribed activities under Part V of the *Environmental Protection Act 1986*.

The occupational health and safety of workers at the Premises is addressed by the *Mines Safety and Inspection Act 1994* and associated regulations, regulated by the Department of Mines, Industry Regulation and Safety. Exposures of emissions to workers from the hydromet plant or concentrator are regulated via that legislation. This works approval considers impacts resulting from exposure to emissions to the environment (that is to fauna, flora, soils and to the public).

5. Legislative context

Table 5 summarises approvals relevant to the assessment.

Table 5: Relevant approvals and tenure

Legislation	Number	Subsidiary	Approval
Dangerous Goods Safety Act 2004	Dangerous Goods Licence DGS020079	Rosslyn Hill Mining Pty Ltd	Storage of reagents and other related chemicals

Legislation	Number	Subsidiary	Approval
Part IV of the EP Act (WA)	Statement Number MS1083	Rosslyn Hill Mining Pty Ltd	Development envelope of 2094 ha with an approved area of disturbance of 980 ha. Includes approval of a hydrometallurgical plant to process lead carbonate concentrate into a lead ingot to a capacity of 70 000 tpa.
Part V of the EP Act (WA)	L8493/2010/2	Rosslyn Hill Mining Pty Ltd	Licence to process 1.7Mtpa of lead carbonate ore, operate a 35m^3/day sewage treatment facility and operate a 250 tpa capacity putrescible landfill (categories 5, 85, 89 respectively). Tailings authorised to be discharged to TSF Cell 1, TSF Cell 2 or the Integrated Waste Landform (IWL).

5.1 Part IV of the EP Act

5.1.1 Background

Rosslyn Hill referred the activities subject to this Part V application as part of a larger proposal to be assessed under Part IV. The EPA set the level of assessment as 'Assessment on Referral Information' as of 4 April 2018. The EPA has since published EPA Report 1620 recommending approval of the project by the Minister for Environment. The Minister approved the proposal on 25 September 2018, via Ministerial Statement 1083 (MS1083).

5.1.2 Ministerial Statement 1083 and EPA Report 1620

Rosslyn Hill previously operated in accord with Ministerial Statement 905 and Ministerial Statement 1042. These statements are now replaced by Ministerial Statement 1083, dated 25 September 2018.

Operational elements approved by MS 1083 (key proposal characteristics) include a hydrometallurgical facility to extract metallic lead from lead carbonate ore concentrate to an authorised extent of 70 000 tpa.

No conditions issued under MS1083 pertain to the construction or operation of the lead hydromet plant specifically. EPA Report 1620 considered that air quality was an environmental factor for their assessment of the lead hydromet plant and the expanded development envelope. The EPA noted that there were no sensitive receptors (public) located near the Premises. The EPA also noted that the most likely group to be exposed to any potential emissions would be the workforce In their summary, the EPA considered that any potential emissions from the hydromet plant could be regulated through the Part V works approval and licence, rather than as a condition under Part IV of the EP Act.

5.2 Contaminated Sites Act

On 16 March 2018, the Premises (comprising Mining tenements M53/502, M53/503 and M53/504) was classified under the *Contaminated Sites Act 2003* as 'possibly contaminated – investigation required', due to potential sources of contamination associated with lead mining and processing. Potential sources and activities of concern include mining pits, beneficiation plant, concentrate drying pad, tailings storage facility, sewage ponds, workshops and a surface water management dam and associated sedimentation pond.

5.3 Part V of the EP Act

5.3.1 Applicable regulations, standards and guidelines

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

The guidance statements which inform this assessment are:

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessments (February 2017)*

5.3.2 Works approval and licence history

Table 6 summarises the works approval and licence history for the premises.

Table 6: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
W3918/2004/1	29/03/2004	Works approval for category 05
L7982/2004/2	07/02/2005	Licence issued
L7982/2004/2	24/06/2005	Licence amendment to increase throughput of category 5 from 1.2 Mtpa to 1.7 Mtpa
L7982/2004/3	07/08/2005	Licence reissue
L7982/2004/4	08/08/2007	Licence reissue
L7982/2004/5	09/10/2008	Licence reissue
L8493/2010/1	29/11/2010	Licence reissue
L8493/2010/1	24/10/2013	Licence amendment, including conversion to REFIRE format, to change the Licensee and premise names and update licence conditions to correct inaccuracies related to monitoring.
L8493/2010/2	28/11/2013	Licence reissue
L8493/2010/2	15/08/2014	Licence amendment to increase frequency of groundwater monitoring and authorise re-routing of a tailings pipeline.
L8493/2010/2	14/02/2017	Licence amendment to authorise construction and operation of the Integrated Waste Landform (IWL). Authorisation to accept product (lead carbonate concentrate) waste in the event of a spill during transport to the port. Administrative changes made by DER.
W6127/2018/1	30/11/2018	Works approval to authorise construction of the lead hydromet facility, upgrades to the existing lead carbonate concentrator, additional gas fired power station and

		ancillary infrastructure.

5.3.3 Key and recent licence amendments

On 14 February 2017, Licence L8493/2010/2 was amended to authorise the construction and operation of the Integrated Waste Landform (IWL), an above ground, combined waste rock and tailings storage facility.

5.3.4 Compliance inspections and compliance history

As of 1 February 2015, the Premises has been in a period of care and maintenance and no processing has occurred.

The works associated with constructing the IWL (subject of the most recent amendment to L8493/2010/2, refer Table 6 above) have not yet commenced. Once these works are completed, construction compliance documents will be required to be submitted.

5.3.5 Clearing

Clearing associated with this application is approved via Ministerial Statement 1083.

6. Location and siting

6.1 Siting context

The Paroo Station Mine is located on mining tenements over pastoral lease, Paroo Station. The Premises are located approximately 3km north of the Wiluna - Meekatharra Road, approximately 34 km west of Wiluna township. Wiluna is a remote town in the north-eastern Goldfields with an approximate population of 200 people.

Dominant industries in the local area are cattle grazing and mining.

6.2 Residential and sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 7.

Table 7: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Town of Wiluna	34 km to the east of the Premises

6.3 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at or Emissions and Discharges from the Premises. The distances to specified ecosystems are shown in Table 8. Table 8 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 8: Environmental values

Specified ecosystems	Distance from the Premises
Ramsar Sites in Western Australia	No Ramsar sites within 200km radius
Important wetlands – Western Australia	Lake Annean, 160km to the west south west

Department of Biodiversity, Conservation and Attractions Managed Lands and Waters	None within 200km radius
Threatened Ecological Communities and Priority Ecological Communities	Millbilillie Bubble Well Calcrete (P1) PEC: buffer zone intersects with the southern boundary of the Prescribed Premises for L8493/2010/2.
Biological component	**Distance from the Premises**
Threatened/Priority Flora	Nine priority flora species recorded within the Development Envelope (wider area including the Hydromet Plant) as per MS 1083). The species were located at the southern and eastern boundaries of the Prescribed Premises boundary – away from the Hydromet Plant. Three species will be impacted by clearing approved under MS1083, *Homalocalx echinulatus*, *Indigofera gilesii* and *Thryptomene* sp. *Leinster*.
Threatened/Priority Fauna	Fauna surveys have recorded the following species within the Development Envelope (wider area including the Hydromet Plant) as per MS 1083: *Dasycercus blythi* (Brush-tailed Mulgara) *Falco peregrinus* (Peregrine Falcon) *Smithopsis longicaudata* (Long Tailed Dunnart)
Other relevant ecosystem values	**Distance from the Premises**
Floodplain vegetation	Creek system located to the north and east of the Prescribed Premises (small section intersecting with the northern boundary).

6.4 Groundwater and water sources

The distances to groundwater and water sources are shown in Table 9.

Table 9: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
Public drinking water source areas - P1 Wiluna Water Reserve	34 km to the east south east	N/A as remote from Premises
Major watercourses	No major watercourses, creek system as detailed in Table 8 above.	N/A
Groundwater	Shallow groundwater aquifer located immediately under the TSF (due to groundwater mounding from seepage). A palaeochannel groundwater system underlies the creek which travels to the north and east of the Premises (refer Figure 5 below for the location of the creek system). Groundwater flow is radial from Magellan Hill (approximately located at the centre of the mining area) out towards the surrounding valleys and creek system. The surficial aquifer is also subject to variances in groundwater levels due to rainfall recharge	Groundwater available for livestock use

	(Pennington Scott 2014).	

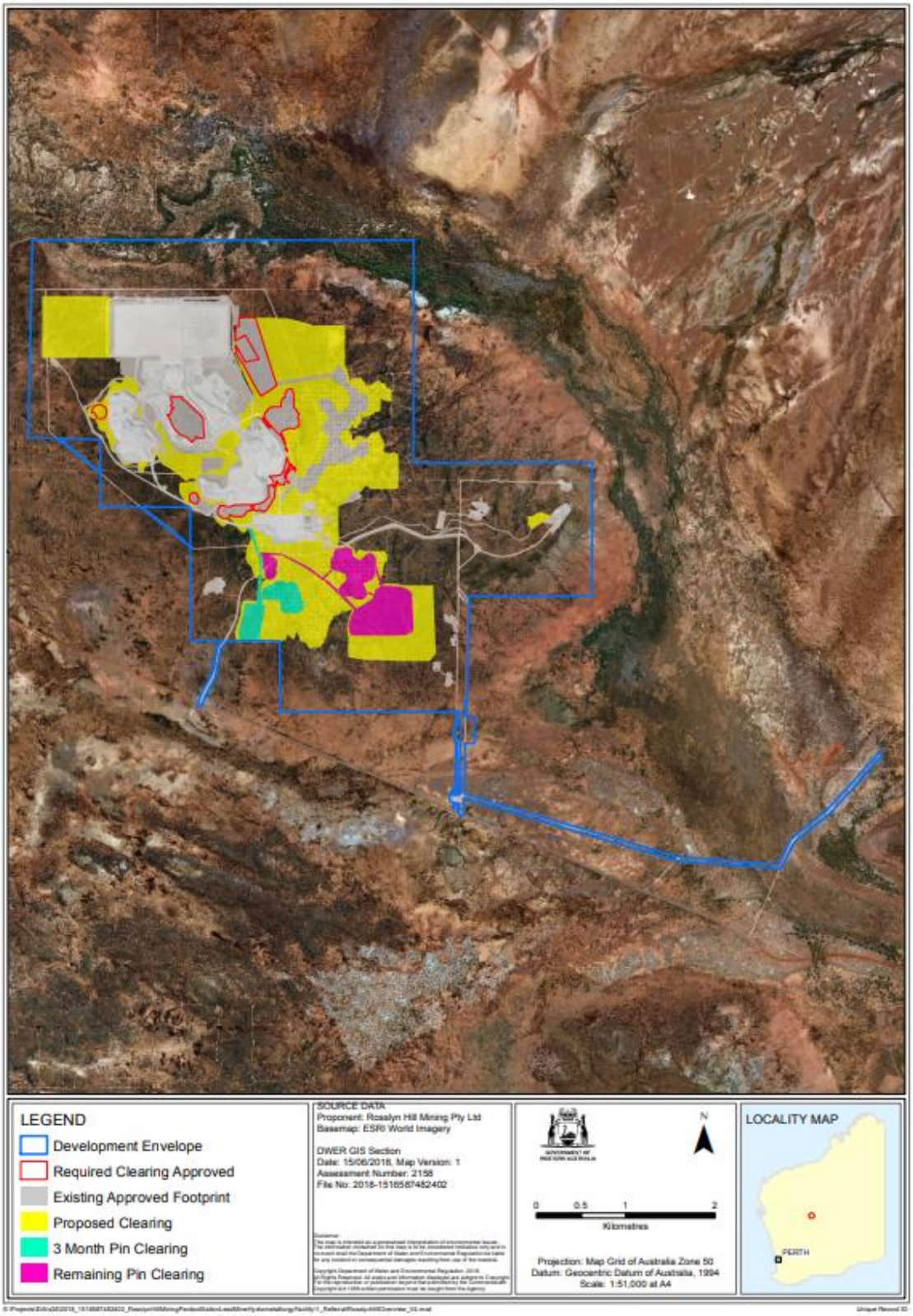

Figure 5: Rosslyn Hill Hydrometallurgical Facility and Mine Expansion Development Envelope assessed by EPA (EPA 2018)

7. Modelling and monitoring data

7.1 Modelling of emissions to air

The data below in Table 10 describes the forecast emissions to air from the lead hydromet plant operating at a capacity sufficient to produce 70 000 tpa lead. This data is derived from a Metsim process model, with data inputs from pilot plant testwork conducted on a 20 tonne ore sample (RHM 2018a).

Table 10: Hydromet plant forecast emissions to air

Location	Rate	Composition	Control	Expected discharge point
Concentrate drying	1 980 m^3/h (Pb ~0.42mg/m^3)	Moist air, low level aerosol containing Pb compounds (7.2 kg pa), low levels of odorous sulphides from decomposition of SIBX. Low levels of alkyl alcohols, cyclohexanol, polyglycols and caprylic acid from volatilisation of residual frother on concentrate	Two stage packed bed wet (caustic) scrubber	Scrubber stack at ~10 m height from ground
MSA and DES leach (DES off-gases vented to MSA scrubber)	1 750 m^3/h (Pb ~0.26mg/m^3)	Moist air, CO_2 and low levels of aerosols containing Pb compounds (4.0 kg pa) and MSA (<1 kg pa)	Packed bed wet (caustic) scrubber	Scrubber stack at ~10 m height from ground
Lead electrowinning (tankhouse off-gases)	520 m^3/h (Pb ~1-2 $\mu g/m^3$)	Moist air, low levels of aerosols containing Pb compounds (1.9 kg pa) and MSA (3.6 kg pa)	Brushes	Tankhouse ventilation
Impurity removal (evaporation from reactors)	0.5 t/h	Water vapour	Not required	To atmosphere
Lead melting (off-gases from induction furnace)	5 000 m^3/h (Pb ~0.0045 mg/m^3)	Dry air, low levels of particulates containing Pb oxide and metal (0.2 kg pa)	Cyclone and baghouse, with baghouse discharge recycled to process	Baghouse discharge to atmosphere (via cyclone and baghouse stack)

7.2 Forecast hydromet tailings chemistry

A bleed stream (tails stream) from the hydrometallurgical process will be pumped to the flotation thickener and mixed with the flotation tailings for eventual deposition into the current approved Tailings Storage Facility, the Integrated Waste Landform. Based on the pilot plant testwork performed on a 20 tonne ore sample, the chemical composition of the forecast hydromet tailings was compared to the expected flotation tailings chemical composition. The only variance in chemistry was recorded for arsenic, chromium, lead and sulphur (see values in red below).

The values for these elements from the hydromet tailings were then also compared to the lead concentrator tailings previously tested in the USEPA LEAF test 1314 in 2015/6 (for expected leachates under a range of solids: liquids ratios; expected to mimic the range of drying and

wetting cycles possible at the Premises) (Golder 2016). The values for arsenic, chromium, lead and sulphur in hydromet tailings were within the range of concentrations of the previous tailings samples tested in 2015.

Table 11: Chemical comparison of hydromet tailings sample and flotation (concentrator) tailings sample (RHM 2018a)

Flotation Tailings Flowrate	168.2	t/h
pH	8.5	

Composite	Ag(ppm)	Al2O3(%)	As(ppm)	Ba(ppm)	Be(ppm)	Bi(ppm)	C(%)	C org(%)	Ca(ppm)	Cd(ppm)	Co(ppm)
Hydromet Tailings											
Average	4965	14.6	52.4	363	BLD	10.0	BLD	BLD	704	BLD	50.4
Minimum	4965	14.6	49.7	359	BLD	10.0	BLD	BLD	695	BLD	50.2
Maximum	4965	14.6	61.4	366	BLD	10.0	BLD	BLD	712	BLD	50.8
Flotation Tailings	5000	14.60	50.00	358	BLD	10	BLD	BLD	700	BLD	50.0
Minimum variance %	99.3	99.9	99.4	100.3	BLD	100.0	BLD	BLD	99.3	BLD	100.4
Maximum variance %	99.3	100.1	123	102.2	BLD	100.0	BLD	BLD	101.7	BLD	101.5

Composite	Cr(ppm)	Cu(ppm)	Fe(%)	Hg(ppm)	K(%)	Li(ppm)	Mg(ppm)	Mn(ppm)	Mo(ppm)	Na(ppm)	Ni(ppm)
Hydromet Tailings											
Average	54.3	204	6.17	NA	2.96	NA	2155	399	NA	NA	53.0
Minimum	50.8	202	6.15	NA	2.95	NA	2151	398	NA	NA	51.1
Maximum	60.9	206	6.20	NA	2.97	NA	2153	402	NA	NA	56.3
Flotation Tailings	60.0	200	6.17	NA	2.96	NA	2123	400	NA	NA	50.0
Minimum variance %	102	101.2	99.7	NA	99.7	NA	101.3	99.6	NA	NA	102
Maximum variance %	122	102.8	100.5	NA	100.3	NA	101.4	100.4	NA	NA	113

Composite	P(ppm)	Pb(%)	S(%)	S-2(%)	Sb(ppm)	SiO2(%)	Sr(ppm)	Ti(ppm)	V(ppm)	Y(ppm)	Zn(ppm)
Hydromet Tailings											
Average	572	0.990	0.062	NA	49.7	63.0	20.5	4103	121	<100	400.4
Minimum	567	0.944	0.052	NA	49.7	62.9	20.1	4081	120	<100	398.8
Maximum	579	1.110	0.081	NA	49.8	63.1	21.5	4136	123	<100	401.6
Flotation Tailings	567	0.930	0.050	NA	50	63.1	20.0	4100	120	BLD	400
Minimum variance %	99.9	101.5	103.2	NA	99.3	99.7	100.4	99.5	100.0	BLD	99.7
Maximum variance %	102.0	119	161.5	NA	99.6	100.0	107.6	100.9	102.6	BLD	100.4

Note BLD = Below Level of Detection
NA = Not Available

8. Consultation

Extensive public and stakeholder consultation has been completed with regard to the proposal submitted for assessment under Part IV and approved by Ministerial Statement 1083. For detail on the consultation process please refer to the proponent information submitted as part of the EPA's assessment, available at www.epa.wa.gov.au.

The draft Decision Report and Works Approval were provided to the Applicant for comment on 2 November 2018.

9. Risk assessment

9.1 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 13.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Tables 12 and 13 below.

Table 12. 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**		
Construction, mobilisation and positioning of infrastructure	Construction of new buildings, plant and infrastructure	Noise	No adjacent receptors	Air / wind dispersion	Amenity impacts	No	No receptors present.
		Dust including lead and other metal(loids)	Rosslyn Hill accommodation camp (3km away). Adjacent soils and native vegetation. Resident and vagrant fauna within the Development Envelope (as defined by MS1083) and immediate adjacent area		Adverse impacts to vegetation health Trace lead exposure for fauna Site contamination	Yes	Potential for disturbance of dust including lead and other metal(loids) Refer to section 9.4 for the risk assessment.

Table 13: 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		
Operation of the upgraded Concentrator	pH modification of the rougher circuit with sulphuric acid and lime addition	Acidic/ alkaline, lead processing slurries	Soil and groundwater	Release from bunding; pipeline failures within the plant outside of bunded compounds	Soil and groundwater contamination	Yes	Alteration of the pipework and processing liquors in this part of the concentrator requires review to ensure adequate provision of containment of processing liquors. Refer to section 9.5 for the risk assessment.
Operation of the Lead Hydromet Plant	Hydromet Bleed (Hydromet Tailings)	Tailings seepage	Groundwater and adjacent groundwater dependent vegetation	Direct through the base of the active Tailings Storage Facility to soil and shallow groundwater aquifer	Groundwater mounding and contamination	No	Negligible impact compared to the existing concentrate tailings. No significant change in the chemistry of the tailings such that it would change the chemical composition of the existing assessed concentrate tailings (refer Section 7.2 previously). The volume of the bleed stream is also not significant when compared to the existing concentrator tailings flow (17 000 tpa versus 1.6 Mtpa). Previous USEPA LEAF 1314 leachate testing of lead concentrator tailings indicated that the leachate from the concentrate tailings did not result in mobilisation of lead or other metals at any significant concentrations (Golder 2016).

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	MSA leach, DES leach, impurity removal, lead electrowinning, bleed treatment	Acidic, lead processing liquors/slurries (leach liquors, lead electrolyte)	Soil and groundwater	Release from bunding (eg due to poor process control or an extreme rainfall event or poor bunding maintenance). Pipeline failures within the plant outside of bunded compounds.	Soil and groundwater contamination	Yes	Spillage of process liquors onto ground may result in localised soil and/or groundwater contamination. Refer to section 9.6 for the relevant risk assessment.
	Concentrate drying, MSA leach, DES leach, lead electrowinning	Lead aerosols Acidic aerosols	Rosslyn Hill accommodation camp (3km away). Adjacent soils and native vegetation. Resident and vagrant fauna within the Development Envelope (as defined by MS1083) and immediate adjacent area.	Discharge to air via pollution control equipment	Health impacts to staff at the accommodation camp Site contamination with lead; adverse growth of native vegetation (acute and/or chronic impacts) Ecotoxic impacts to adjacent fauna, particularly birds (acute and/or chronic impacts)	Yes	Lead emissions and acidic aerosols released to air have the potential to adversely impact on adjacent vegetation and fauna. Deposition of additional lead and metal(loid) particulate over time may in result in uptake by plants and invertebrates and transfer to fauna higher in the food chain. Increased lead deposition may also increase soil contamination. Refer to section 9.7 for the relevant risk assessment. Accommodation camp not considered a receptor for the purposes of this assessment as covered by OHS legislation.

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Lead Melting	Particulates with trace lead concentrations	Rosslyn Hill accommodation camp (3km away). Adjacent soils and native vegetation. Resident and vagrant fauna within the Development Envelope (as defined by MS1083) and immediate adjacent area	Discharge to air via pollution control equipment (baghouse)	Health impacts to staff at the accommodation camp from lead particulates Site contamination with lead; adverse growth of native vegetation (acute and/or chronic impacts) Ecotoxic impacts to adjacent fauna, particularly birds from lead exposure (acute and/or chronic impacts) Poor local air quality	Yes	Lead emissions released to air have the potential to adversely impact on adjacent vegetation and fauna. Deposition of additional lead particulate over time may in result in uptake by plants and invertebrates and transfer to fauna higher in the food chain. Increased lead deposition may also increase soil contamination. Refer to section 9.8 for the relevant risk assessment. Accommodation camp not considered a receptor for the purposes of this assessment as covered by OHS legislation.
Operation of gas fired power station	Operation of 9 x 2MW gas generators	Gas combustion products (carbon monoxide, nitrous oxides, volatile organic compounds)	Rosslyn Hill accommodation camp (3km away).	Off-gases released via stacks to air	Poor local air quality	No	Further advice received 20/9/18 from RHM advised that 9 x 2 MW gas generator units were to be installed and not 10 as originally applied for. This results in a total of 18MW generation capacity, below the category 52 threshold.
Bulk storage of chemicals	Bulk chemical and fuel storage (including acids, flocculants, caustic)	Breach of containment causing discharge to land	Soil and groundwater	Direct discharge	Mobilisation of contaminants through soil resulting in groundwater contamination; potential impact on groundwater dependent vegetation.	No	Regulated under the *Dangerous Goods Act 2004* and Premises' Dangerous Goods Licence.

9.2 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 14 below.

Table 14: 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 15 below.

Table 15: 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.

9.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment table 16 below:

Table 16: 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.

9.4 Risk Assessment – Fugitive dust emissions during construction

9.4.1 Description of fugitive dust emissions during construction

Earthmoving activities associated with civil works for the upgraded concentrator, hydromet plant and gas power station installation resulting in poor local air quality and increased lead deposition to soils and adjacent native vegetation.

9.4.2 Identification and general characterisation of emission and description of potential adverse impact

Potential for fugitive dust emissions containing lead and other metal(loid)s to be released into the adjacent native vegetation, potentially resulting in adverse impacts to vegetation health or to fauna.

9.4.3 Criteria for assessment

National Environmental Protection (Ambient Air Quality) Measure (Schedule 2: Standard for lead concentration of 50 µg/m^3 in ambient air, averaged over a year).

9.4.4 Applicant controls

The Applicant has an existing ambient air quality monitoring program conditioned as part of Licence L8493/2010/2 comprising deposition dust gauges, located across the Premises and a high volume air sampler located at the accommodation camp. Sampling is conducted according to Australian Standards AS/NZS 3580.9.3:2003 (Determination of suspended particulate matter – High volume sampler gravimetric method) and AS/NZS 3580.10.1

(Determination of particulate matter – Deposited matter – Gravimetric method).

It is expected that in the construction environmental management plan for the project, wetting down of work areas and usage of a water cart would be required to reduce the likelihood of dust generation through use of water from existing licenced groundwater borefield.

9.4.5 Consequence

If fugitive dust events occur such that a plume of dust is released to neighbouring vegetation or soils, then the impact will be mid level on site. Therefore, it is considered that the consequence is *moderate*.

9.4.6 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of fugitive dust events such that there is an acute impact on vegetation and /or fauna is *possible*.

9.4.7 Overall rating of fugitive dust emissions during construction

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk is medium.

9.5 Risk Assessment – Upgraded Concentrator Process Liquor/Slurry spills outside containment

9.5.1 Description of concentrator process spills

The rougher circuit is planned to be modified with a two stage pH control step (sulphuric acid addition pre rougher flotation and lime addition post rougher flotation). An additional column flotation step and new concentrate thickener will be installed as part of the proposed upgrades. All of these circuits are handling slurries with lead and other metal(loid)s in solution, some process slurries are also acidic.

9.5.2 Identification and general characterisation of emission

Acidic processing slurries/liquors and reagents (sulphuric acid and lime) proposed for use within the upgraded concentrator plant.

9.5.3 Description of potential adverse impact from the emission

If released to ground, the process slurries and reagents may result in localised soil and possible groundwater contamination.

9.5.4 Criteria for assessment

National Environment Protection (Assessment of Site Contamination) Measure 1999, Schedule B1, Guideline on Investigation Levels for Soil and Groundwater, Table 5A, Soil Investigation Levels.

9.5.5 Applicant/Licence Holder controls

No specific controls for containment of processing liquors within the Concentrator have been proposed.

The Premises does have an existing environmental incident procedure for responding to incidents. The existing Concentrator has containment bunding, however the capacity of the existing facility to contain the additional processing circuits is not determined. No significant process spills have been reported to DWER under Licence L8493/2010/2 to date, noting that

the Premises has been in care and maintenance since February 2015.

9.5.6 Consequence

If a spill of processing slurries to ground outside containment occurs, then the spill will result in localised soil contamination and possibly groundwater contamination. It is unlikely to impact on native vegetation. Therefore, it is considered that the consequence is *minor*.

9.5.7 Likelihood of Risk Event

Given the lack of reported spills to date the likelihood of spills occurring such that localised soil contamination occurs is *unlikely*.

9.5.8 Overall rating of spills of concentrator processing slurries outside containment

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of spills within the concentrator is medium.

9.6 Risk Assessment – Hydromet Process liquor spills outside containment

9.6.1 Description of Hydromet process liquor spills outside containment

The new hydromet plant will be transferring and handling acidic lead process solutions. A spill due to a loss of containment (eg pipeline spill or bunding overflow) would result in a release of these liquors to ground, with potential for soil and possibly groundwater contamination.

9.6.2 Identification and general characterisation of emission

Acidic lead processing slurries/liquors and reagents (eg MSA) proposed for use within the hydromet plant.

9.6.3 Description of potential adverse impact from the emission

Potential for soil and possibly groundwater contamination.

9.6.4 Criteria for assessment

National Environment Protection (Assessment of Site Contamination) Measure 1999, Schedule B1, Guideline on Investigation Levels for Soil and Groundwater, Table 5A, Soil Investigation Levels.

9.6.5 Applicant/Licence Holder controls

Polyurethane coated concrete containment bunding will be installed for the following circuits:

- MSA leach and CCDs
- Acid leach
- DES leach
- Electrolyte filtration
- Bleed electrowinning
- Bleed treatment
- Production electrowinning

- Reagents
- Evaporator

The containment bunds will be sized to contain 110% capacity of the largest vessel in the bund compound as a minimum.

This applicant has proposed to install a 1.5mm polyethylene (HDPE) lined stormwater pond to the west of the hydromet plant. It will contain a volume of 750m^3. This is the capacity to contain a 1:100 year 125mm rainfall event plus a 50%design factor. Rainfall that collects in the individual bunds is able to be pumped to this pond. Each bunded compound has a sump and sump pump which allows spilled process liquors to be returned to the process via a diversion valve (operated manually in the field), on the area sump pumps or to be pumped to the stormwater pond (RHM 2018a).

Some overhead pipe racks connecting processing circuits run over unbunded ground (refer Figure 4 Figure 4approximate locations). Pipelines handling environmentally hazardous materials will be sleeved within another pipe with any spills directed back to a bunded area. In the event that both pipelines fail, spills in these locations will be directed via gravity to the stormwater pond, however surficial soil contamination will occur in the event a pipeline failure occurs.

9.6.6 Consequence

If a process spill or release to ground from processing liquors within the hydromet plant occurs, then the Delegated Officer has determined that the impact on soils will be low level on site. Therefore, the Delegated Officer considers the consequence to be *minor.*

9.6.7 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of process spills causing soil contamination will be *unlikely* due to the provision of containment and a lined stormwater pond.

9.6.8 Overall rating of Hydromet process spills outside containment

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating is medium.

9.7 Risk Assessment – Emissions to air from Lead Hydromet Plant

9.7.1 Description of emissions to air from the Hydromet process

Point source emissions to air will be continuously vented from the concentrate dryer, MSA and DES leach circuits and the electrowinning (EW) tankhouse via pollution control equipment causing an adverse acute or chronic impact on plant or fauna health.

9.7.2 Identification and general characterisation of emission

Moist air containing lead and acidic aerosols released in off-gases from the concentrate dryer, leaching circuits, and the lead EW tankhouse.

9.7.3 Description of potential adverse impact from the emission

Lead is a persistent toxic pollutant. Exposure of fauna to lead emissions may result in damage to tissues, organs, immune and reproductive systems. Lead may be absorbed by plants through the root system and then may enter the food chain. The behaviour of lead in soil is

dependent on the soil pH, particle size, cation-exchange capacity, root surface area, root exudation and degree of mycorrhizal transpiration. Excessive lead accumulation in plant tissue impairs various morphological, physiological and biochemical functions in plants (Pourrat B., *et al,* 2011).

Acidic aerosols may impact on plant growth and soils. Acidic aerosols may retard plant growth by stimulating abnormalities in metabolism of plants and also affect the composition of soil water and the medium of nutrient supply for plants and soil microflora (Lal N., 2016).

9.7.4 Criteria for assessment

National Environmental Protection (Ambient Air Quality) Measure (Schedule 2: Standard for lead concentration of 50 µg/m^3 in ambient air, averaged over a year).

Protection of the Environment Operations (Clean Air) Regulation 2010 NSW (Schedule 3 Non-Ferrous metals (excluding aluminium): primary production; Type 1 (antimony, arsenic, cadmium, lead, mercury) and Type 2 substances (beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium) in aggregate from any smelting of refining process: Group 6 (new plant installed post 2005): total of 1 mg/m^3.

9.7.5 Applicant/Licence Holder controls

This assessment has reviewed the controls set out in Table 17 below.

Table 17: Applicant's proposed controls for lead and acidic aerosol emissions

Emission to air source	Pollution Control Equipment (interlocked with process control)	Design Efficiency
Concentrate Dryer	Two stage packed bed wet (caustic) scrubber	99% lead removal (expected lead concentration ~0.42 mg/m^3)
Solid/Liquid Leaching	Packed bed wet (caustic) scrubber	99% lead removal (expected lead concentration post scrubber 102.7 - 260 µg/m^3 (dependent on design gas flowrate))
Electrowinning tankhouse	Electrowinning cell brushes	98% acid mist removal, lead removal (expected concentrations post brushes: • Lead 1-2 µg/m^3(dependent on design gas flowrate))

It should be noted that process control for the scrubbers have their own individual control using PLS (programmable logic controller) and local HMI (human machine interface). Communication between this equipment and the process control system is made via Ethernet IP. The risk of loss of power to the scrubbers or the process control system is mitigated by the provision of a 1 MW emergency diesel generator to supply power to essential loads, including this plant (RHM 2018a).

RHM currently has an ambient air quality monitoring program that utilises a high volume air sampler to sample total suspended particulates and lead in particulate according to AS/NZS 3850.9.3:2003 *Methods for sampling and analysis of ambient air- Determination of suspended particulate matter – High volume sampler gravimetric method*. The high volume air sampler is located at the accommodation camp. This monitoring program is conditioned on Licence L8493/2010/2. A dust deposition gauge monitoring program is also conditioned on the Licence, providing information on dust concentrations in ambient air. Sampling and analysis of particulate is conducted in accord with AS/NZS 3850.10.1:2003 *Methods for sampling and*

analysis of ambient air- Determination of particulate matter – Deposited matter - Gravimetric method.

9.7.6 Consequence

Emissions released due to a failure of the scrubber system (acute exposures)

If an air emission release causing an acute adverse impact to fauna and/or vegetation occurs, then the Delegated Officer has determined that the impact will constitute a high level on site impact. Therefore, the consequence of an acute adverse impact is considered to be *major.*

Cumulative low emissions (chronic exposure)

If the cumulative air emissions cause a chronic adverse impact to fauna and/or vegetation, then the Delegated Officer has determined that the impact will constitute a mid-level on site impact. Therefore, the consequence of an acute adverse impact to be *moderate.*

9.7.7 Likelihood of Risk Event

Emissions released due to a failure of the scrubber system (acute exposures)

The likelihood of an acute adverse impact on either vegetation or fauna is considered *rare* due to the additional emergency power supply control available to ensure continuity of supply to the air pollution control equipment in the event of a power station outage.

Cumulative low emissions (chronic exposure)

The likelihood of a chronic adverse impact on vegetation is considered *unlikely* given the concentrations emitted are anticipated to be less than the NSW guideline criteria of a total of 1 mg/m^3 lead. This is a preliminary rating subject to confirmation from ongoing monitoring of the performance of the Hydromet Plant's air pollution equipment; and the susceptibility of the local native vegetation to ongoing lead and acidic aerosols emissions.

9.7.8 Overall rating of emitting lead and acidic aerosols at concentrations above criteria

Emissions released due to a failure of the scrubber system (acute exposures)

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of an acute adverse impact on either vegetation or fauna is medium.

Cumulative low emissions (chronic exposure)

The risk rating for the risk of a chronic adverse impact on either vegetation or fauna is considered medium.

9.8 Risk Assessment – Emissions to air from Lead Melting

9.8.1 Description of emissions to air from lead melting

Point source emissions to air which are continuously vented from the lead induction furnace via cyclones and baghouse. Deposition of lead and particulate emissions to surrounding soils and native vegetation.

9.8.2 Identification and general characterisation of emission

Dry air containing lead particulate (lead oxide and lead metal) and particulates.

9.8.3 Description of potential adverse impact from the emission

Lead is a persistent toxic pollutant. Exposure to lead emissions by fauna may result in damage to tissues, organs, immune and reproductive systems. Lead may be absorbed by plants through the root system and then may enter the food chain. The behaviour of lead in soil is dependent on the soil pH, particle size, cation-exchange capacity, root surface area, root exudation and degree of mycorrhizal transpiration. Excessive lead accumulation in plant tissue impairs various morphological, physiological and biochemical functions in plants (Pourrat B., *et al,* 2011).

This risk assessment considers adverse impacts in terms of chronic adverse impacts (from cumulative emission exposures). The potential scenario of acute adverse impacts (from emission events) has been deemed not credible, due to the interlock of process control of the baghouse and the lead furnace (that is, if the baghouse is not operational, the lead furnace is unable to be operated).

9.8.4 Criteria for assessment

National Environmental Protection (Ambient Air Quality) Measure (Schedule 2: Standard for lead concentration of 50 µg/m^3 in ambient air, averaged over a year).

Protection of the Environment Operations (Clean Air) Regulation 2010 NSW (Schedule 3 Non-Ferrous metals (excluding aluminium): primary production; Type 1 (antimony, arsenic, cadmium, lead, mercury) and Type 2 substances (beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium) in aggregate from any smelting of refining process: Group 6 (new plant installed post 2005): total of 1 mg/m^3).

9.8.1 Applicant/Licence Holder controls

The applicant has proposed to install a cyclone and baghouse system to collect lead and particulates from the induction furnace offgas, and recycle this stream back to the process. The design criteria for the baghouse is for 99% recovery of lead, with an estimated emission concentration of 0.0046 mg/m^3 Pb. This concentration is well within the NSW lead concentration guideline of 1 mg/m^3.

The operation of the induction furnace will be interlocked to that of the baghouse, so that in the event of a baghouse failure, feed to the furnace will be stopped.

The applicant is proposing to conduct in-stack sampling of the emissions after the baghouse, following commissioning. This will be to ensure the installed pollution control equipment meets the design criteria.

As per the power supply to pollution control equipment in the other areas of the lead hydromet plant, the baghouse and lead melting circuit is connected to the emergency diesel generator in the event of an outage in power supply.

9.8.2 Consequence

Cumulative low emissions (chronic exposure)

Lead and particulates emission to air from the lead induction furnace and the particulates' eventual deposition to ground at the design concentrations will potentially result in a low level impact on site. Therefore, the Delegated Officer considers the consequence of lead induction furnace emissions causing increasing soil contamination or adverse impacts to vegetation or fauna to be *minor.*

9.8.3 Likelihood of Risk Event

Cumulative low emissions (chronic exposure)

The likelihood of continuous emissions from lead melting (after being treated in the baghouse), causing increased soil contamination or low level impacts to vegetation or fauna as *likely*.

9.8.4 Overall rating of emissions to air from lead melting

Cumulative low emissions (chronic exposure)

The overall rating for the risk of ongoing low level emissions from lead melting causing increased soil contamination or low level impacts to vegetation or fauna is medium.

9.9 Summary of acceptability and treatment of Risk Events, with Regulatory Controls

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 18 below. Controls are described further in section 10.

Table 18: Risk assessment summary with proposed regulatory controls

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)	Resulting Regulatory Controls
	Emission	**Source**	**Pathway/ Receptor (Impact)**				
1.	Fugitive Dust	Construction earthworks	Lead particulate emissions released to land and vegetation via air. Poor local air quality. Possible acute adverse impacts to vegetation and/or fauna.	Ambient air quality monitoring program Specific construction controls: • Water carts • OHS controls including site hygiene protocols	Moderate consequence Possible likelihood **Medium Risk**	Acceptable subject to applicant and regulatory controls conditioned on Works Approval.	Works Approval: • Develop and submit a construction dust management plan at least one month prior to construction work commencing. The plan shall detail how fugitive dust emissions will be mitigated. • In the event of forecast high wind events, earthworks construction activities shall be shutdown for the forecast period of the high wind event. • Record and report the ambient air quality monitoring data (as required by conditions of L8493) for the construction period as part of the construction compliance document for the project.

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)	Resulting Regulatory Controls
	Emission	**Source**	**Pathway/ Receptor (Impact)**				
2.	Acidic lead process slurries/ liquors	Upgraded Concentrator plant	Spills direct to ground from pipeline failure, loss of containment (bunding overflow, poor maintenance) Soil contamination	Containment bunding Existing safety management system with an emergency response plan. Commitment to update the plan to account for the upgraded Concentrator.	Minor consequence Unlikely likelihood **Medium risk**	Acceptable subject to applicant controls and regulatory controls conditioned in the Works Approval and Licence.	Works Approval: Review existing containment in upgraded areas to ensure that the bunding is sufficient to contain 110% of the capacity of the largest vessel in each compound subject. If not, install concrete containment bunding with capacity to contain 110% of the largest vessel for those circuits subject to upgrade works. Licence: Regular integrity checks of the bunding infrastructure to be completed with a summary of results reported in the AER.
3.	Acidic lead process liquors	Hydromet Plant	Spills direct to ground from pipeline failure, loss of containment (bunding overflow, poor maintenance) Soil contamination	Concrete containment bunding of sufficient capacity to contain at least 110% of the largest vessel in each compound. Protective coating to be applied for those bunds handling or storing corrosive processing liquors. Additional secondary containment provided by a 750m^3 PE and clay lined stormwater pond. Site graded so that drainage falls to the pond.	Minor consequence Possible likelihood **Medium Risk**	Acceptable.	Works Approval: • Install concrete bunding (with a protective coating for compounds handling corrosive liquors), as per section 10.1.1. • Construct a 750m^3 stormwater pond with a geomembrane liner in the indicative location as shown in Figure 4. The liner shall be installed in accord with the manufacturer's specifications. An electrical leak location survey shall be completed after installation to identify any holes, with these repaired. The liner

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)	Resulting Regulatory Controls
	Emission	**Source**	**Pathway/ Receptor (Impact)**				
							shall be covered with appropriate ballast so that it is not subject UV/ heat deterioration. • Grade the hydromet site so that any spillage outside containment will drain to the stormwater pond. Licence: • Regular integrity checks of the bunding infrastructure to be completed with a summary of results reported in the AER. • A freeboard limit of 300mm shall apply for the stormwater pond. Regular checks of the pond shall be required.
4a.	Lead and acidic aerosols	Concentrate dryer, solid:liquid leaching circuits, EW tankhouse	Acute adverse impacts to vegetation or fauna via direct exposure through air emissions	• 2 stage packed bed scrubber to treat concentrate dryer offgas • Packed bed scrubber to treat leach circuit offgas • Brushes on EW cells to suppress EW tankhouse acid mist; • Emergency diesel generator to provide emergency backup power to critical plant including scrubbers in the event of a power station outage.	Major consequence Rare likelihood **Medium risk**	Acceptable subject to applicant and regulatory controls conditioned on Works Approval and Licence.	Works Approval: • Install pollution control equipment in accord with Table 19, section 10.1.3 of this Decision Report. • Install stack sampling ports in accord with AS4323.1 post pollution control equipment. • Conduct stack sampling during or after commissioning to ensure the emissions meet the design criteria. Licence • Any failures of pollution control

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)	Resulting Regulatory Controls
	Emission	**Source**	**Pathway/ Receptor (Impact)**				
							equipment that result in an emission event to air shall be reported to the CEO by 5pm of the next business day. • Report a summary of any power outages or pollution control failures that result in an emission events, and resulting corrective actions in the AER • Annual in-stack monitoring of lead and acidic aerosol emissions post each pollution control equipment.
4b.			Chronic adverse impacts to vegetation or fauna via ingestion or other cumulative exposure to air emissions	As above	Moderate consequence Unlikely likelihood **Medium risk**	As above	As above
5.	Lead particulate emissions	Lead melting (induction furnace)	Deposition of lead particulate leading to soil contamination Chronic adverse impacts to	Operation of the lead induction furnace interlocked to baghouse operation in process control system (i.e. lead melting shall cease if the baghouse is not operational). Emergency diesel generator to provide emergency backup power	Minor consequence Likely likelihood **Medium risk**	Acceptable subject to applicant and regulatory controls conditioned on Works Approval and Licence.	Works Approval: • Installation of the cyclone and baghouse system designed and installed to meet the design criteria of 99% removal of lead from induction furnace off-gas. • Stack sampling point to be

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)	Resulting Regulatory Controls
	Emission	Source	Pathway/ Receptor (Impact)				
			vegetation or fauna via ingestion or other cumulative exposure to air emissions	to critical plant including scrubbers in the event of a power station outage. The furnace offgases will be treated in a baghouse. Applicant will conduct air emission sampling of offgas emissions from the lead melting circuit following commissioning, to test that the emissions meet the expected design criteria for the plant.			installed post the baghouse in accord with AS4323.1. • Monitoring of baghouse performance to be conducted at the end of the commissioning period to ensure the emissions meet the design criteria. Licence: • Stack sampling ports and access ways to be maintained in accord with AS4323.1. • Annual stack sampling of emissions to air from the furnace to be conducted for lead particulate and vapour, total particulates. • Pressure drop across the baghouse filter system to be continuously monitored, and recorded each shift • If a pressure drop is detected the Licence Holder shall immediately close-off the section of the leak and not use that filter bag until the leak is repaired.

10. Regulatory controls

10.1 Works Approval controls

10.1.1 Processing liquors and slurries containment

All processing compounds within the new Hydromet Facility will be constructed with concrete bunding sufficient to contain 110% capacity of the largest tank within the individual compound. Concrete compounds containing corrosive materials (for example acidic or caustic materials) will be protected with a polyurethane surface.

The concentrator areas subject to upgrades authorised by this Works Approval shall also have concrete bunding sufficient to contain 110% capacity of the largest tank within the compound. Where the bunds contain corrosive solutions, the compound shall be protected with a polyurethane surface.

10.1.2 Stormwater infrastructure and equipment

The proposed stormwater pond as shown in Figure 4 shall be lined with a geomembrane liner with a hydraulic conductivity of 1 x 10^{-9} m/s or less. The liner installation shall be in accord with the manufacturer's recommendation(s). An electrical leak location survey shall be completed post installation and any identified holes repaired prior to covering the liner with ballast as per the manufacturer's recommendation(s).

The pond shall be located to the west of the Hydromet Facility. The capacity of the stormwater pond is 750 m^3.

The hydromet site shall be graded such that the fall is towards the existing site stormwater drainage management system.

10.1.3 Emissions to air pollution control equipment

The following pollution control equipment shall be installed and designed to achieve the efficiencies listed below:

Table 19: Applicant's proposed controls for Lead Hydromet point source emissions to air

Emission to air source	Pollution Control Equipment	Design Efficiency
Concentrate Dryer	Two stage packed bed wet (caustic) scrubber	99% lead removal (expected lead concentration ~0.42 mg/m^3)
Solid/Liquid Leaching	Packed bed wet (caustic) scrubber	99% lead removal (expected lead concentration post scrubber 102.7 - 260 µg/m^3 (dependent on design gas flowrate))
Electrowinning Tankhouse	Packed bed scrubber	98% acid mist removal, lead removal (expected concentrations post scrubber: • MSA 10.6 µg/m^3, • Lead 5 - 6.2 µg/m^3(dependent on design gas flowrate))
Lead Melting	Cyclones and baghouses	99% lead removal of off-gas stream

Emission to air source	Pollution Control Equipment	Design Efficiency
Induction Furnace		

Sampling ports shall be constructed at the outlet of the off-gas pollution control equipment detailed above. The ports shall be compliant to Australian Standard AS4323.1- 1995 *Stationary Source Emissions Method 1: Selection of sampling positions*.

10.1.4 Commissioning requirements

A commissioning plan for the Hydromet Plant will be required to be submitted to the CEO prior to commissioning. The plan shall include a schedule for the expected activities to take place during commissioning. The plan must detail how emissions will be managed through the commissioning period and procedures for reporting and responding to environmental incidents. The plan must include a risk assessment identifying potential events for releases of processing materials to either land or to air during commissioning, and the measures to prevent or mitigate those events.

At the completion of commissioning, all off-gases shall be tested to determine the concentration of metals, acid, and particulates (where specified) and these results compared to the modelled forecast concentrations as detailed in Table 10 of section 7.1. A commissioning report shall be submitted to the CEO, summarising any environmental incidents that occurred during the commissioning period, and any resulting corrective actions. The commissioning report shall include a copy of the air emission monitoring results. If any results do not meet the design criteria, an action plan for improving the performance of the gas cleaning equipment shall be included in the commissioning report, with timeframes for expected compliance detailed.

10.1.5 Monitoring reports

In stack monitoring as required by the Works Approval shall be submitted to the CEO as part of the commissioning report.

10.2 Licence controls

Licence controls to be added to the Licence following successful completion of the works authorised by the Works Approval. These controls will likely follow the proposed controls listed in Table 18, section 9.9, noting that pending changes in construction works or changes resulting from commissioning there may be a need to alter or add to these controls.

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 or licence under the EP Act.

11. Applicant's comments

The Applicant was provided with the draft Decision Report and draft issued Works Approval on 2 November 2018. The Applicant provided comments which are summarised, along with DWER's response, in Appendix 2.

12. Conclusion

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

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

Tim Gentle

Manager, 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 L8493/2010/2	L8493	Accessed at: www.der.wa.gov.au
2.	EPA Report 1620: Paroo Station Lead Mine Hydrometallurgical Facility	EPA Report 1620	Accessed at: www.epa.wa.gov.au
3.	Golder Associates (2016) Technical Memorandum, Document No. 1537548-004-M-Rev4, Tailings Leachability Assessment, dated 10 February 2016	Golder 2016	DWER record A1057792
4.	Ministerial Statement 1083	MS 1083	Accessed at: www.epa.wa.gov.au
5.	Lal Nand (2016) Effects of Acid Rain on Plant Growth and Development, *e-Journal of*		Accessed at: https://www.researchgate.net/publication/310954525_Effects_of_Acid_Rain_on_Plant_Growth_and_Development/download
6.	Pennington Scott (2014) *Rosslyn Hill Mining Limited TSF Investigation Report Paroo Station Mine*, unpublished report for Rosslyn Hill Mining, 4 September 2018	Pennington Scott 2014	DWER record A806082
7.	Pourrat B., Shahid M., Dumat C., Winterton P., & Pinelli E., (2011) Lead uptake, toxicity and detoxification in plants. In Whitacre D., (eds) *Reviews of Environmental Contamination Toxicology* vol 213: pp 113 -136.	Pourrat B., et al 2011	Accessed at: https://www.ncbi.nlm.nih.gov/pubmed/21541849
8.	Rosslyn Hill Mining (2018) *DWER Works Approval Hydrometallurgical Facility Supplementary Information,* July 2018	RHM 2018a	DWER record A1619409
9.	Rosslyn Hill Mining (2018) Works Approval Application, submitted 31 January 2018	RHM 2018b	DWER record A1605362
10.	Email from B Corry, RHM, to DWER, Re: Works Approval application	RHM 2018c	DWER record A1727262

	queries – Paroo Station Lead Hydrometallurgical Facility, sent 20 September 2018 11:57 AM		
11.	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	DER 2015a	accessed at www.dwer.wa.gov.au
12.	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.	DER 2015b	
13.	DER, November 2016. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	DER 2016b	
14.	DER, November 2016. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	DER 2016c	

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

Condition	Summary of Licence Holder comment	DWER response
2, Table 2	The description of the hydromet plant stormwater management has been refined to refer to drainage being directed to the existing stormwater pond ('environment dam').	Description updated.
2, Table 2	Requirement to install ballast on the liner not appropriate due to the duty of the pond and the small size of the pond.	Accepted and updated.
2, Table 2 and Schedule 2	Detail of the works assessed corrected. The pollution control equipment for the fugitive acidic aerosols in the EW tankhouse has changed from a closed ventilation system and offgas scrubber to installation of brushes at the liquor /air interface of each cell, to collect aerosol contaminants on the brush as the aerosols are generated.	Accepted and updated.
8 & Schedule 3	No combustion gases will be generated from the induction furnace as it is an electric furnace and therefore, monitoring of combustion gases from the lead melter is not required.	Accepted. Requirements to monitor combustion gases from the induction furnace removed from draft works approval.
8 & Schedule 3	The use of the USEPA Method 8 to analyse MSA aerosol emissions is not correct. USEPA Method 18 is a more appropriate method to use for analysis of MSA emissions.	Accepted.
Decision Report, Risk assessment	Noted that the process control for the offgas cleaning equipment is interlocked to the operation of the individual process units (i.e. the lead furnace can not operate if the	Noted.

Condition	Summary of Licence Holder comment	DWER response
	baghouse is not operational, the leaching circuits will not operate if the scrubber is not operational).	
	The scenario of having acute lead particulate emissions following shut down of the baghouse was deemed not credible.	Noted and removed from risk assessment.
Decision Report	Correction that Rosslyn Hill Mining Pty Ltd is not the owner of the Paroo Station pastoral lease.	Noted and updated.
	Clarification of Dangerous Goods licence information and water source for dust suppression.	

Attachment 1: Issued Works Approval W6127/2018/1