



## Application for Works Approval

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

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<b>Works Approval Number</b>	W6455/2020/1
<b>Applicant</b>	Element 25 Limited
<b>ACN</b>	119 711 929
<b>File Number</b>	DER2020/000384
<b>Premises</b>	Butcherbird Manganese Project Mining tenement M52/1074 MEEKATHARRA WA
<b>Date of Report</b>	14 December 2020
<b>Decision</b>	Works approval granted

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**MANAGER, RESOURCE INDUSTRIES**

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

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## 1. Decision summary

This Decision Report documents the assessment of potential risks to the environment and public health from emissions and discharges during the construction and operation of the Premises. As a result of this assessment, Works Approval W6455/2020/1 has been granted.

## 2. Scope of assessment

### 2.1 Regulatory framework

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

### 2.2 Application summary and overview of Premises

On 31 August 2020, the Applicant submitted to the department an application for a works approval under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application is to undertake construction works relating to a processing facility and a Tailings Storage Facility (TSF) for the mining and processing of manganese at the Premises.

The Butcherbird Manganese Project (Premises) relates to the category and assessed production capacity under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which are defined in Works Approval W6455/2020/1. The infrastructure and equipment relating to the Premises category and any associated activities which the department has considered in line with *Guidance Statement: Risk Assessments* (DER 2017) are outlined in Works Approval W6455/2020/1.

### 2.3 Overview of Premises

The Premises is located approximately 115 km south of the town of Newman in the Shire of Meekatharra. The Applicant plans to develop the Premises in stages with this application relating to stage 1 only.

Stage 1 of the Premises, which is expected to have a life of approximately 7 years, will consist of mining of the ore through an open pit method and will reach a depth of 17 metres. The manganese mineralisation at the Premises with the most economic value occurs where the manganese shales intersect the weathering profile where deep chemical weathering has upgraded the grade of the manganese. This has portioned manganese mineralisation into discrete medium grade manganese bands which only require simple physical beneficiation. No chemicals including flocculants are required for the extraction of the manganese ore.

#### 2.3.1 Infrastructure and operational aspects

##### Processing Plant

The processing plant will operate 24 hours a day, 7 days a week and mainly consists of mobile or semi-mobile infrastructure to crush, wash and separate manganese ore and waste. The maximum capacity of the processing plant is 1.6 million tonnes per annum (mtpa), with an estimated process rate of approximately 1.2 mtpa expected. All stages of the process use physical separation with no chemicals used for extracting the manganese product.

Ore will be mined from an open pit then transported to the Run of Mine (ROM) pad for storage before processing through the Processing Plant. Manganese will be extracted from the ore by utilising the following methods:

- ROM ore will be crushed to less than 60mm;

- Crushed ore will be screened to remove any sub 6 mm material;
- Ore greater than 6 mm is fed into a log washer which uses water to remove tough, plastic clay contaminants and other deleterious materials from hard ore and aggregate feeds;
- Water from the log washer which contains reject clays and fine materials will be pumped to the TSF. The cleaned ore leaving the log washer is passed over a washing screen to separate the ore into two sized fractions;
- The two ore fractions both pass through separate rising screen feeders into two ore sorters. The ore sorters use a number of sensors (i.e. 3D laser and colour sensors) to separate the product from the waste;
- The waste materials from the ore sorters will be stockpiled and used for construction of the outer face of the TSF; and
- Manganese ore from the two ore sorters will be stockpiled ready for loading into semi-trailers for export off-site.

Sumps have been incorporated into the design of the wet screening and ore sorter components of the Processing Plant to capture spilt material. The sumps will be fitted with appropriately sized pumps to allow reclaim of material back to the processing circuit.

Dust suppression sprays will be fitted at dust generating locations of the crushing and screening circuit. Fugitive dust from stockpiles is managed by the use of water carts.

### Tailings Storage Facility

The above ground, four-sided paddock style TSF will be constructed from material extracted from the base of the facility, mine waste and process waste. The TSF will be constructed in four separate stages commencing with a starter embankment followed by 3 lifts using a downstream construction method. The final height of the TSF will be 12.5 m above ground level which is expected to provide a total of 7 years storage. The final TSF disturbance footprint will be approximately 40 ha at year 7 with a tailings surface catchment of 18.5 ha. The TSF design storage capacities and timeframes for each staged lift are presented in Table 1 below.

**Table 1: TSF Design Capacities**

Parameter	Units	Starter embankment	Stage 1 lift	Stage 2 lift	Stage 3 lift	Total
Embankment Height	m	5.5	2.5	2.5	2.0	12.5
Assumed Dry Density	t/m <sup>3</sup>	1.15	1.45	1.45	1.45	-
Storage Capacity	t	507,623	491,910	536,394	463,474	1,999,400
Storage Capacity	m <sup>3</sup>	441,441	339,248	369,927	319,637	1,470,233
Stage Life	months	24	23	21	16	84
Stage Rate of Rise	m/yr	2.8	1.3	1.4	1.5	-

The starter embankment will be constructed from material extracted from within the base of the TSF. Then the staged embankment lifts (stage 1 – 3) of the TSF will utilise the dry undersize waste from the processing plant to progressively form the embankment of each lift. The Ore

Sorter waste will then be used to cap the perimeter embankment as rock armouring.

The TSF has been designed to contain rainfall associated with a 1 in 100-year, 72 hour storm event whilst maintaining a 500 mm freeboard. The TSF does not receive rainfall run-off from an upstream catchment.

A 300 mm thick clay liner will be installed at the base of the TSF which will be compacted to achieve a minimum 95% Standard Maximum Dry Density in accordance with AS 1289.5.1.1. A cut-off trench will also be installed beneath the TSF embankment to key the TSF into the natural ground and to restrict lateral seepage beneath the embankment.

Tailings will be pumped to the TSF via a tailings pipeline which will be located within an earthen bunded corridor with a capacity to ensure any lost tailings are captured for a period equal to the time between routine inspections. The Applicant expects to pump between 237,000 to 311,000 tonnes (average 275,000 tonnes) of solids to the TSF per year. The tailings will be deposited into the TSF sub-aerially from multi spigots located on the perimeter embankment. Tailings will be deposited in layers not exceeding 300 mm in thickness to assist drying.

A decant rock ring will be constructed at the center of the TSF for the recovery of supernatant water. The TSF is designed such that tailings material will be discharged from the embankment and beach towards the decant rock ring. A decant pond is expected to form at the decant rock ring where a submerged pump will pump supernatant water via a return water pipeline to the Process Water Pond for use in the Process Plant. The Process Water Pond will be a HDPE lined facility and located adjacent to the Processing Plant.

The Applicant proposes to install a total of four groundwater monitoring bores at the TSF to monitor groundwater levels and groundwater quality against background levels.

### **Tailings waste characteristics**

The applicant proposes to deposit waste fines (wet tailings) into the TSF at a slurry density of approximately 22% solids.

The wet tailings waste, which is segregated from dry wastes (hardpan, coarse/fine rejects and dry screen fines), consists of scrubbed fines from the log washing step in the process and are less than 6 mm in size.

Wet tailings samples were collected and generated by ALS Metallurgy during programs in 2019 and 2020. The samples collected and analysed for geochemical characterisation are expected to represent waste to be generated at the Premises for the first 7 years of the mine life (Stage 1).

Particle size data is available for wet tailings for composite tailings only (2019 scrubbed wet tailings) in which all particles greater than 1 mm were screened out. The particle sizing data indicates the following:

- Contained a moderate clay content consisting of 24 to 36% less than 2 mm fraction and slightly higher silt content at 30 to 49%; and
- Particle size distribution was variable between samples.

The tailings are considered geochemically benign. Total sulfur was very low due to the highly weathered and oxic nature of the ore with no potential for acid production. Environmentally significant metals and metalloids are expected to be below the level of detection or at very low water-soluble concentrations.

## **3. Risk assessment**

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guidance Statement: Risk Assessments* (DER 2017).

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

### 3.1 Source-pathways and receptors

#### 3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation which have been considered in this Decision Report are detailed in Table 2 below. Table 2 also details the proposed control measures the applicant has proposed to assist in controlling these emissions, where necessary.

**Table 2: Emissions and proposed applicant controls**

Emission	Sources	Potential pathways	Proposed controls
<b>Construction</b>			
Dust	Vehicle movement and earth works.	Air/windborne pathway	Wetting down of roads when required. Use of mobile processing plant infrastructure to reduce earth moving and building requirements. Speed restrictions on unsealed roads. Vehicles and mining equipment kept on defined roads.
<b>Operation</b>			
Dust	Vehicle movements	Air/windborne pathway	Wetting down of roads when required. Sealing the first 100 m of the Premises entrance road to reduce dust impacts and sediment tracking onto the Great Northern Highway. Speed restrictions on unsealed roads. Vehicles and mining equipment kept on defined roads.
	Fugitive dust from stockpiles and/or stored product		Wetting down of stockpiles.
	Crushing of material		Crushing and screening infrastructure fitted with multiple dust suppression sprays at strategic locations.
Seepage from TSF	Storage of tailings material at the TSF	Infiltration through soil profile	A low permeability 300 mm thick clay material liner will be installed to the base of the TSF. Liner will be compacted to achieve a minimum 95% Standard Maximum Dry Density (AS 1289.5.1.1). Central decant rock ring system which removes supernatant water and returns the

Emission	Sources	Potential pathways	Proposed controls
			<p>water directly to the Process water Pond.</p> <p>Spigotting sequence will be formulated so the supernatant water pond is always maintained around the decant rock ring structure with a maximum radius of 50m.</p> <p>Sub-areal deposition of tailings in thin lifts to promote air-drying.</p> <p>Perimeter cut-off trench to restrict lateral seepage.</p>
Seepage from Process Water Pond	Return water from the TSF	Infiltration through soil profile	Process Water Pond HDPE lined.
Accidental discharge of product, process waters and tailings to land	Operation of wet processing plant, Process Water Pond, pipelines and tailings dam	Direct discharge	<p>Sumps have been incorporated into the design of the wet screening and ore sorter components of the Processing Plant to capture spilt material. The sumps will be fitted with appropriately sized pumps to allow reclaim of material back to the processing circuit.</p> <p>Slurry pipelines will be located within open bunded trenches with sufficient capacity to ensure liquors are captured and are not released to the environment.</p> <p>Pipelines will incorporate isolation valves at appropriate intervals and periodic visual inspections will be undertaken.</p> <p>Tailings and return water pipelines will be fitted with flow sensors.</p> <p>Sufficient freeboard will be maintained at the Process Water Pond and TSF which also allows storage of rainfall from a 1% AEP 72 hour event.</p> <p>A TSF Operations Manual has been developed to provide direction on the appropriate operation and monitoring of the TSF, including daily inspections.</p> <p>Daily inspections of the Process Water Pond to monitor operations including the freeboard.</p> <p>Surface Water Diversion Bunds will be constructed to divert potential flood water flow away from the faces of the TSF.</p> <p>The TSF will undergo annual audits by a suitably qualified geotechnical engineer.</p>

### 3.1.2 Receptors

In accordance with the *Guidance Statement: Risk Assessment* (DER 2017), the Delegated Officer has excluded employees, visitors and contractors of the applicant's from its assessment.

Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 3 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises (*Guidance Statement: Environmental Siting* (DER 2016)).

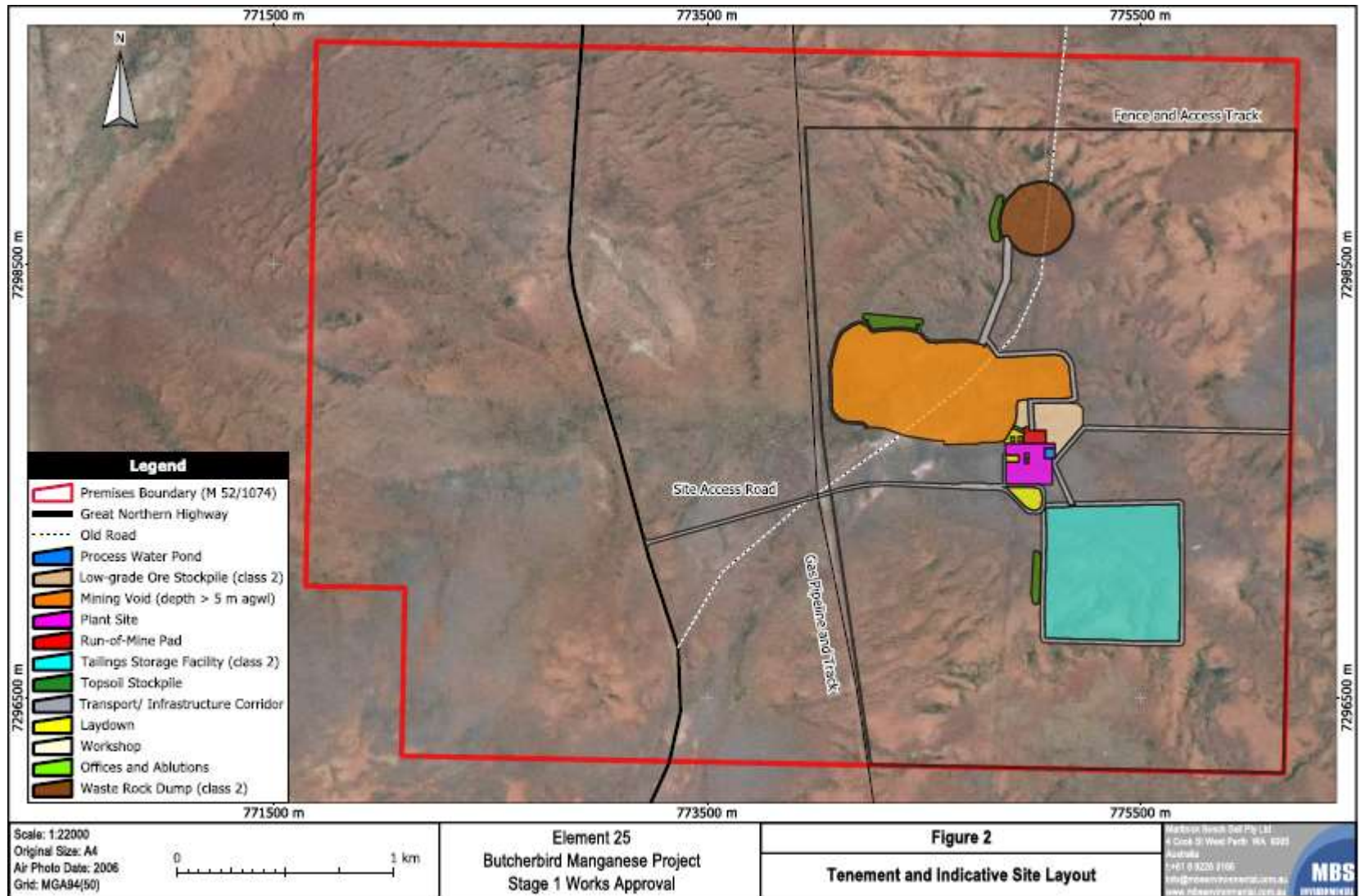
**Table 3: Sensitive human and environmental receptors and distance from prescribed activity**

Human receptors	Distance from prescribed activity
<p>Vehicle movement on the Great Northern Highway.</p>	<p>Highway passes through the Premises (mining tenement) however the Project/infrastructure footprint is located approximately 2 km east of the highway. <b>This receptor has been screened out due to separation distance.</b></p>
<p>Gas pipeline</p>	<p>Approximately one kilometres to the west of the TSF and processing plant. <b>This receptor has been screened out.</b></p>
Environmental receptors	Distance from prescribed activity
<p>Premises is situated in the East Murchison Groundwater Proclamation Area under Section 26B (1) of the <i>RIWI Act 1914</i>.</p> <p>Groundwater at the Premises is of reasonable quality with an average concentration for Total Dissolved Solids of 1,600 mg/L (approximately 2,000 mg/L at the TSF location).</p> <p>Groundwater in this area is used for livestock watering.</p>	<p>Depth to groundwater is greater than 20 metres at the centre of the Premises, with depths of 10 metres or more expected at the proposed TSF, and 15 metres or more expected at the Processing Plant/Process Water Pond. Construction of groundwater monitoring bores at the TSF will provide accurate depths to groundwater at that location.</p> <p>Nearest stock watering bore (Yanneri Well) is located greater than 4 km away. <b>This receptor has been screened out due to the separation distance.</b></p>
<p>There are no permanent surface water bodies or watercourses within the Premises boundary.</p> <p>The mine pit, processing plant and laydown area are centered on a ridge with no upstream catchment. The TSF will be located in a broad valley that will carry overland sheet flows in heavy rainfall events.</p> <p>Water will be present only as shallow sheet flow during and immediately after rainfall events. Although there are no defined channels, flood modelling indicates surface water flow is expected to be in an easterly direction.</p> <p>The closest surface water body to the Premises is the Ilgarari Creek which is located outside of the Premises boundary. Ilgarari Creek drains east past Woolbunna Pool (17 km away) to Yanneri Lake in the Little Sandy Desert (80km east of the Premises).</p>	<p>Ilgarari Creek is located over 4 km away at the closest point to the Premises (south east from the TSF).</p>



<p>Native vegetation (mainly <i>Acacia</i> species in the Mulga complex, and spinifex).</p> <p>Vegetation at the Premises is not considered groundwater dependent due to the lack of landscapes with significant reserves of groundwater and the lack of surface expression of groundwater (Ecoscape 2019a).</p>	<p>Considered to be locally and regionally common and widespread except for <i>Acacia paraneura</i>.</p> <p><i>Acacia paraneura</i> may be of higher significance given the small area identified (&lt;3 ha), however it is located in the southern part of the Mining Lease approximately 2km away from the mining activities. <b><i>Acacia paraneura</i> has been screened out as a receptor.</b></p>
<p>No threatened flora. Four DBCA listed Priority Flora species were identified at the Premises.</p> <ol style="list-style-type: none"> <li>1. <i>Eremophila appressa</i> (P1)</li> <li>2. <i>Eremophila rigida</i> (P3)</li> <li>3. <i>Rhagodia sp.</i> (P3)</li> <li>4. <i>Goodenia nuda</i> (P4)</li> </ol>	<p>Only a small number of species occur within the project/infrastructure footprint with a majority being located outside of this area.</p> <p>A small, isolated group of priority 3 <i>Eremophila rigida</i> are located approximately 200 m to the east of the proposed TSF. However, most of this species located on the Premises are approximately 1 km to the north east.</p> <p>Impacts on Priority Flora and Fauna species by clearing are being assessed by DMIRS as part of the Native Vegetation Clearing Permit application CPS 8991/1.</p>
<p>One DBCA listed Priority Fauna species occurs within the Premises.</p> <p>Brush tailed Mulgara.</p>	<p>Habitat for this species makes up a minor portion (1.1%) of the project/infrastructure footprint. Impacts to habitat will be assessed by DMIRS as part of the Native Vegetation Clearing Permit application CPS 8991/1. <b>This receptor has been screened out.</b></p>

Figure 1: Site layout



## 3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guidance Statement: Risk Assessments* (DER 2017) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

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

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 4.

Works Approval W6455/2020/1 that accompanies this Decision Report authorises construction and time-limited operations. The conditions in the issued Works Approval, as outlined in Table 4 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

A licence is required following the time-limited operational phase authorised under the works approval to authorise emissions associated with the ongoing operation of the Premises i.e. category 5 activities. A risk assessment for the operational phase has been included in this Decision Report, however licence conditions will not be finalised until the department assesses the licence application.

**Table 4: Risk assessment of potential emissions and discharges from the Premises during construction, commissioning and operation**

Risk Event					Risk rating <sup>1</sup> C = consequence L = likelihood	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
<b>Construction</b>								
Construction of the processing plant, process water pond, TSF, pipelines, ROM pad and haulroads.	Dust from vehicle movement and construction activities	Air/windborne pathway. Smothering of vegetation causing impacts to vegetation health.	Native vegetation and priority 3 flora species	Refer to section 3.1.1	C = Slight Minimal on-site impacts L = Unlikely The risk event will probably not occur in most circumstances <b>Low Risk</b>	Yes	Conditions 1 and 2	Construction and installation of infrastructure to be generally located as identified in the submitted application.
<b>Commissioning and Time Limited Operations</b>								
Commissioning and Time Limited Operations of the Processing Plant (crushing and screening)	Dust generated from crushing and screening and stockpiling of ore	Air/windborne pathway. Smothering of vegetation causing impacts to vegetation health.	Native vegetation	Refer to Section 3.1.1	C = Slight Minimal on-site impacts L = Unlikely The risk event will probably not occur in most circumstances <b>Low Risk</b>	Yes	Conditions 1, 7, 8, 11, 13, 15, 16, 17, 18, 20, 21, 22 and 23	Applicant controls conditioned for the management of dust at the crushing and screening circuit.  Standard administration and reporting requirements.
Commissioning and Time Limited Operations of the wet processing plant and pipelines	Accidental discharge of product and tailings to land	Direct discharge Increased concentration of certain elements (including	Soils Native vegetation	Refer to Section 3.1.1	C = Minor Low level on-site impacts with minimal off-site local scale	Yes	Conditions <u>1, 7, 8, 11, 13, 15, 16, 17, 18, 20, 21, 22 and 23</u>	Applicant controls conditioned.  Flow meters required on the tailings discharge

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Risk Event					Risk rating <sup>1</sup>	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls	C = consequence L = likelihood			
		manganese) in soils causing disruption of normal ecosystem function.  Smothering of vegetation with tailings slurry.			impacts L = Possible  The risk event could occur at some time  <b>Medium Risk</b>			pipelines and return water pipelines for determining the water balance at the TSF, and for comparison with the modelling predictions.  Flow sensors to be fitted to pipelines to detect leaks.  Standard administration and reporting requirements.
Discharge of tailings into the TSF	Seepage from storage of tailings	Seepage through embankment walls and base resulting in a change in the groundwater chemistry.  Localised surface expression of groundwater causing detrimental effects on native vegetation.	Soils  Native vegetation and priority 3 flora species  Groundwater	Refer to Section 3.1.1	C = Moderate  Mid level on-site impacts with low level off-site local scale impacts and minimal off-site impacts wider scale.  L = Possible  The risk event could occur at some time  <b>Medium Risk</b>	Yes	<u>Conditions 2, 9, 10, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22 and 23</u>	Refer to Section 3.3 for detailed risk assessment
	Tailings overtopping	Direct discharge	Soils	Refer to	C = Moderate	Yes	<u>Conditions 2, 9, 10, 12, 13, 14, 15, 16, 17, 18,</u>	Applicant controls

Risk Event					Risk rating <sup>1</sup>	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls	C = consequence L = likelihood			
	the TSF embankment	Increased concentration of certain elements (including manganese) in soils causing disruption of normal ecosystem function.  Smothering of native vegetation and priority 3 flora species.	Native vegetation	Section 3.1.1	Mid level on-site impacts with low level off-site local scale impacts  L = Rare  This risk event may only occur in exceptional circumstances.  <b>Medium Risk</b>		<b><u>20, 21, 22 and 23</u></b>	conditioned.  Daily inspections of the TSF to ensure the required freeboard is being maintained.  Standard administration and reporting requirements.
Storage of return water in the Process Water pond	Overtopping of the pond embankment	Direct discharge  Increased concentration of certain elements (including manganese) in soils causing disruption of normal ecosystem function.  Detrimental effects on vegetation due to erosion and inundation.	Soils  Native vegetation	Refer to Section 3.1.1	C = Slight  On-site impacts minimal.  L = Rare  This risk event may only occur in exceptional circumstances.  <b>Low Risk</b>	Yes	Conditions <b><u>1, 7, 8, 11, 13, 14, 15, 16, 17, 18, 20, 21, 22 and 23</u></b>	Applicant controls conditioned.  Daily inspections of the TSF to ensure the required freeboard is being maintained.  Standard administration and reporting requirements.
Stockpiling Manganese concentrate (lump manganese ore) and low-grade ore waste (ore)	Contaminated stormwater	Direct discharge  Increased concentration of	Soils  Native vegetation	Premises centered on a ridge with very little	C = Slight  On-site impacts minimal.	Yes	<b><u>Condition 1</u></b>	Construction and installation of infrastructure to be generally

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Risk Event					Risk rating <sup>1</sup>	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls	C = consequence L = likelihood			
sorter waste)		certain elements (including manganese) in soils causing disruption of normal ecosystem function.		upstream catchment resulting in low surface flow potential.	L = Rare This risk event may only occur in exceptional circumstances. <b>Low Risk</b>			located as identified in the submitted application.  Run-off expected to remain in cleared product laydown area.
	Fugitive dust from stockpiles	Air/windborne pathway. Smothering of vegetation causing impacts to vegetation health.	Native vegetation	Refer to section 3.1.1	C = Slight On-site impacts minimal. L = Unlikely The risk event will probably not occur in most circumstances <b>Low Risk</b>	Yes	<b><u>Condition 1</u></b>	Location of product and waste stockpiles to be generally located as identified in the submitted application.

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guidance Statement: Risk Assessments* (DER 2017).

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

### 3.3 Risk event – Seepage from TSF

Deposition of tailings material into the TSF can result in seepage impacting the groundwater, which is considered suitable for stock watering purposes. Mounding outside of the containment structure footprint resulting in surface expression causing impacts to a Priority 3 flora species and native vegetation may also occur.

#### 3.3.1 Identification and general characterisation

Leachate testing in accordance with the Australian Standard Leaching Procedure (ASLP) was undertaken on the scrubbed ore tailings in 2019 and 2020. The Applicant determined the more accurate LEAF test work in accordance with USEPA Methods 1313 and 1314 was unnecessary for Stage 1 as the tailings characteristics were sufficiently understood. A summary of the results from laboratory test work undertaken in accordance with ASLP is presented below:

- No risk of producing acid drainage due to highly weathered and oxic nature of the manganese deposit (maximum mine depth is 17 metres below ground level for stage 1);
- Geochemically enriched in several elements, including manganese and tellurium, which indicates the geological nature of the deposit. Thallium, tungsten, selenium and silver were other key enriched elements, however these elements are expected to be strongly bound to hydrous iron and manganese oxide surfaces and present low potential for leaching and uptake by vegetation;
- Very low concentrations of uranium and thorium naturally occurring radioactive materials (NORM) elements;
- Geochemically benign with very low/insoluble water-soluble concentrations predicted for environmentally significant metals and metalloids;
- Slightly to moderately alkaline and expected to be non-saline if non-saline process water remains unchanged. Recent groundwater sampling at the proposed borefield indicates quality as marginal to brackish with an average TDS of 2,300 mg/L; and
- Found suitable for rehabilitation purposes.

The results from the test work demonstrated that the potential for significant release of metals, metalloids and salts from the tailings is low and the use of the LEAF testing method is unlikely to change the outcomes.

Seepage analyses modelling was undertaken in 2020 (REC, 2020) to determine the estimated volume of seepage through the embankment walls. The analysis determined a volume of 0.7 m<sup>3</sup>/day at the starter embankment and 3.6 m<sup>3</sup>/day for the Stage 3 embankment. These results were considered conservative upper bound estimates as the models considered the most critical section. A localised groundwater mound can likely be anticipated beneath the TSF during its operating life.

#### 3.3.2 Description of potential adverse impact from the emission

Seepage from the TSF may result in localised groundwater mounding adjacent to the TSF. This mounding could result in surface expression causing an increase in salts in the soil and water logging causing impacts to native vegetation and a small group of priority 3 flora. No threatened flora exist on the Premises.

Seepage from the TSF may also alter the quality of the groundwater in this area which is considered of reasonable quality. Depth to groundwater at the center of the mining lease is generally in excess of 20 metres with depths at the TSF expected to be greater than 10 metres when compared to nearby bore depths.

Sampling of groundwater bores at the Premises and nearby pastoral leases in May 2019 show



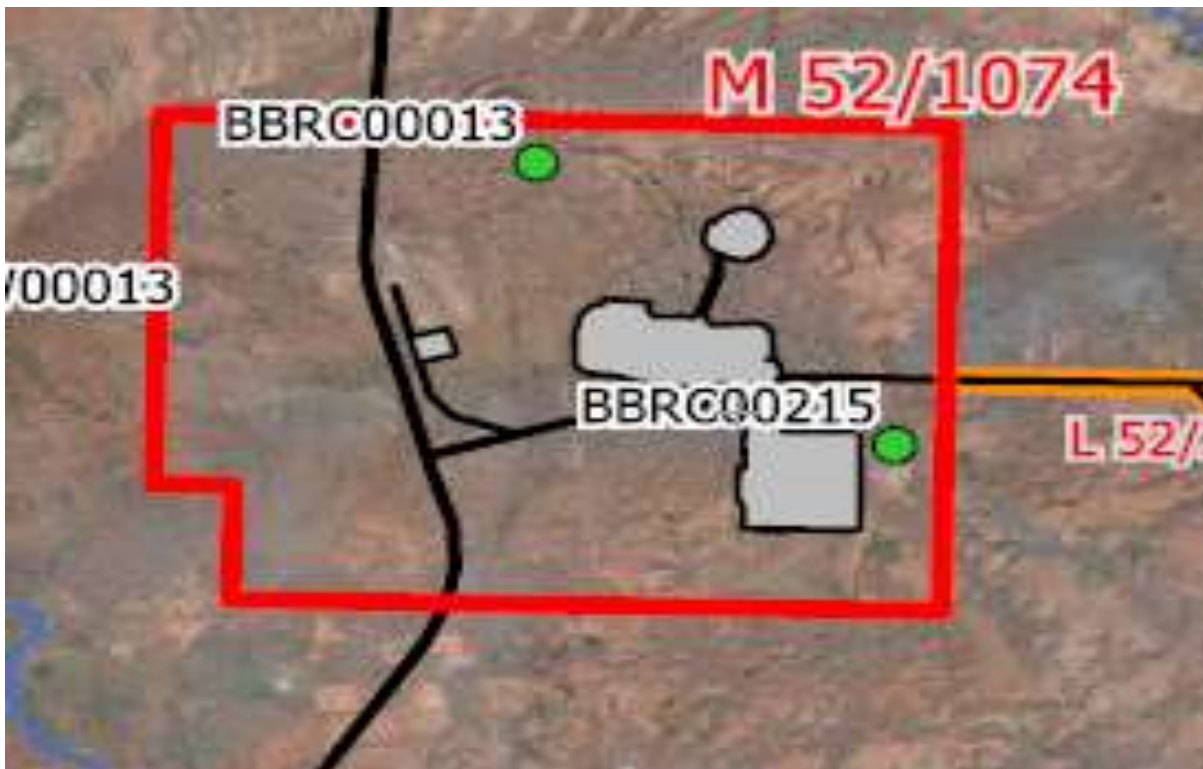
the water quality is marginal to brackish in salinity (2,760 mg/L at the TSF) with low level dissolved metals and major ions. The groundwater is suitable for livestock drinking in accordance the Livestock Drinking Water Guidelines within ANZECC 2000. The groundwater pH was found to be generally neutral to slightly alkaline with a range of 6.3 to 8.45. Results from sampling of the two groundwater bores located at the Premises (BBGW00013 and BBRC00215) are shown in Table 5 below. Groundwater bore BBRC00215 is located adjacent to the proposed TSF on the east side as shown in Figure 2 below.

**Table 5: Groundwater sampling results**

Compound	Unit	BBGW00013	BBRC00215
pH value	pH unit	8.45	8.17
Electrical Conductivity @ 25°C	µS/cm	3,290	4,540
Total Dissolved Solids @ 180°C	mg/L	2,060	2,760
Chloride		656	1,010
Calcium		92	97
Magnesium		75	120
Sodium		418	568
Potassium		53	85
Aluminum		<0.01	0.01
Antimony		<0.001	0.006
Arsenic		0.003	0.007
Boron		2.18	2.69
Barium		0.080	0.048
Beryllium		<0.001	<0.001
Cadmium		<0.0001	<0.0001
Cobalt		<0.001	0.001
Chromium		0.003	<0.001
Copper		0.002	0.002
Manganese		0.001	0.871
Nickel		0.001	0.005
Lead		<0.001	<0.001
Selenium		<0.01	<0.01
Vanadium	0.01	<0.01	
Zinc	<0.005	<0.005	
Silver	<0.001	<0.001	

Tin		<0.001	0.001
Iron		<0.05	<0.05
Mercury		<0.0001	<0.0001
Nitrite + Nitrate as N (NO <sub>x</sub> )		26.8	19.6
Total Kjeldahl Nitrogen as N		5.3	5.3
Total Nitrogen as N (TKN + NO <sub>x</sub> )		32.1	24.9

**Figure 2: Location of groundwater bores BBGW00013 and BBRC00215**



The Applicant conducted four in-situ falling head permeability tests on pre-existing boreholes drilled to 5 metres, at locations originally proposed for the TSF (new TSF location shifted 200 metres to the northwest). The tests were conducted to estimate the permeability of the surficial ground profile across the area of the proposed TSF. The results indicate a permeability of  $4.5E^{-07}$  to  $6.8E^{-07}$  m/s. The soil type was shallow loamy sand or sandy clay A-horizon, underlain by either lateritic hardpan or saprock. Data on other nearby projects indicate the hardpan permeability is typically  $3.0E^{-07}$  to  $5.0E^{-08}$  m/s.

The four test sites were just outside of the new proposed location for the TSF, however the results are expected to reflect the permeability at the new location following an assessment of an independent landform and soil mapping study (Schoknecht and Pathan, 2013). The study found the number of soils types within the Jamindie System for this area is limited and were found to be locally common and widespread. This type of underlying geology is likely to hinder seepage rate to groundwater.

The seepage is expected to be low in salinity as a result of the use of low saline water for processing (average 2,300 mg/L), contain very low/insoluble concentrations for environmentally significant metals and metalloids and moderately alkaline. Groundwater at the TSF is similar with low salinity levels (2,760 mg/L, 2019) and circum-neutral to slightly alkaline.

### 3.3.3 Criteria for assessment

Relevant water quality criteria are the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, *Livestock drinking water quality*, October 2000

### 3.3.4 Applicant controls

This assessment has reviewed the controls set out in Table 6 below.

**Table 6: Applicant's proposed controls for Seepage at the TSF**

Site infrastructure	Description	Operation details	Location
<b>Controls for seepage</b>			
TSF	Low permeable clay liner	<p>A low permeability 300 mm thick clay material liner will be installed to the base of the TSF. Liner will be compacted to achieve a minimum 95% Standard Maximum Dry Density (AS 1289.5.1.1).</p> <p>The compacted clay layer is expected to provide a maximum hydraulic conductivity of <math>5 \times 10^{-8}</math> m/s.</p>	Figure 1: Site layout
	Decant system	<p>Central decant rock ring system which removes supernatant water and returns the water directly to the Process water Pond.</p> <p>The water recovery system will have a minimum capacity of not less than 96 m<sup>3</sup>/hr.</p>	
	Tailings discharge	<p>Spigotting sequence will be formulated so the supernatant water pond is always maintained around the decant rock ring structure to increase water recovery and keep water away from the embankment walls.</p> <p>Sub-areal deposition of tailings in thin lifts (300 mm) to promote air-drying.</p> <p>Perimeter cut-off trench to restrict lateral seepage.</p>	

### 3.3.5 Consequence

#### Seepage resulting in groundwater impacts

If seepage is able to migrate to groundwater at the Premises, then the impacts may result in low level onsite impacts due to seepage water quality expected to be of similar quality to the groundwater at the Premises which is suitable for stockwatering. Therefore, the Delegated Officer considers the consequence to be **Minor**.

### Seepage causing groundwater mounding resulting in surface impacts

If seepage causes mounding beneath the TSF which results in surface water expression outside of the TSF footprint, then the impacts may result in mid-level onsite impacts from water logging of Priority 3 flora species and native vegetation. Therefore, the Delegated Officer considers the consequence to be **Moderate**.

#### 3.3.6 Likelihood of Risk Event

The site-specific permeability behaviours and confirmation of pathways at the new TSF location are assumed to be represented by data obtained from tests undertaken at the adjacent previous proposed TSF location. Therefore, in the absence of site-specific permeability behaviours, the Delegated Officer considers the likelihood of seepage to groundwater and groundwater mounding causing surface expression as **possible**.

#### 3.3.7 Overall rating of seepage from the TSF

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix detailed in the Guidance Statement: Risk Assessments (DER 2017) and determined that the overall rating for the risks from seepage at the TSF as **Medium**.

## 4. Regulatory Controls

### 4.1 Works Approval controls

#### 4.1.1 Construction infrastructure and equipment requirements, commissioning, and time limited operational requirements

Design requirements have been included for the Processing Plant, TSF, Process Water Pond, groundwater monitoring bores and tailings discharge and return pipelines as per the Applicant's commitments.

Commissioning and time limited operational requirements have been included for the Processing Plant, TSF, Process Water Pond, and tailings discharge and return pipelines.

#### 4.1.2 Seepage from the TSF

Applicant controls are conditioned in the works approval and the addition of the following conditions:

- Prior to commissioning of the TSF, baseline groundwater sampling of the newly constructed groundwater monitoring bores is required;
- Applicant to provide a construction report within 60 days following completion of the TSF groundwater monitoring bores;
- Applicant to provide hydraulic specifications for the installed TSF clay liner; and
- Testing requirements of the in-situ clay liner to be installed at the base of the TSF.

#### Justification:

Baseline groundwater monitoring at the TSF is required before the commencement of commissioning to determine if groundwater levels are changing or water quality has been affected as a result of seepage.

Construction reports required for the monitoring bores to determine if they are appropriately located for monitoring purposes.

Falling head permeability testing was only undertaken at the previous proposed location for the TSF and has not been undertaken at the new location. Therefore, installation requirements are

necessary for the installed clay liner to the base of the TSF to ensure an appropriate level of seepage protection is provided.

Testing requirements for the in-situ clay liner required to confirm it meets the construction requirements prior to use of the TSF.

#### 4.1.3 Monitoring requirements

The works approval requires the following monitoring requirements:

- Baseline monitoring of groundwater quality at the newly constructed groundwater monitoring bores at the TSF, and then monthly during commissioning and time limited operations;
- Quarterly monitoring of wet tailings fines during Time Limited Operations;
- The volume of tailings discharged to the TSF; and
- The volume of water recovered from the TSF.

##### Justification:

Monitoring of ambient groundwater levels and quality is required to determine if the SWL is changing or water quality is deteriorating indicating seepage from the TSF.

Monitoring of the waste fines is required to indicate potential changes in quality that may result in downstream impacts.

Monitoring of tailings discharged and volume of water returned for determining the water balance and for comparison with seepage modelling provided in the application.

#### 4.1.4 Inspections

The works approval requires the following inspection procedures:

- Tailings waste delivery pipelines;
- Tailings decant water return pipelines;
- Tailings discharge outlets; and
- Freeboard at the TSF and Process Water Pond.

##### Justification:

Visual inspections of containment infrastructure and pipelines are required during commissioning and time limited operations and the Applicant is required to keep records of visual monitoring undertaken.

#### 4.1.5 Monitoring reports

The works approval requires the following reports be submitted:

- Environmental Compliance Report and Critical Containment Infrastructure Report demonstrating that the infrastructure has been installed as committed to and as per the required Infrastructure and equipment requirements tables, with no material defects;
- Environmental Commissioning Report providing a summary of the commissioning activities with timeframes, ore processed, product produced, tailing waste deposited, summary of monitoring results obtained and environmental performance; and
- Time Limited Operations report providing ore processed, product produced, tailings waste deposited, tailings return water covered, tailings waste fines density (solid vs water content), water balance for the TSF including calculated seepage, summary of monitoring results obtained and environmental performance.

### Justification:

Reporting requirements are necessary for the administration of the works approval, validating against the design criteria and ongoing acceptability of the operations.

## 5. Consultation

Table 7 provides a summary of the consultation undertaken by the department.

**Table 7: Consultation**

Consultation method	Comments received	Department response
Application advertised on the department's website	Comment period expired 29 November 2020. No comments received.	N/A
Shire of Meekatharra advised of proposal 10 November 2020	Comment period expired 24 November 2020. No comments received.	N/A`
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal 10 November 2020	Comment received from Maree Doyle, Environmental Officer on 23 November 2020.  <i>I have reviewed the application form and supporting documentation provided and DMIRS do not have any specific comments on the works approval (W6455/2020/1). The works described are consistent with the Mining Proposal that is currently under assessment (Registration ID 90143). As part of the Mining Proposal assessment, a DMIRS Geotechnical Engineer has had the opportunity to review the Tailings Storage Facility Design Report and is satisfied that "...the project meets geotechnical considerations and meets acceptance criteria."</i>	Comments noted.
Applicant was provided with draft documents on 9 December 2020	Refer to Appendix 1	Refer to Appendix 1
Applicant was provided with an updated draft documents via email on 11 December 2020	Comment received from Kristy Sell on 11 December 2020.  Correction in Table 1 of condition 1. Process water pond has internal wall dimensions of 50 m x 50 m, not external wall dimension as stated in the draft Works Approval.  All other changes supported.	Amended to reflect clarification.

## 6. Conclusion

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

## References

1. Department of Environment Regulation (DER) 2016, *Guidance Statement: Environmental Siting*, Perth, Western Australia.
2. DER 2017, *Guidance Statement: Risk Assessments*, Perth, Western Australia.
3. DER 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
4. Schoknecht, N. and Pathan, S. 2013. Soil Groups of Western Australia. In *Resource Management Technical Report 380, Soil Physical Measurement and Interpretation for Land Evaluation, Australian Soil and Land Survey Handbooks Series 5* (4<sup>th</sup> ed). Perth: DAFWA.
5. Resource Engineering Consultants Pty Ltd, August 2020, *Tailings Storage Facility Design Report*, Butcherbird Manganese Project Western Australia, Element 25 Ltd.
6. Ecoscape. 2019a. Butcherbird Manganese Project – Fauna Assessment, MBS Environmental on behalf of Element 25. Reference: 4250-18R Butcherbird Flora Final.

## Appendix 1: Summary of applicant's comments on risk assessment and draft conditions

Condition	Summary of applicant's comment	Department's response
Works Approval Front page – Assessed production capacity	Change to 1,600,000 tpa	Supported. The application has stated a maximum production rate of 1,600,000 tpa at the processing plant, however the application also estimates an ore processing throughput of 1,200,000 tpa. Stating the maximum capacity aligns with Section 2.2 of DWER's <i>Industry Regulation Guide to Licensing, June 2019</i> . This updated throughput is not expected to alter the risk to the environment.
Table 1 of condition 1	Change wording to lined with 1 -1.5 mm HDPE liner. Cannot test permeability of HDPE when in situ.	Supported. Condition updated requiring a minimum HDPE liner thickness of 1.0 mm is installed. The liner thickness requirement is supported by guidance provided in DWER's WQPN 26 ' <i>Liners for containing pollutants, using synthetic membranes</i> ', August 2013
Table 1 of condition 1	Remove pipeline flow/leak sensors as this will not be fitted. There is no power source at the TSF end to allow flow sensors to work. Will be reliant on visual observations and complying with bunds of specified capacity as in point 1.	Supported. Condition updated by removing this requirement. Bunding capacity and routine inspections provide an adequate level of protection for low hazard waste.
Table 8 of condition 17	The quality parameters required are different between the 2 discharge points. Suggest these should be aligned.  Remove mercury from groundwater and tails as materials characterisation showed none present and geology doesn't support it being present.	Supported. Parameters aligned and also updated to reflect the sampling parameters from groundwater monitoring conducted at the proposed TSF in May 2019.
Table 8 of condition 17	Confirm if this is tailings supernatant or tails solids. Assume supernatant given units are mg/L.	Updated. Sampling of the supernatant pond required.



## Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)				
<b>Application type</b>				
Works approval	<input checked="" type="checkbox"/>			
Licence	<input type="checkbox"/>	Relevant works approval number:		None <input type="checkbox"/>
		Has the works approval been complied with?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Has time limited operations under the works approval demonstrated acceptable operations?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>	
		Environmental Compliance Report submitted?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Date Report received:		
Renewal	<input type="checkbox"/>	Current licence number:		
Amendment to works approval	<input type="checkbox"/>	Current works approval number:		
Amendment to licence	<input type="checkbox"/>	Current licence number:		
		Relevant works approval number:	N/A	<input type="checkbox"/>
Registration	<input type="checkbox"/>	Current works approval number:	None	<input type="checkbox"/>
Date application received	31 August 2020			
<b>Applicant and Premises details</b>				
Applicant name/s (full legal name/s)	Element 25 Limited			
Premises name	Butcherbird Manganese Project			
Premises location	Mining tenement M52/1074			
Local Government Authority	Shire of Meekatharra			
<b>Application documents</b>				
HPCM file reference number:	<ul style="list-style-type: none"> <li>- A1928850</li> <li>- A1943320</li> <li>- DWERDT348861</li> </ul>			
Key application documents (additional to application form):	<p><b>A1928850</b></p> <ul style="list-style-type: none"> <li>- Att 2A - Project Location, Receptors and Landuse Layout</li> <li>- Att 2B - Indicative Site Layout</li> <li>- Att 2C - Indicative Plant Layout</li> <li>- Att 2D - Indicative TSF Layout</li> <li>- Att 3A - Butcherbird Commissioning Plan – Final</li> <li>- Att 3B - Butcherbird WA Final</li> <li>- Att 6A - Butcherbird Emissions and Discharges Final</li> <li>- Att 7 - Sitting Draft – Final</li> </ul>			

	<b>A1943320</b> Email – Response to Butcherbird Manganese Project WA Questions (15/10/20) DWERDT348861 Email - MBS Environmental – Response to Butcherbird Manganese Project Works Approval Questions (15/10/2020)					
<b>Scope of application/assessment</b>						
Summary of proposed activities or changes to existing operations.	Works approval <b>Stage 1 only:</b> Construction of: <ul style="list-style-type: none"> <li>• ore processing equipment consisting of crushing, log-washing, screening, and ore sorting infrastructure to process 1.6 Mt per annum of mined ore;</li> <li>• a tailings storage facility (TSF) for storage of wastes from ore processing; and</li> <li>• process water dam.</li> </ul> Note Stage 1 uses simple, physical ore processing methods with no chemical use for the extraction of manganese (no leaching and therefore no leach residue produced). Stage 1 also consists of mining above the water table and therefore no dewatering is required at the Premises.					
Category number/s (activities that cause the premises to become prescribed premises)						
Table 1: Prescribed premises categories						
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="145 1093 831 1160">Prescribed premises category and description</th> <th data-bbox="831 1093 1471 1160">Proposed production or design capacity</th> </tr> </thead> <tbody> <tr> <td data-bbox="145 1160 831 1249">Category 5: Processing or beneficiation of metallic or non-metallic ore</td> <td data-bbox="831 1160 1471 1249">1,600,000 tonnes per annual period</td> </tr> </tbody> </table>			Prescribed premises category and description	Proposed production or design capacity	Category 5: Processing or beneficiation of metallic or non-metallic ore	1,600,000 tonnes per annual period
Prescribed premises category and description	Proposed production or design capacity					
Category 5: Processing or beneficiation of metallic or non-metallic ore	1,600,000 tonnes per annual period					
<b>Legislative context and other approvals</b>						
Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referral decision No: Managed under Part V <input type="checkbox"/> Assessed under Part IV <input type="checkbox"/>				
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Ministerial statement No: EPA Report No:				
Has the proposal been referred and/or assessed under the EPBC Act?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Reference No:				
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Certificate of title <input type="checkbox"/> General lease <input type="checkbox"/> Expiry: Mining lease / tenement <input checked="" type="checkbox"/> Expiry: 28/6/2041 Other evidence <input type="checkbox"/> Expiry:				

Has the applicant obtained all relevant planning approvals?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>	Approval: Expiry date: If N/A explain why?
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	CPS No: CPS 8991/1 .
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Application reference No: N/A Licence/permit No: N/A
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Application reference No: Licence/permit No: 036433
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Name: East Murchison Groundwater Proclamation Area Type: Proclaimed Groundwater Area Has Regulatory Services (Water) been consulted? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> Regional office: Midwest/Gascoyne office – Water Licensing Officer - Mick Major
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Name: N/A Priority: P1 / P2 / P3 / N/A Are the proposed activities/ landuse compatible with the PDWSA (refer to <a href="#">WQPN 25</a> )? Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Is the Premises subject to any other Acts or subsidiary regulations (e.g. <i>Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxx</i> )	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<i>Dangerous Goods Safety Act 2004</i> <i>Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulation 1974</i>
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Is the Premises subject to any EPP requirements?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	

Is the Premises a known or suspected contaminated site under the <i>Contaminated Sites Act 2003</i> ?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Classification: N/A Date of classification: N/A
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