Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Works Approval Number	W6154/2018/1
Applicant	Albemarle Lithium Pty Ltd
ACN	618 095 471
File Number	DER2018/000968
Premises	Albemarle Kemerton Plant Wellesley Road Wellesley, WA 6233 Part of Lot 253 on Plan 411027 Certificate of Title Volume 2945 Folio 681 As defined by the coordinates in Schedule 1 of the Works Approval
Date of Report	16/11/2018
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1. Definitions of terms and acronyms

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

Table 1: Definitions

Term	Definition
Applicant	Albemarle Lithium Pty Ltd
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CS Act	*Contaminated Sites Act 2003* (WA)
Cth	Commonwealth
Decision Report	refers to this document.
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.
DRCS	Dilute rubidium/caesium solution
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)
KSIA	Kemerton Strategic Industrial Area
LHM	Lithium hydroxide monohydrate
Minister	the Minister responsible for the EP Act and associated regulations
MS	Ministerial Statement
Mtpa	million tonnes per annum
NEPM	National Environmental Protection Measure
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
PM_{10}	used to describe particulate matter that is smaller than 10 microns (µm) in diameter
$PM_{2.5}$	used to describe particulate matter that is smaller than 2 µm in diameter
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
Primary Activities	refers to the prescribed premises activities listed on the front of the works approval as described in Schedule 2 of the works approval, at the locations shown in Schedule 1 of the works approval
Risk Event	As described in *Guidance Statement: Risk Assessment*
SOC	Spodumene ore concentrate
WC Act	*Wildlife Conservation Act 1950* (WA)

2. Purpose and scope of assessment

Albemarle Lithium Pty Ltd (Applicant) lodged an application for a works approval under Part V of the *Environmental Protection Act 1986* (EP Act) on 14 June 2018 (the Application) to construct and operate a facility that will refine spodumene ore concentrate (SOC) into lithium hydroxide monohydrate (LHM). At full capacity the LHM Plant is to have five processing trains each capable of producing 20,000 tonnes per annum (tpa) from spodumene ore concentrate (SOC) for a total LHM production capacity of 100,000 tpa. The proposed site for the LHM Plant is located in the Kemerton Strategic Industrial Area (KSIA) within the Shire of Harvey.

The Application includes the proposed staged construction and initial operation of each processing train with the final processing train estimated to be operational by 2025. This Decision Report documents the Delegated Officer's assessment and determination of the Application consistent with DWER's Regulatory Framework. The scope of risk assessment includes potential impacts from emissions and discharges during the construction and operational phases.

Tailings are proposed to be transferred offsite to an existing third party Class III landfill facility licensed under Part V of the EP Act for storage in a dedicated containment cell. The construction and operation of a tailings storage cell at an offsite landfill facility is not within the scope of this assessment. The Application notes offsite tailings storage will be the subject of a separate application under Part V of the EP Act from a third party.

2.1 Application details

Table 2 lists the documents submitted during the assessment process.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received	DWER ref.
Application Form dated 7 June 2018 with the following supporting documentation: • Albemarle Kemerton Plant, Works Approval Application Supporting Report, June 2018; • Albemarle Kemerton Plant, Report, Water Management Plan, Revision B, June 2018; • Albemarle Kemerton Plant, Air Quality Impact Assessment, November 2017; • Albemarle Kemerton Plant, Noise and Vibration Assessment, November 2017; • Albemarle Kemerton Plant, Report , Acid Sulphate Soils Management Plan, Revision B, May 2018	14/06/2018	A1695607 A1695906 A1695611 A1695613 A1695616 A1695615
Email correspondence from GHD (Amine Callegari): *Water Management Plan, Wood*, Rev0, July 2018	18/07/2018	A1705008
Email correspondence from GHD (Amine Callegari): *Noise and vibration assessment – updated*, Wood, 24 July 2018	25/07/2018	A1705798
Email correspondence from GHD (Amine Callegari): *Air quality impact assessment – updated*, GHD, July 2018	25/07/2018	A1705799
Email correspondence from GHD (Amine Callegari): *Proposed plant layout and air emission source revised site layout maps*	25/07/2018	A1705800
Email correspondence from GHD (Amine Callegari): *Air quality impact assessment model input files*	26/07/2018	A1705960
Email correspondence from Wood (Catherine Paxton): *Commissioning emission overview, air emissions point source table and air emissions key sources table*.	18/08/2018	A1712502
Email correspondence from Wood (Thirl Millachip): *Updated air emissions layout drawing with labels for each individual stack/vent.*	27/08/2018	A1714493
Email correspondence from GHD (Amine Callegari): *Memo with air emissions additional information.*	31/08/2018	A1716098

The Applicant applied for the following prescribed premises categories:

- Category 5 (Processing or beneficiation of metallic or non-metallic ore);
- Category 31 (Chemical manufacturing);
- Category 44 (Metal smelting or refining);
- Category 67 (Fuel burning); and
- Category 73 (Bulk storage of chemicals etc.)

The Delegated Officer reviewed the Application and determined that the primary activities fall within the categories listed in Table 3.

Table 3: Prescribed Premises Categories in the Application

Classification of Premises	Description	Proposed Premises production or design capacity
Category 31	Chemical manufacturing: premises (other than premises within category 32) on which chemical products are manufactured by a chemical process.	100,000 tpa (LHM) 200,000 tpa (sodium sulfate)
Category 44	Metal smelting or refining: premises on which metal ore, metal ore concentrate or metal waste is smelted, fused, roasted, refined or processed.	1 Mtpa (spodumene ore concentrate)
Category 67	Fuel burning: premises on which gaseous, liquid or solid fuel is burnt in a boiler for the supply of steam or in power generation equipment.	2,300 kg/hr
Category 73	Bulk storage of chemicals etc.: premises on which acids, alkalis or chemicals that – (a) contain at least one carbon to carbon bond; and (b) are liquid at STP (standard temperature and pressure, are stored.	8,070 m^3

Key Finding: The Delegated Officer reviewed the Application and has found:

1. Primary Activities in the Application fall with Categories 31, 44, 67 and 73.

3. Background

The LHM Plant is to be located on Part of Lot 253 on Plan 411027 in Wellesley in the Shire of Harvey, approximately 17 km north east of Bunbury as depicted in Map A (Appendix 3). The land is vacant undeveloped land within the strategic industry zone of the Kemerton Strategic Industrial Area (KSIA) as depicted in Map B (Appendix 3).

The Applicant is a wholly owned subsidiary of Albemarle Corporation, a global specialty chemicals company with businesses in lithium, bromine and refining catalysts. It has entered into a two year option to lease the Premises from Landcorp, with the option for an initial 30 year lease term subject to the Applicant obtaining all relevant environmental and planning approvals.

Spodumene ore concentrate will be initially supplied to the LHM Plant by the Talison Lithium Australia Pty Ltd (Talison) Greenbushes Lithium Operation. The Applicant has a 49% ownership of Talison who own and operate the Greenbushes Operation. The SOC refining process also produces sodium sulfate as by-product. Sodium sulfate and LHM will be packaged, loaded into containers and trucked to Fremantle Port for export. At full capacity with five processing trains operating, one million tonnes per annum of SOC will produce

100,000 tpa LHM and 200,000 tpa sodium sulfate.

4. Overview of Premises

4.1 Infrastructure

Table 4 lists infrastructure associated with each prescribed premises category.

Table 4: Premises Category 44, 67 and 73 infrastructure

Area or activity		Infrastructure
Prescribed Activity Category 31 and 44		
At full production capacity (five processing trains) one million tonnes per annum of SOC (a metal ore concentrate) is processed through a pyrometallurgical (calcined, crushed / milled and acid roasted) unit followed by hydrometallurgical (leached, purified, causticised, crystallised and dried) unit to produce 100,000 tpa of LHM and 200,000 tpa of sodium sulfate. Refer to Appendix 3: Map D – Site layout map for the reference plan.		
1	Spodumene delivery / spodumene storage and feed preparation	Covered storage area.
2	Calcining	Natural gas-fired kiln with dust removal circuit consisting of a bag filter and wet alkaline scrubber venting to atmosphere via a stack. Cooling system.
3	Calcine crushing	Screen and small jaw crusher. Grated ball mill with bag filter venting to atmosphere via stack.
4	Acid roasting	Mixing system. Natural gas-fired, indirect heated, acid roasting kiln venting roast kiln flue gas to atmosphere via a stack Cooling system with bag filter vented to atmosphere via a stack.
5	Acid vapour scrubbing	Acid roast kiln process off gas scrubbing system vented to atmosphere via a stack comprising: • water packed scrubber; • sodium hydroxide packed scrubber; and • Electrostatic precipitator.
6	Acidified ore storage	Fully enclosed warehouse with ventilation system.
7	Leaching	Agitated leach tanks with scrubbing system vented to atmosphere via a stack.
8	Filtration and tailings	Tailings filtration vacuum belt filters. Tailing storage bunded hardstand pad.
9	Purification	Agitated tanks and filter press.
10	Causticisation	Reactors and filtration unit.
11	Sodium sulfate decahydrate crystallisation	Primary sodium sulfate with concentrator, cooling crystalliser, wash tank and centrifuge.
12	Sodium sulfate anhydrous crystallisation – lithium removal	Secondary sodium sulfate redissolve circuit tanks, evaporator and centrifuge.
13	Sodium sulfate anhydrous drying and packaging	Natural gas-fired, direct heated dryer with dust removal and bag filter venting to atmosphere via a stack. Automated packing equipment within naturally ventilated roofed warehouse.
14	Sodium sulfate storage	Naturally ventilated roofed warehouse.
15	Crude lithium hydroxide evaporation and	Evaporator-crystallisers with scrubbers vented to atmosphere.

Area or activity		Infrastructure
	crystallisation	Centrifuges. Lithium carbonate precipitation tanks.
16	Pure lithium hydroxide evaporation and crystallisation	Evaporator-crystallisers with scrubbers vented to atmosphere. Centrifuges. Feed tank.
17	Lithium hydroxide monohydrate drying and packaging	Natural gas-fired dryer with scrubber vented to atmosphere. Cooler with scrubber vented to atmosphere. Magnetic screens. Automated packaging equipment housed in an enclosed warehouse under positive air pressure.
18	Lithium hydroxide monohydrate storage	Naturally ventilated roofed warehouse.
19	Miscellaneous common services infrastructure	Potassium removal / collection. Process water tanks. Cooling towers. Reagent storage (quicklime and limestone). Runoff ponds. Cooling towers. Refrigeration plant.
Prescribed Activity Category 67		
At full capacity, 2,300 kg/hr of natural gas will be combusted for the production of steam in five boilers (one for each of the five processing trains).		
20	Boilers	Five natural gas fired steam boilers vented to atmosphere via stack.
Prescribed Activity Category 73		
21	Reagent storage	Sulfuric acid and caustic storage.
Directly related activities		
22	Reverse osmosis (RO) water system	Reverse osmosis (RO) plant with treated water tanks and brine discharge ponds.

4.2 Exclusions to the Premises

The construction and operation of ancillary infrastructure is not related to Prescribed Activities. The following are excluded from the scope of assessment:

- Administration building, production office and control room;
- Employee facilities;
- Emergency response/first aid facility;
- Laboratory;
- Access roads, site security/access control points and carparks;
- Connection to site services;
- Laydown areas;
- Potable water supply; and
- Workshops.

The Applicant proposes a sewage wastewater collection system which will be pumped to Kemerton Wastewater Treatment Plant. It does not fall within Category 54 or 85.

4.3 Construction aspects

Following site clearing and topsoil removal, the Applicant will undertake civil earthworks to establish a base foundation and drainage for the Premises. An existing agricultural drain runs diagonally through the south east corner of the Premises and the Applicant will temporarily divert it to retain its function. Landcorp will establish a permanent diversion at an alternate location as part of the works associated with establishing Kemerton Road after the commencement of LHM Plant construction works.

Perimeter drains will be established at the northern and southern boundaries to convey stormwater to two infiltration basins designed to contain a 1 in 10 year, 24 hour rainfall event. When full, stormwater overflows from the basins via a spill way and road culverts to the adjacent Kemerton roadside drainage channel.

The Applicant expects standard construction hours of 7am to 7pm, Monday to Friday with a half day on Saturdays. Around 25 per cent of construction activities will be required to occur at night and public holidays.

The LHM Plant will consist of five processing trains constructed through a staged approach and maximum production is not expected to be achieved until approximately 2025. Table 5 from the Application outlines the proposed construction schedule. Some common infrastructure (e.g. reagent storage areas, sewage system) will initially be sized for three trains operating and increased when trains 4 and 5 are established.

Table 5: Proposed construction schedule for the Premises (Source: Application)

Stage	Construction	Commissioning	Operation
Common infrastructure	Commence – Q3/Q4 2018	Q4 2019/Q1 2020	Q1/Q2 2020
Train 1	Commence – Q1 2019 Complete – Q1/Q2 2020	Commence – Q1/Q2 2020 Complete – Q2/Q3 2020	Q2/Q3 2020
Train 2	Commence – Q2/Q3 2019 Complete – Q2/Q3 2020	Commence – Q2/Q3 2020 Complete – Q3/Q4 2020	Q3/Q4 2020
Train 3	Commence – Q3/Q4 2019 Complete – Q4 2020/Q1 2021	Commence – Q4 2020/Q1 2021 Complete – Q1/Q2 2021	Q1/Q2 2021
Train 4	2022	2023	2024
Train 5	2023	2024	2025

4.4 Operational aspects

The LHM Plant will have five individual processing trains at completion with each train capable of producing 20,000 tpa LHM and 40,000 tpa sodium sulfate from 200,000 tpa SOC feed material. The LHM Plant will be a 24/7 operation although initial transport of SOC, tailings and products are likely to be undertaken during daylight hours.

Spodumene ore concentrate contains 6% lithium oxide and is delivered via truck and stockpiled in a covered warehouse. The process involves additional reagent inputs of limestone, quicklime, sulfuric acid and caustic. Processing trains have two distinct phases; a pyrometallurgical phase followed by a hydrometallurgical phase.

Pyrometallurgical processing

The SOC is fed into each processing train via front end loader where it is calcined, cooled, screened and oversize crushed in a jaw crusher and combined with undersize for ball mill grinding to a finer size.

After the ball mill, the ground calcine is mixed with concentrated sulfuric acid and the slurry is roasted in a gas-fired, indirect-heated rotary kiln. The gas-fired indirect heating of the kiln means that combustion air emissions are discharged separately to acid gases from the SOC acid roasting that are treated and recovered through a scrubbing circuit. Acid roasted solids are cooled and stockpiled in an acid roasted solids storage warehouse pending input into the start of the hydrometallurgical phase of the refining process.

Hydrometallurgical processing

Acid roasted solids are combined with a recycle water stream to leach the lithium as lithium sulfate, the resulting slurry filtered on vacuum belt filters. It is then washed and a filtrate purified through causticisation with sodium hydroxide and further filtering to remove precipitates. LHM and sodium sulfate are produced through respective crystallisation, centrifuge, washing and drying processes. The products are sealed in bags and stored in sea containers pending truck loading and transport to port for shipment.

The leaching and belt filter process also generates a filter cake tailing which is temporarily stockpiled pending truck loading and storage at an offsite landfill facility. At full capacity (i.e. five processing trains) up to 1.1 million tonnes per year of tailings are expected to be produced. The tailings are comprised of aluminosilicates, gypsum, residual salts and approximately 30% water. An overview schematic of the refining process from the Application is shown in Figure 1 below.

Other processing

DRCS is generated as a by-product due to small quantities present in SOC and will be collected in in tanks to on sell the solution. DRCS makeup comprises approximately 10% lithium sulfate, 5% potassium sulfate, 17% sodium sulfate, 2% rubidium sulfate, 5% caesium sulfate and 30% sodium bicarbonate.

Process water is to be sourced from the Kemerton Waste Water Treatment Plant (KWWTP) and the Harvey Water Scheme. Ultra-filtration and UV treatment plants are to be installed at the supplier's end to produce an industrial water specification. Water will be stored within a raw water pond.

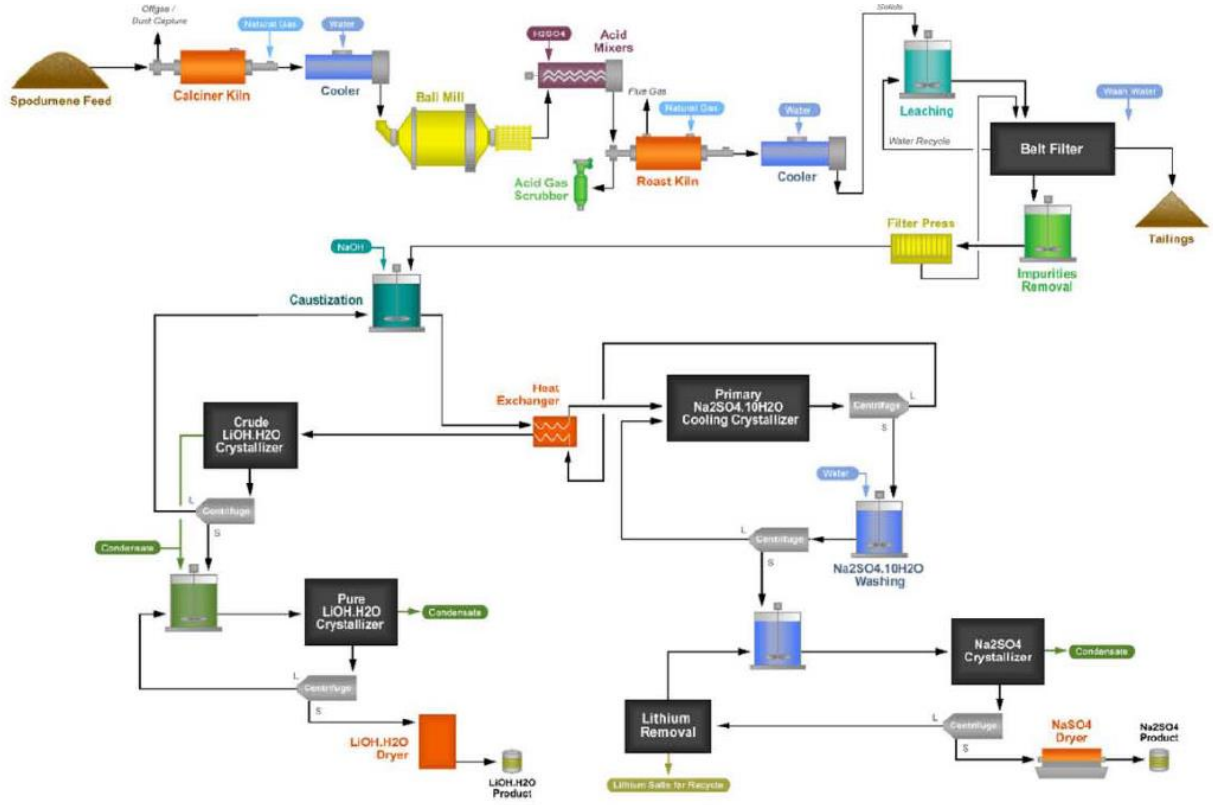


Figure 1: Refining process flow diagram (Source: Application)

The Applicant plans to operate each processing train in a staged manner, based on the expected schedule in Table 5. The Applicant outlines its three internal phases of commencing operations:

1. Function testing whereby equipment is energised to confirm it is operational;
2. 'No load commissioning' whereby equipment is operated without any throughput to confirm all operational components are functioning as designed; and
3. 'Load commissioning' whereby SOC is introduced into the LHM Plant and the functionality of infrastructure and services is checked while the LHM Plant operates with some throughput which is increased over the period.

5. Legislative context

Table 6 summarises approvals relevant to the assessment.

Table 6: Relevant approvals and tenure

Legislation	Number	Subsidiary	Approval
Environment Protection and Biodiversity Conservation Act 1999 (Cth)	EPBC 2017/8099	Albemarle Lithium Pty Ltd	Commonwealth Minister for Environment approval of the proposal under the EPBC Act.
Dangerous Goods Safety Act 2004	Not available		The storage and handling of Dangerous Goods will be subject to a Dangerous Goods licence. The Application notes that a Dangerous Goods licence will be applied for prior to operating storage facilities.
Part IV of the *EP Act (WA)*	MS 1085		Implementation of the Albemarle Kemerton Plant proposal.
Planning and Development Act 2004	18/01404 (earthworks) 18/39393 (construction)		Shire of Harvey development approval for: 1. Bulk earthworks for site development 2. Construction of permanent infrastructure

5.1 Federal legislation - EPBC Act

The LHM Plant proposal was determined to be a controlled action (EPBC 2017/8099) under the EPBC Act given the likelihood of it having a significant impact on one or more Matters of National Environmental Significance (MNES). It was determined that the proposed action would likely have a significant impact on listed threatened species and communities.

The controlled action was assessed by the EPA (W.A) bilaterally on behalf of the Commonwealth as an accredited assessment under the EPBC Act. The EPA provided its advice to the Commonwealth Minister for Environment in EPA Report 1618 for determination of the proposal under the EPBC Act.

5.2 Part IV of the EP Act

5.2.1 Background

The Environmental Protection Authority (EPA) provides the Government with advice on the environmental acceptability of development proposals (including industry proposals) and statutory planning schemes. The Applicant referred the LHM Plant proposal to the EPA in November 2017 who decided to formally assess the proposal at the level of Referral Information.

The details and scope of the EPA's assessment of the proposal are detailed in EPA Report 1618 which is its report and recommendations to the Minister for Environment. The EPA's assessment considered the following key environmental factors:

- Flora and Vegetation – direct impacts associated with the clearing of native vegetation, priority flora and vegetation associated with a Priority Ecological Community (PEC);
- Terrestrial Environmental Quality – waste management impacts associated with the production and management of 1.1 million tonnes of tailings per year;
- Terrestrial Fauna – direct impacts associated with the clearing of potential black cockatoo foraging and breeding habitat;
- Hydrological Processes – direct impacts (i.e. clearing, hardstands, changes to infiltration rates, runoff diversion and short-term dewatering) associated with the alteration of groundwater and surface water regimes;
- Inland Waters Environmental Quality – direct impacts (i.e. sedimentation, acidification and contamination from leaks/spills of reagents, hydrocarbons, ore, lithium products, tailings or contaminated stormwater) on inland waters (groundwater and surface water); and
- Air Quality – direct emissions of air pollutants and greenhouse gases during or processing and vehicle use.

The EPA provided advice on the regulation of emissions and discharges under Part V of the EP Act in Section 8 of EPA Report 1618. An extract of the EPA's advice is provided in Appendix 2 of this assessment. In summary, the EPA advised that DWER should ensure:

- the plant's final design includes the best-available technology to which the Applicant has committed;
- there is suitable end-of-stack monitoring for $PM_{2.5}$;
- site-specific background gathering and modelling is conducted on a yearly basis to show that the emission of $PM_{2.5}$ is as low, if not lower, than predicted in this assessment; and
- a $PM_{2.5}$ target or limit is placed on the licence.

The EPA's advice on $PM_{2.5}$ was based on its findings that annual average concentrations were predicted to be slightly above the NEPM criteria, however noting the LHM Plant's contribution was small (i.e. approximately five per cent on average) and the background concentration was slightly above the NEPM criteria.

The following excerpt from EPA Report 1618 provides context on the background concentration data for $PM_{2.5}$:

"The EPA advises that the background data taken from the Bunbury monitoring station had an elevated annual average $PM_{2.5}$ concentration due to the long-range transport and recirculation of smoke from lightning-caused bushfires in Waroona Shire, as well as several prescribed burns (DER 2016). The EPA advises that the elevated $PM_{2.5}$ levels from bushfires and prescribed burns would not have been included in the background concentration data for the $PM_{2.5}$ 24-hour average concentrations (they are considered exceptional events), but would rather have been used in the background concentration data for the annual average $PM_{2.5}$ concentrations as per the NEPM requirements (DER 2016).

The EPA considers that the difference between the $PM_{2.5}$ 24-hour average and annual average background concentrations may highlight the issue with using all data to develop an annual average $PM_{2.5}$ concentration where bushfire and prescribed burns are common. The

EPA notes that due to the contribution of bushfires and prescribed burns to data at the Bunbury monitoring station, such events may be having a disproportionate impact on the annual average $PM_{2.5}$ average concentration. For example, DER (2016) shows that the 90th percentile $PM_{2.5}$ 24-hour average concentrations are equal to or lower in Bunbury than the Perth monitoring stations, suggesting the background $PM_{2.5}$ concentration in Bunbury- without the influence of bushfires and prescribed burns- is similar or lower than areas of Perth."

5.2.2 Appeals on EPA Report

The content and recommendations of EPA Report 1618 were subject to appeals that were allowed in part by the Minister for Environment on 27 September 2018. The Appeals Convenor prepared a report for the Minister for Environment that considered and made recommendations on broader grounds of appeal challenging the EPA's assessment of the proposal relating to flora and vegetation fauna, waste management, surface waters and groundwater, air quality and offsets.

In allowing the appeals in part, the Minister for Environment required the following alterations to the recommended conditions:

- Further clarification of the extent of clearing flora and vegetation;
- Amendment to condition 10-1 to specify the residual impacts as they relate to both foraging and breeding habitat for black cockatoos; and
- Condition 9 broadened to include a Greenhouse Gas Management Plan.

5.2.3 Ministerial Statement

Ministerial Statement 1085 (MS 1085) was granted by the Minister for Environment on 26 October 2018 and contains conditions that need to be considered in the assessment of emissions and discharges from the LHM Plant and the imposition of regulatory controls. These are summarised in Table 7.

Table 7: Consideration of MS1085 conditions relevant to this assessment

Condition	Summary requirement	Delegated Officer consideration
N/A	Not to exceed the authorised extent of the proposal as defined in Table 2 in Schedule 1, unless amended under the EP Act.	Table 2 in Schedule 1 authorised extent relates to the extent of vegetation clearing, process plant capacity and tailings production. Process plant capacity limited to 100,000 tonnes of lithium hydroxide product and no more than 200,000 tonnes of sodium sulfate by-product produced per year. No more than 1.1 million tonnes per year of tailings production.
6-1	Construction and ongoing operation in a manner that avoids direct or indirect impacts to threatened flora and communities outside the development envelope.	Regulates the risk of impacts on vegetation beyond the premises boundary during construction and operation.
6-2 to 6-5	Flora and vegetation monitoring and management plan requirements	
7-1	Construction and ongoing operation in a manner that maintains the quality and quantity of off-site surface and groundwater, to the receiving environment including but not limited to the threatened orchid habitat.	Condition 7-1 is non-limiting to the threatened orchid habitat receiving environment. The scope of the Water Management Plan required by condition 7-2 includes management actions for potential impacts from ASS, stormwater runoff and sedimentation during construction and operation. Requires surface water and groundwater monitoring programs to be
7-2 to 7-6	Water management plan requirements, including: • acid sulfate soils; • stormwater runoff and sedimentation; • Groundwater and surface water monitoring for	

Condition	Summary requirement	Delegated Officer consideration
	potential contamination; and • Trigger criteria and contingency actions for threatened flora.	established for potential contamination. Development of trigger levels to prevent impacts to the receiving environment and is non-limiting to threatened flora. Potential impacts to surface water and groundwater are regulated under Part IV of the EP Act.
8-1	Ensure all reasonable and practicable measures to minimise generation of waste and its discharge to the environment during operation.	Regulates the risk of impacts from the generation of waste, including tailings.
8-2 to 8-6	Waste management plan requirements, including the application of the waste management hierarchy to avoid, recover and dispose of waste.	
9-1 to 9-6	Minimise and where possible avoid greenhouse gas emissions including preparation and implementation of a Greenhouse Gas Management Plan.	Emissions of greenhouse gases are not within the scope of assessment and regulation under Part V of the EP Act.

In EPA Report 1618, the EPA noted the following can also be assessed and regulated through a works approval or licence under Part V of the EP Act:

- Water management on the site (hydrological processes);
- Use of chemicals (impacts on the terrestrial environment);
- Chemical storage and management of stormwater (impacts on inland waters); and
- Air quality emissions, including $PM_{2.5}$ (air quality).

On review of the EPA's assessment in EPA Report 1618 and the determined conditions under Part IV of the EPA, the Delegated Officer formed the view that the requirements imposed under Part IV of the EP Act address the risk of potential impacts to surface water and groundwater from the LHM Plant.

5.3 Other relevant approvals

5.3.1 Planning approvals

The Application specifies that the KSIA is a designated Industrial Park under the Shire of Harvey District Planning Scheme No. 1, and the Greater Bunbury Region Scheme. The Premises are zoned 'Kemerton Strategic Industrial' under the Shire of Harvey District Planning Scheme No. 1 and 'Industrial' under the GBRS.

The Applicant has lodged two separate development applications with the Shire of Harvey:

1. Bulk earthworks for site development works; and
2. Construction of permanent infrastructure.

5.3.2 Department of Jobs, Tourism, Science and Innovation

The proposal to construct the LHM Plant is designated a Major Project where the lead agency is the Department of Jobs, Tourism, Science and Innovation (JTSI).

5.4 Dangerous Goods Safety Act 2004 (WA)

The Application includes the construction and operation of infrastructure items used for the storage, transfer and use of chemicals classified as Dangerous Goods under the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007.*

Dangerous Goods legislation in W.A. is administered by the Department of Mines, Industry Regulation and Safety (DMIRS). The Applicant will be seeking the relevant Dangerous Goods licences prior to operating the bulk reagent, fuel and gas storage facilities to comply with the

requirements of the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*.

Key Finding: The Delegated Officer has reviewed legislative context and has found:

1. Conditions regulating the following are imposed on the LHM Plant under Part IV of the EP Act:
    - Lithium hydroxide product, sodium sulfate and tailings production capacity;
    - LHM Plant construction and operational impacts on vegetation beyond the premises boundary;
    - LHM Plant construction and operational impacts on groundwater and surface water to prevent impacts on receiving environments including but not limited to the threatened orchid habitat; and
    - LHM Plant operation impacts from the generation of waste, including tailings.

Under section 54(4) of the EP Act, works approval conditions may not be *"contrary to or otherwise than in accordance with*" MS 1085.

2. Consistent with the Department's *Guidance Statement: Setting conditions*, the risk of impacts on vegetation, groundwater, surface water and the generation of waste from the Premises will not be further assessed or subject to works approval controls to avoid regulatory duplication and inconsistency with requirements under Part IV of the EP Act.
3. EPA's advice on $PM_{2.5}$ emissions to air in EPA Report 1618 is relevant to the assessment of risk and determination of any controls.
4. DMIRS is the primary regulatory authority for regulating public health and safety risks associated with the storage and handling of dangerous goods. There are no requirements to assess safety risks in the Decision Report or include conditions on the works approval or a licence to regulate these risks.

5.5 Part V of the EP Act

5.5.1 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: Land Use Planning* (February 2017);
- *Guidance Statement: Decision Making* (February 2017);
- *Guidance Statement: Risk Assessments* (February 2017);
- *Guidance Statement: Environmental Siting (November 2016).*

Other subsidiary legislation of the EP Act which informs this assessment is the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) and the *Environmental Protection (Unauthorised Discharges) Regulations 2005* (UDR's).

6. Modelling Studies

6.1 Air quality impact assessment report

The Applicant included an initial air quality impact assessment, including modelling, in its Application (Initial AQIA). As consequence of modifications and design changes, a revised air

quality impact assessment was submitted to DWER on 25 July 2018 (Revised AQIA) as listed in Table 2 and supersedes the version submitted with the Application. The Delegated Officer has not further considered the Initial AQIA in this assessment.

The Revised AQIA included:

- Outline of the existing baseline air environment and nearby receptors;
- Air dispersion modelling;
- Comparison of predication pollutant concentrations against air quality standards; and
- Re-evaluation of air quality management and mitigation measures as appropriate.

The adopted background concentrations used for the KSIA airshed are summarised in Table 8.

Table 8: Revised AQIA adopted background concentrations for the KSIA airshed

Pollutant	Averaging period	Conc. (µg/m^3)	Source	Applicant comment
PM_{10}	24 hour	21	Bunbury AQMS	Based on year 2015 data at 75th percentile
	Annual	18		
$PM_{2.5}$	24 hour	10		
	Annual	9		
NO_2	1 hour	65	Environmental Alliances 2010	Background including third party operations
SO_2	1 hour	72		

Thirty seven receptors (rural residential dwellings) were identified through cadastral data by the Applicant and are located the north, west and east/south east of the Premises. The NEPM was the main assessment criteria adopted, however the Victorian EPA SEPP was referenced for SO_3 and 1 hour averaged PM_{10} concentrations at 99.9th percentile. There were eleven sources (nine point source and two diffuse) of air emissions included in the dispersion modelling

A summary of maximum predicted receptor ground level concentrations against NEPM standards is shown in Table 9. Predicted concentrations are based on all five processing trains being operational at production capacity (100,000 tpa).

Table 9: Predicted maximum receptor ground level concentrations for all five processing trains and comparison with standards

Pollutant	Averaging period	Air NEPM Criteria	Maximum predicted incremental conc. at receptors (µg/m^3)	Maximum of criteria (%) excluding background	Maximum predicted cumulative conc. at receptors (µg/m^3)	Maximum of criteria (%) including background
PM_{10}	24 hour	50	2.2	4.4	23.1	46.2
	Annual	25	0.3	1.2	17.8	71.2
$PM_{2.5}$	24 hour	25	1.1	4.4	11	44
	Annual	8	0.15	1.9	9	112.5
NO_2	1 hour	246	147	59.8	212	86.2
	Annual	62	1.6	2.6	N/A (13[1])	21
SO_2	1 hour	570	19	3.3	91	16
	24 hour	228	1.7	0.7	N/A (9[1])	3.9

Pollutant	Averaging period	Air NEPM Criteria	Maximum predicted incremental conc. at receptors (µg/m^3)	Maximum of criteria (%) excluding background	Maximum predicted cumulative conc. at receptors (µg/m^3)	Maximum of criteria (%) including background
	Annual	60	0.22	0.4	N/A (5[1])	8.3
CO	8 hour	10,000	N/A (11[1])	0.11	N/A (586[1])	5.86

Note 1: Initial AQIA used background data from the South Lake air quality monitoring station (AQMS) and Environmental Alliances 2010 for modelling NO_2, SO_2 and CO as these parameters are not measured at the Bunbury AQMS. The Revised AQIA did not source any background data from the South Lake AQMS therefore citing a lack of data, the Applicant only remodeled NO_2 and SO_2 1-hr averages and omitted CO.

An additional assessment of predicted cumulative impact was made by the Applicant using the Environmental Alliances 2010 air emissions modelling for the KSIA. As shown in below, the Applicant found that predicted cumulative emissions of NO_2 and SO_2 for the LHM Plant with a full suite of industries within the KSIA, are well within the assessment criteria.

Table 10: Predicted cumulative impact of the LHM Plant (100,000 tpa) and a full suite of industry in the KSIA using Environmental Alliance 2010 modelling

Pollutant	Criterion (µg/m^3)	Maximum 1 hr ground level conc. from Premises emissions (µg/m^3)	Maximum 1 hr ground level conc. from hypothetical full KSIA scenario (µg/m^3)	Cumulative impact (µg/m^3)
NO_2	246	12	71	83
SO_2	572	9	169	178

6.1.1 Review of the Revised AQIA

The Revised AQIA including the air emissions model has been reviewed by the Department's air quality experts. The review concluded that:

- The dispersion modelling was performed with AERMOD software which is viewed as the most widely used for regulatory purposes.
- The requisite metoreological data sourced from the Bunbury weather station has not undergone a detailed analysis to demonstrate its suitability for air quality assessments, however the low emission rates and subsequent estimated ambient concentrations do not indicate a need for further analysis.
- Comparison criterion values used were appropriate in the absence of guideline values specific to W.A.
- The conclusions in the Revised AQIA are viewed as reliable.
- The Applicant adopted a background concentration approach of using the 70th percentile concentration. This is considered reasonable for particles, noting that a non-varying background concentration cannot represent temporal variation that may be important in terms of cumulative impacts under some meteorological conditions.
- The Bunbury data is likely to be a reasonable representation of regional particle levels, noting the importance of region-wide particle events in the area (e.g. fires). Important local sources (other Kemerton industries) were not represented in these data.
- In this case, the measured $PM_{2.5}$ concentrations for the modelled year were higher than average as a result of bushfires and prescribed burns. This is most likely the reason for the predicted exceedance of the annual average $PM_{2.5}$ concentration.
- Concentrations predicted by dispersion models are entirely dependent on the assumed source strengths or emission rates. Apart from a statement the parameters were obtained

from the Applicant, there was limited detail on these parameters. The AQIA gives qualitative consideration to upset conditions for scenarios such as power failure or control system failure, for which plant shutdown is the planned response. Other upset conditions such as plant start-up can also be important for short term (e.g. hourly) concentrations.

- In noting the EPA's advice for Part V of the EP Act regulatory licensing, the $PM_{2.5}$ emissions and contribution to cumulative impacts of $PM_{2.5}$ appears to be low. However, given the uncertainty regarding the emissions estimation used in the assessment it would be valuable to undertake an emissions verification process through end-of-stack monitoring.

Key Finding: The Delegated Officer reviewed the Revised AQIA and found:

1. The Applicant's air dispersion modelling used a background annual average $PM_{2.5}$ concentration of 9 µg/m^3 sourced from the Bunbury AQMS. This concentration value exceeds the NEPM criteria (8 µg/m^3) due to contribution from events such as bushfires and prescribed burns.
2. Due to the background concentration of annual average $PM_{2.5}$, the Applicant's modelling of $PM_{2.5}$ annual average air quality impacts shows a predicted exceeded of the NEPM criteria at receptors.
3. The LHM Plant annual average contribution is low (0.15 µg/m^3 equivalent to 1.9 per cent of the NEPM criteria)

6.2 Noise and vibration assessment report

The Applicant included an initial noise and vibration assessment, including modelling, in its Application (Initial NVA). As consequence of modifications and design changes, a revised noise and vibration assessment was submitted to DWER on 25 July 2018 (Revised NVA) as listed in Table 2 and supersedes the version submitted with the Application. The Delegated Officer has not further considered the Initial NVA in this assessment.

The Revised NVA included:

- Measurement of background noise levels at locations representative of the potentially worst affected noise sensitive receptors;
- Determination of the applicable assigned noise levels in accordance with the Noise Regulations'
- A predictive noise model;
- Noise predictions for potentially worst affected noise sensitive premises outside the Premises boundary under a range of operational and weather scenarios; and
- Comparison of predicted noise levels to calculated assigned noise levels to assess predicted compliance.

Two operational scenarios were modelled; a three processing train LHM Plant (Scenario 1) and a five processing train LHM Plant (Scenario 2). For each of the two scenarios, the noise model was executed for two atmospheric conditions:

- Neutral atmosphere (night), consisting of calm conditions (no wind) and no positive lapse rate; and
- 'Worst-case' weather conditions.

The Revised NVA considered forty seven noise receiver locations, all considered 'highly sensitive areas' as defined in the Noise Regulations. Influencing factors applied to assigned noise levels for individual receiver locations were varied based on current land use and traffic factors. Receivers in the Wellesley North region were identified within the KSIA Core Industrial Zone and receivers in the Wellesley region and one in Wellesley South are located in the KSIA Ancillary zone.

A +5 dB adjustment was added to the influencing factor in accordance with the Noise

Regulations as the LHM Plant is located within the Kemerton Industrial Park Policy Area as specified in the Shire of Harvey District Planning Scheme No. 1. A summary of the Revised NVA calculated assigned noise levels (including influencing factors) and the model predicted noise levels is provided in Table 11 and Table 12 for a three and five processing train scenario respectively. Localities in Table 11 and Table 12 marked with an asterisk are inside the KSIA Core or auxiliary boundaries and the assigned noise level ranges are due to the proximity of some receivers to Old Coast Road.

Table 11: Summary of Revised NVA predicted noise levels against calculated assigned noise levels for a three processing train scenario

Locality / area	L_{A10} assign noise level (including influencing factor) dBA	Predictive level (LA_{10}) in dBA	
		Calm	'Worst Case'
Benger & Brunswick	40	21.0 - 27.2	26.2 - 32.6
Benger North	40	16.5 - 22.4	21.3 - 27.6
Leschenault	40-46	21.2	26.5
Parkfield (North)	40-42	20.9 - 25.2	26.1 - 30.4
Parkfield (South)	40-42	24.4 – 25.1	29.5 - 30.3
Wellesley *	35	33.5 - 38.4	38.9 - 43.6
Wellesley (North) *	40	26.2 - 30.2	31.5 - 35.5
Wellesley (South) *	35	31.6	36.9
Wellesley (South)	35	27.1	32.5

Table 12: Summary of Revised NVA predicted noise levels against calculated assigned noise levels for a five processing train scenario

Locality / area	L_{A10} assign noise level (including influencing factor) dBA	Predictive level (LA_{10}) in dBA	
		Calm	'Worst Case'
Benger & Brunswick	40	22.9 - 29.1	28.1 - 34.6
Benger North	40	18.5 - 24.1	23.3 - 29.3
Leschenault	40-46	22.4	27.7
Parkfield (North)	40-42	21.9 - 26.1	27.0 - 31.4
Parkfield (South)	40-42	25.6 - 26.2	31.1 - 31.4
Wellesley *	35	35.4 - 40.3	40.8 - 45.5
Wellesley (North) *	40	27.9 - 31.9	33.2 - 37.2
Wellesley (South) *	35	33.5	38.8
Wellesley (South)	35	28.7	34.2

6.2.1 Review of the Revised NVA

The Revised NVA including the noise model has been reviewed by the Department. The review concluded the following:

- The modelled results and conclusions of the Revised NVA are reasonable on the basis that:
    - the methodology of the noise model, its assumptions and the selection of the modelling inputs seems correct and reliable;
    - background ambient noise monitoring was conducted appropriately;
    - a KSIA increase adjustment of 5dB to the influencing factor as required under the Noise Regulations was correctly considered;
    - modelled results are based on a set of sound power level limits that apply to all major equipment items and the limits don't seem unachievable.
- Modelled results indicate the noise emission levels for a five-train plant will not exceed the assigned noise levels at any noise sensitive receptor outside the KSIA boundary. However, the assigned noise level is approached at one receptor outside the KSIA under 'worst-case' conditions and implies that noise emissions may potentially exceed the assigned noise levels.
- The modelled noise levels at the receptor indicate the predicted LA10 noise level is 34.2 dB(A) under the 'worst-case' scenario. This is significantly lower than the night-time assigned noise level of 40 dB(A) for that receptor, but only marginally lower than the noise level of 35 dB(A) for it 'not to significantly contribute.' The requirement for 'not to significantly contribute' also depends on the noise emission levels from existing industries in proximity. Therefore, the risk of noise non-compliance at the particular receptor outside the KSIA is considered insignificant.
- The Revised NVA predicted LHM Plant noise emission levels will exceed the night-time noise limit of 35 dB(A) at two areas within the KSIA boundary – namely Wellesley and Wellesley South for either the three-train plant or five-train plant. The exceedances can be as high as 10.5 dB under the 'worst-case' scenario. The Applicant didn't discuss or propose noise control measures to address this noise non-compliance issue and appeared to consider that the compliance with the assigned noise levels is not required at those existing homes located inside KSIA core and auxiliary (buffer) boundaries. This is not necessarily a correct interpretation.
- However, all lands within the KSIA boundaries are currently zoned as Kemerton Park Industry, which are Type A lands as specified by Schedule 1 of the Noise Regulations. Based on Schedule 3 of the Noise Regulations, the influencing factor of these noise sensitive premises located within KSIA should be at least 20dB. Therefore, the actual night-time noise limit for those existing homes located within KSIA boundaries should be 55 dB(A) (for 'not to significantly contribute'), instead of 35 dB(A) as calculated in the Revised NVA. Predicted noise emission levels from LHM Plant operation are therefore expected to comply with the night-time assigned noise level at all existing homes within KSIA.
- The predicted environmental vibration impact results, construction noise impact and proposed construction noise management measures all seem acceptable.
- Proposed noise control measures seem practicable and effective for the LHM operation. However, the final design and implementation of the noise control measures depend on the actual purchased equipment items and their noise emission levels.

Key Finding: The Delegated Officer reviewed the Revised NVA and found:

1. Review of the Revised NVA identified errors in the calculation of assigned noise levels and consequently the predicted noise levels from the LHM Plant operation are expected to comply with the night-time assigned noise levels at all existing modelled receptors within and outside the KSIA boundary.

7. Consultation

The Delegated Officer had regard to the location of the Premises and did not identify direct interest stakeholders on the basis of proximity to the Premises. The Application was directly referred to the Shire of Bunbury and Shire of Harvey for comment.

The Application was advertised on the Department's website for a 21 day comment period with a notification placed in the *West Australian* newspaper. The Department did not receive any submissions and did not receive a response from the Shire of Bunbury or Shire of Harvey.

8. Location and siting

8.1 Siting context

The Premises are located approximately 17 km north east of Bunbury and 210 km south of Perth and within the KSIA's Strategic Industry Zone which is a designated industrial park under the Shire of Harvey District Planning Scheme No. 1 and the Greater Bunbury Region Scheme.

The KSIA was established in 1985 as a location for major (heavy) industry to undertake downstream processing and value-adding to the primary resources in the South West. The EPA Report 1618 describes the KSIA as presently being made up of cleared former grazing land, forestry plantations, semi-rural residential land holdings and areas of native vegetation and wetlands with land ownership divided into three categories:

- LandCorp – approximately 57 per cent within the Strategic Industry Zone and 24 percent within the Industry Buffer Zone;
- Department of Biodiversity, Conservation and Attractions (DBCA) – approximately 10 percent within Strategic Industry Zone and 47 per cent within the Industry Buffer Zone; and
- Other ownership (private, local government, infrastructure service agencies) – approximately 33 per cent within the Strategic Industry Zone and 32 per cent within the Industry Buffer Zone.

The location of the Premises within the KSIA is depicted in Map B (Appendix 3).

EPA Report 1618 describes vegetation condition within the Premises as being identified as predominantly being in 'Completely Degraded' (57.75 ha) or 'Degraded' (25.04 ha) condition, affected by cattle grazing, weed invasion, unauthorised access (e.g. unplanned tracks, rubbish dumping, motorbikes) and clearing/logging. It also notes there is a small area (0.09 ha) of vegetation in 'Excellent' condition, with the remaining 6.37 ha mapped as being in 'Good' condition.

8.2 Residential and sensitive Premises

The distances to residential and sensitive receptors are detailed in Table 13. A reference map is provided in Map C (Appendix 3).

Table 13: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Closest rural residential premises	Approximately 1.2 km east of the Premises within the boundary of the KSIA
Rural residential premises	Table 6-10 in the Application lists 37 residential premises between approximately 1.2 km and 4.2 km of the Premises

8.3 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 14 and a reference map is provided in Appendix 3 (Map C).

Components have been identified consistent with DWER's *Guidance Statement: Environmental Siting* and unless otherwise indicated, distances have been identified using DWER's spatial viewer.

Table 14: Specified Ecosystems

Component Description	Distance from the premises
Specified ecosystems	
Geomorphic Wetlands	multiple use wetland areas mapped within the Premises The Application identifies Conservation Category Wetlands 530 m north east, 1.2 km east, 1.1 km south and 2 km south east. of the Premises boundary Resource Enhancement Wetland (Kemerton Wetlands) mapped approximately 1 km north east of the Premises boundary. Resource Enhancement Wetlands mapped approx. 880 m south of the Premises boundary (excluding the main access road)
Department of Biodiversity, Conservation and Attractions (DBCA) Managed Lands and Waters	DBCA managed lands are located north west (approx. 530 m), south (approx. 1.7 km) and west (approx. 1.8 km) of the Premises boundary.
Priority Ecological Community (PEC) – '*Low lying Banksia attenuate woodlands or shrublands*'	Two vegetation associations identified as being representative of the PEC and covers an area of 6.37 ha within the Premises and extends into areas outside the Premises. Almost all the PEC (6.27 ha) was recorded as being in 'Good' or 'Excellent' condition, within the remaining ara classed as 'Completely Degraded.' Vegetation associations that form this PEC are also representative of the 'Banksia woodlands of the Swan Coastal Plain' Threatened Ecological Community (TEC) listed as endangered under the EPBC Act. *(Source: EPA Report 1618)*
Biological component	
Threatened/Priority Flora	No threatened flora listed under the EPBC Act and WC Act were identified within the Premises. Desktop searches identified two locations of an orchid (*Drakaea elastic* - Glossy-leafed Hammer Orchid) listed as endangered under the EPBC Act and Threatended under the WC Act, approx. 45 m from the northern Premises boundary Two other orchids listed as threatened under the WC Act are known to occur within the KSIA; *Diuris micrantha* (dwarf bee-orchid) and *Drakea micrantha* (dwarf hammer-orchid) were not considered likely to occur within the Premises due to long-term ground disturbance. *(Source: EPA Report 1618)*
Threatened/Priority Fauna	Fauna surveys identified two conservation-significant species under the WC Act within the Premises: • *Calyptorhynchus latirostris* (Carnaby's black cockatoo); • *Calyptohynchus banksia naso* (forest red-tailed

Component Description	Distance from the premises
	black cockatoo*)* *Calyptohynchus baudinii* (Baudin's black cockatoo) was not found during surveys but determined that it might still occur within the Premises.
Physical Component	
Hydrography WA 205K – Surface Water Polygons	Unnamed swamp approx. 700 m north east of the Premises boundary. Unnamed swamp approx. 1.65 km south of the Premises boundary (excluding access road) Mialla Lagoon (swamp) approx. 1.95 km north west of the Premises boundary Benger Swamp approx. 5.5 km north east of the Premises boundary.
GEODATA Waterbodies	A minor non-perennial watercourse intersects the eastern portion of the Premises. EPA Report 1618 notes this is an agricultural drain.
Acid sulfate soils (ASS) Risk Map, Lower Southwest	Desktop surveys have classified soils across the Premises as potentially 'high to moderate risk' and 'moderate to low risk of ASS within 3 m of the natural soil surface. *(Source: EPA Report 1618)*
Contaminated Sites – Reported Sites	The Premises is not reported or classified under the CS Act. The Kemerton Titanium Dioxide Processing Plant is located approx. 600 m south of the Premises boundary (excluding access road) and classified as 'Contaminated – remediation required.'

8.4 Groundwater and water sources

The premises are located within two gazette groundwater areas proclaimed under the RIWI Act; the South West Coastal Groundwater Area and the Bunbury Groundwater Area. EPA Report 1618 notes the area is relatively low lying. Groundwater within the Premises is shallow, generally 0-5 metres below ground level (mbgl). Surface water is expected to flow to the east, although natural surface water drainage is limited given the low topography and deep, well-drained sandy soils. A drain occurs on the Premises and as noted in Section 4.1 of this Report, the Applicant intends to temporarily divert the drain and the land owner (LandCorp) will establish a permanent diversion at an alternate location after the commencement of construction works for the LHM Plant.

The distances to groundwater and water sources are shown in Table 15. A reference map is provided in Appendix 3 (Map A).

Table 15: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
South West Coastal Groundwater Area and Bunbury Groundwater Area	Northern two thirds of Premises is within the South West Coastal Groundwater Area Southern third of the Premises is within the Bunbury Groundwater Area	Groundwater areas proclaimed under the RIWI Act
Brunswick River and Tributaries and Collie	The Brunswick River and Tributaries and Collie River Irrigation District are	Surface water and irrigation districts proclaimed under the RIWI Act

Groundwater and water sources	Distance from Premises	Environmental value
River Irrigation District	located 1.5 km east of the Premises.	
Groundwater	The following is summarised from the Application. 1. Superficial Unconfined, approx. 20 – 40 m thick and recharged by rainfall. Groundwater flow generally westwards with seasonal variations in the water table of 1 – 2 m due to rainfall. 2. Leederville Confined, mainly recharged by downward leakage from superficial. Upward leakage from Yarragadee may also occur. Groundwater flow westwards and discharges to the ocean. 3. Yarragadee Only present in the southern part of the KSIA (including the Premises). Groundwater flow westwards and discharges into the ocean. 4. Cattamarra Coal Measures Confined, multi-layered and not recharged by leakage.	EPA Report 1618 notes that groundwater in the Kemerton area is used for industry, agriculture and public water supply. Existing industries in the KSIA abstract water for process and potable requirements from the unconfined and confined groundwater aquifers and the Harvey Irrigation Scheme. EPA Report 1618 describes the dispersed nature of the superficial aquifer which makes extraction for industrial use difficult so water is generally abstracted from the Cattamarra Coal Measures aquifer, although challenging at >150 mbgl and highly saline. It notes superficial is generally fresh to marginal (250-1500 mg/L TDS) and is closer to brackish within the Premises.

8.5 Meteorology

The Application provided information on climate and meteorology related to the Bunbury region with reference to Bureau of Meteorology (BoM) data for the Bunbury station (Site number: 9965). The Delegated Officer formed the view this information was relevant and accurate.

The Bunbury region experiences a Mediterranean type climate characterised by warm dry summers and cool wet winters, with the majority of the rain falling in the winter. Figure 2 below is from Application that shows a summary of the rainfall and temperature data collected since 1995.

The Application states that the average morning (9 am) wind speed reporting during summer for the Bunbury station is 17.8 km/h, prevailing predominantly from the east and south east. The wind speed typically increases in the afternoon (3 pm) with an average wind speed of 22.1 km/h reported which prevails from a westerly direction. During winter months winds typically abate to an average of 12.5 km/h during the morning prevailing from the east and north east. Afternoon winds increase to an average of 18.2 km/h during wind months and range in direction from the west, north west and north.

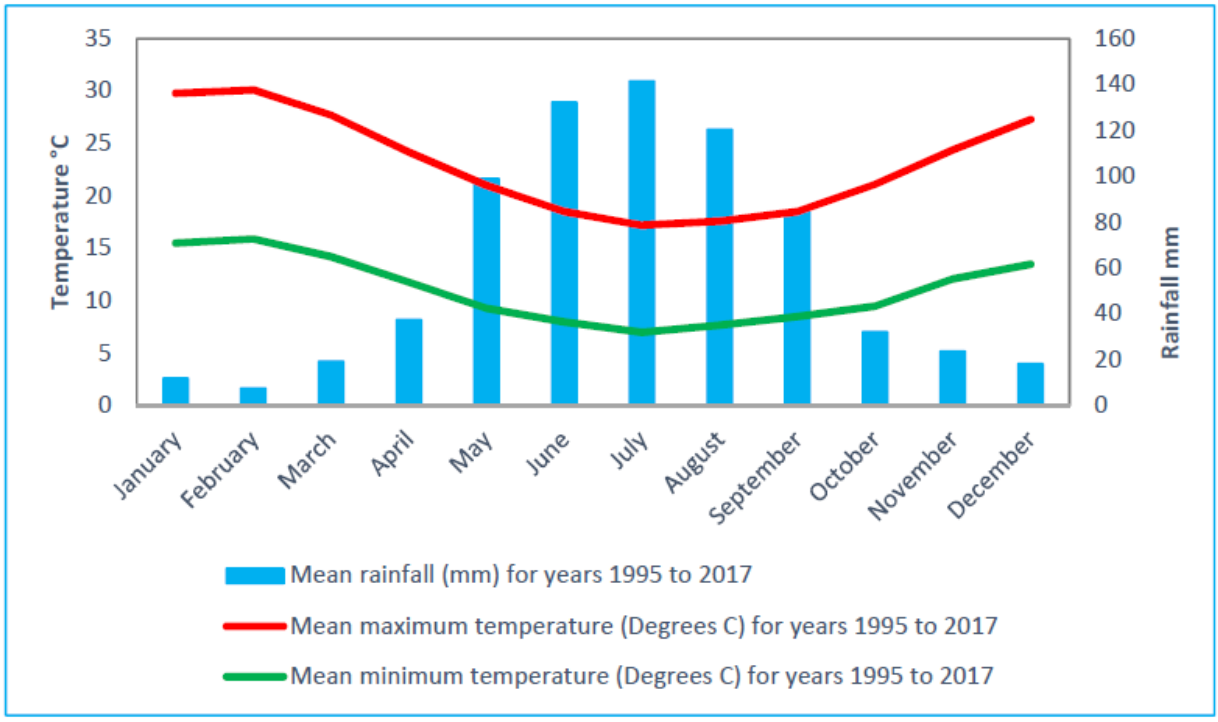


Figure 2: BoM Climate Statistics for Bunbury (Source: Figure 6-1 in the Application)

8.6 Geology and soils

The Application refers to the underlying regional geology of the KSIA as comprising superficial sands resting on the Leederville Formation which overlies the Yarragadee Formation or the Cattamarra Coal Measures. The Premises are described as occurring within the Swan Province and primarily intersecting the Bassendean dune and sandplain system with a small area intersecting the Spearwood dune and sandplain system.

As noted in Table 14, desktop surveys have classified soils across the Premises as potentially 'high to moderate risk' and 'moderate to low risk of ASS within 3 m of the natural soil surface. The Application notes that the eastern part of the Premises is a higher risk area being classified as 'high to moderate risk' and coincides with multiple use sumplands present. The Application references an ASS investigation of the Premises undertaken by Galt 2018a that found <1% of soil samples tested were indicative of actual acid sulfate soils (ASS) and 31% of soil samples tested were indicative of potential acid sulfate soils (PASS). The proponent has committed to conduct an ASS investigation in accordance with "Identification and investigation of acid sulfate soils and acidic landscapes 2015" (DER 2015) before land clearing begins (EPA Report 1618). If the investigation identifies that ASS may be disturbed, then the proponent has committed to develop ASS management measures (EPA Report 1618).

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 16 or Table 17.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 16 or Table 17 below.

Table 16. 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**		
Earthworks, construction, mobilisation and positioning of infrastructure	Earthworks, construction of new buildings, plant and infrastructure and vehicle movements	Dewatering and ASS disturbance	Groundwater and soils	Exposure of acid forming soils	Acidification and mobilisation of metals in soils Groundwater quality and beneficial use impacts	No	This risk of impacts associated with potential short-term dewatering during site development and the consequent potential exposure and management of ASS are the subject of requirements under Part IV of the EP Act.
		Fugitive dust	Closest receptor (rural residential dwelling) is within the KSIA approx. 1.2 km east of the Premises. Thirty seven rural residential premises between 1.2 km and 4.2 km of the Premises	Air / wind dispersion	Public health and amenity impacts	Yes	Refer to Section 9.4
		Noise			Amenity impacts	No	Regulation 13 of the Noise Regulations applies to construction work on a construction site. Regulation 13 additionally outlines requirements where construction work is undertaken outside of 7am to 7pm Monday to Saturday (excluding public holidays). On consideration of the Application information on construction noise, including the Revised NVA, the Delegated Officer does not expect noise impacts during the construction period and does not warrant detailed assessment.

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

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
SOC receipt, storage and handling	Receipt and unloading of feed material via truck, stockpiling and input into the LHM Plant via front end loader	Fugitive dust	Closest receptor (rural residential dwelling) is within the KSIA approx. 1.2 km east of the Premises. Thirty seven rural residential premises between 1.2 km and 4.2 km of the Premises	Air / wind dispersion	Public health and amenity impacts	Yes	Refer to Section 9.5
		Noise			Amenity impacts	Yes	Refer to Section 9.6
		Light		Air dispersion	Amenity	No	The Delegated Officer has determined that light emissions during operation are not likely to cause significant impacts considering the location and presence of other industrial premises in the vicinity.
		Contaminated stormwater runoff and seepage	Surface water, groundwater and soil	Direct discharge and infiltration through soil	Surface water quality and ecosystem impacts Groundwater quality and beneficial use impacts Soil contamination	No	Requirements under Part IV of the EP Act regulate the potential for surface water and groundwater impacts and consequent impacts on receiving environments.
Processing and refining of SOC	Pyrometallurgical and hydrometallurgical processing of spodumene to produce LiOH, $NaSO_4$ and tailings	Fugitive dust	Closest receptor (rural residential dwelling) is within the KSIA approx. 1.2 km east of the Premises. Thirty seven rural residential premises between 1.2 km and 4.2 km of the Premises	Air / wind dispersion	Public health and amenity impacts	Yes	Refer to Section 9.5
		Noise			Amenity impacts	Yes	Refer to Section 9.6
		Point source emissions to air			Public health and amenity impacts	Yes	Refer to Section 9.7 Note: Carbon monoxide (CO) emissions will occur, however these are not expected to be significant when compared to assessment criteria. Therefore emissions of CO have not been considered further.
		Odour not expected to be generated			None expected	No	In consideration of the nature of process input materials, products, the manufacturing process, characteristics of air emissions and distance to receptors, the Delegated Officer formed the view that sources of odour and therefore adverse impacts on receptors are not expected.
		Light		Air dispersion	Amenity impacts	No	The Delegated Officer has determined that light emissions during operation are not likely to cause significant impacts considering the location and presence of other industrial premises in the vicinity.
		Contaminated stormwater runoff, seepage, process water leaks, spills, overflows and containment ruptures	Surface water, groundwater and soil	Direct discharge and infiltration through soils	Surface water quality and ecosystem impacts Groundwater quality and beneficial use impacts Soil contamination	No	Requirements under Part IV of the EP Act regulate the potential for surface water and groundwater impacts and consequent impacts on receiving environments.
Product and by-product handling and storage	LiOH and $NaSO_4$ handling, bagging and storage	Fugitive dust	Closest receptor (rural residential dwelling) is within the KSIA approx. 1.2 km east of the Premises. Thirty seven rural residential premises between 1.2 km and 4.2 km of the Premises	Air / wind dispersion	Public health impacts	Yes	Refer to Section 9.5
		Noise			Amenity impacts	Yes	Refer to Section 9.6

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
		Light		Air dispersion	Amenity impacts	No	The Delegated Officer has determined that light emissions during operation are not likely to cause significant impacts considering the location and presence of other industrial premises in the vicinity.
Tailings storage and handling	Conveyance of tailings, stockpiling and loading in trucks for transport offsite	Fugitive dust	Closest receptor (rural residential dwelling) is within the KSIA approx. 1.2 km east of the Premises. Thirty seven rural residential premises between 1.2 km and 4.2 km of the Premises	Air / wind dispersion	Public health and amenity impacts	Yes	Refer to Section 9.5
		Noise			Amenity impacts	Yes	Refer to Section 9.6
		Light		Air dispersion	Amenity impacts	No	The Delegated Officer has determined that light emissions during operation are not likely to cause significant impacts considering the location and presence of other industrial premises in the vicinity.
		Contaminated stormwater runoff and seepage	Surface water, groundwater and soil	Direct discharge and infiltration through soil	Surface water quality and ecosystem impacts Groundwater quality and beneficial use impacts Soil contamination	No	Requirements under Part IV of the EP Act regulate the potential for surface water and groundwater impacts and consequent impacts on receiving environments.

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 18 below.

Table 18: Risk rating matrix

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

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

Table 19: Risk criteria table

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

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

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

"onsite**"** means within the Prescribed Premises boundary.

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 20 below:

Table 20: Risk treatment table

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

9.4 Risk Assessment – Fugitive dust (construction)

9.4.1 Description of fugitive dust risk event

Fugitive dust from construction activities becomes airborne and is dispersed beyond the Premises boundary impacting on the health and/or amenity of a receptor.

9.4.2 Identification and general characterisation of emission

The construction phase will include some earthmoving activity which has potential to generate airborne dust as material is collected, transported, spread and compacted in the formation of infrastructure. There is also the potential for airborne dust through wind erosion on open areas and vehicle movements. The Applicant is undertaking construction activities that are common place on site development and construction projects.

While airborne dust can be generated on the Premises from construction activities at any time, the potential for broader dispersion and offsite impacts is likely to be related to weather conditions, most notably wind speed and direction. Short-term fugitive dust emissions may occur during medium to high wind conditions, particularly during the summer months. Other significant sources of regional and localised airborne dust would also be expected during high wind events.

9.4.3 Description of potential adverse impact from the emission

Fugitive dust emissions have the potential to impact on health and amenity. Dust exposure health risks are determined by particulate size, chemical composition of the particulates, mass concentration of airborne particulates and duration of exposure. Chemical composition of dust is not a consideration for the risk of fugitive dust emissions during the construction phase.

In general terms, long-term repeated exposure to dust is more detrimental than sporadic short-term exposure. Construction phase fugitive dust emissions are expected to be short-term in nature, related to specific weather events causing wind erosion for dispersion of dust from specific activities.

Particulate matter greater in size than 10 microns is generally associated with nuisance or amenity impacts with a lower potential for health impacts as particles are typically trapped in the nose, mouth or throat. Smaller size particulate matter less than 10 microns in size (PM_{10}) typically poses a greater health risks due to the potential for it to be drawn deeper into the lungs.

Fugitive dust can cause nuisance or amenity impacts. Amenity values can be highly subjective and while dust has the potential to interfere with the convenience and comfort of people's lives, they also have different levels of perception or tolerance for matters that impact amenity. Dust may cause unreasonable amenity impacts if it results in excessive dust deposition settling on surfaces, often causing soiling and discolouration, for example on fabrics (such as washing) or on house roofs.

9.4.4 Criteria for assessment

Ambient air quality goals for particulate matter in the NEPM, as amended on 4 February 2016 are considered appropriate and summarised in Table 21.

Table 21: NEPM ambient air assessment criteria for particulate matter

Pollutant	Maximum concentration standard	Averaging period	Maximum allowable exceedances
PM_{10}	50 µg/m^3	24-hour	Exceptional events (as per NEPM)
	25 µg/m^3	Annual	None
$PM_{2.5}$	25 µg/m^3	24-hour	Exceptional events (as per NEPM)
	8 µg/m^3	Annual	None

Recent epidemiological research suggests that there is no threshold below which health effects do not occur. A single NEPM exceedance of the NEPM PM_{10} standard does not mean there will be health effects. However, a significant exceedance or regular exceedances over a considerable period of time could lead to acute or chronic health effects (EPA 2017).

Dust amenity impacts can be assessed against the general provisions of the EP Act, specifically, whether there is a risk of fugitive dust unreasonably interfering with the convenience, comfort or amenity of a receptor. There are no air quality standards for the level of dust in air which is likely to cause unacceptable amenity impacts.

9.4.5 Applicant controls

The Applicant listed the following controls to address the risk of fugitive dust impacts during the construction phase:

- Daily monitoring of weather conditions used to guide controls and activities, particularly if strong winds are predicted;
- Daily visual monitoring of open areas and activities with targeted dust suppression application;
- Application of water or chemical dust suppressant;
- Restricting vehicle speeds on unsealed areas and movements to established areas; and
- Record, investigate and respond to any dust complaints.

The Premises are located within the Strategic Industry Zone of the KSIA.

9.4.6 Consequence

In consideration of the nature of construction activities, the risk of airborne dust relates to the

potential for localised short-term amenity impacts from specific construction activities (e.g. land forming, earthmoving, internal traffic) or wind erosion from exposed areas during moderate to high wind conditions. There are thirty seven rural residential dwellings between approximately 1.2 km and 4.2 km from the Premises. During high wind conditions, there is likely to be other sources of regional and localised fugitive dust emissions not associated with activities on the Premises.

The Delegated Officer has determined that the consequence of fugitive dust from the Premises during construction to be *Minor*.

9.4.7 Likelihood of Risk Event

The Applicant has proposed fugitive dust controls that are common place for the proposed activities. The Delegated Officer expects that the Risk Event will be related to moderate to high wind conditions. With the implementation of proposed Applicant controls, construction activities are not expected to significantly contribute to localised and regional ambient dust levels during high wind events.

The Delegated Officer has determined that fugitive dust from the Premises impacting on the amenity of receptors will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood to be *Unlikely*.

9.4.8 Overall rating of fugitive dust

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating is ***Medium***.

9.5 Risk Assessment – Fugitive dust (operation)

9.5.1 Description of fugitive dust risk event

Fugitive dust associated with the storage and handling of feed material, acid roasted solids, products or tailings occur from the operating the LHM Plant occur and impact on the health or amenity of a receptor.

9.5.2 Identification and general characterisation of emission

Fugitive emissions of dust may occur from the storage and handling of feed material (SOC), acid roasted solids, tailings, reagents (limestone and quicklime) and products (LHM and sodium sulfate).

Spodumene ore concentrate and acid roasted solids will be stockpiled within a building or warehouse therefore dust emissions from respective material stockpiles is not expected, subject to the implemented of proposed design controls. Similarly, dust forming reagents such as limestone and quicklime will be stored in silos which will incorporate common place monitoring and dust filtrations systems and are therefore not expected to be sources of fugitive dust. Sodium sulfate and LHM will be sealed in bags within buildings and packed in containers pending transport. Product materials are not expected to be sources of dust if design controls are implemented.

Tailings will be temporarily stockpiled in the open pending transport offsite, therefore activities associated with the storage and handling of tailings are considered to be the main foreseeable potential source of potential dust.

9.5.3 Description of potential adverse impact from the emission

The generic potential adverse health and amenity impacts from exposure to fugitive dust are discussed in Section 9.4.3.

The Application characterises tailings as comprising aluminosilicate, gypsum and small levels of other salts, after the lithium extraction process, including approximately 30% water. Aluminosilicate is a mineral composed of aluminium, silicon and oxygen plus counter cations such as sodium, potassium or calcium.

Dust from SOC is not expected to be hazardous in terms of its chemical composition. LHM and sodium sulfate are both eye and skin irritants through direct exposure. LHM is corrosive and acute and chronic health impacts can occur. Acid roasted solids are acidic in nature and therefore health impacts and irritation may occur through exposure to dust. In consideration to the proposed design controls, potential adverse impacts from SOC, acid roasted solids, dust forming reagents and products are not expected if design controls are implemented.

9.5.4 Criteria for assessment

Refer to Section 9.4.4.

9.5.5 Applicant controls

The Applicant's proposed controls for operational fugitive dust emissions are outlined in Table 22.

Table 22: Applicant's proposed controls for operational fugitive dust emissions

Control type	Description
Siting	• Location within the Strategic Industrial Zone of the KSIA
Spodumene ore concentrate	• Delivered via covered B-double trucks and unloaded to a covered stockpile area. • Material stored inside a covered storage area
Acid roasted solids	• Material stored inside an enclosed warehouse • Applicant describes roasted solids as a fine fluffy powder, somewhat sticky, hygroscopic with minimal dusting potential when handled.
Tailings	• Approx. 30% water content
LHM and sodium sulfate	• Bagged within a warehouse and stored within a warehouse pending transport off site.
Reagents	• Limestone and quicklime storage in silos with dust collectors

GHD 2017 is a best available techniques (BAT) benchmarking study for the proposal application as lodged with the EPA under Part IV of the EP Act. GHD 2017 benchmarks the proposal against the European Commission BREF for Non-Ferrous Metals Industries (BREF), while noting it is not necessarily specific to lithium.

GHD 2017 outlined the following fugitive dust controls for the LHM Plant in its comparison to BREF.

- use of covered storage areas;
- dust extraction by means of baghouses or cyclones at all transfer points / delivery points and silo vents where dust emissions are likely to be generated.
- dust forming materials stored in covered storage or silo/bins including SOC, LHM, sodium sulfate anhydrous, tailings and reagents;
- acid roasted solids stored within a covered storage area;
- LHM and sodium sulfate anhydrous packaged lined bags, stored in warehouse and transported in enclosed containers;
- feed points are either enclosed or have dust extraction if not enclosed and the feed system

will have negative pressure;
- tanks will have level gauges with alarms linked to the process control/monitoring system to detect potential leaks;
- cleaning and housekeeping;
- operational procedures; and
- conveyors outside of buildings will be enclosed or covered to prevent water ingress and dust egress.

9.5.6 Consequence

In considering the information above, the Delegated Officer has determined the consequence of fugitive emissions of dust is *Minor*.

9.5.7 Likelihood of Risk Event

With consideration to the Applicant's proposed controls (including extensive containment and enclosure) and distance to nearby receptors, fugitive dust impacts from LHM Plant operational activities will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood to be *Unlikely*.

9.5.8 Overall rating of fugitive dust

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of fugitive emissions of dust from the operating LHM Plant causing health or amenity impacts is ***Medium***.

9.6 Risk Assessment – Noise (operation)

9.6.1 Description of noise risk event

Noise emissions from operation of the LHM Plant impact on the amenity of a noise sensitive receptor.

9.6.2 Identification and general characterisation of emission

Noise generated and emitted from the LHM Plant due to:

- Operation of major plant and ancillary equipment;
- Onsite vehicle movements (loaders, trucks etc.); and
- Generators, pumps, fans, compressors, etc.

The LHM Plant is a 24/7 operation, however during initial stages of the plant, transport of SOC, tailings and products is expected during daylight hours only.

The Applicant characterised predicted noise emissions during the operational phase in its Revised NVA as summarised in Section 6.2. DWER noise experts reviewed the Revised NVA and summary findings are provided in 6.2.1. Noise emissions are expected to comply with assigned noise levels at receptors both inside and outside the KSIA boundary.

9.6.3 Description of potential adverse impact from the emission

Noise can be annoying, interfere with speech, disturb sleep or interrupt work. Prolonged exposure to loud noise can also result in increased heart rate, anxiety, hearing loss and other health effects. The impacts of noise depend on the noise level, its characteristics and how it is perceived by the person affected.

9.6.4 Criteria for assessment

The Noise Regulations specify the assigned noise levels that apply to noise emissions from the LHM Plant during the operational phase. Clause 2(5) of the Noise Regulations specifies requirements for an adjustment of 5dB added to the influencing factor at the point of reception of the noise emission, where the source premises is within the KSIA.

9.6.5 Applicant controls

The Applicant's proposed source controls for noise emissions from infrastructure and equipment are outlined in the Revised NVA. In consideration of the size and scale of the LHMP Plant, the Delegated Officer has not listed all proposed noise controls in this section. In general, source controls include:

- Sound power level (SWL) limits for infrastructure and equipment;
- Acoustic enclosures and noise insulating treatments;
- Air emission stack silencers;
- Location of equipment within buildings, some of which will be fully enclosed;
- Mobile equipment procedures and measures;
- Implementation of as low as reasonably practicable principle.

9.6.6 Consequence

In consideration of the above information and the Revised NVA, operational noise emissions are expected to comply with assigned noise levels at all receptors. The Delegated Officer therefore determined the consequence of noise emissions is *Minor*.

9.6.7 Likelihood of Risk Event

With consideration to the Applicant's proposed controls, the Delegated Officer considers the likelihood of noise emissions impacting on the amenity of a noise sensitive receptor is *Unlikely*.

9.6.8 Overall rating of noise

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of noise emissions from the operating LHM Plant impacting on the amenity of a noise sensitive receptor is ***Medium***.

9.7 Risk Assessment – Point source emissions to air (operation)

9.7.1 Description of point source gaseous emissions risk event

Point source emissions to air from the LHM Plant operation cause a health or amenity impact on receptors.

9.7.2 Identification and general characterisation of emission

Point source emissions to air from the LHM Plant are generated from the processing trains and the package steam boilers. A processing train has two distinct component phases;

- Pyrometallurgical (pyromet) – feed, calcining, grinding, roasting and scrubbing; and
- Hydrometallurgical (hydromet) – leaching, filtration, crystallisation, drying and packaging.

The air emissions summary characteristics shown in Table 23 apply to one 20,000 tpa LHM capacity processing train and is replicated across each of the five processing trains (e.g. each individual processing train has a calciner with a three-stage dust removal circuit and emissions through a discrete 30 m high calcining off-gas stack).

As shown in Table 23, air emissions from the LHM Plant predominantly include:

- Particulate matter including PM10 and $PM_{2.5}$; and
- Combustion gases – nitrogen oxides (NOx), sulfur dioxide (SO_2) and carbon monoxide (CO).

The acid roast kilns for each processing train are indirectly heated and combustion gases emitted through respective flue gas stacks. However, SO_2 is emitted from the acid roast scrubber stacks through treatment of sulfur trioxide (SO_3) acid gas generated in the acid roast kilns. Air emissions from the hydromet phase are limited to particulate matter with the exception of the respective sodium sulfate dryer vents which emit combustion gases. Sulfur dioxide emission rates and concentrations are low as kilns, dryers and boilers are fired on imported natural gas.

Processing trains will be constructed and commence operating in stages. Each processing train will individually commence operating in three stages where the boiler is operated, the pyromet component (including air emission sources) operates and lastly the hydromet component (including air emission sources) operates.

The Revised AQIA addressed upset conditions and considered multiple aspects for LHM Plant breakdown, including power failure, control equipment failure and rupturing to piping and ducts. These were qualitatively assessed by the Applicant due to the short-term time period for elevated pollutant concentrations. In the event of a power failure, the Applicant notes the LHM Plant will shut down and spodumene feed will cease.

Three control equipment failure events are described in the Revised AQIA. In the event of a calciner flue gas extraction fan failure, there will be a sharp but brief (approx. 2-3 mins) increase in NO_2 and SO_2 emissions, however the spodumene feed and therefore emissions will cease. In the event of a roast scrubber fan stoppage or failure, there will be a sharp but brief increase in SO_2 emissions, however the spodumene feed and therefore emissions will cease.

In the event of a LHM Plant shutdown there is no further feed and no increase in NO2 and SO_2 emissions, The Applicant states this is due to the multiple stages of scrubbing for the roast scrubber and the calciner scrubber which will still perform some scrubbing with residual water. In the event of a pipe or duct rupture, the LHM Plant also immediately shuts down including the cessation of spodumene feed.

The Application including the Revised AQIA address air emissions from normal operating conditions and upset conditions which were generally resulted in plant or equipment shutdown. During this assessment, the Applicant was requested to provide additional information on process variability, control and the extent to which air emission concentrations may be affected. The Applicant provided addendum information on 31 August 2018 as listed in Table 2.

The Applicant does not expect variability in air emissions beyond the types of upset conditions outlined in the Revised AQIA and described above. The LHM Plant will have a process control system (PCS) which will operate all process and emissions abatement equipment, and be configured with automatic shut down and start up sequences to ensure abatement equipment is operating prior to feed input. Key infrastructure for startup and shutdown includes the calciners, ball mill, acid roast and dryers. Emissions are expected to gradually increase as feed increases through the plant and reach steady state and conversely decrease to zero during shutdown.

The PCS will monitor process variables, with allowance for small variations within the operational conditions. The Applicant notes there will be alerts in place within the system so that a larger variation in conditions occurs (indicating a potential upset condition), the plant can be shut down if required with a potential short term emissions spike until that occurs.

Additional information was provided on a power failure scenario. The Applicant advised that

emergency power supply is linked to all key extraction fans and associated scrubber recirculation pumps and the emergency supply is triggered in the event of a power failure. Plant feed is ceased, however extraction fans and recirculation pumps continue to be operational with air emissions trending towards zero. Failure of abatement equipment will be detected in the PCS and trigger an automatic cease of feed to the relevant section of plant.

Overall, there is not expected to be significant variability with air emissions with day to day normal operating conditions of the LHM Plant

Table 23: Summary characteristics of point source emissions to air from the Premises (Source: Application)

Area description	System description	Emission source	Emission point	Stack height	Max instantaneous flow	Abatement equipment	Estimated emission rates (normal operating conditions) g/s				Estimated emission concentrations (normal operating conditions mg/m^3		
							PM_{10}	$PM_{2.5}$	NOx	SO_2	PM_{10}	NOx	SO_2
Pyromet	Calcining	Calcining off-gas	Calcine flue gas vent stack	30	39,606	Baghouse and wet alkaline scrubber	0.33	0.17	2.47	0.33	30	224	30
	Calcine grinding	Ball mill off-gas and calcine cooler off-gas	Ball mill vent stack	30	2,655	Bag filter	0.022	0.01	-	-	30	-	-
	Roast flue gas	Fan and stack next to roast kiln	Acid roast kiln flue gas stack	30	19,249	None	0.01	0.01	0.088	0.005	2	17	1
	Acid vapour scrubbing	Acid mixer off-gas	Acid gas stack	30	1,026	Multiple stage acid gas treatment system	0.009	0.004	0	0.009	30	0	30
Hydromet	Leaching	Vapour generated in the leach tanks	Leach scrubber stack	10.3	3,354	Wet spray scrubber	0	0	0	0	0	0	0
	Filtration and Tails	Vacuum pump discharge	Vacuum vent	5	3,275	None	0.005	0.002	0	0	5	0	0
	Sodium sulfate anhydrous drying and packaging	Vapour from sodium sulfate dryer package	Sodium sulfate dryer stack	20	5.359	Bag filter	0.045	0.02	0.055	0.03	30	37	2
	Crude LHM crystallisation	Vapour from crude LiOH crystallisers	Crude LiOH vent scrubber stack	4.2	73	Wet scrubber	0	0	0	0	0.5	0	0
		Vapour from Li carbonate precip tanks	Li carbonate precipitation scrubber stack	4.2	195	Wet scrubber	0	0	0	0	0.5	0	0
	Pure LHM crystallisation	Vapour from pure LiOH crystallisers	Pure LiOH vent scrubber stack	4.2	66	Wet scrubber	0	0	0	0	0.5	0	0
	LHM drying and packaging	Vapour from pure LiOH dryers	LiOH dryer scrubber vent stack	5.1	1,106	Wet spray scrubber	0.009	0	0	0	30	0	0
		Vapour from LiOH coolers	LiOH cooler scrubber vent stack	4.2	979	Wet spray scrubber	0.008	0	0	0	30	0	0
Steam	Steam boilers	Natural gas-fired steam boilers	Steam boiler stacks	10	24,497	None	0.04	0.02	0.273	0.014	6	40	2

9.7.3 Description of potential adverse impact from the emission

In general terms, short term exposure to increased levels of NOx and SO_2 may cause respiratory problems, particularly for people for with asthma. NO_2 can affect humans both directly and indirectly; directly, by irritation that leads to an inflammatory reaction in the lungs, and indirectly by affecting the immune system. Oxides of nitrogen can react with VOCs in the presence of sunlight to form photochemical smog. NO_2 will dissolve in water to form nitrates and nitric acid.

SO_2 is a colourless, irritating and reactive gas with a strong odour. There odour is perceptible at different levels depending on the individual's sensitivity. Short term exposures to SO_2 are most pronounced in people with asthma and other respiratory conditions and the elderly. Particulate matter has the potential health and amenity impacts outlined in Section 9.4.3. SO_3 is a strong oxidising agent, corrosive and is toxic by inhalation.

The Applicant undertook air dispersion modelling of estimated operational air emissions from the LHM Plant with all five processing trains operating to predict ground level concentrations and potential impacts on receptors.

EPA Report 1618 considered the Initial AQIA which included air dispersion modelling that is not materially different to the Revised AQIA review by DWER in this assessment in terms of the methodology, input data and emissions characteristics. The EPA found the LHM Plant would be a minor contributor to air emissions for most parameters and including cumulative results the EPA noted that:

- NO_2 and SO_2 air concentrations were well below NEPM criteria at all sensitive receptors;
- PM10 and $PM_{2.5}$ 24-hour average concentrations were also well below the NEPM criteria; and
- The annual average $PM_{2.5}$ concentrations were predicted to be slightly above NEPM criteria. The LHM Plant's contribution to the $PM_{2.5}$ concentrations was small (i.e. approx. five per cent on average) and the background concentration was slightly above the NEPM criteria.

Air dispersion modelling in the AQIA predicted ground level concentrations from LHM Plant air emissions, including consideration to background air quality, and compared concentrations to NEPM standards. Table 9 in Section 6.1, summarises the maximum predicted ground level concentrations at receptors. Based on review of the Revised AQIA, the Delegated Officer noted that:

- SO_2 air concentrations were well below NEPM criteria at all sensitive receptors;
- NO_2 receptor maximum air concentrations were:
- 60 per cent (LHM Plant only) and 86 per cent (LHM Plant with background) of the NEPM 1-hour average standard; and
- 3 per cent (LHM Plant only) of the NEPM annual average standard.
- PM10 receptor maximum air concentrations were:
- 4 per cent (LHM Plant only) and 46 per cent (LHM Plant with background) of the NEPM 24-hour average standard; and
- 1 per cent (LHM Plant only) and 71 per cent (LHM Plant with background) of the NEPM annual average standard.
- $PM_{2.5}$ receptor maximum air concentrations were:
- 4 per cent (LHM Plant only) and 44 per cent (LHM Plant with background) of the NEPM 24-hour average standard; and
- 2 per cent (LHM Plant only) and 113 per cent (LHM Plant with background) of the NEPM annual average standard.

9.7.4 Criteria for assessment

The NEPM sets ambient air quality standards for particulate matter, NO_2 and SO_2 for the protection of human health and well-being. These standards are outlined in Table 24 and are appropriate assessment standards for ambient air quality impacts.

Table 24: NEPM ambient air quality standards for particulate matter, NO_2 and SO_2

Pollutant	Maximum concentration standard	Averaging period	Maximum allowable exceedances
NO_2	0.12 ppm	1-hour	1 day a year
	0.03 ppm	Annual	None
SO_2	0.2 ppm	1-hour	1 day a year
	0.08 ppm	24-hour	1 day a year
	0.02 ppm	Annual	None
PM_{10}	50 µg/m^3	24-hour	Exceptional events (as per NEPM)
	25 µg/m^3	Annual	None
$PM_{2.5}$	25 µg/m^3	24-hour	Exceptional events (as per NEPM)
	8 µg/m^3	Annual	None

9.7.5 Applicant controls

Point source emissions to air controls proposed by the Applicant are summarised in Table 25 below.

Table 25: Applicant proposed engineering controls for point source emissions to air

Component / source	Control description
Pyromet	
Calcining	• Natural gas-fired calciner with flue gas treated in a bag filter and wet alkaline scrubber. • Stack sampling ports meeting AS4323.1 to be installed for monitoring. Stack monitoring within first month of feed, then 3-monthly until consistency and 6-monthly thereafter
Ball mill and calcine cooler	• Bag filter • Stack sampling ports meeting AS4323.1 to be installed for monitoring. Stack monitoring within first month of feed, then 3-monthly until consistency and 6-monthly thereafter
Acid roasting	• Indirect heating of roaster • Process off-gas treatment of SO3 including water scrubber, sodium hydroxide scrubber and ESP • Rotary water cooler in the acid roast section has a bag filter that discharges to the acid roast scrubber vent stack. • Stack sampling ports meeting AS4323.1 to be installed for monitoring. Stack monitoring within first month of feed, then 3-monthly until consistency and 6-monthly thereafter
Hydromet	
Sodium sulfate drying and packing	• Natural gas-fired flash dryer with a Bag filter • Stack sampling ports meeting AS4323.1 to be installed for monitoring.

Component / source	Control description
	Stack monitoring within first month of feed, then 3-monthly until consistency and 6-monthly thereafter
LHM drying and packing: • Dryer • Cooler	• Wet spray scrubber for moist vapour on each of the dryer and cooler • Stack sampling ports meeting AS4323.1 to be installed for monitoring. Stack monitoring within first month of feed, then 3-monthly until consistency and 6-monthly thereafter
• Leaching and neutralisation • LHM drying and packaging (dryers and coolers)	• Wet spray scrubbers
Steam boilers	
Boilers	• Natural gas-fired package steam boilers • Stack sampling ports meeting AS4323.1 to be installed for monitoring. Stack monitoring within first month of feed, then 3-monthly until consistency and 6-monthly thereafter

The Application outlined general process control and management controls including the following:

- A plant control system (PCS) to monitor and control (in some instances) critical parameters including feed rates, temperature, pressure, flow rates, pH, reagent supply, vibration, voltage and tank/pond/silo levels.
- Alarms to alert operators to potential issues such as high pond levels, reagent storage levels and emission control infrastructure function;
- Alarms relating to the risk of emissions and functioning of emission control infrastructure such as scrubbers and baghouses will be given a high priority for immediate action;
- Stack monitoring campaigns.

9.7.6 Consequence

Considering the information above, including the Revised AQIA outcomes in Section 6.1, the Delegated Officer considers the consequence of point emissions to air as follows:

- SO_2: When background concentrations are considered, NEPM standards are met at all receptors and well below the NEPM standards and no health or amenity impacts are expected. The Delegated Officer considers the consequence of impacts from LHM Plant SO2 emissions is Slight.
- NOx: When background concentrations are considered, the NEPM 1-hour average is at risk of not being met. When background concentrations are excluded, the NEPM criteria is likely to be met. The Delegated Officer considers the consequence to be Moderate.
- PM10: When background concentrations are considered, the NEPM 24-hour standard is likely to be met and the NEPM annual average standard is at risk of not being met. When background concentrations are excluded, the LHM Plant contribution is minor at 2.2 percent and 0.3 per cent of the NEPM 24-hour and annual average criteria respectively. The Delegated Officer does not expect LHM Plant PM10 emissions to impact on receptor health or amenity and considers the consequence to be Slight.
- PM2.5: When background concentrations are considered, the NEPM 24-hour standard is likely to be met and the NEPM annual average is predicted to be exceeded. When background concentrations are excluded, the LHM Plant contribution is minor at 1.1 per cent and 0.15 per cent of the NEPM 24-hour and annual average criteria respectively. The Delegated Officer does not expect LHM Plant PM2.5 emissions to impact on receptor health or amenity and considers the consequence to be Slight.

Likelihood of Risk Event

- Considering the information above, the Delegated Officer considers the likelihood of an

impact occurring on a receptor as follows, if the Applicant implements the design and engineering measures proposed:

- SO_2: Rare;
- NOx: Unlikely;
- PM10: Slight. Predicted emissions of PM10 from the LHM Plant will be minor, with the implementation of Applicant proposed controls on point source emissions to air. While modelling indicates the NEPM annual average criteria is at risk of not being met when background concentrations are included, LHM Plant PM10 emissions are trivial in comparison to the background concentration. The Delegated Officer considers the likelihood of LHM Plant PM10 point source emissions impacting on the health or amenity of a receptor to be Slight, if the Applicant controls are implemented.
- $PM_{2.5}$: Slight. Predicted emissions of $PM_{2.5}$ from the LHM Plant will be minor, with the implementation of Applicant proposed controls on point source emissions to air. While modelling indicates an exceedance of the relevant NEPM annual average criteria, an exceedance would be solely dependent on external variability and influence from bushfires and prescribed burning activities in combination with meteorological conditions as outlined in Section 5.2 and 6.1. The Delegated Officer considers the likelihood of LHM Plant $PM_{2.5}$ points emissions impacting on the health or amenity of a receptor to be slight, if the Applicant controls are implemented.

9.7.7 Overall rating of point source gaseous emissions

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 18) and determined that the overall rating for the risk of point source emissions to air from the LHM Plant causing health or amenity impacts on a receptor for each pollutant is:

- SO2: ***Low***
- NOx: ***Medium***
- PM10: ***Low***
- $PM_{2.5}$: ***Low***

9.8 Summary of acceptability and treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the risk events set out above, with the appropriate treatment and control, are set out in Table 26 below. Controls are described further in section 11.

Table 26: Risk assessment summary

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway / Receptor (Impact)**			
LHM Plant construction						
1.	Fugitive dust (construction)	Earthworks, vehicle movement and exposed areas	Air / wind dispersion	Refer to Section 9.4.5	Minor consequence Unlikely likelihood **Medium risk**	Acceptable, subject to Applicant controls conditioned
LHM Plant operation						
2.	Fugitive dust (operation)	Feed, intermediate, product and tailings storage and handling activities	Air / wind dispersion	Refer to Section 9.5.5	Minor consequence Unlikely consequence **Medium risk**	Acceptable, subject to Applicant controls conditioned
3.	Noise (operation)	Major plant and ancillary equipment Vehicles Pumps, fans, compressors and generators	Air / wind dispersion	Refer to Section 9.6.5	Minor consequence Unlikely consequence **Medium risk**	Acceptable, subject to Applicant controls conditioned
4.	Point source emissions to air (operation)	Processing trains 1-5 stacks and vents. Boilers	Air / wind dispersion	Refer to Section 9.7.5	SO_2: **Low risk** PM_{10}: **Low risk** $PM_{2.5}$:: **Low risk** NOx: **Medium risk**	Acceptable, subject to Applicant controls conditioned and regulatory conditions

10. Regulatory controls

A summary of regulatory controls determined to be appropriate for the Risk Event is set out in Table 27. The risks are set out in the assessment in Section 9 and the controls are detailed in this section. The Delegated Officer will determine controls having regard to the adequacy of controls proposed by the Applicant. The conditions of the works approval will be set to give effect to the determined regulatory controls.

Table 27: Summary of regulatory controls to be applied

		Controls (references are to sections below, setting out details of controls)				
		10.1.1 and 10.3.1 - Infrastructure requirements (design and construction)	10.1.2 and 10.2.1 - Specified actions	10.3.3 Emission limits	10.2.1, 10.3.4 and 10.3.5 - Monitoring and / or reporting requirements	10.1.3 and 10.3.2 – Infrastructure requirements (operation)
Risk Items (see risk analysis in Section 9)	1. Fugitive dust during construction		●			
	2. Fugitive dust during operation	●				●
	3. Noise during operation		●		●	
	4. Point source emissions to air during operation	●		●	●	●

10.1 Works approval controls – fugitive dust

10.1.1 Infrastructure and equipment (design and construction)

Requirement for conveyors external to a building to be fully enclosed.

Grounds: Fugitive dust impacts during the operational phase have been assessed as medium risk. The requirement is derived from controls outlined by the Applicant.

10.1.2 Specified action

The Applicant will be required to undertake the minimum requirements in Table 28 to minimise the generation of airborne dust from the works.

Table 28: Fugitive dust control requirements for construction activities

Dust control	Requirements
Water carts	Operate when visible dust is generated from ground surface areas on the Premises. Operate proactively subject to weather forecasting over a rolling 24 hour period. Operate when visible dust is reported within the Premises by site personnel.
Dust Suppressants	Applied proactively. Re-apply proactively subject to visual inspection and weather forecasting over a rolling 24 hour period.
Vehicles	Defined haul routes for vehicles to traverse unsealed surfaces or unformed roads.

Grounds: Fugitive dust impacts during construction have been assessed as medium risk. Requirements are derived from controls outlined by the Applicant.

10.1.3 Infrastructure and equipment (operation)

The following requirements will be specified in the works approval:

- The use of dedicated enclosed buildings or containment vessels (e.g. silos) for the stockpiling or storage of loose dust forming materials including limestone, quicklime, spodumene and acid roasted solids; and
- Measures must be taken to prevent the generation of visible dust from tailings stockpiles.

Grounds: The use of dedicated infrastructure to contain the specified dust forming materials mitigates the risk of generating airborne dust from the storage and handling of these materials. The requirement is derived from controls outlined by the Applicant in the design and construction of infrastructure.

Tailings are stored in the open on a dedicated pad. The Applicant's control for airborne dust from tailings is that they are generated with an approximate 30% water content, therefore are unlikely to generate airborne dust. The Application did not contain specific detail on stockpiling such as the length of storage time and controls around dimensions/height. Using a precautionary approach, the Delegated Officer will require the Applicant to take measures to minimise the generation of visible dust from tailings stockpiles.

10.2 Works approval controls - noise emissions

10.2.1 Specified action

The following requirements will be included in the works approval:

- Retain the services of person qualified and experienced in the area of environmental noise assessment to compile and provide the Applicant with a report detailing a noise monitoring program.
- Provide the CEO with a report on a noise monitoring program that:
    - investigates the nature and extent of noise emissions from the premises for a three processing train and five processing train operational scenario to assess:
        (i) noise emissions from the Premises in accordance with the methodology required in the *Environmental Protection (Noise) Regulations 1997*, against the relevant assigned levels in those Regulations;
        (ii) against design criteria and predicted noise emissions from the Premises in the '*Albemarle Kemerton Plant Noise and Vibration Assessment Updated, Wood, 24 July 2018* , Rpt01 – 1402980Rev- 24 Jul18' noise assessment.

Grounds: Noise emissions from the operating LHM Plant have been assessed as medium risk. Noise emissions at sensitive noise receptors both within and outside the KSIA are predicted to comply with the assigned noise levels under both three-train and full capacity five train scenarios modelled, including under a worst-case scenario. However, noise outcomes are dependent on effective implementation of noise controls through the various design, procurement construction/installation and operational phases of the project. This is acknowledged by the Applicant in the Revised NVA.

The Delegated Officer had regard to the predicted noise outcomes and controls and considers it appropriate that the Applicant be required to validate predicted noise emissions against Revised NVA predictions and also the assigned levels in the Noise Regulations.

As per the summary of regulatory controls in Table 27, there will be requirements for noise monitoring during the operational phase of the LHM Plant. The works approval will allow staged construction and operation of the works, which broadly includes common services infrastructure and five processing trains. It is expected that a licence will apply to the LHM Plant upon completion of the first processing train and associated operating monitoring requirements. The Delegated Officer therefore considers a future application for licence to be the appropriate mechanism to determine noise monitoring requirements.

Noting the absence of Applicant detail on proposed noise monitoring programs for noise monitoring and validation, the Delegated Officer has included a works approval specified action for the Applicant to provide DWER with a report on a proposed noise monitoring program. This will form future risk assessment and form the basis by which requirements for noise monitoring on the licence can be determined.

10.3 Works approval controls – point source emissions to air

10.3.1 Infrastructure and equipment (design and construction)

The following requirements will be included in the works approval:

- Significant discharge points to air will be required to have monitoring ports that meet AS 4323.1. Significant sources are the calciners, ball mills, acid scrubber systems, sodium sulfate dryers, LHM dryers and LHM coolers
- The Applicant will be required to ensure it proposed pollution control equipment meets specified design and construction requirements:
    - Bag filter systems;
    - Calciner dust removal circuit;
    - Acid roast kiln scrubbing system;
    - Wet scrubbing systems;

Grounds: Stack monitoring will be a requirement of the works approval and future licences. Significant sources that will be the subject of monitoring requirement must have monitoring locations and ports that meet AS4323.1 to ensure data is accurate and reliable. Engineering design measures incorporated in LHM Plant design are intrinsic to emission control and emission outcomes.

The bag filters will be required to meet a TSP emission concentration of less than 50 mg/m^3 which is an appropriate and achievable standard of concentration for this type of equipment and specified in Schedule 3 (non-ferrous industries) of the NSW *Protection of the Environment Operations (Clean Air) Regulations 2010*. A concentration of 100 mg/m^3 is also specified in Schedule 2 of the NSW *Protection of the Environment Operations (Clean Air) Regulations 2010* and an appropriate and achievable standard of concentration for the acid roast kiln scrubber system.

10.3.2 Infrastructure and equipment (operation)

The following requirements will be included in the works approval:

- Significant emission points will be specified as authorised emission points. These include the stacks and vents listed in Table 23 and included in air dispersion modelling in the Revised AQIA.
- The Applicant will be required to ensure pollution abatement equipment on discharge points to air are active and operational (as listed in Table 23) when the respective sources are in operation.

Grounds: As above. Accordingly, emission control technology specified in the infrastructure design and constructions requirements will be specified under operational requirements.

10.3.3 Emission limits (operation)

Point source emission limits will be specified as per Table 29.

Table 29: Proposed emission limits

Parameter	Stack reference	Recommended Limit	Justification for the limit value proposed
NOx	Calciner flue gas vent stacks	350 mg/m^3	Limits derived from Schedule 3 and 4 of the NSW *Protection of the Environment Operations (Clean Air) Regulations 2010*
SO_3	Acid gas stacks	100 mg/m^3	
TSP	Calciner flue gas vent stacks	50 mg/m^3	
	Ball mill vent stack		
	Acid gas stacks		
	Sodium sulfate dryer stack		
	LiOH dryer scrubber vent stack		
	LiOH cooler scrubber vent stack		

Grounds: NOx emissions are assessed as medium risk and the calcining off-gas is the single largest source (estimated 224 mg/m^3 during normal operating conditions). The limit applied to SO3 from the acid vapour scrubbing system is precautionary and subject to further review once operational monitoring validation has been completed. Particulate matter emissions are assessed as medium risk.

10.3.4 Monitoring (operation)

Monitoring of discharges to air will be included in the works approval:

- Two separate validation stack sampling events of all discharge points and corresponding parameters based on Table 23 will be required once a processing train commences operating;

Grounds: The stack monitoring requirements demonstrate acceptability of the constructed works and accuracy of the estimated emissions in the Revised AQIA. The monitoring results will inform the determination of ongoing monitoring requirements once a licence application is received from the Applicant. Monitored parameters are informed by the limits in Table 29 and

the information in Table 23.

The Delegated Officer had consideration to the EPA's advice on the regulation of $PM_{2.5}$ emissions from the LHM Plant in EPA Report 1618 (refer to Section 5.2). It was noted that modelled annual average $PM_{2.5}$ concentrations, with background concentrations included, were the result of external variable sources such as bushfires and prescribed burns. The expected LHM Plant expected contribution is minor by comparison to background. The Delegated Officer will require the implementation of point source controls as proposed by the Applicant (refer to Section 10.3), and require the Applicant to monitor and validate its $PM_{2.5}$ stack emissions from key sources. Ongoing requirements for monitoring $PM_{2.5}$ can be further reviewed upon submission of monitoring data and an application for licence.

10.3.5 Monitoring reports (operation)

The following requirements will be included in the works approval:

- Requirement to submit a report on air emissions monitoring specified in the works approval including:
    - sample analysis reports;
    - analysis of sampling methods against standards;
    - comparison of results against any limits specified in the works approval;
    - commentary on how the emissions compare with works approval application modelling inputs and design criteria.

Grounds: Reporting requirements are necessary for the administration of the works approval, validating ongoing acceptability of the Premises operation and for post-construction validation against design criteria.

10.3.6 Notification

The Applicant will be required to notify DWER of any exceedances of limits specified in the works approval.

Grounds: Notification of limit exceedances is required for the effective administration of the works approval.

11. Licence controls

The works approval allows the Applicant to undertake works, subject to conditions, in addition to allowing a finite period of emissions and discharges from the LHM Plant as it is completed and commences operating in a staged approach, also subject to conditions.

It is expected the Applicant will apply for a licence towards the completion of the first processing train and common service infrastructure. The determined controls for a licence will be generally consistent with the operation based conditions outlined in Section 10 and included on the works approval as follows:

1. Operation of infrastructure and equipment;
    (a) Discharges to air requirements; and
    (b) Fugitive dust to air requirements;
2. Discharges to air;
    (a) Authorisation of discharge points to air;
    (b) Emission limits;
    (c) Monitoring of discharges to air;

3. Noise emissions – validation monitoring program
4. Annual reporting
5. Notification of limit exceedances

Final determination of licence controls will consider information submitted by the Applicant in its licence application and in response to works approval requirements. Subject to the review of monitoring data submitted by the Applicant under works approval requirements, the Delegated Officer considers ongoing monitoring of discharge points to air are likely to include the following:

- Bi-annual particulate matter (total suspended solids, PM10 and $PM_{2.5}$) stack sampling of significant sources;
- Bi-annual NOx stack sampling of the calcine flue gas vent stack; and
- Bi-annual acid gas (as SO_3) stack sampling of the acid gas stacks.

12. Determination of Works Approval conditions

The conditions in the granted works approval have been determined in accordance with the *Guidance Statement: Setting Conditions*. The works approval will be granted for a period of seven years considering the size, scope and staged nature of the works.

Table 30 provides a summary of the conditions to be applied to this works approval.

Table 30: Summary of conditions to be applied to the works approval

Condition Ref	Grounds
Part A: Works	
Instructure and equipment (design and construction Condition 1, 2, 3 and 4	These conditions are valid, risk based and contain appropriate controls on the design and construction of infrastructure.
Fugitive dust Condition 5	This condition is valid, risk-based and consistent with the EP Act
Emissions Condition 6	The general and authorised emissions condition is a valid, risk-based condition to ensure appropriate extent of authorised emissions.
Part B: Operations	
Noise emissions Condition 7 and 8	This condition is valid, risk-based and consistent with the EP Act.
Infrastructure and equipment (operation) Condition 9	The condition is valid, risk-based and contains appropriate controls on infrastructure requirements.
Discharges to air Condition 10, 11, 12, 13 and 14	These conditions are valid, risk-based and consistent with the EP Act.
Records and reporting Condition 15, 16. 17. 18 and 19	Reporting conditions are valid, risk-based and consistent with the EP Act.

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

13. Applicant's comments

The Delegated Officer met with representatives of the Applicant on 8 October 2018 to discuss a preliminary works approval and decision reports interim of a formalised 21 day comment period on the drafts to commence upon determination of the proposal under Part IV of the EP Act. The Applicant viewed the drafts and provided the Delegated Officer with the feedback in Table 31 for consideration in the final draft for Applicant comment.

Table 31: Summary of Applicant feedback on the preliminary draft works approval and Delegated Officer consideration

Applicant comment	Delegated Officer consideration
Insert a definition for 'operation'	Inserted a definition as it is agreed a definition will provide further clarity and enforceability.
Review the wording of draft condition 3 (submission of compliance reports to the CEO) to account for potential delays between completing works, submitting reports and commencing initial operations	The requirement to submit the report within 30 days of completing works (or part thereof) was removed as the requirement to submit the report prior to operation remains part of the condition.
Review several fugitive dust management requirements in Table 2 of condition 5	Specified Applicant control for vehicle speeds was deleted. Delegated Officer noted the Applicant had revised this control, however formed the view the control was unnecessary. Requirement to cease activities causing visible dust lift-off during high winds was deleted. Remaining requirements in Table 2 were viewed as adequate to manage the risk of fugitive dust during construction and the Delegated Officer agreed the requirement would otherwise require further revision and associated definitions to improve clarity and enforceability.
Review specified timeframes and due dates on a number of draft conditions	Condition 6 – Operation under the works approval for each processing train increased from 6 months to 12 months to account for unforeseen issues during initial operation phase. Condition 8 – Proposed due date for noise program report changed from 31 March 2020 to 31 July 2019. Condition 15 – Proposed due date for emissions report changed from within 30 days of completing sampling events to within 30 days of the applicant receiving third part analysis reports.
There are several items of infrastructure omitted from Table 12	Reference to the spodumene storage/handling area and tailings storage area inserted into Table 12.
Typographical errors	Corrected correct reference to Initial NVA that was superseded and reference to 'PM' in Table 14.

The Applicant was provided with final draft works approval and draft decision report for comment on 2 November 2018. The Department received tabulated comments from the Applicant on 12 November 2018. The Applicant comments on the draft works approval and the Delegated Officer's consideration are summarised in Table 32.

The Applicant provided comments on the draft decision report that were reviewed and accepted by the Delegated Officer. The Applicant's suggested changes to the draft decision report addressed typographical errors, matters of fact and improved clarity.

Delegated Officer noted the requested change from referencing Table 23 to Table 29 which specifies determined air emission limits. The specified air emissions limits include TSP, SO_3 and NOx, however the Applicant is required to undertake stack monitoring for a broader range of parameters as part of emissions validation. The stack monitoring requirements includes parameters subject to limits (Table 29) but is also informed by Table 23. The Delegated included additional clarity in the grounds for Section 10.3.4.

Table 32: Summary of Applicant feedback on the final draft works approval and Delegated Officer consideration

Draft works approval condition ref	Applicant comment	Delegated Officer consideration
Condition 5 (Table 2)	Uncertainty regarding reference to 'external ground surface areas' with respect to water cart requirements.	Deleted the word 'external' to improve clarity.
	Change 'internally' to 'within the Premises' with respect to water cart requirements.	Agreed.
Condition 7 (Noise)	Specify that the report is for a proposed noise monitoring program.	Agreed.
Condition 9 (Table 4)	Spodumene ore concentrate must be stored in dedicated buildings, covered storage areas, warehouses, silos, tanks or vessels.	Agreed as the wording is consistent with the Delegated Officer's assessment on the basis that the spodumene storage area is not a fully enclosed structure.
Table 7 (boundary coordinates	Specify that coordinates are in GDA94	Agreed.
Table 10 (Infrastructure requirements)	"alarms and interlocks to prevent operation of exhaust fans"	Omission of the word 'operation' is a typographical error and was corrected.
Condition 3(c)	Typographical error	Corrected
Table 6 (due date)	Change the reporting requirement to provide monitoring data for all sampling events for each processing train	Agreed. Change will result in a consolidated set or stack monitoring results for each processing train which has no impact to risk control and reduces administrative burden.
Table 9	Include missing reference to diesel storage tank and raw water pond	Agreed.
Table 12	Include reference to raw water pond and change reference to stormwater run-off pond to site run-off ponds	Agreed.
Appendix 1 (Premises layout map)	Old version of submitted map shown.	Correct to the version submitted to DWER on 25/07/2018 as per Table 2. Also updated in decision report.

14. 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 works approval will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements. The works approval applied to the design and construction of the LHM Plant and to the initial phases of staged operation of the plant for a specified period of time. The Applicant will need to lodge an application for licence in respect of emissions and discharges from the LHM Plant beyond any operational time constraints in the works approval.

Paul Byrnes
Manager Process Industries
Delegated Officer
an Officer delegated under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Appeals Convenors report and Minister for Environment's determination of Appeals 018 of 2018 against the content and recommendations of EPA Report 1618	N/A	www.appeals convenor.wa.gov.au
2.	Application for works approval lodged on 14 June 2018.	the Application	DWER records (refer to Table 2)
3.	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	NA	www.dwer.wa.gov.au
4.	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.		
5.	DER, August 2016. *Guidance Statement: Licence duration.* Department of Environment Regulation, Perth.		
6.	DER, November 2016. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.		
7.	DER, November 2016. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.		
8.	Environmental Alliances Pty Ltd 2010. Air Quality Modelling for the Expansion of the Kemerton Industrial Estate.	Environment Alliance 2010	www.landcorp.com.au
9.	EPA June 2017. *Consideration of potential health and amenity impacts of dust in determining the size of a buffer for urban development in the Mandogalup area.* Environmental Protection Authority, Perth	EPA 2017	www.epa.wa.gov.au
10.	EPA, June 2018. *Report and recommendations of the Environmental Protection Authority, Albemarle Kemerton Plant, Report 1618*. Environmental Protection Authority, Perth.	EPA Report 1618	
11.	EPA Victoria 2001. State environment protection policy (Air Quality Management), Victoria Government Gazette, No. S 240 Friday 21 December 2001.	Victorian EPA SEPP	www.epa.vic.gov.au
12.	Galt Geotechnics (Galt), 2018a. 'Interpretive report on stage 1 geotechnical and acid sulfate soil study proposed Albemarle Kemerton Plant Project Kemerton Strategic Industrial Area, WA.' Prepared for Albemarle Lithium Pty Ltd.	Galt 2018a	Applicant
13.	GHD, November 2017. *Albemarle Kemerton Plant Best Available Techniques Benchmarking*	GHD 2017	www.epa.wa.gov.au
14.	Ministerial Statement 1085	MS 1085	www.epa.wa.gov.au
15.	National Environment Protection Council 2016. National Environment Protection Measure for Ambient Air Quality	NEPM	www.nepc.gov.au
16.	Protection of the Environment Operations (Clean Air) Regulation 2010, NSW	N/A	www.legilsation.nsw.gov.au

Appendix 2: EPA Report 1618 excerpt

The following excerpt is from Section 8 of EPA Report 1618 and outlines EPA advice on regulation of the Premises under Part V of the EP Act.

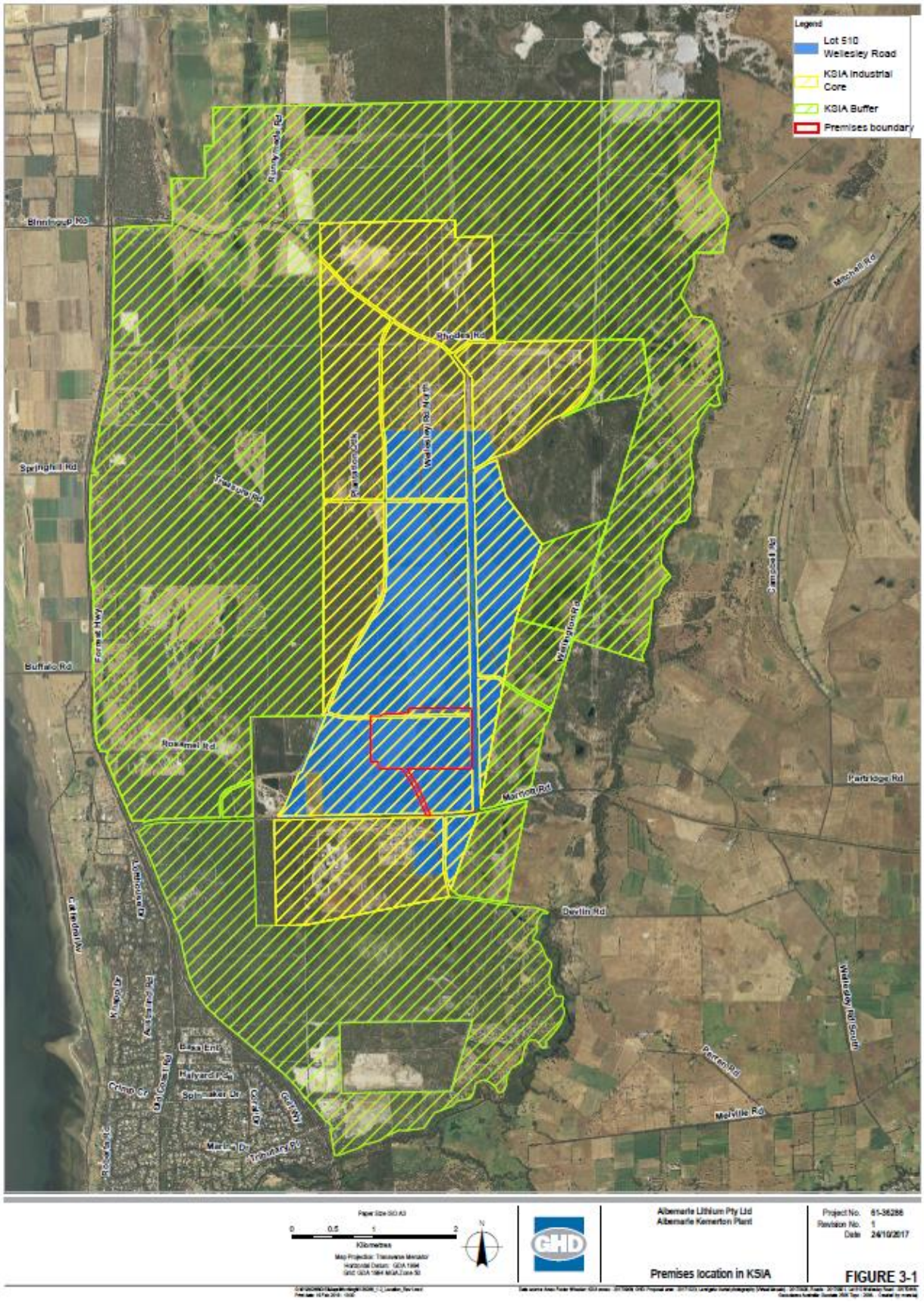
"The EPA notes that the annual average $PM_{2.5}$ concentrations were elevated in the South West region as a result of bushfires and prescribed burns. The EPA notes that many of these events are unavoidable (in this case the most significant event that caused particulates to increase was caused by a lightning strike), The risk of bushfires is ever-present in the south west of Western Australia during the dry summer months and the potential impacts of fire on conservation reserves, home owners and industry needs to be continually managed. The EPA recommends that development of specific $PM_{2.5}$ air quality criteria be considered for the KSIA that takes into account the episodic nature of prescribed burns and bushfires. Although this may not be a major concern with the limited number of industries in the KSIA at present, it is something that needs to be considered as the state further develops this area.

The EPA notes that many of the potential emissions and discharges assessed in this report will be regulated under Part V of the EP Act via a works approval and licence (Category 5). The EPA notes that DWER will need to ensure the plant's final design includes the best-available technology to which the proponent has committed. The EPA recommends that suitable end-of-stack monitoring for $PM_{2.5}$, site specific background data gathering and modelling is conducted on a yearly basis to show that the emission of $PM_{2.5}$ is as low, if not lower than predicted in this assessment. The EPA recommends that a target or limit on $PM_{2.5}$ is placed on the licence."

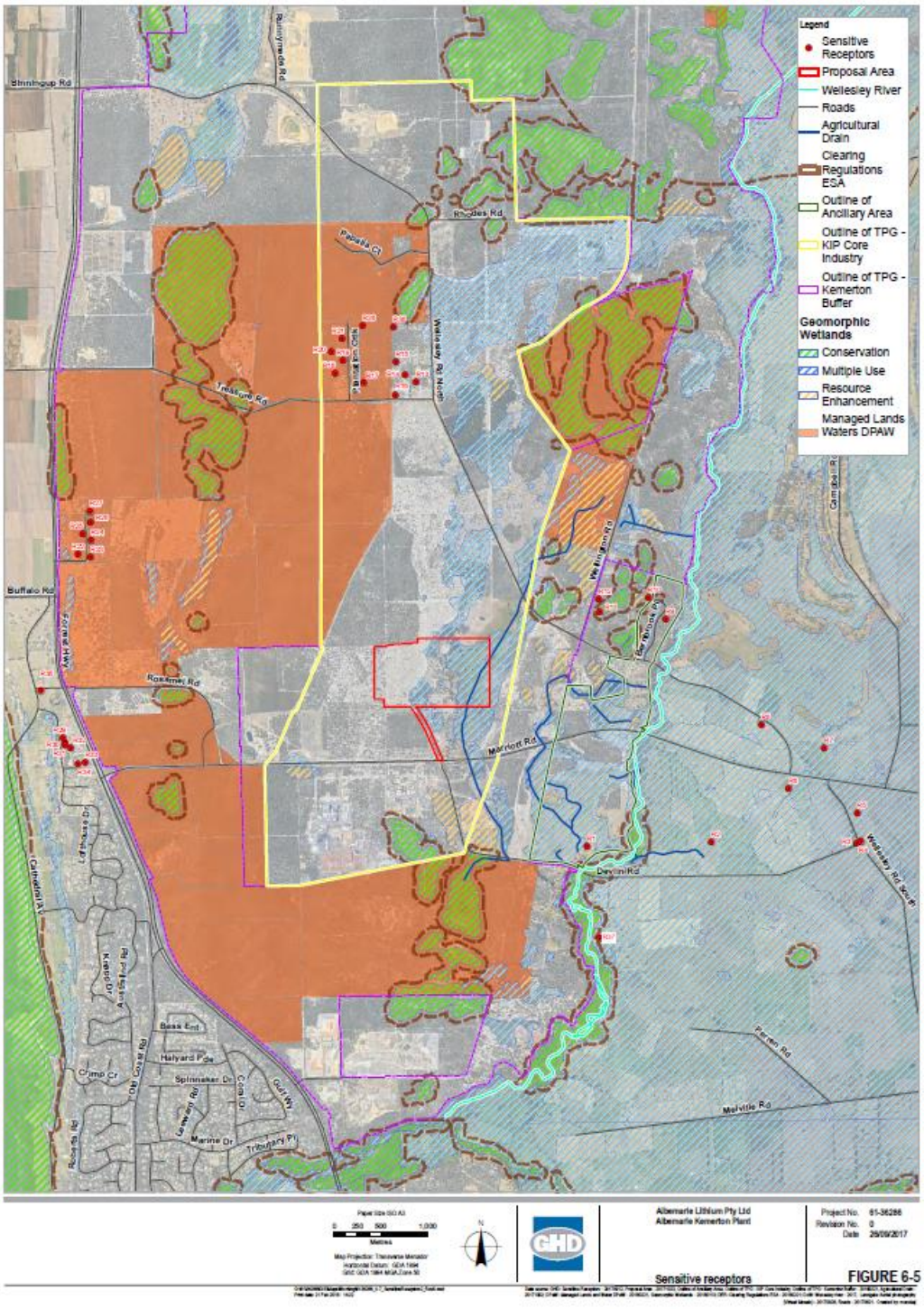
Appendix 3: Maps and plans

MAP A: The following map depicts the regional location of the Premises and is sourced from Figure 2-1 in the Application.

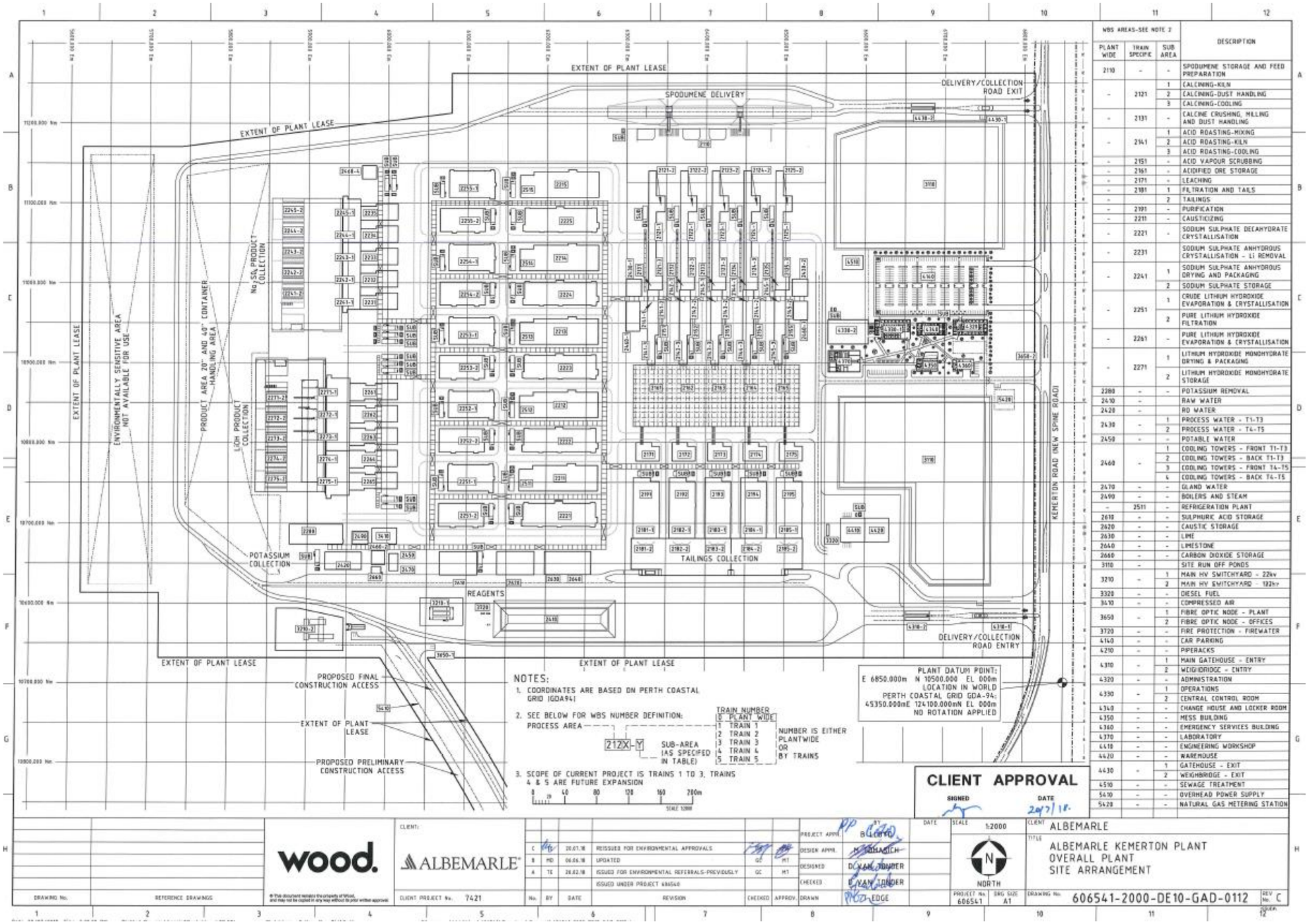
MAP B: THe following map depicts the location of the Premises within the KSIA sourced from Figure 3-1 in the Application.



MAP C: The following map depicts the location of receptors and is sourced from Figure 6-5 in the Application



MAP D: Site layout plan



WBS AREAS-SEE NOTE 2			DESCRIPTION
PLANT WIDE	TRAIN SPECIFIC	SUB AREA	
2110	-	-	SPODUMENE STORAGE AND FEED PREPARATION
-	2121	1	CALCINING-KILN
		2	CALCINING-DUST HANDLING
		3	CALCINING-COOLING
-	2131	-	CALCINE CRUSHING, MILLING AND DUST HANDLING
-	2141	1	ACID ROASTING-MIXING
		2	ACID ROASTING-KILN
		3	ACID ROASTING-COOLING
-	2151	-	ACID VAPOUR SCRUBBING
-	2161	-	ACIDIFIED ORE STORAGE
-	2171	-	LEACHING
-	2181	1	FILTRATION AND TAILS
-		2	TAILINGS
-	2191	-	PURIFICATION
-	2211	-	CAUSTICIZING
-	2221	-	SODIUM SULPHATE DECAHYDRATE CRYSTALLISATION
-	2231		SODIUM SULPHATE ANHYDROUS CRYSTALLISATION - LI REMOVAL
-	2241	1	SODIUM SULPHATE ANHYDROUS DRYING AND PACKAGING
		2	SODIUM SULPHATE STORAGE
-	2251	1	CRUDE LITHIUM HYDROXIDE EVAPORATION & CRYSTALLISATION
		2	PURE LITHIUM HYDROXIDE FILTRATION
-	2261	-	PURE LITHIUM HYDROXIDE EVAPORATION & CRYSTALLISATION
-	2271	1	LITHIUM HYDROXIDE MONOHYDRATE DRYING & PACKAGING
		2	LITHIUM HYDROXIDE MONOHYDRATE STORAGE
2380	-	-	POTASSIUM REMOVAL
2410	-		RAW WATER
2420	-		RO WATER
2430	-	1	PROCESS WATER - T1-T3
		2	PROCESS WATER - T4-T5
2450	-	-	POTABLE WATER
2460	-	1	COOLING TOWERS - FRONT T1-T3
		2	COOLING TOWERS - BACK T1-T3
		3	COOLING TOWERS - FRONT T4-T5
		4	COOLING TOWERS - BACK T4-T5
2470	-	-	GLAND WATER
2490	-	-	BOILERS AND STEAM
-	2511	-	REFRIGERATION PLANT
2610	-	-	SULPHURIC ACID STORAGE
2620	-	-	CAUSTIC STORAGE
2630	-	-	LIME
2640	-	-	LIMESTONE
2660	-	-	CARBON DIOXIDE STORAGE
3110	-		SITE RUN OFF PONDS
3210	-	1	MAIN HV SWITCHYARD - 22kv
		2	MAIN HV SWITCHYARD - 132kv
3320	-	-	DIESEL FUEL
3410	-	-	COMPRESSED AIR
3650	-	1	FIBRE OPTIC NODE - PLANT
		2	FIBRE OPTIC NODE - OFFICES
3720	-	-	FIRE PROTECTION - FIREWATER
4140	-	-	CAR PARKING
4210	-	-	PIPERACKS
4310	-	1	MAIN GATEHOUSE - ENTRY
		2	WEIGHBRIDGE - ENTRY
4320	-	-	ADMINISTRATION
4330	-	1	OPERATIONS
		2	CENTRAL CONTROL ROOM
4340	-	-	CHANGE HOUSE AND LOCKER ROOM
4350	-	-	MESS BUILDING
4360	-	-	EMERGENCY SERVICES BUILDING
4370	-	-	LABORATORY
4410	-	-	ENGINEERING WORKSHOP
4420	-	-	WAREHOUSE
4430	-	1	GATEHOUSE - EXIT
		2	WEIGHBRIDGE - EXIT
4510	-	-	SEWAGE TREATMENT
5410	-	-	OVERHEAD POWER SUPPLY
5420	-	-	NATURAL GAS METERING STATION

No.	BY	DATE	REVISION	CHECKED	APPROV.
C	MS	20.07.18	REISSUED FOR ENVIRONMENTAL APPROVALS	GC	MT
B	MD	06.06.18	UPDATED	GC	MT
A	TE	26.02.18	ISSUED FOR ENVIRONMENTAL REFERRALS-PREVIOUSLY ISSUED UNDER PROJECT 606540	GC	MT

PROJECT APPR. BLOOD
DESIGN APPR. M CHIASICH
DESIGNED D VAN TONDER
CHECKED E VAN TONDER
DRAWN PROD-EDGE
DATE
SCALE 1:2000
NORTH
CLIENT ALBEMARLE
TITLE ALBEMARLE KEMERTON PLANT OVERALL PLANT SITE ARRANGEMENT
PROJECT No. 606541
DRG SIZE A1
DRAWING No. 606541-2000-DE10-GAD-0112
REV No. C

DRAWING No. | REFERENCE DRAWINGS | CLIENT PROJECT No. 7421

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CLIENT: ALBEMARLE