SOUTH32
Worsley Alumina

DUST MANAGEMENT PLAN – BAUXITE MINING & TRANSPORT

SOUTH32 WORSLEY ALUMINA

Table of Contents

Table of Figures

Table of Table

Table **Page**

1 CONTEXT, SCOPE AND RATIONALE

1.1 PROPOSAL BACKGROUND

South32 Worsley Alumina Propriety Limited (Worsley Alumina) is proposing to continue existing mining operations and access additional ore resources to maintain the continuity of the Boddington Bauxite Mine (BBM), which has been in operation for over 35 years. A new Contingency Bauxite Mining Envelope (CBME) is also proposed within the existing Refinery Lease Area located at the Worsley Alumina Refinery (the Refinery). These works are referred to as the Project. Bauxite is mined and transported to various crushing facilities at Marradong and Saddleback before being transported via overland conveyor to the Refinery. Alumina refinery production is currently permitted at a rate of 4.7 Million tonnes per annum (Mtpa).

Mining is expected to continue within the approved Project boundaries under current and future approvals. Current mining operations are subject to Ministerial Statement No. 719 (MS719). MS719 contains environmental conditions relating to the extension of mining activities into new areas beyond those where mining had previously been approved. It also consolidates and replaces environmental management commitments as set out in previous approval documents.

1.2 PURPOSE

The Dust Management Plan – Bauxite Mining and Transport has been prepared in accordance with the requirements of Proponent Commitment 2 of MS719, relating to the Worsley Alumina approved bauxite mining operations expansion to increase alumina production to a maximum capacity of 4.7 Mtpa, as amended on 26 February 2008.

This objectives of the requirements of MS719 are to:

- Comply with statutory requirements so that the amenity of nearby residences is protected from dust impacts resulting from bauxite mining activities, construction of bauxite transport corridors and operation of overland conveyors; and
- Ensure that dust management techniques meet relevant best practice principles.

This Dust Management Plan describes the strategies and procedures that have been implemented to ensure Worsley Alumina complies with its obligations and management objectives.

MS719 replaces Statement No. 423 and its commitments relating to dust from mining and transport. This Plan consolidates Worsley Alumina's dust management commitments and obligations, as described under the following approvals and documents:

- MS719;
- Environmental Licence No. 5960/1983;
- Works Approval W4510/2008/1; and
- South32 Environment Standard.

This management plan is a directory to those documents associated with dust management. It also provides the objectives for dust management that must be adhered to when preparing or modifying documents that relate to dust management.

1.3 SCOPE

This Plan applies to all current and future approvals boundaries, including Worsley Alumina's BBM operations, the proposed Contingency Bauxite Mining Envelope (CBME) within the Refinery Lease Area (RLA) and the overland conveyors and unsealed roads managed by Worsley Alumina (referred to as the Project Area – Figure 1-1: Worsley Project Area (BBM) and Figure 1-2).

This management plan includes a description of:

- The environmental setting of the bauxite mine and transport corridors, as it relates to dust;
- Potential environmental impacts associated with high dust levels;
- Principle objectives and/or criteria relevant to dust management;
- The strategies and actions to manage dust that are specified within various documents;
- Monitoring and revision mechanisms to ensure that the performance of dust management measures is routinely assessed against the objectives; and
- Processes for the reporting of performance and the identification and/or implementation of change, based on feedback.

The Plan includes review mechanisms to ensure that the dust management techniques are kept up to date with community and government expectations and industry performance benchmarks. The plan also includes a management action table to assist in the implementation of the plan.

This plan excludes activities within the Refinery Lease Area (RLA), with the exception of the proposed Contingency Bauxite Mining Envelope (CBME). The Bauxite Residue Disposal Areas (BRDAs), transport activities and Refinery infrastructure are not included in this plan. Activities within the RLA are managed under a separate Air Quality and Dust Management Plan (Refinery).

This plan also excludes the management of combustion products including oxides of nitrogen (NOX), sulfur dioxide (SO2) and carbon monoxide (CO). Management of combustion product emissions at the BBM is described in the Worsley Alumina Mine Expansion Environmental Review Document (ERD) (South32, 2021).

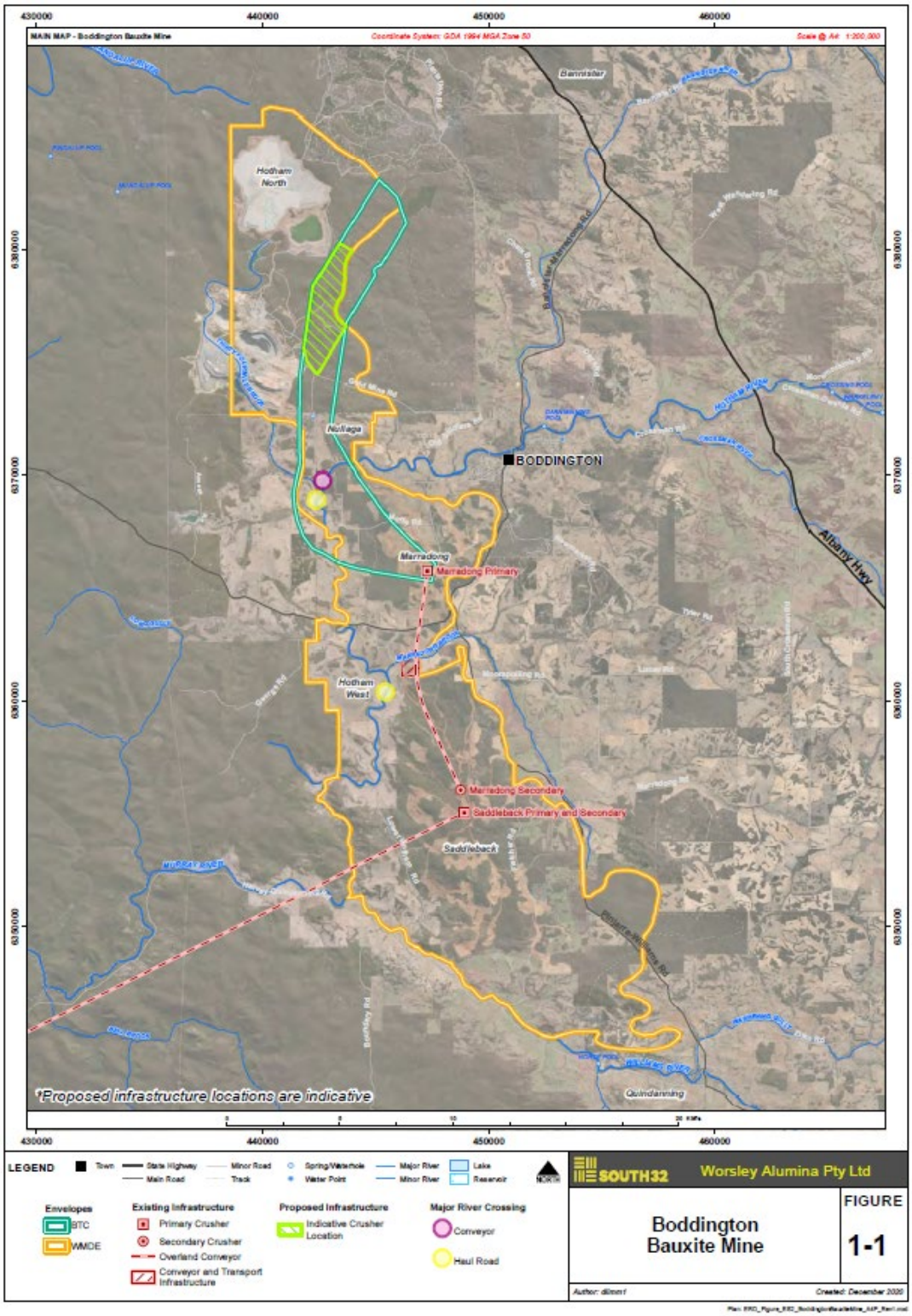

Figure 1-1: Worsley Project Area (BBM)

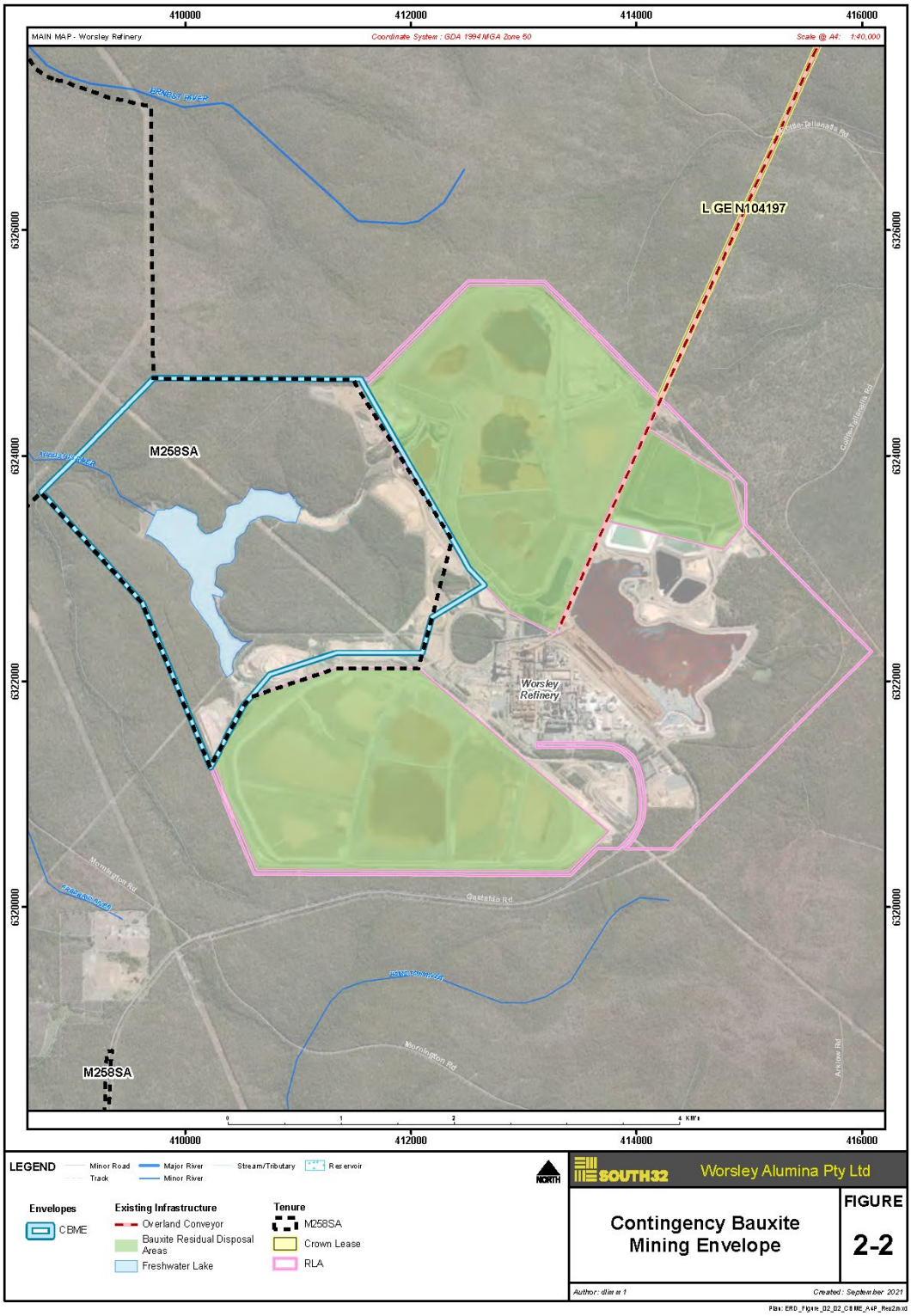

Figure 1-2: Worsley Project Area (CBME)

1.4 CURRENT MINISTERIAL CONDITION REQUIREMENTS

MS719 effectively consolidates the various pre-existing dust management and performance commitments made by Worsley Alumina in previous environmental assessments, into the single broad commitment to manage dust from mining and transportation. MS719 – Proponent Commitment 2 states:

Worsley Alumina will prepare and implement a Dust Management Plan that addresses the following:

- Suppression of dust from the construction of bauxite transport corridors and operation of overland conveyors;
- Suppression of dust in all areas where Worsley Alumina operates, including the use of additives to reduce water consumption, where appropriate;
- Monitoring of dust levels at locations upwind and downwind of mining activities; and
- Monitoring the impact of dust on vegetation adjoining haul roads and the development of measures to address any identified significant adverse impacts.

The Plan will be prepared on advice from the Environmental Management Liaison Group (EMLG), which includes the Department of Water and Environmental Regulation (DWER).

1.5 STATUTORY, REGULATORY AND CORPORATE REQUIREMENTS

1.5.1 Environmental Licence No. 5960/1983

There are a number of conditions in Worsley Alumina's BBM Environmental Licence that are relevant to this Plan as follows:

Condition No.	Area	Condition Requirement
2	Emissions and discharges	The licence holder must ensure that where waste is emitted to air from the emission points in Table 3 and identified on the map of emission points in Schedule 1 it is done so in accordance with the conditions of this Licence.
3	Emissions and discharges	The Licensee must use all reasonable and practical measures to prevent, and where that is not practicable, to minimise dust emissions from the Premises.
5	Monitoring	The license holder must record production or throughput data and any other process parameters relevant to any non-continuous or CEMS monitoring undertaken.
6	Monitoring	The license holder must ensure that all monitoring equipment used on the Premises to comply with the conditions of this Licence is calibrated in accordance with the manufacturer's specifications.
7	Monitoring	The license holder must, where the requirements for calibration cannot be practicably met, or a discrepancy exists in the interpretation of the requirements, bring these issues to the attention of the CEO accompanied with a report comprising details of any modifications to the methods.
9	Ambient air quality monitoring	The license holder must undertake the monitoring in Table 5 according to the specifications in that table. The Licensee shall record and investigate results that do not meet any target specified.
10	Ambient air quality monitoring	The licence holder must; (a) develop a Sampling and Analysis Plan, prepared by an Air Quality Professional for dust composition sampling that includes: i) sampling regime; ii) averaging period that must not be less than one 24 hour sample collected every 6 days for a period of at least 3 months; iii) sampling methodology; iv) siting requirements; v) appropriate target levels; vi) quality assurance / quality control (QA/QC) program; (b) Install a monitor that is capable of collecting bulk dust for quantitative analysis as specified in the Plan required by condition 10(a) within two months of the date of this

Condition No.	Area	Condition Requirement
		amendment (located in proximity to the Marradong Primary Crusher and placed to primarily collect dust that is emitted from the Marradong Primary Crusher). (c) undertake monitoring as specified in the sampling and analysis plan specified by condition 10(a) and commencing within 4 weeks of installation of the monitoring equipment specified in condition 10(b).
13	Records and reporting	The licence holder must record the following information in relation to complaints received by the licence holder (whether received directly from a complainant or forwarded to them by the Department or another party) about any alleged emissions from the premises: (a) the name and contact details of the complainant, (if provided); (b) the time and date of the complaint; (c) the complete details of the complaint and any other concerns or other issues raised; and (d) the complete details and dates of any action taken by the licence holder to investigate or respond to any complaint.
17	Records and reporting	The licence holder must submit to the CEO by no later than 90 days after the end of each annual period, an Annual Environmental Report for that annual period for the conditions listed in Table 8, and which provides information in accordance with the corresponding requirement set out in Table 8
20	Notification	The licence holder must ensure that the investigation of any target PM10 exceedances listed in Condition 9, and reported as per Condition 19 must include, but is not limited to: (a) meteorological details: temperature, wind speed and wind direction, humidity at the time of the exceedance; (b) any site operational activities that may have contributed to the exceedance; (c) any detail on the ore body mined at the time of exceedance; (d) any dust suppression activities utilised at the time of exceedance (or failures of dust suppression equipment); (e) any complaints received that may have been caused or associated with the exceedance; (f) the root cause analysis for the exceedance; and (g) a description of remedial measures taken or planned to be taken, including those taken to prevent recurrence of the exceedances.

1.5.2 Air Quality Guidelines

Dust from mining and associated activities is subject to air quality standards as described by the National Environment Protection Measure (NEPM) for Ambient Air Quality (NEPC, 2021). The measure includes standards for air quality for particulate matter 10 micrometres or less in size (PM10); as well as advisory reporting standards for fine particulate matter 2.5 micrometres or less in size (PM2.5), which is typical smoke particle size. The goals for the measure (as outlined in

Table 1-1) specify the maximum allowable levels for PM10 and advisory standards for PM2.5.

In 2011, the Department of Environment and Conservation (DEC) released an updated dust management guideline, '*A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities*'. This guideline was developed to assist proponents in developing and implementing dust management programs specific to their operations. It covers the management of dust generated from land clearing activities, earthworks during construction, remediation of contaminated sites, demolition works, bulk materials handling, mining and quarrying activities including the storage, transport and stockpiling of soil or other material on site (DEC, 2011). This document has been used as a guideline for the design of appropriate monitoring and management methods for dust emissions that may be generated by Worsley Alumina's bauxite mining or transport activities.

For the management of dust that may be generated by Worsley Alumina's bauxite mining and transport activities, the NEPM for ambient air quality (PM10) has been applied as an objective and/or target for site.

Table 1-1: National Environmental Protection Measure for Ambient Air Quality

Pollutant	Averaging period	Maximum concentration	Maximum allowable exceedances
Standards and goal for pollutants other than particles as $PM_{2.5}$			
Particles as PM_{10}	1 day	50 µg/m^3	0 days a year (within 10 years from commencement)
Advisory reporting standards and goal for particles as $PM_{2.5}$			
Particles as $PM_{2.5}$	1 day	25 µg/m^3	Goal is to gather sufficient data nationally to facilitate a review of the Advisory Reporting Standards as part of the review of this Measure scheduled to commence in 2005.

1.5.3 Corporate Requirements

Worsley Alumina has established a comprehensive set of Corporate Policies and Standards covering all operational aspects and activities that have the potential to affect aspects of health, safety, environment or community (HSEC), either positively or negatively. Those relevant to dust are described below.

South32 Environment Standard

Purpose: To create value through environmental and social leadership.

General requirements: To provide an environmental management framework that ensures appropriate focus and accountability, continuous improvement and a standardised process that prevents environmental harm.

1.6 RELEVANT KEY ENVIRONMENTAL FACTORS

This Plan specifically addresses the following key environmental factors:

- Air Quality, in which the EPA's objective is "*To maintain air quality and minimise emissions so that environmental values are protected.*"
- Social Surroundings, in which the EPA's objective is "*To protect social surroundings from significant harm.*"
- Flora and Vegetation, in which the EPA's objective is "*To protect flora and vegetation so that biological diversity and ecological integrity are maintained.*"

2 STATE OF KNOWLEDGE, RISK CONTEXT AND MANAGEMENT APPROACH

2.1 EXISTING ENVIRONMENT

2.1.1 Description

Current bauxite mining operations at the BBM are located within the eastern Jarrah forest bioregion of the Darling Range, with mining activities occurring primarily within State Forest and on privately owned land, including native vegetation and agricultural areas (Figure 1-1: Worsley Project Area (BBM)). The CBME is located in an industrial setting, within the RLA, which is surrounded by State Forest and private land (predominantly Worsley JV land) (Figure 1-2).

Farming, burning activities, residential vehicle activity (along sealed and unsealed roads) and wind erosion occurring throughout much of the local and wider region contribute to background dust levels, with seasonal trends detected as cleared agricultural land ground cover changes on a seasonal basis. In addition, smoke from hazard reduction burning, burning of cleared vegetation, household use and wildfires is a substantial contributor to elevated levels of airborne particulates.

2.1.1.1 Natural Setting

State Forest areas in the vicinity of the Project Area are typically forest and/or woodland communities dominated by tree species such as Jarrah (Eucalyptus marginata), Marri (Corymbia callophylla), Wandoo (Eucalyptus wandoo) and Powderbark Wandoo

(Eucalyptus accedens). The understorey varies between dense Dryandra thickets, heathlands and more open vegetation community types. Vegetation within the Project Area ranges from excellent to completely degraded condition. Disturbance associated with logging, spread of invasive pathogens (Dieback and Australian honey fungus), and weeds is evident. Where native vegetation occurs on private agricultural land, it is typically represented by small isolated pockets of trees with limited understorey.

2.1.1.2 Public Access and Use

Several recreational attractions and cultural and heritage places intersect or occur in close proximity to the Project Area. This includes the picnic ground and walking trail associated with the Tullis Bridge, located within the WMDE and BTC, Mount Wells Camp on the Bibbulmun Track adjacent to the north-western boundary of the WMDE and the Munda Biddi Trail, which runs close to the south-western boundary of the CBME (Figure 2-1). Registered archaeological and ethnographic Aboriginal heritage sites and European heritage places are also known to occur within and surrounding the Project Area.

2.1.1.3 Potential Sensitive Receptors

The location of domestic residences and other premises that may be susceptible to dust from the current approved and proposed mining envelopes at the BBM has been documented and this information is used in mine planning (see Figure 2-2). Figure 2-2 does not display all sensitive receptors within the vicinity of the mining areas, only those who may be impacted from operational dust emissions. The sensitive receptors shown in Figure 2-2 are current as of August 2020, and are subject to change depending on the mine plan and other external factors.

Worsley Alumina encourages members of the community to contact the operation for any concerns, through a community contact phone line or through the Community Liaison Committee. This assists with immediate management measures and also highlights any potential unidentified sensitive receptors.

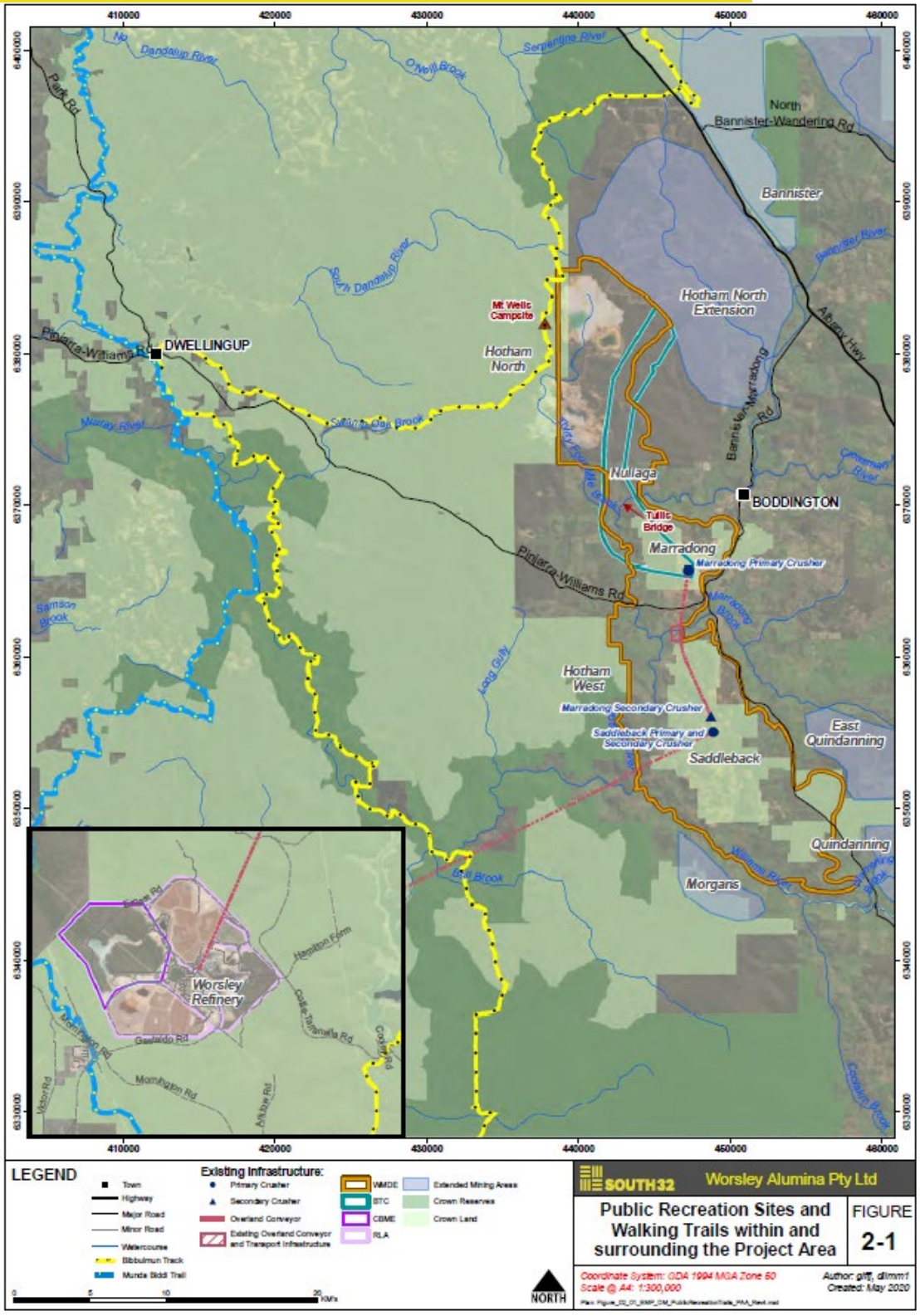

Figure 2-1: Public Recreation Sites and Walking Trails within and surrounding the Project Area

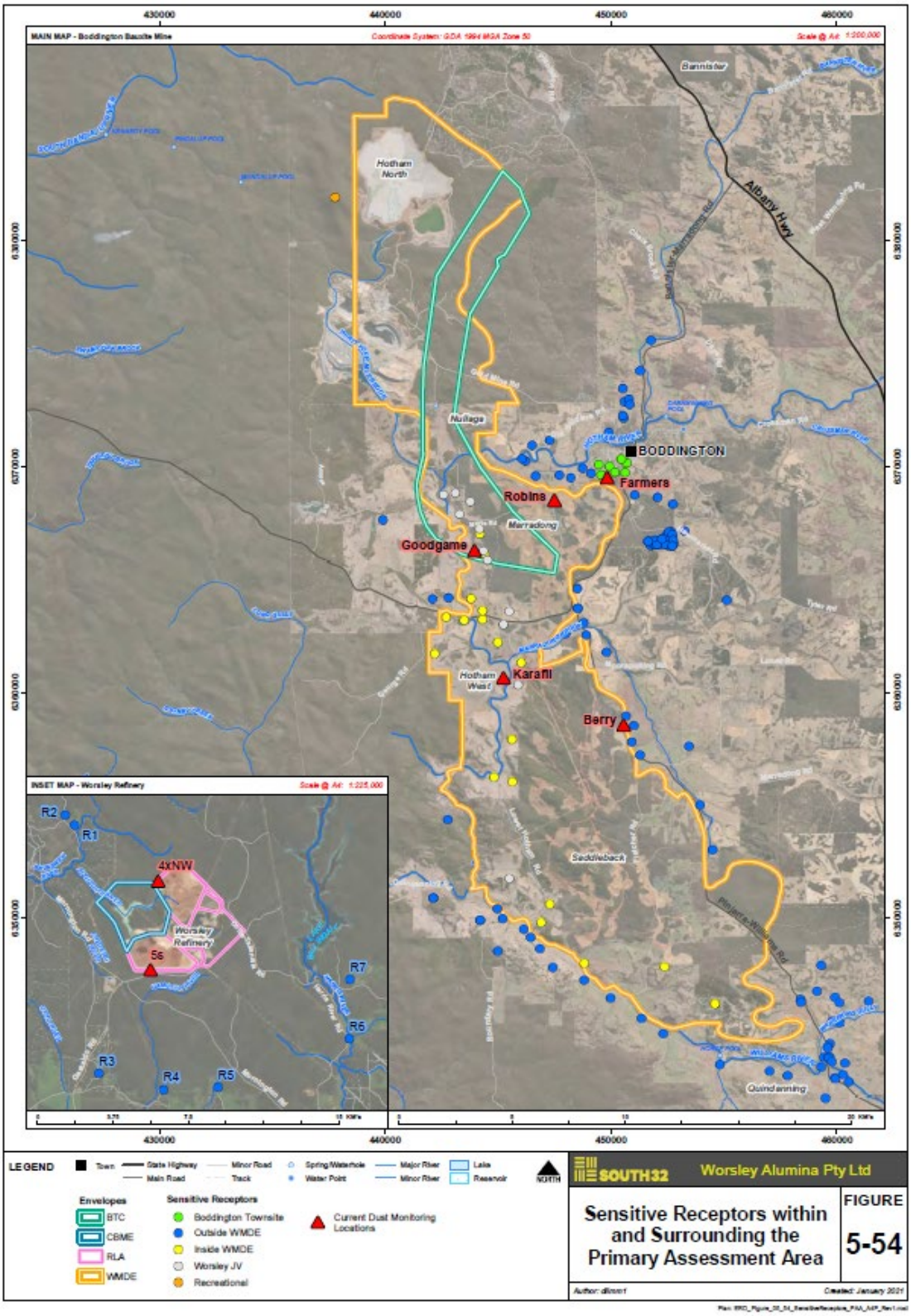

Figure 2-2: Potential Sensitive Receptors within and surrounding the Project Area

2.1.2 Prevailing Weather Patterns

2.1.2.1 Climate

The region is characterised as having a Mediterranean climate with typically hot, dry summers and mild, wet winters. Average temperatures during summer range from 12°C to 32°C and during winter range between 4°C to 17°C.

Average monthly rainfall is typically low during the summer months and increases during the winter months, with maximum rainfall occurring in July and August (ETA, 2020a).

High temperatures and low rainfall in the summer months increases the potential for dust generation from Worsley Alumina's operations, as compared to the winter months with lower temperatures and greater rainfall (ETA, 2020a).

2.1.2.2 Wind Direction

Annual wind roses have been developed to display historical data collected at the BBM using an on-site anemometer (at a height of 21m) over a six-year period from July 2006 to June 2012 (Figure 2-3). During 2019, modelling has been undertaken to predict wind speeds and directions at heights of 35m and 10m (Figure 2-3). The average predicted wind speeds and directions within the model are consistent with the historical wind roses, with both showing prevailing winds from the east-south-east to south-south-east during summer, and from the west-south-west to west-north-west during the winter months (ETA, 2020a). Wind speeds are typically calmer during winter and increase during summer. Average wind speeds generally remained below 10 m/s during both winter and summer from 2006 to 2012, with minimal wind speed records exceeding 10 m/s. Modelling undertaken in 2019 predicted wind speeds of greater than 10 m/s at 35m during the summer months.

Stronger winds during the summer months are expected to generate greater amounts of dust emissions due to increased dust-lift from open, disturbed areas during dry conditions (ETA, 2020a).

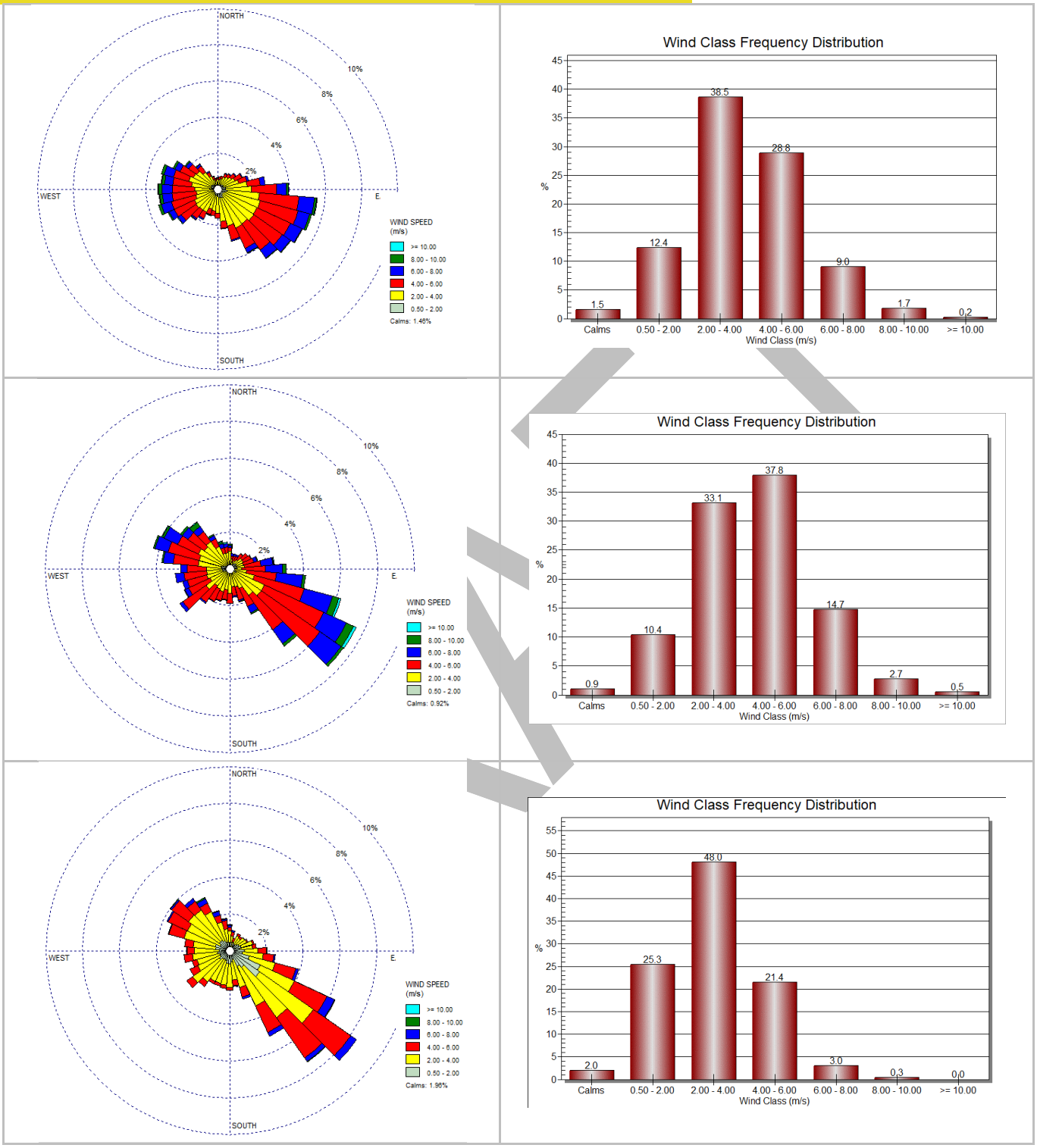

Figure 2-3: Winds measured at the BBM from July 2006 to June 2012 using an on-site anemometer at 21m height (top) compared to predicted winds from the 2019 modelling domain at 35m height (middle) and 10m height (bottom) (ETA, 2020a)

2.2 PROJECT RISKS

2.2.1 Description of the Hazard

A wide range of bauxite mining and transport activities have the potential to generate dust, namely through material handling, vehicle movement and wind erosion. Material handling includes material movements (clearing, mining operations, conveying, stacking and reclaiming), blasting and vehicular movement over unsealed or dust laden surfaces. The amount of particulate matter generated is highly dependent on the moisture properties of the material being transferred, the particle size distribution (PSD) of the material, drop heights and the dust management measures and emission controls in place for the sources.

Dust generated by vehicle movements occurs when the passage of vehicles loosens particulate matter, which is uplifted by turbulent air behind the vehicle. There are numerous factors that influence the quantity of particulate emissions from unpaved roads, including surface moisture, road composition, vehicle speed, number of wheels, traffic volume and road length. Heavy vehicles and high speeds will produce higher emissions than light vehicles and low speeds.

Particle movement occurs when the wind speed exceeds a 'threshold' velocity (nominally in the 5 – 10 m/s range), causing larger particles (> 100 microns) to be dislodged and move across the ground surface. This in turn can dislodge smaller particles which remain suspended in the air. The amount of particulate matter generated is highly dependent on the wind speed, surface properties and PSD of the material.

Localised dust sources from bauxite mining and transport activities include blasting / drilling, land / vegetation clearing, topsoil and overburden stripping, excavation (including loading / unloading of ore and waste), vehicle movement (including light and heavy vehicles), crushing, crusher screening, conveyor transfer and stacking / reclaiming stockpiles (ETA, 2020b). These localised sources are usually visible and readily identifiable. Other sources of dust may be more diffuse, arising from wind erosion of areas such as waste dumps, pits and areas of disturbed and cleared ground in and around the site. Dust from Worsley Alumina's bauxite mining activities is almost entirely generated by wind erosion, soil-disturbances within active mining pits, vehicle movements on unsealed roads, crushing, reclaim stockpiles and conveying activities, burning activities and blasting (Table 2-1).

A recent Dust Control Benchmarking Study undertaken by Environmental Technologies & Analytics (ETA – 2020b) has confirmed that the current relative contribution (%) of the predominant dust-generating activities at Worsley Alumina to the estimated PM10 emissions aligns with the levels described by Strategen in 2005 (Table 2-1).

Dust from the existing overland bauxite conveyors is not considered to be an environmental issue, on the basis that:

- Crushed ore on the conveyor is stationary relative to the surface on which it is in contact with;
- The conveyor is covered;
- Dust containment systems such as covers, and watering points are strategically placed on the conveyor belts and at transfer points; and
- Dust abstraction systems are in place for the Marradong conveyor extension.

Future overland bauxite conveyors will be constructed in alignment with the existing conveyors. Construction activities associated with extension of the conveyors may be a potential source of dust.

Table 2-1: Description and indicative contribution of operational aspects to total PM_{10} emissions (Strategen, 2005)

Aspect	Brief description	Relative contribution to estimated PM_{10} (%)
Earthworks/load and haul	Includes: vegetation clearing, topsoil and overburden removal and stockpiling; ore removal; rehabilitation; transport of ore to the crusher by trucks and other vehicle movements.	39
Blasting	Involves drilling of blast holes (to about 4 m depth) and blasting of lateritic hardcap for mining.	4
Crushing and materials handling	Includes the transfer of ore into crushers, reclaim stockpile and loading of crushed material onto the overland conveyor for transfer to secondary crushers or the refinery.	13
Burning	Involves periodic burning of forestry residues not required for rehabilitation.	5
Wind erosion	Dust generated by wind and occasional traffic over areas disturbed by mining and not yet rehabilitated to a stable landform.	39

2.2.1.1 Nature of Dust

In the assessment of environmental impacts, dust is more conventionally referred to as 'airborne particles' or 'particulates' and is measured as total suspended particulates (TSP), PM10 and PM2.5. Worsley Alumina reports annually on dust emissions (PM10) from mining operations in accordance with the requirements of the National Pollution Inventory.

2.2.2 Potential Impacts from Dust Emissions

Dust emissions generated from the bauxite mining and transport have potential to directly or indirectly impact on relevant key environmental factors (see Section 1.6). Potential impacts (direct and indirect) that may result from Worsley Alumina's operations are discussed below.

Health Impacts

Epidemiological studies show associations between elevated PM10 concentrations and above normal numbers of hospital admissions, respiratory illness and asthma attacks, as well as premature mortality in susceptible sub-populations (NSW Minerals Council, 2000). Smoke particles are typically of a smaller size (2.5 micrometres) and can pose a greater health risk than dust by becoming imbedded within the respiratory system.

In 2021 GHD undertook a study to address condition 10 of the BBM Environmental licence, which included a review of health target criteria. This report will be utilised to update, if required, the dust management program at Worsley.

Social Impacts

Potential social impacts relating to dust are predominantly due to the nuisance and aesthetical problems that arise from visible dust emissions. Airborne particles are generated during mining mainly by mechanical disturbances, such as road traffic, blasting and earthmoving. These are generically referred to as "activity-dependent" sources.

In dry, windy conditions, particles can be lifted from open or disturbed areas, resulting in visible dust. These are typically referred to as "wind-dependent" sources. Most airborne particles that originate from these sources are larger than 10 micrometres diameter and are more commonly associated with nuisance impacts rather than with public health problems. The larger particles tend to resettle on the ground within a short distance of the source (typically less than 300m).

Vegetation Health Impacts

Dust may have physical effects on plants resulting from blockage and damage to stomata, shading, abrasion of leaf surface or cuticle, and cumulative effects, e.g. drought stress on already stressed species (NSW Minerals Council, 2000). The chemical effects of dust, either directly on the plant surface or on the soil, are unlikely given the characteristics of crustal materials in bauxite mining areas.

Areas of high ecological value or agricultural resources may be more sensitive to dust emissions than other areas. However, the effects of dust fallout throughout the current and proposed bauxite mining areas are predominantly localised. Background levels in the area, and distances from sensitive agricultural activities such as horticulture, suggest dust generated from mining and mining-related activities is unlikely to have a significant effect on these sensitive agricultural operations (Strategen, 2005).

Investigation into dust impact on vegetation has been progressed by Worsley Alumina. See Section 3.2.4 for further details.

2.3 MANAGEMENT APPROACH

2.3.1 Overview

Within the Worsley Alumina document structure, there are a number of documents applicable to the management of dust for safety and environmental reasons. These are:

- Workplace Dust Control Standard (00112051);
- Environmental Dust Minimisation – BBM Standard (01016063);
- Dust Investigation – Standard Work Instruction (01028763) (Draft)
- Saddleback Crushing Inspection Form (01017015); and
- Secondary Plant Inspection Form (01017016).

Section 2.3.2 to Section 2.3.5 describe the strategies and actions contained in the documents listed above to minimise dust. Refer to Section 3 for details of the key actions relevant to this management plan.

Dust management requirements are also implemented through internal procedures. A summary of these is provided in Table 3-1.

2.3.2 Planning and Mine Development

2.3.2.1 Dust Management Plans

Worsley Alumina incorporates dust minimisation into its mine planning and development procedures by minimising the time between clearing and rehabilitation. The mine planning process also assesses the sensitive premises and public utilities that may be susceptible to dust emissions.

Worsley Alumina is required to prepare a Plan of Bauxite Mining (Ten Year Plan) in accordance with Clause 16(10) of the Worsley State Agreement. The Ten Year Plan provides a rolling 10-year plan for mining and ancillary operation and assists Worsley Alumina to:

- Model operations to identify sensitive premises and public utilities;
- Plan for rehabilitation activities to minimise the time between clearing and rehabilitation which assists with limiting dust generation potential; and
- Consider the need for buffer zones (including weather dependent risk impacts).

The Ten Year Mine Plan is developed annually and submitted to the EMLG in the last quarter of the calendar year. The annual rolling Ten Year Mine Plan is developed in a consultative manner with relevant Government agencies and is tabled for acceptance at meetings of the EMLG. The plan provides an opportunity for agencies to contribute to the long-term planning of mining operations on an annual basis and also provides agencies with forward advice to build into their planning process.

2.3.2.2 Buffer Zones

The concentration of particulate matter in the air decreases with distance from source (NSW Minerals Council, 2001). The effect of both dispersion (decrease in concentration due to increased mixing) and deposition (the settling of particles and removal from the air column) is relative to travel time and distance from the source of dust. Buffer zones (risk rating dependent) may be established to protect sensitive receptors that may be exposed to dust emissions from high risk operations and time frames. Risk management processes for sensitive receptors is described below in Section 2.3.3.

2.3.2.3 Drilling and Blasting

Dust from drilling and blasting represents a localised and relatively minor emission source. As with all machinery operations on cleared areas, running surfaces are wetted to minimise dust. Dust generated from drilling is minimised by wetting when required, and any dust emissions are localised to the immediate drilling area.

Blasting activities are carefully controlled through monitoring climatic conditions. Blasts are delayed or avoided when conditions (primarily wind direction and speed) are likely to impact on amenity (both noise and dust) of nearby sensitive receptors. Mining pits located on premises boundaries must be carefully managed to minimise dust emissions as far as reasonably practicable. Where dust emissions cannot be prevented from crossing the premises boundary, controls must be in place to ensure that impacts on nearby sensitive receptors and roadways are minimised. Control measures implemented (where necessary) include:

- Potential relocation agreements; and/or
- Temporary road closures or traffic control points.

2.3.3 Bauxite MINING & ANCILLIARY OPERATIONS

2.3.3.1 Mine Operation and Haulage

Dust emissions from earthworks and loading and hauling of bauxite represent one of the larger potential sources of dust in mining operations. However, the pits that are actively mined at any one time are widely dispersed and the location of the pits changes over time (e.g. to manage grade and environmental impacts).

Mined ore is transported along haul roads to a primary crusher near the centre of the general mining areas. Dust management actions that are implemented to suppress dust produced from these operations include:

- Ensuring active haulage routes are wetted by dedicated water tankers during periods when dust lift off is likely. This wetting is typically reduced during periods of rainfall and low evaporation;
- Utilising dust suppressants other than water, in order to minimise dust creation in high risk areas (e.g. by binding the road surface together to minimise dust creation and lift-off); and
- Minimising drop heights (where possible) of materials from excavators and loading units during mining and waste movements and the transfer of crushed ore to the reclaim stockpiles.

2.3.3.2 Stockpiles and Open Areas

Along with earthworks and load and haul operations, wind erosion resulting in dust mobilisation from cleared surfaces represents a significant potential source of dust from mining operations under dry and windy conditions.

In addition to maintaining wetted surfaces within active mining areas, Worsley Alumina utilises water trucks for surface watering during periods where unfavourable weather conditions could pose a high dust emission risk.

Worsley Alumina proactively rehabilitates all areas disturbed by mining operations as soon as practicable following mining. Early rehabilitation ensures that the total cleared area at the mine is minimised and therefore, reduces the potential for dust during dry conditions with strong winds.

2.3.4 Bauxite Crushing

2.3.4.1 Marradong Two Stage Primary Crusher

First Stage

The Marradong two-stage primary crusher is located in an excavated pit approximately 27 m deep, to minimise noise and dust emissions from the crushing and screening operations. Haul trucks tip ore into a twin access 450 tonne (t) tipping hopper located directly above the Stage 1 primary crusher unit. Dumped ore feeds into the Stage 1 primary sizer and rock breaker, reducing the ore to <300 mm. Crushed ore feeds onto the primary discharge conveyor (approximately 100 m long), a conventional conveyor running on supporting idlers. Dust collectors are located at transfer points. All air from the dust collectors is filtered and dust is collected and returned to the conveyor.

Second Stage

Ore is reduced to <100 mm by the Stage 2 primary sizer. Dust collectors are located at the transfer point where the ore is fed onto the 10.5 km overland conveyor (OLC) to the Saddleback mine site. The transfer point is located in a pit approximately 30 m deep.

2.3.4.2 Dust Emissions and Controls

Dust Suppression and Collection

The first stage of the crusher incorporates water sprays across the dump hopper and on the discharge conveyor leaving the stage one primary sizer. The second stage incorporates dust collectors on both sides of the discharge chute to the conveyor (i.e. upstream and downstream of the run of the conveyor). It should be noted that ore entering the second stage is still wet from the first stage.

All dust collectors are a bag type with a rated air volume flow of approximately 5,000 m3/hour each and designed to meet the AEC/NHMRC limit for solid particle emissions of 250 mg/m3 (AEC/NHMRC 1985).

The emissions from the primary crusher (both stages) were estimated for dust impact assessment purposes in 2009 using the NPI emission Estimation Technique Manual for Mining (NPI, 2003) general equation. As a conservative measure, an additional 25% was added to the emissions estimated from the above to account for the incorporated second crushing stage. This estimated an average PM10 emission rate of 6,332 kg/year or 0.21 g/s.

Crushing facilities are considered to be "fugitive" dust sources as it is not possible to reliably sample individual emission points. Therefore, the preferred method for quantifying dust emissions is downwind ambient sampling of the plume concentration profile and "back-calculating" the emission from the facility as a whole.

2.3.4.3 Saddleback Secondary Crusher (Marradong Operations)

The secondary crusher was approved under a separate Works Approval (W4509/2008/1) issued 4/6/2009. Ore Reclaim System

The reclaim system consists of a conveyors from each of the two secondary crushers to stockpiles on top of a vault and tunnel arrangements used for reclaiming bauxite from the stockpiles. Both reclaim conveyors feed to a 400 tonne bin which allows controlled feed directly to the overland conveyor via a belt feeder.

2.3.5 Bauxite Conveying

2.3.5.1 Overland Bauxite Conveyor

The overland bauxite conveyors (OBC) are mostly covered, which minimises the risk of bauxite dust becoming airborne (ETA, 2020a). In addition, dust risk is low as belt speed is below dust lift-off velocities and material is relatively stationary on the conveyor belt. All conveyor transfer points are fitted with dust containment systems.

For future proposed transport corridors, Worsley Alumina will develop and submit a dust management strategy as part of its Transport Corridor Route Plan as required by MS719.

2.3.5.2 Marradong Overland Conveyor

The Marradong OLC is covered, which prevents bauxite dust from becoming airborne. In addition, the bauxite is relatively stationary on the conveyor belt and the belt speed is below that required to cause dust lift-off velocities. All conveyor transfer points are fitted with dust containment systems.

2.3.6 Risk Management

Application of the mitigation hierarchy (avoid, minimise and rehabilitate environmental impacts, prior to applying compensatory actions) is used to manage dust related impacts associated with Worsley Alumina's operations.

2.3.7 Risk Assessment

Works Approval W4510/2008/1 condition 4(b) requires Worsley Alumina "to undertake a risk assessment of the operation" in relation to dust impacts, as a provision of the Dust Management Plan.

2.3.7.1 Potential Dust Impacts

The current risk assessment procedure follows the methodology described in the Department of Biodiversity, Conservation and Attractions (DBCA – previously the Department of Environment and Conservation) document "Draft - A guideline for the development and implementation of a dust management program" (Department of Environment and Conservation, May 2008), which is designed for land development activities. This procedure is applicable to only those locations within the mining lease where mining activities are occurring.

Due to the age of operations, dust management risks have previously been assessed, with control programs and monitoring systems implemented. Existing procedures and controls established and implemented for previously approved mining areas, will be extended to include all mining areas (existing and proposed) within the Project Area. Internal reviews of visibility of dust from public access areas will occur as mining pits are extended.

Current identified risks and management programs for dust will be expanded for mining areas within future approved mining envelopes.

2.3.7.2 Aspect and Impact Analysis

Aspect and impact analysis identified dust generating aspects of the project and the environmental, human health and amenity impacts potentially associated with each. This assessment is detailed below in Table 2-2.

Changes to operational areas and operational strategy may alter the dust risk profile associated with these activities. In the event of such changes, a risk assessment will be undertaken on the modified dust risk profile and will consider:

- Current and reasonably foreseeable activities consistent with the Life of Operations plan;
- Closure plans; and
- Impacts from dust on potential sensitive receptors.

Table 2-2: Aspect and impact table for dust generating activities

Mining Activity / Duration	Aspect	Impact
Clearing of vegetation exposes topsoil to wind erosion - continuous at various locations as new pits are developed. There is usually a significant vegetation buffer around each pit towards sensitive land uses.	Transient dust source.	Potential localised impact on any nearby residences – minimal
Forest residue (after timber harvest and salvage of logs for wildlife) windrowed and burnt when weather conditions permit.	Smoke from burning.	Contribution to local and/or regional smoke levels.
Topsoil removal.	Transient dust source at location of removal and topsoil stockpiling.	Potential localised impact on any nearby residences.
Bauxite mining dust sources: • Pits (blasting, wind erosion, activities) • Waste dumps (wind erosion, activities) • Hauling (wind erosion, activities) • Crushing • Conveyors • Bauxite Stockpiles	Dust sources associated with principal activity of the operation. Visible emissions from various sources.	Potential impact on nearby residences. Potential concern from community/neighbours inferring dust impacts.

2.3.7.3 Site Risk Assessment

The factors that influence the levels of dust emitted into the ambient air can be used to qualitatively assess a site's risk potential. Each factor is given a rating of high, medium or low dust risk potential. The overall site dust risk potential rating for bauxite mining and transport activities within the Project Area is shown in Table 2-3 below. Risk potential ratings have been determined based on the South32 Consequence and Likelihood Risk Matrix and have been rated against the recent benchmarking study (ETA, 2020b) for dust control methods.

Appropriate dust control measures, contingency measures and monitoring requirements are described in Section 2.3.1.

Table 2-3: Site risk assessment chart

Factor	Assessment	Risk Potential
Nature of works	Mining operation.	Moderate
Topography	Hilly with mining predominantly within ridge areas. Most mining areas are reasonably shielded from prevailing winds by forest buffer.	Low - Moderate
Soil type	High moisture soils.	Low
Water Supply	Availability of sufficient water for dust mitigation	High
Exposed area on site	Only a relatively small proportion of the lease area is exposed at a time.	Moderate - High
Duration of works	The BBM operation is continuous for the next 15+ years.	High
Proximity to sensitive receptors	Peripheral pits can be relatively close to residences. However, there is sometimes a vegetation buffer of residual forest.	Moderate - High
Contamination level	No known contamination since site has been used for forestry and agricultural activities.	N/A
Prevailing wind direction and speed	The operation is within a medium to high rainfall zone within the South West of WA. Summer-time winds are predominantly easterly. There are, however, potential	Moderate - High

Factor	Assessment	Risk Potential
	off-site dust impacts for all wind directions and wind speeds.	
Drying climate	Impacted rainfall amounts will result in longer periods of drier conditions with potential for increased dust events impacting receptors.	Moderate - High
Overall site dust risk potential		Moderate

2.3.8 Roles and Responsibility

Worsley Alumina's Policies and Standards specify requirements for all Worsley Alumina assets. All Worsley Alumina employees and contractors are required to comply with these requirements.

The roles and responsibilities of onsite personnel specified in dust management procedures are provided in Table 2-4…

Table 2-4: Roles and responsibilities of onsite personnel in relation to dust emissions management

Procedure	Personnel	Responsibilities
BBM Dust Minimisation (00113422)	All BBM Employees	• Alert Pit Control in the event of visible dust exiting the mine site boundary. • Raise an event in the site risk notification system if visible dust generated from Worsley Alumina activities is seen exiting the mine site boundary.
	Mining Supervisor	• Visually monitor operational areas for excessive dust. • Modify operations to minimise dust generation. • Implement haul road dust control.
	Mining Superintendent(s)	• Include an allowance for chemical water additives in annual budget. • Formally review success of dust management program on an annual basis and keep minutes of the meeting. • Ensure all supervisors are aware of the need to consider weather conditions and subsequent dust risk associated with mining, rehabilitation and development activities. • Investigate chemical additives to increase effectiveness of haul road watering process. Implement the use of approved chemical additives in haul road watering process.
	Fixed Plant Superintendents	• Ensure that fixed plant watering and dust extraction systems are functioning effectively. Ensure that fixed plant watering and dust extraction systems are used as required
	Environmental Team	• Ensure dust risk has been captured in the relevant risk management register. • Provide advice where necessary on methods of minimising dust. Report incidents where licence conditions relating to dust have been exceeded, to the DWER.
BBM Community Complaints Procedure (01029471)	Worsley Alumina Community Relations	• Receives verbal and written community complaints during and after business hours. • Collects initial information, rates urgency of community complaint and determines ensuing actions and timeframes. • Notifies and forwards information to appropriate Worsley Alumina personnel for follow up as above. • Provides feedback to complainant within specified timeframe. • Manages and completes Event Notifications for all community complaints. • Enters details of all community complaints in the Community Relations Stakeholder Engagement Tracker. • Provides a monthly report of confirmed community complaints to HSEC
	Worsley Alumina Community Complaints Line	• Receives community complaints via a dedicated 24/7 1800 telephone service. • Collects initial information, rate urgency of community complaint; determine ensuing actions and timeframe. • Notifies and forwards information to appropriate Worsley Alumina personnel for follow up as above. • Provides daily, weekly and monthly reports to Community Relations.
	Community Complaints Recipient and Operations	• Direct all community complaints to either the Worsley Alumina Community Complaints Line (1800 555 958) or Community Relations.

Procedure	Personnel	Responsibilities
		• Investigate community complaints referred by the Community Complaints Line or Community Relations within the specified timeframe. • Take remedial action as deemed appropriate. • Provide feedback to Community Relations within timeframe specified by complaint rating. • Fill out relevant sections of Complaints Form, email to Community Relations. • Raise an event within the Worsley Alumina risk notification system for community complaints if an operational issue.

3 PLAN PROVISIONS

This section of the Plan describes the measures that Worley implements to meet the requirements established by the ministerial conditions and other requirements, as outlined in Section 1.4 and Section 1.5, respectively.

3.1 MANAGEMENT ACTIONS

The key management actions related to this plan are outlined in Table 3-1.

Table 3-1: Management actions in place to manage dust emissions from mining

Ref	Aspect	Phase	Management Action	Procedure	Evidence
MS719					
Condition 10	Transport corridors and conveyors	Pre-construction	Condition 10 of Statement 719 requires that, prior to the commencement of ground disturbing activities, Worsley Alumina will prepare and submit a Transport Corridor Route Plan. As part of this Dust Management Plan, Worsley Alumina will develop procedures to assess and manage dust risk along the proposed corridor, as well as design and/or operational controls to manage dust from transport operations within the corridor.	Not applicable	Third party verification as part of audit.
P2.1	Dust suppression on haul roads	Operation	Implement a management standard for mine haul roads that specifies: • Management of dust levels so that no employees are exposed to excessive dust levels or have impairment of visibility, that the amenity of nearby residences is maintained, and that vegetation is protected from dust impacts; • Responsibilities for haul road watering, water reticulation, workforce training and use of alternative dust (chemical) suppressants; Suitable water sources and water use efficiency measures.	Environmental Dust Minimisation – BBM Standard (01016063)	Third party verification as part of audit.
P2.2	Dust suppression in and around mine areas	All	Implement a management procedure for the bauxite mine that specifies: • Responsibilities and methods for minimising and reducing dust emissions from the mine site and preventing off-site impacts; • Factors to be considered (such as weather) when planning mine operations so that dust emissions are managed appropriately; • Responsibilities for watering stockpiles, active mining routes and disturbed / open areas during unfavourable weather conditions (dry and strong winds); Internal and external risk event reporting procedures.	Environmental Dust Minimisation – BBM Standard (01016063)	Third party verification as part of audit.
P2.3	Dust monitoring	All	Develop and implement a management procedure for the bauxite mine that specifies:	Environmental Dust Minimisation – BBM Std (01016063)	Third party verification as part of audit.

Ref	Aspect	Phase	Management Action	Procedure	Evidence
			• A program for monitoring dust emissions from the mine site that includes recording dust levels upwind and downwind of the area of operations; • A program for assessing and reporting monitoring results and implementing corrective actions.	Dust Investigation (01028763)	
P2.4	Impacts of dust on vegetation	All	Report on the impacts of bauxite and other dust from haul roads on vegetation and, if impacts are significant, the measures to be taken to manage those impacts.	Report completed	Report on dust impacts.
Licence L5960/ 1983/11					
3	Controlling dust leaving premises.	Event and Hazard Reporting Procedure (00100891) Dust Investigation (01028763)	Details the process for raising and completing a notification in the Worsley Alumina risk and event system.	Verification as part of internal audit. AER	3
13	In relation to public complaints – including dust.	BBM Community Complaints Procedure (01029471) Event and Hazard Reporting Procedure (00100891)	Purpose: Describes the process for effectively receiving, dealing with and reporting public complaints and reports regarding Worsley Alumina operations at the Refinery, BBM and the Port. Covers: • Recording of all public complaints and reports in a consistent manner across all Worsley Alumina sites; • Investigation, recording of findings, remedial action taken where necessary, and informing the complainant of outcomes of all public complaints and reports; and Accountability for handling public complaints and reports.	Verification as part of internal audit. AER	13
-	Internal reviews		Reported within the AER	AER	AER
-	Occupational dust control	Workplace Dust Control (00112051)	Details how dust in the workplace is controlled and monitored (from a health and safety point of view).		-

3.2 DUST MONITORING AND REVIEW

Worsley Alumina's dust monitoring network is comprised of both Tapered Element Oscillating Microbalances (TEOMs) and Met One E-Samplers (E-Samplers). All dust monitoring stations (except Farmers) are installed within the WMDE boundary. Details of the current ambient dust monitoring stations at the BBM are provided in Table 3-2 and the monitoring programs are further discussed in Sections 3.2.1 to 3.2.3.

Table 3-2: Worsley Alumina Ambient Dust Monitoring Stations

Monitor	Easting	Northing	Mining Area	Monitor	Parameters
Farmers (AQ1)	449,634	6,369,617	Marradong	TEOM	PM_{10}
Goodgame (AQ4)	444,292	6,366,258	Marradong	TEOM	PM_{10}
Karafil (AQ3)	445,243	6,360,647	Saddleback	E-Sampler	PM_{10}, WS/WD
Berry (AQ2)	450,025	6,358,678	Saddleback	E-Sampler	PM_{10}, WS/WD

WS = Wind Speed, WD = Wind Direction

3.2.1 Saddleback Monitoring Program

An ambient dust monitoring program for mining and associated activities was implemented at Saddleback in July 2006, in accordance with the Environmental Licence. To the extent possible, the monitoring sites are aligned with the requirements of Australian/New Zealand Standard (AS/NZS) 3580.1.1:2016 Methods for the sampling and analysis of ambient air – Guide to siting air monitoring equipment. The 'AQ' numbers are reference points listed within the mine Environmental Licence No. 5960/1983.

The monitoring program at the BBM includes the use of continuous PM10 photometric air samplers (E-samplers) located near the premise boundary. These dust samplers are specifically designed to provide indicative levels of ambient dust generated from within the mining operation, as well as provide data from prescribed burns and wildfires. The locations of these dust monitors are shown in Figure 2-2 (Berry and Karafil).

Results of the dust monitoring program are used to inform the required level of management (e.g. pit scheduling) and dust control at the mine. A summary of dust monitoring data and events for each financial year is provided in Worsley Alumina's AER.

3.2.2 Marradong Monitoring Program

Two TEOM monitors fitted with PM10 cyclone heads to provide real time levels are used to monitor dust impacts around Marradong. These are supported by Australian Standard (AS) 3580.9.8—2008 Methods for sampling and analysis of ambient air Method 9.8: Determination of suspended particulate matter—PM10 continuous direct mass method using a tapered element oscillating microbalance analyser, as well as other international regulatory standards. These have been selected on the basis of the 6th highest 24-hour average 10 µg/m3 contour predicted using dispersion modelling (EA, 2009) as a "benchmark" of relatively equivalent risk, then considering the number of residents at risk within the same general area that could be represented by a monitor. The 6th highest has been used as it underlies the NEPM PM10 goal and predictions of higher percentiles such as the maximum, are statistically less robust and can potentially be misleading.

To the extent possible, the monitoring sites have been selected to meet the requirements of AS/NZS 3580.1.1:2016 Methods for the sampling and analysis of ambient air – Guide to siting air monitoring equipment. A compliance assessment against the standard was undertaken and is included in the annual data review reports. The locations of the dust monitors are shown in Figure 2-2 (Farmers and Goodgame).

Dust concentrations upwind of the TEOM sites are measured using the Saddleback dust monitors.

3.2.3 Refinery Monitoring Program

One TEOM and one E-Sampler, targeting PM10 particles, are used to monitor dust impacts from activities undertaken at the Refinery, which will include the proposed mining and transport activities within the CBME. The locations of these dust monitors are shown in Figure 2-2 (4xNW, Hamilton and 5s). PM10 particles are monitored according to the NEPM standard and are reported in Worsley's AER. Dust monitoring at the Refinery is currently managed under a separate Air Quality and Dust Management Plan (Refinery). However, dust management practices within the CBME will be consistent with dust management practices undertaken at the BBM.

3.2.4 Investigation into Dust Impact on Vegetation

The ERMP (Strategen, 2005) includes the commitment by Worsley Alumina to investigate the effects of bauxite and other dust on native vegetation adjacent to haul roads. The effects have been determined over time by examining:

- The chemical reactivity of the bauxite dust;
- The impacts of various rates of dust deposition on growth and reproduction; and
- The characteristics of dust plumes from mining/transport activities (e.g. dispersal and deposition, size fractionation).

Remote sensing opportunities were also assessed as part of this study. A summary of investigations is provided in Table 3-3.

Table 3-3: Outline of completed environmental investigations

Study objective	Method	Date completed
To determine the effects of dust from mining/transport activities on native vegetation.	Investigate the effects of dust from mining/transport activities on native vegetation by examining the nature and extent of dust deposition and the responses of the vegetation over time.	September 2008
To manage the effects of dust from mining/transport activities on native vegetation.	If required, management measures to address any significant adverse impacts of dust from mining/transport activities on native vegetation will be developed and implemented.	September 2009
To monitor the effectiveness of dust management.	Examine the benefits of operating continuous photometric air samplers (PM_{10}) up and down-wind of the mine site, relative to the town site of Boddington. Develop an appropriate method.	September 2008

Outcome

Bennett Environmental Consulting Pty Ltd (2008) was contracted by Worsley Alumina to undertake an assessment of dust impact on vegetation along haul roads within the mining area, in proximity to the crushers. Haul routes with varying levels of traffic were selected for the study, and classified as highest, high, moderate or low impact.

Leaves from representative species within the area surveyed were collected for dust analysis. Where there was an obvious colour change due to dust on the leaf surface, this was recorded using a Munsell Soil Colour Chart. The leaves were examined by electron microscope to evaluate whether dust was entering the leaf stomata, and x-ray spectrum analysis was used to determine the element composition of the dust on the leaf surface.

In general, the study showed that the plants from the most used haul routes had the densest covering of dust on the leaves. In some plants analysed the dust entered the pores of some stomata, but typically it was not all leaves, or all stomata affected. Many plants have their stomata sunken below the leaf surface or protected by dense hairs, which tended to trap the dust or had numerous stomata so that only a small percentage had dust in the pores.

3.3 PERFORMANCE INDICATORS AND CORRECTIVE ACTIONS

3.3.1 Performance Indicators and Criteria

The effectiveness of this Dust Management Plan will be assessed against the following performance indicators and criteria:

- The number of complaints received from neighbours regarding dust from mining and transport activities and the Refinery open areas; and
- The contribution of Worsley Alumina's mining and transport activities to ambient dust levels. The operation does not cause 24-hour PM_{10} concentrations to exceed 50 $\mu g/m^3$ at any residence as demonstrated by ambient monitoring data.

As discussed in Section 2.1.1, a contributor to airborne particles in the region arises from smoke in the form of hazard reduction burning, the burning of cleared vegetation and wildfires external to the Project. These contributions to airborne particle levels are excluded from the objectives of this Dust Management Plan but need to be considered in the method for assessing the performance criteria.

3.3.2 Ambient Trigger Levels

The ambient trigger level for a response and corrective action is a 24-hour PM10 concentration in excess of 50 µg/m3 at any monitor.

Monitoring data is streamed on a live basis to Equis (data management software for environmental data). Triggers are set and alerts are generated each time an exceedance occurs. Any exceedances of the trigger levels (as specified within licence conditions) are investigated and where found to be associated with Worsley Alumina operations, are reported to the DWER in accordance with the requirements of the licence.

Experience with real-time ambient monitor data collection using telemetry in the Saddleback/Marradong regions to date, has demonstrated some reliability problems. These are addressed as soon as possible upon identification to maximise data collection.

3.3.3 Corrective Action and Reporting

Should the Worsley Alumina operation be identified as the cause of a trigger level exceedance, an event notification will be raised in Worsley Alumina's formal incident reporting and response system. The key steps involved in responding to an event notification are:

- Take immediate action (if appropriate) to minimise risk;
- Report the event to the Mining Operations Supervisor and Environmental Specialist;
- Investigate the event (with a focus on "root cause analysis");
- Implement corrective actions as required;
- Monitor, review and follow-up actions to completion;
- Review Risk management register and controls; and
- Attach documents as required by the site risk, event and notification system.

All exceedances will be reported to the DWER in accordance with the requirements of licence L5960/1983. A summary of all exceedances will be provided in Worsley Alumina's AER.

3.4 AUDIT AND REPORTING REQUIREMENTS

The Dust Management Plan will be audited and reviewed every three years and a performance assessment conducted every five years, in accordance with Condition 5 of MS719 and the Environmental Audit Schedule specification (00113088).

Worsley Alumina will report on its compliance with the provisions set out in this Dust Management Plan and with all requirements of MS719 in the AER, which is produced at the end of each fiscal year for the preceding twelve-month period. Worsley Alumina will submit the Annual Audit Compliance Report contained within the AER, to the Chief Executive Officer of the DWER no later than 30 September each year.

3.5 STAKEHOLDER ENGAGEMENT

This Dust Management Plan may be presented to the EMLG following the 3-yearly audit review to ensure that dust management techniques are kept up to date with community and government expectations and industry performance benchmarks.

3.5.1 Complaints Management

Environmental complaints are documented and investigated in accordance with the BBM Community Complaints Procedure (01029471) as described in Table 3-1.

3.6 PLAN REVIEW

This Dust Management Plan will be reviewed by Worsley Alumina on a three-yearly basis (or as necessary), to assess effectiveness, ongoing relevance and incorporate improved management strategies derived from assessment of monitoring programs and positive performance indicators and corrective actions.

The three-yearly review of this plan will consider:

- Monitoring program outcomes;
- Specialist advice and stakeholder consultation;
- Implementation and effectiveness of mitigation measures;
- Performance indicators and any corrective actions;
- Issues raised through the CLC;
- Significant changes, improvements or new technology;
- Changes to operational activities leading to changes in the risk; and
- Changes to relevant legislation, policy, guidelines, guidance material and industry practices.

This Plan has been prepared in accordance with the conditions and requirements set out in MS719 for the management of dust-related impacts. Therefore, any changes to the management measures described in the Plan must align with the requirements of MS719 (see Section 1.4). Additionally, the Audit Branch of the DWER must be notified of any changes to the Plan and the audit table for MS719 will be updated as appropriate (Environmental Audit Schedule Specification - 00113088).

4 DEFINITIONS, TERMS AND ABBREVIATIONS

Term	Description
AER	Annual Environmental Report
AS/NZS	Australian/New Zealand Standard
AS	Australian Standard
BBM	Boddington Bauxite Mine
BRDA	Bauxite Residue Disposal Area
CBME	Contingency Bauxite Mining Envelope
CLC	Community Liaison Committee
DBCA	Department of Biodiversity, Conservation and Attractions
DWER	Department of Water and Environmental Regulation
EMLG	Environmental Management Liaison Group
EPA	Environmental Protection Authority
ERMP	Environmental Review and Management Programme
HSEC	Health, Safety, Environment or Community
MS719	Ministerial Statement No. 719
Mtpa	Million tonnes per annum
NEPM	National Environmental Protection Measure
OBC	Overland Bauxite Conveyor
OLC	Marradong conveyor
PM10	all particles smaller than 10 µm in aerodynamic diameter
PM2.5	all particles smaller than 2.5 µm in aerodynamic diameter
the Refinery	Worsley Alumina Refinery
RLA	Refinery Lease Area
t	tonne
TEOM	Tapered Element Oscillating Microbalance
WA	Western Australia
Worsley Alumina	South32 Worsley Alumina Pty Ltd

5 REFERENCES

	Australian Environment Council/National Health and Medical Research Council (AEC/NHMRC), (1985). National Guidelines for Control of Emission of Air Pollutants from New Stationary Sources.
	Bennett, (2008). Impacts of Dust on Functioning of Leaves, July 2008.
	DEC, (2006). Compliance Monitoring – Guidelines for Proponents (Draft). Prepared by Environmental Management Division, Department of Environment, Government of Western Australia, May 2006.

	DEC, (2008). Draft - A guideline for the development and implementation of a dust management program. May 2008
	DEC, (2011). A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities. March 2011
	EAPL, (2004). Proposed Ambient Dust Monitoring Plan For Boddington Bauxite Mine. Confidential report prepared for Worsley Alumina Pty Ltd by Environmental Alliances Pty Ltd (EAPL), September 2004.
	Environmental Alliances, (2006). Worsley Alumina Refinery - Quality Plan for Ambient Air Monitoring Network. January 2006
	Environment Australia, (1998). Dust Control, Part of the Best Practice Environmental Management in Mining series. Department of Environment and Heritage (Commonwealth), September 1998.
	Environmental Technologies & Analytics (ETA), (2020a). Worsley Mine Expansion – Revised Proposal: Air Quality Assessment. Report prepared by ETA for South32 Worsley Alumina Pty Ltd.
	Environmental Technologies & Analytics (ETA), (2020b). Worsley Mine Expansion – Revised Proposal: Dust Control Benchmarking. Report prepared by ETA for South32 Worsley Alumina Pty Ltd.
	EPA, (2001). Towards an Environmental Protection Policy (EPP) for Ambient Air Quality in Western Australia. Environmental Protection Authority, Western Australia, March 2001.
	EPA, (2005). Bulletin 1209. Worsley Alumina - Efficiency and Growth Increase of Existing Operations to 4.4Mtpa Alumina Production. Report and Recommendations of the Environmental Protection Authority, Environmental Protection Authority, Western Australia, November 2005.
	EPA, (2009). Draft State Environmental (Ambient Air) Policy 2009. Environmental Protection Authority, Western Australia, June 2009
	NEPC, (2015). National Environment Protection Measure for Ambient Air Quality. National Environment Protection Council, December 2015.
	NSW Minerals Council, (2000). Particulate Matter and Mining. A NSW Minerals Council Technical Paper. New South Wales, July 2000.
	Standards Australia, (2016). AS/NZS 3580.1.1:2016 Methods for the sampling and analysis of ambient air – Guide to siting air monitoring equipment.
	Standards Australia, (2008). AS 3580.9.8—2008 Methods for sampling and analysis of ambient air Method 9.8: Determination of suspended particulate matter—PM10 continuous direct mass method using a tapered element oscillating microbalance analyser
	Strategen (2005). Worsley Alumina Pty Ltd Bauxite-Alumina Project Expansion Environmental Review and Management Program. Prepared by Strategen for Worsley Alumina Pty Ltd, May 2005.
	Strategen (2008). Audit Program - Ministerial Statements No. 719 and 751. Unpublished Report for Worsley Alumina Pty Ltd, Jan 2008
	South32 (2021). Worsley Mine Expansion Environmental Review Document. EPA Assessment #2216.
	Audit Program – Ministerial Statements No. 719 and 751. Prepared for Worsley Alumina Pty Ltd by Strategen. January 2008.
	South32 Environment Standard
00100923	Quality Records Procedure
01000891	Event and Hazard Reporting Procedure
01029471	BBM Community Complaints Procedure
01006874	Water Supply System Management – BBM Procedure
01028763	Dust Investigation – Standard Work Instruction

00100891	Event and Hazard Reporting Procedure
00112051	Workplace Dust Control Standard
00113088	Environmental Audit Schedule Specification
01003872	STA.009 Risk Management Standard
01016063	Environmental Dust Minimisation – BBM Standard
01017015	Saddleback Crushing Inspection Form
01017016	Secondary Plant Inspection Form

6 DOCUMENT CONTROL

Reviewer Circulation

Role	Name	Endorsed	Date
Environmental Supervisor	Craig Kimpton	✓	03.12.2021
Superintendent Execution – Operations Fixed Plant Crusher	Mark Darcy	✓	29.11.2021
Superintendent Execution – Mining	Kai Laver	✓	29.11.2021
Superintendent Execution – Mining Services	Carl Garrick	✓	02.12.2021

Approval Circulation

Role	Name	Approved	Date
HSERT Manager	Dale McAtee	✓	25.11.2021