Questdale Holdings

Dust Management Plan

Lot 2 and Lot 10 Rowley Road
Mandogalup

22 September 2021

56799/126,638 (Rev 3)

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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1. Introduction

Questdale Holdings Pty Ltd (proponent) (in association with Frankland Sand Supplies) is proposing to extend an existing sand quarry extraction operation on Lots 2 and 10 Rowley Road, Mandogalup (the site) and clear vegetation for bushfire risk management. The site consists of 43.67 ha within Lots 2 and 10.

The site is located approximately 33 km south of Perth and is enclosed within an area bounded by the Kwinana Freeway to the east, Anketell Road to the south, Mandogalup Road to the west and Rowley Road to the north (Figure 1.1).

This dust management plan (DMP) has been prepared to support planning approvals for the quarry extension.

1.1 Scope, objective and purpose

The scope of the DMP is to provide a framework for the management of dust. This DMP consists of the following:

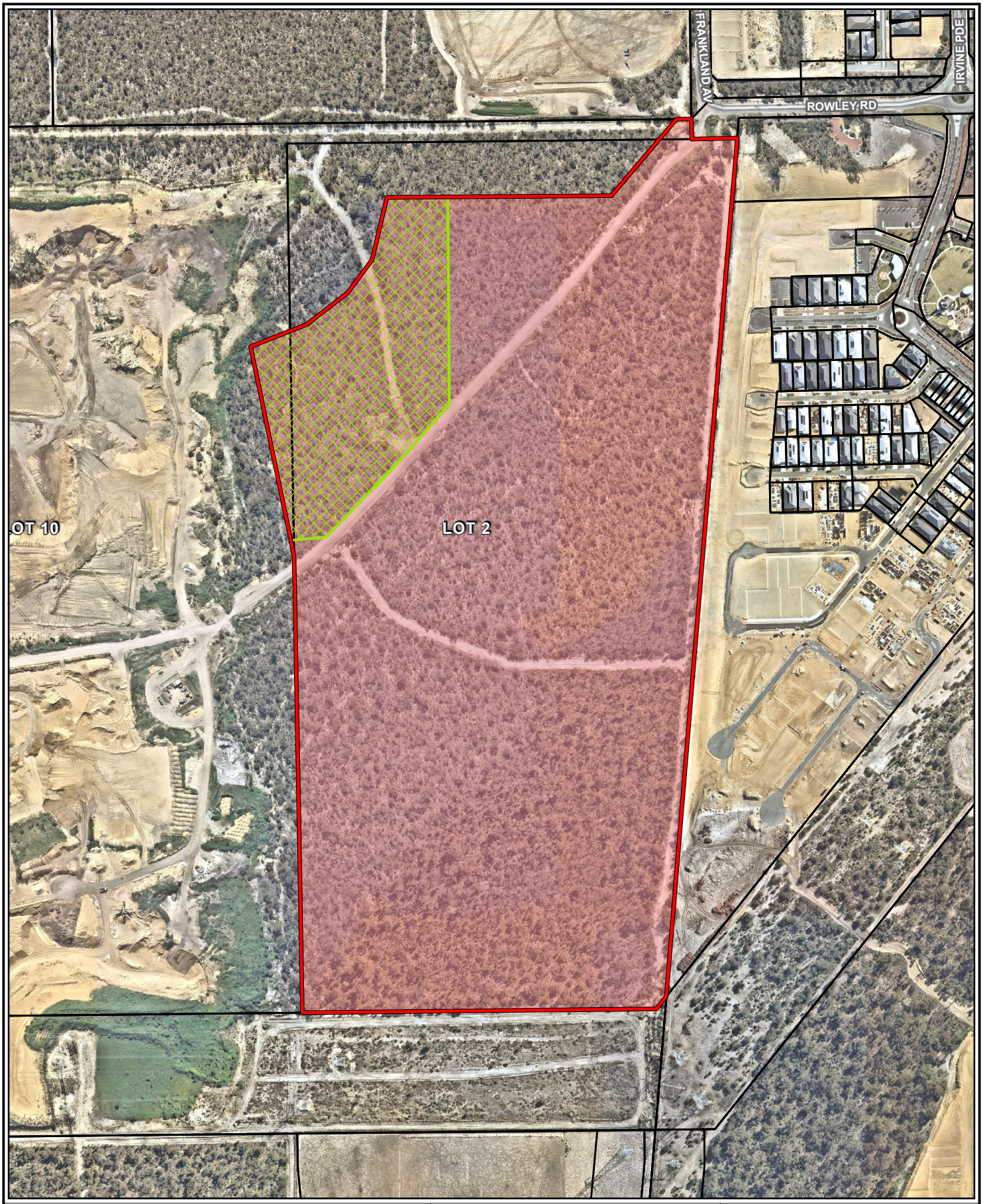
- introduction outlining project background, context and purpose of the DMP
- a description of the existing environmental setting, regulatory obligations, site characteristics and significant environmental aspects to be managed
- dust risk assessment
- details of the proposed dust management measures.

The purpose of the plan is to prevent dust-related impacts to surrounding residences and the environment from the clearing of vegetation, materials extraction, handling and storage, and vehicle movements.

1.2 Site Background

The site is located within the Swan Coastal Plain. The Swan Coastal Plain comprises five major geomorphologic systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf. The site is located within the Bassendean Dune system. The materials associated with this location are highly sought after by the building and construction industry.

In the *State Planning Policy 2.4 Basic Raw Materials*, Lot 10 was identified as an extraction area. Based on historical aerial photography, sand extraction activities commenced in Lot 10 between 1977 and 1979. By 1995, extraction activities were significantly progressed on Lot 10.



Legend:

- Proposal area
- Conservation area
- Clearing area
- Cadastral boundaries
- Roads (MRWA)

Scale 1:5,000 at A4 (0 50 100 metres)		**Lot 2 and 10 Rowley Road Mandogalup**
Coord. Sys. GDA 1994 MGA Zone 50		**SITE LAYOUT PLAN SHOWING CONSERVATION AREA**
Job No: 56799		
Client: Questdale Holdings Pty Ltd		**FIGURE 1.1**
Version: A	Date: 16-Sep-2021	strategen JBS&G
Drawn By: cthatcher	Checked By: ES	

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Image Reference: www.nearmap.com© - Imagery Date: 24 August 2021

2. Environmental setting

2.1 Existing land use

The site is located at Lots 2 and 10 Rowley Road, Mandogalup, and covers an area of approximately 44 ha.

The site contains a mixture of relatively undisturbed land, as well as areas which show signs of having been degraded through clearing for firebreaks, roads and other activities, as well as weed invasion, particularly along the western boundary adjacent to the area already cleared for sand extraction.

2.2 Surrounding land use

Surrounding land uses include:

- North: Frankland Park Bushland, then rural residential and residential development
- East: Apsley Estate (residential development) and Western Power Transmission Corridor
- South: Bushland and market garden
- West: existing sand quarry (Figure 1.1).

The nearest residential property is 50 m northeast of the site boundary (corner of Rowley Rd and Frankland Ave).

There are no Conservation Category Wetlands within 1 km of the site.

2.3 Climate

The Mandogalup locality experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The nearest Bureau of Meteorology weather station at Medina Research Centre (Station No. 009194) provides average monthly climate statistics for the Mandogalup locality (Figure 2.1).

Average annual rainfall recorded at Medina Research Centre since 1983 is 745.5 mm. Rainfall can occur at any time of year; however, the most rain occurs in winter in association with cold fronts from the southwest. Highest temperatures occur between January and February, with average monthly maximums ranging from 18°C in July to 31.5°C in February. Lowest temperatures occur in July and August, with average monthly minimums ranging from 8.2°C in July and August to 17.6°C in February.

The prevailing winds, as measured at a weather monitoring site to the north west of the current quarry operations, are described by the wind rose shown in Figure 2.2. The prevailing winds are from the south east; however, the strongest winds originate from the west.

2.4 Topography

The site varies in height from 41 mAHD in the northeast to approximately 30 mAHD within the vegetation to be retained on site (Figure 2.3). Similar topography extends to the north of the site, where the landform has been impacted by urban development.

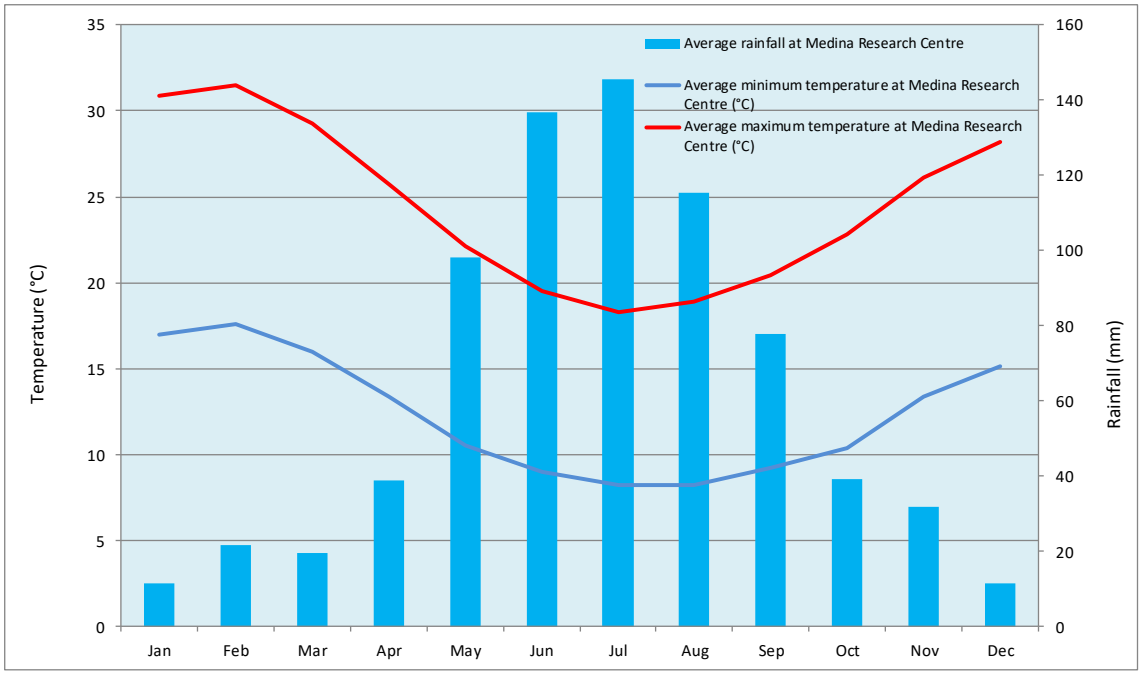


Figure 2.1: Mean monthly climatic data for Medina Research Centre (BOM 2019)

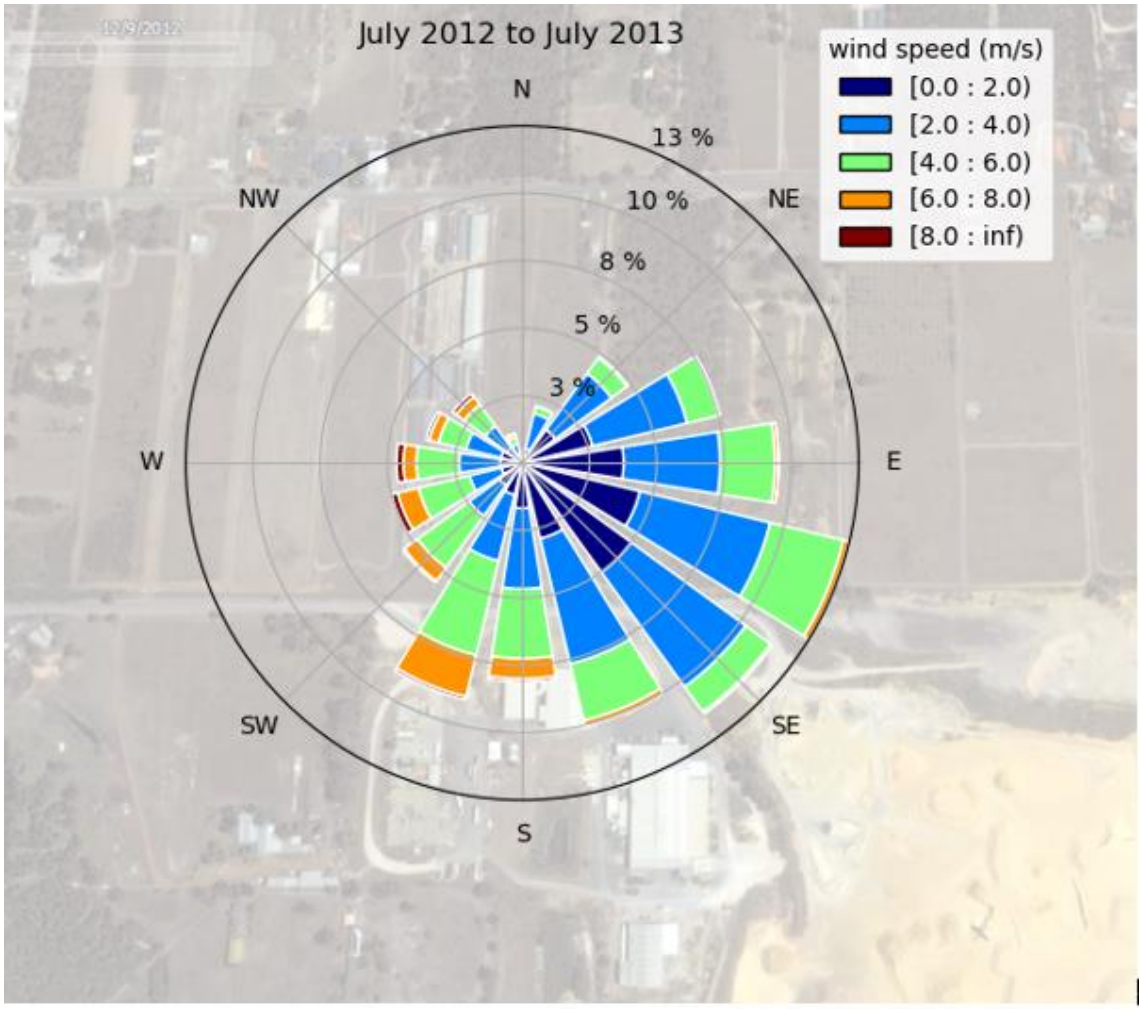
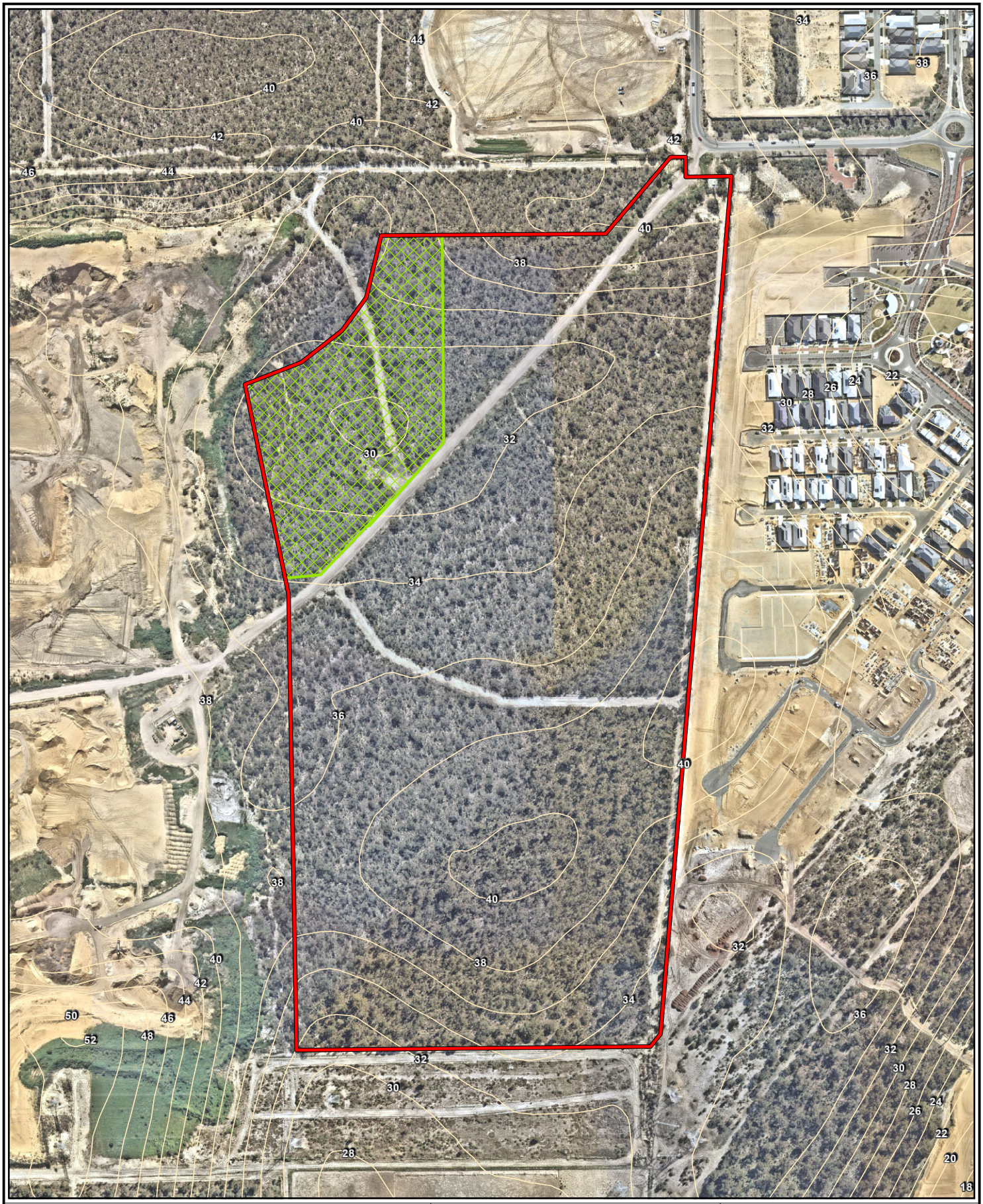


Figure 2.2: Annual wind rose for Qube Wattleup Road monitoring site



Legend:

- Proposal area
- Conservation area
- Topographic contours (mAHD)
- Local roads

Scale 1:5,000 at A4 (0 50 100 metres)		**Lot 2 and 10 Rowley Road Mandogalup**
Coord. Sys. GDA 1994 MGA Zone 50		**SITE TOPOGRAPHY**
Job No: 56799		
Client: Questdale Holdings Pty Ltd		**FIGURE 2.3**
Version: A	Date: 16-Sep-2021	strategen JBS&G
Drawn By: cthatcher	Checked By: ES	

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Image Reference: www.nearmap.com© - Imagery Date: 28 August 2021

2.5 Existing dust impacts

A dust assessment was conducted using 12 months of dust (PM_{10}) data[1] measured at a monitoring station located approximately 320 m north west of the existing sand quarry boundary (Figure 1.1).

The objective of the dust assessment was to predict the likelihood of dust crossing the boundary of the site. Due to the location of the monitoring station, it is possible that any airborne dust arising from the operational areas of the site could have impacted the monitoring station during winds from the south east.

The assessment methodology was based on the determination of whether impacts from the direction of the operational areas of the sand quarry site could be discerned at the monitoring station. Furthermore, the relationship between wind speed and dust measurements was examined to determine the potential for direct wind erosion of the exposed surface.

The assessment determined:

1. PM_{10} concentrations recorded during winds from the site arc were comparable to the concentration range recorded during winds from other directions.
2. No correlation between wind speed and measured dust concentration was evident; therefore, windblown dust is unlikely to result in dust crossing the site boundary.
3. Peaks during winds from the direction of the site coincided with light winds from the south east mainly around 7 am. This could be concurrent with vehicles arriving at the quarry at the start of the workday, on unsealed areas where fine particles are created by repeated trafficking resulting in airborne dust during calm conditions when dispersion is poor.

3. Regulatory framework and guidance

The site is zoned 'Rural' under the Metropolitan Regional Scheme, 'Rural A' under the City of Kwinana Town Planning Scheme No. 2 and is within the City's Development Contribution Plan No. 8. Under 'Rural A' zoning, extractive Industry use class is a discretionary land use which requires council approval.

There is an existing Extractive Industry Licence (held by Frankland Sand Supplies) associated with Lot 1 Rowley Road, Mandogalup. An application to extend the operation or an additional licence to cover Lot 2 will be required under the City of Kwinana Extractive Industries Local Law (as amended 2016).

Air quality in the Kwinana area is regulated by the *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* (the Kwinana EPP) and *Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations 1992* (the Kwinana EPP Regulations).

The Kwinana EPP defines three areas. The site is located within Area C, which is predominantly rural and residentially zoned land located beyond Areas A (heavy industry) and B (industry) within the City of Rockingham, Town of Kwinana and City of Cockburn.

The Kwinana EPP Regulations include air quality standards and limits for sulfur dioxide and total suspended particles (TSP). Because of the potential for dust emissions, the TSP standards and guidance are relevant for the site.

[1] Monitoring was conducted by the Wattleup Development Company (part of the Qube Property Group) at their Wattleup Road landholdings from 1 July 2012 to 25 July 2013. These data were provided in evidence for State Administrative Tribunal matter Wattleup Road Development Company Pty Ltd and Western Australian Planning Commission [2014] WASAT 159, File DR 362 of 2013.

The (then) Department of Environment and Conservation document*, A guideline for managing the impacts of dust and associated contaminates from land development sites, contaminated sites remediation and other related activities* is applicable to the dust management requirements of the site (DEC 2011).

The guideline provides guidance on the following:

- identification of dust sources, impacts and associated risks
- legislative framework surrounding dust management policy and requirements in WA
- dust management program design
- dust monitoring program design.

4. Proposed activities

4.1 Project phases

The residential area immediately to the east is being cooperatively developed by Qube Property Group and the owners of the quarry. To assist with managing potential dust (and noise) impacts on the residences located to the east, the quarry development will be staged as follows:

Stage 1

- A 100 m strip of vegetation will be cleared along the eastern boundary of the site in order to reduce the bushfire hazard to the adjacent residential development.
- Quarrying of sand will commence along the eastern boundary within the 100 m fire break to create a 1:3 batter within Lot 2.

Stage 2

- Quarrying will progress from the existing Lot 10 quarry, extending the quarry floor in an eastward direction through Lot 2 to the edge of the fire break. Extraction works will be below the existing ground surface level with the pit wall providing a barrier to the east. Active clearing will be limited to blocks of less than 10 ha with a vegetated buffer retained to the east of the pit.

Stage 3

- The final stage of quarrying will clear the remaining vegetation buffer and extract the sand through the 100 m fire buffer to the eastern boundary.

4.2 Operations

Sand extraction is carried out using front end loaders (3), a track dozer (1) and a mechanized screening machine (1). Excavated material is screened where required to remove organic and deleterious materials prior to loading. Transport consists of various rigid and semi-trailer trucks moving to and from the site on a consistent basis. Site access is at the north east corner via a stabilised compacted limestone road directly from Rowley Road with major distribution via the Kwinana Freeway. The sand extraction rate is predicted to be up to 195,000 tonnes per year with a quarry life of around 10 years.

5. Potential impacts

Quarrying and associated activities have the potential to result in airborne dust which could impact upon human health and amenity. Impacts to amenity from dust include:

- regular dust events over several weeks leading to a gradual build-up of dust on surfaces
- short period dust events of very high concentrations which cause a rapid build-up of dust on surfaces, or soiling, if dust deposition rates are high.

In both cases the visual amenity maybe impacted if the dust is visible to nearby residents.

Dust may impact upon the environment where surface deposition affects vegetation growth.

5.1 Parameters of interest

Dust arising from the quarrying operation will include Total Suspended Particulates (TSP) and PM_{10}.

- TSP are particles each having an equivalent aerodynamic diameter of up to nominal 50 micrometres (µm). The primary issue with TSP emissions that could arise from quarry

operations relates to impacts on amenity from a visible dust perspective and deposition onto surfaces.

- PM_{10} is particulate matter of 10 µm or less in diameter, which is the fine particle fraction of TSP. PM_{10} includes inhalable particles that are small enough to penetrate the thoracic region of the lungs, where they can have a direct physical (inflammatory) effect and/or be absorbed into the bloodstream. All people are continuously exposed to PM_{10} from naturally occurring and anthropogenic dust emissions in urban and industrial areas. Health impacts are related to the chemical composition of PM_{10}.

There are no areas of known soil or water contamination on site; therefore, the potential impacts have been assessed as uncontaminated dust with impacts to amenity being the primary risk.

5.2 Emissions sources

The potential dust generating sources and activities identified for the operation of the site are described in Table 5.1.

Table 5.1: Potential dust sources and dust-generating activities

Activity	Duration	Dust generation potential
Vehicle movements: • transporting sand • movement of plant and machinery around site	Ongoing throughout project duration	• Vehicle movements on paved and unpaved roads could mobilise fine particles in air • Vehicles can track sand out onto the public road
Clearing of vegetation	1 - 2 days periodically throughout project duration to prepare cells ready to extract sand	• Topsoil disturbance by machinery resulting in airborne particulate • Unvegetated soils exposed to wind erosion
Topsoil stripping	1 day following clearing phases	Physical handling of topsoil mobilising particulates in air
Topsoil stockpiling	Ongoing throughout project	Un-vegetated stockpiled soils exposed to potential wind erosion
Materials handling activities: • sand extraction • screening of sand • stockpiling of material • loading vehicles	Ongoing throughout project duration	Physical handling of sand may result in suspended particulates
Windblown dust	Ongoing throughout project duration	Wind action on exposed surfaces[2]

[2] The sand being extracted is coarse and, while it is possible for sand to be blown off-site, the potential for wind erosion directly causing dust from the site to cross the site boundary is considered low

5.3 Relevant air quality criteria

5.3.1 TSP

The Kwinana EPP Regulations include air quality standards and limits for TSP relevant for the site located in Area C of the Kwinana EPP, as presented in Table 5.2. The Kwinana EPP Regulations define TSP as inert particles having an equivalent aerodynamic diameter of less than 50 micrometres (50 µm), referred to as PM_{50}.

Table 5.2: Ambient air quality standards and limits for PM_{50}

Kwinana EPP Regulations Area	Standard (µg/m³)	Limit (µg/m³)	Averaging period
Policy Area	-	1000	15 minutes
Area C	90(Note)	150	24 hours

Note: The Area C standard has been adopted into the draft DWER Air Emissions Guideline released for comment in 2019 but not yet finalised

5.3.2 PM_{10}

The *National Environmental Protection (Ambient Air Quality) Measure (NEPM) 2015* (NEPC 2015) provides air quality standards applicable to urban airsheds including criteria for particles as PM_{10}. The NEPM sets a standard for PM_{10} at 50 µg/m³ on a 24-hr averaging period.

6. Dust risk assessment

A site risk assessment/classification was conducted in accordance with the site risk assessment framework provided in the DEC (2011) guidance to determine the level of dust management and monitoring required for the site for each of the stages of development (Section 4.1). The site classification chart for uncontaminated dust was utilised.

The risk assessment classification process assumes that exposed surfaces in the disturbed area are inherently unstable and subject to wind erosion and prescribes mitigation measures accordingly. The sand being extracted is coarse, and while it is possible for sand to be blown off-site, the potential for wind erosion directly causing dust from the site to cross the site boundary is considered low. The topsoil material is expected to be less coarse with a higher potential for windblown dust; therefore, dust mitigation measures will be implemented to manage this aspect.

6.1 Site classification – Stage 1

Stage 1 concerns the establishment of a 100 m fire buffer and a 1:3 batter at the eastern boundary of Lot 2. The site classification assessment for Stage 1, including commentary on how the scores were derived, is presented below:

Part A: Nature of site – Stage 1

Item	Commentary	Score
Nuisance potential of soil when disturbed	Clearing and extraction activities have the potential to produce airborne dust resulting in impacts to amenity due to visible and deposited dust. The nuisance potential due to clearing is limited due the short duration of the activity. The nuisance potential of the underlying material to be extracted is low due relatively coarse particle size distribution limiting the likelihood of the material becoming entrained in the overland airflows.	2
Topography and protection provided by undisturbed vegetation	The topography is not elevated therefore not considered wind prone, in addition the adjacent bushland will provide some screening to the western edge of the firebreak area.	12
Area of site disturbed by the works	The fire buffer area to be cleared for stage 1 is between 5 and 10 ha.	6
Type of work being done	Bulk extraction and deep excavation will be carried out.	9
Total part A score		**29**

Part B: Proximity of site to other land uses – Stage 1

Item	Commentary	Score
Distance of other land uses from site	Stage 1 clearing and sand extraction will be less than 100 m from residences therefore the maximum score is applicable for this item.	18
Effects of prevailing wind direction (at time of construction) on other land uses	The dust assessment determined the prevailing wind direction had little influence on measured dust levels. However, should dust become airborne above the surface then winds originating from the W/SW could carry dust from the Stage 1 works to residences to the E or NE.	9
Total Part B score		**27**

Site classification score (A x B) = 783

The preliminary risk assessment results in a site classification score of 3 – considered medium risk.

6.2 Site classification – Stage 2

Stage 2 concerns the extension of the existing quarry in an eastwards direction working from the quarry floor and retaining a vegetative buffer to the east of the active extraction area. The site classification assessment for Stage 2, including commentary on how the scores were derived, is presented below:

Part A: Nature of site - Stage 2

Item	Comment	Score
Nuisance potential of soil when disturbed	Clearing and extraction activities have the potential to produce airborne dust resulting in impacts to amenity due to visible and deposited dust. The nuisance potential due to clearing is limited due the short duration of the activity. The nuisance potential of the underlying material to be extracted is low due to relatively coarse particle size distribution limiting the likelihood of the material becoming entrained and carried across the boundary in the overland airflows	2
Topography and protection provided by undisturbed vegetation	Extraction will be carried out from the bottom of the existing pit extending eastwards. Therefore, the active works will be below the level of the surface ground to the east effectively providing a barrier that could assist in containing any dust within the pit. Furthermore, the undisturbed belt of vegetation to be retained as long as practicable will provide physical screening benefit to the extraction operations through physical interception of airborne dust entrained in surface air and increasing wind turbulence above thus encouraging dust deposition.	1
Area of site disturbed by the works	The quarry will be developed in <10 ha blocks. Active clearing operations with the potential to cause dust emissions will be limited to these blocks.	6
Type of work being done	Bulk extraction and deep excavation.	9
Total part A score		**18**

Part B: Proximity of site to other land uses – Stage 2

Item	Commentary	Score
Distance of other land uses from site	The staged approach to the quarrying (described in Section 4.1) means that ongoing clearing and extraction works will be >100 m from residences.	12
Effects of prevailing wind direction (at time of construction) on other land uses	The dust assessment determined the prevailing wind direction had little influence on measured dust levels. However, should dust become airborne then winds originating from the W/SW could carry dust from the Stage 2 works to residences to the E or NE.	9
Total Part B score		**21**

Site classification score (A x B) = 378

The preliminary risk assessment results in a site classification score of 2 – considered low risk.

6.3 Site classification – Stage 3

Stage 3 includes the removal of the final vegetation to the east of the pit and extraction of the sand through to the eastern boundary. The site classification assessment for Stage 3, including commentary on how the scores were derived, is presented below:

Part A: Nature of site - Stage 3

Item	Comment	Score
Nuisance potential of soil when disturbed	Clearing and extraction activities have the potential to produce airborne dust resulting in impacts to amenity due to visible and deposited dust. The nuisance potential due to clearing is limited due the short duration of the activity. The nuisance potential of the underlying material to be extracted is low due to relatively coarse particle size distribution limiting the likelihood of the material becoming entrained in the overland airflows.	2
Topography and protection provided by undisturbed vegetation	During Stage 3 the remaining vegetation buffer will be removed and as completion nears there will be no differential in heights between the pit and the adjacent surface. The Stage 3 area is considered exposed and wind prone.	18
Area of site disturbed by the works	The quarry will be developed in <10 ha blocks. Active clearing operations with the potential to cause dust emissions will be limited to these blocks.	6
Type of work being done	Bulk extraction and deep excavation.	9
Total part A score		35

Part B: Proximity of site to other land uses – Stage 3

Item	Commentary	Score
Distance of other land uses from site	Final clearing of vegetation will be along the western edge of the fire buffer. This will be greater than 100 m from the boundary as the fire buffer will be already cleared, however extraction of the final materials will be within the fire buffer and therefore has potential to be < 100 m from the residences to the east.	18
Effects of prevailing wind direction (at time of construction) on other land uses	The dust assessment determined the prevailing wind direction had little influence on measured dust levels. However, should dust become airborne above the surface of the ground winds originating from the W/SW could carry dust from the Stage 3 works to residences to the E or NE.	9
Total Part B score		27

Site classification score (A x B) = 945

The preliminary risk assessment results in a site classification score of 4 – considered high risk.

7. Dust management controls

The following control measures will be implemented at the site as part of standard site operations to prevent dust generation and provide contingency arrangements should significant dust emissions arise. A summary of the controls applied to each stage of quarrying is presented below.

7.1 Project phasing

The quarrying will be staged so that the first stage of vegetation clearing and sand extraction will occur in a 100 m strip on the eastern boundary of the site to create a fire buffer and batter. The second stage of the project will be the bulk extraction of sand progressively expanding the existing quarry eastwards while retaining a vegetation buffer to the east. Clearing and extraction will occur progressively to limit the exposed ground at surface level to <10 ha blocks to minimise potential dust generation.

7.2 Clearing of vegetation and stripping topsoil

Clearing of vegetation and handling of the topsoil, to occur throughout the three stages, has been identified as the highest risk for dust generation. Furthermore, during Stage 1 and Stage 3, clearing activities will occur in close proximity to the residential development to the east (Aspley Estate).

The following measures, including stage-specific measures will be implemented to mitigate dust emissions:

- clearing of vegetation during dry and adverse wind conditions will be avoided[3]
- clearing will be avoided during westerly or south westerly winds above 5 m/s as predicted by the BOM forecast
- water suppression will be readily available during clearing and topsoil stripping as well as for use on newly cleared areas
- surface stabilisation will be commenced following clearing, within 48 hours for Stage 1 and Stage 3, to minimise the availability of exposed surface area for wind erosion
- surface stabilisation of the cleared topsoil and batter within the fire break will be reapplied on an annual basis
- wind fencing (nominal 50% permeability and at least 2 m high) will be erected at the eastern boundary and north-eastern corner (~1 km in length) prior to clearing and retained for the duration of Stage 1 activities until the fire break surface is stabilised
- wind fencing (nominal 50% permeability and at least 2 m high) will be kept on-site for installation on the eastern (and northern as required) margin of the active work area during Stage 2 should the vegetation clearing be found to generate dust and require further controls.
- prior to clearing associated with Stage 3 of the project, a wind fence (nominal 50% permeability and at least 2 m high) will be erected on the eastern boundary and north-eastern corner of the site and retained until the surface is stabilised
- topsoil handling will be as prescribed for materials handling below
- topsoil stockpiles will be stabilised by spreading of mulch (from cleared vegetation where practicable) over the surface.

7.3 Operation of vehicles

Vehicle movements across the site may disturb soils and generate dust during all project stages. The following measures will be adopted during all operational stages to prevent excessive dust generation:

- unnecessary vehicle movements within the site will be avoided as far as reasonably practicable
- vehicles will adhere to speed restrictions within the site (e.g. 20 km/h) – the appropriate speed limit will be subject to the determination of the Site Manager based on the activities being undertaken, location and site conditions at the time
- vehicles will keep to designated access roads as far as reasonably practicable
- vehicles deviating from designated access route will do so only as required for specific work activities and under appropriate permissions
- access roads and haul roads will be constructed using suitable road base (local Tamala Limestone) and dust stabilising materials applied as required[4]
- public roadways used for access will be kept clear of deposited material tracked from the site by vehicles; dust from deposited material will be mitigated by wetting down and the material removed as soon as practicable.

[3] Recognising the increased risk of spread due to clearing during wetter months, the Environmental Management Plan will implement appropriate *Phytophthora cinnamomi* management measures. .

[4] Lignosulfonate based dust stabilisers are proven technology for stabilisation of haul roads

7.4 Pre-wetting of work areas and haul roads

The following pre-wetting procedures of work areas and haul roads will be undertaken throughout all stages to prevent excessive dust generation:

- water suppression equipment will be available close to the site entrance to enable pre-wetting of the site entrance, access roads and areas where vehicle movements are anticipated (i.e. prior to the start of the working day and arrival of site personnel), pre-wetting requirements to be determined on site by the Site Manager
- water suppression will be available in operational areas to provide contingency in the event of excessive dust generation.

7.5 Materials handling (including topsoil)

Materials handling operations during all stages will be conducted using good work practices to mitigate dust generation, including:

- the height that material is dumped from excavator / loader buckets will be minimised to avoid dust generation
- topsoil will be wet down prior to removal
- if the sand is dry and readily producing dust when being worked, it will be wet down periodically to keep it damp, and water for dust suppression will be directly applied to the area of active excavation
- wind fencing (nominal 50% permeability and at least 2 m high) will be available for installation should operational activities generate significant airborne dust and require further control.

7.6 Stabilisation

No rehabilitation of the quarried areas is proposed as the site is to be utilised for urban or industrial land uses, consistent with the surrounding land uses. The site will be stabilised using mulch or dust suppressant surface coverings post mining to minimise any wind-blown dust generation.

7.7 Administrative controls

The following administrative controls are to be implemented:

- site personnel and contractors will be trained at induction; training will include mechanisms of the generation of dust emissions, the importance of and responsibility of individuals to implement mitigation measures and reporting of visible dust emissions
- site personnel and contractors will be required to record observations of visible dust emissions that appear to cross the boundary of the site, including date, time, location and extent of the visible plume
- advisory notices will be distributed to adjoining landowners prior to commencement of Stage 3.
- a complaints management system will be implemented (Section 10).
- a notice will be erected at the site entrance providing contact details of the person that can be contacted regarding the mine activities (e.g. Site Manager).

8. Dust monitoring

8.1 Visual monitoring

Visual assessments of fugitive dust emissions will be conducted by operational personnel during working hours throughout all project stages. A 'dust event' is defined as the occurrence of visible fugitive dust from a source or activity at the site that exits a boundary of the site for a duration of greater than one (1) minute.

Upon reporting of an observed 'dust event', the following actions will be implemented:

- the site operational personnel will review the working methodology of the dust-generating activity and ensure that the appropriate measures listed in the DMP have been implemented
- if the dust event continues following implementation of the above measures, the activity will be controlled, and work will not recommence until the dust event is under control.

8.2 Dust monitoring

During Stage 1 and Stage 3, continuous (instrumental) dust monitoring will be carried out at a location to the east of the active work areas to assist proactive dust management.

The air quality monitoring program will utilise real-time nephelometer dust monitoring instruments equipped with sensors to monitor wind speed and direction. The objective of the monitoring will be to verify implemented dust management measures are effective at mitigating off-site dust impacts The PM_{10} fraction was selected for the monitoring program since this can be readily monitored in near-real time, is relevant to human health and has criteria to assess against (NEPM). TSP levels can be estimated on the conservative basis that PM_{10} constitutes 60% of TSP.[5]

Two dust monitoring instruments will be situated along the eastern boundary. One instrument will be situated at the north-east corner of the development area to monitor dust entrained in the winds from the south-west with potential to cross Rowley Road (final location to be confirmed following site assessment).

The second monitor will be located on the boundary adjacent to the residences to the east. As far as practicable, as works migrate along the north south axis the second instrument will be relocated to remain between the active work cells and the residential receptors to the east.

Instrumental dust monitoring is not proposed during Stage 2 when a vegetation buffer between the active work area and the boundary will be in place. However, should visual monitoring detect dust crossing the boundary and/or complaints of dust impacts from nearby residences be received boundary monitoring will be in implemented to inform operational dust management controls.

8.2.1 On-site performance criteria

Performance criteria (trigger levels) will be set to inform site personnel should elevated dust be detected to the east of the activities during Stages 1 and 3.

The following preliminary trigger levels (Table 8.1) will be applied to the monitoring. The purpose of the trigger levels is to inform the risk of dust emission events that could adversely impact on nearby sensitive receptors so controls can be adjusted in real-time to significantly reduce the risk of off-site impacts. Wind data will be considered in conjunction with the particulate data. The trigger levels will be reviewed and refined once the monitoring program is implemented to ensure effectiveness at informing site management to adjust dust controls.

[5] The DWER LiDAR study reported that 60-100% of the TSP at the Mandogalup Rd and Norkett stations (closest to the sand quarry) was PM_{10} and 40-100% for the Central station located slightly further away from the sand quarry. The proportion of PM_{10} in TSP decreases to 40-75% further away at Anketell Rd. A value of 60% was considered a reasonably conservative value for estimation of TSP from PM_{10} monitoring proposed for the site.

Table 8.1: Preliminary trigger levels

Alarm type	PM_{10} Trigger value	Trigger level rational	Management response.
15 minute	600 µg/m^3	Kwinana EP nuisance TSP criteria for any location within policy area is 1000 µg/m^3 (thus applicable to boundary location), 600 µg/m^3 was selected based on assumption that PM_{10} makes up 60% or more of TSP that may cross the boundary thus providing a conservative trigger criteria	SMS alarm to Leading Hand. Leading Hand to immediately evaluate conditions and implement contingency measures
24 hour	75 µg/m^3	1.5 x the 50 µg/m^3 NEPM criteria which is applicable at a population receptor site therefore 1.5 times the criteria for a boundary monitor is appropriate	SMS alarm to Leading Hand and Site Manager. Dust controls for the site to be re-evaluated and upgraded as required to prevent a recurrence

9. Roles and responsibilities

Roles and responsibilities with respect to management of fugitive dust emissions are outlined in Table 9.1 below:

Table 9.1: Site roles and responsibilities

Role	Responsibilities
All personnel	Monitor (visual) and report instances of fugitive dust
Site Manager	Develop and allocate resources to provide for a level of risk of fugitive dust that is as low as reasonably practicable. Manage operations to maintain vegetation buffer between clearing/extraction for as long as practicable. Ensure clearing is not scheduled to be conducted during unfavourable conditions Review dust alarm trigger values during stage 1 and stage 3 and ensure contingency measures applied are effective.
Leading Hand	Incorporate appropriate controls into planning and modulation of operations, including guidance and coaching of personnel and allocation of water cart routes. Intervene in and modify/stop active operations in response to reports of dust crossing the site boundary. Receive dust alarms during medium risk stages and apply contingency measures when unfavourable impacts are detected. Investigate complaints as required.

10. Complaints management

A complaints management system will be in place which will as a minimum record:

- the number and details of complaints received concerning dust impacts
- any action taken in response to the complaints to reduce or eliminate the risk of future events

11. Contingency measures

Actions to be taken in the event that complaints of dust impacts at off-site receptors are received are detailed below.

Should complaints of dust being observed crossing the boundary be received in the absence of triggers being exceeded at boundary, then the monitoring data will be interrogated to determine the recorded dust levels at the time. The 15 minute trigger value will be evaluated to determine if refinement is necessary to alert operations earlier to the need for implementation of increase dust controls prior to impacts being experienced off-site. Should it be confirmed that impacts have been experienced offsite but elevated dust levels have not been detected by the monitors then the

monitoring locations (and wind directions) will be reviewed to ensure positioning is sufficient to capture potential dust plumes crossing the boundary towards receptors. .

The boundary monitoring data from any day when a complaint is received will be reviewed for compliance against the 24 hour PM_{10} NEPM criteria. Should this analysis not reveal elevated values then a change in performance monitoring to the TSP fraction will be considered, to better understand risk from visible dust and impacts on amenity (if any). TSP data from the boundary could then be evaluated against the Kwinana EPP Area C criteria (Table 5.2) to determine impacts at the boundary location and inform dust management controls. Furthermore, the positioning of the monitors and any installed wind fencing will be evaluated to ensure applicable locations are being used for performance monitoring and dust mitigation.

11. Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen-JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen-JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen-JBS&G has also not attempted to determine whether any material matter has been omitted from the data. Strategen-JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen-JBS&G. The making of any assumption does not imply that Strategen-JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen-JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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12. References

Department of Environment and Conservation (2011). *A guideline for managing the impacts of dust and associated contaminates from land development sites, contaminated sites remediation and other related activities* Retrieved from https://www.der.wa.gov.au/images/documents/your-environment/air/publications/Guideline_for_managing_impacts_of_dust.pdf (Accessed October 2020)

National Environmental Protection Council (NEPC) (2015). National Environmental Protection (Ambient Air Quality) Measure. Accessed from https://www.legislation.gov.au/Details/F2016C00215

Appendix A Dust management controls for each phase

Table A.1: Stage 1 dust sources and controls

Stage 1 description	Establishment of a 100 m fire buffer and a 1:3 batter at the eastern boundary of Lot 2
Minimum distance to receptors	<100 m
Risk class (prior to controls)	Level 3 Medium
Monitoring	Visual monitoring and optical real time monitoring (e.g., nephelometer) at two location on the eastern boundary between active work area and receptors to the east/north east
Source/activity	Mitigation measure
Clearing of vegetation and stripping of topsoil	avoidance of clearing of vegetation during dry and adverse wind conditions (westerly or south westerly winds above 5 m/s as predicted by the BOM forecast) water suppression will be readily available during clearing as well as for use on newly cleared area wind fencing (50% permeability or less and at least 2 m high) will be erected at the eastern boundary and north-eastern corner (~ 1km in length) prior to clearing and retained for the duration of Stage 1 activities until the fire break surface is stabilised
Topsoil handling	topsoil will be wet down prior to removal the height that material is dumped from excavator / loader buckets will be minimised to avoid dust generation topsoil stockpiles will be stabilised by spreading of mulch (from cleared vegetation where practicable) over the surface
Exposed surfaces	surface stabilization will be commenced within 48 hours following clearing and stripping surface stabilisation of the cleared topsoil and batter within the fire break will be reapplied on an annual basis
Operation of vehicles	water suppression equipment will be available close to the site entrance to enable pre-wetting of the site entrance, access roads and areas where vehicle movements are anticipated, pre-wetting requirements to be determined on site by the Site Manager unnecessary vehicle movements within the site will be avoided as far as reasonably practicable vehicles will adhere to speed restrictions within the site (e.g. 20 km/h) – the appropriate speed limit will be subject to the determination of the Site Manager based on the activities being undertaken, location and site conditions at the time vehicles deviating from designated access route will do so only as required for specific work activities and under appropriate permissions public roadways used for access will be kept clear of deposited material tracked from the site by vehicles; dust from deposited material will be mitigated by wetting down and the material removed as soon as practicable

Table A.2: Stage 2 dust sources and controls

Stage 2 description	Extension of the existing quarry in an eastwards direction working from the quarry floor and retaining a vegetative buffer to the east of the active extraction area
Minimum distance to receptors	>100 m
Risk class (prior to controls)	Level 2 Low
Monitoring	Visual monitoring
Source/activity	Mitigation measure
	• avoidance of clearing of vegetation during dry and adverse wind conditions (westerly or south westerly winds above 5 m/s as predicted by the BOM forecast) • water suppression will be readily available during clearing as well as for use on newly cleared areas • surface stabilization will be commenced within 48 hours following clearing • wind fencing (50% permeability or less and at least 2 m high) will be kept on-site for installation during Stage 2 on the eastern (and northern as required) margin of the active work area should the vegetation clearing be found to generate dust and require further controls
Topsoil handling	• topsoil will be wet down prior to removal • the height that material is dumped from excavator / loader buckets will be minimised to avoid dust generation • topsoil stockpiles will be stabilised by spreading of mulch (from cleared vegetation where practicable) over the surface

Exposed surfaces	• surface stabilisation is to be applied to the disturbed area of each section of the site upon completion of the works in that section. • the site will be stabilised using mulch or dust suppressant surface coverings post mining to minimise any wind-blown dust generation.
Operation of vehicles	• access and haul roads will be constructed using suitable road base and dust stabilisation be applied as required • water suppression equipment will be available close to the site entrance to enable pre-wetting of the site entrance, access roads and areas where vehicle movements are anticipated, pre-wetting requirements to be determined on site by the Site Manager • unnecessary vehicle movements within the site will be avoided as far as reasonably practicable • vehicles will adhere to speed restrictions within the site (e.g. 20 km/h) – the appropriate speed limit will be subject to the determination of the Site Manager based on the activities being undertaken, location and site conditions at the time • vehicles will keep to designated access roads as far as reasonably practicable • vehicles deviating from designated access route will do so only as required for specific work activities and under appropriate permissions • public roadways used for access will be kept clear of deposited material tracked from the site by vehicles; dust from deposited material will be mitigated by wetting down and the material removed as soon as practicable
Excavation and materials handling	• the height that material is dumped from excavator / loader buckets will be minimised to avoid dust generation • water suppression will be available in operational areas to provide contingency in the event of excessive dust generation • wind fencing (50% permeability or less and at least 2 m high) will be available for installation on the eastern (and northern as required) margin of the active work area should operational activities generate significant airborne dust and require further control.

Table A.3: Stage 3 dust sources and controls

Stage 3 description	The final stage of quarrying will clear the remaining vegetation buffer and extract the sand through the 100 m fire buffer to the eastern boundary
Minimum distance to receptors	<100 m
Risk class (prior to controls)	Level 4 High
Monitoring	Visual monitoring and real time monitoring (e.g., nephelometer) at the eastern boundary
Source/activity	Mitigation measure
	• avoidance of clearing of vegetation during dry and adverse wind conditions (westerly or south westerly winds above 5 m/s as predicted by the BOM forecast) • water suppression will be readily available during clearing as well as for use on newly cleared areas • surface stabilization will be commenced within 48 hours following clearing • a wind fence (50% permeability or less and at least 2 m high) will be erected on the eastern boundary and the north eastern corner of the site and retained until the surface is stabilised
Topsoil handling	• topsoil will be wet down prior to removal • the height that material is dumped from excavator / loader buckets will be minimised to avoid dust generation • topsoil stockpiles will be stabilised by spreading of mulch (from cleared vegetation where practicable) over the surface
Exposed surfaces	• surface stabilization will be commenced within 48 hours following clearing and stripping to minimise the exposed surface area • surface stabilisation is to be applied to the disturbed area of each section of the site upon completion of the works in that section. • the site will be stabilised using mulch or dust suppressant surface coverings post mining to minimise any wind-blown dust generation

Operation of vehicles	• water suppression equipment will be available close to the site entrance to enable pre-wetting of the site entrance, access roads and areas where vehicle movements are anticipated (i.e., prior to the start of the working day and arrival of site personnel), pre-wetting requirements to be determined on site by the Site Manager • unnecessary vehicle movements within the site will be avoided as far as reasonably practicable • vehicles will adhere to speed restrictions within the site (e.g., 20 km/h) – the appropriate speed limit will be subject to the determination of the Site Manager based on the activities being undertaken, location and site conditions at the time • vehicles will keep to designated access roads as far as reasonably practicable • vehicles deviating from designated access route will do so only as required for specific work activities and under appropriate permissions • public roadways used for access will be kept clear of deposited material tracked from the site by vehicles; dust from deposited material will be mitigated by wetting down and the material removed as soon as practicable
Excavation and materials handling	• the height that material is dumped from excavator / loader buckets will be minimised to avoid dust generation • water suppression will be available in operational areas to provide contingency in the event of excessive dust generation • wind fencing (50% permeability or less and at least 2 m high) will be available for installation along the eastern edge of the active work area should operational activities generate significant airborne dust and require further control.
Administrative controls	• Advisory notices shall be issued to adjoining land occupiers at least 48 hours before site works commence.

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