Questdale Holdings Pty Ltd

Environmental Management Plan
Lots 2 and 10 Rowley Road, Mandogalup
Assessment Number 2197

22 September 2021

56799/132,016 (Rev 2)

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

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Declaration of accuracy

I declare that to the best of my knowledge, all the information contained in, or accompanying this document is complete, current and correct. I am duly authorised to sign this declaration on behalf of the proponent/approval holder. I am aware that:

1. Giving false or misleading information is a serious offence under section 137.1 of the Criminal Code Act 1995 (Cth)
2. Section 137.2 of the Criminal Code Act 1995 (Cth) makes it an offence for a person to produce a document to another person in compliance or purported compliance with a law of the Commonwealth where the person knows that the document is false or misleading;
3. Section 490 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading; and
4. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth) (EPBC Regulations) where the person knows the information or document is false or misleading.

Signed

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Full name (please print)

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Organisation (please print)

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Date

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1. Introduction

1.1 Project background

Questdale Holdings Pty Ltd (in association with Frankland Sand Supplies) propose to extend the operation of an existing sand quarry at Lots 2 and 10 Rowley Road, Mandogalup and clear approximately 26.2 ha of native vegetation (the Proposal Area; Figure 1.1). The Proposal area is located approximately 33 km south of the Perth CBD within the City of Kwinana (CoK), and is bounded by Rowley Road to the north, the existing sand quarry to the west, a Western Power powerline corridor to the south, and residential development to the east.

At the federal level, the Proposal will result in impacts to Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), including:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) - Endangered
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable
- Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC) – Endangered.

At the state level, four preliminary key environmental factors relevant to the Proposal have been identified, which are:

- Flora and vegetation
- Terrestrial fauna
- Air quality
- Social surroundings.

The Proposal was initially referred to the then Commonwealth Department of the Environment and Energy (DoEE, now Department of Agriculture, Water and the Environment [DAWE]) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 6 April 2018. The DoEE advised on 19 June 2018 that the Proposal was determined to be a Controlled Action under the EPBC Act (EPBC 2018/8182).

The Proposal was referred to the Environmental Protection Authority (EPA) under section 38 of the *Environmental Protection 1986* (EP Act) on 7 December 2018. The EPA advised on 28 February 2019 that the level of assessment for the Proposal was set as a Public Environmental Review (PER) with a public consultation period of four weeks.

Given the proposal is determined to be a controlled action, the proposal is being assessed under the Bilateral Agreement between the Commonwealth of Australia and the State of Western Australia made under section 45 of the EPBC Act.

The Environmental Scoping Document (ESD) was prepared by the proponent and the finalised ESD was issued on 10 December 2019. The Environmental Review Document (ERD) is currently being prepared.

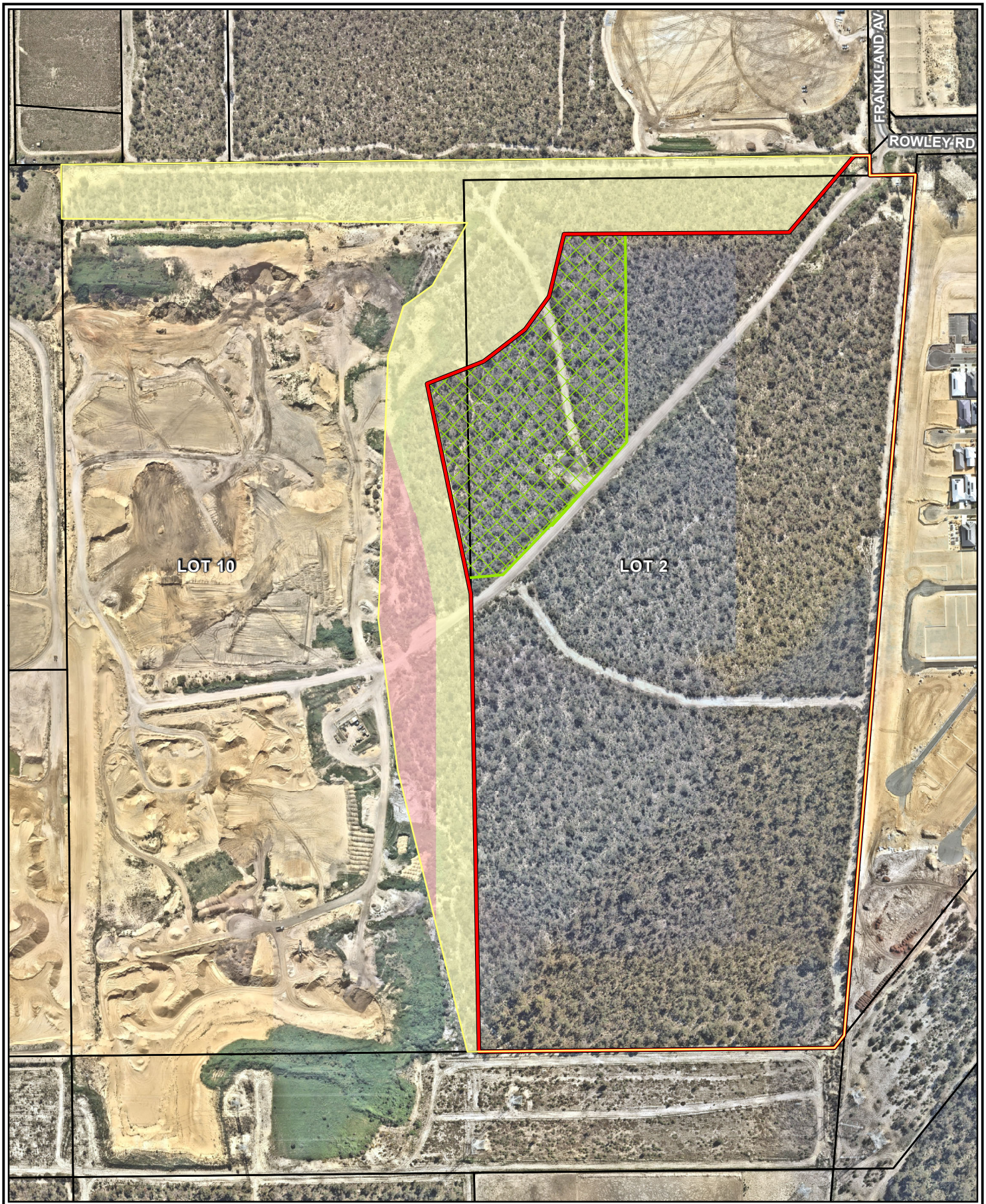
1.2 Purpose and scope

This Environmental Management Plan (EMP) has been prepared in support of the Proposal's assessment under the EP Act and EPBC Act, in accordance with the DAWEs *Environmental Management Plan Guidelines 2014* and EPAs *Instructions on how to prepare* Environmental Protection Act 1986 *Part IV Environmental Management Plans* 2020*.* Also supporting the Proposal's assessment under the EP Act and EPBC Act is a Conservation Area Management Plan (CAMP). The

CAMP will operate alongside this EMP with interactions identified and reflected in each management plan where appropriate. A separate Dust Management Plan is currently in preparation for the Proposal.

All management actions contained within this EMP have been designed according to the SMART principle, in that all actions are:

- Specific
- Measurable
- Attainable
- Relevant
- Time bound.



Legend:

- Survey area
- Proposal area
- Conservation area
- Future Hammond and Rowley Roads (excised from previous referral area)
- Existing quarry approval
- Cadastral boundary
- Roads (MRWA)

Scale 1:5,000 at A4	0 50 100 metres
Coord. Sys. GDA 1994 MGA Zone 50	
Job No: 56799	
Client: Questdale Holdings Pty Ltd	
Version: A	Date: 22-Sep-2021
Drawn By: hsullivan	Checked By: ES

Lot 2 and 10 Rowley Road Mandogalup

SITE LOCATION

FIGURE 1.1

strategen JBS&G

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Qube\56799 Approvals Rowley Road Mandogalup\GIS\Maps\R05_Rev_A\56799_01_1_SiteLocn.mxd
Image Reference: www.nearmap.com© - Imagery Date: 24 August 2021

2. Statutory and policy context

2.1 Environmental Protection Act 1986

The EP Act is the primary legislation governing environmental protection and impact assessment in Western Australia. Division 1 of Part IV of the EP Act provides for the referral and assessment of significant and strategic proposals.

If a proposal is likely to have a significant effect on the environment, the proposal should be referred to the EPA in accordance with section 38 of the EP Act. The EPA reviews the referral and decides whether to assess a referred proposal. The EPA then determines whether it will assess a proposal and the level of assessment for that proposal.

The Proposal was referred to the EPA on 7 December 2018 and, following a request from the EPA, further information provided on 31 January 2019. The EPA advised on 28 February 2019 that the level of assessment for the Proposal was set as a Public Environmental Review (PER) with a public consultation period of four weeks.

The Environmental Scoping Document (ESD) was prepared by the proponent and the finalised ESD was issued on 10 December 2019. The Environmental Review Document (ERD) is currently being prepared.

Table 2.1: Key environmental factors

Key environmental factor	EPA objective	Section addressed in EMP
Flora and vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	Sections 4.3, 5.1.3 and 5.1.5
Terrestrial fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained	Section 4.4 and 5.1.4
Air quality	To maintain air quality and minimise emissions so that environmental values are protected	Section 5.1.8
Social surroundings	To protect social surroundings from significant harm	Section 5.1.9

2.2 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is administered by the DAWE on behalf of the Commonwealth Minister for the Environment. If a Proposed Action will have, or is likely to have, a significant impact on MNES, the Proposed Action must then be referred to the Minister for a decision on whether assessment and approval is required under the EPBC Act.

The MNES are:

- World heritage properties
- National heritage places
- Wetlands of international importance (often called 'RAMSAR' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities;
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

If the Proposed Action is determined to be a Controlled Action, the Proposal will be assessed in accordance with s87 of the EPBC Act. If nominated by the proponent and agreed by DAWE the proposed action may be assessed under the accredited assessment between the Commonwealth and the State of Western Australia. Under an accredited assessment, the Commonwealth has endorsed the State's environmental impact assessment (EIA) process, effectively delegating the responsibility of assessing the Proposal to the State.

The Proposal was referred to the Commonwealth Department of the Environment and Energy (DoEE), now DAWE, on 6 April 2018. DEE advised on 19 June 2018 that the Proposal was determined to be a Controlled Action under the *Environment Protection and Biodiversity Act* (EPBC Act) (EPBC 2018/8182).

The Proposal will be assessed under the accredited process.

2.3 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) has now replaced the *Wildlife Conservation Act 1950* (WC Act). On 3 December 2016, several parts of the new Act were enacted by the State Governor. The remaining parts of the Act and the associated Regulations came into effect on 1 January 2019.

In addition to providing for the protection of flora and fauna, the BC Act includes provisions for state listed threatened ecological communities, threatening processes, critical habitats and environmental pests.

2.4 Other approvals and regulation

The Proposal Area is zoned Rural under the Metropolitan Regional Scheme (MRS) and 'Rural A' City of Kwinana Town Planning Scheme No. 2 (TPS) and is within the City's Development Contribution Plan No. 6. The MRS identifies other regional road zone which intersects Lots 2 and 10.

Under 'Rural A' zoning, the Extractive Industry use class is a land-use which the City's Council exercising the discretionary powers available to it may approve under the TPS after notice of application has been given in accordance with advertising requirement (TPS No. 2 clause 2). There is an existing Extractive Industry Licence (2014) (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).

A licence will be required from the Department of Water and Environmental Regulation (DWER) in accordance with Schedule 1 Prescribed premises, *Environmental Protection Regulations 1987*.

Other approvals and regulations associated with the proposal activities are outlined in Table 2.2.

Table 2.2: Other approvals and regulations

Proposal activities	Land tenure/access	Type of approval	Legislation regulating the activity
Extraction of sand	Freehold	Extractive Industry Licence	City of Kwinana Extractive Industries Local Law
Screening of material (Item 12 Schedule 1 Prescribed premises)	Freehold	Licence	Environmental Protection Regulations 1987

3. Stakeholder consultation

3.1 Key stakeholders

The key stakeholders associated with the Proposal include the following:

- Department of Agriculture, Water and the Environment (DAWE)
- Department of Water and Environmental Regulation (DWER)
- Department of Biodiversity, Conservation and Attractions (DBCA)
- City of Kwinana (CoK).

3.2 Stakeholder engagement process

Limited stakeholder engagement has been undertaken in relation to the Proposal. The following stakeholders have been consulted:

- DWER
- DAWE.

3.3 Stakeholder consultation

Stakeholder consultation undertaken to date has been in relation to:

- The proposal's referral under the EPBC Act to the (then) DoEE in April 2019
- Preliminary discussions with the DWER regarding referral of the proposal under section 38 of the EP Act
- Development of the agreed ESD with DWER.

As previously advised and considering the (then) DoEE determined that the proposal is a controlled action (EPBC 2018/8182), the Proposal is being assessed, following the request by the Proponent, by the Environmental Protection Authority (EPA) using the bilateral agreement between Commonwealth of Australia and the State of Western Australia made under section 45 of the EPBC Act.

As a requirement of the environmental impact assessment process, consultation with key stakeholders will be undertaken and submissions will be received during the public comment period.

A period of 4 weeks has been set by the EPA for public consultation.

4. Existing environment

4.1 Soils and topography

Topography across the Proposal Area is generally undulating, with elevation ranging between approximately 30 m Australian Height Datum (AHD) to 40 m AHD.

The Proposal Area is located within the Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell *et al*. 2002). 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 (Churchward & MacArthur 1980; Gibson et al. 1994). The Proposal Area is located within the Bassendean Dune system (Churchward & McArthur 1980).

4.2 Hydrology

There are no geomorphic wetlands mapped within the Proposal Area. Surface water discharge across the area is generally to the south west, where sand mining works within Lot 10 have lowered natural surface levels.

Depths to groundwater across the Proposal Area vary between 14.5 m (16.5 m AHD) to 24 m (16 m AHD), with regional groundwater flow anticipated to be towards the west.

4.3 Vegetation and flora

In 2017, Strategen (now Strategen-JBS&G) completed a flora and vegetation survey of the Proposal Area which involved a desktop assessment and field surveys during August and October. Subsequent to this survey, targeted winter and spring surveys were carried out in August and October 2018 for the threatened species *Drakea elastica* and *Caledenia huegelii* respectively. Both surveys were conducted consistent with the requirements of *Technical guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). A summary of the results of these surveys across the Proposal area is provided in the following sections.

4.3.1 Vegetation

Based on the field survey undertaken by Strategen (2017), three vegetation types (VTs) were defined and mapped across the broader survey area, as summarised in Table 4.1 and as shown in Figure 4.1 (note the survey area extends outside of the Proposal footprint). Areas which have been cleared of vegetation have not been counted as unique VTs but have been included for area calculation purposes.

Table 4.1: Vegetation types recorded within the survey area (Strategen 2017)

Vegetation type	Description	Area (ha)
VT1	Low woodland of *Banksia menziesii* and *B. attenuata* over open heath of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* with emergent *Eucalyptus marginata*.	37.48
VT2	Closed scrub of *Acacia saligna* over mixed introduced species.	1.28
VT3	Closed herbland of mixed introduced species with emergent *Eucalyptus marginata*, *Allocasuarina fraseriana* and *Acacia saligna*.	0.62
C	Cleared areas with exotic grasses and herbs.	4.30
Total		**43.67**

Vegetation condition within the survey area ranged from 'Completely Degraded' to 'Very Good - Excellent' and is summarised in Table 4.2 and shown in Figure 4.2. Approximately 3.74 ha of 'Very Good – Excellent' condition vegetation will be retained in the designated Conservation Area.

Table 4.2: Vegetation condition recorded within the survey area

Vegetation condition	Area (ha)
Very Good – Excellent	34.61
Good – Very Good	1.83
Degraded – Good	1.04
Completely Degraded	1.84
Cleared	4.35
Total	**43.67**

Vegetation within the Proposal Area was assessed against the key diagnostic criteria for the Commonwealth listed 'Banksia Woodlands of the Swan Coastal Plain' Threatened Ecological Community (TEC), the results of which are presented in Table 4.3.

Table 4.3: Assessment of Banksia woodland within the survey area against TSSC (2016) key diagnostic criteria

Key diagnostic criteria (TSSC 2016)	Banksia woodlands within the Proposal Area
Location Occurs in the Swan Coastal Plain or Jarrah Forest IBRA bioregions.	Yes. Banksia woodlands within the Proposal Area occur on the Swan Coastal Plain.
Soils and landform Occurs on: • well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands • sandy colluviums and aeolian sands of the Ridge Hill Shelf • Whicher Scarp and Dandaragan Plateau transitional substrates and sandflats.	Yes. Banksia woodlands within the Proposal Area occur on Bassendean sands.
Structure Low woodland to forest with: • a distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall), typically dominated or co-dominated by one or more of the banksia species identified below • emergent trees of medium or tall (>10 m) height. I or *Allocasuarina* species may sometimes be present above the banksia canopy • an often highly species-rich understorey.	Yes. Banksia woodlands within the Proposal Area display the structure characteristics described.
Composition Contains at least one of the following species: • *Banksia attenuata* • *Banksia menziesii* • *Banksia prionotes* • *Banksia ilicifolia.*	Yes. Banksia woodlands within the Proposal Area contain *Banksia attenuata* and *B. menziesii*.
Condition (Keighery 1994) 'Pristine': no minimum patch size 'Excellent': 0.5 ha 'Very Good': 1 ha 'Good': 2 ha.	Yes. Banksia woodlands within the Proposal Area are predominantly in Very Good - Excellent condition and comprise 37.5 ha.

The results of the assessment against diagnostic criteria indicate that VT1 is associated with the Banksia Woodlands of the Swan Coastal Plain TEC. Statistical analysis of the species composition of VT1 showed strong linkage of this VT to Floristic Community Type (FCT) 28, which is described as Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* woodlands (Strategen 2017). All vegetation mapped as VT1 met diagnostic criteria provided in the approved conservation advice for the Banksia Woodlands of the Swan Coastal Plain TEC (Strategen 2017).

No evidence of the presence of dieback within the Proposal Area was observed during the Biologic (2020a) survey.

4.3.2 Flora

A total of 74 native vascular plant taxa from 25 plant families were recorded within the survey area. No Threatened flora species as listed under section 178 of the EPBC Act were recorded within the Proposal area. No Threatened flora species as listed under section 19(1) of the BC Act and no Priority flora species as listed by the DBCA were recorded within the Proposal area (Strategen 2018).

A total of 15 introduced (exotic taxa) were recorded within the wider Proposal area, of which one species (*Zantedeschia aethiopica*) is a Declared Plant species in Western Australia pursuant to section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2017).

4.4 Fauna and habitat

4.4.1 Terrestrial and vertebrate fauna

Desktop assessment

Four databases were searched by Biologic (2020a) to obtain information on species and communities previously recorded within the vicinity of the Development Envelope (Birdata, NatureMap and Threatened and Priority Fauna Search), and conservation significant species and communities likely to occur within the Proposal Area (Protected Matters Database).

- BirdLife Australia's Birdata Custom Search (Birdlife Australia 2019) – to determine black cockatoo roosting sites recorded from the region;
- Department of Biodiversity Conservation and Attractions' (DBCA) NatureMap database (DBCA 2019a) to determine fauna recorded from the region;
- DBCA's Threatened and Priority Fauna Search (DBCA 2019b) - to determine threatened fauna recorded from the region and;
- DoEE's Protected Matters database (DoEE 2019b) – to determine matters of national environmental significance recorded from the area.

The database searches retrieved a total of 206 vertebrate fauna species as having the potential to occur within 12 km of the Proposal area, comprising of 22 mammal, 145 bird, 32 reptile and 7 amphibian species (Biologic 2020a). Fifty-five species of conservation significance have previously been recorded within 12 km of the Proposal Area, however three species returned from the database searches were disregarded based on the absence of required habitat within the Proposal Area (Carter's Freshwater Mussel), or records which fall outside of currently known distribution ranges (Western Ringtail Possum and Numbat). One invertebrate species, Graceful Sunmoth, was also disregarded.

A likelihood assessment of the remaining 55 conservation significant species determined that a total of 10 conservation significant species, listed in Table 4.4 below, are considered as possible or likely to occur within the Proposal Area.

Table 4.4: Conservation significant species likelihood assessment results (adapted from Biologic 2020a)

Species	Conservation Status			Preferred broad habitats	Recorded within Proposal Area	Likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Mammals						
Southern Brown Bandicoot (*Isoodon fusciventer)*	-	-	Priority 4	Jarrah Forest and swamp habitats, preferring dense vegetation around wetland fringes and heathland (Cooper, 1998; Woinarski et al., 2014).	Yes	Confirmed
Western Quoll, Chuditch (*Dasyurus geoffroii*)	Vulnerable	Vulnerable	-	In the Jarrah forest, Chuditch occur in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in Riparian vegetation (Orell & Morris, 1994).	No	Possible
South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*)	-	Conservation Dependent	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Woinarski et al., 2014).	No	Possible
Western Brush Wallaby (*Notamacropus irma*)	-	-	Priority 4	The species inhabits a wide-range of habitats including low Banksia woodlands, Jarrah/Marri woodlands and moist Melaleuca lowlands, favours open, grassy areas (Wann & Bell, 1997; Woinarski et al., 2014).	No	Likely
Tammar Wallaby (*Notamacropus eugenii subsp. derbianus*)	-	-	Priority 4	Dense, low vegetation for daytime shelter and open grassy areas for feeding. Inhabits coastal scrub, heath and dry sclerophyll forest (Woinarski et al., 2014).	No	Possible
Birds						
Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)	Vulnerable	Vulnerable	-	Inhabits humid and subhumid eucalypts forests with an average of 600mm rainfall. They mainly inhabit dense Jarrah, Karri and Marri forests with high rainfall. Attracted to seeding Albany Blackbutt, Blackbutt, Karri, Snottygobble and Sheok (Johnstone & Storr, 1998).	Yes	Confirmed

Species	Conservation Status			Preferred broad habitats	Recorded within Proposal Area	Likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)	Endangered	Endangered	-	Occurs in semiarid eucalypt woodlands, preferring Wandoo and Salmon Gum. Will also inhabit proteaceous scrubland and heaths dominated by dryandra, grevillea and banksia species. Prefer coastal areas and banksia woodlands during the non-breeding season. (Johnstone & Storr, 1998).	No	Highly Likely
Baudin's Cockatoo (*Calyptorhynchus baudinii*)	Endangered	Endangered	-	Species forages primarily in humid and sub-humid Eucalypt forests, feeding on Marri nuts, flowers, nectar and seeds, as well as, Banksia and Hakea species (Johnstone & Storr, 1998). Nesting trees are Karri, Marri, and Wandoo. Species is less frequently found in Wandoo, Blackbutt, Flooded Gum and farming or urban areas (Johnstone & Kirkby, 2008).	No	Likely
Reptiles						
Perth Slider (*Lerista lineata*)	-	-	Priority 3	Found in loose soil or sand, particularly in coastal heaths and low shrublands (Cogger, 2014).	No	Likely
Black-Striped Snake (*Neelaps calonotos*)	-	-	Priority 3	The species inhabits sandy areas, Banksia and Eucalypt woodlands (ALA, 2019).	No	Possible

Field survey

Biologic (2020a) recorded a total of 25 vertebrate fauna species during the field survey, comprising of 14 bird, 4 mammal and 7 reptile species. Two conservation significant species were recorded, namely the Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) (DBCA listed Priority 4) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (EPBC Act and BC Act listed Vulnerable).

4.4.2 Fauna habitat

Two broad fauna habitats were identified within the survey area, which have been derived from the flora and vegetation survey undertaken by Strategen (2017) and six habitat assessments undertaken during the Biologic (2020a) field survey. These comprise of:

- Low Banksia Woodland (Plate 4.1): Open *Banksia menzesii* and *Banksia attenuata* woodland with emergent *Eucalyptus marginata* (Jarrah), over an open understorey including *Xanthorrhoea*, *Hibbertia hypericoides* and mixed *Acacia* species. This habitat type comprises

38.09 ha (87%) of the Proposal Area, and was assessed to be in 'Very Good – Excellent' condition. This fauna habitat type aligns with the Commonwealth listed Endangered 'Banksia Woodlands of the Swan Coastal Plain' Threatened Ecological Community.

- Acacia Scrubland (Plate 4.2): Scrubland of *Acacia saligna* with emergent *Eucalyptus marginata* (Jarrah) and *Allocasuarina fraseriana*. This habitat type comprises 1.27 ha (3%) of the Proposal Area, and was assessed to be in 'Good' condition. This fauna habitat type was described by Strategen (2017) as 'closed', however Biologic (2020a) considered that it was not 'closed'.

A further 4.29 ha of 'Cleared' areas comprising of cleared tracks, infrastructure (radio towers) and roads occur within the Proposal Area, which have limited potential to support conservation significant species. Only the habitat 'Low Banksia Woodland' will be impacted by the proposal.

Plate 4.1: Example of Low Banksia Woodland fauna habitat type within the Proposal Area

Plate 4.2: Example of Acacia Scrubland fauna habitat type within the Survey Area

4.4.3 Black Cockatoo habitat

Habitat quality analysis has been undertaken by Strategen-JBS&G, which requires consideration of impact site's condition, context and species stocking rates in determining significance of impact and offset requirements. This analysis assigned a foraging quality score to each vegetation type within the Proposal Area based on the scoring system developed by Bamford Consulting Ecologists (2018), for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo (Strategen JBS&G 2020a; Figure 4.3 and Figure 4.4). The scoring system developed by Bamford Consulting Ecologists (2018) comprises of:

- A score out of six for vegetation composition, condition and structure
- A score out of three for the context of the site
- A score out of one for species density.

Table 4.5 and Table 4.6 below present the foraging quality scores assigned to each vegetation type for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo, respectively. In total, the survey area contains 37.48 ha of Moderate quality foraging habitat for Carnaby's Black Cockatoo and 37.48 ha of Low to Moderate quality foraging habitat for Forest Red-tailed Black Cockatoo within VT1. A further 1.28 ha of Low quality foraging habitat occurs for Carnaby's Black Cockatoo within VT2.

Table 4.5: Carnaby's Black Cockatoo foraging habitat quality

Vegetation type	Area (ha)	Vegetation composition score and corresponding quality description (out of 6)	Site context score (out of 3)	Species density score (out of 1)	Total foraging habitat quality score (out of 10)
VT1: Low woodland of *Banksia menziesii* and *B. attenuata* over open heath of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* with emergent *Eucalyptus marginata*.	37.48	4 – Moderate foraging value	1	1	6

Vegetation type	Area (ha)	Vegetation composition score and corresponding quality description (out of 6)	Site context score (out of 3)	Species density score (out of 1)	Total foraging habitat quality score (out of 10)
VT2: Closed scrub of *Acacia saligna* over mixed introduced species.	1.28	2 – Low foraging value	0	0	2
VT3: Closed herbland of mixed introduced species with emergent *Eucalyptus marginata*, *Allocasuarina fraseriana* and *Acacia saligna*.	0.62	0 – No foraging value	0	0	0
Cleared	4.30	0 – No foraging value	0	0	0

Table 4.6: Forest Red-tailed Black Cockatoo foraging habitat quality

Vegetation type	Area (ha)	Vegetation composition score and corresponding quality description (out of 6)	Site context score (out of 3)	Species density score (out of 1)	Total foraging habitat quality score (out of 10)
VT1: Low woodland of *Banksia menziesii* and *B. attenuata* over open heath of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* with emergent *Eucalyptus marginata*.	37.48	3 – Low to Moderate foraging value	1	1	5
VT2: Closed scrub of *Acacia saligna* over mixed introduced species.	1.28	0 – No foraging value	0	0	0
VT3: Closed herbland of mixed introduced species with emergent *Eucalyptus marginata*, *Allocasuarina fraseriana* and *Acacia saligna*.	0.62	0 – No foraging value	0	0	0
Cleared	4.30	0 – No foraging value	0	0	0

Potential breeding habitat

A total of 64 potential breeding trees comprising of *Eucalyptus marginata* and *Eucalypt* sp. (dead trees which could not be identified to species level) were recorded within the survey area, of which 23 contained visible hollows of at least 10 cm diameter, however no further assessment of suitability for Black Cockatoo breeding was made at the time of the survey (Strategen 2019). Tony Kirkby undertook a targeted hollow assessment of the 23 trees identified by Strategen (2019; Table 4.7) to determine the suitability for Black Cockatoo nesting, using a pole-mounted camera in accordance with advice received from the EPA and (then) DEE. None of the hollows present were considered suitable for use by Black Cockatoos for breeding in relation to depth or size, and no evidence of usage (e.g. chew marks, feathers, droppings) were observed (Biologic 2020a; Table 4.7). The location of these trees is depicted in Figure 4.3 and Figure 4.4.

Table 4.7: Location and notes on usage of hollows within the Proposal Area (Biologic 2020a)

Species	Latitude	Longitude	Comments on Black Cockatoo usage
Eucalyptus marginata	-32.183°	115.845°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.183°	115.846°	No hollows suitable for black cockatoos
Eucalyptus sp.	-32.181°	115.844°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.185°	115.844°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.183°	115.844°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.183°	115.843°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.183°	115.844°	Very shallow hollow (floor can be seen from ground level). Duck down at entrance.
Eucalyptus marginata	-32.184°	115.844°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.182°	115.846°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.846°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.846°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.846°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.844°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.844°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.845°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.845°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.845°	No hollows suitable for black cockatoos
Eucalyptus sp.	-32.188°	115.845°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.188°	115.846°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.186°	115.845°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.186°	115.844°	No hollows suitable for black cockatoos
Eucalyptus marginata	-32.186°	115.844°	No hollows suitable for black cockatoos
Eucalyptus sp.	-32.182°	115.845°	No hollows suitable for black cockatoos

Roosting habitat

Biologic (2020a) identified potential roosting habitat for Black Cockatoos across the Low Banksia Woodland fauna habitat type based the habitat mapping and the presence of *Eucalyptus marginata* (Jarrah) trees which are a recognised roosting species (Johnstone *et al.* 2011). Black Cockatoos favour roost sites that are within close range of a water source (DSEWPaC, 2012). Although there are no water sources within the Development Envelope, there are numerous waterbodies within 5 km of the Study Area including Mandogalup Swamp South (approximately 1 km south), The Spectacles North (approximately 3 km south) and Thomsons Lake (approximately 3.5 km north).

While it is acknowledged that not all suitable roosting trees were visited, no current evidence of Black Cockatoo roosting was observed within the Proposal Area, based on the lack of observed feather piles, piles of droppings, the absence of large quantities of defoliated leaves or large quantities of foraging evidence (Biologic 2020a).

4.4.4 Short Range Endemic invertebrate fauna

Biologic (2020b) undertook a desktop assessment to assess the likelihood of occurrence of conservation significant Short Range Endemic (SRE) invertebrate fauna within the Proposal Area. The desktop assessment was guided by advice provided by the Western Australian Museum (WAM) and other taxonomic experts, and in accordance with EPA guidance documents.

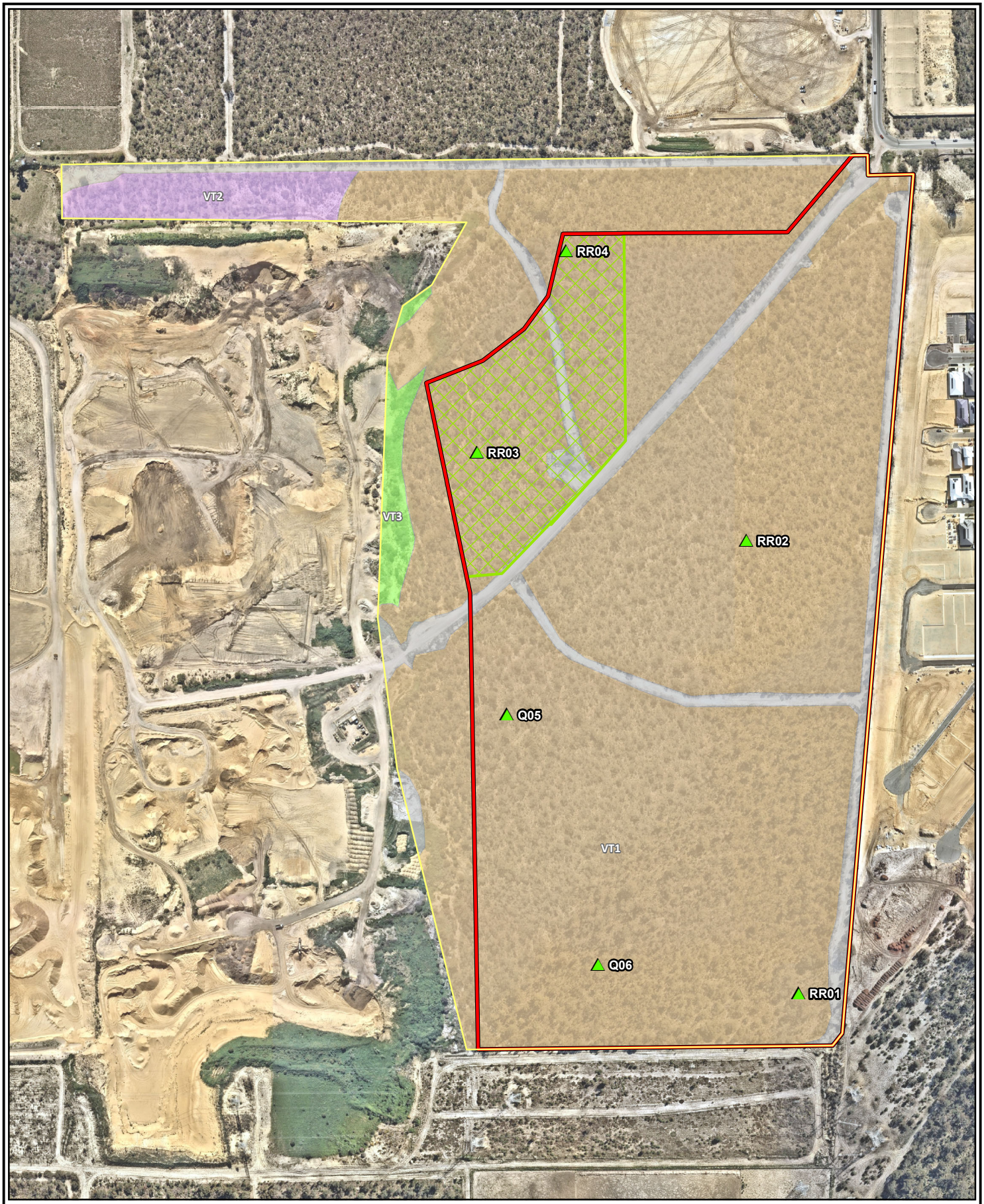
The database and literature searches retrieved 21,481 insect, mollusc, crustacean, arachnid and myriapod records, none of which were recorded within the Proposal Area itself. However, 56 SRE invertebrate species were identified as having the potential to occur within the Proposal Area. Forty-seven species were considered Confirmed or Potential SRE species, and 21 were conservation significant species listed under the EPBC Act or BC Act. A total of 14 species were considered to have a High likelihood of occurrence within the Proposal Area, and are summarised in Table 4.8 below. Of the remaining 42 species identified as having the potential to occur within the Proposal Area, 13 were considered to have a Moderate likelihood, 24 had a Low likelihood and 5 had a Very Low likelihood.

No Critically Endangered, Endangered or Vulnerable SRE species listed under the EPBC Act were considered as having a High likelihood of occurrence within the Proposal Area. One Priority 1, one Priority 3, and one Priority 4 species were considered as having a High likelihood of occurrence within the Proposal Area.

Table 4.8: Confirmed and Potential SRE invertebrate fauna species with an assessed High likelihood of occurrence within the Proposal Area

Higher taxon	Family	Scientific name	Conservation status		SRE status	Recorded within 20 km of Proposal Area	Habitat present	Likelihood of occurrence
			BC Act	EPBC Act				
Araneomorphae	Lamponidae	*Paralampona marangaroo*	-	-	Potential	Yes	Yes	High
		Pseudolampona woodman	-	-	Potential	Yes	Yes	High
Mygalomorphae	Anamidae	*Aname `MYG405`*	-	-	Potential	Yes	Yes	High
		Aname `MYG496`	-	-	Potential	Yes	Yes	High
		Kwonkan `UBS Cat sp. 126`	-	-	Potential	Yes	Yes	High
		Proshermacha `MYG449`	-	-	Potential	Yes	Yes	High
	Idiopidae	*Idiosoma sigillatum*	Priority 3	-	Confirmed	Yes	Yes	High
		Idiosoma `MYG189`	-	-	Potential	Yes	Yes	High
Lepidoptera	Castniidae	*Synemon gratiosa*	Priority 4	-	Widespread	Yes	Yes	High
Orthoptera	Tettigoniidae	*Throscodectes xiphos*	Priority 1	-	Confirmed	Yes	Yes	High
Polydesmida	Paradoxosomatidae	*Antichiropus `UBS2, disgregus, DIP126`*	-	-	Potential	Yes	Yes	High
		Antichiropus `UBS3, DIP127`	-	-	Potential	Yes	Yes	High
Isopoda	Armadillidae	*Buddelundia `sp. 7`*	-	-	Potential	Yes	Yes	High
Gastropoda	Bothriembryontidae	*Bothriembryon kendricki*	-	-	Potential	Yes	Yes	High

.



Proposal area
Conservation area
Survey area
Quadrat locations

Vegetation type

VT1: Low woodland of *Banksia menziesii* and *B. attenuata* over open heath of *Xanthorrhoea preissii, Hibbertia hypericoides* and *Mesomelaena pseudostygia* with emergent *Eucalyptus marginata*

VT2: Closed scrub of *Acacia saligna* over mixed introduced species

VT3: Closed herbland of mixed introduced species with emergent *Eucalyptus maginata,Allocasuarina fraseriana* and *Acacia saligna*

Cleared

Scale 1:5,000 at A4	0 50 100 metres
Coord. Sys. GDA 1994 MGA Zone 50	
Job No: 56799	
Client: Questdale Holdings Pty Ltd	
Version: A	Date: 22-Sep-2021
Drawn By: cthatcher	Checked By: ES

Lot 2 and 10 Rowley Road Mandogalup

VEGETATION TYPES (VTS) MAPPED WITHIN THE SURVEY AREA

FIGURE 4.1

strategen JBS&G

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

Legend:

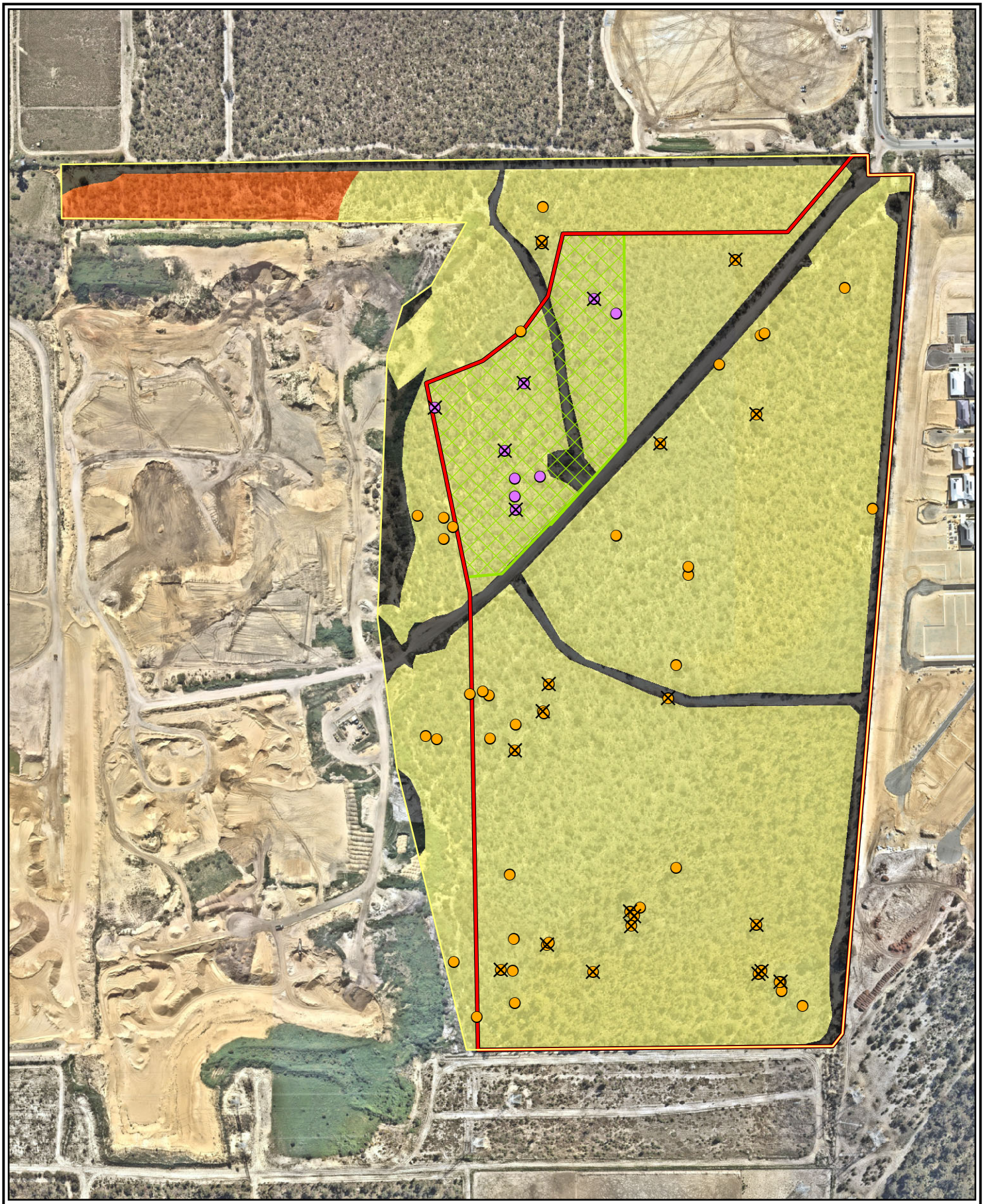
- Survey area
- Proposal area
- Conservation area
- Quadrat locations

Vegetation condition

- Very good - Excellent
- Good - Very good
- Degraded - Good
- Completely degraded
- Cleared

Scale 1:5,000 at A4 (0, 50, 100 metres)	**Lot 2 and 10 Rowley Road Mandogalup**
Coord. Sys. GDA 1994 MGA Zone 50	**VEGETATION CONDITION WITHIN THE SURVEY AREA**
Job No: 56799	
Client: Questdale Holdings Pty Ltd	**FIGURE 4.2**
Version: A — Date: 22-Sep-2021	strategen JBS&G
Drawn By: cthatcher — Checked By: ES	

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Qube\56799 Approvals Rowley Road Mandogalup\GIS\Maps\R05_Rev_A\56799_04_2_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 24 August 2021



Legend:

- Survey area
- Proposal area
- Conservation area

Fauna habitat
- Nil
- Low
- Moderate

- Significant trees to be removed (55)
- Significant trees to be retained (9)
- Hollows present (23)
- Local Road; Main Roads Controlled Path

Scale 1:5,000 at A4	0 50 100 metres
Coord. Sys. GDA 1994 MGA Zone 50	
Job No: 56799	
Client: Qube	
Version: A	Date: 22-Sep-2021
Drawn By: cthatcher	Checked By: ES

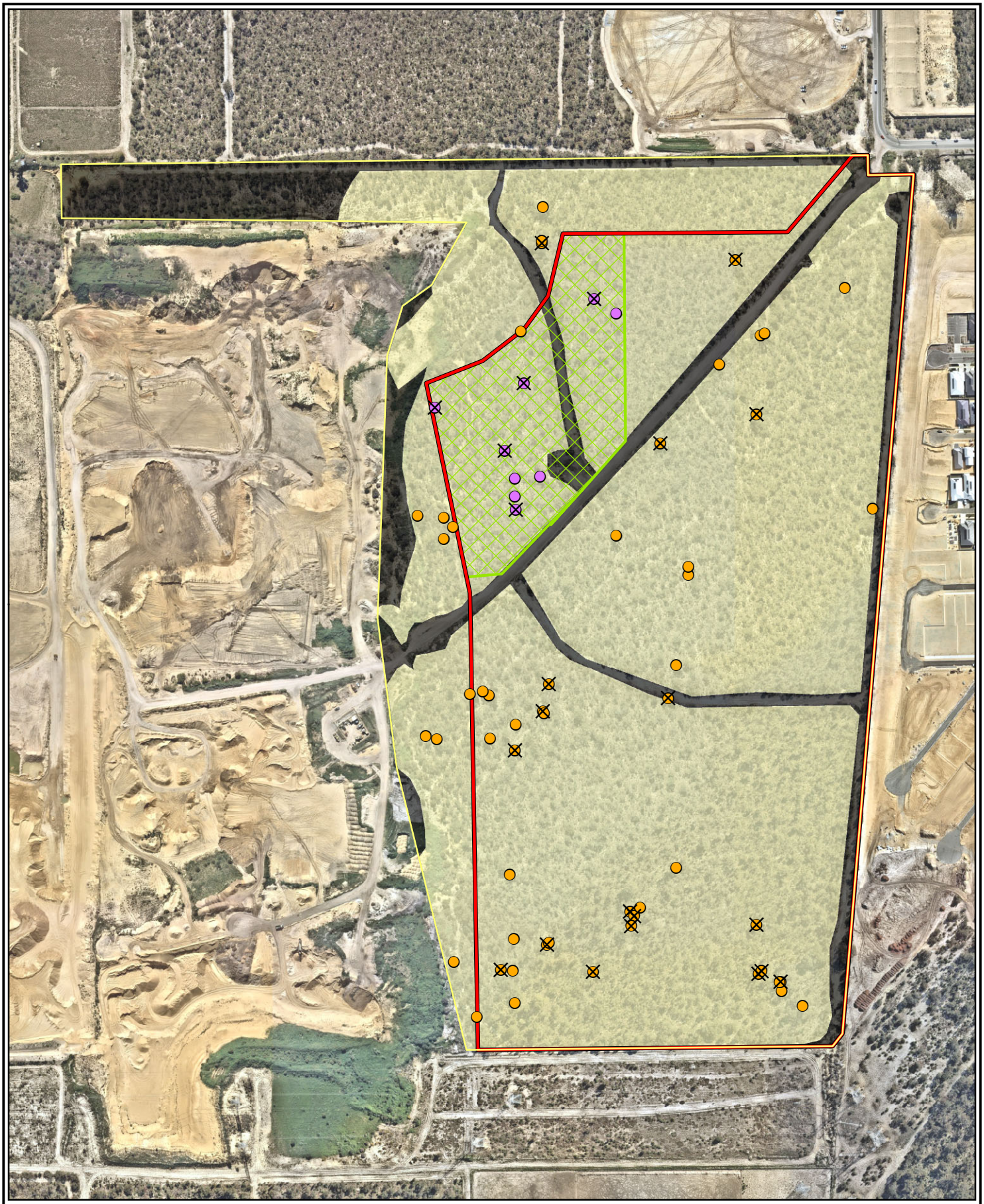
Lot 2 and 10 Rowley Road Mandogalup

FORAGING HABITAT (CARNABY'S COCKATOO)

FIGURE 4.3

strategen JBS&G

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Qube\56799 Approvals Rowley Road Mandogalup\GIS\Maps\R05_Rev_A\56799_04_3_CBCForagingHabitat.mxd
Image Reference: www.nearmap.com© - Imagery Date: 24 August 2021



Legend:

- Survey area
- Proposal area
- Conservation area

Fauna habitat
- Nil
- Low to moderate

- Significant trees to be removed (55)
- Significant trees to be retained (9)
- Hollows present (23)
- Roads

Scale 1:5,000 at A4

0 50 100
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 56799

Client: Qube

Version: A | Date: 22-Sep-2021

Drawn By: cthatcher | Checked By: ES

Lot 2 and 10 Rowley Road Mandogalup

FORAGING HABITAT (FOREST RED-TAILED BLACK COCKATOO)

FIGURE 4.4

strategen JBS&G

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

5. Potential impacts

The following sections discuss the potential impacts associated with the Proposal which may be incurred during the construction and operational/extraction phase of the mine.

5.1 Potential impacts

5.1.1 Land clearing

A total of 26.2 ha of native vegetation will be cleared to facilitate sand mining within the Proposal Area, and as such, the following activities or aspects of the sand mining operation require management to minimise the following potential land clearing impacts:

- Direct removal of 26.2 ha of native vegetation, of which 26.2 ha comprises of the Commonwealth listed 'Banksia Woodlands of the Swan Coastal Plain' TEC
- Direct loss of habitat for terrestrial fauna, including 26.2 ha of Moderate quality Carnaby's Black Cockatoo foraging habitat, and 26.2 ha of Low to Moderate quality Forest Red-tailed Black Cockatoo foraging habitat
- Removal of 42 suitable DBH trees, of which 17 contain hollows but which are unsuitable for Black Cockatoo breeding
- Land degradation and erosion.

If not managed appropriately, accidental clearing of vegetation within the Conservation Area and adjacent to the Proposal area may occur. In addition, if not managed appropriately, clearing may result in indirect impacts to surrounding residents as a result of dust and noise impacts.

As the potential impacts of land clearing relate to a number of environmental aspects, management measures are discussed under each respective aspect in Section 6.

5.1.2 Hydrology

5.1.2.1 Surface water

Potential surface water impacts of the Proposal include:

- Erosion or scour at drainage outlets, occurring when the velocity of surface flows are increased by drainage design
- Changes to natural hydrology (surface flows, erosion, inundation and surface/groundwater interaction).

Due to the sandy nature of the Proposal Area, there is expected to be minimal stormwater runoff from the mine area as the Bassendean Sands have a high hydraulic conductivity and rainfall infiltrates rapidly. Flooding is not considered an issue in the mine area due to the high infiltration capacity of the sands and the relatively high clearance to the groundwater table (greater than 1 m) in the area to be mined.

5.1.2.2 Groundwater

There are not expected to be any direct impacts to groundwater by the Project as there will be no dewatering activities or groundwater abstraction for water supply to facilitate mining.

Adequate sand will be retained on the site (i.e. 1.2 m above AGL) to ensure that waterlogging and inundation will not occur after rainfall events as a result of the Proposal. Groundwater flow directions will not be affected by the Proposal.

5.1.2.3 Dewatering

No pit dewatering or groundwater abstraction for water supply is proposed as part of the Proposal and there will be no impact to groundwater from such activities.

5.1.3 Vegetation and flora

A total of 26.2 ha of native vegetation will be cleared to facilitate sand mining within the Proposal Area, of which 26.2 ha comprises the Commonwealth listed 'Banksia Woodlands of the Swan Coastal Plain' TEC. No conservation significant flora species are expected to be impacted, given that no conservation significant flora species were recorded during the field survey undertaken by Strategen (2017).

Sand mining activities have the potential to impact adjacent vegetation through accidental clearing and dust deposition.

Management measures to be implemented for vegetation and flora are described in Section 6.2.

5.1.4 Fauna and habitat

A total of 26.2 ha of native vegetation and 42 suitable DBH trees will be cleared to facilitate sand mining within the Proposal Area, which provides confirmed and potential habitat for conservation significant fauna species.

The following impacts to fauna may be incurred as a result of the Proposal:

- Sand clearing may reduce and/or fragment the habitat of conservation significant fauna species
- Clearing and construction works may result in the death or injury of conservation significant and other fauna species
- Increased vehicular traffic may result in increased number of fauna road kills
- Increased human activities and rubbish may encourage habitation of introduced fauna species
- Direct and indirect disturbance from light, noise and dust may reduce habitat quality in areas surrounding the disturbance area.

Management measures to be implemented for fauna are described in Section 6.3.

5.1.5 Weeds and pathogens

Increased vehicle traffic through the Proposal Area has the potential to increase the risk of spread of weeds and dieback (*Phytophthora cinnamomi*) to the Conservation Area and surrounding vegetation. Biologic (2020a) did not observe any evidence of the presence of dieback during the fauna survey undertaken within the Proposal Area, however, there is potential for dieback to be introduced to the Proposal Area or Conservation Area from a source outside of the Proposal Area.

Management measures to be implemented for weeds and pathogens are described in Section 6.3.2.

5.1.6 Hydrocarbons and hazardous chemicals

The storage and usage of hydrocarbons, chemicals and other materials at the Proposal Area such as fuel, oils, greases and degreasers, lubricants, solvents, detergents, glues, paints and sewage has the potential to cause atmospheric, soil or water contamination and human health issues if incorrectly stored, used or disposed of.

Minimal hydrocarbons and chemicals are proposed to be stored on site. Questdale Holdings Pty Ltd will not service machinery or construct a fuel farm on site. Fuel, oil, coolant and lubricant will be brought on site as required by a fully contained mobile service truck. The service truck has separate

tanks for lubricants, including a waste oil tank and evacuation pump. As a result, there will be no storage of hydrocarbon waste on site.

Any hydrocarbon or chemical leaks or spills have the potential to contaminate surface water and seep into the groundwater if not readily contained and cleaned up.

Management measures to be implemented for storage and usage of hydrocarbons and hazardous chemicals are described in Section 6.6.

5.1.7 Waste

Wastes will be managed in order to prevent visual impacts, contamination of groundwater, soil and surface water, and human health issues. Questdale Holdings Pty Ltd will apply the waste management principles of reduce, re-use and recycle. The following wastes may potentially be produced by the Proposal:

- Hydrocarbon and chemical contaminated wastes (such as used oil, empty drums and containers, spill absorbent materials etc). This will be minimal as no hydrocarbons will be stored on site, but brought on site as required by a mobile service truck and removed immediately
- General waste (such as kitchen waste, paper, cardboard etc)
- Sewage and domestic wastewater.

Management measures to be implemented for waste are described in Section 6.7.

5.1.8 Dust

Excessive dust can have adverse impacts on both workers and health of surrounding vegetation. Dust may be generated by:

- Earthworks during the construction and operational phase
- Clearing and stripping
- Excavation
- Loading and transport
- Movement of vehicles
- Wind erosion of exposed surfaces.

A separate Dust Management Plan has been prepared for the Proposal and is provided in Appendix A.

5.1.9 Noise and vibration

Noise generated by the proposed mine is expected to be localised and due to:

- Operation of earthmoving equipment throughout the construction and operational phases
- Traffic along the transport routes

There will be no blasting or breaking of a dense duricrust required due to the local geology within the area. Operational noise for mining sand is expected to be less than other forms of mining. Vibration disturbance is expected to be minimal as the Proposal does not include blasting.

Management measures to be implemented for noise and vibration are described in Section 6.9.

5.1.9.1 Acoustic assessment

An acoustic assessment of noise emissions from the proposed sand extraction operations has been undertaken by Herring Storer Acoustics (HSA), and is provided in Appendix B.

The allowable noise level at the surrounding locales is prescribed by the *Environmental Protection (Noise) Regulations 1997*. Regulations 7 & 8 stipulate maximum allowable external noise levels determined by the calculation of an influencing factor, which is then added to the base levels shown below. The influencing factor is calculated for the usage of land within two circles, having radii of 100m and 450m from the premises of concern. It is a requirement that received noise be free of annoying characteristics (tonality, modulation and impulsiveness), defined below as per Regulation 9.

Modelling of noise levels has been based on noise sources and sound power levels outlined in Table 5.1.

Table 5.1: Sound Power Level – Noise sources dB(A)

Noise source	Quantity	SWL dB(A)
Front End Loader (Komatsu WA430)	1	105
Screening Plant	1	101
Truck (Semi trailer)	3	98

Based on calculated noise levels at the nearest premises and the monitored ambient noise levels, noise levels are unlikely to be considered as being tonal in characteristics due to the background noise level being between 50 and 60 dB(A), however, to provide a conservative assessment, a +5 dB(A) penalty has been included to allow for a tonal component for the future residence. At the neighbouring residences, the applicable acoustic criteria for this assessment are the assigned L_{A10} day period noise level of 50 dB(A).

Noise received at the nearest residential premises has been determined to be 50 dB(A) for the sand operations (HSA 2020), and is compliant with the *Environmental Protection (Noise) Regulations 1997*.

5.1.9.2 Timing and staging

Quarrying will be staged so that the first stage of clearing and sand excavation will occur on the eastern boundary of the Proposal Area, and limited to clearing a 100 m fire buffer and creating a batter on the boundary, which will act as a natural noise bund and assist with minimising impacts on future residents to the east.

The second stage and ongoing operation will continue quarrying from the existing Lot 10 quarry, extending the quarry floor in an eastwards direction through Lot 2 to the edge of the firebreak. 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.

The third and final stage of quarrying will entail removal of the remaining vegetation to the east of the pit and extraction of sand through the 100 m fire buffer to the eastern boundary.

5.1.10 Noise bund

Whilst, the worst case for noise emissions will be experienced at the start of operations along the eastern boundary when sand extraction occurs at natural ground level, clearing will be limited to a 100 m fire buffer and creating a batter along the boundary that will act as a natural noise bund and assist with minimising noise impacts on future residents to the east. It is anticipated that this first stage of works will take 1 to 2 weeks.

5.1.10.1 Hours of operation

The proposed hours of operation for the facility are during the day, between 0700 – 1900 Monday to Friday and 0700 – 1600 on Saturdays, with no operations occurring on Sundays or Public Holidays.

5.1.11 Bushfire risk

The Proposal Area is designated as bushfire prone on the Western Australian map of Bushfire Prone Areas (DFES 2020). Implementation of the Proposal may increase the risk of fire through:

- The operation of equipment and machinery
- Handling and storage of flammable liquids
- Inappropriate storage of waste materials including cigarette butts
- The presence of vegetation stockpiles which can act as fuel sources.

Management measures to be implemented for bushfire risk are described in Section 6.10.

5.2 Risk assessment

A qualitative risk assessment was conducted in accordance with the DAWE *Environmental Management Plan Guidelines* to assess the risks of the Proposal. Each environmental risk identified has been provided a likelihood and consequence rating using the criteria in Table 5.2 and Table 5.3. These ratings are then combined using Table 5.4 to generate a risk rating of Low, Medium, High or Severe. Results of the risk assessment are shown in Table 5.5.

Table 5.2: Likelihood

Likelihood	Qualitative Measures for likelihood (How likely is it that this event/issue after control strategies have been put in place)
Highly likely	Is expected to occur in most circumstances.
Likely	Will probably occur during the life of the project.
Possible	Might occur during the life of the project.
Unlikely	Could occur but considered unlikely or doubtful.
Rare	May occur in exceptional circumstances.

Table 5.3: Consequence

Consequence	Qualitative Measures for consequence (what will be the consequence/result if this issue does occur rating)
Minor	Minor incident of environmental damage that can be reversed.
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts.
High	Substantial instances of environmental damage that could be reversed with intensive efforts.
Major	Major loss of environmental amenity and real danger of continuing.
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage.

Table 5.4: Risk rating

Likelihood	Consequence				
	Minor	Moderate	High	Major	Critical
Highly likely	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

Table 5.5: Environmental risk assessment

Aspect	Potential impacts	Inherent risk rating			Management measures	Residual risk rating		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Delineation and access	Ineffective delineation of the Conservation Area and Proposal Area boundary may result in accidental unauthorised clearing, unauthorised vehicle and pedestrian access, and introduction of weeds or pathogens.	Possible	Moderate	**Medium**	Refer to Section 6.1.	Rare	Moderate	**Low**
Vegetation and flora	Poor management and/or supervision during delineation and clearing works may lead to the loss of remnant native vegetation within the Conservation Area or vegetation adjacent to the Proposal Area	Possible	Moderate	**Medium**	Refer to Section 6.2.	Unlikely	Moderate	**Low**
Fauna and habitat	Poor management and/or supervision during clearing works may lead to the loss of fauna habitat outside of the approved clearing boundary, and fauna injury or mortality as a result of machinery and/or vehicle strike.	Possible	Moderate	**Medium**	Refer to Section 6.3.	Unlikely	Moderate	**Low**
Weeds and pathogens	Introduction and/or spread of weed species and pathogens leading to reduced flora species and system diversity.	Likely	Moderate	**Medium**	Refer to Section 6.3.2.	Possible	Moderate	**Low**
Hydrocarbons and hazardous chemicals	Incorrect storage and handling of hazardous materials (hydrocarbons) on site has the potential to impact sensitive receptors.	Possible	Moderate	**Medium**	Refer to Section 6.6.	Unlikely	Moderate	**Low**
Waste	Uncontrolled release of waste may result in pollution to nearby sensitive receptors and could release contaminants into areas accessed by the public.	Unlikely	Moderate	**Low**	Refer to Section 6.7.	Unlikely	Moderate	**Low**
	Transportation and/or storage of portable ablution facilities may lead to contamination of local soil or groundwater.	Likely	Moderate	**Medium**		Unlikely	Moderate	**Low**
	Inadequate storage of waste may attract feral animals to the work area.	Likely	Minor	**Low**		Unlikely	Minor	**Low**
Dust	Refer to the Dust Management Plan prepared by Strategen-JBS&G (2020x) provided in Appendix A.							
Noise and vibration	Temporary behavioural changes in fauna due to noise and vibration from clearing/extraction activities.	Likely	Minor	**Low**	Refer to Section 6.9.	Possible	Minor	**Low**
	Noise generated outside of hours without prior approval.	Unlikely	Minor	**Low**		Unlikely	Minor	**Low**

Aspect	Potential impacts	Inherent risk rating			Management measures	Residual risk rating		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Bushfire risk	Proposal activities have the potential to cause bush fires to the surrounding environment leading to damage or death to local flora and fauna communities.	Possible	High	**Medium**	Refer to Section 6.10.	Unlikely	High	**Medium**

6. Management provisions

6.1 Delineation and access

Delineation of the Conservation Area and the Proposal Area from the adjacent vegetation is important during the clearing and extraction/operational phases of the Proposal to prevent unauthorised access. If the Conservation Area or adjacent vegetation are not effectively delineated, accidental unapproved clearing may occur, and may result in unauthorised vehicle and pedestrian access. This may increase the risk of spread of weeds and pathogens such as dieback and dumping of waste. Delineation and access management measures are presented in Table 6.1.

Table 6.1: Delineation and access management measures

Reference No.	Action	Target	Timing	Responsibility
EMP 1.	Install appropriate fencing around the periphery of the Proposal area and Conservation Area. Lockable gates are to be installed at appropriate locations to enable vehicle access when required. Fencing is to be covered with suitable dust screening material.	To prevent unauthorised vehicle and pedestrian access to the Proposal area and Conservation Area.	During clearing adjacent to the Conservation Area.	Construction contractor
EMP 2.	Clearly demarcate each staging boundary within the Proposal Area with flagging.	To ensure vegetation clearing does not exceed each staging boundary.	Prior to the commencement of each stage of clearing.	Construction contractor
EMP 3.	Install signage on periphery fencing detailing access restrictions to the Proposal area and presence of the Conservation Area.	To discourage unauthorised access to the Proposal area and Conservation Area.	As periphery fencing is installed around the Conservation Area.	Construction contractor

6.2 Vegetation and flora

The proposal will result in the clearing of approximately 26.2 ha of native vegetation, and the retention of 3.74 ha of native vegetation within the designated Conservation Area. Poor management and/or supervision during delineation and clearing works may lead to the loss of remnant native vegetation within the Conservation Area or vegetation adjacent to the Proposal Area. Vegetation and flora management measures to be implemented are presented in Table 6.2.

Table 6.2: Vegetation and flora management measures

Reference No.	Action	Target	Timing	Responsibility
EMP 4.	Provide GPS co-ordinates of areas approved to be cleared and retained to the contractor to ensure no unapproved clearing is undertaken.	To prevent accidental or unauthorised clearing of vegetation.	Prior to the commencement of clearing.	Project Manager
EMP 5.	Clearing stage boundaries must be clearly delineated prior to undertaking clearing activities.		Prior to the commencement of each stage of clearing.	Site Supervisor

Reference No.	Action	Target	Timing	Responsibility
EMP 6.	Vegetation to be retained within the Conservation Area will be clearly marked with flagging tape at minimum and communicated to clearing personnel prior to the commencement of clearing. Following clearing activities temporary fencing will be erected to clearly mark, and restrict access to, retained vegetation.	To ensure no clearing within the Conservation Area. To restrict unauthorised vehicle and pedestrian access to the Conservation Area.	Prior to the commencement of clearing.	Site Supervisor
EMP 7.	No machinery, equipment or laydown areas to be located within areas of native vegetation to be retained.	To prevent damage to retained vegetation.	Ongoing until cessation of mining activities.	Site Supervisor

6.3 Fauna

6.3.1 General fauna management

A total of 26.2 ha of native vegetation will be cleared to facilitate sand mining within the Proposal Area, which provides confirmed and potential habitat for conservation significant fauna species. Poor management and/or supervision during clearing works may lead to the loss of fauna habitat outside of the approved clearing boundary. Fauna management measures to be implemented are presented in Table 6.3.

Table 6.3: General fauna management measures

Reference No.	Action	Target	Timing	Responsibility

EMP 8.	All site personnel are required to undertake an induction. The induction must address a range of issues, including, but not limited to:
	• Relevant details of the EMP including purpose and scope
	• Conditions of relevant environmental licences, permits and approvals
	• Fauna of conservation significance found within the Proposal Area
	• Mitigation measures for the control of impacts to the above fauna, including:
	  ○ speed limits
	  ○ retained habitat
	  ○ incident response and reporting requirements.
		To ensure all site personnel are made aware of fauna values and their obligations relating to fauna management.	Prior to commencing work on site	Construction Contractor / Project Manager

EMP 9.	Contact the Department of Biodiversity, Conservation and Attractions (DBCA) Wildcare Helpline 24hour emergency hotline on (08) 9474 9055 if sick or injured animals are encountered.	To ensure sick or injured fauna are attended to.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 10.	Vehicle speed limits are to be clearly signposted throughout the Proposal Area.	To prevent fauna vehicle strikes.	Ongoing until cessation of mining activities.	Site Supervisor

Reference No.	Action	Target	Timing	Responsibility
EMP 11.	In the event that fauna is struck by a vehicle report the incident immediately to the Site Supervisor.	To ensure that any incidents relating to fauna are recorded and any injured fauna are attended to.	Ongoing until cessation of mining activities.	Site Personnel and Contractors
EMP 12.	Any injured fauna shall be left alone and observed until a suitably qualified person can attend to the animal.	To ensure injured fauna are attended to by a suitably qualified person.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 13.	A fauna interaction register is to be maintained to capture observations and interactions with fauna.	To ensure that any interactions or incidents relating to fauna are recorded.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 14.	All domestic waste will be disposed of in designated bins.	To prevent the attraction of native fauna or feral animals into the Proposal Area and to prevent harm to fauna.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 15.	Feeding of fauna is not permitted.	To prevent harm to fauna caused by consumption of human products.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 16.	No domestic animals will be permitted to be brought into the site by Construction personnel.	To prevent interaction between domestic animals and native fauna.	Ongoing until cessation of mining activities.	Site Supervisor

6.3.2 Pre-clearing fauna trapping and relocation

Clearing associated with the Proposed Action is proposed to be undertaken in stages across the Proposal Area. Prior to each stage of clearing, fauna trapping and relocation will be undertaken not more than seven days prior to commencement of clearing. A period of seven days has been chosen to ensure fauna to not migrate back into the area prior to clearing commencing.

Given the diversity of vertebrate fauna potentially present within the site, pre-clearance fauna trapping and relocation will incorporate a variety of methodologies to maximise the number and diversity of vertebrate fauna relocated. To this end, trapping will incorporate a combination of:

- Tree hollow inspections
- Pitfall trapping
- Sheffield cage traps
- Elliot traps.

This combined trapping approach is known to be highly effective at relocating amphibians, reptiles and small mammals that would otherwise be lost either during the clearing program or immediately after due to predation (Thompson & Thompson 2015).

The following guidance documents will be adhered to by the fauna clearance contractor for the duration of the trapping and relocation program:

- The DBCA's *Standard Operating Procedure: Cage Traps for Live Capture of Terrestrial Vertebrates*
- *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020).

Pre-clearing fauna trapping and relocation management measures to be implemented are presented in Table 6.4.

Table 6.4: Pre-clearing fauna trapping and relocation management measures

Reference No.	Action	Target	Timing	Responsibility
EMP 17.	A fauna taking (relocation) license will be applied for through the DBCA's Wildlife Licensing online portal.	To remove fauna from each clearing stage boundary prior so as to reduce the risk of fauna injury or mortality.	Prior to undertaking the fauna trapping and relocation program.	Fauna Clearance Contractor
EMP 18.	Prior to clearing, trapping will be undertaken within all staged clearing areas not more than seven days prior to clearing activities commencing to remove fauna from the clearing area.		Not more than 7 days prior to the commencement of each stage of clearing.	Fauna Clearance Contractor
EMP 19.	Fauna trapping will be undertaken utilising a combination of Sheffield cage traps (70cm x 31cm x 31cm), Elliot traps, and pitfall traps positioned around drift fencing within each stage of clearing.		During the fauna trapping and relocation program.	Fauna Clearance Contractor
EMP 20.	Fauna trapping will be undertaken in accordance with the fauna taking (relocation) license, DBCA's SOP: Cage Traps for Live Capture of Terrestrial Vertebrates, and the EPA's Technical Guidance.		During the fauna trapping and relocation program.	Fauna Clearance Contractor
EMP 21.	All fauna trapping and relocation will be undertaken by a suitably qualified professional.		During the fauna trapping and relocation program.	Fauna Clearance Contractor
EMP 22.	A post trapping and relocation report is to be prepared and submitted to Questdale Holdings and the City of Kwinana, detailing: • The duration of each trapping event • The number of traps deployed, and the location of each trap • The total number of animals relocated • Where animals were relocated to • Details of any contingency actions		Within 28 days of completion of the pre-clearing fauna trapping and relocation program.	Fauna Clearance Contractor
EMP 23.	Relocation sites will be determined based on consultation with the City of Kwinana and DBCA.	To ensure suitable fauna relocation sites are determined.	Prior to undertaking the fauna trapping and relocation program.	Fauna Clearance Contractor

6.4 Pre-clearing significant tree inspections

Clearing associated with the subdivision development is proposed to be undertaken as one action, divided into a number of discrete stages across the site. This staged approach to clearing will

facilitate progressive inspections of significant trees for black cockatoos and other vertebrate fauna, which will be undertaken of each tree no more than seven days prior to clearing in a given area.

A period of seven days has been chosen to minimise the risk of black cockatoos and other vertebrate fauna utilising the trees following the inspection, before clearing commences.

Locations of significant trees for Black Cockatoos are presented in Figure 4.3.

In the event that juvenile avifauna are observed utilising the hollows, then the Wildcare Helpline will be contacted on 08 9474 9055. Given that birds are often difficult to identify at species level when young, specific care and relocation requirements cannot be determined at this stage. It is therefore proposed that following consultation with DBCA through the Wildcare Helpline, juvenile avifauna will be placed into the custody of local wildlife rescue services.

Pre-clearing significant tree inspection management measures to be implemented are presented in Table 6.6.

Table 6.5: Pre-clearing significant tree inspection management measures

Reference No.	Action	Target	Timing	Responsibility
EMP 24.	If clearing is to be undertaken during the breeding season (July to November), potential breeding trees are to be investigated to detect the presence of Black Cockatoos using hollows.	To ensure all significant trees with hollows are inspected during the breeding season.	Within 7 days prior to clearing, before each stage of clearing	Fauna Clearance Contractor
EMP 25.	If a Black Cockatoo is detected using a hollow in a tree or trees: • The tree or trees are to be clearly identified with fencing and signage • The respective tree/s are not to be cleared • Undertake measures to avoid the tree/s being cut down, felled, removed, killed, destroyed, poisoned, ring-bared, uprooted or burned.	To ensure that any trees with Black Cockatoo breeding activity have been demarcated and protected until no longer in use.	Upon detection of a Black Cockatoo utilising a significant tree, until the hollow/s are no longer being used by the cockatoo as determined by a suitably qualified and experienced person.	Fauna Clearance Contractor

6.5 Weeds and pathogens

Increased vehicle traffic through the Proposal Area has the potential to increase the risk of spread of weeds and dieback (*Phytophthora cinnamomi*) to the Conservation Area and surrounding vegetation. Biologic (2020a) did not observe any evidence of the presence of dieback during the fauna survey undertaken within the Proposal Area, however, there is potential for dieback to be introduced to the Proposal Area or Conservation Area from a source outside of the Proposal Area. Weed and pathogen management measures to be implemented are presented in Table 6.6.

Table 6.6: Weed and pathogen management measures

Reference No.	Action	Target	Timing	Responsibility
EMP 26.	All vehicles and machinery must be cleaned down of all soil and vegetation material prior to entering the Proposal Area.	To prevent the introduction of weeds and dieback.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 27.	All vehicles and machinery must be inspected for soil and vegetative material prior to entering the Proposal Area.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 28.	Any stockpiles of soil will be stored hydrologically down gradient of, and kept a minimum of 50 m from, the Conservation Area.	To prevent the spread of weeds and dieback into the Conservation Area.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 29.	Any seedlings used as part of revegetation activities within the Conservation Area are to be free of soil that may contain dieback or weeds (i.e., plants must be supplied by a NIASA accredited nursery).	To prevent the introduction of weeds and dieback into the Conservation Area.	During revegetation within the Conservation Area.	Revegetation contractor

6.6 Hydrocarbons and hazardous chemicals

The storage and usage of hydrocarbons, chemicals and other materials at the Proposal Area such as fuel, oils, greases and degreasers, lubricants, solvents, detergents, glues, paints and sewage has the potential to cause atmospheric, soil or water contamination and human health issues if incorrectly stored, used or disposed of. Purchase, storage and transport of fuel will comply with the *Poisons Act 1964*, Poisons Regulations 1965, *Mines Safety and Inspection Act 1994*, Mines Safety and Inspection Regulations 1995, *Dangerous Goods Safety Act 2004*, Dangerous Goods (Storage) Regulations 2007 and Dangerous Goods (Road Transport) Amendment Regulations 1988. Further Hydrocarbon and chemical management measures to be implemented are presented in Table 6.7.

Table 6.7: Hydrocarbons and hazardous chemicals management measures

Reference No.	Action	Target	Timing	Responsibility
Storage				
EMP 30.	All hazardous materials must be stored and used in compliance with their Safety Data Sheets (SDS) and in accordance with relevant legislation and standards.	To prevent spills impacting native vegetation and fauna habitat within the Conservation Area and adjacent to the Proposal Area.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 31.	All products and materials used on site will have a valid MSDS available.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 32.	A hazardous materials (hydrocarbons) register will be maintained to record all products onsite including non-hazardous, non-dangerous, hazardous and dangerous goods used on the Proposal.		Ongoing until cessation of mining activities.	Site Supervisor

Reference No.	Action	Target	Timing	Responsibility
EMP 33.	The hazardous materials (hydrocarbons) register must be easily accessible for personal at all times.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 34.	All containers used for the storage of decanted hazardous materials (hydrocarbons) must be appropriately labelled.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 35.	Hydrocarbons/chemicals to be stored in appropriate bunds with 110% capacity of material being stored.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 36.	All chemical storage areas must have relevant signage to identify Dangerous Goods classes and HAZCHEM within each container.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 37.	Storage containers must be locked and secured outside of the hours of construction works to deter unauthorised access and potential theft.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 38.	Ensure storage areas and generators are protected against damage from impact of vehicles and mobile plant etc.		Ongoing until cessation of mining activities.	Site Supervisor
Handling				
EMP 39.	All decanting, refuelling and servicing of vehicles must be undertaken at least 50 m away from the Conservation Area.	To prevent spills impacting native vegetation and fauna habitat within the Conservation Area and adjacent to the Proposal Area.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 40.	All hydrocarbon and chemical transfer points must be secondarily contained.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 41.	All heavy vehicles are to be fitted with spill kits and drip trays.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 42.	Inspect hydraulic hoses daily (prestart) to limit leaks from plant and equipment.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 43.	Major maintenance of plant, machinery and vehicles is to be carried out off site (where practicable).		Ongoing until cessation of mining activities.	Site Supervisor
Spill response				
EMP 44.	Laydown, refuelling and work areas must be equipped with complete spill kits.	To prevent spills impacting native vegetation and fauna habitat within the	Ongoing until cessation of mining activities.	Site Supervisor

Reference No.	Action	Target	Timing	Responsibility
EMP 45.	Spill management equipment must be appropriate to the volume and type of hydrocarbons or chemicals being stored and must be available clearly labelled and highly visible at all times.	Conservation Area and adjacent to the Proposal Area.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 46.	All spills are to be communicated to the Site Supervisor.		Ongoing until cessation of mining activities.	All personnel.

6.7 Waste

The increased use of the Proposal Area is likely to result in increased unregulated waste disposal, which may have adverse impacts on flora and fauna. Waste management measures to be implemented are presented in Table 6.8.

Table 6.8: Waste management measures

Reference No.	Action	Target	Timing	Responsibility
Domestic waste				
EMP 47.	Waste skips and bins must have lids and kept closed to contain litter.	To prevent rubbish/waste impacting native vegetation and fauna within the Conservation Area and adjacent to the Proposal Area.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 48.	Littering is prohibited and all areas must be kept free from wind-blown waste generated through storage or transport.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 49.	Waste must be taken offsite to the nearest landfill regularly to ensure it does not overflow.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 50.	Remove rubbish that may drift along the boundary before it enters the Conservation Area.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 51.	Removal of any rubbish that has been dumped or drifted into the Conservation Area.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 52.	All waste must be removed from site following the completion of extraction works (for every stage).		Ongoing until cessation of mining activities.	Construction Manager
Controlled/sewage waste				
EMP 53.	Chemical, hydrocarbon and other hazardous waste material must be appropriately stored, transported and disposed off-site.	To prevent chemical and hazardous chemical spills impacting native vegetation and fauna habitat within the Conservation Area and adjacent to the Proposal Area.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 54.	All controlled waste must be transported off site via a licensed controlled waste carrier. All receipts and tracking numbers must be retained.		Ongoing until cessation of mining activities.	Site Supervisor

Reference No.	Action	Target	Timing	Responsibility
EMP 55.	Portable ablution blocks must be stored at least 50m from the conservation area.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 56.	Level indicators must be fitted on all portable ablution blocks to indicate that the facility is nearing capacity.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 57.	Levels must be monitored regularly to ensure that they do not reach maximum levels.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 58.	Portable ablutions sewerage must be removed offsite by a licenced carrier.		Ongoing until cessation of mining activities.	Site Supervisor

6.8 Dust

Dust management measures will be implemented in accordance with the Dust Management Plan (Appendix A).

6.9 Noise and vibration

Noise and vibration can impact on local fauna as well as sensitive noise receptors within the vicinity of the Proposal Area. Noise and vibration management measures to be implemented are presented in Table 6.9.

Table 6.9: Noise and vibration management measures

Reference No.	Action	Target	Timing	Responsibility
EMP 59.	Undertake operations between 0700 and 1900 Monday to Friday, and between 0700 and 1600 on Saturdays only, and not on Sundays or Public Holidays.	To reduce noise impacts to local fauna and noise sensitive receptors in the vicinity of the Proposal Area.	During construction and operation of the Proposal, until cessation of mining activities.	Site Supervisor
EMP 60.	Road traffic movements will be scheduled to avoid noise sensitive period (i.e. after work hours)			Site Supervisor
EMP 61.	Speed limits are enforced on all site access roads			Site Supervisor
EMP 62.	All plant and equipment must be appropriately fitted, maintained or substituted with noise reduction devices to comply with the noise limits (use of exhaust mufflers/noise dampers for noise suppression).			Site Supervisor
EMP 63.	Regular checks and maintenance must be undertaken to ensure all equipment and vehicles are in good working order.			Site Supervisor
EMP 64.	Noise monitoring to ensure compliance with *Environmental Protection (Noise Regulations) 1997* requirements			Site Supervisor

6.10 Bushfire risk

The activities undertaken during construction may represent a fire risk. Such risks may arise from vehicle movements over dry vegetation, storage of hazardous materials (hydrocarbons) and disposal of matches or cigarettes. Fires have the potential to cause irreversible damage to the environment, property and human health or life. Bushfire management measures to be implemented are presented in Table 6.10.

Table 6.10: Bushfire risk management measures

Reference No.	Action	Target	Timing	Responsibility
EMP 65.	The daily 'fire danger' ratings will be obtained from the Bureau of Meteorology and communicated to personnel during the daily pre-start meeting.	To minimise the risk of preventable fires occurring as a result of activities associated with the Proposed Action.	Ongoing until cessation of mining activities.	Site Supervisor
EMP 66.	Smoking must only take place in designated smoking areas.		Ongoing until cessation of mining activities.	All personnel
EMP 67.	Restrict or prohibit vehicle movements during times of increased fire risk/total fire bans.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 68.	Provide and maintain onsite firefighting and first aid equipment.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 69.	All vehicles must be fitted with fire extinguishers.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 70.	Do not store bulk fuel in construction areas.		Ongoing until cessation of mining activities.	Site Supervisor
EMP 71.	Although considered unlikely, plant and vehicles operating over or through uncleared vegetation must be fitted with appropriate exhaust systems positioned or covered so that the vegetation cannot come into contact with the exhaust system.		Ongoing until cessation of mining activities.	Site Supervisor

7. Monitoring and assessment

The following monitoring actions have been developed enable an assessment of the effectiveness of the management actions (Table 7.1).

Monitoring actions to be undertaken specifically within the Conservation Area are presented in the CAMP (Strategen-JBS&G 2020a). Dust monitoring actions are outlined within the Dust Management Plan (Strategen-JBS&G 2020b).

Table 7.1: Monitoring actions

Monitoring activity	Performance target/s	Parameter/s measured	Location	Timing/frequency	Responsibility
Assessment of clearing boundaries	No clearing outside approved clearing boundaries boundary	Site inspection to assess the condition of fencing used to delineate the Conservation Area, and barriers used to block unwanted access	Around the Conservation Area near clearing boundaries	Fortnightly/Opportunistically once fencing has been installed, until cessation of mining activities.	Project Manager
		Approved clearing boundaries cross referenced against site inspections and/or current aerial photography	Clearing boundaries	Within 1 month of completion of each stage of clearing.	Project Manager
		Total area cleared not to exceed a total of 26.2 ha	Proposal Area	Not applicable.	Project Manager
Assessment of impacts to fauna	No death or injury to fauna caused by vehicle collisions	Evidence of vehicle speeds restricted to a maximum of 20km/hr (i.e. inductions and signage)	Proposal Area	During clearing and mining activities, until cessation of mining activities	Project Manager
		Reports of fauna collisions	Proposal Area	Opportunistically during clearing and mining activities, until cessation of mining activities.	Project Manager
	No death or injury to fauna as a result of the trapping and relocation process	The following information will be recorded during the pre-clearing fauna trapping and relocation: • The duration of each trapping event • The number of traps deployed, and the location of each trap • The total number of animals relocated, the species of each animal, and when each was relocated • Where animals were relocated to • Details of any contingency actions implemented	Proposal Area	During fauna trapping and relocation program.	Fauna Clearance Contractor

Monitoring activity	Performance target/s	Parameter/s measured	Location	Timing/frequency	Responsibility
	No impacts to nesting Black Cockatoos	The following information will be recorded during the tree inspection program: • The number and location of trees inspected • Findings of the inspection	Proposal Area	During tree inspection program.	Fauna Clearance Contractor
Weed and pathogen assessment	No increase in weed distribution or species in vegetation adjacent to the Proposal Area No evidence of plant pathogens within or adjacent to the Proposal Area	Site walkover by a qualified consultant (Botanist/Ecologist) to assess distribution, and abundance of weed species, and evidence of decline in tree health	Conservation Area, road reserves, and along the boundary of the Proposal Area where there is vegetation present.	Annually in Spring following commencement of clearing until cessation of mining activities	Project Manager / Environmental Consultant
Assessment of rubbish drift/dumping	No Proposal associated rubbish observed within or adjacent to the Proposal Area	Site inspection to assess Proposal associated rubbish drift/dumping in vegetation adjacent to the Proposal Area	Within the Proposal Area, along the boundary of the Proposal Area and adjacent vegetation.	Fortnightly/ from the commencement of clearing until the cessation of mining activities	Project Manager

8. Incident management and corrective actions

All site personnel have a duty of care to report all incidents in the workplace, including environmental.

An Incident and Complaints register will be established and maintained by the Site Supervisor. Any incidents of non-compliance with the EMP will be recorded and the Environmental Consultant will be notified as soon as possible. Any complaints received will be recorded in the same register. The register will include a record of when the complaint was received, the nature of the complaint, when it was responded to, by whom and how.

8.1 Incident/trigger types and corrective actions

Table 8.1 presents the corrective actions to be implemented in the event that an environmental incident occurs.

Table 8.1: Incident/trigger and corrective actions

Incident/trigger	Corrective actions	Responsibility
Unauthorised access to the Proposal area or Conservation Area	• Record and report unauthorised access to site supervisor • Determine how access was gained and if possible, the likely time of access • Implement remedy, which may include repairing damaged infrastructure or the installation of additional signage • If access is gained to Conservation Area, record as an environmental incident for cross referencing against weed or dieback observations.	Project Manager

Unauthorised clearing beyond approved boundaries	• Determine extent of additional clearing.
	• Report additional clearing to EPA and DAWE
	• Implement contingency actions which may include:
	  ○ Review management measures practicality or relevance
	  ○ Improve training and education for all personnel
	  ○ Improve and implement increased protective measures as necessary
	  ○ Improve methods for marking clearing lines
	  ○ Install additional temporary fencing or signs
	• Undertake any additional required remedial measures as determined by EPA and DAWE
	• Monitor success
		Project Manager

Vehicle collisions with fauna	• Contact DBCA Wildcare Helpline: (08) 9474 9055 • Investigate cause • Undertake intervention or remediation works (e.g. further reduce speed limit, educate workforce) • Monitor success • Report to Project Manager	Project Manager/Environmental Consultant
A trapped animal is injured or killed as a result of the trapping relocation process	• Either the DBCA Wildcare Helpline or veterinarian is to be contacted in order to obtain advice on the animal's requirements for medical attention • Based on advice received, make arrangements for the animal to either receive medical attention, or euthanise the animal • Any instances of euthanisation are to be reported to DBCA • Any instances of euthanisation are to be recorded within the post-relocation report • Investigate the reasons why an animal required medical attention/euthanisation • Revise capture techniques as required.	Fauna Clearance Contractor

Incident/trigger	Corrective actions	Responsibility
Nesting Black Cockatoo is recorded during pre-clearing significant tree inspection	• The tree or trees are to be clearly identified with fencing and signage • The respective tree/s are not to be cleared • Undertake measures to avoid the tree/s being cut down, felled, removed, killed, destroyed, poisoned, ring-bared, uprooted or burned.	Fauna Clearance Contractor/Project Manager/Construction Contractor
Juvenile avifauna are observed utilising a hollow proposed to be cleared	• Contact the DBCA Wildcare Helpline on (08) 9474 9055 • Relocate avifauna into the custody of the local wildlife rescue service, based on consultation with Wildcare Helpline.	Fauna Clearance Contractor
A tree identified as being utilised by a Black Cockatoo is damaged or killed as a result of activities associated with the Proposed Action	• If the action results in injury or mortality to Black Cockatoos, then: ○ Immediately contact the DBCA Wildcare Helpline on (08) 9474 9055 • Advise the City of Kwinana, DBCA, and DAWE of the action • Investigate reasons why the tree was damaged, despite demarcation measures • Revise clearing and demarcation techniques as required	Fauna Clearance Contractor/Project Manager/Construction Contractor
Observations indicate presence of dieback within or adjacent to the Proposal Area	• Identify potential sources of dieback spread and determine likely cause • Map dieback affected areas • Undertake dieback control ○ Control methods may include phosphite treatment to minimise the spread of dieback • Review success of dieback control methods and continue monitoring • Review and update management plan accordingly.	Project Manager/Dieback contractor
Introduction of new significant weed species to the Proposal Area or adjacent to the Proposal Area	• Map the distribution of the newly introduced significant weed species • Identify activities that may have potentially introduced the significant weed species • Plan and implement a significant weed control program (may involve seeking advice from relevant authorities) • Apply hygiene control and education measures.	Environmental Consultant/Field Ecologist or Botanist
Increase in distribution or abundance of a significant weed species within or adjacent to the Proposal Area	• Identify activities that may have potentially increased the abundance, distribution or density/cover of significant weed species • Plan and implement a significant weed control program (may involve seeking advice from relevant authorities) • Apply hygiene control and education measures	Environmental Consultant/Field Ecologist or Botanist

Incorrect dieback hygiene procedures being undertaken	• Stop vehicle's activity and inspect for build-up of mud or vegetative material, and remove the vehicle to be cleaned off site
	• Determine why appropriate hygiene procedures were not followed.
	• Implement remedy, which could include:
	  ○ Educating employees on appropriate hygiene measures
	  ○ Erect signs to highlight prohibited access
	• Review education measures (e.g. inductions, toolbox/site meetings and communications)
	• Monitor success of control.
		Vehicle operator Project Manager

Proposal associated rubbish observed along the Proposal Area boundary and / or within the adjacent vegetation	• Removal of any rubbish drift along the boundary • Removal of any Proposal associated rubbish dumped in the adjacent vegetation from the Proposal Area • Review education measures (e.g. inductions, toolbox/site meetings and communications) • Monitor success of control.	Project Manager

Incident/trigger	Corrective actions	Responsibility
Hydrocarbon or hazardous chemical spill	• Turn off vehicle/turn container upright immediately following identification of spill, and: ○ Use contents of spill kits to contain spill ○ Place contaminated soil in bags/bunded areas for offsite removal.	Vehicle operator
Disposal of waste in a manner that harms or is likely to harm the environment	• Retrain staff in correct waste management and disposal procedures • Ensure appropriate storage and facilities are available for controlled and general waste.	Project Manager
Uncontrolled discharge from ablution facilities	• Using earth or spill kit equipment to contain the material around the spill • Delineate the area from personnel • Contact provider of ablution facilities to inform of deficiency/overflow and request assistance in removing contaminated soil from the work site.	Project Manager
Noise and/or vibration that travels beyond the Proposal Area boundary as a result of poorly operated or maintained plant or equipment OR failure to comply with the approved hours of work.	• Determine requirement for additional management measures, which may include: ○ Developing a noise management plan ○ Limiting the quantity of machinery/vehicles in operation ○ Utilising noise attenuating measures (e.g. mufflers) on equipment and machinery/vehicles.	Project Manager
Bushfire	• Small fires – fire extinguishers and/or on-site water tankers will be used by the field personnel to extinguish the fire • Large fires – FESA will be called (000) to attend and extinguish fires that cannot be managed by the field personnel.	All personnel/Site Supervisor

8.2 Incident investigation

All incidents must be investigated as soon as possible after the event. The incident will be recorded in the *Environmental Incident Form* (Appendix C) and maintained for audit purposes.

8.3 Notification – Internal

All environmental incidents must be reported to the Site Supervisor immediately so that appropriate action can be taken to recover from, or reduce the risk of further harm to people and the environment.

8.4 Notification – External

The Project Manager is responsible for all external communication relating to matters concerning the environment. Personnel and contractors are not to communicate directly with stakeholders or government agencies.

9. Reporting

A report summarising the results of all monitoring will be prepared annually, for provision to the Project Manager. This monitoring report is also to be provisioned to the City of Kwinana, EPA, or DAWE upon request. The report may be used as evidence of legal compliance or non-compliance and must be correct and auditable. The annual monitoring report will include at minimum:

- Methodology employed during monitoring
- Monitoring results
- Assessment of revegetation against completion criteria
- Details of any contingency actions implemented
- Recommendations for changes to this EMP if required.

10. Adaptive management and review

The Proponent will implement an adaptive management system to provide a robust management plan, which effectively meets the environmental objectives. To achieve this, this EMP will be reviewed regularly (at least biennially) to ensure that the plan takes into consideration:

- Any revision or change to the Proposal
- Results of annual monitoring
- Outcomes of compliance assessment reporting
- Continuous improvement
- Changes in regulatory or corporate requirements.

If revised, a copy of the revised EMP will be provided to the DWER and DAWE for approval prior to implementation of the revised EMP.

11. Plan implementation

This EMP will be implemented by Questdale Holdings Pty Ltd in association with Frankland Sand Supplies until the cessation of sand extraction activities.

11.1 Roles and responsibilities

All contractors and staff are required to operate in accordance with this EMP. Key personnel and responsibilities are described in the following sections.

11.1.1 Project Manager

The primary responsibilities of the Project Manager include:

- Ensure all works comply with relevant regulatory and project requirements
- Ensure the requirements of this EMP are fully implemented, and in particular, that environmental requirements are not secondary to other construction requirements
- Participate and provide guidance in the regular review of this EMP and supporting documentation
- Provide adequate resources (personnel, financial and technological) to ensure effective development, implementation and maintenance of this EMP
- Ensure that all personnel receive appropriate induction training, including details of the environmental and community requirements
- Ensure that complaints are investigated, and issues raised resolved
- Direct that works be stopped immediately where there is an actual or potential risk of harm to the environment.
- Report to DAWE and the EPA in accordance with the requirements of Section 9 of this EMP.

11.1.2 Site Supervisor

Responsible for the day-to-day overall environmental performance and implementation of all requirement of the EMP. The environmental responsibilities of the Site Supervisor include:

- Plan construction works in a manner that avoids or minimises impact to environment
- Ensure the requirements of this EMP are fully implemented
- Ensure construction personnel manage construction works in accordance with statutory and approval requirements
- Ensure environmental management procedures and protection measures are implemented
- Communicate with all personnel and subcontractors regarding compliance with the EMP and site-specific environmental issues
- Ensure all site workers attend an environmental induction prior to the commencement of works
- Coordinate the implementation of the EMP
- Coordinate the implementation and maintenance of pollution control measures
- Identify resources required for implementation of the EMP
- Report any activity that has resulted, or has the potential to result, in an environmental incident immediately to the Project Manager

- Coordinate action in emergency situations and allocate required resources
- Stop activities where there is an actual or potential risk of harm to the environment and advise the Project Manager
- Ensure all personnel and contractors have completed a site induction
- Provide relevant environmental management information to personnel in daily pre-start and toolbox meetings.

11.1.3 Environmental Consultant

The primary responsibilities of the Environmental Consultant will include:

- Conduct site inspections as required
- Implement the EMP for all environmental matters on site, with authority to direct compliance with the EMP
- Investigate and review nonconformances and identify, implement and monitor corrective and preventative actions for nonconformances
- Notification to relevant internal and external parties of environmental incidents
- Ensure the Construction Contractor is aware of the vegetation and fauna habitat to be retained within the Conservation Area
- Undertaking required monitoring within the Proposal Area and implementation of any associated corrective actions.

11.1.4 Construction Contractor

The primary responsibilities of the Construction Contractor include:

- Overall accountability to ensure construction activities do not adversely affect retained vegetation and fauna habitat within the Conservation Area, and vegetation adjacent to the Proposal Area
- Ensure all site personnel are aware of the requirements of the EMP and related management plans
- Undertake regular monitoring of the integrity of delineation infrastructure during construction.

11.1.5 Site personnel and contractors

The primary responsibilities of all site personnel and contractors include:

- Undertake environmental training as directed by the Site Supervisor and/or Environmental Consultant
- Undertake site works as instructed by the Site Supervisor
- Undertake site works with a duty of care under the *Environmental Protection Act 1986*
- Undertake activities in compliance with this EMP
- Report all concerns, complaints, incidents, near misses, spills or non-conformances with the EMP to Site Supervisor.

11.1.6 Fauna clearance contractor

The primary responsibilities of the Fauna Clearance Contractor will include:

- Implementation of pre-clearing fauna trapping and pre-clearing significant tree inspections as required
- Liaison with DBCA and the City of Kwinana as required to obtain relevant licences
- Provision of closure report following each stage of pre-clearing fauna trapping and significant tree inspections.

12. 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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Appendix A Dust Management Plan

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

www.jbsg.com.au

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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:

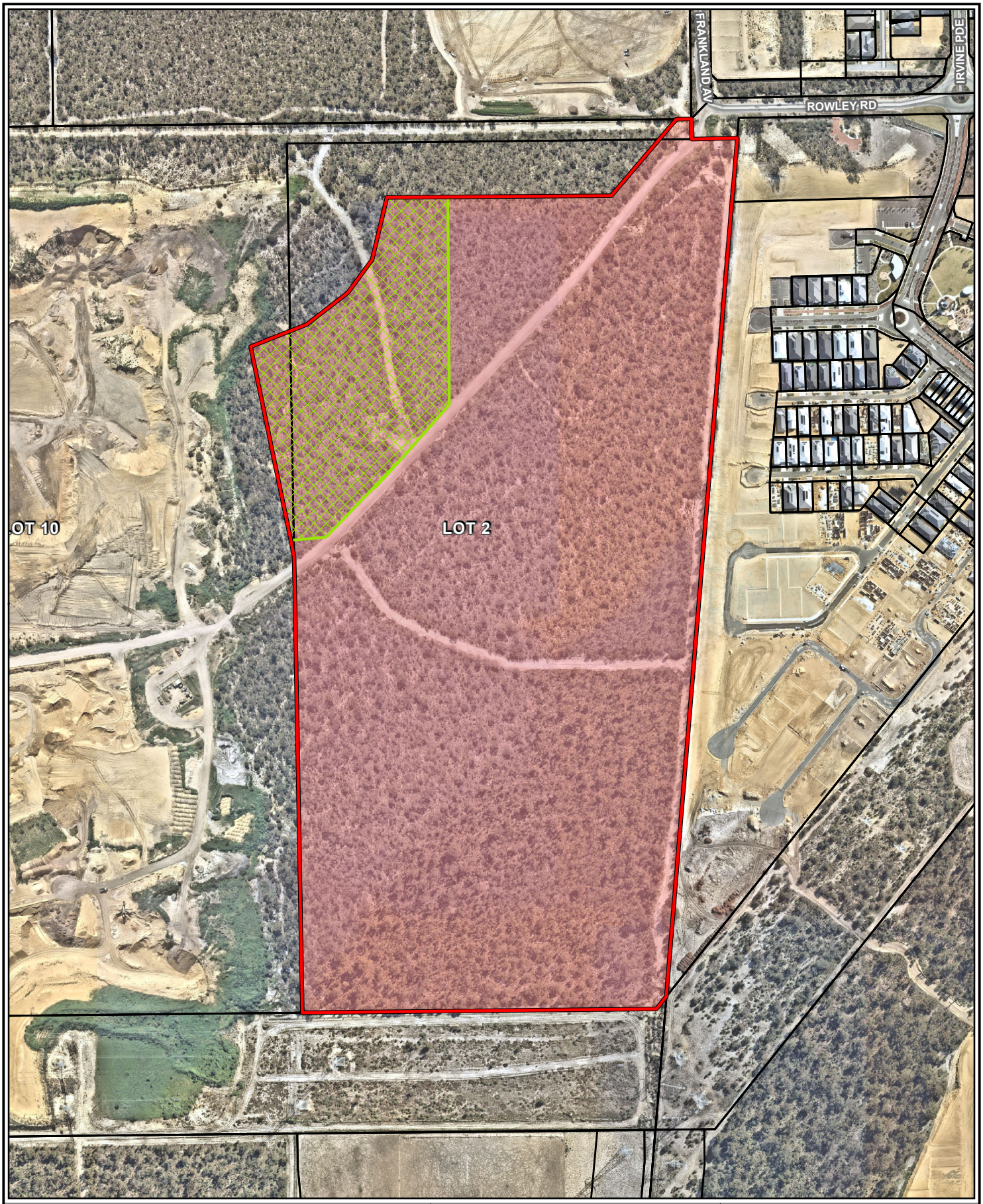
- introduction outlining project background, context and purpose of the DMP
- a description of the existing environmental setting, regulatory obligations, site characteristics and significant environmental aspects to be managed
- dust risk assessment
- details of the proposed dust management measures.

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	

File Name: W:\Projects\1)Open\Qube\56799 Approvals Rowley Road Mandogalup\GIS\Maps\R01_Rev_A\56799_02_1_SiteLayout.mxd
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.

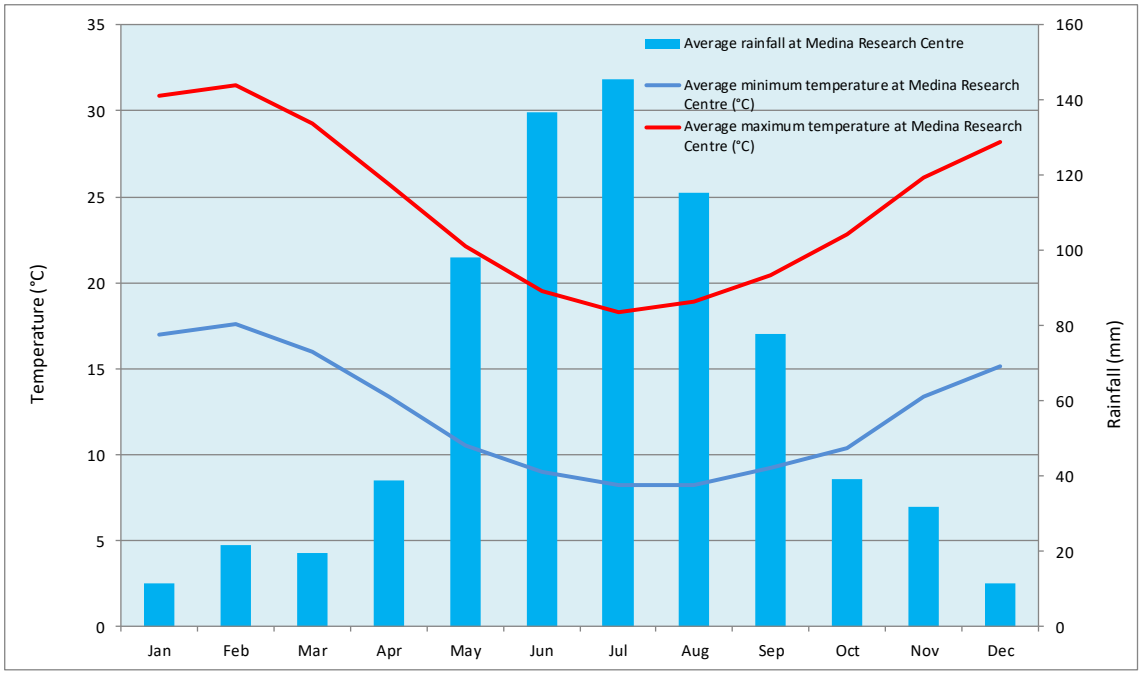


Figure 2.1: Mean monthly climatic data for Medina Research Centre (BOM 2019)

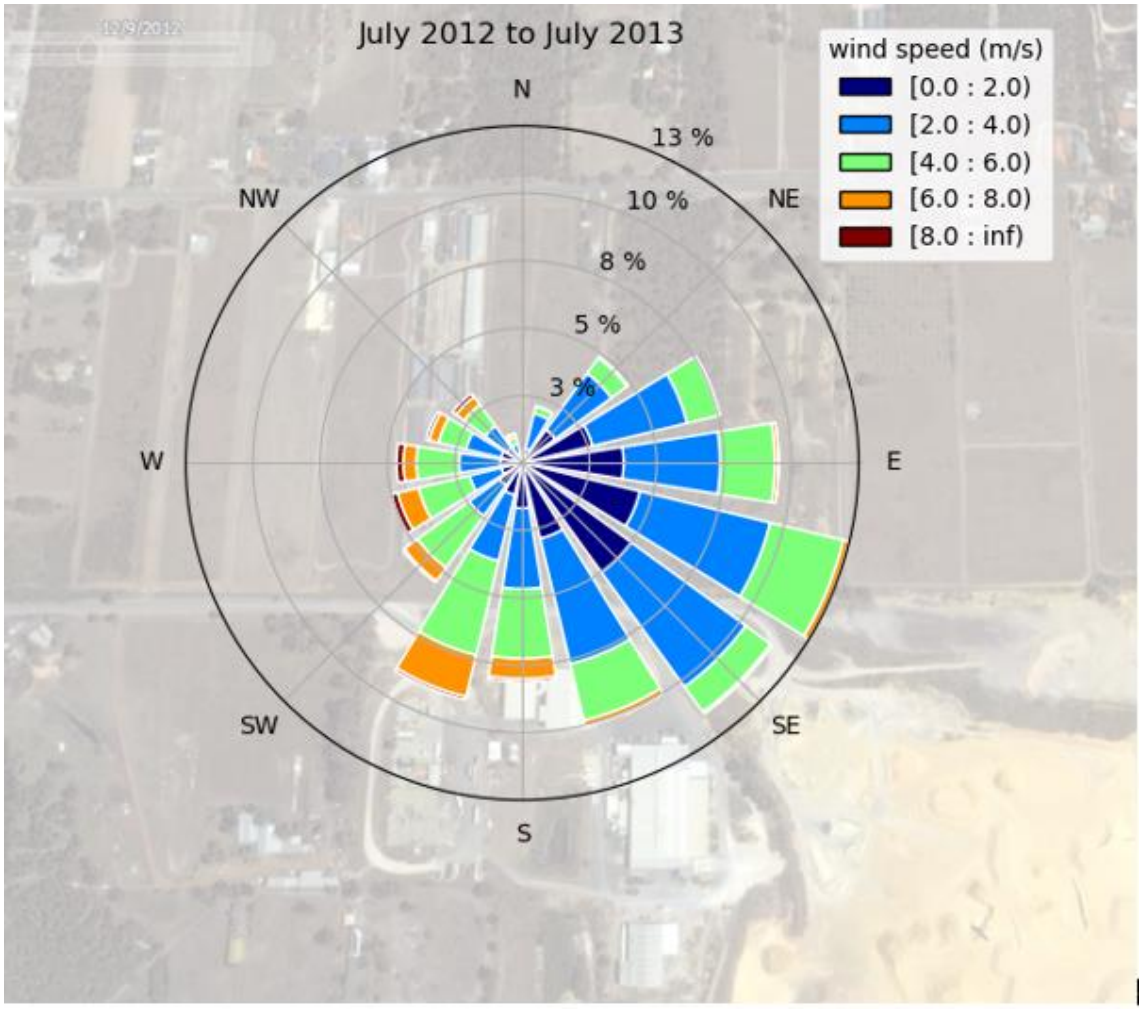
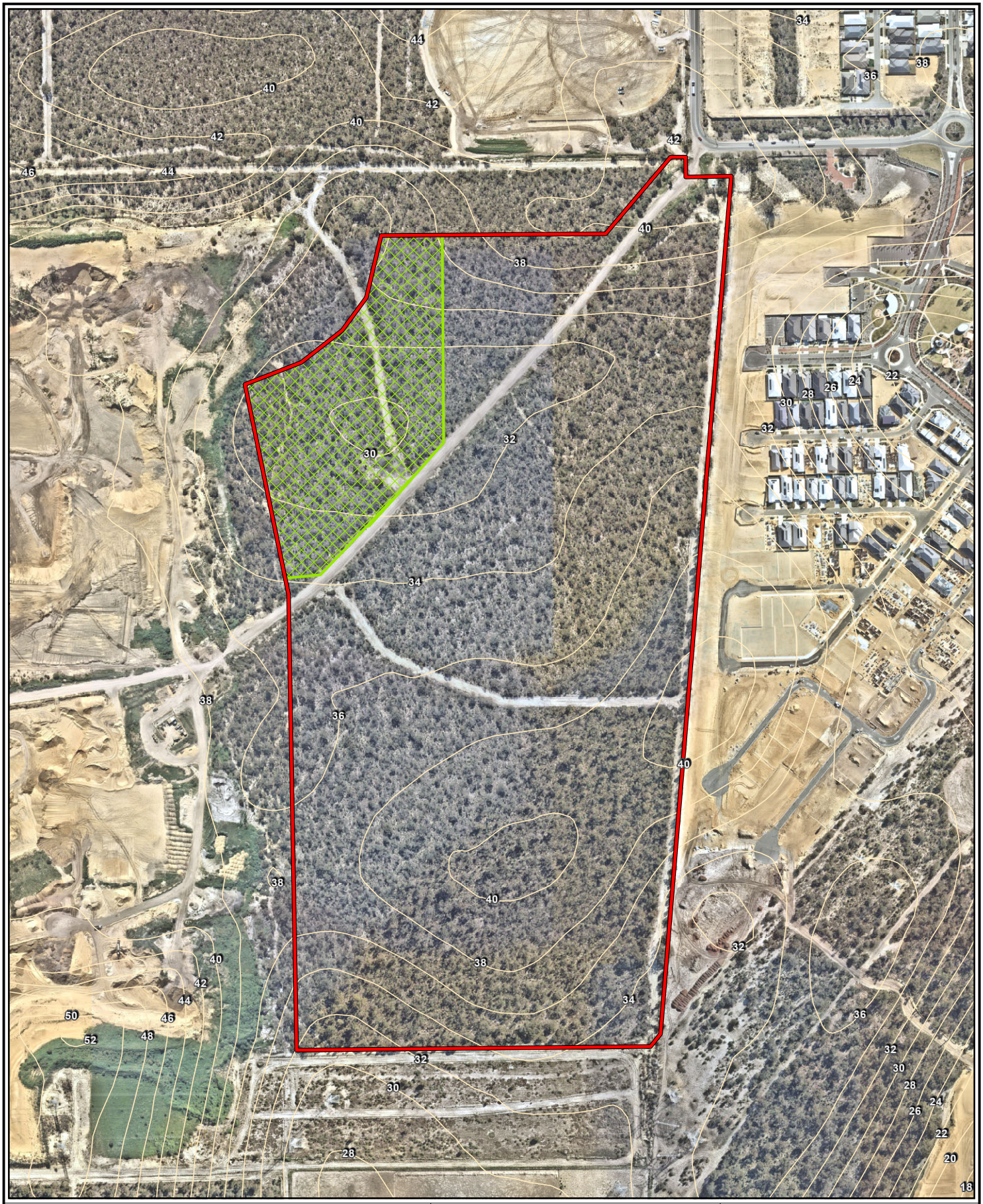


Figure 2.2: Annual wind rose for Qube Wattleup Road monitoring site



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	

File Name: W:\Projects\1)Open\Qube\56799 Approvals Rowley Road Mandogalup\GIS\Maps\R01_Rev_A\56799_02_4_Topography.mxd
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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0	Electronic	Questdale Holdings Pty Ltd	3 February 2020
1	Electronic	Questdale Holdings Pty Ltd	28 October 2020
2	Electronic	Questdale Holdings Pty Ltd Environmental Protection Authority	2 December 2020
3	Electronic	Questdale Holdings Pty Ltd	6 July 2021

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Rev No.	Author	Reviewer	Approved for Issue		
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2	K Choo	K Choo			2 December 2020
3	C Ingram	P.Forster			6 July 2021

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Appendix B Acoustic Assessment

Appendix C Environmental Incident Form

Environmental incident details	
Date of Incident:	Time of Incident (am/pm):

Detailed Location of Incident: ***(include maps, diagrams and photos where possible)***

Nature of Incident: ***(including probable cause*****)**

Include details of the incident such as:	**Volume discharged?** *(if applicable)*	**Duration of incident** *(hrs/days etc):*	**GPS coordinate:** *Easting:* *Northing:*

Type of Environmental Incident

☐ Soil Contamination ☐ Air ☐ Water ☐ Fauna ☐ Vegetation ☐ Other: *Specify*

Steps to be taken to prevent incident from occurring again:

Close out and Incident Reporting

Site Supervisor Contacted? **YES** ☐ **NO** ☐ Site Supervisors Name: _____

Site Supervisor contacted Project Manager? **YES** ☐ **NO** ☐

Further Comments *(if any)***:**

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