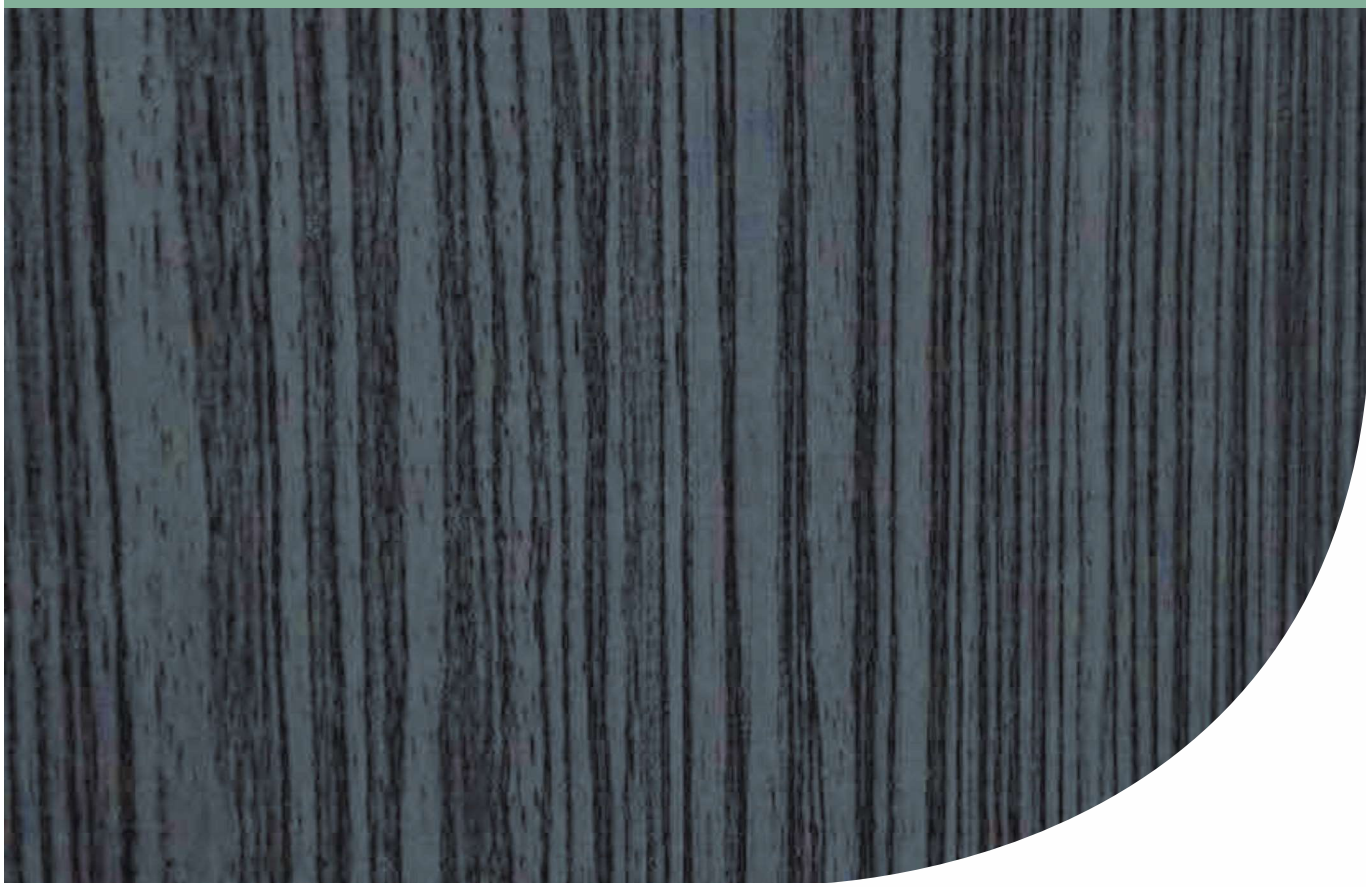
Environmental Management Plan

Lot 9 Brookton Highway, Karragullen

Project No: EP20-040(14)

Prepared for Vinci Gravel Supplies Pty Ltd
September 2021



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Executive Summary

This *Environmental Management Plan* (EMP) has been prepared on behalf of Vinci Gravel Supplies Pty Ltd (the proponent) for the proposed expansion of their existing gravel quarry at Lot 9 Brookton Highway, Karragullen (herein referred to as 'the site'). The site is 48.23 hectares in size and is located within the City of Armadale (CoA) municipality, 15 kilometres east of Armadale town centre (**Figure 1**). The site is generally bound by broad acre rural landholdings zoned 'General Rural' to the north and south, Midgegooroo National Park to the north and east, and Brookton Highway and Canning Road to the south and west.

The CoA has previously granted approval for stages 1 to 4 of the gravel extraction and processing quarry, and the proponent is now seeking Development Approval (DA) and an Extractive Industry Licence (EIL) for a further expansion of the quarry referred to as 'stage 5'. The stage 5 extraction area is adjacent to the existing approved stage 4 extraction area, and is approximately 5 ha in size, divided into stage 5a (2.82 ha) and stage 5b (2.17 ha) in addition to the access road (0.30 ha) and the vehicle compound (0.48 ha) (**Figure 2**).

The stage 5 extraction area is broken up into two stages for ease of reference and to assess the visual impact of screening vegetation, however the quarry will be excavated over several substages. The extraction activities will begin at the furthest eastern extent and gradually move in a westerly direction. Progressive rehabilitation works will occur on a yearly basis following the closure of previously extracted areas of the quarry, with the backslope to be rehabilitated in the first instance so the quarry is less visually prominent. The staged approach also allows for the temporary retention of vegetation for screening purposes during the excavation of stage 5a, before quarrying moves in the westerly direction.

This EMP is the primary supporting environmental document for the DA and EIL applications to facilitate consideration of relevant environmental issues associated with the proposed quarry expansion. At the CoA's request this EMP also summarises and consolidates existing commitments from the previously approved extraction stages 1 to 4 of the quarry, and details new commitments for the proposed expansion to support the DA application.

The existing environmental assets and sensitive receptors within and adjacent to the site, that have the potential to be impacted by the quarry expansion are summarised as follows:

- Several sensitive land uses including residential landholdings and scenic walking tracks are located within a 450 m radius of the quarry expansion.
- The head of a tributary of the ephemeral Stinton Creek occurs in the centre of the site, 400 m south of the proposed quarry expansion area and flows in a south-westerly direction to a dam in the central southern portion of the site.
- The majority of the site comprises remnant native vegetation ranging from 'Excellent' to 'Good' condition, with the remainder comprising non-native vegetation and cleared areas (14.35 ha/30% of the site) largely associated with previously excavated areas within the site's western portion.

- The site was found to support native vegetation with high fauna habitat values associated with marri and jarrah forest, shrubland, granite outcrop, sedgeland and creek line. A total of 25 native and three introduced fauna species, including three species of conservation significant black cockatoos (Baudin's cockatoo, Carnaby's cockatoo and forest red-tailed black cockatoo), were directly or indirectly recorded during the field survey.
- The site contains suitable roosting, breeding and foraging habitat for black cockatoos including approximately 23.41 ha of high value foraging habitat, 22.85 ha of moderate foraging habitat and 23.46 low value foraging habitat, along with a total of 468 habitat trees, of which two contain hollows suitable for breeding.
- The site is identified as bushfire prone in the WA *Map of Bush Fire Prone Areas* (OBRM 2019).
- No evidence of *phytophthora* dieback infestation is currently present within the site, however previous studies indicated some evidence of dieback presence.

The flora and vegetation and fauna habitat impacts associated with the stage 5 quarry-footprint has been determined from the baseline surveys and compared against the same values within the remainder of the site. This summary has been presented within **Table E1**.

This EMP outlines the corresponding management strategies to mitigate and manage the identified risks to key environmental assets and sensitive receptors. The management actions to be implemented comprise eight categories with associated objectives as summarised below:

- **Stormwater soil and erosion:** Stormwater will be managed during the construction and operational phases of the gravel quarry such that no uncontrolled discharge of water from the extraction area will result in erosion or sedimentation into the Stinton creek. A waterway 'avoidance area' has been identified either side of the Stinton Creek tributary to a width of 30 meters (m). No disturbance will occur within this area during the excavation activities in order to protect the waterway, avoid the trampling of riparian vegetation and minimise weed and pest encroachment. Diversion banks and catch drains will ensure avoidance of sediment-laden runoff and allow clean surface water to return to natural watercourses or to retained vegetation along natural drainage lines.
- **Native vegetation:** Native flora and vegetation will be managed so that biological diversity and ecological integrity are maintained within and adjacent to the site. A total 30.83 ha native vegetation will be retained and protected within the broader site (referred to as the 'Clearing Avoidance Footprint'). The extent of the clearing area will be clearly defined before any clearing activities commence to ensure there will be no encroachment of disturbance activities into adjacent vegetation. Clearing of native vegetation will occur progressively associated with extraction stages and rehabilitated in accordance with the *Rehabilitation and Decommissioning Programme*, detailed further below.
- **Weeds and *phytophthora* dieback:** Hygiene procedures will be adopted during excavation activities to prevent spread of weed species or *Phytophthora* dieback within the site.
- **Fauna:** The biological diversity and ecological integrity of terrestrial fauna within and adjacent to the site will be maintained. A pre-disturbance fauna inspection will be undertaken 1-2 days before clearing and progressive clearing in one direction undertaken enabling fauna species to move to adjacent vegetation.
- **Bushfire risks:** Part 10A Bushfire Risk Management 'deemed provisions' of City of Armadale TPS No.4 does not apply to the proposed expansion, because it does not include the

construction or use of any habitable buildings. Notwithstanding, certain activities will not occur on site including construction of permanent or temporary habitable buildings on site, the storage of large quantities of fuel and the parking and servicing of trucks on site.

- **Dust:** Procedures to control dust will ensure dust levels meet statutory requirements and acceptable standards including watering haul roads and stockpiles, use of dust technologies (crusher enclosures, wet drilling, automatic sprinklers) and speed restrictions on unsealed access roads.
- **Noise**: The results of the *Acoustic Assessment* (Lloyd George 2021) indicate noise levels associated with the stage 5a and 5b gravel extraction pits would comply with the daytime regulations at the surrounding noise sensitive receivers. With regard to night-time loading of trucks (between 6am and 7am), a marginal 1 dB exceedance is predicted at one receiver. To mitigate this exceedance, truck movements between 6am and 7am will be limited to a maximum of four trucks.
- **Visual amenity:** The results of the *Visual Impact Assessment* (Emerge Associates 2021) concluded the expansion would not cause a major visual impact on the landscape of this area with the proposed mitigation measures in place, namely, utilising a staged quarrying approach with retention of vegetation between stages, progressive revegetation and the retention of a 20 m vegetation buffer from the extraction area to the site boundary to the north to provide a visual screen.

This EMP provides a Rehabilitation and Decommissioning program consolidating previous rehabilitation commitments associated with historically approved stages of the existing quarry and proposes additional revegetation commitments.

A total 13.43 ha of native revegetation will be established within the site which will ultimately establish potential breeding and foraging habitat for a number of conservation significant flora and fauna, including Baudin's cockatoo, Carnaby's cockatoo and forest red-tailed black cockatoo. Based on the vegetation selected, it is expected that it would take between three and seven years from initial establishment for the revegetation to provide black cockatoo foraging habitat value, noting that abundance would increase with maturity.

This incorporates the 5.01 ha of native revegetation previously conditioned under Clearing Permit 8273-1 for stage 4 of the quarry. The remaining 8.42 ha comprises additional revegetation areas (i.e. not already required as part of previous approvals), with 4.99 ha of the stage 5 expansion, and 3.43 ha across the stage 4 quarry and previously disturbed areas of the site, collectively to counterbalance the residual impact of the stage 5 expansion site. Maintenance and monitoring will be conducted until completion criteria are met for these areas. Compliance reporting and adaptive management measures are also specified in this EMP, to ensure the intended outcomes are achieved.

Overall, the environmental attributes and values of the site can be managed appropriately through the implementation of this EMP in line with the relevant state and local government legislation, policies and guidelines and best management practices.

Table E1: Assessment of environmental conditions within the proposed stage 5 quarry footprint and the remainder of the site

		Description	Clearing Footprint (ha)	Remainder of the site (ha)
Site Extent	Boundary		5.75	42.49
Flora and Vegetation	Vegetation Condition	Pristine	0	0
		Excellent	0	3.02
		Very Good	4.54	10.57
		Good – Very Good	0.006	6.98
		Good	0.16	6.27
		Degraded	0	2.19
		Completely Degraded	1.03	11.41
	Plant Community	AeGm	0	3.70
		Bs	0	3.02
		CcEmBa	4.71	21.47
		CcLI	0	0.06
		Cd	0	0.51
		LeH	0	0.22
		TIBr	0	0.05
		Revegetation	0.007	1.80
		Cleared and Non-native	1.03	11.40
		Water	0	0.11

Table E1: Assessment of environmental conditions within the proposed stage 5 quarry footprint and the remainder of the site (continued)

		Description	Clearing Footprint (ha)	Remainder of the site (ha)
	Community	Threatened Ecological Community	0	0
		Priority Ecological Community	0	0
Level 1 Fauna	Fauna Habitat	Marri and Jarrah Forest	4.71	21.58
		Shrubland	0	4.44
		Sedgeland	0	0.05
		Revegetation	0.007	1.79
		Granite Outcrop	0	3.02
		Non-native Vegetation	0	0.15
		Predominantly Cleared Area	1.03	11.25
		Waterbody	0	0.11
		Creekline	0	0.08
Black Cockatoo	Carnaby's Cockatoo Foraging Habitat	High value	4.67	18.74
		Moderate value	0	0.26
		Low value	0.002	5.34
	Baudin's Cockatoo Foraging Habitat	High value	4.61	18.24
		Moderate value	0	0.30
		Low value	0.06	3.60

Table E1: Assessment of environmental conditions within the proposed stage 5 quarry footprint and the remainder of the site (continued)

		Description	Clearing Footprint (ha)	Remainder of the site (ha)
	Forest Red-Tailed Cockatoo Foraging Habitat	High value	4.67	18.79
		Moderate value	0	0.26
		Low value	0	1.25
	Black Cockatoo Breeding Trees (no.)	Confirmed Nest	0	0
		Potential Nest	0	0
		Suitable Hollow	0	2
		Potentially Suitable Hollow	0	0
		No Suitable Hollow	102	366

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1 Introduction

1.1 Background

Vinci Gravel Supplies Pty Ltd (the proponent) is proposing to expand their existing gravel quarry located at Lot 9 Brookton Highway, Karragullen. Lot 9 (herein referred to as 'the site') is 48.23 hectares (ha) in size and is located within the City of Armadale (CoA) municipality, approximately 15 kilometres (km) east of Armadale town centre (**Figure 1**).

The CoA has previously granted conditional approval for Stages 1 to 4 of the gravel extraction and processing at the quarry, and the proponent is now seeking Development Approval (DA) and an Extractive Industry Licence (EIL) for a further expansion of the quarry, hereafter referred to as 'stage 5a and 5b', together with a separate vehicle compound to the south (**Figure 2**).

1.2 Purpose of report

Emerge Associates (Emerge) was engaged by the proponent to prepare an EMP to outline the environmental management procedures to be implemented by the proponent for the proposed stage 5a and 5b expansion area, as well as detailing existing commitments held by the proponent in relation to the previous Stage 1 to 4 expansion areas.

Specifically, this report:

- Identifies the existing environmental values and attributes of the site (**Section 2**)
- Discusses the proposed expansion and quarry operations (**Section 3**)
- Discusses how the proposed expanded quarry design responds to the existing environmental features and values and provides an implementation framework for environmental management procedures to comply with identified environmental objectives (**Section 5**).

1.3 Scope of report

This EMP is the primary supporting environmental document for the DA and EIL applications to facilitate consideration of relevant environmental issues associated with the proposed stage 5 quarry expansion. At the CoA's request this EMP also summarises and consolidates existing commitments from previously approved extraction stages 1 to 4 of the quarry, specifically contained in the following:

- *Site Environmental Management Plan* (Accendo Australia 2019)
- *Site Environmental Management Plan* (Accendo Australia 2017a)
- *Dust Management Plan* (Harley Dykstra 2017)
- *Phytophthora Dieback Management Plan* (Accendo Australia 2017b)
- *Acoustic Assessment* (Lloyd George Acoustics 2017).

In addition, Emerge have prepared or commissioned the following technical reports to support the DA and EIL applications for the site:

- *Detailed Flora and Vegetation Survey - Lot 9 Brookton Highway, Karragullen* (Emerge Associates 2021a) (**Appendix A**)
- *Level 1 Fauna Assessment - Lot 9 Brookton Highway, Karragullen* (Emerge Associates 2020) (**Appendix B**)
- *Targeted Black Cockatoo Habitat Assessment - Lot 9 Brookton Highway, Karragullen* (Emerge Associates 2021b) (**Appendix C)**
- Acoustic Assessment (Lloyd George Acoustics 2021) (**Appendix D**)
- Visual Impact Assessment – Lot 9 Brookton Highway, Karragullen Gravel Quarry Expansion (Emerge Associates 2021c) (**Appendix E**).

The outcomes of these site-specific investigations, as well as a comprehensive desktop review of available information on environmental conditions has provided context for the following within and adjacent to the site:

- Landforms, topography and soils
- Flora and vegetation
- Terrestrial fauna
- Surface and groundwater hydrology
- Aboriginal and non-indigenous heritage
- Historical and existing land uses within and surrounding the site
- Bushfire hazards.

1.4 Stakeholder consultation

As a component of the DA and EIL processes, the proposal will be advertised, and stakeholders will have the opportunity to comment on the proposal. The proponent will be required to provide a response to all submissions received. In addition, the proponent has held three meetings with CoA between February 2020 and March 2021, to specifically address the proposed quarry expansion. Key topics which were discussed with the CoA were related to bushfire risk management and visual impact concerns.

It was confirmed with the CoA that a separate Bushfire Management Plan or Risk Management Plan will not be required for the quarry expansion, however mitigation measures for the increased risk of bushfire ignition, such as fuel storage, would need to be addressed in the Environmental Management Plan to support the DA/EIL applications. On review of the proposed visual impact mitigation approach, the CoA raised no visual concerns for the quarry expansion given the implementation of proposed vegetative screening and rehabilitation works.

2 Statutory Context

2.1 City of Armadale development approval

Local and regional planning schemes provide guidance on what types of development and building activities require local government planning approval. Under the CoA's TPS No. 4, activities involving the extraction of raw materials are to be addressed as part of a formal DA application.

A summary of the planning approvals history for previous extraction phases within the site is provided in **Table 1**. It is noted that this EMP summarises and consolidates existing commitments from previously approved extraction stages 1 to 4 of the quarry (**Table 1**), and details new commitments for the proposed stages 5a and 5b to support the DA application.

Table 1: Planning approvals history

Extractive stage	Date of Approval	CoA Reference	Details
Stage 1	28 October 2003	A117566: PRR	DA granted for proposed extractive industry renewal subject to conditions.
Stage 2	29 July 2014	PR5514; 10.2013.355.1	DA granted for expansion of existing extractive industry (gravel quarry) subject to conditions.
Stage 3	5 April 2016	PR5514; 10.2015.379.1	DA granted for expansion of industry – extractive (gravel) subject to conditions.
Stage 4	24 May 2018	PR5514; 10.2017.154.1	DA granted for industry extractive (gravel) – stage four extraction area subject to conditions. Conditions 2 & 4 subsequently revised 26 February 2019 through State Administrative Tribunal (SAT) review (DR148/2018).

2.2 City of Armadale Extractive Industries Licence

The *City of Armadale Extractive Industries Local Law* (City of Armadale 2000) establishes the need for extractive industries to operate under a licence. The CoA has previously issued Extractive Industry Licences (EILs) for stages 2 to 4 of the existing gravel quarry, subject to specific conditions (incorporated in **Section 5** of this EMP).

The information provided in this EMP is intended to support the EIL application for the proposed stage 5 quarry expansion.

2.3 State planning policy 2.4 – basic raw materials

State Planning Policy 2.4 - Basic Raw Materials (SPP 2.4) (WAPC 2000) was prepared, in part, to assist local governments in the determination of applications for extractive industry proposals. This EMP has been prepared with regard to all the relevant considerations set out in SPP 2.4.

2.4 Environmental Protection Act 1986

2.4.1 Part IV *Environmental Protection Act 1986 (WA)*

Part IV of the EP Act provides for the consideration of proposals that could result in a significant adverse impact on the environment. The stage 5 expansion proposal will likely require referral to the Environmental Protection Authority (EPA) pursuant to Section 38 of the EP Act, on the basis that the proposal may impact on the following key environmental factors:

- Land – Flora and vegetation (the removal of intact native vegetation representative of the Yarragil Complex).
- Land – Terrestrial fauna (impacts to roosting, foraging and potential breeding habitat for the three species of threatened black cockatoo; CBC, FRTBC and BC (listed as endangered and vulnerable under the BC Act))
- Water – Inland waters (i.e. uncontrolled runoff into Stinton Creek tributary and waterway management requirements)
- People – Social surroundings (visual amenity, dust, and noise).

The proponent met with the EPA Services Unit on 9 April 2021 to discuss the proposal, specifically whether the proposal is likely to warrant referral to the EPA under Section 38 Part IV of the EP Act for a determination on whether it is a 'significant proposal'. The details discussed during this meeting included potential impacts, possible preliminary key environmental factors, stakeholder consultation, proposed management measures and possible assessment pathways, including possible level of assessment.

On review of the information provided, the EPA Services Unit did not raise any concerns with regards to the level of environmental investigations undertaken and the assessment of impacts to key environmental factors. It was considered it likely that the proposal can be adequately regulated through other state and federal environmental and planning approvals without the need for further regulation through Section 38 Part IV of the EP Act. The EPA Services Unit is interested in the outcome of the other environmental approvals including Native Vegetation Clearing Permit approval under Part V of the EP Act and approval under the EPBC Act given potential impacts on Matters of National Environmental Significance. The EPA Services Unit did not recommend that the proponent refer the proposal, particularly given that there has been no previous community interest in the existing gravel extraction activities.

2.4.2 Part V *Environmental Protection Act 1986 (WA)*

A Native Vegetation Clearing Permit pursuant to Part V of the EP Act will be sought from the Department of Water and Environmental Regulation (DWER). A clearing permit ref. CPS 8273/1 (area permit) was granted by DWER in June 2019 to facilitate the stage 4 quarry operations.

DWER regulates industrial emissions and discharges to the environment through a works approval, licensing, and registration process, under Part V of the EP Act. Industrial premises with potential to cause emissions and discharges to air, land or water are known as 'prescribed premises' and trigger regulation pursuant to the EP Act. Prescribed premises categories are outlined in Schedule 1 of the *Environmental Protection Regulations 1987*.

The relevant prescribed premise for the quarry operations is category 70 (Part 2, Schedule 1), defined as 'screening etc. of material: premises on which material extracted from the ground is screened, washed, crushed, ground, milled, sized or separated.' Category 70 applies to operations with a production or design capacity of 'more than 5,000 but less than 50,000 tonnes per year.' Should the annual extraction volumes of the proposed operations fall within this range a prescribed premises registration will be sought pursuant to Part V, Division 3 of the EP Act.

2.5 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth Government's principal environmental legislation and provides for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places, defined as 'Matters of National Environmental Significance' (MNES).

The relevant MNES which applies to this site are *'nationally threatened species and ecological communities.'* Any action that is likely to have a significant impact on listed threatened species and ecological community under the EPBC Act must be referred to the Minister and potentially undergo an environmental assessment and approval process.

The proposed stage 5a and 5b expansion of the quarry will impact on threatened black cockatoo habitat and is therefore being referred to the Department of Agriculture, Water and Environment (DAWE) pursuant to the EPBC Act. Should the proposed expansion be deemed to be a 'Controlled Action' requiring formal assessment and approval, consideration will be given to utilising the Native Vegetation Clearing Permit assessment process, as this is an 'accredited process' under the State and Commonwealth's assessment bilateral agreement.

3 Existing Environment

3.1 Climate

The climate of the site (which applies to the wider Perth region) is described as Mediterranean, with hot, dry summers and moderately wet, mild winters. An average of 1019.5 millimetres (mm) of rainfall is recorded annually from the Karragullen North weather station, which is the closest weather station, located approximately 800 m north-east of the site (BoM 2021). The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Bickley weather station, which is the nearest temperature recording station approximately 10 km north of the site, range from 15.1 °C in July to 30.5 °C in January and February, while mean minimum temperatures range from 7.3 °C in July to 15.9 °C in February (BoM 2021).

3.2 Geomorphology

3.2.1 Topography

The topography of the site slopes in a south westerly direction, with elevation ranging from approximately 349 metres Australian height datum (AHD) in the north-eastern corner to 268 m AHD in the south western corner (**Figure 3**).

3.2.2 Landform, soils, and geology

The site is located on the western side of the Darling Plateau and broad scale soil mapping places the site within the Yarragil and the Dwellingup soil associations (Churchward and McArthur 1980). The Yarragil association occurs in the western portion of the site and is described as gentle valleys with sandy gravels on the slopes and orange earths on flat swampy floors (Churchward and McArthur 1980). The Dwellingup association occurs in the eastern portion of the site and is described as a 'gently undulating landscape with duricrust on ridges; sands and gravels in shallow depressions' (Churchward and McArthur 1980).

Finer scale mapping by DPIRD (2018) shows four soil landscape units as occurring within the site, as described in **Table** 2 and shown in **Figure 4**.

Table 2: Soil landscape mapping units within the site (DPIRD 2018)

Soil landscape unit	Location within site	Description
Yarragil 1 Phase	South-western portion and small area in south eastern portion	Very gentle to moderately inclined concave sideslopes (with) moderately well drained yellow duplex soils and yellow and brown massive earths and gravels.
Yarragil 4 Phase	Small area in the central southern portion	Valley floors with some poorly drained mottled yellow duplex soils and gentle lower slopes with moderately well to well drained loamy and sandy earths, gravels and duplex soils.
Dwellingup 2 Phase	North-western and south eastern portions	Very gently to gently undulating terrain (<10%) with well drained, shallow to moderately deep gravelly brownish sands, pale brown sands and earthy sands overlying lateritic duricrust.

Table 2: Soil landscape mapping units within the site (DPIRD 2018) (continued)

Soil landscape unit	Location within site	Description
Cooke Subsystem	Eastern portion	Crests and upper slopes dominated by granite outcrop and very shallow yellow duplex soils, and yellow and brown massive earths.

Geotechnical surveys undertaken over the site to date generally found the soil conditions representative of the regional mapping with the dominant soils being brown lateritic sands containing abundant lateritic gravel throughout the profile, overlaying laterite and clays with weathered granite at depth. The surface was found to be 100 to 200mm of grey/black to brown sands which grade into the lateritic sands (Accendo Australia 2019).

Based on the location of the expansion area, the extent of the future quarry activities will suitably avoid the identified granite outcrop within the eastern portion of the site.

3.2.3 Acid sulfate soils

Acid sulfate soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state, ASS are generally present in waterlogged and/or anoxic conditions and do not present any risk to the environment. ASS can pose issues when oxidised, producing sulphuric acid, which can present a range of risks for the surrounding environment, infrastructure and human health.

The Department of Water and Environment Regulation (DWER) provides broad-scale mapping indicating areas of potential ASS risk (DWER 2021) however, the site does not fall within the extent of this mapping. ASS risk mapping does not extend over the Darling Scarp primarily due to the lack of ASS forming soil types characteristic of well drained sandy soils. The Yarragil (Yg1) and Dwellingup 2 Phase (DW2) soil units mapped as occurring within the site are free-draining sandy soils and are consequently unlikely to experience waterlogged conditions prone to forming ASS.

The tributary of the ephemeral Stinton Creek intersects with the southern portion of the site and disturbance of these seasonally waterlogged soils may present an ASS risk. However, the proposed expansion avoids the Stinton Creek tributary and will not cause any disturbance to the creek bed or its banks.

No further consideration of ASS is required as part of the management considerations for the proposed gravel quarry expansion.

3.3 Hydrology

3.3.1 Surface water

The head of a tributary of the ephemeral Stinton Creek occurs in the centre of the site (just south of the proposed stage 5 expansion area) and flows in a south-westerly direction to a dam in the central southern portion of the site (**Figure 5**). The tributary remains dry for the majority of the year. No activities associated with the gravel extraction operation have previously disturbed or are likely to disturb the bed or banks of the tributary as a result of the proposed expansion.

Two non-perennial watercourses extend into the south of the site (DWER 2018); however, these are outside of the proposed stage 5 expansion area and will not be impacted by the gravel extraction operation.

Foreshore buffers provide for the protection of riparian vegetation communities along watercourses and provide a barrier to slow down or limit the passage, via surface runoff or groundwater, of contaminants resulting from chemical or wastewater spills from potentially polluting land uses and activities. The *Operational policy 4.3: Identifying and establishing waterways foreshore areas* (DWER 2012) recommends a foreshore area width of 30 metres for waterways and 50 metres for estuaries. To prevent the disturbance to riparian vegetation a waterway 'avoidance area' has been identified to a width of 30 m either side of the Stinton Creek tributary, as shown in **Figure 5.** No machinery or support vehicles will enter the waterway 'avoidance area'. This will ensure the environmental values of local conservation and buffer areas are maintained and ensure no disturbance activities will occur within this area during the excavation activities.

3.3.2 Groundwater

Groundwater within the site is expected to be in excess of 15 m below the natural ground levels and increases in depth in an easterly direction (Accendo Australia 2019). Groundwater has not been encountered during any of the excavation activities previously undertaken within the site.

3.3.3 Wetlands

Wetlands are areas which are permanently, seasonally, or intermittently waterlogged or inundated with water. Naturally occurring wetland features are common across the Swan Coastal Plain and can contain fresh or salty water, which may be flowing or still.

The Department of Biodiversity Conservation and Attractions (DBCA) maintains the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2021) database, which categorises geomorphic wetland features into specific management categories based on their attributes and management objectives. A review of this dataset confirms that no geomorphic wetlands are mapped within the site or in close proximity to the site.

3.4 Flora and vegetation

3.4.1 Regional context

The site is contained within the 'JF1' or northern jarrah forest subregion, as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Environment Australia 2000). The subregion is characterised as *Eucalyptus marginata* (jarrah) – *Corymbia calophylla* (marri) forest on laterite gravels with Eucalyptus wandoo – marri woodlands in the eastern part (Beard 1990).

Regional vegetation complex mapping extending over the Darling Scarp undertaken by (Heddle et al. 1980) delineates the various vegetation complex types which would have occurred across the region prior to European settlement in Western Australia. Based on this mapping, two vegetation complexes have been mapped as occurring within the site, as summarised below:

- Dwellingup Complex (D2) – Open forest of E*ucalyptus marginata subsp marginata – Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones; and
- Yarragil Complex (Yg1) - Open forest of *Eucalyptus marginata subsp. marginata- Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens and E. megacarpa* on the valley floors in humid and subhumid zones.

The Dwellingup and Yarragil complexes have 82.50% and 80.95% of their pre-European extents respectively remaining (Government of Western Australia 2018), thus exceed the EPA's 30% minimum threshold for unconstrained areas of the Perth and Peel regions.

The native vegetation within the site in 'Good' or better condition is considered representative of the Dwellingup and Yarragil complexes, extending over 31.52 ha. This intact vegetation is also likely to occur within the Korung National Park and Midgegooroo National Parks which supports similar jarrah and marri bushland extending to the north and east of the site and protected through MRS 'Parks and Recreation' reserves.

3.4.2 Plant communities

A flora and vegetation assessment to the standard required of a 'detailed' survey in the Environmental Protection Authority's (EPA's) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b) was undertaken by Emerge Associates on multiple dates between May and December 2020 (Emerge Associates 2021a) (**Appendix A**). Vegetation within the site was determined to be representative of eight plant communities including cleared/planted vegetation, as described in **Table 3** and shown in **Figure 6**.

Approximately 70% of the site (33.88 ha) supports plant communities dominated by native vegetation. The remainder of the site comprises non-native vegetation, cleared areas and water bodies (14.35 ha/30% of the site).

Table 3: Description and extent of plant communities identified within the site.

Plant community	Description	Area (ha)
AeGm	Closed shrubland *Acacia ephedroides* and *Grevillea manglesii* subsp. *manglesii*	3.70
Bs	Granite outcrop comprising bare rock surfaces and bryophytes and herbland dominated by *Borya sphaerocephala*	3.02
Cd	Low shrubland *Calytrix depressa* over mixed open native herbland	0.51
CcEmBa	Open forest *Corymbia calophylla* and *Eucalyptus marginata* with *Allocasuarina fraseriana* over shrubland to tall shrubland *Banksia grandis* and *Bossiaea aquifolium* over shrubland *Xanthorrhoea preissii* over mixed native herbland *Platysace filiformis*, *Stylidium* spp. and *Scaevola* spp.	26.25
CcLl	*Corymbia calophylla* over scattered shrubs *Taxandria linearifolia* over closed sedgeland *Lepidosperma longitudinale*	0.12
LeH	Tall shrubland *Leptospermum erubescens* and *Hakea undulata* over shrubland *Xanthorrhoea preissii, Melaleuca trichophylla, Allocasuarina humilis* and *Hakea erinacea* over low shrubland *Gastrolobium villosum* over mixed open herbland *Stylidium* spp.	0.22
TlBr	Tall open shrubland *Taxandria linearifolia* over closed sedgeland *Baumea rubiginosa*	0.06
Revegetation	Planted vegetation - closed shrubland dominated by *Calothamnus quadrifidus*	1.81
Cleared and non-native	Cleared areas and predominantly scattered non-native plants including patches of non-native planted trees	12.43

3.4.3 Vegetation condition

The most intact vegetation in the site is located within plant community **Bs** which comprises granite rises with exposed rock, mosses and native shrubs and herbs. This vegetation was mapped as being in 'excellent' condition as it comprises a vegetation structure expected of granite outcrops and very low weed cover was recorded. Plant community **TlBr** was also mapped as being in 'excellent' condition as it supports an intact structure, high cover of native species and very low cover of weeds.

Plant communities **CcEmBa**, **LeH** and **Cd** in the north-eastern portion of the site comprise relatively intact native vegetation and were mapped as being in 'very good' condition. This vegetation shows some signs of disturbance such as patches of bare ground, altered structure and/or weeds but generally supports moderate to high cover of native species and low weed cover. One patch of plant community **CcEmBa** in the north-western portion of the site, and small areas of plant communities **CcLl** and **Bs** in the central southern portion of the site, were also mapped as being in 'very good' condition for the same reasons.

Most of the portion of plant community **CcEmBa** in the south-eastern portion of the site was mapped as being in 'very good – good' condition. This vegetation comprises a mosaic of small intact patches with moderately intact structure and native species diversity interspersed with small patches supporting an altered structure and reduced native understorey diversity. Parts of this plant community that were significantly altered and comprises scattered native plants only were mapped as being in 'degraded' condition.

Vegetation in the central portion of the site and southern portions of the site were mapped as being in 'good' condition as they have been subject to disturbance and comprise an altered structure with reduced native species diversity. Vegetation subject to higher levels of disturbance and with minimal native species diversity were mapped as being in 'degraded' condition.

The remainder of the site was mapped as being in 'completely degraded' condition as it mainly consists of bare ground including tracks and the current quarry, with scattered native and non-native plants. The 0.11 ha of open water and the 1.81 ha of revegetation in the site were not assigned a condition category.

The extent of vegetation by condition category is detailed in **Table 4** and shown in **Figure 7**.

Table 4: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	3.02
Very good	15.24
Good	6.99
Good – degraded	6.43
Degraded	2.19
Completely degraded	12.44

3.4.4 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate, and water availability (DAWE 2020). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

An ecological community under consideration for listing as a TEC in Western Australia, but which does not yet meet survey criteria or has not been adequately defined, or which is rare but not currently threatened, is referred to as a 'Priority Ecological Community' (PEC). Whilst PECs are not afforded statutory protection in Western Australia, they are also considered during other approval processes, such as those administered under Part IV and Part V of the EP Act.

No TECs or PECs were identified as occurring within the site.

3.4.5 Conservation significant flora

Certain flora species that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora species may be listed as 'threatened' pursuant to the EPBC Act. At a State level, plant species may also be classed as 'threatened' under the BC Act. Species which are potentially rare or threatened meet the criteria for near threatened; or have recently been removed from the threatened species list are classed as 'priority' flora species. However, priority flora species are not afforded statutory protection.

No threatened or priority flora have been recorded within the site.

3.4.6 National Parks

The Midgegooroo National Park, reserved as 'Parks and Recreation Regional' under the City of Armadale TPS No.4, is located immediately adjacent the north and east boundaries of the site (**Figure 8**).

3.4.7 Environmentally sensitive areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding values such as significant wetlands, threatened flora, threatened communities and *Bush Forever* sites. Within an ESA none of the exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply. However, exemptions under Schedule 6 of the EP Act still apply, which includes any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the EP Act).

No ESAs occur within the site.

3.4.8 *Phytophthora* dieback

Phytophthora dieback is caused by the plant pathogen, *Phytophthora cinnamomi*, which kills susceptible plants, such as banksias, jarrah and grass trees, by attacking their root systems. Dieback is a symptom of a *Phytophthora* infection and affects more than 40 per cent of the native plant species and half of the endangered ones in the south-west of Western Australia.

An initial site investigation was undertaken in November 2014 by qualified interpreter Colin Walker from Geo and Hydro Management Pty Ltd on behalf of Berry Consultants. It was concluded that stages 1, 2 and 3 were 'uninfected'. A portion of stage 4 was identified as 'suspected as infected' due to the presence of a positive soil sample result for *Phytophthora* species. A 2016 investigation reported no observed evidence of *Phytophthora* infestation within the proposed stage 4 extraction area. However, evidence symptomatic of *Phytophthora* infestation such as *Xanthorrhoea pressii* and *Banksia grandis* deaths was observed downslope of the site in a southerly direction by Accendo Australia (2017b). Soil and plant tissue samples taken from this area were analysed and returned positive results for the presence of *Phytophthora* (Accendo Australia 2017b).

A recheck of the lines established in April 2016, conducted in March 2017 consisted of a visual site assessment in combination with soil and plant tissue samples and confirmed the presence of *Phytophthora* spp in the area outlined in 2016 and recorded no further spread of the disease (Accendo Australia 2017b). No evidence of the disease occurring within the stage 4 area was recorded.

A detailed flora and vegetation assessment within the proposed stage 5 area (Emerge Associates 2021a) was undertaken in 2020 and reported no visual evidence of *Phytophthora* dieback. Prior to the commencement of the proposed stage 5 quarrying works, a pre-disturbance dieback survey shall be undertaken specifically for the stage 5 expansion area.

3.4.9 Summary of proposed stage 5 footprint

Table 5 below provides a summary of the impact footprint within the proposed expansion area, based on the flora and vegetation values present within the impact footprint and the remainder of the site.

Table 5: Extent of flora and vegetation conditions within the proposed stage 5 quarry footprint and across the remainder of the site

		Description	Clearing Footprint (ha)	Remainder of the site (ha)
Flora and Vegetation	Vegetation Condition	Pristine	0	0
		Excellent	0	3.02
		Very Good	4.54	10.57
		Good – Very Good	0.006	6.98
		Good	0.16	6.27
		Degraded	0	2.19
		Completely Degraded	1.03	11.41
	Plant Community	AeGm	0	3.70
		Bs	0	3.02
		CcEmBa	4.71	21.47
		CcLl	0	0.06
		Cd	0	0.51
		LeH	0	0.22
		TlBr	0	0.05
		Revegetation	0.007	1.80
		Cleared and Non-native	1.03	11.40
		Water	0	0.11
	Community	Threatened Ecological Community	0	0

Table 5: Extent of flora and vegetation conditions within the proposed stage 5 quarry footprint and across the remainder of the site (continued)

		Description	Clearing Footprint (ha)	Remainder of the site (ha)
		Priority Ecological Community	0	0

3.5 Terrestrial fauna

3.5.1 Fauna habitat

A fauna assessment to the standard required of a 'level 1' survey in the Environmental Protection Authority's (EPA's) *Technical Guidance – Terrestrial Fauna Surveys* (EPA 2016a) was undertaken by Emerge Associates on 27 May and 2 June 2020 (Emerge Associates 2020) (**Appendix B**). The majority of the site (70.24%) was found to support native vegetation with high fauna habitat values, including marri and jarrah forest, shrubland, granite outcrop, sedgeland and creek line as described in **Table 6**: Fauna habitats identified within the site **a**nd shown in **Figure 9**.

Table 6: Fauna habitats identified within the site

Fauna habitat classification	Description	Area (ha)
Marri and jarrah forest	Open forest *Corymbia calophylla* and *Eucalyptus marginata* over tall shrubland *Bossiaea aquifolium* and shrubland *Xanthorrhoea preissii* over assorted native shrubs and forbs.	26.29
Shrubland	Closed shrubland *Acacia oncinophylla* subsp. o*ncinophylla* (P3) and *Grevillea manglesii.*	4.44
Sedgeland	Tall open shrubland *Taxandria linearifolia* over closed sedgeland *Baumea rubiginosa*.	0.05
Granite outcrop	Granite outcrop comprising bare rock surfaces, bryophytes and herbland dominated by *Borya* sp.	3.02
Creekline	Shallow creeks running off granite outcrops through **marri and jarrah forest** and **sedgeland**.	0.08
Waterbody	Temporary or permanent waterbodies (dams) containing limited native and/or non-native (or absent) vegetation.	0.11
Revegetation	Shrubland *Calothamnus quadrifidus*, *Eucalyptus* sp. and other associated native species over non-native grassland or bare ground.	1.8
Non-native vegetation	Predominantly non-native vegetation, including *Eucalyptus botryoides* and *Eucalyptus camaldulensis* over non-native shrubs and/or bare ground with occasional native plant species.	0.15
Predominantly cleared area	Heavily disturbed areas containing primarily pasture and bare ground with isolated native and non-native trees and shrubs.	12.28

A total of 25 native and three introduced fauna species, including three species of conservation significance (Baudin's cockatoo, Carnaby's cockatoo and forest red-tailed black cockatoo), were directly or indirectly recorded during the field survey. All these fauna species are generally common and widespread in the Jarrah Forest region, including the three species of black cockatoo.

3.5.2 Conservation significant fauna

3.5.2.1 Black Cockatoos

A targeted black cockatoo assessment has been undertaken by Emerge Associates with four ecologists visiting the site multiple times between September to December 2020 to conduct the field survey (Emerge Associates 2021b) (**Appendix C**). The site occurs within the modelled distribution of all three black cockatoos and within the breeding range of Carnaby's cockatoo and forest red-tailed black cockatoo. Direct or indirect evidence of all three species was recorded in the site.

A total of 468 habitat trees have been recorded within the site, of which two contain hollows suitable for breeding by black cockatoos (**Figure 10**). The site is therefore considered to provide suitable breeding habitat for Carnaby's cockatoo and forest red-tailed black cockatoo.

No evidence of black cockatoo roosting activity was observed within the site. Potential roosting habitat that is suitable for all three species of black cockatoo occurs within the site in the form of tall native and non-native trees.

A total of 29.01 ha of foraging habitat for Carnaby's cockatoo, 26.82 ha for Baudin's cockatoo and 24.97 ha for Forest red-tailed black cockatoo were recorded within the site. Of this, 23.41 ha, 22.85 ha and 23.46 ha of the respective black cockatoo habitat is considered to possess a high value. Further extensive areas of remnant native vegetation that may provide foraging habitat for all three species of black cockatoo occur adjacent to the site within Midgegooroo National Park.

3.5.2.2 Chuditch

The chuditch was historically distributed across the majority of Australia and was known to utilise a range of habitats including woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Chuditch require adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles and small mammals) to survive. Chuditch are rarely found in habitats fragmented by clearing, except as transient animals and may utilise these areas as part of a much larger home range.

A search of *NatureMap* (DBCA 2021) does not identify any previous records of the Chuditch occurring within the site, however a number of historical records (dated pre-1997) occur within 2 km of the site within the Korung National Park to the north and a private landholding 1.5 km to the west. The species was not directly or indirectly observed during the fauna assessment (Emerge Associates 2021c).

Given the species' wide habitat preference, the remnant native vegetation within the site may provide potential habitat for the species as part of a much larger home range. A total 35.55 ha of potentially suitable habitat for the chuditch was identified within the site, comprising a suitable microhabitat of dense understory and hollow logs**.** While it is possible that chuditch may occasionally utilise the habitat within the site, it would only form part of a much larger home range, if the species occurs at all.

3.5.3 Summary of proposed stage 5 footprint

Table 7 below provides a summary of the impact footprint within the proposed stage 5 expansion area, based on the flora and vegetation values present within the impact footprint and the remainder of the site.

Table 7: Extent of fauna habitat within the proposed stage 5 quarry footprint and across the remainder of the site

		Description	Clearing Footprint (ha)	Remainder of the site (ha)
Level 1 Fauna	Fauna Habitat	Marri and Jarrah Forest	4.71	21.58
		Shrubland	0	4.44
		Sedgeland	0	0.05
		Revegetation	0.007	1.79
		Granite Outcrop	0	3.02
		Non-native Vegetation	0	0.15
		Predominantly Cleared Area	1.03	11.25
		Waterbody	0	0.11
		Creekline	0	0.08
Black Cockatoo	Carnaby's Cockatoo Foraging Habitat	High value	4.67	18.74
		Moderate value	0	0.26
		Low value	0.002	5.34
	Baudin's Cockatoo Foraging Habitat	High value	4.61	18.24
		Moderate value	0	0.30
		Low value	0.06	3.60
	Forest Red-Tailed Cockatoo Foraging Habitat	High value	4.67	18.79
		Moderate value	0	0.26
		Low value	0	1.25

Table 7: Extent of fauna habitat within the proposed stage 5 quarry footprint and across the remainder of the site (continued)

		Description	Clearing Footprint (ha)	Remainder of the site (ha)
	Black Cockatoo Breeding Trees (no.)	Confirmed Nest	0	0
		Potential Nest	0	0
		Suitable Hollow	0	2
		Potentially Suitable Hollow	0	0
		No Suitable Hollow	102	366

3.6 Heritage

3.6.1 Indigenous heritage

The Aboriginal Heritage Inquiry System (AHIS) is maintained pursuant to Section 38 of the *Aboriginal Heritage Act 1972* by the Department of Planning, Lands and Heritage, containing information on Registered Aboriginal Heritages Sites and Other Heritage Places throughout Western Australia.

In accordance with the *Aboriginal Heritage Due Diligence Guidelines* (DAA 2013), a search of the AHIS online database (DPLH 2020) was undertaken. No Registered Aboriginal Heritage Sites or Other Heritage Places have been identified within the site.

3.6.2 Non-Indigenous heritage

A desktop search of the Australian Heritage Database (Department of the Environment 2020), the State Heritage Office database (Heritage Council 2020) and the City of Armadale Local Government Inventory (City of Armadale 2020) indicated there are no registered heritage sites within or in close proximity to the site.

3.7 Bushfire hazards

The Map of Bush Fire Prone Areas published by the Office of Bushfire Risk Management (OBRM, 2019) identifies the site and surrounding area as a 'bushfire prone area.' Development within an area identified as bushfire prone is subject to consideration under the *Planning and Development Act 2005*, and in turn *State Planning Policy 3.7 – Planning in Bushfire Prone Areas (SPP 3.7)* and its Guidelines.

For the stage 5 expansion, the City of Armadale's consideration of the requirements of SPP 3.7 will be consistent with the approach taken to the Development Approval for Stage 4, as detailed in the following extract from the Council's report, namely that a Bushfire Attack Level assessment, and associate Bushfire Management Plan, are not required:

> *"State Planning Policy SPP3.7 Planning in Bushfire Prone Areas (SPP3.7) is applicable to certain development proposals in designated Bushfire Prone Areas. The intent of the policy is to "preserve life and reduce the impact of bushfire on property and infrastructure". The Part 10A Bushfire Risk Management 'deemed provisions' of TPS No.4 do not apply to this proposal because it does not include the construction or use of any habitable buildings. The proposal does not include the bulk storage of hazardous materials or result in the intensification of land use, or increase numbers of residents or employees, therefore is unlikely to result in an increase to the threat of bushfire. SPP3.7 does not specifically exempt the proposal from assessment against the criteria contained in Guidelines for Planning in Bushfire Prone Areas however it is considered that there is little practicable reason to require a BAL Assessment given the absence of habitable buildings. It is recommended however that any approval should be subject to a condition requiring all areas in use by machinery and vehicles to be maintained in a state that minimises the risk of machinery and vehicles setting fire to vegetation" (City of Armadale 2018 Council Report).*

3.8 Other land use considerations

3.8.1 Historic and existing land uses

A review of historical aerial imagery from 1965 onwards indicates the majority of the site supported relatively undisturbed native vegetation until 1974, after which gravel quarry activities began within the western portion of the site. With the exception of scattered paddock trees, the southern portion of the site was cleared circa 1974 for agricultural purposes including livestock grazing.

Several small clearing events have occurred associated with the expansion of the quarry and construction of vehicle tracks through the northern patch of remanent vegetation between 1977 and 2001. There is evidence of vegetation regrowth within the south-eastern portion of the site from 1985 to 2020, however several bare ground areas are still evident due to historical clearing.

3.8.2 Potential site contamination

A review of the DWER Contaminated Sites Database (DWER 2021b) indicates that the site is not registered as a contaminated site pursuant to the Contaminated Sites Act 2003, nor are other registered sites located nearby.

Given the historic land uses within the site, the majority of the site is unlikely to pose significant contamination risks. Additionally, given there will be no intended change in land use (and particularly the sensitivity of the land use), contamination is unlikely to be an issue which would require any specific consideration.

3.8.3 Surrounding land uses

The site is surrounded by adjacent broad acre rural landholdings zoned ‘General Rural’ and Midgegooroo National Park zoned ‘Parks and Recreation’ under the MRS and ‘Parks and Recreation Regional’ under the City of Armadale Town Planning Scheme (TPS) No. 4 to the north and east. The site is also bound to the west by Brookton Highway zoned ‘Primary Regional Road’ under the MRS and broad acre agricultural landholdings to the south. Canning Road and Stinton Creek tributary are located to the west of the site.

Approximately 14 residential dwellings are located within a 500 m radius of the stage 5 quarry expansion and an additional 30 within a 1km radius as shown in **Figure 11.** EPA Guidance Statement no. 3 *Separation Distances Between Industrial and Sensitive Land Uses* specifically addresses generic separation distances between industrial and sensitive land uses to avoid conflicts between these land uses. The generic separation distances are based on the consideration of typical emissions that may affect the amenity of nearby sensitive land uses. The guidance’s recommended buffer distance for ‘Extractive Industries - hard rock, sand, limestone’ ranges from 300 m to 1 km.

If the distance from the industrial land use to the sensitive land use is less than the generic separation distance, a scientific study based on site- and industry-specific information must be presented to demonstrate that a lesser distance will not result in unacceptable impact.

3.9 Noise impacts

Several residential dwellings are located between 300 m and 1 km from the site, with the closest dwelling located 350 m to the south-east which is considered as a sensitive land-use under the *Environmental Protection (Noise) Regulations 1997.*

The proposed stage 5 expansion has been subject to a Noise Assessment (Lloyd George Acoustics 2021) (**Appendix D**), which compares the predicted noise levels from front-end loaders, dozers, excavators, truck movements and rock breakers, against the "assigned levels" contained within the regulations.

The assessment assumes one front-end loader will be used to load product into trucks, operating from behind a 4 m high stockpile within the confines of the stage 5 quarry. It is assumed that a 4 m high quarry face will be maintained at all times and will provide a noise barrier to the houses located to the south and west. An average of 3.3 truck movements per day are expected in accordance with current quarry operations. Up to five trucks per hour could access the site between 6am and 7am.

Works generating excessive noise and rock breaking are not permitted outside the hours of 7am to 7pm or on a Sunday or Public Holiday, however the loading of materials is permissible between 6am and 7am. During this time, the excavation operation noise emissions are considered against the night time assigned noise levels.

The results of the assessment indicate noise levels associated with the operation of stage 5a and 5b are predicted to comply with the daytime assigned levels at the surrounding noise sensitive receivers. A marginal 1 dB exceedance is predicted at one receiver during night-time assigned levels (between 6am and 7am), associated with the loading of trucks.

In order to reduce noise levels to compliance under worst-case meteorological conditions, the number of trucks accessing the site for loading purposes between 6am and 7am (night-time) will be limited to no more than four trucks. No further noise mitigation measures are required to comply with the *Environmental Protection (Noise) Regulations 1997.*

3.10 Dust impacts

Dust is a generic term used to describe 'solid airborne particles generated and dispersed into the air by processes such as handling, crushing and grinding of organic or inorganic materials such as rock, ore, metal, wood or grain and stockpiling of materials and wind-blown dust' (DEC 2011).

There are several activities within the proposed stage 5a and 5b quarries that have potential to generate dust, including:

- Removal of topsoil and overburden, and stockpiling of topsoil on site (lifting onto vehicles, movement of vehicles and placement of soils in stockpiles)
- Extraction of gravel resource
- Crushing of extracted material
- Transfer/relocation of stockpiled soils
- Vehicular movement within the site on unsealed roads, as well as entering and exiting the site. It is noted that access to the site is via a sealed driveway that traverses over a right-of carriageway extending from Brookton Highway. The access way has been sealed from Brookton Highway to within 50m of the current extraction area (stage 4), thereby reducing dust associated with its operations.

Specific dust management actions for the site are detailed in **Section 5.6**.

3.11 Visual amenity

Due to the proximity of the proposed quarry expansion to existing sensitive uses, as well as sight lines from Brookton Highway, a Visual Impact Assessment (VIA) has been undertaken to support the stage 5a and 5b expansion DA and EIL applications (Emerge Associates 2021c) (**Appendix E**).

The VIA identified that the proposed quarry expansion may be visible at times by users driving along Brookton Highway in an easterly direction (depending on location), when climbing a soft ridgeline in front of the site. Due to a valley landform and the height and form of existing vegetation, the existing and proposed quarry expansion area will not be visible from the scenic Munda Biddi Cycle Track to the east of the site, Springdale Road walking trail and vehicle access track to the north-west of the site, or the majority of Canning Road within a 1 km radius to the north of the site.

The VIA considers that the existing quarry is not easily discernible within the contextual landscape and found that the existing quarry was visible at three viewpoints, with existing vegetation at the boundary of the site and within the broader area shielding most views of the quarry. The VIA concludes that the proposed stage 5a and 5b excavations would not cause a major visual impact on the landscape of this area with vegetation screening measures in place, see **Section 6.1**.

4 Stage 5 Works and Excavation Program

4.1 Overview

With the gravel resource in the stage 4 extraction area soon to be exhausted, the proponent is seeking approval to continue gravel extraction within their site. Specifically, the proposed stage 5 extraction area located adjacent to the existing approved stage 4 extraction area, together with a separate vehicle compound to the south.

The proposed stage 5 extraction area is approximately 5 ha in size and divided into stage 5a (approximately 2.82 ha) and stage 5b (approximately 2.17 ha) (**Figure 2**). It is projected that the gravel will be extracted at a rate of approximately 16,000 m³ a year (dependent on market demand) to a maximum depth of 10 m, or as determined by the depth of the gravel resource. This is consistent with the previously approved stages 1 to 4 of the existing quarry.

The proposed quarrying process and operations within the expanded gravel quarry will continue in accordance with existing operations. The following section is structured to specifically respond to the operational descriptions required by the *City of Armadale Extractive Industries Local Law* (City of Armadale 2000). Descriptions of environmental considerations and corresponding management are covered within **Sections 3 and 5** of this EMP.

4.2 Nature and duration of proposed excavation

Stage 5 works will begin at the furthest eastern extent, gradually expand the quarry in a westerly direction. Progressive rehabilitation works will occur on a yearly basis following the closure of previously extracted areas with the majority of stage 5a to be completed prior to the commencement of excavation within stage 5b. All quarrying operations will be confined within the site.

Hours of operation for the proposed expansion will remain the same, occurring between 6am to 7pm Monday to Friday. Operations permissible prior to 7.00am will be limited to the loading of no more than four trucks which can also traverse in and out of premises prior to this time, in accordance with the Acoustic Assessment, as detailed in **Section 3.9**. This includes the operation of front-end loaders, used inside the quarry to load gravel into the trucks. Operations prohibited prior to 7.00am include, but are not limited to, the operation of bulldozers, water trucks, fuel trucks and rock breaking machines.

4.3 Excavation stages and timing

The resource within stage 5a is equivalent to approximately three years of supply, and Stage 5b is equivalent to approximately two years of supply. Therefore, if there is maximum demand, quarrying could be completed within five years; however, more typical demand forecasts indicate that quarrying could continue or up to 10 years.

Following completion of quarrying in stage 5a, operations will move to stage 5b with revegetation occurring in stage 5a. The staged approach allows for the temporary retention of vegetation during the stage 5a quarrying activities for screening purposes before the quarrying moves in a westerly direction.

Quarrying in stages, moving in a westerly direction ensures that the quarry face provides a noise barrier to the houses located to the south and west of the pit. It is assumed that a quarry face of 4 m high or greater would be always maintained and the front-end loader used to load product into trucks, operates from behind a 4 m high stockpile during activities.

4.4 Extraction methods and on-site processing works

Extraction is to be undertaken on the following basis:

- Topsoil will be removed (approximately 50 mm thick) and stockpiled in windrows.
- Overburden will be removed (approximately 250-300 mm thick).
- A bulldozer will rip the gravel and then blade it into a raw material stockpile. No over-excavation will be undertaken below pit finished floor levels.
- The raw gravel material will subsequently be crushed by way of a mobile (tracked) impact crusher.
- Trucks cart material from the quarry throughout the extraction period.
- Upon completion of extraction, the quarry floor will be ripped prior to topsoil replacement. The area will be rehabilitated in accordance with this EMP.
- The approximate annual gravel removal will be 16,000 m^3 however, this will be dependent on demand.
- The removal of gravel from the quarry will include the use of a bulldozer, a rock breaker, excavators, a loader and a crusher.

4.5 Depth and extent of the existing and proposed excavation

The ultimate depth of excavation will be to a maximum of 10 m below the natural surface and batters of 1:3 (vertical:horizontal) will be maintained throughout the operation.

4.6 Depth and description of topsoil to be removed

Topsoil will consist of 50 mm depth across the extraction area.

4.7 Removal of vegetation, topsoil, and overburden

Vegetation, overburden, and topsoil will be removed in sections and stockpiled as detailed in **Section 6.3**. All stockpiles associated with the stage 5 expansion will be located within the stage 5 quarry working area, and not within other areas of the site.

4.8 Site access

Site access for vehicles (i.e. 6 x 4 trucks and semi-trucks) entering and exiting the site will continue to occur via a sealed driveway crossing over a right-of-carriageway easement extending from Brookton Highway. A maximum speed limit of 25 km per hour will be applied to all internal roads, driveways and vehicle access ways and signs in this regard displayed at the entrances to the site.

4.9 Truck usage

The number of vehicular movements (employee and truck movements) will remain the same as existing operations. An average of 3.3 truck movements between 7am and 7pm are expected in accordance with current quarry operations. Between 6am and 7am, the number of trucks accessing the site will be restricted to four trucks to achieve compliance with night-time noise levels. The maximum number of employees on site at any one time will remain the same. A small extension of the current access road may be required to gain access into the stage 5 quarry area.

4.10 Proposed structures

No structures are proposed.

4.11 Drainage conditions

Surface water protection is an important part of the management of quarries. The extraction of gravel and hard rock is a clean operation as no chemicals are used apart from machinery lubricants.

Detailed management measures for stormwater, soil and erosion control are provided in **Section 5.1**. It is anticipated that any stormwater not diverted away from the extraction area will be easily contained within the confines of the quarry excavation area and will infiltrate through the soil profile.

4.12 Specific exclusions

Given some of the issues raised during previous applications, it is important to note that the following activities will not be occurring on site:

- Mass storing of fuel. The only fuel that is stored on site comprises small amounts, no greater than three 20 Litre jerry cans at any time.
- The parking of trucks at the site. Trucks are not parked at the premises given that they are parked at the landowner's premises in Pickering Brook.
- The servicing of vehicles at the site. Only minor greasing of vehicles will occur occasionally onsite. All other vehicle maintenance and servicing will occur elsewhere.
- The undertaking of extraction activities on Sunday and Public Holidays. Operational hours have been stated above, and the operators will strictly adhere to these.
- Dewatering or blasting. No dewatering or blasting activities are proposed within the stage 5 expansion area, nor are currently undertaken as part of the existing quarry operations.

4.12.1 Clearing and disturbance exclusion areas

A waterway 'avoidance area' has been identified either side of the Stinton Creek tributary to a width of 30 m, as shown in **Figure 5.** No disturbance activities will occur within this area during the excavation activities in order to protect the natural flow of the waterway, avoid the trampling of riparian vegetation, and weed and pest encroachment.

A total 30.83 ha native vegetation will be retained and protected within the broader site (referred to as the 'Clearing Avoidance Footprint'), as shown in **Figure 13**. The extent of the clearing area will be clearly defined on the ground before any clearing activities commence to ensure there will be no inadvertent encroachment of disturbance into retained vegetation. The vegetation proposed to be retained comprises native vegetation with high fauna habitat values suitable for a number of conservation significant fauna including the three species of black cockatoo and the chuditch, and includes:

- A total 366 black cockatoo habitat trees, two with suitable breeding hollows.
- At least 24.34 ha of Carnaby's cockatoo (CC) foraging habitat, 22.14 ha of Baudin's cockatoo (BC) foraging habitat and 20.30 ha of Forest red-tailed black cockatoo (FRTBC) foraging habitat will be retained within the broader site. Both BC and CC are listed as 'Endangered' under the EPBC Act, whilst the FRTBC is listed as 'vulnerable'.
- A total 26.18 ha of good quality consolidated habitat for the Chuditch, listed as 'Vulnerable' under the EPBC Act, will be retained within the broader site, contiguous with the similar jarrah/marri forest habitat within protected conservation reserves Korung National Park and Midgegooroo National Park to the north and east.

5 Environmental Management

The following section provides a summary of the potential environmental issues that may be encountered during the proposed extraction activities and the corresponding management strategies to minimise impacts. The management measures are consistent with existing commitments from the previously approved stages 1 to 4 of the quarry and included revegetation commitments for the proposed stage 5 expansion.

The environmental impacts associated with the project and the management measures to be implemented at the site are summarised in **Section 9**, and addressed individually in the sections below.

5.1 Stormwater, soil, and erosion

5.1.1 Objective

To control the severity and extent of soil erosion and pollutant transport during the construction and operational phases of the gravel quarry. To maintain the quantity of surface water so that adjacent environmental values, including the Stinton Creek are protected.

The site is elevated and is well drained with good potential for surface water management. There is an ephemeral watercourse (Stinton Creek) located approximately 400 m south of the existing and proposed operations which will not be directly impacted by the quarry activities. On this basis, erosion and sedimentation is not expected to be a significant issue for the site.

5.1.2 Target

No uncontrolled discharge of water from the extraction area that results in erosion or sedimentation into the Stinton Creek or areas of retained vegetation.

5.1.3 Management actions

Table 8: Management actions for stormwater, soil and erosion control

Parameter	No.	Action	Timing
Stormwater	S1	Construct diversion banks and contour drains upslope of disturbed areas to allow clean surface water to return to the Stinton Creek and other natural watercourses.	Prior to clearing and excavation.
	S2	Construct catch drains to capture runoff from disturbed areas and direct into the quarry area to enable infiltration.	Prior to clearing and excavation.
	S3	Construct drainage works to mimic natural drainage patterns.	Prior to clearing and excavation.
	S4	Drains will discharge clean stormwater into vegetated natural drainage lines.	At all times
	S5	No machinery or support vehicles will enter the waterway 'avoidance area' either side of the Stinton Creek tributary to a width of 30 m and no clearing of this vegetation will be permitted, as shown in **Figure 5.** Ensure no disturbance activities will occur within the waterway buffer area during the excavation activities.	At all times.

Table 8: Management actions for stormwater, soil and erosion control (continued)

Parameter	No.	Action	Timing
Erosion control	S6	Use existing access tracks or roads wherever possible rather than creating new ones.	At all times.
	S7	Clearing will only be undertaken as required for quarrying operations and will not be conducted in adverse and extreme weather conditions (e.g. excessive windy and dry conditions);	Evaluate prior to clearing
	S8	Stabilise disturbed land as soon as possible and no later than the winter wet season, to minimise erosion.	After quarry completion
	S9	Level or gently sloping areas will be selected as stockpile sites to minimise erosion and potential soil loss.	During topsoil removal
	S10	Appropriate sediment controls will be installed upslope of stockpiles to divert water around and downslope of the stockpiles to prevent soil loss.	Prior to clearing and excavation.
	S11	Provide adequate erosion control structures on sloping ground such as spur drains or contour banks at suitable intervals.	Prior to clearing and excavation.

5.2 Native vegetation

5.2.1 Objective

To protect native flora and vegetation as far as practicable so that biological diversity and ecological integrity are maintained within and adjacent to the site.

5.2.2 Target

Clearing of native vegetation within the site is limited to the access road extension and proposed stage 5a and 5b extraction area.

5.2.3 Management actions

Table 9: Management actions for native vegetation management

Parameter	No.	Action	Timing
Native vegetation	V1	Native vegetation to be retained will be visibly delineated on site according to the clearing avoidance areas as shown on **Figure 13**. No clearing of this vegetation is permitted.	During clearing activities
	V2	Clearing of native vegetation within the excavation area will occur progressively associated with extraction stages and rehabilitated in accordance with the Rehabilitation and Decommissioning Programme (**Section 6**).	During clearing activities

5.3 Weeds and *Phytophthora* dieback

5.3.1 Objective

To prevent spread of weed species and *Phytophthora* dieback within the site. The implementation of measures to limit or control weed infestation and pathogen spread is necessary to protect the surrounding vegetated areas within the site and the adjacent Midgegooroo National Park.

5.3.2 Target

Controlled management of weeds, particularly those listed as a Weed of National Significance (WoNS), and *Phytophthora* dieback within the site and enhanced outcomes from the proposed rehabilitation works. No weed or disease encroachment into the native vegetation proposed to be retained within the 'clearing avoidance footprint', including the Stinton Creek tributary 30 m buffer area. Ensure no disturbance activities occur within these areas during the excavation activities. Within zones 1 – 3, the target weed coverage is 10%.

5.3.3 Management actions

The primary objective of a weed control program is to prevent weed species competing with the native plants for light, nutrients and moisture. Two methods of weed control are to be utilised within the site: chemical and non-chemical.

- Chemical controls can be applied by water spraying (from small backpacks to large machinery operated systems), wiping and pasting (used in conjunction with manual cutting of woody weeds).
- Methods of nonchemical weed control include using steam, manual removal (mainly for woody weeds using either machinery or hand implements), soil scalping, soil cultivation and mulching.

Herbicides will be selected for the target species, taking into account the surrounding environment and the constraints this may present. Amongst remnant native vegetation, selective herbicides (i.e. grass or broadleaf-specific) will be favoured over general knockdown herbicides to keep off-target damage to a minimum. In consideration of the identified weed species, primarily introduced grasses and daisy species (*Asteraceae* spp.), the most suitable method for weed control is chemical spraying. It is recommended that spot spraying with a backpack spray unit is utilised to reduce impacts to non-target species. Some large woody weeds may require mechanical removal using on site machinery.

Based on the location and species of weeds present, the recommended weed treatments are detailed in **Table 10**.

Table 10: Weed control treatment

Treatment	Suggested Constituents	Target species
Glyphosate spray	2% Glyphosate including Pulse®, wetting agent and Chlorsulfuron	Broadleaf species e.g. *Sonchus oleraceus* Woody weeds e.g. *Gomphocarpus fruticosus*, *Ricinus communis*
Selective grass spray	Fusilade and approved adjuvant (e.g. Pulse®)	Grass species e.g. *Ehrharta longifolia*

While no evidence of *phytophthora* dieback infestation is currently present within the site, it has historically been present within the stage 4 extraction area and therefore could be dormant within material on the site. Prior to the commencement of the stage 5 quarrying works, a pre-disturbance dieback survey shall be undertaken. Furthermore, hygiene procedures will be adopted during excavation in stage 5a and 5b to ensure that incidence of dieback is not increased.

Specific management actions for weed and dieback control are provided in **Table 11**.

Table 11: Management actions for weed and dieback control

Parameter	No.	Action	Timing
Surface Material	W1	Assess weed and dieback potential within topsoil material prior to removal and separate topsoil for treatment or disposal if required.	Prior to and during topsoil removal
	W2	Stockpile all surface materials in the general vicinity of its origin	Surface material removal
Hygiene Measures	W3	Avoid moving surface material or fill material from weed infected areas to non-infested areas.	Surface material removal
	W4	As far as reasonable and practicable all vehicles and machinery will be cleaned of plant material, mud and soil prior to entry and exit of the site.	At all times
	W5	No soil and/or vegetation should be brought to the site apart from that to be used in rehabilitation. Those used in rehabilitation should be free from weeds and dieback.	At all times
Access	W6	Control access within the quarry area to reduce the spread of weeds and dieback, especially off-road vehicle access. This will prevent disturbance to vegetation and weed/dieback invasion.	At all times
	W7	Restrict access to areas outside the quarry operations to reduce the spread of weeds and dieback into or out of the site.	At all times
Weed Control	W8	Chemical spot-spraying is to be undertaken, as necessary, as per Table 10.	At all times
Weeds of National Significance and Priority Weeds	W9	Any identified WoNS will be given priority and removed promptly, to mitigate negative impacts on rehabilitated areas and nearby native vegetation. All WoNS have an individual strategic management plan, which will be adhered to.	At all times
Water	W10	The site will be managed to ensure water runoff is contained within the quarry and does not exit the area.	At all times
Stockpile	W11	Excavated materials that require stockpiling (topsoil and overburden) from the Stage 5 quarry area shall not be removed from the quarry. This material will be stockpiled within the vicinity of excavation and will prevent the potential spread of dieback out of the quarry.	At all times
	W12	Suspected dieback infested material, vegetation and topsoil will be contained in a separate stockpile and within the quarry boundary away from native vegetation.	At all times
Survey	W13	Pre-disturbance dieback survey shall be undertaken within the stage 5 quarry region.	Prior to stage 5 works commencing

5.4 Fauna

5.4.1 Objective

To protect terrestrial fauna so that biological diversity and ecological integrity are maintained within the native vegetation proposed to be retained and adjacent conservation areas.

5.4.2 Target

Fauna habitat disturbance within the site is limited to the access road extension and proposed stage 5 extraction area.

5.4.3 Management actions

Table 12: Management actions for local fauna

Parameter	No.	Action	Timing
Native Fauna	F1	The extraction stages with be progressively cleared and rehabilitated following completion of works to minimise impacts on native fauna.	At all times.
	F2	To minimise the risk of disturbing active bird nests, clearing is to be undertaken outside of the main bird breeding season (spring).	Prior to clearing.
	F3	A pre-disturbance fauna inspection will be undertaken 1-2 days before clearing	Prior to clearing.
	F4	As far as practical, clearing will be completed in a single direction without creating islands of vegetation, ensuring that fauna do not become trapped during works.	During clearing.
	F5	An experienced fauna specialist will be present as a fauna spotter during clearing of vegetation searching for fauna in areas to be cleared and areas just cleared to identify the presence of bird or marsupial species in trees and more common ground dwelling fauna species, such as small mammals, lizards and snakes. If encountered, these animals will be assisted to disperse to nearby vegetation, if appropriate, or translocated.	During clearing.
	F6	Fauna must not be intentionally harmed and any feeding of or contact with native fauna is not permitted.	At all times.
	F7	Any instances of native fauna mortality will be reported immediately to the Site Manager and fauna habitats identified for protection not disturbed.	As required.
	F8	Native fauna habitat to be retained which comprises high fauna habitat values suitable for a number of conservation significant fauna, including the three species of black cockatoo and the Chuditch, will be visibly delineated on site according to the clearing avoidance areas as shown on **Figure 13**. No clearing of this vegetation is permitted.	During clearing.
Pest Fauna	F9	Feral fauna species identified within the quarry or surrounding site shall be recorded, reported to the Site Manager, and control measures will be undertaken where necessary.	As required.
	F10	1.5 m high fence composed of steel star pickets with rammed in corner assemblies along the perimeter of revegetation areas. The fencing surrounding active rehabilitation areas shall be maintained and used to control herbivorous fauna (i.e. kangaroos and rabbits) entering these zones.	As required.

5.5 Bushfire

The proposed quarry expansion does not meet the SPP 3.7 definition of a 'high-risk' development. There is no threshold for what constitutes a proposal as high-risk, but decision-makers may consider the quantity of hazardous materials stored such as explosives. As part of the extraction activities, the quantities of fuel storage on site will not necessitate the requirement to obtain a Dangerous Goods Licence under the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007.* The only fuel that is currently stored on site comprises approximately three 20 Litre jerry cans

at any time. The removal of gravel from the quarry will occur through ripping by bulldozers and excavators and will not require blasting activities.

The following activities will not occur on site:

- Construction of permanent or temporary habitable buildings on site
- Mass storing of fuel
- Parking of trucks at the site
- Servicing of vehicles at the site.

Further consideration of bushfire will be required if any future building construction, that requires Development Approval, is proposed within the 'bushfire prone areas' (within the Map of Bush Fire Prone Areas, as published).

The CoA releases a Firebreak Notice on an annual basis to provide a framework for bushfire management within the municipality. The CoA can enforce this notice in accordance with Section 33 of the *Bush Fires Act 1954*. In addition, Section 33 1(b) also provides the CoA with additional power to direct landowners to undertake works to remedy conditions conducive to the outbreak or spread of bushfire.

The proponent will be required to comply with the Firebreak Notice, including the maintenance of minimum 3 m-wide perimeter firebreaks to accommodate for the width of emergency vehicles and have a minimum height clearance of 4 m to allow for the height of emergency vehicles.

5.6 Dust

5.6.1 Objective

To control the severity and extent of dust impacts off site during the construction and operational phases of the gravel quarry.

5.6.2 Target

No substantiated complaints received from the community, neighbours, other stakeholders, or regulatory authorities in relation to off-site dust impacts from the extractive operations.

5.6.3 Management actions

Table 13: Management actions for dust control

Parameter	No.	Action	Timing
Dust control	D1	Monitor weather forecasts to determine ground moisture level, wind strength (especially prevailing winds) or direction or other seasonal conditions applicable to the extractive operations.	At all times
	D2	In the event that weather conditions are unfavourable, especially in the case of adverse ground moisture level or wind strength or direction, operations will be rescheduled or ceased to minimise excessive dust emissions.	When required by unfavourable weather conditions

Table 13: Management actions for dust control (continued)

Parameter	No.	Action	Timing
	D3	A water truck (6 x 4 in size) with hydraulic water pumps is to be used to wet the access/driveways and stockpiles when hot, dry and windy conditions are anticipated to occur during operations.	When required by unfavourable weather conditions
	D4	A 25 km/hr speed limit will be applied to all internal roads, driveways and vehicle access ways, supported by appropriate signage.	At all times

5.7 Noise

5.7.1 Objective

To control the severity and extent of noise impacts off site during the construction and operational phases of the gravel quarry.

5.7.2 Target

No substantiated complaints received from the community, neighbours, other stakeholders, or regulatory authorities in relation to off-site noise impacts from the extractive operations.

5.7.3 Management actions

An acoustic report was prepared by Lloyd George Acoustics (2021) to reflect the new stage 5 extraction area. The findings of the acoustic report have confirmed that the impact of excavation in the stage 5 area will continue to comply with the relevant noise regulations, with the restrictions of truck movements in place, as outlined in **Table 14**.

The results of the assessment indicate that the night-time loading of trucks (between 6am and 7am), causes a marginal 1 dB exceedance at one receiver. Therefore, the number of truck loadings will be reduced to four trucks during this time. The acoustic report indicates that the predicted noise levels will comply with the required levels, and as such, no additional noise reducing measures are required.

Table 14: Management actions for noise

Parameter	No.	Action	Timing
Noise control	N1	Works generating excessive noise and rock breaking will not occur outside the hours of 7am to 7pm or on a Sunday or Public Holiday.	Between 7am to 7pm or on a Sunday or Public Holiday.
	N2	Prior to 7am Monday to Friday, works are limited to loading of a maximum of four trucks per hour.	Prior to 7am Monday to Friday.
	N3	The crusher and front-end loaders will operate from behind stockpiles of at least 4 m height	During excavation activities.
	N4	Rock breaker and dozer will operate behind the 4 m high pit face within the confines of the approved expansion area.	During excavation activities

Table 14: Management actions for noise (continued)

Parameter	No.	Action	Timing
	N5	Undertake regular maintenance of plant and ensuring acoustic enclosures or covers fitted to plant are used at all times.	During excavation activities as required
	N6	A limit of two items of plant will be in operation at any one time due to the number of personnel of site.	At all times.

5.8 Visual amenity

5.8.1 Objective

To reduce adverse visual impacts on the surrounding environment as low as reasonably practicable.

5.8.2 Target

Works in visually prominent places are minimised and disturbed natural areas rehabilitated to maintain the existing landscape character.

5.8.3 Management actions

The Visual Impact Assessment (Emerge Associates 2021) concluded that with the proposed vegetation screening measures, outlined in **Table 15** below, the expansion would not cause a major visual impact or alteration to the landscape of this area.

Table 15: Management actions for visual amenity

Parameter	No.	Action	Timing
Visual	V1	Retain temporary strip of vegetation over stage 5b during the stage 5a excavation activities for screening purposes.	During stage 5a extraction activities
	V2	Respread topsoil and progressively rehabilitate post-quarried areas in accordance with the Rehabilitation and Decommissioning Programme (**Section 6**), so the exposed quarries are less visually prominent.	At the completion of each quarry
	V3	Revegetate visual screening strip (Zone 1) with planting dieback resistant tubestock in a linear arrangement and undertake weed control in accordance with the Rehabilitation and Decommissioning Programme (**Section 6**) so the exposed gravel quarries are less visually prominent.	During revegetation activities
	V4	Retain of a 20 m vegetation buffer from the extraction area to the site boundary to the north to provide a physical separation barrier.	At all times.
	V5	Ensure barriers, fences and gates are compatible with the semi-rural style of the surround land areas and natural landscape.	At all times
	V6	Locate stockpiles within confines of a gravel quarry.	During excavation activities

6 Rehabilitation and Decommissioning Program

The following section is structured to provide a rehabilitation and decommissioning program in accordance with the requirements of the *City of Armadale Extractive Industries Local Law* (CoA 2000). The rehabilitation program proposed for stage 5a and 5b also takes into account previous rehabilitation commitments associated with historically approved stages of the existing quarry, as well as new revegetation commitments for the proposed expansion area.

A total 13.43 ha of native revegetation will be established within the site which will ultimately establish potential breeding and foraging habitat for a number of conservation significant fauna, including Baudin's cockatoo, Carnaby's cockatoo and forest red-tailed black cockatoo.

This incorporates the 5.01 ha of native revegetation using a mixture of tube stock and direct seeding previously conditioned under Clearing Permit 8273/1 for stage 4 of the quarry. The remaining 8.42 ha comprises additional revegetation areas (i.e. not already required as part of previous approvals), with 4.99 ha of the stage 5 expansion, and 3.43 ha across the stage 4 quarry and previously disturbed areas of the site, collectively to counterbalance the residual impact of the stage 5 expansion site.

Maintenance and monitoring will be conducted until completion criteria are met for these areas. Compliance reporting and adaptive management measures are also specified in this EMP to ensure the intended outcomes are achieved, further detailed in **Section 6.1** to **Section 9**.

Completion criteria for species diversity, species density, topsoil management and reinstatement of the site has been determined in accordance with specific advice sought and received from Tranen Revegetation Systems, a specialist revegetation contractor. All advice has been accommodated within this EMP.

6.1 Program objectives

The site is classified into post-quarrying land uses, with specific objectives for each land use. The planned post-quarrying land uses, their relevant objectives and the measurable goals for each zone to achieve the objectives are described below. The planned post-quarrying land uses, and the relevant objectives are illustrated in **Figure 12**.

6.1.1 Land use – screening (zone 1)

The objective is to reduce any visual impacts associated with the excavation area via vegetative screening. This will involve planting dieback resistant tubestock in a linear arrangement and undertaking weed control.

The completion criteria for zone 1 is as follows:

- Establish three tree rows, 5 m apart, with one tree per 10 m and three shrub rows, 5 m apart, with one shrub per 2 m
- Reduce weed cover to less than 10%.

6.1.2 Land use – native revegetation (zones 2 and 3)

Zone 2 incorporates the 4.35 ha of native revegetation previously conditioned under Clearing Permit 8273/1. The objective is to further revegetate a previously stabilised area (i.e. existing rehabilitation area) with native vegetation to create a diverse, self-sustaining vegetation community. This will include additional direct seeding with dieback resistant species and the implementation of a weed control program.

Zone 3 extends over 8.42 ha including the stage 4 quarry and previously disturbed areas of the site, which covers 3.43 ha, in addition to the revegetation of 4.99 ha encompassing the proposed stage 5a and 5b quarries. The objective is to revegetate a historically disturbed and future stabilised area with native vegetation to create a diverse, self-sustaining vegetation community. This will include direct seeding of over 15 dieback resistant species of tree, shrub and herbs and the implementation of a weed control program.

The completion criteria for zones 2 and 3 are as follows:

- A native density of approximately 0.8 plants/1m^2
- A species richness of no less than 15 species of tree, shrub and herbs
- Reduce weed cover to less than 10%.

6.2 Restoration and reinstatement of excavation site

In areas where excavation is completed, and prior to the ultimate re-forming of the area for subsequent revegetation, slopes around the perimeter of the excavation area will be re-contoured to achieve stable gradients (less than 1:4 vertical to horizontal) and the quarry floor will have at least a 1:100 fall. The post-quarried stage 5 will be recontoured to the above dimensions, this is depicted based on existing topographic contours, in **Figure 14**.

The final landform is anticipated to be a gently sloping surface created by the gravel extraction 'scalping' the existing upland topography. The floor of the excavated areas, which generally bottoms out in clayey material, will be deep ripped parallel to contours to minimise or eliminate erosion and seed loss and provide a base for native revegetation, as discussed below.

It is noted that the restoration and reinstatement of the excavation site will be undertaken progressively upon the completion of each extraction stage.

6.3 Topsoil and overburden replacement and revegetation

Topsoil is an integral part of rehabilitation as it contains organic matter and seed bank which assists in establishing vegetation when respread on disturbed areas.

Topsoil at the site will be stripped and stockpiled prior to commencing quarrying. If possible, progressive rehabilitation will be undertaken whereby topsoil will be directly replaced onto a previously excavated stage. The soils will be stripped in a dry state to preserve soil structure and stripping will be undertaken in relatively still weather conditions. Management of the topsoil will involve the following:

- Stockpiles will be located sufficiently distant from quarrying operations so that they will not be disturbed prior to being used in rehabilitation (if progressive rehabilitation is not possible).
- Topsoils should be stripped to a depth of approximately 50 mm, respread separately. In some areas, topsoil depth may differ due to the topography of the site.
- Soil stripping should be avoided during wet conditions.
- The dimensions of the topsoil stockpiles will not exceed 2 m in height. This is to prevent topsoil becoming anaerobic and deteriorating in soil structure, organic matter, nutrients, seed resource and populations of beneficial soil micro-organisms.
- All topsoil and overburden stockpiles will be located within the general vicinity of its origin, and stockpiles associated with the stage 5 expansion will remain in the stage 5 extraction footprint. This is to prevent the potential spread of weeds and *Phytophthora* dieback.

Furthermore, to maximise the reuse of valuable materials from clearing events, large logs will be salvaged from clearing areas and then utilised within rehabilitation areas to provide fauna habitat.

6.4 Revegetation details

In consideration of the post-quarried land use and the site's environmental values and distinct rehabilitation zones have been identified. These are depicted on **Figure 12** and described as follows:

- Zone 1 – Visual Screening
- Zones 2 and 3 – Native Revegetation

Revegetation activities have commenced within previously disturbed portions of the site. Informal visual investigations of rehabilitation success within these areas have indicated some vegetation has established, however the native plant percentage cover targets in most survey locations have not been met. Therefore, the rehabilitation programme will utilise infill planting and direct seeding with species from the local province at the densities required to reach the completion criteria as outlined in **Section 6.1**.

A species list for revegetation with native species is provided in **Table 16**.

A key objective of the revegetation is to re-establish black cockatoo habitat, and particularly foraging habitat within the site. Based on the species selected, it is expected that shrubs would mature (flower and fruit) and provide foraging habitat for black cockatoos within approximately three to five years, and trees would be expected to provide a foraging resource for black cockatoos from around five to seven years. Noting that these timeframes would be the initial flowering and fruiting and abundance would increase with maturity.

Table 16: Revegetation plant species list

Form	Species	
Groundcovers	*Hardenbergia comptoniana* *Kennedia coccinea* *Orthrosanthus laxus* *Dampiera linearis*	*Burchardia congesta* *Clematis pubescens* *Kennedia prostrata* *Conostylis aculeata*
Shrubs	*Allocasuarina humilis* *Calothamnus quadrifidus* *Hakea amplexicaulis* *Hakea lissocarpha* *Mirbelia dilatata* *Hakea petiolaris*	*Acacia drummondii* *Acacia huegelii* *Acacia preissiana* *Hemiandra pungens* *Hibbertia racemosa* *Acacia lateriticola* *Acacia pulchella*
Trees	*Eucalyptus patens* *Eucalyptus lane-poolei* *Eucalyptus laeliae*	*Eucalyptus wandoo* *Corymbia calophylla*

Direct seeding is a key component of the revegetation approach. This is considered acceptable and will ensure appropriate outcomes on the basis that adequate site preparation is undertaken, and the specified (and higher) seed application rates (i.e. kg/ha) are adopted.

6.4.1 Zone 1 – visual screening

It is proposed to continue to improve the vegetative screen associated with the existing stage 4, to the west of the internal haul road. Revegetation activities have previously commenced for visual screening purposes however the native plant percentage cover targets have not been met.

Where necessary, soil in this area will be ripped (excluding areas that contain native vegetation) prior to additional planting to loosen soil aggregate and provide a softer soil surface for the establishment of plant roots.

Tubestock will be used in this zone in consideration of the small planting area and layout requirements. The maximum stock size will be limited to tubestock size as larger stock is likely to require supplementary watering to ensure survival. All revegetation stock will be sourced from (preferably) local nurseries with NIASA accreditation to ensure that tubestock soil is disease free. Provenance stock will be used to revegetate this zone.

Planting will be undertaken by ripping to loosen the soil. The planting hole will be excavated vertically to accommodate the root ball of the plant, such that the top of the plant root ball finishes below the existing ground surface and creates a watering saucer suitable for the size of the plant. Seedlings will be watered before delivery to site on the day of planting to reduce the potential for transplant shock.

The planting of seedlings will occur between the months of May to July after substantial rain has saturated the soil profile. Prior to planting the seedling, any tangled roots will be loosened and good soil to plant contact will be made. Seedlings will not be staked for support as free standing plants have increased durability and strength as opposed to staked plants.

6.4.2 Zone 2 – native revegetation

Zone 2 consists of the previous stage 4 rehabilitation areas. Zone 2 will continue to be revegetated with native species via infill planting to improve the overall success.

An informal assessment was undertaken on 8 March 2021 to measure progress towards the EMP revegetation targets and quantify the requirements to meet the commitments. The assessment found some vegetation had established within zone 2 as part of previous revegetation activities, however, native stem density met the target in only two of the 20 survey points, both in the northwest of the site. Weed cover met the target in just three of 20 survey locations, two of those being the areas where the native stem density target was also met and averaged over 30% across the site.

Two revegetation methodologies will be utilised within zone 2; infill planting for areas semi established but plant density is below target, and direct seeding for areas where establishment has not met the completion criteria.

Areas where revegetation has not met the completion criteria will undergo new site preparation and seeding. Seed will be broadcast uniformly within the marked areas in overlapping passes using portable hand-held equipment to allow for complete and even seed coverage of the pre-prepared area. Seed will be mixed with a bulking agent such as vermiculite, clean sand or sawdust in a ratio of two parts bulking agent to one part seed. If deemed necessary, seed will be covered by very light

harrowing, scarifying, bagging, dragging or light raking of the seeded area as soon as practical and within the same day of seeding. Recommended sowing rates to ensure successful revegetation are based on up to 4kg of seed per hectare.

6.4.3 Zone 3 – native revegetation

Zone 3 consists of the previous stage 4 extraction area, as indicated by rehabilitation area 3C on **Figure 12** and the proposed stage 5a and 5b extraction areas, as indicated by rehabilitation area 3A and 3B on **Figure 12**. Zone 3 will be revegetated with native species via direct seeding.

Seed will be broadcast uniformly within the marked areas in overlapping passes using portable hand-held equipment to allow for complete and even seed coverage of the pre-prepared area. Seed will be mixed with a bulking agent such as vermiculite, clean sand or sawdust in a ratio of two parts bulking agent to one part seed. If deemed necessary, seed will be covered by very light harrowing, scarifying, bagging, dragging or light raking of the seeded area as soon as practical and within the same day of seeding.

Recommended sowing rates to ensure successful revegetation are based on up to 3 to 6 kg of seed per hectare.

6.5 Maintenance of rehabilitation areas

Maintenance will be undertaken following planting/seeding with all activities to be conducted in response to the maintenance inspections and monitoring (as discussed below). The key elements associated with maintenance works will include suppression of smothering weeds and infill planting. The requirement to implement revegetation maintenance and infill planting measures will be determined following each monitoring event.

To reduce the risk of mortality, watering will occur if required during the first summer after tubestock have been planted (i.e. only within zone 1). This will entail periodic watering from December to April using a mobile watering vehicle. It is expected that two watering events per month is sufficient to establish the revegetation planting, however if plants are suffering drought stress, additional water may be required. Watering will be undertaken at an approximate rate of two litres per plant.

Maintenance will continue to be undertaken as required until the criteria have been achieved or as otherwise agreed with the CoA. Following the successful completion of the revegetation program, and the submission of a final report, the CoA will, upon application from the owner, refund the bond lodged against the implementation of the EMP.

6.6 Program of works

The site has historically been revegetated via direct seeding within zone 1 and zone 2. This technique, however, has not met the completion criteria in many areas and as such, it is recommended that this be rectified with infill planting of tubestock to ensure that the completion criteria can be met. Whilst direct seeding could be reapplied in these areas, it would require extensive site preparation works, which would impact on those plants already established, and take

several years for any vegetation cover to form. Tubestock/seedling planting is likely to lead to quicker establishment in the short term and therefore has been selected as the most appropriate revegetation technique for zone 1 and zone 2. Based on an assessment undertaken on 30th July 2021, the infill planting and direct seeding required to achieve the target density has been specified for zone 1 and zone 2, as outlined in **Table 17** below. Zone 2 has been further categorised into five areas (2A – 2E), in accordance with the revegetation requirements (whether infill planting or direct seeding is required) and the density of plants/seeds needed to fulfil the specified target within **Section 6.1**.

Table 17: Revegetation schedule for zones 1 and 2

Revegetation area	Method of revegetation	Infill density required (plants/m²)	Seed @ 4 kg/ha (kg)	Comments
Zone 1	Infill planting	381	N/A	Very few plants have established so this area will be replanted at 100% of the target density, with the screening lines reinstated
Zone 2A		1,096	N/A	Some established plants but density below target
Zone 2B		2,040	N/A	
Zone 2C		6,154	N/A	
Zone 2D		3,282	N/A	
Zone 2E	Direct seeding	N/A	1.76	Recontour and seed rather than infill plant. This is because preparatory earthworks in this area would not result in many plant losses due to very low establishment densities

The ongoing and proposed maintenance schedule for decommissioned pre-disturbed portions of the site, incorporating zone 1 and zone 2 is provided in **Table 18**. The timing provided is indicative only as the specified actions will be undertaken at times appropriate to the activity and conditions (i.e. soil conditions, weather, growth of weeds).

Table 18: Maintenance schedule for zone 1 and zone 2

Timing	Action	Purpose/Frequency
Site preparation		
2021 September – November	Herbicide application	To target spring weeds before seeds set.
2021 September – November	Woody weed removal	Are to be initially treated with herbicide. Some may require mechanical removal using onsite machinery. Undertaken on an as needs basis between the specified months, and prior to planting or seeding in weed affected areas
2021	Fence installation – 1.2 m star picket ringlock	Upon completion of quarry activities. Post quarry closure

Table 18: Maintenance schedule for zone 1 and zone 2 (continued)

Timing	Action	Purpose/Frequency
2021/2022 December – February	Order seeds on species list for zone 2E Order local endemic plants on species list for zone 1 and zone 2A – 2D	In preparation of infill/seeding
2021/2022 December – February	Herbicide application	To target late summer weeds
2021/2022	Plastic tree guard removal and disposal	Prior to ripping and re-contouring
2022 March – May	Herbicide application	To target new autumn weeds
Revegetation		
2022 March – May	Ripping and re-contouring	Prior to planting
2022 April – June	Seed pre-treatment and batching Seed hand broadcasting (zone 2E) Tree guard supply and installation in zone 2B	Prior to direct seeding and may include aerosol smoke treatment, mechanical scarification and hot water treatment, depending on species Hand broadcasting ensures even dispersal of all seed types Once seedlings have been established, to reduce potential loss from herbivory fauna, and foot and vehicle traffic
2022 June – August	Tubestock installation (zone 1 and zone 2A – 2D)	
2022 September – November March – May	Visual inspection of plant numbers and species (infill). Monitoring for weed invasion, seedling survival, plant pests and other factors affecting seedling survival (seed)	Every two years.
2022 September – November	Herbicide application	To target spring weeds before seeds set.
2022/2023 December – February	Herbicide application	To target late summer weeds.
2022/2023 December – April	Watering seedlings during the first summer	Every second week at an approximate rate of two litres per plant.
2023 March – May	Herbicide application	To target new autumn weeds.
2023 June – August	Infill planting – 30% required density Infill tree guards – 30% in zone 2B	Once seedlings have been established, tree guards to be established to reduce potential loss from herbivory fauna, and foot and vehicle traffic
2023 September – November	Herbicide application	To target spring weeds before seeds set.
2023/2024 December – February	Herbicide application	To target late summer weeds.

Table 18: Maintenance schedule for zone 1 and zone 2 (continued)

Timing	Action	Purpose/Frequency
2024 March – May	Tree guard removal year 1 infill Herbicide application	To target new autumn weeds.
2024 June – August	Infill planting – 15% required density (no guards required for zone 2B)	N/A

The proposed program of works for rehabilitation areas 3A and 3B within zone 3, which specifically relates to the stage 5 quarry, has been provided in **Table 19**. To reach the native vegetation density of 0.8 plants/m^2, 19.98 kg seeds at 4 kg/ha are required to be dispersed across the area. Since the stage 5 quarry will be rehabilitated progressively following the closure of pits, the dates provided are indicative based on the demand for gravel resource.

Table 19: Rehabilitation of 3A and 3B within zone 3 (indicative timeframes only based on the progressive revegetation of the pit)

Timing	Action	Purpose/Frequency
Site preparation		
March – May	Herbicide application pre-planting	To target new autumn weeds
March – May or post quarry closure.	Fence installation	Upon completion of quarry activities
December – February	Order seeds on species list for zone 3	
Revegetation		
March – May	Seed pre-treatment and batching Ripping and re-contouring	Prior to direct seeding and may include aerosol smoke treatment, mechanical scarification and hot water treatment, depending on species Prior to planting
April – June	Seed hand broadcasting	Hand broadcasting ensures even dispersal of all seed types
Maintenance		
September – November March – May	Monitoring for weed invasion, seedling survival, plant pests and other factors affecting seedling survival	Every two years
September – November	Herbicide application	To target spring weeds before seeds set
December – April	Watering seedlings during the first summer	Every second week at an approximate rate of two litres per plant
December – February	Herbicide application	To target late summer weeds.
March – May	Herbicide application	To target new autumn weeds.
June – August	Infill planting – 30% required density	N/A
September – November	Herbicide application	To target spring weeds before seeds set.
December – February	Herbicide application	To target late summer weeds.

Table 19: Rehabilitation of 3A and 3B within zone 3 (indicative timeframes only based on the progressive revegetation of the pit) (continued)

Timing	Action	Purpose/Frequency
March – May	Herbicide application	To target new autumn weeds.
June – August	Infill planting – 15% required density	N/A

The proposed program of works for rehabilitating area 3C within zone 3, which specifically relates to the historical stage 4 quarry, has been provided in **Table 20**. To reach the native vegetation density of 0.8 plants/m^2, 15.92 kg seeds at 4 kg/ha are required to be dispersed across the area. Since the stage 4 quarry will be rehabilitated upon the completion of gravel extraction, and prior to the commencement of extraction within stage 5a, dates provided are indicative.

Table 20: Rehabilitation of 3C within zone 3 (indicative timeframes only based on the progressive revegetation of the pit

Timing	Action	Purpose/Frequency
Site preparation		
March – May	Herbicide application pre-planting	To target new autumn weeds
March – May or post quarry closure.	Fence installation	Upon completion of quarry activities
December – February	Order seeds on species list for zone 3	
Revegetation		
March – May	Seed pre-treatment and batching Ripping and re-contouring	Prior to direct seeding and may include aerosol smoke treatment, mechanical scarification and hot water treatment, depending on species Prior to planting
April – June	Seed hand broadcasting	Hand broadcasting ensures even dispersal of all seed types
Maintenance		
September – November March – May	Monitoring for weed invasion, seedling survival, plant pests and other factors affecting seedling survival	Every two years
September – November	Herbicide application	To target spring weeds before seeds set
December – April	Watering seedlings during the first summer	Every second week at an approximate rate of two litres per plant
December – February	Herbicide application	To target late summer weeds.
March – May	Herbicide application	To target new autumn weeds.
June – August	Infill planting – 30% required density	N/A
September – November	Herbicide application	To target spring weeds before seeds set.
December – February	Herbicide application	To target late summer weeds.
March – May	Herbicide application	To target new autumn weeds.
June – August	Infill planting – 15% required density	N/A

6.7 Monitoring and reporting

A program of monitoring of the revegetation works is required to ensure that the objectives are achieved.

Two maintenance inspections will be undertaken each year during the key growth periods of spring and autumn by the proponent to determine the requirement for maintenance measures. Maintenance reports will outline the current status of the revegetation program and establish trends with respect to previous assessments, as well as determine whether remedial actions such as weed control and infill planting are required to meet the completion criteria.

Formal monitoring for native species establishment, invasive species, and erosion will be undertaken in spring, every two years, by a qualified botanist. The frequency of formal monitoring has been developed in consideration of the variable germination rates between species and the typically long establishment times associated with direct seeding. Given that half-yearly maintenance inspections will be undertaken to determine the requirement for maintenance measures (i.e. weed management), the formal monitoring schedule is considered suitable.

Formal monitoring within zone 1 will involve a visual inspection of plant numbers and species within each row. This will include specific counts and percentage cover of native species, and a list of weed species with estimates of percentage cover.

Formal monitoring for zones 2 and 3 will involve an assessment of randomly selected quadrats within both zones. This will include photo monitoring points at each quadrat. The dimensions of the monitoring quadrats will be approximately five metres by five metres and will be pegged on each corner. An average of the revegetation success will be determined based on the results from the monitoring quadrats. The following characteristics will be assessed:

- Stem density and health
- Weed cover
- Plant pests
- Herbivory
- Other factors affecting seedling survival, such as water stress and disease
- Species richness.

A report will be prepared on the results from each formal monitoring event, addressing the criteria provided above. A copy will be provided to the CoA by way of reporting on the success of the program by 29th July each year, with the reporting period being from 30th June to 1st July the following year.

Whilst weed suppression will primarily be required in those areas that have been disturbed, as these have a greater susceptibility to weed invasion compared to those areas with intact vegetation, weed monitoring shall extend to the wider regions of the site. This will involve annual visual inspections to monitor the presence and introduction of weeds beyond each of the zones. On the identification of weed invasion, weeds will either be removed, buried or sprayed with herbicide. Weeds identified as a Weed of National Significance or a declared and priority weed will take precedence and will be promptly removed from site.

Audit reports will continue to be submitted to the City of Armadale by 29th July each year to illustrate the applicant's compliance with the relevant criteria. This currently includes the following for zone 1, zone 2 and zone 3 (rehabilitation area 3C):

- Emissions, discharges and wastes associated with the extraction of gravel
- Dust emissions
- Noise emissions
- Groundwater separation
- Potential contamination of the surrounding environment
- Management of complaints
- Rehabilitation of disturbed areas

Zone 3 incorporates all future rehabilitative work, specifically the historically disturbed stage 4 (rehabilitation area 3C) and the proposed stage 5 quarry (rehabilitation areas 3A and 3B), as illustrated in **Figure 12**. Historically, it was the objective of the applicant to return the stage 4 gravel extraction land to a condition capable of supporting agricultural activities, using a variety of dryland pasture species. It is now the intent to revegetate the land with native species. Future audit reports shall include the audit and monitoring results within zone 3. The purpose of the audit report is to assess conformance with the EMP.

6.8 Management actions

Table 21: Management actions for revegetation

Parameter	No.	Action	Timing
Landform	R1	All slopes will be contoured to achieve a maximum slope of 1:4 vertical to horizontal.	Prior to revegetation
	R2	Deep rip (approximately 0.5 m) on contours to reduce erosion, reduce flow velocities, promote water capture/infiltration, and promote soil binding. Carry out shallow ripping as required.	Prior to revegetation
	R3	Stockpiled topsoil will be re-spread to create a land surface that is safe and stable.	Prior to revegetation
Revegetation	R4	Undertake revegetation within each zone as per **Section 6.4**.	During revegetation activities
Maintenance	R5	Undertake maintenance measures as per **Section 6.5**.	During revegetation activities
Monitoring	R6	Monitoring and reporting work are required to ensure that the revegetation objectives are achieved. Undertake monitoring as per **Section 6.7**.	Refer to **Section 6.7**.

7 Quarry closure

The proposed rehabilitation and decommissioning commitments are outlined within **Table 22**.

Table 22: Rehabilitation and decommissioning commitments

Task	Description	Frequency and duration
Rehabilitation monitoring	Assessment of success of rehabilitation areas and identification of additional works required to progress site towards completion criteria.	Formal monitoring undertaken in spring, every two years.
Decommissioning of infrastructure	Removal of non-natural infrastructure.	Upon completion of site rehabilitation.
Weed control	Chemical weed spraying, mechanical removal of large weeds as necessary.	To be identified during rehabilitation monitoring
General maintenance	Fence maintenance, rubbish removal, infill planting.	As required.

The closure planning will be updated on an as needs basis as the excavation progresses towards completion. This will include anticipated costs and procedures.

Table 23 provides the methods to be used to achieve the closure and rehabilitation objectives. The following procedures will be used for final closure and rehabilitation of the quarry.

- The closure of completed areas of the operations will be progressive with closure of all remaining ground at the end of operations.
- Maintenance and monitoring will be conducted until completion criteria are met (refer to **Section 6.5**).
- Unexpected or early closure will be completed in the same way as permanent closure.

Table 23: Closure measures

Closure objective	Completion criteria	Measurement tool	Performance indicator	Remediation
All non-natural structures will be removed.	Non-natural materials associated with quarrying will be removed. All hardstands and roads will be removed.	Visual audit of site.	No non-natural structures will be retained on site.	Remove any non-natural materials.
All wastes will be removed from site.	No waste material on site	Visual audit of site.	No waste material on site.	Remove any non-natural materials.
Provide a safe and stable landform	All slopes will be contoured to achieve a maximum slope of 1:4 vertical to horizontal.	Feature survey of the site.	Feature survey confirms gradients within rehabilitated areas.	Undertake further earthworks to create a safe and stable landform.
The land surface and soils are to be capable of supporting native vegetation.	Soil properties and the landform will be appropriate for the future land use.	Formal monitoring as per **Section 6.7**.	Visually observe the land surface and compliance with completion criteria (refer to **Section 6.1**).	Undertake further earthworks to provide the required land surface.

Table 23: Closure measures (continued)

Closure objective	Completion criteria	Measurement tool	Performance indicator	Remediation
Soils and landforms exhibit erosion rates consistent with surrounding areas and do not compromise post-mining land uses.	No active gully erosion or sedimentation.	Visual audit of the site.	Stable soils and landforms.	Undertake additional drainage works to control erosion.

8 Implementation

8.1 Roles and responsibilities

Key roles and responsibilities for the implementation of this EMP are presented in **Table 24.** These will be clearly communicated to personnel via site induction. It is essential that all personnel associated with the quarrying comply with the requirements of applicable environmental legislation, regulations and standards.

Table 24: Roles and responsibilities for EMP implementation

Roles	Responsibilities
Site Manager	• Ensure that all personnel are inducted in the requirements of this EMP, and the system used for reporting of environmental incidents. • In the event of a non-compliance, take corrective action to prevent repeat offences. • Ensure that the site remains tidy and safe for personnel.
All personnel (including subcontractors)	• Attend environmental induction or any other training as required. • Report all environmental non-compliances or risks as they occur to the Site Manager.

8.2 Inspections and reporting

8.2.1 Induction records

All personnel will be provided with a site induction covering the requirements of this EMP prior to commencing work on the site. Records of site induction training attendance will be kept on-site.

8.2.2 Inspections

The Site Manager will undertake regular inspections to ensure management measures contained in this EMP are being followed. All non-compliances during inspections will be documented and details provided to the CoA regarding how these were handled.

8.2.3 Compliance register and consultation

The Site Manager is responsible for dealing with any complaints received by the community, neighbours, other stakeholders or regulatory authorities in relation to the extractive operations. The Site Manager will also be responsible for informing neighbours or other relevant parties of clearing, overburden removal or crushing operations as planned to minimise any complaints which are specifically related to dust emissions.

A compliance register should be established, and appropriate consultation should be undertaken with the relevant parties immediately to address their concerns in relation to reducing dust emissions associated with the operations.

9 Summary of Management Actions

Table 25 below provides a summary of the management commitments to be implemented by Vinci Gravel Supplies Pty Ltd in order to reduce the impact of quarrying activities on the environment. The following actions outline how environmental impacts will be avoided, minimised, and managed. The items within Table 25 will also provide the audit template/framework for annual compliance reports.

Table 25: Summary of Management Commitments

Parameter	No.	Action	Timing
Stormwater and erosion			
Stormwater	S1	Construct diversion banks and contour drains upslope of disturbed areas to allow clean surface water to return to the Stinton Creek and other natural watercourses.	Prior to clearing and excavation.
	S2	Construct catch drains to capture runoff from disturbed areas and direct into the quarry area to enable infiltration.	Prior to clearing and excavation.
	S3	Construct drainage works to mimic natural drainage patterns.	Prior to clearing and excavation.
	S4	Drains will discharge clean stormwater into vegetated natural drainage lines.	At all times
	S5	No machinery or support vehicles will enter the waterway 'avoidance area' either side of the Stinton Creek tributary to a width of 30 m and no clearing of this vegetation will be permitted, as shown in **Figure 5.** Ensure no disturbance activities will occur within the waterway buffer area during the excavation activities.	At all times.
Erosion control	S6	Use existing access tracks or roads wherever possible rather than creating new ones.	At all times.
	S7	Clearing will only be undertaken as required for quarry operations and will not be conducted in adverse and extreme weather conditions (e.g. excessive windy and dry conditions).	Evaluate prior to clearing
	S8	Stabilise disturbed land as soon as possible and no later than the winter wet season, to minimise erosion.	After pit completion
	S9	Level or gently sloping areas will be selected as stockpile sites to minimise erosion and potential soil loss.	During topsoil removal
	S10	Appropriate sediment controls will be installed upslope of stockpiles to divert water around and downslope of the stockpiles to prevent soil loss.	Prior to clearing and excavation.

Table 25: Summary of Management Commitments (continued)

Parameter	No.	Action	Timing
	S11	Provide adequate erosion control structures on sloping ground such as spur drains or contour banks at suitable intervals.	Prior to clearing and excavation.
Native vegetation			
Native vegetation	V1	Native vegetation to be retained will be visibly delineated on site according to the clearing avoidance areas as shown on **Figure 13**. No clearing of this vegetation is permitted.	During clearing activities
	V2	Clearing of native vegetation within the excavation area will occur progressively associated with extraction stages and rehabilitated in accordance with the Rehabilitation and Decommissioning Programme (**Section 6**).	During clearing activities
Weed and dieback			
Surface material	W1	Assess weed and dieback potential within topsoil material prior to removal and separate topsoil for treatment or disposal if required.	Prior to and during topsoil removal
	W2	Stockpile all surface materials in the general vicinity of its origin.	Surface material removal
Hygiene measures	W3	Avoid moving surface material or fill material from weed infected areas to non-infested areas.	Surface material removal
	W4	As far as reasonable and practicable all vehicles and machinery will be cleaned of plant material, mud and soil prior to entry and exit of the site.	At all times
	W5	No soil and/or vegetation should be brought to the site apart from that to be used in rehabilitation. Those used in rehabilitation should be free from weeds and dieback.	At all times
Access	W6	Control access within the quarry area to reduce the spread of weeds and dieback, especially off-road vehicle access. This will prevent disturbance to vegetation and weed/dieback invasion.	At all times
	W7	Restrict access to areas outside the quarry operations to reduce the spread of weeds and dieback into or out of the site.	At all times
Weed Control	W8	Chemical spot-spraying is to be undertaken, as necessary, as per Table 10.	At all times
Weeds of National Significance and Priority Weeds	W9	Any identified WoNS will be given priority and removed promptly, to mitigate negative impacts on rehabilitated areas and nearby native vegetation. All WoNS have an individual strategic management plan, which will be adhered to.	At all times
Water	W10	The site will be managed to ensure water runoff is contained within the quarry and does not exit the area.	At all times

Table 25: Summary of Management Commitments (continued)

Parameter	No.	Action	Timing
Stockpile	W11	Excavated materials that require stockpiling (topsoil and overburden) from the Stage 5 quarry area shall not be removed from the quarry. This material will be stockpiled within the vicinity of excavation and will prevent the potential spread of dieback out of the quarry.	At all times
	W12	Suspected dieback infested material, vegetation and topsoil will be contained in a separate stockpile and within the quarry boundary away from native vegetation.	At all times
Survey	W13	Pre-disturbance dieback survey shall be undertaken within the stage 5 quarry region.	Prior to stage 5 works commencing
Fauna			
Native Fauna	F1	The extraction stages with be progressively cleared and rehabilitated following completion of works to minimise impacts on native fauna.	At all times
	F2	To minimise the risk of disturbing active bird nests, clearing is to be undertaken outside of the main bird breeding season (spring)	Prior to clearing
	F3	A pre-disturbance fauna inspection will be undertaken 1-2 days before clearing.	Prior to clearing
	F4	As far as practical, clearing will be completed in a single direction without creating islands of vegetation, ensuring that fauna do not become trapped during works.	During clearing
	F5	An experienced fauna specialist will be present as a fauna spotter during clearing of vegetation searching for fauna in areas to be cleared and areas just cleared to identify the presence of bird or marsupial species in trees and more common ground dwelling fauna species, such as small mammals, lizards and snakes. If encountered, these animals will be assisted to disperse to nearby vegetation, if appropriate, or translocated.	During clearing
	F6	Fauna must not be intentionally harmed and any feeding of or contact with native fauna is not permitted.	At all times
	F7	Any instances of native fauna mortality will be reported immediately to the Site Manager and fauna habitats identified for protection not disturbed.	As required
	F8	Native fauna habitat to be retained which comprises high fauna habitat values suitable for a number of conservation significant fauna, including the three species of black cockatoo and the Chuditch, will be visibly delineated on site according to the clearing avoidance areas as shown on **Figure 13**. No clearing of this vegetation is permitted.	During clearing

Table 25: Summary of Management Commitments (continued)

Parameter	No.	Action	Timing
Pest Fauna	F9	Feral fauna species identified within the quarry or surrounding site shall be recorded, reported to the Site Manager, and control measures will be undertaken where necessary.	As required
	F10	1.5 m high fence composed of steel star pickets with rammed in corner assemblies along the perimeter of revegetation areas. The fencing surrounding active rehabilitation areas shall be maintained and used to control herbivorous fauna (i.e. kangaroos and rabbits) entering these zones.	As required
Dust			
Dust control	D1	Monitor weather forecasts to determine ground moisture level, wind strength (especially prevailing winds) or direction or other seasonal conditions applicable to the extractive operations.	At all times
	D2	In the event that weather conditions are unfavourable, especially in the case of adverse ground moisture level or wind strength or direction, operations will be rescheduled or ceased to minimise excessive dust emissions.	When required by unfavourable weather conditions
	D3	A water truck (6 x 4 in size) with hydraulic water pumps is to be used to wet the access/driveways and stockpiles when hot, dry and windy conditions are anticipated to occur during operations.	When required by unfavourable weather conditions
	D4	A 25 km/hr speed limit will be applied to all internal roads, driveways and vehicle access ways, supported by appropriate signage.	At all times
Noise			
Noise Control	N1	Works generating excessive noise and rock breaking will not occur outside the hours of 7am to 7pm or on a Sunday or Public Holiday.	Between 7am to 7pm or on a Sunday or Public Holiday
	N2	Prior to 7am from Monday to Friday, works are limited to loading of a maximum of four trucks per hour.	Prior to 7am from Monday to Friday
	N3	The crusher and front-end loader will operate from behind stockpiles of at least 4 m height	During excavation activities
	N4	Rock breaker and dozer will operate behind the 4 m high pit face within the confines of the approved expansion area.	During excavation activities
	N5	Undertake regular maintenance of plant and ensuring acoustic enclosures or covers fitted to plant are used at all times.	As required
	N6	A limit of two items of plant will be in operation at any one time due to the number of personnel of site.	At all times

Table 25: Summary of Management Commitments (continued)

Parameter	No.	Action	Timing
Visual amenity			
Visual impacts	V1	Retain temporary strip of vegetation over stage 5b during the stage 5a excavation activities for screening purposes.	During stage 5a extraction activities
	V2	Respread topsoil and progressively rehabilitate post-quarried areas in accordance with the Rehabilitation and Decommissioning Programme (**Section 6**), so the exposed gravel pits are less visually prominent.	Rehabilitation activities
	V3	Revegetate visual screening strip (Zone 1) with planting dieback resistant tubestock in a linear arrangement and undertake weed control in accordance with the Rehabilitation and Decommissioning Programme (**Section 6**).	Rehabilitation activities
	V4	Retain of a 20 m vegetation buffer from the extraction area to the site boundary to the north to provide a physical separation barrier.	At all times
	V5	Ensure barriers, fences and gates are compatible with the semi-rural style of the surround land areas and natural landscape	At all times
	V6	Locate stockpiles within confines of gravel quarry.	During excavation activities
Revegetation			
Landform	R1	All slopes will be contoured to achieve a maximum slope of 1:4 vertical to horizontal.	Prior to revegetation
	R2	Deep rip (approximately 0.5 m) on contours to reduce erosion, reduce flow velocities, promote water capture/infiltration, and promote soil binding. Carry out shallow ripping as required.	Prior to revegetation
	R3	Stockpiled topsoil will be re-spread to create a land surface that is safe and stable.	During excavation activities
Revegetation	R4	Undertake revegetation within each zone as per **Section 6.4**.	During excavation activities
Maintenance	R5	Undertake maintenance measures as per **Section 6.5**.	During excavation activities
Monitoring	R6	Monitoring and reporting work are required to ensure that the revegetation objectives are achieved. Undertake monitoring as per **Section 6.7**.	Refer to **Section 6.7**.

10 References

10.1 General references

Accendo Australia 2017a, *Environmental Management Plan Stage 4 - Lot 9 Brookton Hwy, Karragullen*, 1708_Lot 9 Brookton Hwy EMP, Version 5.

Accendo Australia 2017b, *Phytophthora Dieback Management Plan: Stage 4 - Lot 9 Brookton Highway, Karragullen*, 1723_Lot 9 Brookton Hwy DMP, Version 2.

Accendo Australia 2019, *Site Environmental Management Plan - Lot 9 Brookton Highway, Karragullen*, 1826_Lot 9 Brookton Hwy Site EMP, Version 6.

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Figures

Figure 1: Site Locality

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F49

Drawn:	AFF
Date:	25/02/2021
Checked:	JMM
Approved:	JMM
Date:	5/03/2021

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Metres

Scale: 1:8,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

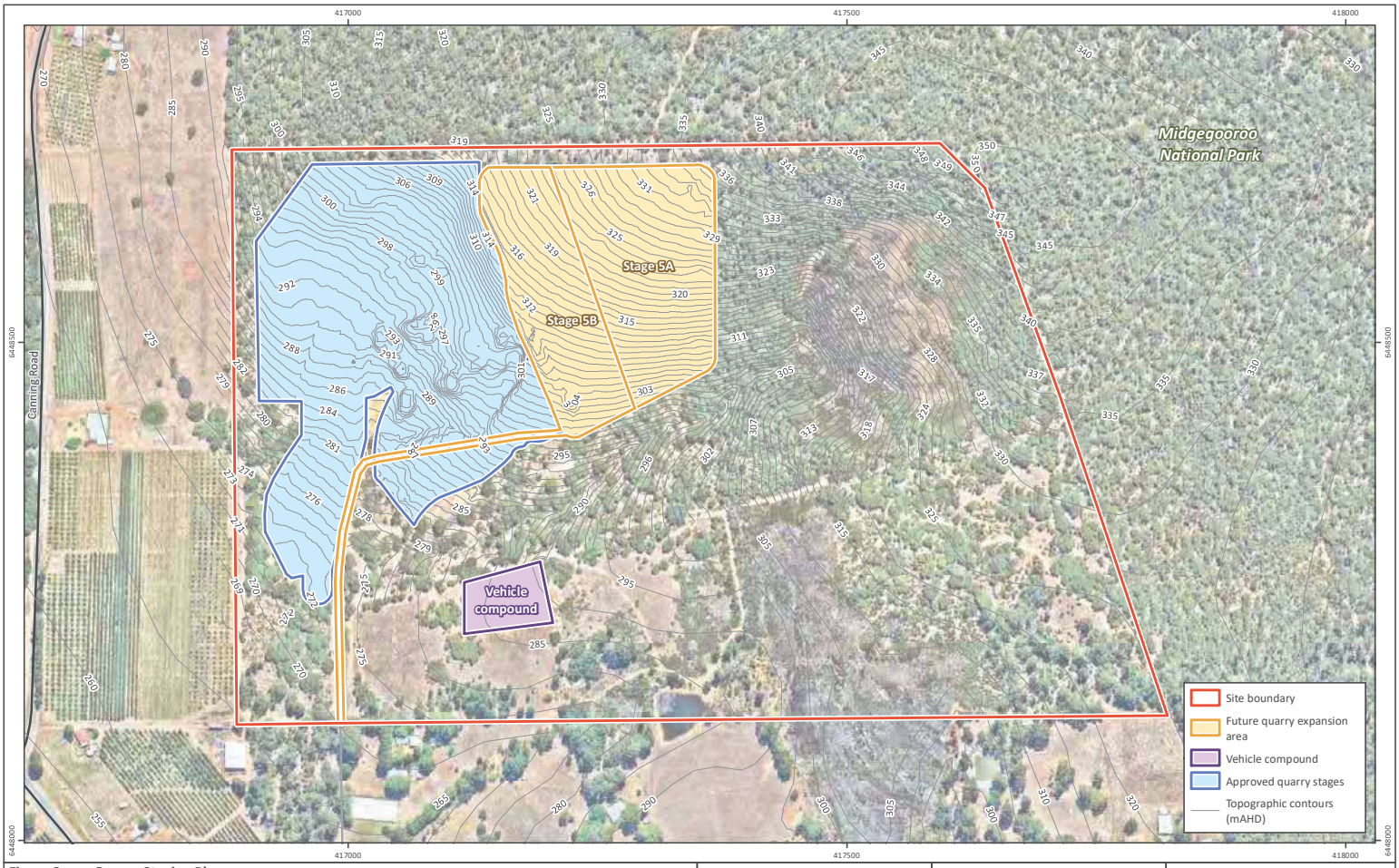

Figure 2: Quarry Staging Plan

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F50a

Drawn:	GAR
Date:	26/05/2021
Checked:	ALB
Approved:	ALB
Date:	26/05/2021

N

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Metres

Scale: 1:5,000@A4

GDA 1994 MGA Zone 50

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Figure 3: Topography

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F51a

Drawn:	GAR
Date:	21/05/2021
Checked:	ALB
Approved:	ALB
Date:	21/05/2021

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GDA 1994 MGA Zone 50

emerge ASSOCIATES

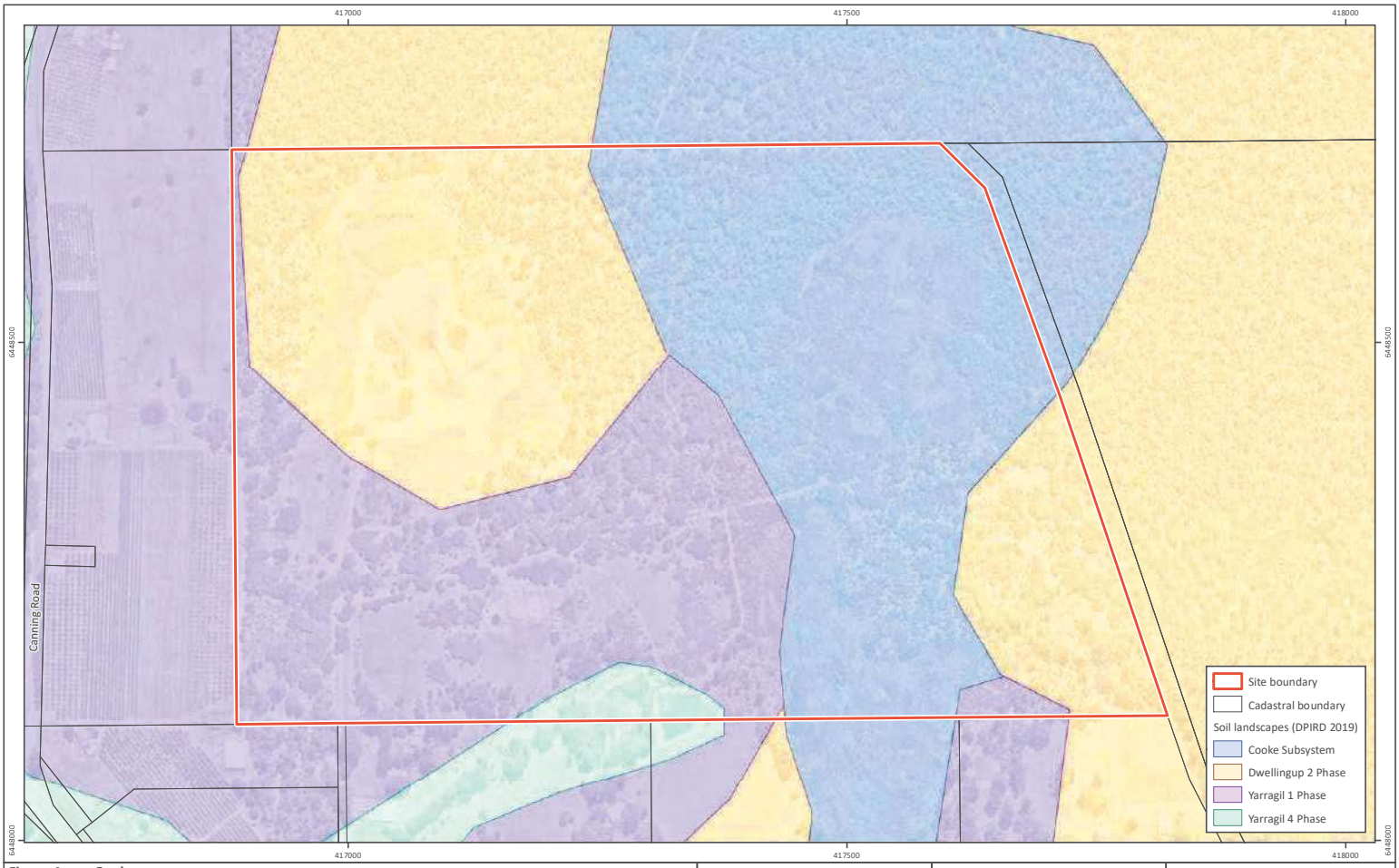

Figure 4: Geology

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F52

Drawn:	AFF
Date:	25/02/2021
Checked:	JMM
Approved:	JMM
Date:	5/03/2021

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Metres

Scale: 1:5,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 5: Hydrology

Project: Environmental Management Plan
Lot 9 Brookton Highway, Karragullen
Client: Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F53
Drawn: AFF
Date: 25/02/2021
Checked: JMM
Approved: JMM
Date: 5/03/2021

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GDA 1994 MGA Zone 50

emerge ASSOCIATES

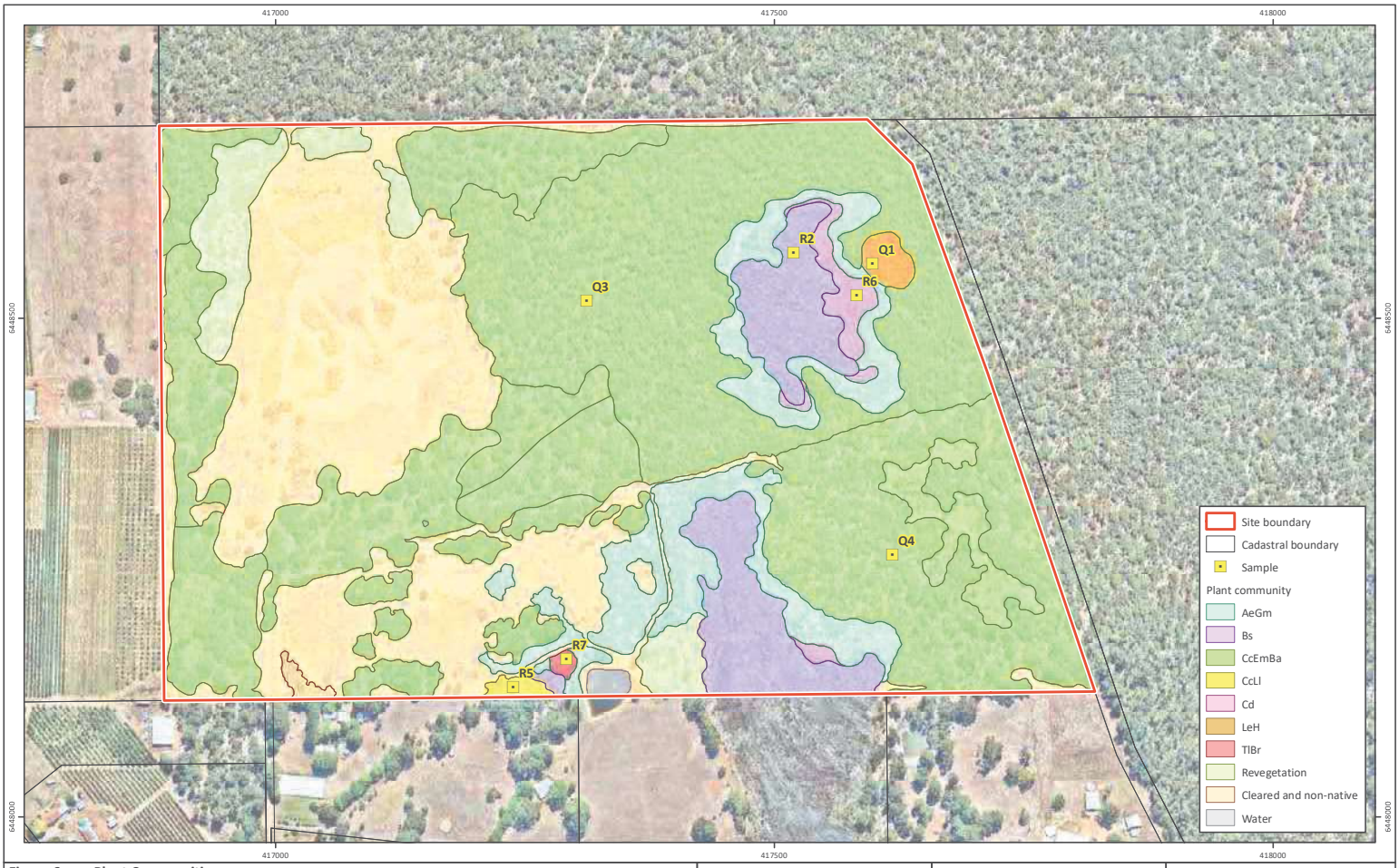

Figure 6: Plant Communities

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F54

Drawn:	AFF
Date:	25/02/2021
Checked:	JMM
Approved:	JMM
Date:	5/03/2021

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Metres

Scale: 1:5,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

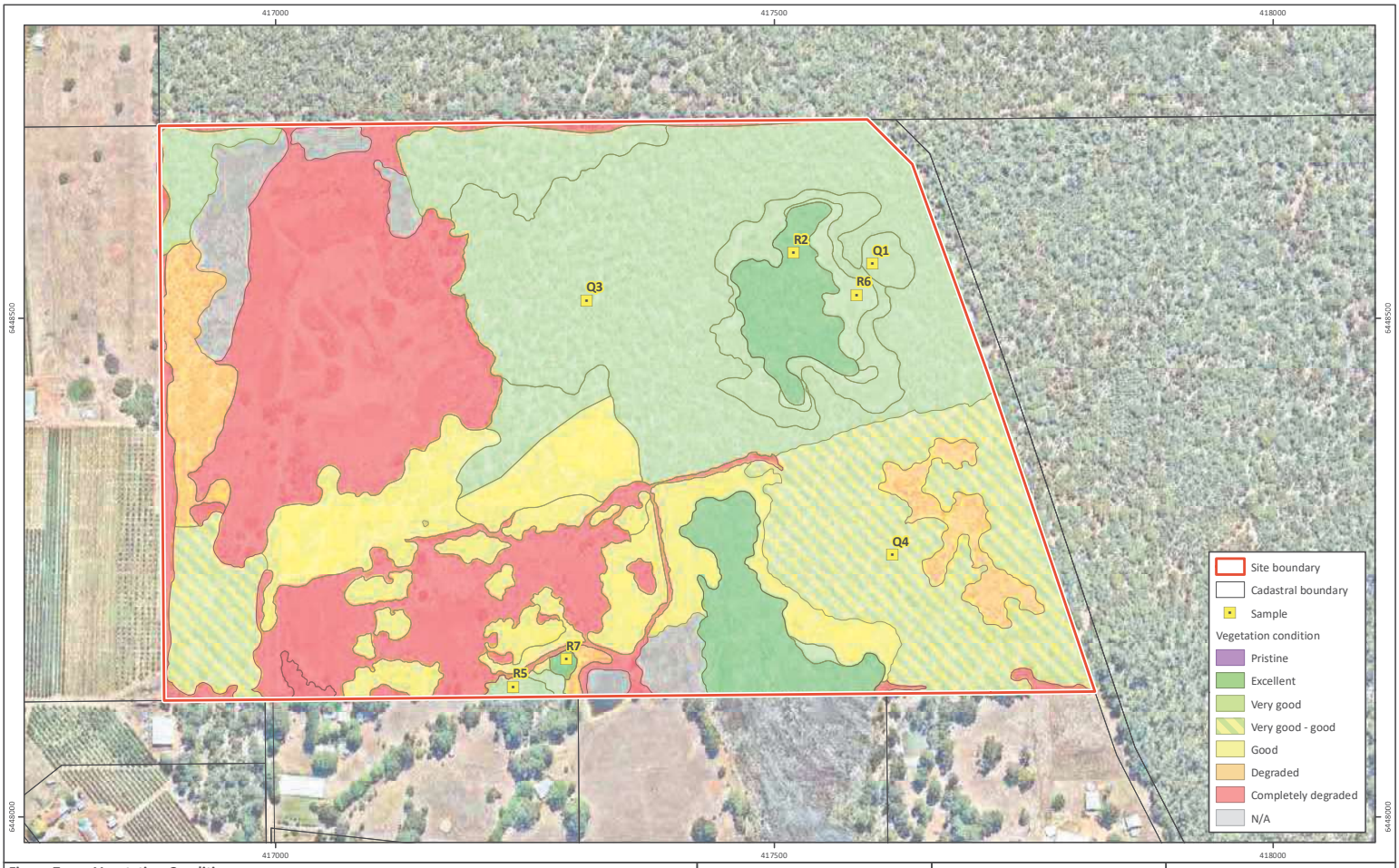

Figure 7: Vegetation Condition

Project: Environmental Management Plan
Lot 9 Brookton Highway, Karragullen
Client: Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F55
Drawn: AFF
Date: 25/02/2021
Checked: JMM
Approved: JMM
Date: 5/03/2021

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Metres
Scale: 1:5,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 8: Conservation Reserves

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F56

Drawn:	AFF
Date:	25/02/2021
Checked:	JMM
Approved:	JMM
Date:	5/03/2021

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GDA 1994 MGA Zone 50

emerge ASSOCIATES

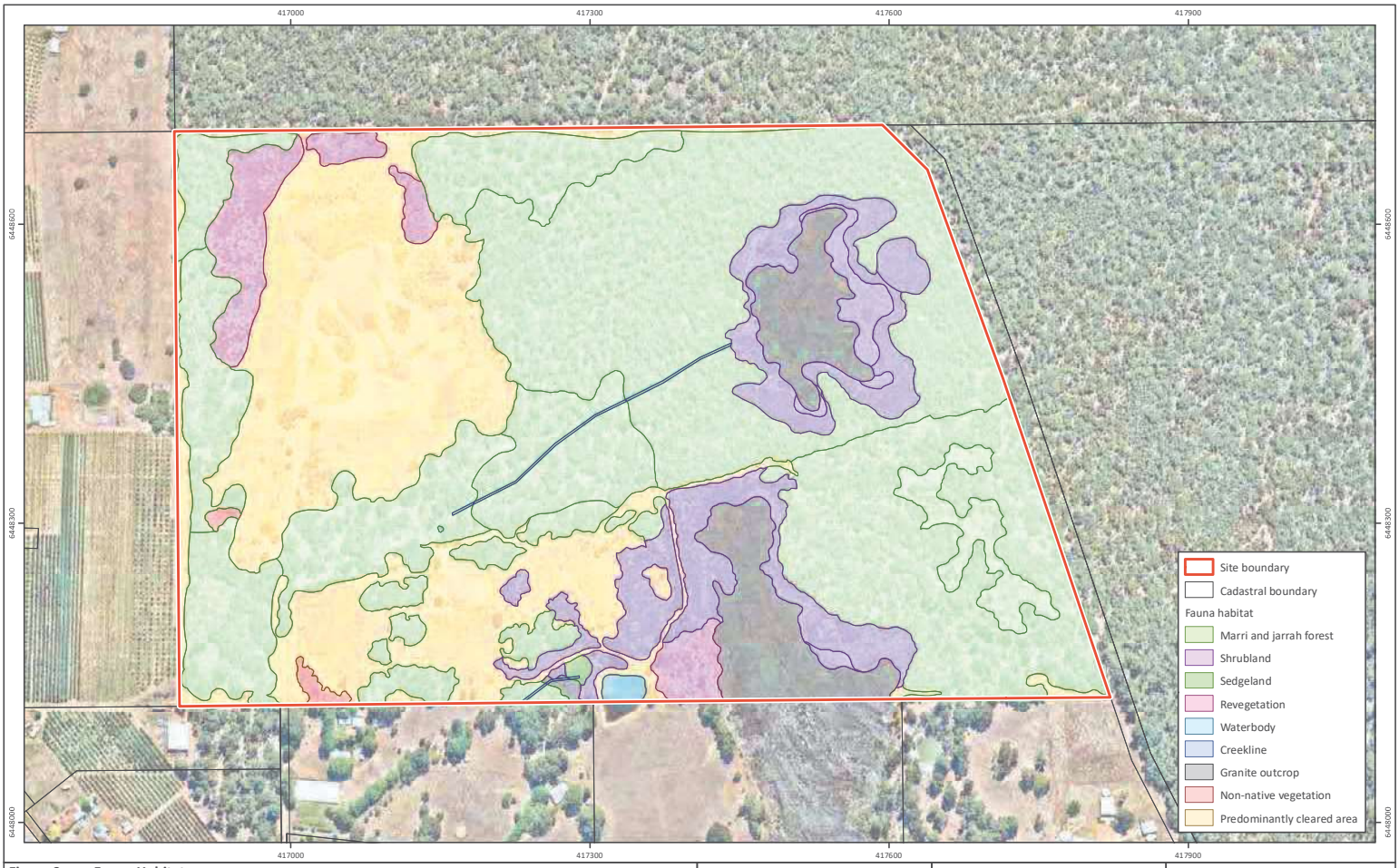

Figure 9: Fauna Habitat

Project: Environmental Management Plan
Lot 9 Brookton Highway, Karragullen
Client: Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F57
Drawn: AFF
Date: 25/02/2021
Checked: JMM
Approved: JMM
Date: 5/03/2021

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Scale: 1:5,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

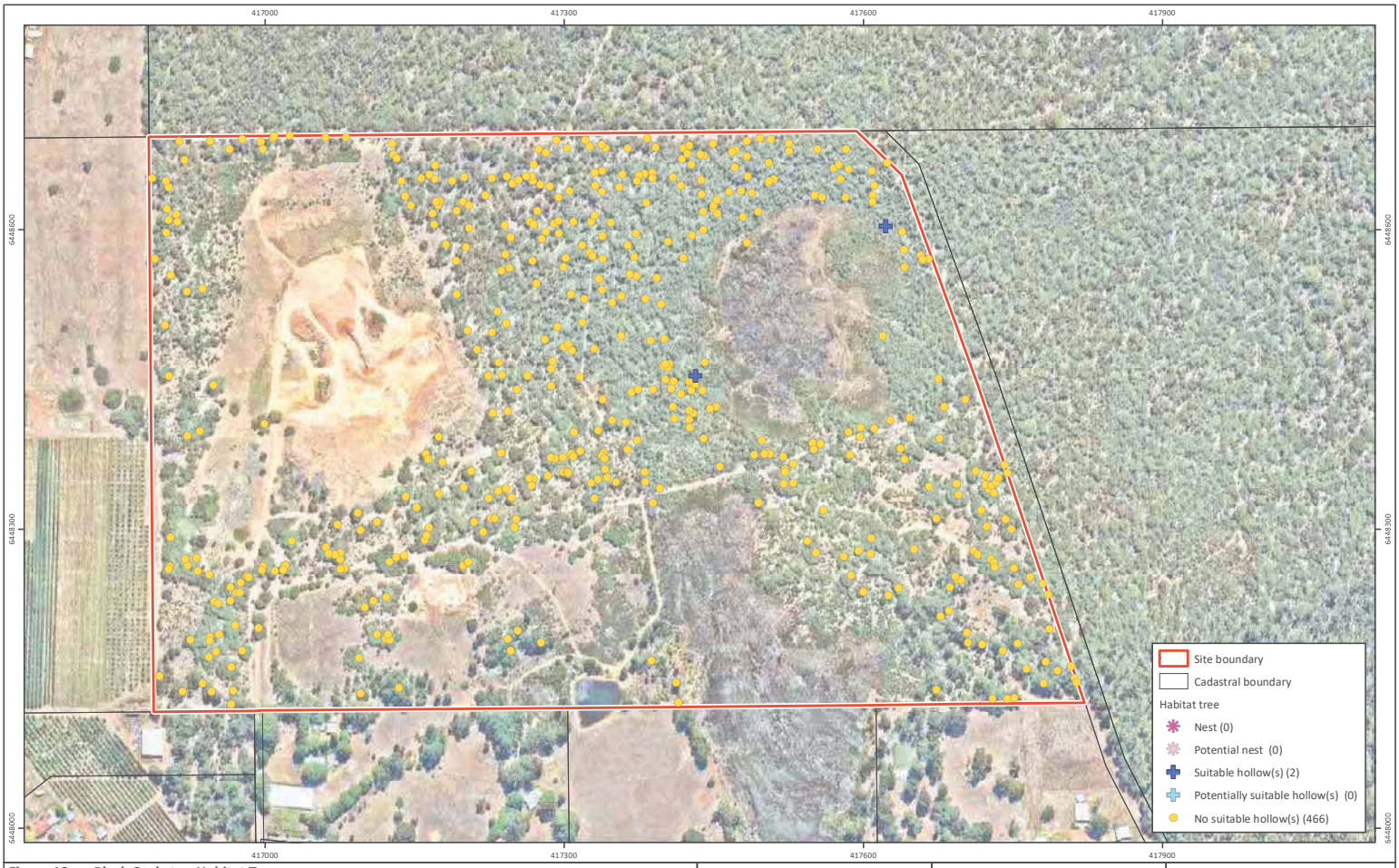

Figure 10: Black Cockatoo Habitat Trees

Project: Environmental Management Plan
Lot 9 Brookton Highway, Karragullen
Client: Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F58
Drawn: AFF
Date: 25/02/2021
Checked: JMM
Approved: JMM
Date: 5/03/2021

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GDA 1994 MGA Zone 50

emerge ASSOCIATES

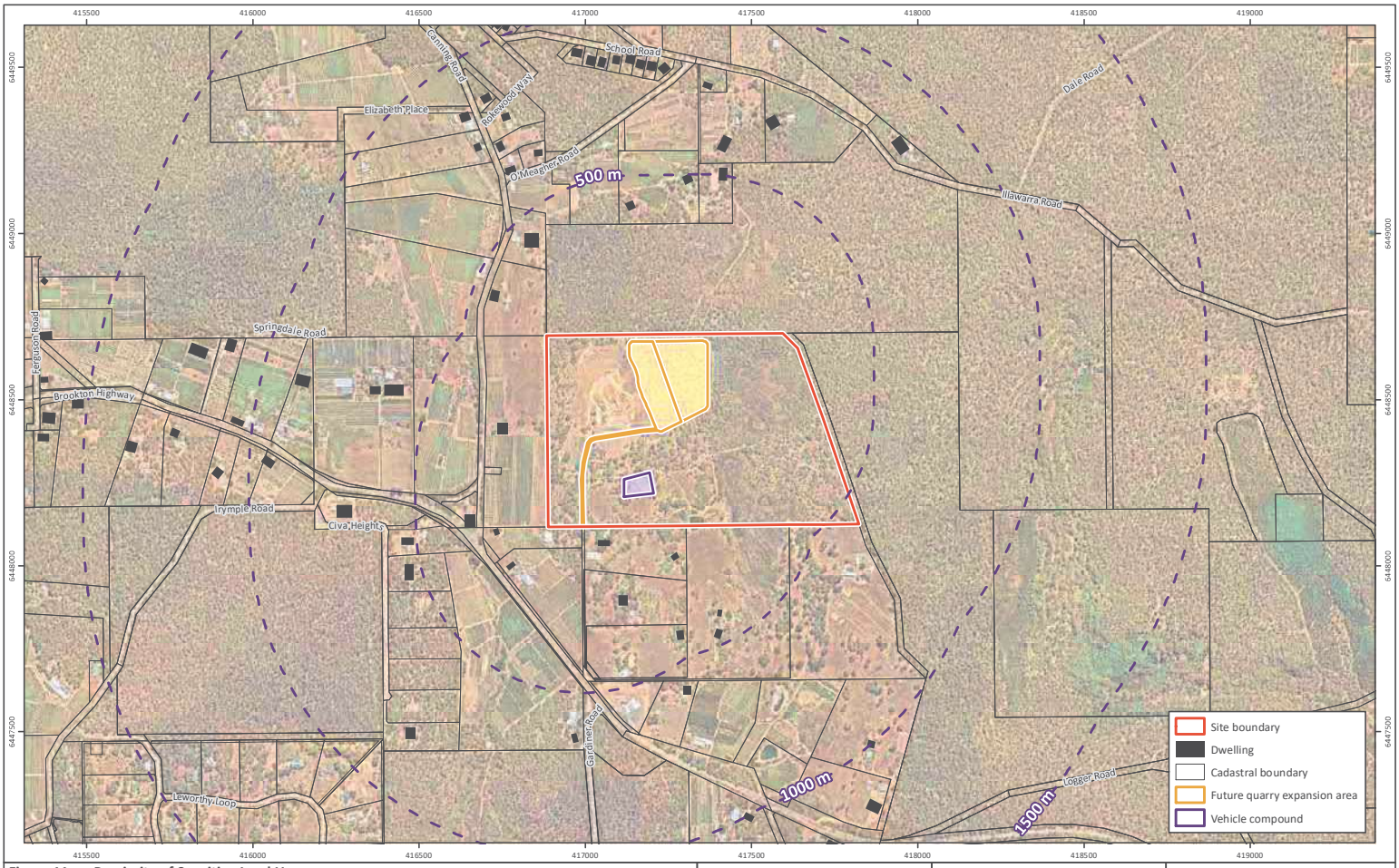

Figure 11: Proximity of Sensitive Land Uses

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F60b

Drawn:	GAR
Date:	26/05/2021
Checked:	ALB
Approved:	ALB
Date:	26/05/2021

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GDA 1994 MGA Zone 50

emerge ASSOCIATES

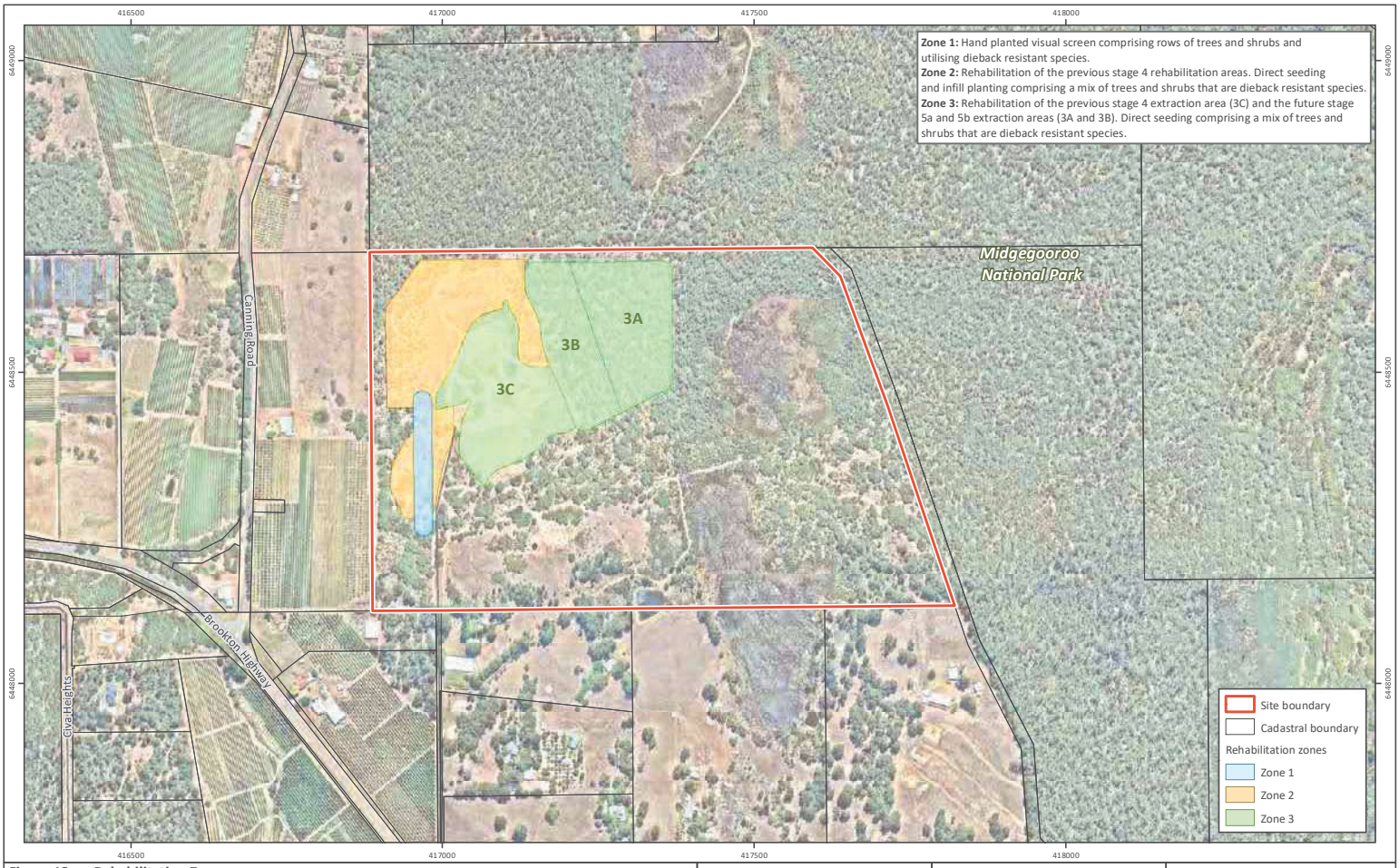

Figure 12: Rehabilitation Zones

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Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F61b

Drawn:	GAR
Date:	18/08/2021
Checked:	SJP
Approved:	BRB
Date:	19/08/2021

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GDA 1994 MGA Zone 50

emerge ASSOCIATES

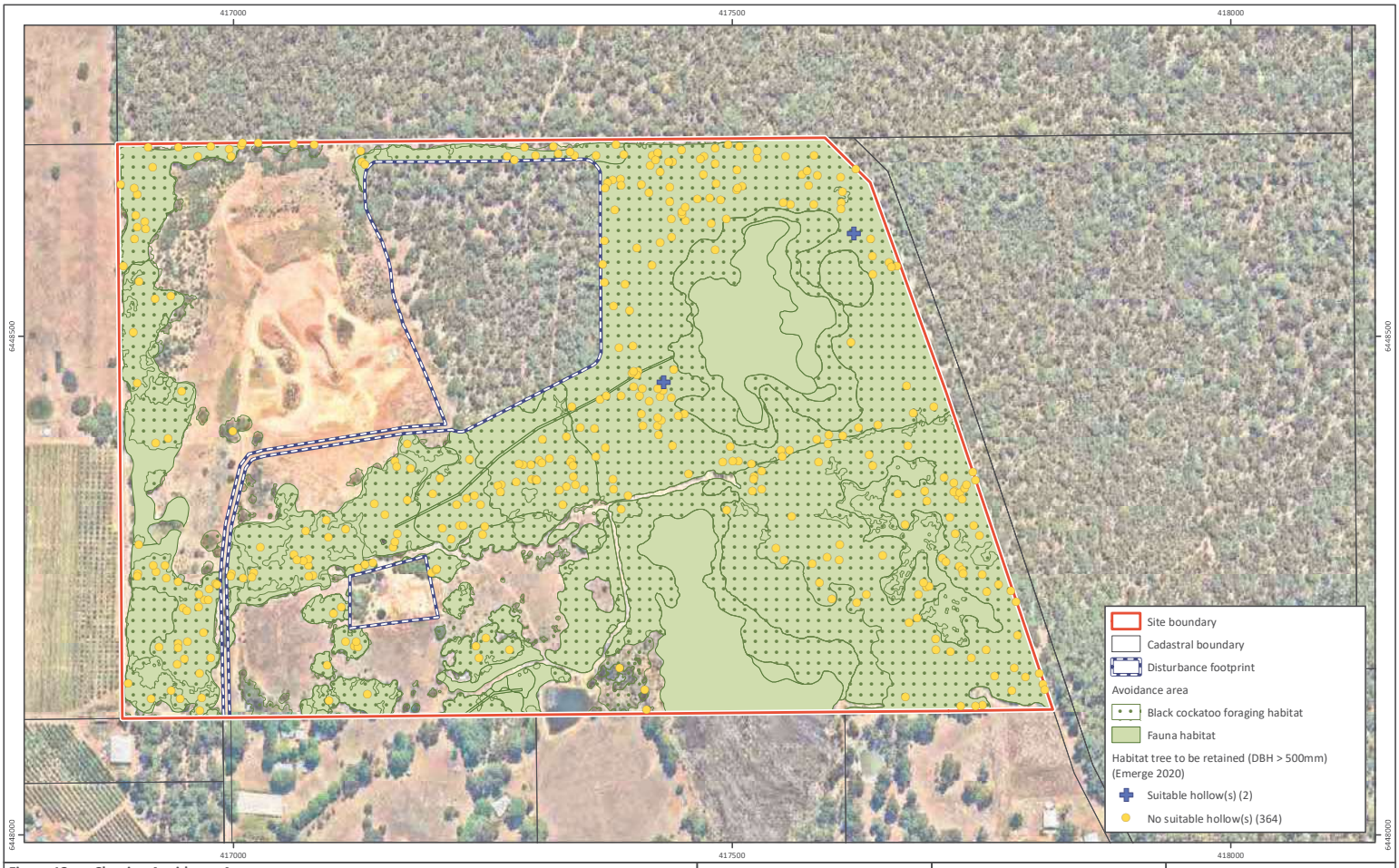

Figure 13: Clearing Avoidance Area

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F62

Drawn:	GAR
Date:	22/03/2021
Checked:	DRAFT
Approved:	DRAFT
Date:	--/--/----

N

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Metres
Scale: 1:5,000@A4
GDA 1994 MGA Zone 50

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Figure 14: Quarry Closure Contours

Project:	Environmental Management Plan Lot 9 Brookton Highway, Karragullen
Client:	Vinci Gravel Supplies Pty Ltd

Plan Number:
EP20-040(14)--F63a

Drawn:	GAR
Date:	06/04/2021
Checked:	DRAFT
Approved:	DRAFT
Date:	--/--/----

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GDA 1994 MGA Zone 50

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