



Vegetation Flora, Fauna and Environmental Considerations, and Targeted Flora Report

Site B – Shao Lu Rd Gravel Pit

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1 Executive Summary

This 'Vegetation, Flora, Fauna and Environmental Considerations and Targeted Flora Report' has been undertaken in accordance with the 'Environmental Protection Authority (EPA) Technical Guidance, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (2016)' as part of the Shire of Esperance's '2020 Strategic Purpose Permit' application to the Department of Water and Environmental Regulation (DWER). The 'Shao Lu Rd Gravel Pit' is Site B, proposing the clearing of 5.19 ha of native vegetation for the purpose of gravel extraction.

2 Introduction

The Shire of Esperance manages the largest road network of any local government in Western Australia, encompassing a total of 4 593 km of road. Of these, 830 km is sealed and the remaining 3763 km is unsealed. The Shire of Esperance endeavors to maintain a high level of road safety, and therefore requires a continual supply of gravel for routine maintenance to ensure the running surface of unsealed roads are safe. The Shire of Esperance requires vegetation to be cleared at 'Site B - Shao Lu Rd Gravel Pit' for the purpose of extracting gravel materials.

The site is located on the western road reserve of Shao Lu Rd, located ~2 km north of Fisheries Rd, at straight line kilometre (SLK) 2.10 (Main Roads 2020). A point within the clearing permit area is - 33.727378 S, 122.896005 E (GDA94). Regionally, it is located ~95 km east of Esperance town-site and 34 km east of Condingup town-site.

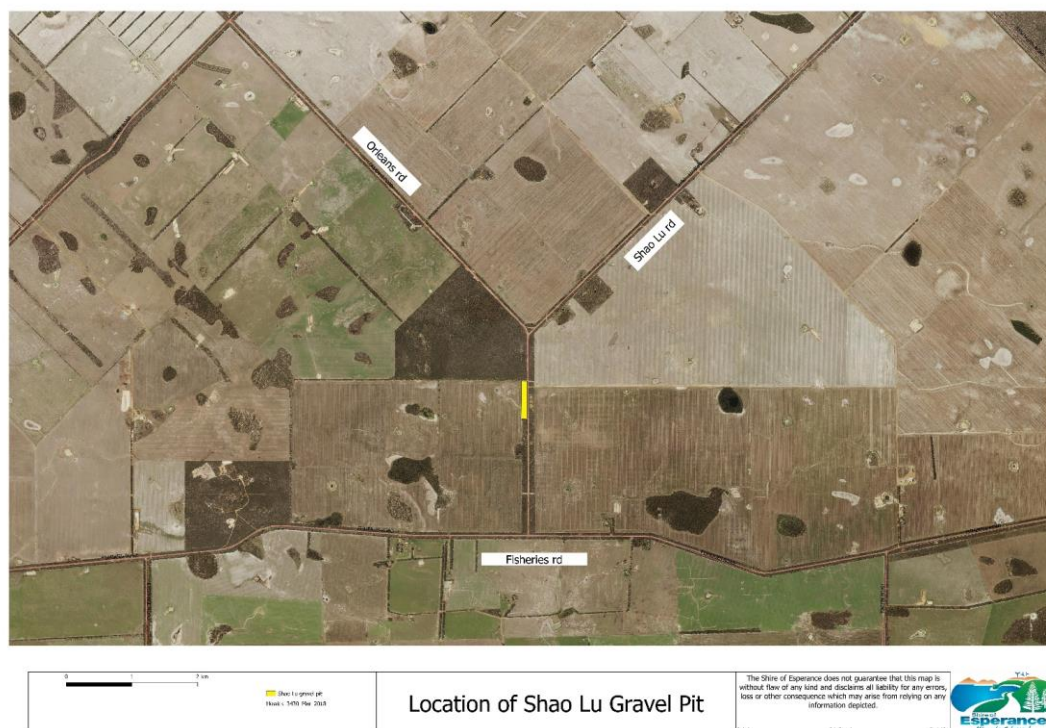


Figure 1. Location of 'Site B – Shao Lu Rd Gravel Pit' clearing permit application, submitted under the Shire of Esperance's '2020 Strategic Purpose Permit'.

3 Environmental Background

3.1 Scope

The removal of native vegetation to access gravel resources has the potential to affect multiple environmental factors.

Possible impacts include;

- Threatened flora (TF) and priority flora (PF).
- Threatened (TEC) and priority (PEC) ecological communities, specifically the Environment Protection and Biodiversity Conservation (EPBC) Act 1999 listed 'Proteaceae Dominated Kwongkan Shrublands of the South-east Coastal Floristic Province of Western Australia (Kwongkan)'.
- Threatened fauna, specifically potential feeding, nesting and roosting habitat of endangered Carnaby's Black Cockatoo, *Calyptorhynchus latirostris*.

Assessing these impacts involves two approaches: desktop study and field survey. A desktop study will gather background information on the target area. The field survey will allow for detailed understanding of vegetation communities, targeted flora surveys for possible TF or PF species, environmental condition, presence of PEC and TEC, and overall potential impact of clearing.

3.2 Catchment

The 'Site B - Shao Lu Rd gravel pit' is located within the Blackboy creek catchment area.

3.3 Climate

The climate of the Esperance region is described as Mediterranean, characterized by cool wet winters and dry warm summers. The area receives an average annual rainfall of 500 mm (BoM 2019).

3.4 Geology

The geology of 'Site B – Shao Lu Rd Gravel Pit' is described by Schoknecht et al. (2004) as Tertiary marine sediment of the Pallinup formation over Proterozoic granite and gneiss.

3.5 Soils and Topography

Topography of the site is described as dominated by a level plain (Schoknecht et al. 2004). The soil substrate is alkaline grey deep sandy duplex soils and grey deep sandy (gravelly) duplex soils, with associated pale deep sands. It is located within the Esperance 6 soil sub-system.

3.6 Vegetation

The site is located in the Interim Biogeographic Regionalisation for Australia (IBRA) Esperance Plains region (Esp2) and Recherche sub-region. The Esp2 region is described as "Proteaceae scrub and Mallee heaths on sandplain overlying Eocene sediments, rich in endemics. Herbfields and heaths (rich in endemics) on abrupt granite and quartzite ranges that rise from the plain. Eucalyptus woodlands occur in gullies and alluvial foot-slopes."

Beard (1973) described this area as Vegetation Association (VA) 1047 (WALGA LGMap 2019). VA 1047 is described as 'shrublands; with *Eucalyptus incrassata* Mallee-heath'. 71.25% of pre-European extent remains in the Esp2 IBRA bioregion and 84.96% in the Shire of Esperance area (DPaW 2017). In total, 54.77% of the pre-European extent of VA 1047 is formally conserved within the International Union for Conservation of Nature (IUCN) reserves across Western Australia.

3.7 Land use

The proposed 'Site B - Shao Lu gravel pit' is located within the 200 m wide Shire of Esperance managed Shao Lu Rd road reserve. The road reserve consists of intact vegetation. There has been historic gravel extraction on the eastern road reserve, opposite the proposed clearing site. Agricultural land surrounds the road reserve. The 240 ha Crown Reserve 32802 is immediately to the north of the area remains entirely as intact vegetation.

4 Methodology

4.1 Desktop study

A desktop study was completed prior to the field survey. Geographical Information System (GIS) review included the following:

- Existing site digital orthophotos, as sourced from LandGate (Howick 2018).
- Western Australian Local Government Association's (WALGA) 'Local Government Mapping (LGMap)' program was used to assess spatial information of geology, topography, soil profiles, native and planted vegetation, water bodies and Interim Biogeographical Regionalisation for Australia (IBRA; Thackway & Cresswell 1995) classification system.
- Data provided by Department of Biodiversity, Conservation and Attractions (DBCA) and Western Australian Herbarium in October 2019 was used to assess threatened flora (TF), priority flora (PF) and threatened (TEC) and priority (PEC) ecological communities. Specifically, spatial data included;
 - WAHerb extract (DBCA 2019f).
 - Threatened and Priority Reporting (TPFL; DBCA 2019d).
 - Esperance District Threatened Flora (DBCA 2019a).
 - PEC and TEC 'Likely to Occur' buffer and boundary areas (DBCA 2019e).
- NatureMap was used to assess fauna records within a 20km buffer from the centre of the site (from centre coordinate 122° 53'40" E, 33° 43'36" S; DBCA & WAM 2020).

4.2 Field investigation: possible ecological impacts

The site was surveyed on 01/10/2019 by Shire of Esperance's Environmental Officer's Julie Waters and Katie White. Numerous possible ecological impacts by clearing vegetation were assessed, including;

- Describing and mapping vegetation community types by structure and composition. Condition of vegetation was assessed using Keighery (1994) categories, as 'Excellent', 'Very Good', 'Good', 'Degraded' or 'Completely Degraded'. This illustrates how healthy vegetation is, determine by number of dead or dying plants, weed cover and other forms of degradation.
- Degradation or disturbing factors, including historical clearing, artificial water way construction, impact of inappropriate fire regimes, regeneration from disturbance, waterlogging, senescence, weeds, erosion, sedimentation, invasive fauna, *Phytophthora cinnamomi* Dieback, and illegal dumping of rubbish.
- Possible environmentally sensitive areas, such as wetlands or granite were noted.
- Observations of fauna presence, such as call sounds, footprints and scats were also noted. The suitability of the area for Carnaby's Black Cockatoo, *Calyptorhynchus latirostris*, habitat as feeding, roosting and nesting habitat was particularly focused on.

4.3 Field Investigation: Targeted flora survey

The targeted flora survey was completed in in mid-spring on 01/10/2019, when majority of the Esperance sandplain's flora is flowering. Of the nine species deemed likely to occur by the desktop study, only priority three species *Persoonia scabra* wouldn't be flowering or carry fruit for confident

identification in mid-spring. However due to the unique rough leaves and familiarity of surveyors with this species, the species was unlikely to be overlooked. Priority one species *Scaevola archeriana*, may also flower at odd times of the year. However, again due to the familiarity of personnel surveying with key taxonomic feature of this species and associated habitat, it is also considered unlikely to be overlooked. Additionally, soil type and associated species at the site were quite different to other locations where *S. archeriana* has been found.

The site was extensively covered by two personnel carrying out a number of transects through the 5.19 ha site. Transect lines were designed so the site was “sufficiently covered”. Due to the high diversity and complexity of flora in the Esperance region, all species were recorded from the area. From this an incidental species list was compiled (Appendix 9.1). For all species not identifiable in the field, a sample was collected under Katie White’s Regulation 61 Flora Taking Licence FT61000029 and identified exsitu. Species were identified using local botanical knowledge, DBCA’s Esperance District Herbarium, Florabase and field guides. Any species that were unable to be identified were submitted to the WA Herbarium for identification. This ensured no PF or TF were overlooked.

Over the course of the 2019 wildflower season, surveyors visited verified known populations of *Astartea eobalta* (P2) and *Scaevola archeriana* (P1) to re-familiarise themselves with key taxonomic indicators and associated habitat. For other TF and PF identified in the desktop survey as possible to occur, scans of pressed specimens from the local Esperance District Herbarium were taken into the field. Any flora thought to be TF or PF were formally collected, counted and mapped using a Panasonic FS-G1 Toughpad with the program ROAM or a GPS Garmin GPS64. Specimens were then lodged with the WA Herbarium for formal verification. When PF were confirmed, TPFL forms were completed and submitted to the DBCA’s district Conservation Officer and Species and Communities Branch.

4.4 Field investigation: Assessing Threatened and Priority Ecological Communities

The vegetation community of ‘Site B – Shao Lu Rd Gravel Pit’ was assessed for the presence of PEC and TEC’s, specifically the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 listed ‘Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia (Kwongkan)’ TEC. Across the site, it was regularly examined to determine if it met the characteristics of Kwongkan, as defined by diagnostic characteristics in the Approved Conservation Advice for Kwongkan (Commonwealth of Australia 2014);

2a) Characterised by Proteaceae species having 30% or greater cover of Proteaceae species across all layers where these shrubs occur (crowns measured as if they are opaque).

And/or

2b) Two or more diagnostic Proteaceae species are present that are likely to form a significant vegetative component when regenerated.

PEC’s do not have published approved conservation advice. Comparison of the vegetation community occurred using ‘Priority Ecological Communities for Western Australia Version 28 (DBCA 2019c)’ definitions.

5 Results and Discussion

5.1 Possible Ecological Impacts

Two vegetation communities were identified within the 'Site B – Shao Lu Gravel Pit' area, as defined by structure and composition (Figure 2). The southern 2.031 ha of the area is described as '*Eucalyptus angulosa* Mallee, with mixed heathland' (Figure 3), and the northern 3.17 ha is described as '*Eucalyptus angulosa* Mallee, with mixed Proteaceae dominated heathland, dominated by *Banksia repens* and *Anarthria laevis*' (Figure 4). It is believed that the vegetation communities observed during the field survey matched the Beard (1973) description of the area.

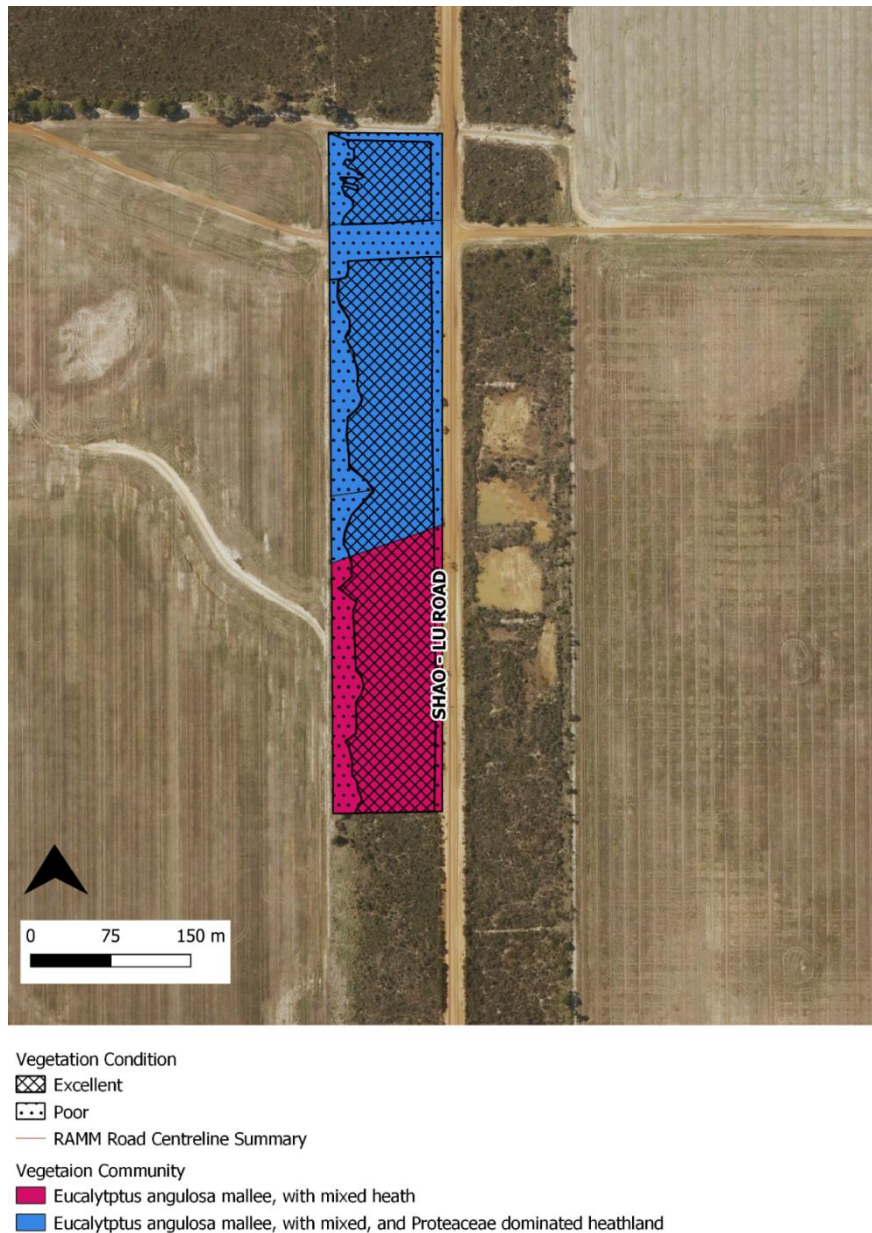


Figure 2. Vegetation community and condition identified in the field survey of 'Site B – Shao Lu Gravel Pit' area.



Figure 3. The vegetation community in the southern area of 'Site B – Shao Lu Gravel Pit' described as *Eucalyptus angulosa* Mallee - mixed heathland. Distinguishable from the northern communities by lacking *Banksia repens* and *Anarthria laevis* under-story.



Figure 4. Vegetation community located in the northern area of 'Site B – Shao Lu Rd Gravel Pits', described as *Eucalyptus angulosa* Mallee with mixed Proteaceae dominated heathland, with an understorey of *Banksia repens* and *Anarthria laevis*.

Of the 5.201 ha of vegetation proposed to be cleared, 3.533 ha was identified as being in excellent condition (Figure 2). Along the periphery of intact vegetation, there was extensive weed invasion and scattered rubbish. These areas included adjacent farmland to the west of the site, the existing driveway dissecting the site, and less so from the road itself to the east. These areas were then considered to be in degraded to poor condition. In total 1.688 ha was considered in degraded to poor condition. No other degrading factors, such as invasive animals or historical clearing was observed.

No wetland species or observed water bodies were present within the area. It is highly unlikely that clearing vegetation will result in a significant change to the water table or natural hydrological regimes. No signs of recent fire were present, and it is likely the site is long unburnt.

Very limited data collection on the presence of *Phytophthora cinnamomi* Dieback has been conducted on roadsides in Western Australia. No positive or negative sample points are collated on the Dieback Information Delivery and Management System (DIDMS; GAIA Resources, State NRM & SCNRM 2020). Vegetation is largely *P. cinnamomi* dieback susceptible, dominated by Proteaceae species. All susceptible species were extremely healthy, showing no signs of stress or key Dieback infection indicators. It is therefore probable the site remains un-infected by *P. cinnamomi*. Clearing will occur in dry conditions with clean machinery, limiting the likelihood that dieback will spread, but there is always a possibility that introduction will occur.

5.2 Threatened and Priority Ecological Communities

No priority (PEC) or threatened (TEC) ecological communities were directly identified by the desktop study as within the footprint of the 'Site B – Shao Lu Rd Gravel Pits'. However, the TEC 'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia (Kwongkan)' and the PEC "Subtropical and Temperate Coastal Salt Marsh" were recorded within the 20 km buffer of the site.

The field survey determined that the northern vegetation community, which was described as *Eucalyptus incrassata* Mallee, with mixed Proteaceae dominated heathland, dominant under-story of *Banksia repens* and *Anarthria laevis*, met the Kwongkan TEC criteria (Figure 4). Foliage cover of Proteaceae species was greater than 30%. Additionally, a total of 15 Proteaceous species were recorded within the application area. Seven of these are diagnostic species listed in Table 1 of the *Approved Conservation Advice for Kwongkan* (Commonwealth of Australia 2014). However, the periphery of the northern area along farmland and roads was in such a degraded to poor state that it was not considered in good enough quality to consists as Kwongkan TEC. Therefore, overall a total of 2.037 ha (39% of the application area) of Kwongkan TEC was present within the 'Site B – Shao Lu Rd Gravel Pits' area (Figure 2).

The southern vegetation community, *Eucalyptus incrassata* mallee with mixed heathland did not meet the criteria to be considered Kwongkan TEC, most notably lacking the dominance of *B. repens* and *Banksia armata*. No vegetation species complex or landscape requirements matching the PEC "Subtropical and Temperate Coastal Salt Marsh" were recorded in 'Site B – Shao Lu Rd Gravel Pit'.

5.3 Threatened and Priority Flora

No spatial records of threatened (TF) or priority (PF) were present within the 'Site B – Shao Lu Rd Gravel Pit' area (DBCA 2019a; DBCA 2019d; DBCA 2019f). Three TF and 30 PF species were recorded within a 20 km radius of the site, when completing the desktop survey (Table 1). However, of these, only ten species were identified as possible or likely to occur, as inferred by the suitable habitat type. The extensive targeted flora survey did not identify any PF or TF within the clearing permit area, with all species to be identified as common and non-threatened.

Overall, the site has a high species richness, with a total of 79 native species identified within the clearing permit area (Appendix 9.1). The most abundant families were Myrtaceae (17 species), Proteaceae (15 species), and Fabaceae (nine species). 11 invasive species were recorded within the application area.

Table 1. Threatened flora and priority flora identified by the desktop study to be present within a 20 km radius of 'Site B - Shao Lu Road gravel pit' area, using Threatened and Priority Flora Reporting (TPFL; DBCA 2019d), WA Herbarium (DBCA 2019f) and Esperance District Threatened Flora (DBCA 2019b). Nt. Acronyms used in the table include threatened flora (TF), priority flora (P), Biodiversity Conservation (BC) Act 2016, Environmental Protection and Biodiversity Conservation (EPBC) Act 1999, vulnerable (VU), critically endangered (CR) and endangered (EN).

Species	Conservation Status	Description and habitat	Likelihood to occur
<i>Acacia nitidula</i>	P2	Shrub of 0.6-2 m height. Associated with granite.	No
<i>Andersonia carinata</i>	P2	Erect slender shrub, growing up to 0.8 m in height. Grows on white sand, and gravelly lateritic	No

		soils. No WA Herbarium records close to Esperance.	
<i>Anigozanthos bicolor</i> subsp. <i>minor</i>	TF – VU under BC Act 2016 and EN under EPBC Act 1999	Dwarf rhizomatous herb. Associated with granite.	No
<i>Astartea eobalta</i>	P2	Grows on grey sand over ironstone gravel, granite, winter wet, creek-lines and swamps.	No
<i>Caesia viscida</i>	P2	Described as rhizomatous and tuberous, tufted perennial herb growing up to 0.3 m. Grows on Aeolian sand, low dunes, and loamy sand over lateritic gravel.	Yes
<i>Caladenia arrecta</i>	P4	Tuberous, perennial, herb, of 0.12 - 0.35 m height. Grows on loam, gravel, and laterite. Associated with moist conditions.	Yes
<i>Calectasia jubilea</i>	P2	Rhizomatous shrub, that grows to 0.3 - 0.5 m high. Preferred habitat described as low Shrubland, including Proteaceous-rich low heathland with <i>Eucalyptus angulosa</i> .	Yes
<i>Eriochilus dilatatus</i> subsp. <i>orientalis</i>	P3	Grows on shallow soil on limestone cliffs and nearby woodland.	No
<i>Eucalyptus creta</i>	P3	Tree, that grows to 3 - 15 m high. Grows on sandy clay or loam. Preferred habitat described as open Mallee, dominated by Eucalyptus.	No
<i>Eucalyptus semiglobosa</i>	P3	Mallee species, that grows up to 6 m high. Grows on white sand over laterite, silty sand on edge of granite shelf, and limestone. Recorded on hillslopes, gullies, and cliffs.	Possible
<i>Eucalyptus sweetmaniana</i>	P2	Mallee that grows to 1 m height. Associated with granite.	No
<i>Gonocarpus pycnostachyus</i>	P3	Erect annual herb, that grows to 0.1-0.15 m high. Grows on wet depressions near granite. Disturbance opportunist after fire.	No
<i>Grevillea baxteri</i>	P4	Shrub that grows up to 3.5 m tall. Grows on sand, sandy loam, granitic loam, and is associated with low heath, to tall open shrubland and open Mallee.	Yes
<i>Hibbertia hamata</i>	P3	Erect shrub, that grows up to 0.5 m high. Flowers are yellow, flowering from October to December. Often associated with inland granite outcrops.	No
<i>Isopogon alcornis</i>	P3	Grows on grey brown loams, in Mallee shrubland.	Unlikely
<i>Kennedia beckxiana</i>	P4	Described as course woody prostrate or twining climber. Only recorded from granite outcrops in Cape Arid.	No
<i>Lambertia echinata</i> subsp. <i>echinata</i>	TF – CR under BC Act 2018 and EN under EPBC Act 1999	Described as prickly, much-branched, non-lignotuberous shrub, that grows up to 1.5 m high. Grows on gravelly sandy loam, brown sandy loam, white-grey sand, granite, and laterite. Recorded below & between rock outcrops, slopes, and hill crests.	No

<i>Lasiopetalum parvuliflorum</i>	P3	Erect, spreading shrub, that grows up to 0.35 - 1 m high. Grows on sand, and gravelly loam. Recorded along creeks, and seasonal swamps.	Yes
<i>Leucopogon corymbiformis</i>	P2	Shrub of 0.5 m tall. Grows on deep sand.	No
<i>Leucopogon florulentus</i>	P3	Erect slender shrub, of 0.3-0.8 m high. Grows on sand, sandy clay, and gravelly lateritic soils. No WA Herbarium records close to Esperance.	No
<i>Melaleuca dempta</i>	P3	Shrub that grows up to 2.2 m in height. Associated habitat described as dense scrub in sandy soil, swampy areas and on the edges of clay pans.	No
<i>Melaleuca viminea</i> subsp. <i>appressa</i>	P2	Shrub of 1.3-4 m in height. Grows near creeks, wet depressions and clay soils.	No
<i>Microtis quadrata</i>	P4	Grows in seasonally wet depressions and in swampy mounds in near-coastal areas.	No
<i>Myoporum velutinum</i>	TF – listed as EN under the BC Act 2016 and not listed under EPBC Act 1999	Shrub that grows on creek-lines.	No
<i>Myriophyllum petraeum</i>	P4	Aquatic annual herb, that grows in granite pools.	No
<i>Paracaleana parvula</i>	P2	Perennial, herb, that grows to 0.18 m high. Flowers are yellow/green, occurring from October to November. Grows in deep white sands along plains.	No
<i>Persoonia scabra</i>	P3	Shrub of 0.5 m height that grows in sandy heathland environment, often overlying gravel, granite or limestone.	Yes
<i>Persoonia spathulata</i>	P2	Erect, spreading shrub, of 0.2 - 0.6 m height. Flowers are yellow, flowering in December or January. Grows in deep sandy soils, with other Proteaceae species.	No
<i>Scaevola archeriana</i>	P1	Erect, re-sprouting, multi-stemmed, clonal herb, growing up to 0.45 m high.	Possible
<i>Spyridium mucronatum</i> subsp. <i>multiflorum</i>	P2	Shrub of 0.15-0.6 m height. Grows on gravel and is associated with Mallee-heath.	Yes
<i>Stachystemon vinosus</i>	P4	Shrub that grows up to 0.4 m in height. Grows on sandy duplex gravelly soils in scrub heathland.	Yes
<i>Stylidium roseonanum</i>	P3	Short-lived annual, herb of 0.015-0.03 m height. Flowers are red-white, flowering recorded in October. Records associated with swamps.	No
<i>Trithuria australis</i>	P4	Annual herb, associated with wetter areas. All WA Herbarium records area a long way from Esperance.	No

5.4 Fauna

22 threatened, priority or internationally protected fauna have been recorded in a 20 km radius of 'Site B – Shao Lu Rd Gravel Pit' (Table 2; DBCA & WAM 2020). Of these, only two have been assessed as likely to occur in the area. Carnaby's Black Cockatoo, *Calyptorhynchus latirostris*, forages in Proteaceous shrub-lands and nests in the hollows of live or dead eucalypts. The application area therefore is considered as possible feeding habitat for Carnaby's Black Cockatoos, with the high portion of Hakea and Banksia species present. The larger Tuart trees in the adjacent paddock may also be used by the Carnaby's Black Cockatoos as roosts (Figure 5). The trees were not observed to contain any nesting hollows. The second species that was identified as possible to occur was the Southern Death Adder, *Acanthophis antarcticus*. The vegetation community of the site is suitable habitat.

Multiple species have been identified as possible to occur, such as Peregrine Falcon, *Falco peregrinus*, and Pacific Swift, *Apus pacificus*, but are believed to not be significantly impact by proposed works, due to their low population densities and wide range of habitats.

Table 2. Threatened and priority fauna identified by NatureMap (DBCA & WAM 2020) within a 20 km radius of 'Site B - Shao Lu Road gravel pit area'.

Nt. Acronyms used include priority (P), threatened (T), specially protected fauna (S), protected under International agreement (IA).

Species	Common Name	Conservation Status	Likelihood to occur	Description of habitat
<i>Acanthophis antarcticus</i>	Southern Death Adder	P3	Yes	Associated with open woodland, scrub and heathland areas.
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	T	Yes	Known to forage in Proteaceous woodlands and shrublands. Nesting occurs in the hollows of live or dead Eucalypts, primarily the smooth-barked Salmon Gums and Wandoo.
<i>Cereopsis novaehollandiae</i>	Cape Barren Goose	T	No	Recorded across various habitats, on offshore islands, improved pastures or clovers, salty ground with native succulents, camps on margins of dams, fresh or brackish swamps and lakes.
<i>Falco hypoleucos</i>	Grey Falcon	T	No	Recorded on inland plains with sparse trees, gibber desserts, sand ridges, pastoral lands, timbered water courses. They are seldom present in drier deserts.
<i>Falco peregrinus</i>	Peregrine Falcon	S	Possible; although unlikely to be impacted upon due	Not confined to a specific habitat.

			to low population densities and wide range of habitats.	
<i>Oxyura australis</i>	Blue-billed Duck	P4	No	Prefers densely vegetated freshwater swamps, large dams, lakes, and open waters
<i>Petrogale lateralis</i> subsp. <i>hacketti</i>	Recherche Black-footed Rock-Wallaby	T	No	Prefers rocky habitats. They occur on a wide variety of rock types, but require complex caves and crevices as opposed to large, smooth surfaces. Confined to 3 islands in the Recherche Archipelago.
<i>Pezoporus flaviventris</i>	Western Ground Parrot	T	Possible; although unlikely as known to be restricted to Cape Arid National Park.	Associated with coastal heaths, swampy areas, drier ridges, and grasslands.
<i>Actitis hypoleucos</i>	Common Sandpiper	IA	No	Present on margins of coastal or inland waters.
<i>Apus pacificus</i>	Fork-tailed Swift or Pacific Swift	IA	Possible; although unlikely to be impacted upon due to low population densities and wide range	Aerial species, recorded over open country from semi deserts to coast, islands, and sometimes over forests and cities.
<i>Ardenna tenuirostris</i>	Short-tailed Shearwater	IA	No	Confined to coastal islands, inshore and offshore waters.
<i>Thinornis rubricollis</i> ,	Hooded Plover or Hooded Dotterel	P4	No	Prefers sandy ocean beaches and open edges of inland salt lakes.
<i>Calidris alba</i>	Sanderling	IA	No	Prefers sandy ocean beaches, sandbars, and mudflats.
<i>Calidris ruficollis</i>	Red-necked Stint	IA	No	Associated with coastal intertidal zones, inland saline and freshwater marshes.
<i>Eubalaena australis</i>	Southern Right Whale	T	No	Lives in the ocean.
<i>Hydroprogne caspia</i>	Caspian Tern	IA	No	Associated with directly coastal, offshore waters, beaches, mudflats, estuaries, larger rivers, reservoirs, and lakes. Some inland records have occurred.
<i>Limosa lapponica</i>	Bar-tailed Godwit	IA	No	Recorded on coastal mudflats, and sandy intertidal zones.

<i>Pluvialis fulva</i>	Pacific Golden Plover	IA	No	Recorded on coastal mudflats, sandy intertidal zones. Known to roost in short saltmarsh, herb-fields or short grassed pastures.
<i>Pluvialis squatarola</i>	Grey Plover	IA	No	Recorded on coastal mudflats, and sandy intertidal zones.
<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	T	No	Occurs on offshore and inshore waters of Southern Australia.
<i>Thalasseus bergii</i>	Crested Tern	IA	No	Associated with coastal, offshore waters, beaches, bays, inlets, tidal rivers, salt swamps, lakes, and larger rivers.
<i>Tringa nebularia</i>	Common Greenshank	IA	No	Occurs on coastal mudflats, inland saline and freshwater marshes.



Figure 5. Tuart trees in the adjacent paddock of 'Site B – Shao Lu Rd Gravel Pit', which may be used as roosts by Carnaby's Black Cockatoos, *Calyptorhynchus latirostris*.

6 Conclusion: assessment of Department of Water and Environmental Regulations Clearing principles

'Site B – Shao Lu Rd Gravel Pit' may be at variance to some of the clearing principles against which applications to clear are assessed by the Department of Water and Environmental Regulations, under Part 5 of the Environmental Protection Act (DWER 2019). High biodiversity is present at the site, but the overall vegetation community remains well protected in the conservation estate, with >30% remaining of pre-European distributions within the Interim Biogeographical Regionalisation of Australia (IBRA) Esperance Plains Region and the Shire of Esperance area. A portion of the site meets criteria as the Threatened Ecological Community (TEC) 'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia', and remains in excellent condition. Lastly, the site is a potential feeding site for the Carnaby's Black Cockatoo, *Calyptorhynchus latirostris*.

The Shire of Esperance does not prefer clearing vegetation to extract materials, and particularly on road reserves in excellent condition. However, this region has largely been exhausted for supplies of gravel within existing cleared areas. During works, additional care and focus on dieback hygiene and integrated weed management is required to prevent degradation of rehabilitated vegetation community.

7 References

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8 Appendix

8.1 Incidental species list

Table 3. Flora species present within 'Site B - Shao Lu Road Gravel Pit' application area.

Family	Genus	Species	Common Name	Invasive
Anarthriaceae	<i>Arnarthria</i>	<i>laevis</i>		
Asparagaceae	<i>Lomandra</i>	<i>hastilis</i>		
Asteraceae	<i>Arcotheca</i>	<i>calendula</i>	Capeweed	x
Asteraceae	<i>Argentipallium</i>	<i>niveum</i>		
Asteraceae	<i>Conyza</i>	sp.	Fleabane	
Asteraceae	<i>Ursinia</i>	<i>anthemoides</i>	Ursinia Daisy	
Brassicaceae	<i>Raphanus</i>	<i>raphanistrum</i>	Wild Raddish	x
Casuarinaceae	<i>Allocasuarina</i>	<i>humillis</i>		
Casuarinaceae	<i>Allocasuarina</i>	<i>thyoides</i>	Horned Sheoak	
Cyperaceae	<i>Mesomelaena</i>	<i>stygia</i>		
Cyperaceae	<i>Tricostularia</i>	<i>aphylla</i>	Curled Sedge	
Dilleniaceae	<i>Hibbertia</i>	<i>andrewsiana</i>		
Dilleniaceae	<i>Hibbertia</i>	<i>gracilipes</i>	Esperance Butter Cup	
Droseraceae	<i>Drosera</i>	<i>menziesii</i>	Pink Rainbow	
Ericaceae	<i>Leucopogon</i>	<i>carinatus</i>		
Ericaceae	<i>Lysinema</i>	<i>ciliatum</i>	Native Curry Flower	
Euphorbiaceae	<i>Monotaxis</i>	<i>paxii</i>		
Euphorbiaceae	<i>Stachystemon</i>	<i>virgatus</i>		
Fabaceae	<i>Acacia</i>	<i>cochlearis</i>	Rigid Wattle	
Fabaceae	<i>Acacia</i>	<i>cyclops</i>	Coastal Wattle	
Fabaceae	<i>Acacia</i>	<i>pycnantha</i>	Golden Wattle	x
Fabaceae	<i>Chorizema</i>	<i>obtusifolium</i>		
Fabaceae	<i>Davieisia</i>	<i>incrassata</i> subsp. <i>recurva</i>		
Fabaceae	<i>Davieisia</i>	<i>major</i>	Bitter Pea	
Fabaceae	<i>Davieisia</i>	<i>teretifolia</i>	Bitter Pea	
Fabaceae	<i>Hovea</i>	<i>trisperma</i>		
Fabaceae	<i>Ornithopus</i>	<i>compressus</i>	Yellow Serradella	x
Fabaceae	<i>Sphaerolobium</i>	<i>daviesioides</i>	Prickly Globe-pea	
Fabaceae	<i>Trifolium</i>	sp.	Clover	x
Geraniaceae	<i>Erodium</i>	sp.	Stork's Bill	x
Goodeniaceae	<i>Dampiera</i>	<i>lavandulaceae</i>		
Goodeniaceae	<i>Dampiera</i>	<i>sacculata</i>	Pouched Dampiera	
Goodeniaceae	<i>Goodenia</i>	<i>incana</i>	Hoary Goodenia	
Goodeniaceae	<i>Lechenaultia</i>	<i>tubiflora</i>	Heath Leschenaultia	
Haloragaceae	<i>Glischrocaryon</i>	sp.	Globular Pop Flower	
Hemerocallidaceae	<i>Dianella</i>	<i>brevicaulis</i>	Flax Lilly	

Iridaceae	<i>Patersonia</i>	<i>juncea</i>	Rush leaved Patersonia	
Malvaceae	<i>Malva</i>	sp.	Mallow	x
Myrtaceae	<i>Beaufortia</i>	<i>empetrifolia</i>	South Coast Beaufortia	
Myrtaceae	<i>Calothamnus</i>	<i>gracilis</i>	One-sided Bottle Brush	
Myrtaceae	<i>Calytrix</i>	<i>decandra</i>	Pink Starflower	
Myrtaceae	<i>Calytrix</i>	<i>leschenaultii</i>		
Myrtaceae	<i>Cyathostemon</i>	<i>ambiguus</i>		
Myrtaceae	<i>Darwinia</i>	<i>vestita</i>	Pom-pom Darwinia	
Myrtaceae	<i>Eucalyptus</i>	<i>angulosa</i>	Ridge-fruited Mallee	
Myrtaceae	<i>Leptospermum</i>	<i>spinescens</i>		
Myrtaceae	<i>Melaleuca</i>	<i>pulchella</i>	Claw Flower	
Myrtaceae	<i>Melaleuca</i>	<i>rigidifolia</i>		
Myrtaceae	<i>Melaleuca</i>	<i>scabra</i>	Rough Honey Myrtle	
Myrtaceae	<i>Melaleuca</i>	<i>suberosa</i>	Corky Honey Myrtle	
Myrtaceae	<i>Melaleuca</i>	<i>thymoides</i>		
Myrtaceae	<i>Melaleuca</i>	<i>tuberculata</i> subsp. <i>macrophylla</i>		
Myrtaceae	<i>Taxandria</i>	<i>marginata</i>		
Myrtaceae	<i>Verticordia</i>	<i>densiflora</i>	Compacted Feather flower	
Myrtaceae	<i>Verticordia</i>	<i>minutiflora</i>		
Orchidaceae	<i>Cyanicula</i>	<i>gemmata</i>	Blue China Lady	
Orchidaceae	<i>Disa</i>	<i>bractea</i>	South African Orchid	x
Orchidaceae	<i>Diuris</i>	<i>laxiflora</i>	Bee Orchid	
Orchidaceae	<i>Elythranthera</i>	<i>brunonis</i>	Purple Enamel Orchid	
Orchidaceae	<i>Thelymitra</i>	sp.	Sun Orchid	
Pittosporaceae	<i>Billardiera</i>	<i>fusiformis</i>	Australian Bluebell	
Poaceae	<i>Briza</i>	<i>maxima</i>	Blowfly grass	x
Poaceae	<i>Ehrharta</i>	<i>longiflora</i>	Veld Grass	x
Poaceae	<i>Hordeum</i>	<i>leporinum</i>	Barley Grass	x
Poaceae	<i>Neurachne</i>	<i>alopeкуроidea</i>	Foxtail Mulga Grass	
Proteaceae	<i>Banksia</i>	<i>obovata</i>	Wedge-leaved Banksia	
Proteaceae	<i>Banksia</i>	<i>obtusa</i>	Shining Honey-pot	
Proteaceae	<i>Banksia</i>	<i>pulchella</i>	Teasel Banksia	
Proteaceae	<i>Banksia</i>	<i>repens</i>	Creeping Banksia	
Proteaceae	<i>Hakea</i>	<i>cinerea</i>	Ashy Hakea	
Proteaceae	<i>Hakea</i>	<i>corymbosa</i>	Cauliflower Hakea	
Proteaceae	<i>Hakea</i>	<i>marginata</i>		
Proteaceae	<i>Hakea</i>	<i>obliqua</i>	Needles and Cork Hakea	
Proteaceae	<i>Hakea</i>	<i>Pandanicarpa</i> subsp. <i>crassifolia</i>		

Proteaceae	<i>Hakea</i>	<i>prostrata</i>	Harsh Hakea	
Proteaceae	<i>Hakea</i>	<i>trifurcata</i>	Two Leaved Hakea	
Proteaceae	<i>Hakea</i>	<i>varia</i>	Variable Hakea	
Proteaceae	<i>Isopogon</i>	<i>polycephalus</i>	Clustered Cone Flower	
Proteaceae	<i>Petrophile</i>	<i>fastigiata</i>		
Proteaceae	<i>Petrophile</i>	<i>linearis</i>	Pixie Mops	
Restionaceae	<i>Desmocladius</i>	<i>flexuosus</i>		
Restionaceae	<i>Desmocladius</i>	<i>lateriflorus</i>		
Restionaceae	<i>Hypolaena</i>	<i>fastigiata</i>		
Rubiaceae	<i>Opercularia</i>	<i>vaginata</i>	Dog Weed	
Rutaceae	<i>Boronia</i>	<i>crassifolia</i>		
Rutaceae	<i>Boronia</i>	<i>ramosa</i> subsp. <i>anethifolia</i>		
Rutaceae	<i>Boronia</i>	<i>spathulata</i>	Pink Boronia	
Stylidiaceae	<i>Stylidium</i>	<i>piliferum</i>	Common Butterfly Triggerplant	
Xanthorrhoeaceae	<i>Chamaescilla</i>	<i>corymbosa</i>	Blue Squill	
Xanthorrhoeaceae	<i>Xanthorrhoea</i>	<i>platyphylla</i>	Grass Tree	