GMA Mining Australia

Supporting Documentation for a Native Vegetation Clearing Permit Application

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Abbreviations

Abbreviation	Definition
BAM Act	Biosecurity and Agricultural Management Act 2007
BoM	Bureau of Meteorology
DAWE	Department of Agriculture, Water and Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DMPE	Department of Mines, Petroleum and Exploration
DP	Declared Pest
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986*
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
ESA	Environmentally Sensitive Area
IUCN	International Union for Conservation of Nature
NVCP	Native Vegetation Clearing Permit
PEC	Priority Ecological Community
RIWI Act	*Rights in Water and Irrigation Act 1914*
TEC	Threatened Ecological Community
BC Act	*Biodiversity and Conservation Act 2016*
DMPE	Department of Mines, Petroleum and Exploration

1. Introduction

1.1 Background

GMA Garnet Pty Ltd (GMA) is a wholly owned subsidiary of Garnet International Resources Pty Ltd. GMA owns and operates the garnet mineral sand mining and processing operations in the Mid-West Region, Port Gregory, Western Australia. GMA operates two open-cut alluvial garnet mines, the Hose Mine (tenements G70/171, M70/856, M70/926 and M70/927) and the Lynton Mine (tenements M70/204, M70/259, M70/968, M70/1330 and M70/1331). Mining is currently undertaken within M70/204 (Lynton north and south pit) and M70/926. All ore is processed at the wet separation plant (wet plant) located on M70/856.

This native vegetation clearing permit (NVCP) application seeks approval to clear regrowth of native vegetation on M70/856 (previously cleared), as GMA is required by the Landholder to ensure the land is returned to pre-mining conditions, namely pasture. The application also seeks approval to clear a narrow tract of native vegetation to expand the haul road. The clearing extent is up to 60 hectares within an approximately 121-hectare approval envelope. Most of the proposed clearing was previously approved under NVCP CPS 9065; however, that program expired in December 2025.

A clearing permit is required under the *Environmental Protection (Clearing of Native Vegetation) Regulation 2004* and the *Environmental Protection Act 1986* (EP Act), which contains provisions that protect native vegetation while allowing approved clearing activities.

1.2 Document Purpose

This document provides the supporting information for a NVCP under *Section 50E of Part V of the Environmental Protection Act 1986*, to clear no more than 60 hectares (ha) (the application area) in M70/856 and G70/171.

This document comprises the following:

- A description of the clearing details.
- Environmental Setting.
- Details on other environmental approvals.
- Risk assessment and management, including mitigation hierarchy.
- Assessment of the Ten Clearing Principles as defined in Schedule 5 of the EP Act.

GMA commissioned Earthstewardship (2020) and GHD Pty Ltd (GHD, 2022) to undertake a basic flora and vegetation survey of the application area. The information contained within the flora and vegetation survey has formed the robust environmental assessment component of this report (Appendix A).

The survey supporting this NVCP application was submitted to the Index of Biodiversity Surveys for Assessments (IBSA). The submission details are summarised in Table 1.

Table 1 IBSA Submission Details

Report name	IBSA number
GHD (2022) Basic and Targeted Flora and Vegetation Survey M70/926	IBSA-2025-0438.
Earth Stewardship (2020) GMA Garnet Hose Mining Operation Vegetation Survey	IBSA-2020-0406

220000 m

225000 m

000 m

000 m

6895000

6890000

Legend

- GMA Mining Tenements
- NVCP Hose

M70/926

M70/927

G70/171

M70/856

M70/1330

Map Projection: Transverse Mecator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50
Imagery: Google (2023)
Survey: GMA (2026)

0.0 km 1.0 km 2.0 km

N

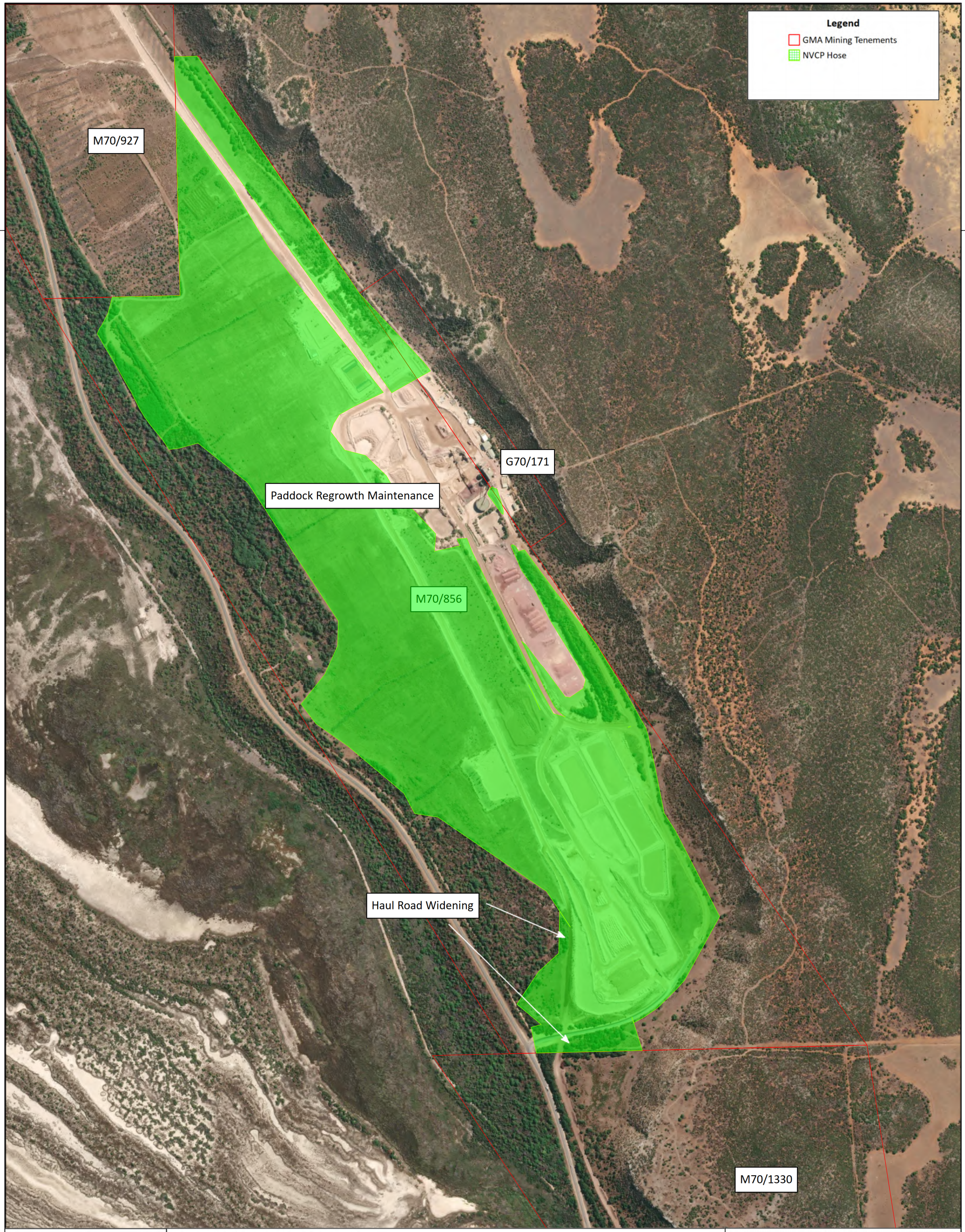
Figure 1
GMA Garnet
Port Gregory Mine Site
New NVCP
Location

2. Proposed Clearing Activities

The clearing activities within the application area are outlined below:

- Expand the existing Haul Road to meet Haul Road standards related to mining operations.
- Maintenance of native vegetation regrowth on the paddock and growing along the roadside.

The proposed clearing method predominantly uses a dozer with a scrub rake. The clearing activities are shown in Figure 2.



Map Projection: Transverse Mecator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50
Imagery: Google (2023)
Survey: GMA (2026)

0 m 150 m 300 m 450 m

N

Figure 2
GMA Garnet
Port Gregory Mine Site
New NVCP
Clearing Activities

3. Environmental Setting

3.1 Climate

The application area is located within the Midwest Region of Western Australia. The climate of the Midwest is considered warm semi-arid to Mediterranean climate with 400 to 500 mm of rainfall per annum (Desmond & Chant, 2002). The region experiences a short, mild, wet winter, and the remainder of the year is warm to hot, dry to windy.

The Annual Evaporation rate in the area is around 2,500 mm.

The nearest Bureau of Meteorology (BoM) station that provides reliable wind data is Geraldton Airport (Site No. 8051). The BoM's 2007 meteorological file for Geraldton Airport indicates that the dominant winds blow from the south and south-east, with a secondary prevailing wind from the north-east (Chart 1). Wind speeds between 2 and 6 m/s are most often observed, with gusts up to 8 m/s from the south-east.

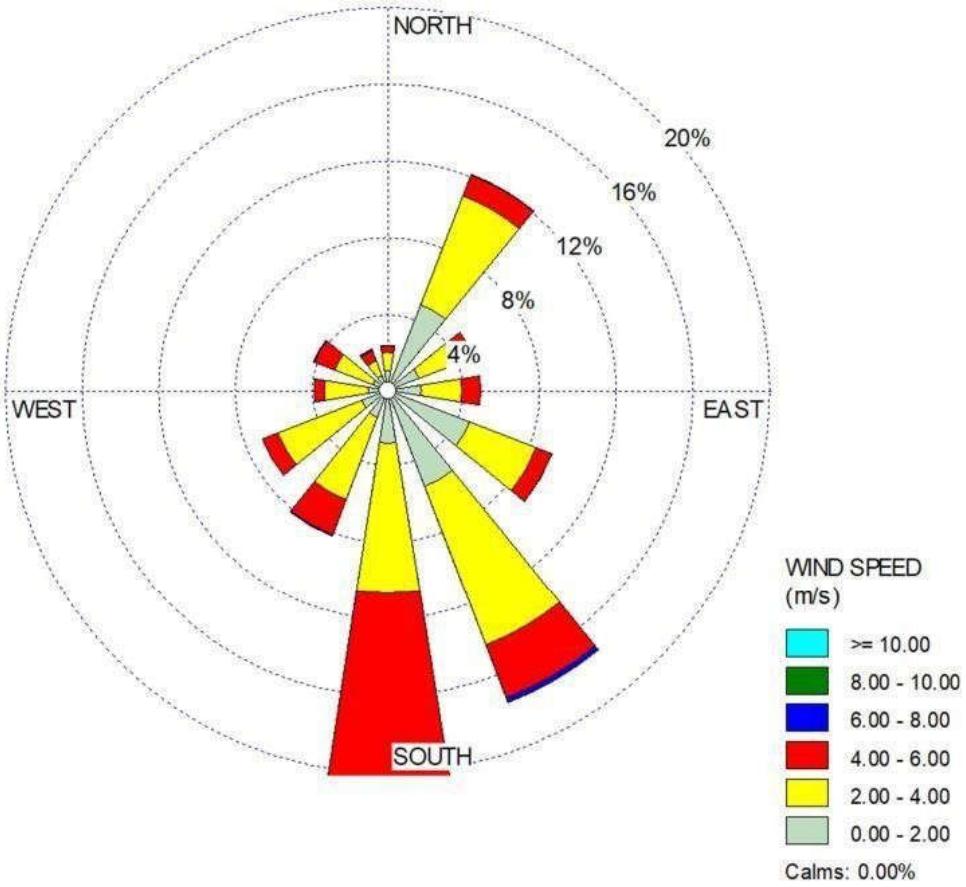


Chart 1 Wind Rose (9 am and 3 pm) BoM 2007

3.2 Land use

3.2.1 Current and Historical Land Use

Review of historical aerial imagery from January 2000 onwards indicates that the footprint has been cleared and used for pasture, and more recently for mining. As outlined in section 1.1, the area has been subject to a previously approved vegetation maintenance clearing permit, which expired in December 2025. This permit was issued to fulfil the requirements of the Land Access Agreement and the Mine Closure Plan, which require GMA to return the land to pasture.

3.2.2 *Reserves*

A review of publicly available data confirmed that the IUCN Category 1a Nature Reserve, Utcha Well, is located approximately 160 m west of the clearing envelope (DBCA, 2025) (Figure 2a).

3.3 *Landforms, geology and soils*

The application area is covered by two soil-landscape mapping systems as described:

- The Grey System (23 – Riverbeds, terraces, and alluvial flats include dissected margins of relic alluvial plains.
- Tamala North System – Low hills with relic dunes and some limestone outcrop. Forms a coastal band 3 to 7 km wide.

The application area lies within the Tumblagooda Sandstone, characterised by sandstone interbedded with minor siltstone and granule-to-pebble conglomerate. Most of the survey area lies within the Tamala North Land System, described as low hills with relic dunes and some limestone outcrop, forming a coastal band 3 to 7 km wide. Parts of the survey area's western boundary lie within the Grey Land System, described as riverbeds, terraces and alluvial flats, including dissected margins of relic alluvial plains (GHD 2020a). GMA engaged Landloch (2024) to complete a baseline soil assessment of the Port Gregory Site. The findings of the assessment mapped two soil mapping units (SMU) and rehabilitated soils including:

- Rehabilitated soils - Soils that have been returned as part of post-mining rehabilitation. The reconstituted profile comprises two materials, with the top 0.5 m consisting of potentially returned topsoil and subsoils. The material below 0.5 m is sandy and has increased coarse-fragment abundance; it is likely mining waste (approximately 87% of the application area).
- Deep sands (SMU1) – Deep, alkaline, sandy soils with limited pedological development and increased coarse fragments at depth. Soil profiles were deeper than 1.5 m (approximately 2% of the application area).
- Shallow sands (SMU2) – Shallow, alkaline, sandy soils with minimal pedological development. Soil profile depth is less than 0.8 m. These soils lie atop a hardened limestone layer (approximately 1% of the application area).

There were unmapped areas, which was due to the absence of soils (i.e. ROM, haul roads).

The topography of the application area ranges from 6 to 44 metres above sea level. Soils within M70/856 are brown to orange sands (GHD, 2022). The application area was within the Hose Resource area, which had been previously mined, resulting in modifications to the site's topography.

The mapped soil units are shown in Figure 3b, and the topography in Figure 3c.

220000 m

225000 m

6895000

6890000

000 m

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Legend

- DBCA Reserves
- GMA Mining Tenements
- NVCP Hose

M70/926

M70/927

G70/171

M70/856

M70/1330

Map Projection: Transverse Mecator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50
Imagery: Google (2023)
Survey: GMA (2026), DBCA (2025)

0.0 km 1.0 km 2.0 km

N

Figure 3a
GMA Garnet
Port Gregory Mine Site
New NVCP
DBCA Reserve

225000 m

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Legend

- G70/171
- M70/1330
- M70/204
- M70/856
- M70/926
- M70/927
- NVCP Application Area
- Rehabilitated Soils
- SMU1
- SMU2
- Unknown Area Type

G70/171

M70/856

125 m 375 m 625 m

N

Map Projection: Transverse Mecator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50
Imagery: Google (2023)
Survey: GMA (2026), Landloch (2024)

Figure 3b
GMA Garnet
Port Gregory Mine Site
New NVCP
Soil Mapping (Landloch 2024)

225000 m

225000 m

000 m

6890000

Legend

- GMA Mining Tenements
- NVCP Hose
- Landgate Topography 2m

M70/926

M70/927

M70/856

G70/171

M70/1330

38 m
44 m
36 m
28 m
18 m
6 m
32 m
14 m
32 m
8 m
24 m
18 m
10 m
6 m

Map Projection: Transverse Mecator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50
Imagery: Google (2023)
Survey: GMA (2026),WAGov(2025)

125 m 375 m 625 m

N

Figure 3c
GMA Garnet
Port Gregory Mine Site
New NVCP
Topography

3.4 Hydrogeology and Hydrology

3.4.1 Surface water

The clearing application area is not within a proclaimed surface water catchment area and has a low average annual rainfall (400 mm/year); however, it is subject to cyclonic events. The project is located on sandplains and has minimal drainage lines due to the porous nature of the sandplain and the underlying carbonate sedimentary rock, which allows groundwater to flow. URS (2013) identified that a small proportion of groundwater recharge originates from rainfall that infiltrates during the winter months and from episodic significant rainfall events associated with cyclones (URS, 2013). GHD (2022) did not record drainage lines within the clearing application area.

The sandplain is bounded to the east by a low limestone escarpment (Tamala Limestone). The Tamala Limestone consists of unconsolidated sands, limestone lenses/layers and patchy zones of carbonate cementation. Minor drainage lines occur on the slope of the Tamala Limestone escarpment; however, due to the porous nature of the underlying geology, any rainfall will likely infiltrate into the groundwater (URS, 2013).

The nearest surface water is the Hutt Lagoon, located approximately 350 metres west of the project. It is approximately 15 km long and up to 2.5 km wide. The Lagoon is listed as a wetland of national importance in the Directory of Important Wetlands in Australia (DIWA) and as an Environmentally Sensitive Area (DEC, 2009). Water supply to the Hutt Lagoon derives from direct precipitation, surface inflows from several minor creeks, and groundwater seepage (DEC 2009).

The Hutt Lagoon is listed as a wetland of national importance in the Directory of Important Wetlands in Australia (DIWA) (DEC, 2009). Hutt Lagoon is a macroscale, elongate sump land aligned northwest to southeast, parallel to the coast. The Lagoon is usually partially filled with hypersaline water in winter; for the remainder of the year, it is usually dry. The Lagoon is home to the world's largest microalgae production facility, a 250-hectare series of artificial ponds used to produce beta-carotene. During summer and the dry season, the Lagoon is mostly empty, except for the artificial ponds used for algal cultivation (URS, 2013). The Hutt Lagoon is bordered by a macroscale, elongate floodplain (to the north-west and the south-east) that includes more than twenty microscale, elongate sump lands, such as Utcha Swamp (Jaensch, 1992). Water supply to the Hutt Lagoon derives from direct precipitation, surface inflows from several minor creeks, and groundwater seepage (DEC, 2009).

The mapped ESA is shown in Figure 3d.

3.4.2 Groundwater

The Department of Water and Environmental Regulation (DWER) Perth Groundwater Map indicates the survey area is within the Gascoyne Groundwater Area.

A shallow aquifer underlies the Application Area, with superficial formations up to 15 m thick that become progressively thinner towards the east. Subsurface flows are from east to west and discharge into the Hutt Lagoon. The flows discharge over a hypersaline saltwater wedge extending from the eastern portion of the Hutt Lagoon. Groundwater salinity within the Application Area varies from 800 mg/L to 1,500 mg/L. Salinity is higher towards the Utcha Swamp (up to 30,000 mg/L) and the Hutt Lagoon perimeter (up to 150,000 mg/L). Groundwater levels vary from 15 m below ground level (m bgl) near the western boundary of the tenement to 35 m bgl (URS, 2013).

3.4.3 Public Drinking Water Source Areas

There are no public drinking water source areas within 10 km of the application area. The nearest public drinking water source is located 60 km north of the application area, at the Kalbarri Water Reserve (Department of Water and Environmental Regulation, 2020).

225000 m

000 m

6890000

Legend

- Environmentally Sensitive Areas
- GMA Mining Tenements
- NVCP Hose

M70/927

G70/171

M70/856

M70/1330

Map Projection: Transverse Mecator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50
Imagery: Google (2023)
Survey: GMA (2026), DBCA (2025)

125 m 375 m 625 m

N

Figure 3d
GMA Garnet
Port Gregory Mine Site
New NVCP
Environmental Sensitive Areas

225000 m

3.5 Flora and Vegetation

3.5.1 Broad Vegetation Mapping and Extent

Broadscale mapping (1:1,000,000) pre-European vegetation mapping (Beard, 1976) indicates two Beard Vegetation Associations (BVA) were mapped within the application area, including:

- BVA 371 - Low forest.
- BVA 17 - Thicket

Shephard et al. (2002) adapted and digitised the pre-European mapping. The extent of vegetation associations has been determined by the State-Wide vegetation extent calculations maintained by the DBCA (current as of March 2019—GoWA, 2019).

As shown in Table 3, the current extent of BVA 371 is below the 30% retention target of the pre-clearing size at all levels except Local Government Authority Levels.

Table 2 Pre-European Vegetation Extent Association (GoWA, 2020)

Pre-European Vegetation Extent Association	Pre-European (ha)	Current extent (ha)	Remaining pre-European extent (%)
Greenough_17			
State	76,633.84	67,605.49	88.22
IBRA Bioregion: Geraldton Sandplains	54,078.08	45,159.85	83.51
Sub-IBRA: Geraldton Hills	49,605.04	42,016.28	84.70
LGA: Shire of Northampton	49,549.89	41,939.33	84.64
Greenough_371			
State	32,816.04	3,499.60	10.66
IBRA Bioregion: Geraldton Sandplains	32,807.53	3.499.10	10.67
Sub-IBRA: Geraldton Hills	32,807.53	3,499.10	10.67
LGA: Shire of Northampton	5,749.92	2,142.08	36.94

3.5.2 *Mapped vegetation types and conditions*

GHD (2022) mapped one vegetation type within the application area:

- Vegetation type 1: *Acacia rostellifera* open woodland to woodland.

Earth Stewardship (2020) mapped seven vegetation types within the application area, and these included:

- Vegetation type 1: Cleared Tracks and Infrastructure.
- Vegetation type 2: Paddocks.
- Vegetation type 3: Regrowth.
- Vegetation type 4: Artificial plantings.
- Vegetation type 5: *Acacia rostellifera* Dense Shrublands.
- Vegetation type 6: *Acacia rostellifera* Open Shrublands on Limestone.
- Vegetation type 7: *Acacia rostellifera* Tall Shrublands.

The pre-European broad vegetation map shows BVA 371 and BVA 17 within the survey area. VT01 and VT02 align more closely with BVA 17 (*Acacia rostellifera* thicket) than with BVA 371 (Low forest; *Acacia rostellifera*). Beard and Burns (1976) describe BVA 371 as occurring on black-clay bottomland soils, with wattles exceeding 10 m in height, in pure stands with no Melaleuca sp. This vegetation type does not match these habitat characteristics and structural elements. BVA 17 (*Acacia rostellifera* thicket) occurs on shallow sandy and thin, rocky soils over limestone (Beard & Burns, 1976). All vegetation types align with BVA 17 based on soil type and landscape position.

The mapped vegetation types and conditions are shown in Figures 4a and 4b.

3.5.3 *Ecological Communities*

GHD (2022) desktop searches did not identify Threatened Ecological Communities within 10 km of the application area. Two Priority Ecological Communities PECs were identified within 10 km of the application, and these include:

- The Kalbarri Ironstone Community (P1) – 8 km east of the application area.
- Shrubland of the Northampton Area, dominated by Melaleuca species over exposed Kockatea shale
- (Priority 1 – PEC) – 5 km south-east of the application area.
- No PECs or TECs were delineated from the application area (GHD, 2022).

3.5.4 *Flora Diversity*

Fifty-four flora taxa (including subspecies and varieties) representing 26 families and 50 genera were recorded from the survey area during the field survey. This total comprised 38 native taxa and 16 introduced flora taxa (GHD, 2022). Earth Stewardship (2020) recorded 73 flora taxa from 35 families in the application area. In total, 29 were considered weeds or introduced species, and two were deliberately planted.

3.5.5 *Conservation significant flora*

No conservation-listed flora species were recorded within the survey area. The survey area was in degraded condition, with very high invasive weed cover throughout and significant wild pig grazing, which has impacted habitat conditions. (GHD (2022) and Earth Stewardship (2020)).

3.5.6 *Environmentally Sensitive Area*

One Environmentally Sensitive Area (ESA) was identified 500 meters west of the application area (GHD 2022).

3.6 Fauna

A Fauna assessment was not undertaken during the field surveys, as the survey area contained regrowth and was considered low value due to degradation and high modification.

225000 m

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6890000

M70/927

G70/171

M70/856

M70/1330

Legend

Environmental Surveys

EarthStewardship (2020) Mapped Vegetation Types

- Artificial Planting
- Cleared Tracks / Infrastructure
- Dense Shrublands
- Open Shrublands on Limestone
- Paddocks
- Regrowth
- Tall Shrubland

M70-926 Enviro Survey 2022

2C_Vegetation_py.shp

- Acacia rostellifera
- Cleared
- Melaleuca cardiophylla
- Myoporum

NVCP

NVCP Hose

- NVCP Application Area

GMA

Map Projection: Transverse Mecator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50
Imagery: Google (2023)
Survey: GHD (2022) & Earth Stewardship (2020)

125 m 375 m 625 m

N

Figure 4a
GMA Garnet
Port Gregory Mine Site
New NVCP
Vegetation Types

225000 m

225000 m

000 m

6890000

M70/927

G70/171

M70/856

M70/1330

Legend

Environmental Surveys

EarthStewardship (2020) Mapped Vegetation Conditions

- Completely Degraded
- Degraded
- Good

M70-926 Enviro Survey 2022

2D_VegetationCondition_py.shp

- Cleared
- Degraded

NVCP

NVCP Hose

- NVCP Application Area

GMA

Map Projection: Transverse Mecator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50
Imagery: Google (2023)
Survey: GHD (2022) & Earth Stewardship (2020)

125 m 375 m 625 m

N

Figure 4a
GMA Garnet
Port Gregory Mine Site
New NVCP
Vegetation Conditions

225000 m

3.6.1 *Fauna Diversity*

A search of the Dandjoo Biodiversity Data Repository indicated that 78 terrestrial fauna species are known within 10 km of the application area. The total included 73 birds and one reptile.

The following fauna are known to the area as they have been previously recorded in fauna surveys in adjacent mining tenements, including:

- *Felis catus* (Cat).
- *Sus scrofa* (Feral Pig).
- *Vulpes vulpes* (Red Fox).
- *Capra hircus* (Goat).
- *Oryctolagus cuniculus* (European Rabbit).
- *Mus musculus* (Mice)

3.6.2 *Conservation Significant Fauna*

Number of records from the EPBC PMST and the Dandjoo database for the potential presence of nine conservation-significant fauna taxa within 10 km of the application area. It should be noted that all migratory marine and wetland-listed species were excluded from this total, as no marine or wetland habitat types are present within the application area.

A likelihood assessment was undertaken and is presented in Appendix D. The likelihood-of-occurrence assessment concluded that all conservation-significant fauna species were unlikely to occur within the application area.

Carnaby's Black cockatoo

Description and Ecology

The Carnaby's Black-cockatoo, predominantly found in the Wheatbelt region of southwest Western Australia, breeds from July to August and from January to February. This species exhibits a seasonal migratory pattern, with most birds moving to coastal areas with higher rainfall for foraging during the non-breeding season (DSEWPaC, 2012).

According to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), in 2012 the survey area fell within the non-breeding range of Carnaby's Black cockatoo. However, the available foraging habitat within the survey area is marginal. This information is crucial for understanding the distribution and behaviour of these birds and can aid in conservation efforts and habitat management.

Habitat

The habitat within the application area is at the outer (northern) non-breeding range for the presence of the Carnaby's Black cockatoo. As indicated in Table 3, the recorded habitat types within the survey area do not support roosting habitat or foraging habitat for the Carnaby's Black cockatoo. A review of the DEC (2013) Plants Used by Carnaby's Black Cockatoo further indicates that no potential foraging species were recorded within the application area by GHD (2020a).

Table 3 Summary and extent of Carnaby's Black-cockatoo habitat within the application area

Habitat type	Presence within the survey area	Evidence
Foraging habitat	There is no suitable foraging habitat within the application area.	None
Actual breeding habitat	The application area falls outside the modelled breeding range	None
Roosting habitat	The fauna habitat types do not support roosting habitat	None

Local and regional context

One reported moderately certain sighting (y., 2006) of the Carnaby's Black cockatoo within the local area, approximately 2 km east of the survey area, at Port Gregory, Western Australia (DBCA 2013).

Anecdotally, the Carnaby's Black cockatoo is known to breed and roost within the Kalbarri National Park, approximately 40 km north of the survey area (pers. com. Birdlife Australia 2019). Breeding success depends on the quality and proximity of feeding habitat within 12 km of nesting sites (DEC, 2013). There is no suitable habitat within the application area.

4. Environmental Risk Assessment and Management

4.1 Identifying Environmental Threats

Threats related to the clearing of native vegetation for the Lynton Project are summarised in Table 4.

Table 4 Threats related to the clearing of native vegetation.

Environmental Threats	Potential Risk
Clearing of native vegetation	Clearing beyond approved boundaries and/or exceeding approved disturbance boundaries.
Dust	The impacts on native flora are caused by dust emanating from the area.
Native fauna and habitat	Clearing of vegetation and activity associated with the project has the potential to directly (vehicle strikes, habitat removal) and indirectly impact native fauna (changes to foraging and dispersion dynamics)
Introduced flora	Weeds compete with native species and impact the success of rehabilitation.

4.2 Risk Assessment

An Environmental Risk Assessment was completed for the threats identified above using the criteria adopted from the DMPE Statutory Guidelines for Mining Proposal (2020); refer to Table 5. The environmental risk assessment criteria are provided in Appendix B.

Table 5 Risk assessment and management

Environmental Threat	Cause	Potential impact	C	L	Inherent Risk Level	Management	C	L	Treated risk
Clearing of vegetation	Clearing works undertaken to the proposal.	Clearing native vegetation in unapproved areas and/or outside the tenement boundary. Environmental factor: • Biodiversity/flora/fauna and biodiversity.	minor	possible	9 - medium	• Awareness training highlights the procedure for clearing and • Clearing and Ground Disturbance permit systems and procedures are in place. • Survey control of areas to be cleared. • Post-clearing checks to ensure clearing has been undertaken following the permit conditions.	minor	Infrequent	5 – low
Dust	Vehicle and machinery movement	Fugitive dust from vehicle movement and machinery operations settle on adjacent vegetation, causing plant death. Environmental Factors: • Biodiversity/flora/fauna/ecosystem	minor	possible	9 - medium		minor	Infrequent	5 - low
	Wind	Fugitive dust from wind blowing across cleared areas and stockpiles settle on adjacent vegetation, causing plant death. Environmental Factors: Biodiversity/flora/fauna/ecosystem	moderate	likely	17- high	Dust management will be undertaken in accordance with the GMA's Dust Management Procedure in Appendix C. The following management measures are proposed: • Water carts will undertake dust suppression on haul roads • Dust suppressant	minor	infrequent	5 - low

Environmental Threat	Cause	Potential impact	C	L	Inherent Risk Level	Management	C	L	Treated risk
						additives (mulches or polymer additives) will be used if water application is insufficient to control dust generation. Any mining activities will cease if dust suppression controls fail to mitigate dust emissions.			
Native fauna and habitat	Clearing vegetation.	Impact on native fauna and habitat. Environmental factor: • Biodiversity and habitat loss.	minor	likely	10-medium	Clearing is managed through the clearing and ground disturbance procedure.	minor	infrequent	5 - Low
Native fauna and habitat	Interaction with fauna.	Interaction with native fauna. Environmental Factors: Biodiversity/flora/fauna/ecosystem	minor	likely	10-medium	Fauna awareness training. Speed limits are imposed on access and haul roads.	minor	infrequent	5 - Low
Introduced flora	New invasive weed species introduced to the site.	Any machinery brought to the Port Gregory mine site must be inspected and have a completed weed-and-seed certificate. Environmental Factors: Biodiversity/flora/fauna/ecosystem	Minor	Likely	10 – medium	• Weed and hygiene procedure • Machinery or equipment brought to site is cleaned and inspected before mobilisation.. • Inspection of machinery on	minor	Infrequent	5- low

Environmental Threat	Cause	Potential impact	C	L	Inherent Risk Level	Management	C	L	Treated risk
						arrival. • Weed surveys to be undertaken.			

4.3 *Specific Management Actions to Address Impacts from Clearing*

4.3.1 *Clearing of Native Vegetation*

Management Action

To ensure clearing is managed appropriately, management actions will include:

- Vegetation clearing procedures and processes to prevent unauthorised clearing, including as part of the Site induction training.
- A clearing and ground disturbance permit system that requires authorisation from the Environmental and Land Access and Compliance departments.
- Survey control to ensure the clearing extent is demarcated with flagging tape.
- All site personnel undertaking clearing activities have been inducted and understand the clearing procedure and permitting processes.

4.3.2 *Dust*

The main environmental impact of dust emissions is vegetation death, caused by high levels of dust settling on plant leaves, which prevents photosynthesis and respiration.

The primary dust sources are vegetation clearing, vehicle movement, machinery operations, and strong winds.

Newly cleared areas, along with existing open areas such as run-of-mine, laydown, and stockpiles, can generate dust, particularly in windy conditions.

Management Actions

As per our Environmental Licence, dust generation management actions include:

- Land clearing and topsoil handling should be avoided in windy conditions, particularly where they may affect sensitive receptors.
- Water carts to suppress dust.
- Soil stockpile heights limited.

4.3.3 *Application of Mitigation Hierarchy*

In accordance with a guide to the assessment of applications to clear native vegetation (DER 2014), the clearing has been considered in the context of the impact mitigation hierarchy and outlined below.

Avoidance

Avoidance measures have been prioritised in project planning. The area proposed for clearing is limited to previously disturbed and degraded paddock areas with native regrowth, thereby avoiding intact remnant vegetation where practicable.

The alignment of the proposed haul road expansion has been designed to follow existing disturbance corridors and cleared paddock areas. Transects associated with the haul road have been positioned to pass through areas of degraded vegetation where possible, avoiding patches of higher-quality native vegetation and minimising fragmentation.

Mitigation

Where complete avoidance is not practicable, mitigation measures will be implemented to reduce potential impacts associated with clearing activities. These include:

- Clearly delineating approved clearing boundaries prior to works.
- Progressive clearing to allow fauna dispersal.

5. Assessment of the Ten Clearing Principles

The clearing of regrowth of native vegetation on M70/856 (previously cleared) is required by the Landholder, as GMA is required to ensure the land is returned to pre-mining conditions, namely pasture. The application also seeks approval to clear a narrow tract of native vegetation to expand the haul road. An assessment of the proposed clearing action against the ten clearing principles, as outlined in Schedule 5 of the EP Act, is provided in Table 7.

The assessment indicates that the clearing is 'not considered to be at variance with the Ten Clearing Principles'.

Table 6 Assessment of the Ten Clearing Principles

Clearing Principle	Assessment	Conclusion
Principle (a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.	The application area is in the Geraldton Hill sub-region of the Geraldton Sandplains IBRA. Two Beard Vegetation Association has been mapped in the application area BVA 371 and BVA 17. The pre-European remaining for BVA 371 is 10.67% at the State, IBRA, and Sub-IRA levels. At the LGA level, 36.9% of native vegetation remains. The mapping results from the vegetation and flora surveys conducted by GHD (2022) and Earth Stewardship (2020) identified a total of eight vegetation types, including planted and degraded areas. A comparison with the Beard Vegetation Association description confirms that these vegetation types are equivalent to BVA 17. 54 taxa (including subspecies and varieties) representing 26 families and 50 genera were recorded in the survey area during the field survey. This total comprised 38 native taxa and 16 introduced taxa (GHD, 2022). Earth Stewardship (2020) recorded 73 flora taxa from 35 families in the application area. In total, 29 were considered weeds or introduced species, and 2were deliberately planted. The EPBC Act PMST and DBCA Threatened and Priority Flora databases identified the presence/potential presence of 48 conservation-significant flora taxa within 10 km of the survey area. The likelihood-of-occurrence assessment post-field survey concluded that 29 species are highly unlikely to occur in the survey area, and 19 are unlikely to occur. The application area is not within a TEC or PEC. All areas were mapped as degraded, except for cleared areas. The majority of the application has undergone historical clearing (agriculture), with regrowth in some areas. Other disturbances include signs of high grazing impacts and evidence of wild pig digging. The proposal involves clearing up to 60 hectares of degraded to completely degraded vegetation to widen the haul road and to support regrowth maintenance in paddock areas and along the access road edges. Most of the paddock and edges of the access road have been previously cleared.	The proposed clearing is not considered to be at variance with this Principle.
Principle (b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significant Habitat for fauna indigenous to Western Australia.	The EPBC Act PMST and DBCA Threatened, and Priority Flora databases identified the presence/potential presence of 48 conservation-significant flora taxa within 10 km of the survey area. The likelihood-of-occurrence assessment post-field survey concluded that 29 species are highly unlikely to occur in the survey area, and 19 are unlikely to occur.	The proposed clearing is not considered to be at variance with this Principle.
Principle (c) – Native vegetation should not be cleared if it includes or is necessary for the continued existence of rare flora.	No Threatened (Declared Rare) flora was recorded from the application area (Earth Stewardship 2020 and GHD 2022).	The proposed clearing is not considered to be at variance with this Principle.

Clearing Principle	Assessment	Conclusion
Principle (d) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	There are no known TECs within the application area. The vegetation types mapped within the application area are not considered to be representative of the TEC or PEC (GHD, 2022.	The proposed clearing is not considered to be at variance with this Principle.
Principle (e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	The mapping results from the vegetation and flora surveys conducted by GHD (2022) and Earth Stewardship (2020) identified a total of eight vegetation types, including planted and degraded areas. A comparison of vegetation types with the Beard Vegetation Associations mapped within the application area indicates that vegetation types closely align with BVA 17. The current extent of vegetation Greenough 17 is greater than 30% of its pre- European extent at State, IBRA regional and sub-regional, and LGA levels.	The proposed clearing is not considered to be at variance with this Principle.
Principle (f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	There are no watercourses within the application area. The nearest watercourse is the Hutt River, located 15 km south of the application area (GHD 2022). There are no wetlands within the application area. The nearest wetland is the Hutt Lagoon, which is approximately 650 m from the area (GHD 2022).	The proposed clearing is not considered to be at variance with this Principle.
Principle (g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	The deep sands in the area have a high to very high risk of wind erosion. GMA proposes to expand the existing haul road and clear vegetation regrowth in an existing paddock.	The proposed clearing is not considered to be at variance with this Principle.
Principle (h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	There are no conservation areas within the application area. The nearest reserve is Utcha Well, located approximately 2.3 kilometres north of the application area. There is no direct linkage between the reserve and the application area; therefore, clearing is unlikely to affect the environmental values of the nearby reserve. Additionally, much of the area surrounding the application area has been cleared or previously cleared.	The proposed clearing is not considered to be at variance with this Principle.
Principle (i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water	Due to the soils' porous nature, rainfall rapidly infiltrates directly through the limestone. Most of the surface water is expected to infiltrate rapidly. The clearing is limited to a small extent of regrowth and is not expected to alter the quality of surface or groundwater within the application area. The water table is too deep (16 to 35 m bgl) to support the root systems of any species (URS 2013).	The proposed clearing is not considered to be at variance with this Principle.
Principle (j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	The climate of the application is semi-arid to Mediterranean, with 400 to 500 mm of rainfall per annum (Desmond & Chant, 2002). The region experiences a short, mild, wet winter, and the remainder of the year is warm to hot, dry to windy. Due to the porous nature of the soil, rainfall rapidly infiltrates directly through the limestone. It is expected that most of the surface water will rapidly infiltrate. Clearing of native vegetation is not expected to cause or exacerbate the incidence or intensity of flooding. The application area is on sandy soils, which are not prone to flooding.	The proposed clearing is not considered to be at variance with this Principle.

6. Reference

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Appendix A. Environmental Surveys

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GMA Garnet Pty Ltd:

Hose Mining Operations – Vegetation Survey

September 2020

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1 Introduction

GMA Garnet Pty Ltd (GMA) requires survey of eight areas of vegetation within the vicinity of the Hose Mining Operations, located east of George Grey Drive, Yallabatharra.

1.1 Scope of Works

The scope of works included:

- A Level 1 vegetation survey using a series of relevés and wandering transects. It also included survey of non-permanent 10 m x 10 m quadrats (where suitable[1]);
- Mapping of vegetation communities and tabular description of vegetation types and condition;
- Supply of survey data and GIS shapefiles; and
- Production of a short report detailing outcomes of vegetation survey.

1.2 Project Background – Hose Operations Area Vegetation

Vegetation in the vicinity of the Hose Mining Operations area consists of areas of cleared paddocks, trees planted as shelter-belts, locations where regrowth has occurred as part of natural recovery and/or rehabilitation efforts, and areas of native vegetation (Figure 1).

[1] Although included in the original scope, the survey of 10 m x 10 m quadrats was excluded from the field survey due to the small areal extent of vegetation present within the survey areas.



Figure 1 - Survey Areas

Hose Operations Vegetation Survey - August 2020

Legend

GMA Garnet Survey Area

Google Hybrid

0 250 500 m

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2 Methodology

2.1 Desktop Review (GMA)

GMA Garnet has completed the desktop review of the Hose Mining Operations area.

2.2 Field Survey

A single season reconnaissance vegetation assessment (Level 1) of the survey area was conducted by experienced botanist Joshua Foster on the 20 August 2020. The field survey was undertaken to ground-truth the results of the desktop review, identify and describe the vegetation types and assess vegetation condition.

The survey methodology employed for the survey was undertaken with reference to the EPA (2016) *Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* and the EPA (2004) *Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*.

2.2.1 Collection of Data

Survey methods involved the sampling of relevés located in identified vegetation types, wandering transects and through opportunistic sampling. The survey area was traversed on foot and by vehicle. Twenty-six relevés were assessed within the survey areas. The location of the relevés was based on aerial photography, and each site was *in situ*, through observations of vegetation during the field assessment. Field data for each relevé was recorded on a pro-forma data sheet and included the parameters detailed in Table 1. The locations of the relevés surveyed are indicated in Figure 2.

Table 1: Data collected during the field surveys

Aspect	**Data collected**
Collection Attributes	Personnel/recorder; survey date, photograph of the relevé site.
Location	Co-ordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately ± 5 m.
Vegetation Condition	Vegetation condition was assessed using the condition rating scale as adopted by the EPA (2016).
Disturbance	Level and nature of disturbances.
Flora Taxa	List of all species within the relevé.



Figure 2 - Survey Sites

Hose Operations Vegetation Survey - August 2020

Legend

GMA Garnet Survey Area

Google Hybrid

0 250 500 m

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2.2.2 Vegetation Types

Vegetation types were identified and boundaries delineated using a combination of aerial photography, topographical features and field observations. The vegetation types were described from vegetation existing at the time of survey.

Vegetation types were described based on structure, dominant taxa and cover characteristics as defined by relevé observations. Vegetation type descriptions broadly follow the National Vegetation Inventory System (NVIS) and are broadly consistent with NVIS Level V (Association) (ESCAVI, 2003). The mapping of vegetation types has been undertaken at a scale suitable for this project.

2.2.3 Vegetation Condition

The vegetation condition of the survey area was assessed and mapped in accordance with the vegetation condition rating scale for the South Western and Interzone Botanical Provinces (EPA, 2016). The scale recognises the intactness of vegetation and consists of six rating levels.

2.2.4 Flora Identification and Nomenclature

A flora inventory was compiled from taxa recorded in the relevés, and from opportunistic records made throughout the survey areas.

Flora taxa were well known to the botanist and all were identified in the field. No taxa were required to be collected for later identification.

Nomenclature used in this report follows that used by the Western Australian Herbarium.

2.3 Limitations

The services undertaken by Earth Stewardship in connection with preparing this report were limited to those specifically detailed in the report and are subject to the limitations set out in the report. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report (including flora taxa nomenclature and listings).

The EPA (2016) Technical Guide states that vegetation and reports in Western Australia should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2.

Table 2: Survey Limitations

Aspect	Constraint	Comment
Sources of desktop information and availability of additional broader scale information	Minor	Adequate information is available for the survey areas and surrounding locale.
Scope of survey (i.e. what life forms were sampled)	Nil	Vascular flora taxa were sampled during the survey. Non-vascular flora taxa were not assessed as part of survey.

Aspect	Constraint	Comment
Proportion of flora collected and identified (based on sampling, timing and intensity).	Minor	The vegetation survey was undertaken on the 20 August 2020. Flora identification was undertaken by Joshua Foster in the field. Survey of the area was completed during the best period for identification of flowering plants at the location in the Mid West of Western Australia (i.e. mid-August), following the majority of Winter rainfall. The timing of the survey also maximised the potential for record of any conservation flora considered possible to occur in the local area.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed).	NA	The survey areas were traversed on foot and vehicle. Information gained from the survey was extrapolated across those small sections of the survey area not traversed to assist with determining the vegetation types for the entire survey areas.
Mapping reliability	Nil	High resolution aerial imagery was available. Data was recorded in the field using hand-held GPS tools (Garmin GPS). Some atmospheric factors and other sources of error can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are considered accurate to within ±5 m on average. Therefore, the data points consisting of coordinates recorded from the GPS may contain inaccuracies.
Timing/weather/season/cycle	Moderate	The field survey was conducted in August (Winter). The EPA (2016) preference for surveys in the South-western botanical province is in the season following greatest rainfall. The survey was designed to identify vegetation types and flora taxa. This survey timing was considered acceptable for this purpose.
Disturbances (e.g. fire, flood, accidental human intervention)	Minor	The majority of the survey area has been impacted to some degree by past and current disturbances including clearing, grazing by livestock feral and native animals, weed infestation, infrastructure development (roads), mining, and agricultural activities.
Intensity and resources (in retrospect, was the intensity adequate)	Nil	The vascular flora of the survey area was sampled with reference to the EPA (2016) Technical Guide. The survey was considered to be a reconnaissance survey due level of the survey. The survey areas were sufficiently covered by the botanist during the survey.
Access restrictions	Nil	No access problems were encountered during the survey. GMA (land manager) readily provided access to the survey areas, with GMA Environmental Co-ordinator (Steven Petts) accompanying Joshua Foster on the field survey. The survey areas were readily accessed on foot and vehicle.

Aspect	Constraint	Comment
Experience levels	Nil	Joshua Foster is suitably qualified and has over fifteen years' experience conducting surveys in the Mid West. He has over 20 years' experience in undertaking ecological surveys within Western Australia.

3 Desktop Review

The desktop review was completed by GMA Garnet (attached).

4 Field Survey Results

4.1 Survey Areas

Eight survey areas were assessed during the field survey.

Survey Area	Location
1	Main Entrance and Haul Road Intersection
2	Topsoil Stockpile West
3	Office West
4	Powerline Corridor
5	Topsoil Stockpile North
6	Old Pit boundary - Weather Station
7	Hose Access Road
8	Loading Zone - Western Strip

4.1.1 Survey Area Notes

Survey Area 1 – This is located at the main entrance to the Hose mining operations. It comprises the access to the Hose plant, existing and proposed roads (Vegetation Type 1 (VT1))(Figure 3a). It supports a large area of paddock with isolated native plants (VT2), and shelter belt planting of *Eucalyptus utilis* (Coastal Moort) on the Hose access road. There are some small patches of regrowth (VT3) of *Acacia rostellifera* between an old fenceline and the Hose access road. Of note, aerial photography indicates that the small patch of dense *Acacia rostellifera* shrubland (VT5) present at the corner of the Hose access road and George Grey Drive has only been present since 2011.

Survey Area 2 – This is a topsoil pile at the western side of the Hose mining operations. This now supports a very dense *Acacia rostellifera* shrubland (VT5), which is also noted after review of aerial photography to have become established from previously cleared paddock, grown within the past seven years (Figure 3b).

Survey Area 3 – This is a small area of regrowth opposite the Hose access road at the main site office. It contains scattered native plants and planted *Eucalyptus camaldulensis* (River Gum) (Figure 3c).

Survey Area 4 – This comprises the powerline corridor, which is narrow strip behind the Hose main office. It contains mostly cleared vegetation along the powerline access tracks; but does contain some native plants from the lower limestone footslope as an open shrubland of *Acacia rostellifera* and *Grevillea argyrophylla* (VT6) (Figure 3c).

Survey Area 5 – This survey area is very degraded and consists of mostly cleared tracks (VT1) (Figure 3d). It does contain recent topsoil piles, with scattered native regrowth (VT3) plants along the piles and edges. In the central south portion of this survey area a cleared pit containing slimes and fines from the mining operation is present.

Survey Area 6 – This supports isolated native regrowth plants (VT3) on the edge of the original Hose pit, as well as access tracks and infrastructure (site weather station) (VT1) (Figure 3c).

Survey Area 7 – This is located along the western side of the Hose access road, and supports some older growth *Acacia rostellifera* Tall Shrublands (VT7) (Figure 3c). This is quite degraded due to adjacent infrastructure, weed infestation, and agricultural activities. The survey area was historically at least partially cleared (as indicated by aerial photography from 2003). The lack of fire to support vegetation type renewal has caused the *Acacia* to senesce and community to degrade further. Other parts of this area are previously cleared along old pit areas, for mining access, infrastructure (water bores) and a topsoil pile, now support regrowth (VT3).

Survey Area 8 – This survey area is located on the eastern side of cleared paddocks, adjacent to the ore load-out area, and consists of regrowth vegetation (VT3), in a location unable to be maintained as cleared paddock (i.e. steep slope) (Figure 3c).

4.2 Vegetation

4.2.1 Types and Condition

Vegetation within the survey areas is dominated by *Acacia rostellifera* (Summer-scented Wattle) and introduced pasture grasses and herbs. Seven vegetation types (VT1-7) were recorded from the survey areas, delineated by density, plant height and species composition, associated with topography and underlying geology and disturbance history (Figure 3a-d; and, Table 3). The vegetation types are described from vegetation existing at the time of survey. Condition is indicated in Figure 4a-d).

Four vegetation types: VT1, VT2, VT3 and VT4, are synonymous with a high level of disturbance, being:

- VT1: Cleared Tracks and Infrastructure
- VT2: Paddocks
- VT3: Regrowth
- VT4: Artificial Planting

Both VT1 and VT2 are typically cleared, with some scattered native plants. Paddocks within the Hose area are required to be maintained as pasture, in accordance with original mine closure planning.

Vegetation Type 4 (Artificial planting) consists of a narrow band of planted *Eucalyptus utilis* (Coastal Moort), used as a shelter belt along the Hose access road. Regrowth of some native plants (as well as weedy species) occurs in the shelter belt areas.

Regrowth areas (VT3) occur where freshly stored topsoil piles are beginning to support natural regrowth, or in areas not maintained for mining or agricultural purposes, e.g. along the edges of old mine pits and transport corridors. Older areas of regrowth along the edges of mining and infrastructure typically support a narrow band of *Acacia rostellifera* over scattered native shrubs but is dominated by weedy species in the understorey.

Vegetation Types 1, 2, and 4 are considered to be Completely Degraded (Figure 4a-d). Vegetation Type 3 contains some areas where the density of native shrubs and weed infestation is lower and

therefore is considered Degraded. The majority of this vegetation type remains Completely Degraded.

In Survey Area 2, the regrowth has been unchecked, and the vegetation on older topsoil storage has resulted in a dense shrubland of *Acacia rostellifera* (VT5) (Figure 3b). The vegetation on this topsoil store is less than ten years old, and in Good condition due to its density causing repression of weeds (Figure 4b). A similar stand of *Acacia rostellifera* mapped as VT5 is present in Survey Area 1, where natural regrowth has also occurred on a previously cleared location (Figure 3a). A high level of grazing from pigs and kangaroos is present, particularly in Survey Area 2.

Vegetation Type 7 occurs as an older, Degraded version of *Acacia rostellifera* shrublands (Figure 3c and Figure 4c). The narrowness of the area, combined with repeated disturbance from mining, infrastructure maintenance and agricultural activities has resulted in a vegetation decline. The lack of community renewal through fire has resulted in a post-climax community which now consists of senescing large shrubs, scattered remnant mid-storey native shrub species, and a significant infestation of understorey weedy grasses and herbs. A high level of grazing from pigs and kangaroos is present.

Vegetation Type 6 is also Degraded but differs from Vegetation Type 7 in the presence of *Grevillea argyrophylla* and its occurrence on the lower limestone slopes (Figure 3a,c and d; and, Figure 4a,c and d). This vegetation type is limited in extent and is severely impacted in the local area from historical clearing and current grazing by livestock, feral and native fauna.

4.2.2 Comparison to Other Surveys

No vegetation types recorded within the survey areas are considered to approach the under-represented Beard Vegetation Association (BVA) 371 (*Acacia rostellifera* low forest) (described in Beard and Burns, 1976), due to the level of lack of correct community structure and high level of degradation from current and historical impacts. The Good condition vegetation of Vegetation Type 5 *Acacia rostellifera* Dense Shrublands cannot be considered to be close to the BVA 371 as both recorded areas (in Survey Area 1 and 2) support a community less than 10 years old (Figure 3a and b; and, Figure 4a and b).

Vegetation in the survey areas is considered to be broadly comparable to a lower structural version of that described by GHD (2020) as:

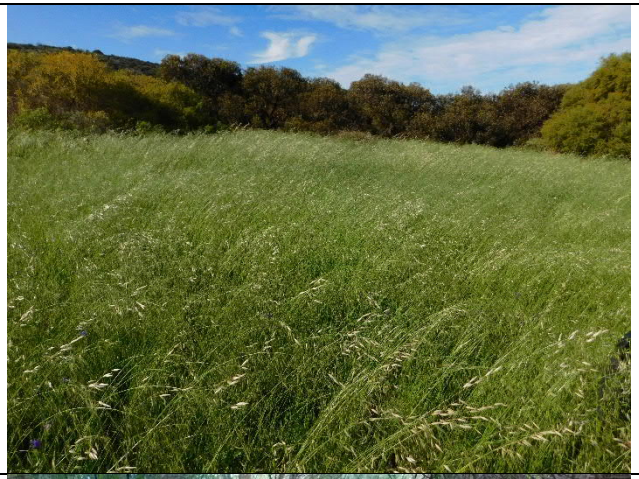
- VT01: *Acacia rostellifera* Open Woodland to Woodland, and
- Rehabilitation Areas that contain fragmented vegetation resembling VT01.

The lack of records of *Melaleuca cardiophylla* (in this survey), and the fact that areas surveyed were lower in the landscape dismiss the possibility that vegetation types recorded in this survey are comparative to either BVA 17 (Shrublands, *Acacia rostellifera*) or GHD (2020) VT02: *Melaleuca cardiophylla* shrubland to open shrubland.

Table 3: Survey Area Vegetation Types

Vegetation Type	Short Description	Description	Example Photograph	Condition	Survey Areas	Relevé locations
VT1	Cleared Tracks and Infrastructure	Completely cleared tracks and mining infrastructure. May contain some scattered native plants, but generally dominated by weedy species.		Completely Degraded	1, 3, 4, 5, 6, 7, 8	R13, R18
VT2	Paddocks	Completely cleared paddocks with scattered native plants, including *Acacia rostellifera, Commicarpus australis, Alyogyne hakeifolia.* Dominated by pasture grasses and weeds, including **Avena barbata, *Bromus diandrus, *Sonchus oleraceus, *Cenchrus ciliaris, *Euphorbia terracina, *Reichardia tingitana, *Helianthus annuus.*		Completely Degraded	1	R1, R3, R6 (north), R10

Vegetation Type	Short Description	Description	Example Photograph	Condition	Survey Areas	Relevé locations
VT3	Regrowth	Areas of *Acacia rostellifera* (typically over weeds) along non-maintained edges of mine pits, roads, infrastructure. Also includes recently installed topsoil stockpiles. Where taller and denser, regrowth occurs in thin strips of vegetation, particularly along the edges of the original mine, and ore loading area.	 	Completely Degraded to Degraded	1, 3, 4, 5, 6, 7, 8	R9, R11, R15, R16, R17, R19, R20, R22, R23, R25, R26

Vegetation Type	Short Description	Description	Example Photograph	Condition	Survey Areas	Relevé locations
VT4	Artificial Planting	Strip of *Eucalyptus utilis* (Coastal Moort), planted as wind shelter belt, along the Hose mine access road. Regrowth *Acacia rostellifera* and weed species are also present		Completely Degraded	1, 4	R6 (south)
VT5	*Acacia rostellifera* Dense Shrublands	Dense shrublands of *Acacia rostellifera* over *Alyogyne hakeifolia* over *Rhagodia* spp., *Tetragonia implexicoma, Pimelea microcephala* over mixed weed species on topsoil mounds and an area of regrowth.		Good	1, 2	R4, R5, R7, R8

Vegetation Type	Short Description	Description	Example Photograph	Condition	Survey Areas	Relevé locations
VT6	*Acacia rostellifera* Open Shrublands on Limestone	Open Shrubland of *Acacia rostellifera* over *Grevillea argyrophylla* with scattered *Diplolaena grandiflora, Androcalva gaudichaudii, Scaevola tomentosa, Enchylaena tomentosa* over mixed weed species on lower limestone footslopes.		Completely Degraded	1, 4	R2, R12, R14
VT7	*Acacia rostellifera* Tall Shrubland	Tall Shrubland to Open Woodland of *Acacia rostellifera* over *Templetonia retusa, Commicarpus australis, Rhagodia* spp., *Alyxia buxifolia, Enchylaena tomentosa* over mixed weed species		Degraded	7	R21, R24

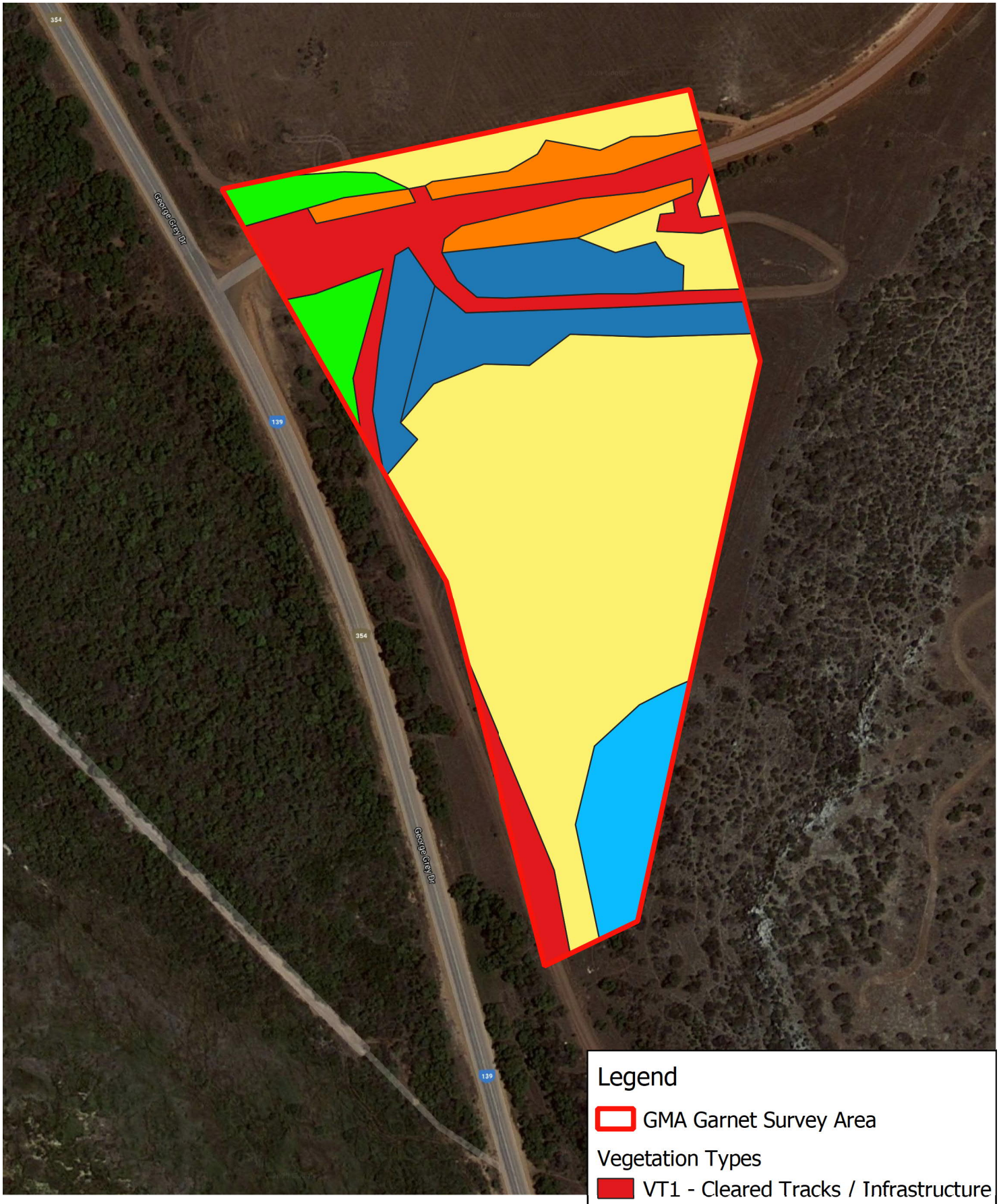


Figure 3a - Vegetation Types
Survey Area 1

Hose Operations Vegetation Survey - August 2020

0 25 50 m

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Figure 3b - Vegetation Types
Survey Area 2

Hose Operations Vegetation Survey - August 2020

0 25 50 m

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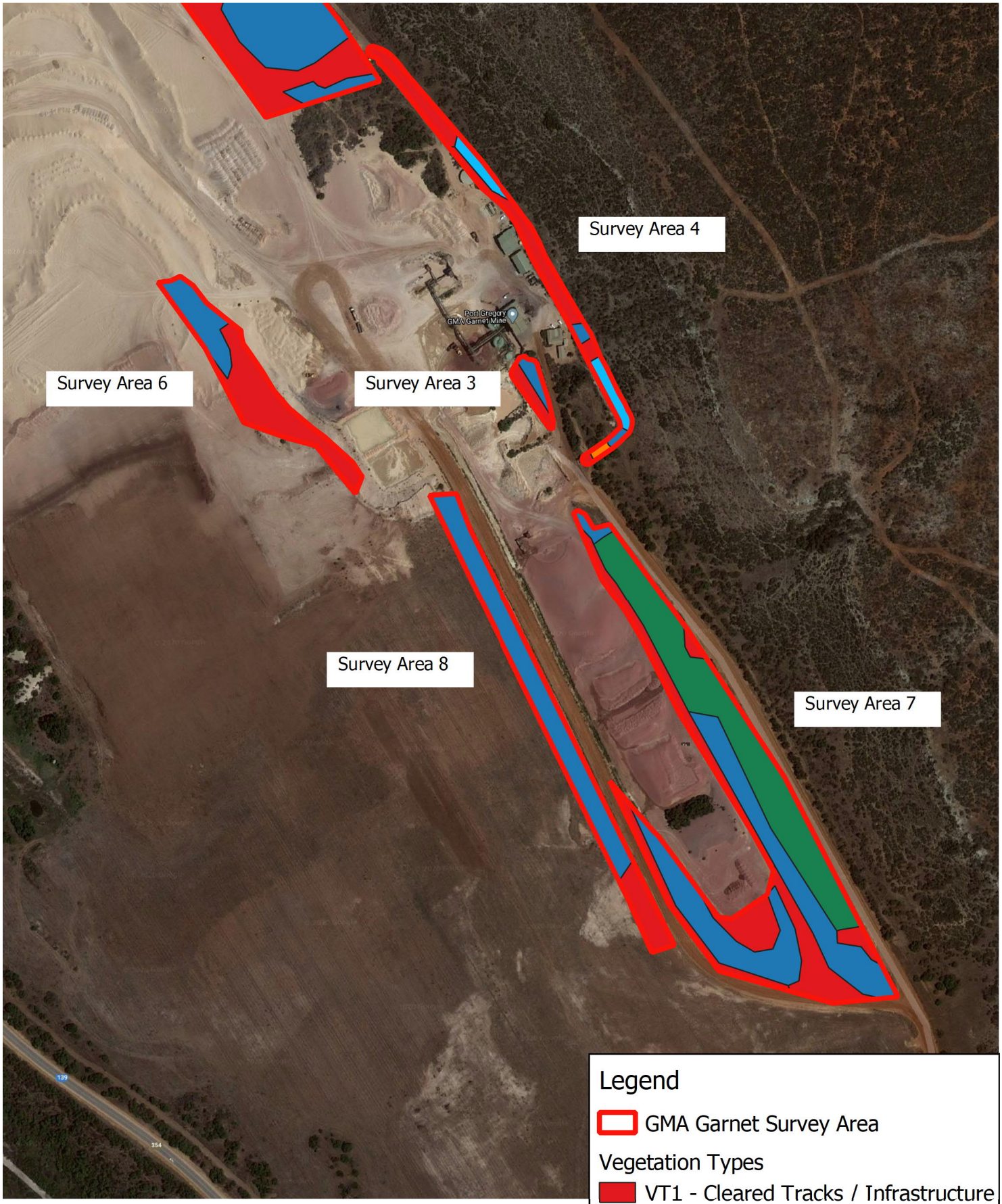


Figure 3c - Vegetation Types
Survey Areas 3, 4, 6, 7, 8

Hose Operations Vegetation Survey - August 2020

0 50 100 m

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Legend

GMA Garnet Survey Area

Vegetation Types

- VT1 - Cleared Tracks / Infrastructure
- VT2 - Paddocks
- VT3 - Regrowth
- VT4 - Artificial Planting
- VT5 - Dense Shrublands
- VT6 - Open Shrublands on Limestone
- VT7 - Tall Shrubland

Google Hybrid

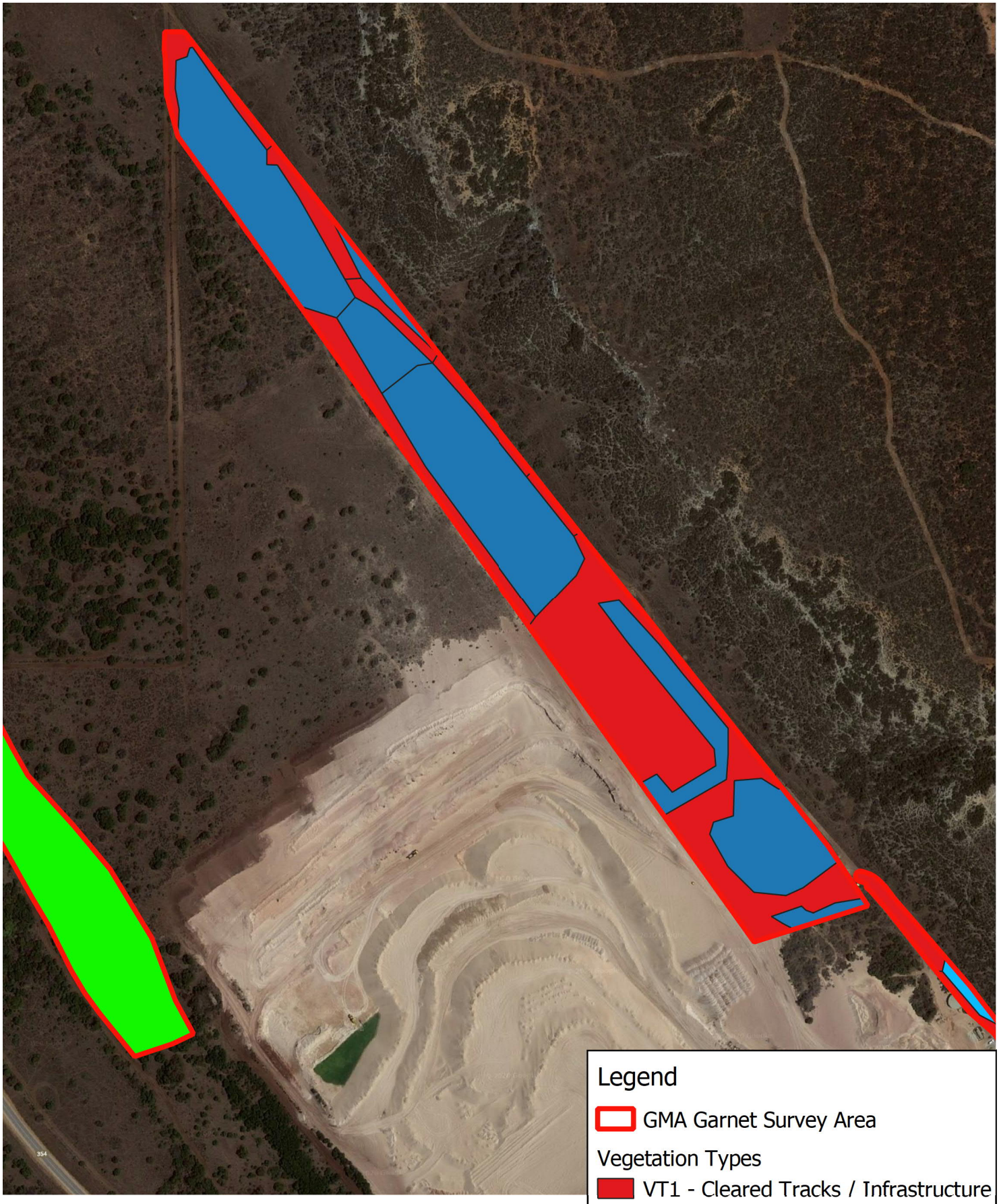


Figure 3d - Vegetation Types
Survey Area 5

Hose Operations Vegetation Survey - August 2020



Figure 4a - Vegetation Condition
Survey Areas 1

Hose Operations Vegetation Survey - August 2020

0 25 50 m

earth stewardship

Legend

GMA Garnet Survey Area

Vegetation Condition

Completely Degraded

Degraded

Good

Google Hybrid



Figure 4b - Vegetation Condition
Survey Area 2

Hose Operations Vegetation Survey - August 2020

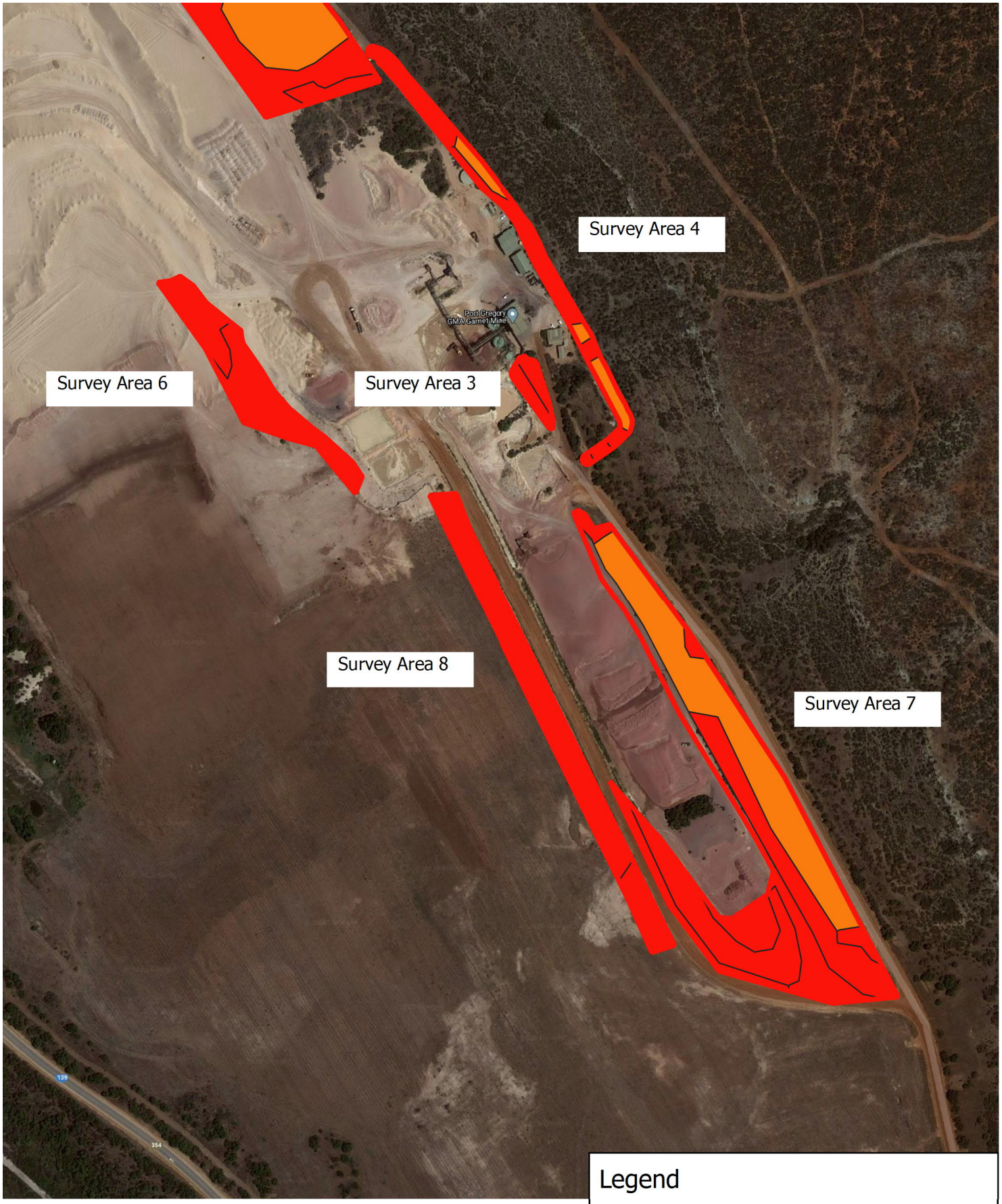


Figure 4c - Vegetation Condition
Survey Areas 3, 4, 6, 7, 8

Hose Operations Vegetation Survey - August 2020

0 50 100 m

earth stewardship

Legend

GMA Garnet Survey Area

Vegetation Condition

Completely Degraded

Degraded

Good

Google Hybrid



Figure 4d - Vegetation Condition
Survey Area 5

Hose Operations Vegetation Survey - August 2020

4.3 Flora

4.3.1 List of Recorded Flora Taxa

A list of flora taxa recorded by Survey Area is included in Table 4.

A total of 73 flora taxa from 35 families were recorded from the survey areas. Of the taxa recorded, 29 were weed/introduced flora, dominated by pasture grasses and weeds. An additional two species were recorded in the survey areas that had been deliberately planted for shelter belt purposes.

Most dominant families included Poaceae (grasses; 10 taxa); Asteraceae (daisies; 8 taxa); Chenopodiaceae (chenopods; 7 taxa); and Fabaceae (peas, wattles; 6 taxa).

4.3.2 Conservation Significant Flora

No Threatened species pursuant to the Environment Protection and Biosecurity Conservation Act 1986 (EPBC Act) were recorded during the survey of the survey area.

No plant taxa gazetted as Threatened (Declared Rare) pursuant to the Biodiversity Conservation Act 2017 (BC Act) were recorded in the survey area.

No Priority Flora taxa were recorded in the Survey Areas during the field assessment.

The Grey Copperburr (*Sclerolaena diacantha*) was recorded in the Survey Areas (VT2 – Paddocks). This record is a minor extension to the known range – 75 km west of the nearest known record. This species is widespread across Western Australia and not considered to be of conservation significance.

4.3.3 Significant Weed Species

Echium plantagineum (Paterson's Curse) is listed as a Declared Pest (s22(2)) of the Biosecurity and Agriculture Management Act 2007 (BAM Act), and is widespread in the local and regional area. Control of this pest into areas where infestations do not occur, is considered warranted.

Table 4 Flora List by Survey Area

Family	Genus	Species	Common Name	Status	Survey Area							
					1	2	3	4	5	6	7	8
Aizoaceae	*Mesembryanthemum*	*crystallinum*	Iceplant	*							x	
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach		x		x		x	x	x	x
Amaranthaceae	*Ptilotus*	*divaricatus*	Climbing Mulla-mulla						x			
Aphanopetalaceae	*Aphanopetalum*	*clematideum*			x							
Apocynaceae	*Alyxia*	*buxifolia*	Dysentery Bush					x			x	
Asparagaceae	*Acanthocarpus*	*preissii*	Prickle Lily			x			x		x	
Asteraceae	*Helianthus*	*annuus*	Sunflower	*							x	x
Asteraceae	*Lactuca*	*serriola*	Prickly Lettuce	*	x							
Asteraceae	*Olearia*	*axillaris*	Coast Daisybush				x	x				
Asteraceae	*Olearia*	sp. Kennedy Range							x	x	x	
Asteraceae	*Reichardia*	*tingitana*		*	x		x		x	x	x	x
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*	x		x		x		x	x
Asteraceae	*Urospermum*	*picroides*	False Hawkbit	*		x						
Asteraceae	*Verbesina*	*encelioides*	Golden Crownbeard	*			x			x	x	
Boraginaceae	*Echium*	*plantagineum*	Paterson's Curse	*DP	x				x		x	x
Brassicaceae	*Sisymbrium*	*orientale*	Indian Hedge Mustard	*	x	x	x		x	x	x	
Chenopodiaceae	*Atriplex*	*isatidea*	Coast Saltbush				x					
Chenopodiaceae	*Chenopodium*	*murale*	Nettle-leaf Goosefoot	*	x							
Chenopodiaceae	*Enchylaena*	*tomentosa*	Barrier Saltbush		x		x	x		x	x	x
Chenopodiaceae	*Rhagodia*	*latifolia*			x	x			x			x
Chenopodiaceae	*Rhagodia*	*preissii* subsp. *obovata*			x	x			x	x	x	
Chenopodiaceae	*Salsola*	*tragus*	Roly Poly		x				x	x		x
Chenopodiaceae	*Sclerolaena*	*diacantha*	Grey Copperburr	RE	x			x				
Convolvulaceae	*Convolvulus*	*remotus*			x	x				x	x	x
Convolvulaceae	*Cuscuta*	*epithymum*	Lesser Dodder	*	x				x			
Cucurbitaceae	*Citrullus*	*lanatus*	Pie Melon	*		x			x			
Dioscoreaceae	*Dioscorea*	*hastifolia*	Yam								x	
Euphorbiaceae	*Adriana*	*quadripartita*	Bitter Bush			x		x				
Euphorbiaceae	*Euphorbia*	*drummondii*	Caustic Weed		x							x
Euphorbiaceae	*Euphorbia*	*tannensis*	Gascoyne Spurge							x		x
Euphorbiaceae	*Euphorbia*	*terracina*	Geraldton Carnation Weed	*	x						x	
Fabaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		x	x	x	x	x	x	x	x
Fabaceae	*Kennedia*	*prostrata*	Running Postman							x	x	

Family	Genus	Species	Common Name	Status	Survey Area							
					1	2	3	4	5	6	7	8
Fabaceae	*Lupinus*	*cosentinii*	Blue Lupin	*	x							
Fabaceae	*Medicago*	*polymorpha*	Burr Medic	*	x							
Fabaceae	*Melilotus*	*indicus*		*	x				x			
Fabaceae	*Templetonia*	*retusa*	Cockies Tongue		x	x				x	x	
Geraniaceae	*Erodium*	*cygnorum*	Blue Heronsbill		x	x			x		x	
Goodeniaceae	*Goodenia*	*berardiana*							x			
Goodeniaceae	*Scaevola*	*tomentosa*			x			x			x	
Lamiaceae	*Westringia*	*dampieri*						x				
Loranthaceae	*Amyema*	*miraculosa*						x				
Malvaceae	*Alyogyne*	*hakeifolia*			x	x		x		x	x	x
Malvaceae	*Androcalva*	*gaudichaudii*			x			x	x			
Malvaceae	*Lasiopetalum*	*angustifolium*						x				
Myrtaceae	*Eucalyptus*	*camaldulensis*	River Gum	+			x					
Myrtaceae	*Eucalyptus*	*utilis*	Coastal Moort	+	x							
Nyctaginaceae	*Commicarpus*	*australis*	Perennial Tar Vine		x				x		x	
Oxalidaceae	*Oxalis*	*exilis*	Native Soursob								x	
Pittosporaceae	*Pittosporum*	*ligustrifolium*			x						x	
Poaceae	*Austrostipa*	*elegantissima*	Showy Feathergrass								x	
Poaceae	*Austrostipa*	sp. (insufficient material)	Feathergrass			x		x				
Poaceae	*Avena*	*barbata*	Wild Oat	*	x	x	x	x	x	x	x	x
Poaceae	*Bromus*	*diandrus*	Great Brome	*	x	x			x			
Poaceae	*Cenchrus*	*ciliaris*	Buffel Grass	*	x						x	x
Poaceae	*Cenchrus*	*setaceus*	Fountain Grass	*							x	
Poaceae	*Cynodon*	*dactylon*	Couch	*							x	x
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*	x	x			x		x	
Poaceae	*Hordeum*	*leporinum*	Barley Grass	*							x	
Poaceae	*Paractaenum*	*novae-hollandiae*	Reflexed Panic Grass		x							
Polygonaceae	*Rumex*	*hypogaeus*	DoubleGee	*				x				
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*	x	x		x	x		x	
Proteaceae	*Grevillea*	*argyrophylla*						x				
Rhamnaceae	*Diplolaena*	*grandiflora*	Wild Rose		x			x				
Santalaceae	*Santalum*	*acuminatum*	Quandong					x				
Scrophulariaceae	*Eremophila*	*glabra*	Tar Bush			x						
Scrophulariaceae	*Myoporum*	*insulare*	Blueberry Tree		x							
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower			x						

Family	Genus	Species	Common Name	Status	Survey Area							
					1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Solanaceae	*Solanum*	*nigrum*	Black Berry Nightshade	*	x	x				x		
Surianaceae	*Stylobasium*	*spathulatum*	Pebble Bush		x						x	
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		x		x	x	x		x	x
Vitaceae	*Clematicissus*	*angustissima*	Native Grape		x				x		x	
Zygophyllaceae	*Roepera*	*similis*			x				x			

Table 5 Flora List by Relevé

Family	Genus	Species	Common Name	Status	Relevé																										
					R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23	R24	R25	R26
Aizoaceae	*Mesembryanthemum*	*crystallinum*	Iceplant	*																						x				
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach		x	x			x				x		x			x		x	x	x	x		x			x	x	x
Amaranthaceae	*Ptilotus*	*divaricatus*	Climbing Mulla-mulla																	x	x										
Aphanopetalaceae	*Aphanopetalum*	*clematideum*				x																									
Apocynaceae	*Alyxia*	*buxifolia*	Dysentery Bush															x							x			x			
Asparagaceae	*Acanthocarpus*	*preissii*	Prickle Lily								x		x							x	x				x			x			
Asteraceae	*Helianthus*	*annuus*	Sunflower	*										x										x						x
Asteraceae	*Lactuca*	*serriola*	Prickly Lettuce	*					x																						
Asteraceae	*Olearia*	*axillaris*	Coast Daisybush												x		x														
Asteraceae	*Olearia*	sp. Kennedy Range																		x	x		x		x			x			
Asteraceae	*Reichardia*	*tingitana*		*		x	x	x		x			x		x					x	x		x	x	x	x	x	x	x	x
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*	x	x	x		x	x			x		x						x			x		x	x		x	x
Asteraceae	*Urospermum*	*picroides*	False Hawkbit	*							x																				
Asteraceae	*Verbesina*	*encelioides*	Golden Crownbeard	*											x								x	x							
Boraginaceae	*Echium*	*plantagineum*	Paterson's Curse	*DP	x		x			x			x								x					x			x	x
Brassicaceae	*Sisymbrium*	*orientale*	Indian Hedge Mustard	*	x				x	x	x		x		x				x	x	x			x	x	x	x	x			
Chenopodiaceae	*Atriplex*	*isatidea*	Coast Saltbush												x																
Chenopodiaceae	*Chenopodium*	*murale*	Nettle-leaf Goosefoot	*	x																										
Chenopodiaceae	*Enchylaena*	*tomentosa*	Barrier Saltbush		x				x	x			x		x	x						x	x	x					x	x
Chenopodiaceae	*Rhagodia*	*latifolia*			x	x					x		x							x	x	x							x	
Chenopodiaceae	*Rhagodia*	*preissii* subsp. *obovata*			x				x		x		x							x	x		x	x						x
Chenopodiaceae	*Salsola*	*tragus*	Roly Poly						x	x			x	x							x		x						x		
Chenopodiaceae	*Sclerolaena*	*diacantha*	Grey Copperburr	RE					x								x														
Convolvulaceae	*Convolvulus*	*remotus*			x						x		x										x		x			x	x		
Convolvulaceae	*Cuscuta*	*epithymum*	Lesser Dodder	*		x														x	x										
Cucurbitaceae	*Citrullus*	*lanatus*	Pie Melon	*						x	x								x		x										
Dioscoreaceae	*Dioscorea*	*hastifolia*	Yam																						x			x			
Euphorbiaceae	*Adriana*	*quadripartita*	Bitter Bush								x		x					x													
Euphorbiaceae	*Euphorbia*	*drummondii*	Caustic Weed						x																				x		
Euphorbiaceae	*Euphorbia*	*tannensis*	Gascoyne Spurge																				x						x		
Euphorbiaceae	*Euphorbia*	*terracina*	Geraldton Carnation Weed	*		x			x															x			x				
Fabaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fabaceae	*Kennedia*	*prostrata*	Running Postman																				x		x			x			
Fabaceae	*Lupinus*	*cosentinii*	Blue Lupin	*		x	x			x																					
Fabaceae	*Medicago*	*polymorpha*	Burr Medic	*	x					x																					
Fabaceae	*Melilotus*	*indicus*		*					x	x											x					x	x			x
Fabaceae	*Templetonia*	*retusa*	Cockies Tongue		x						x		x										x		x		x	x			
Geraniaceae	*Erodium*	*cygnorum*	Blue Heronsbill			x				x	x		x							x	x				x		x	x			
Goodeniaceae	*Goodenia*	*berardiana*																		x	x										
Goodeniaceae	*Scaevola*	*tomentosa*			x											x									x			x			
Lamiaceae	*Westringia*	*dampieri*														x															
Loranthaceae	*Amyema*	*miraculosa*																x													
Malvaceae	*Alyogyne*	*hakeifolia*			x				x		x		x			x		x				x	x		x	x	x	x	x	x	x
Malvaceae	*Androcalva*	*gaudichaudii*			x											x				x	x										
Malvaceae	*Lasiopetalum*	*angustifolium*														x															
Myrtaceae	*Eucalyptus*	*camaldulensis*	River Gum	+											x																
Myrtaceae	*Eucalyptus*	*utilis*	Coastal Moort	+					x																						
Nyctaginaceae	*Commicarpus*	*australis*	Perennial Tar Vine			x				x			x	x						x	x				x			x			
Oxalidaceae	*Oxalis*	*exilis*	Native Soursob																						x			x			

Family	Genus	Species	Common Name	Status	Relevé																										
					R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23	R24	R25	R26
Pittosporaceae	*Pittosporum*	*ligustrifolium*				x																			x			x		
Poaceae	*Austrostipa*	*elegantissima*	Showy Feathergrass																						x			x		
Poaceae	*Austrostipa*	sp. (insufficient material)	Feathergrass								x		x			x															
Poaceae	*Avena*	*barbata*	Wild Oat	*	x	x	x	x	x	x	x		x	x	x	x			x		x	x	x	x	x	x	x	x	x	x
Poaceae	*Bromus*	*diandrus*	Great Brome	*	x		x			x	x		x	x							x	x				x	x			
Poaceae	*Cenchrus*	*ciliaris*	Buffel Grass	*		x	x		x	x			x												x	x	x	x	x	x
Poaceae	*Cenchrus*	*setaceus*	Fountain Grass	*																						x	x			
Poaceae	*Cynodon*	*dactylon*	Couch	*																				x						x
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*				x		x	x	x	x	x					x		x	x			x	x	x	x		
Poaceae	*Hordeum*	*leporinum*	Barley Grass	*																							x			
Poaceae	*Paractaenum*	*novae-hollandiae*	Reflexed Panic Grass						x																					
Polygonaceae	*Rumex*	*hypogaeus*	DoubleGee	*												x	x										x			
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*		x	x			x	x		x			x			x	x	x			x						
Proteaceae	*Grevillea*	*argyrophylla*														x														
Rhamnaceae	*Diplolaena*	*grandiflora*	Wild Rose			x										x														
Santalaceae	*Santalum*	*acuminatum*	Quandong															x												
Scrophulariaceae	*Eremophila*	*glabra*	Tar Bush									x																		
Scrophulariaceae	*Myoporum*	*insulare*	Blueberry Tree						x																					
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower							x			x	x																
Solanaceae	*Solanum*	*nigrum*	Black Berry Nightshade	*		x				x			x										x							
Surianaceae	*Stylobasium*	*spathulatum*	Pebble Bush		x				x				x													x	x			
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		x	x							x		x			x		x	x	x					x		x	
Vitaceae	*Clematicissus*	*angustissima*	Native Grape			x			x				x							x	x				x			x		
Zygophyllaceae	*Roepera*	*similis*			x															x	x									

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Basic and Targeted Flora and Vegetation Survey

M70-926

GMA Garnet Pty Ltd

02 February 2022

→ **The Power of Commitment**



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Executive summary

GMA Garnet Pty Ltd (GMA) are currently in the process of planning for the expansion of their operations within the Lynton open-cut Mine, located to the east of Hutt Lagoon, near Port Gregory in Western Australia. Mining activities are currently being undertaken within Hose mining tenement, M70/926. The survey area includes four areas within the Hose tenement with a total area of approximately 109.86 hectares in total. GHD was engaged by GMA Garnet to undertake a basic and targeted flora and vegetation survey.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.1 and the assumptions and qualifications contained throughout the Report.

Three vegetation aligning with broad landforms were identified and described in the survey area, not including cleared areas for tracks. The vegetation has been mapped as VT01 - *Acacia rostellifera* open woodland to woodland, VT02 - *Melaleuca cardiophylla* shrubland to open shrubland and VT03 - *Myoporum insulare* shrubland.

The pre-European broad vegetation mapping has BVA 371 and BVA 17 mapped within the survey area. VT01 and VT02 aligns more closely with BVA 17 (*Acacia rostellifera* thicket) rather than BVA 371 (Low forest; *Acacia rostellifera*). Beard and Burns (1976) describes BVA 371 as occurring on black clay bottomland soils with wattles exceeding 10 m in height with pure stands. VT01 and VT02 do not align with these habitat characteristics and structural elements. BVA 17 *Acacia rostellifera* thicket occurs on shallow sandy soil and thin rocky soil on limestone (Beard and Burns 1976). VT01 and VT02 align with BVA 17 based on soil types and position in the landscape. VT03 covers a small area that is more similar with BVA 125 (Salt lake, lagoon, clay pan) (Beard 1975) that describes the Hutt Lagoon (Beard 1975). While VT03 is not connected with Hutt Lagoon it has similar saline flats community.

No TEC's listed under the EPBC Act or BC Act or PECs listed by DBCA were identified within the survey area during the field survey.

Fifty-four flora taxa (including subspecies and varieties) representing 26 families and 50 genera were recorded from the survey area during the field survey. This total comprised 38 native taxa and 16 introduced flora taxa. No introduced flora species recorded are listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) or Weed of National Significance (WoNS). All introduced flora species recorded are considered environmental weeds and all have been previously recorded on the Geraldton Sandplains bioregion.

No conservation listed flora species were recorded within the survey area. The survey area was in Degraded condition with very high invasive weed cover throughout the survey area with significant wild pig grazing that has impacted on the habitat condition. The likelihood of occurrence assessment post-field survey concluded that 29 species highly unlikely and 19 species unlikely to occur in the survey area.

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1. Introduction

1.1 Project background and purpose of this report

GMA Garnet Pty Ltd (GMA) are currently in the process of planning for the expansion of their operations within the Lynton open-cut Mine, located to the east of Hutt Lagoon, near Port Gregory in Western Australia (WA). Mining is undertaken using an open-cut sand mining method. Mobile earthmoving equipment, including front-end loaders, excavator and dump trucks are used for pit excavation and backfilling. Mining activities are currently been undertaken within Hose mining tenement, M70/926. GHD was engaged by GMA Garnet to undertake a basic and targeted flora and vegetation survey.

1.2 Location

The survey area is located at Port Gregory, approximately 96 kilometres (km) north of Geraldton in the mid-west of WA. The survey area includes four areas within the Hose tenement with a total area of approximately 109.96 hectares (ha) in total. The location of the survey area is shown on Figure 1, Appendix A.

A desktop study area (study area) was defined for the desktop based searches of the assessment and includes a 10 km buffer of the survey area.

1.3 Scope of works

The scope of works was to undertake a basic assessment of the flora and vegetation values of the survey area. The following actions were completed to fulfil the scope:

– Undertake a desktop assessment of relevant ecological aspects and constraints including a review of previous survey report results completed for the area
– Complete a basic and targeted flora and vegetation survey
– Prepare a report on the findings of the survey

1.4 Report limitations and assumptions

This report has been prepared by GHD for GMA Garnet Pty Ltd and may only be used and relied on by GMA Garnet Pty Ltd for the purpose agreed between GHD and the GMA Garnet Pty Ltd a s set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than GMA Garnet Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report based on information provided by GMA Garnet Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.5 Relevant legislation, conservation codes and background information

In WA some ecological communities, flora and fauna are protected under both Federal and State Government legislation. In addition, regulatory authorities also provide a range of guidance and information on expected standards and protocols for environmental surveys.

An overview of key legislation and guidelines, conservation codes and background information relevant to this biological survey is provided in Appendix B.

2. Methodology

2.1 Desktop assessment

Prior to the commencement of the field survey, a desktop assessment was undertaken to identify relevant environmental information pertaining to the study area and to assist in survey design. The desktop assessment included a review of:

- The Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) to identify communities and species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) potentially occurring within the study area (DAWE 2021) (Appendix C)
- The Department of Biodiversity Conservation and Attractions (DBCA) Threatened and Priority Ecological Community (TEC and PEC) database (DBCA 2021a) to determine the potential for significant ecological communities to be present within the study area
- The DBCA Threatened and Priority Flora and WA Herbarium databases for Threatened flora listed under the BC Act and listed Priority by the DBCA previously recorded in the desktop study area (DBCA 2021b)
- The Department of Biodiversity, Conservation and Attractions (DBCA) *NatureMap* database for flora species previously recorded within the study area (DBCA 2007–) (Appendix C)
- Environmentally Sensitive Areas (ESAs) search (Department of Water and Environmental Regulation 2020)
- A review of reports and biological survey data relevant to the survey area
- Aerial photography, climate and soils information to provide background information on the variability of the environment and likely vegetation present.

2.2 Field survey

The basic and targeted flora and vegetation survey was carried out by senior botanist Joel Collins (flora licence no. FB62000200-2) on 8-13 August 2021.

2.2.1 Guiding documents

The survey methodology and data collection that GHD employed was consistent with:

- Environmental Protection Authority (EPA) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016)

2.2.2 Data collection and storage

Field data collection for the flora, vegetation and fauna survey was undertaken using GPS enabled Samsung tablets using electronic forms in Collector and tailored to IBSA spatial data requirements. Data was synced to the cloud at the conclusion of each field day. Field photographs were stored and where applicable have been provided as part of the Project deliverables.

2.2.3 Basic and targeted flora and vegetation survey

The field survey was undertaken to identify and describe the broad dominant vegetation types, assess vegetation condition, and low intensity sampling of vascular flora taxa present at the time of survey. Searches for significant ecological communities and flora species were also undertaken during the field survey.

Field survey methods involved a combination of low intensity releve sampling and traversing the survey area by foot. Releves were conducted within the survey area to describe the broad-scale vegetation and physical features (Figure 1, Appendix A).

Field data at each releve site was recorded on a pro-forma data sheet and included the parameters detailed in Table 1. Survey and releve data are provided in Appendix D. A flora species list was compiled from taxa listed in the releves and from opportunistic floristic records throughout the survey area.

Table 1 Data collected during field survey

Aspect	Measurement
Collection attributes	Site code, personnel/recorder, date, photograph of the releve.
Physical features	Landform, slope, aspect, soil attributes, ground surface cover, leaf and wood litter.
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately ± 5 m.
Vegetation condition	Vegetation condition was assessed using the condition rating scale adapted by EPA (2016) for the South West Botanical Province.
Disturbance	Level and nature of disturbances (e.g. weed presence, fire and time since last fire, impacts from grazing, anthropogenic activities).
Flora	List of dominant flora from each structural layer, list of all species within the quadrat including stratum, average height and percentage foliage cover (using National Vegetation Information System (NVIS)

Vegetation types

Vegetation units were identified and boundaries delineated using a combination of aerial photography, topographical features and field data/observations.

Vegetation units were described based on structure, dominant taxa and cover characteristics as defined by quadrat data and field observations. Vegetation unit descriptions follow the NVIS and are consistent with NVIS Level V (Association) and are grouped within NVIS Level III (Broad Floristic Formation). At Level V up to three taxa per stratum are used to describe the association (NVIS Technical Working Group 2017).

Vegetation condition

The vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South-West Botanical Provinces EPA (2016). The scale recognises the intactness of vegetation and consists of six rating levels. The vegetation condition rating scale is outlined in Appendix B.

Flora list, identification and nomenclature

A flora list was compiled from taxa listed in described releves and from opportunistic floristic records throughout the survey area.

Species well known to the survey botanist were identified in the field; all other species were collected and assigned a unique collection number to facilitate tracking. All specimens collected during the field assessment were dried and processed in accordance with the requirements of the WA Herbarium. Species were identified by the use of taxonomic literature, electronic keys and online electronic databases with reference to specimens at the WA Herbarium. Relevant taxonomic experts were also consulted where required.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (WA Herbarium 1998–) and the EPBC Act Threatened species database provided by DAWE (2021).

Nomenclature used in this report follows that used by the WA Herbarium as reported on *FloraBase* (WA Herbarium 1998–).

Conservation significant flora – targeted searches

Prior to the field survey, information obtained from the desktop assessments (e.g. EPBC Act PMST, *NatureMap*) was reviewed to determine conservation significant flora taxa potentially present within the survey area and existing locations. Targeted searches for conservation significant flora were undertaken throughout the survey area through completion of transects. Where individuals were identified, the location and number of plants present were recorded using tablet and/or handheld GPS unit. As the survey area was in Degraded condition with very high invasive weed cover throughout the survey area with significant wild pig grazing transect spacing was spread out to reflect the conditions.

2.3 Limitations

2.3.1 Desktop limitations

The EPBC Act PMST is based on bioclimatic modelling for the potential presence of species. As such, this does not represent actual records of flora and fauna species within the area. The records from the DBCA searches of Threatened (T) and Priority (P) flora provide more accurate information for the general area and local occurrence. However, some collection records cannot be dated and may misrepresent the current range of Threatened and Priority species.

2.3.2 Survey limitations

The EPA (2016) states that flora and fauna survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2.

Table 2 Survey limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information.	Nil	Adequate information is available for the survey area. – Pre-European vegetation mapping (Beard 1976) – GHD (2020) GMA Garnet Port Gregory Mine Targeted *Caladenia bryceana* subsp. *cracens* survey and conservation listed flora survey of proposed haul road Targeted Orchid Survey – GHD (2019) GMA Garnet Port Gregory Mine Mining Tenement M70/1380 Biological Survey – GHD (2016) GMA Garnet Mining Lease M70/926 – GHD (2014) GMA Garnet Port Gregory Mine Targeted Flora Survey – GHD (2013) GMA Garnet Port Gregory Mine M70/968 Vegetation, Flora and Fauna Assessment.
Scope (what life forms were sampled etc).	Nil	Vascular flora was sampled during the survey. Non-vascular flora was not surveyed.
Proportion of flora collected and identified (based on sampling, timing and intensity)	Minor	The survey sampling and intensity was considered adequate for a basic survey, and seasonal conditions were considered satisfactory. The basic flora and vegetation survey was undertaken from 8-13 August 2021, with three days spent undertaking the survey. Spring is considered the most optimal time to undertake vegetation surveys in the Geraldton bioregion. This survey is considered slightly prior to spring, however, is deemed satisfactory as sufficient flowering had commenced and is within the flowering period for *Caladenia bryceana* subsp. *cracens* (Threatened). The vegetation survey was a broad scale and targeted assessment, undertaken to identify and describe the dominant vegetation units and map conservation significant flora. The portion of flora collected and identified was considered appropriate for the level of experience of the Senior Botanist undertaking the survey. All taxonomic groups were considered to be represented.
Flora determination	Nil	Flora determination was undertaken by the survey botanist in the field. Species that could not be identified in the field were collected and identified at the WA Herbarium by the experienced taxonomic botanist Pali Jayasekara (GHD). One taxa were uncertain at a species level due to lack of fruiting material. These collections are not similar to known conservation significant flora (as identified in the desktop searches). The taxonomy and conservation status of the WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time report development, but it should be noted this may change in response to ongoing research and review of International Union for Conservation Nature criteria.

Aspect	Constraint	Comment
Completeness and further work which might be needed	Nil	The whole of the survey area was accessed on foot and vehicle. The survey area was adequately surveyed during the field survey in line with the scope.
Mapping reliability	Nil	Data was recorded in the field using hand-held GPS tools (e.g. Samsung tablet and/or Garmin GPS). Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are accurate to within ± 2 - 5 m on average, therefore the data points consisting of coordinates recorded from the GPS may contain minor inaccuracies.
Timing/weather/season cycle	Nil	The basic flora and vegetation was conducted in from 8-13 August 2021. In the three months prior to the flora survey (May-July), Lynton weather station (BoM 2021) recorded a total of 393.5 mm of rainfall. This survey is considered slightly prior to spring, however, is deemed satisfactory as sufficient rainfall had been received with suitable flowering had commenced and *Caladenia bryceana* subsp. *cracens* (Threatened) was flowering at known locations at the time of the survey.
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	Much of the survey area had undergone historical clearing (farming/exploration) and rehabilitation of some of these areas. Newly cleared or disturbed areas (roads and tracks) were also prevalent. These disturbances did not limit the survey.
Resources	Nil	Adequate resources were employed during the field survey. One staff over three days were spent undertaking the basic flora and vegetation survey using a dedicated botanist.
Access restrictions	Nil	No access problems were encountered during the survey. There were some areas of large piles of dead *Acacia* logs and branches which restricted movement by foot, however, these areas could still be groundtruthed.
Experience levels	Nil	The botanist/ecologists who executed the survey were practitioners suitably qualified in their respective fields. Joel Collins, is suitably qualified with over 17 years' experience in undertaking flora and vegetation surveys and assessments in Western Australia. Joel has extensive experience undertaking flora and vegetation assessments on the Geraldton Sandplains, with several previous surveys undertaken at the site.

3. Desktop assessment

3.1 Literature review

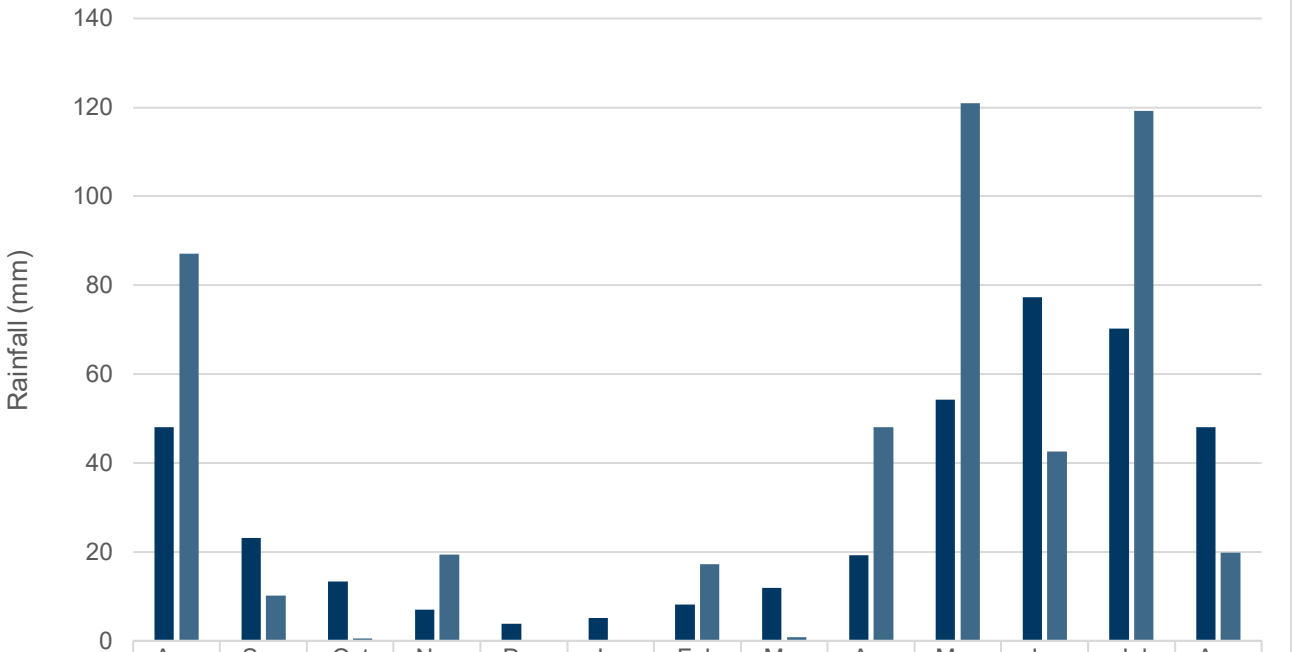
A literature review of surveys undertaken in and around the survey area is summarised in Table 3.

3.2 Climate

The Port Gregory region experiences a Mediterranean type of climate, characterised by warm to hot dry summers and mild wet winters. The majority of rainfall occurs in the winter months and is generally associated with frontal systems from the southwest. The summer rains are associated with isolated thunderstorms and tropical lows.

The closest Bureau of Meteorology (BoM) weather station that provides continuous reliable data to the site is located a Kalbarri (Site Number 8251). Climatic data from this site indicates the mean maximum temperature of the area ranges from 34.1 °C in February to 21.9 °C in July. Mean minimum temperature ranges from 20.1 °C in February to 9.8 °C in July. The mean annual rainfall is 337.7 mm with an average of 48 rain days per year (BoM 2021).

Kalbarri recorded 282.7 mm of rainfall in the three months (May-July) preceding the survey. This is above the long-term average of 201.7 mm (Plate 1).



	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Mean	48.1	23.2	13.4	7	3.8	5.2	8.2	11.9	19.2	54.2	77.3	70.2	48.1
2020/21	87.1	10.2	0.5	19.4	0	0	17.3	0.8	48	120.9	42.6	119.2	19.9

Plate 1 ***Annual rainfall statistics recorded at Kalbarri (BOM 2021)***

3.3 Soil landscapes

The Department of Primary Industries and Regional Development (DPIRD) soil mapping indicates there is one land system intersecting the survey area.

– Tamala North System (231Ta): Low hills with relict dunes and some limestone outcrop. Forms a coastal band 3 to 7 km wide.

Table 3 Literature review of reports relevant to the survey area

Citation	Location	Survey dates	Survey techniques	Flora Survey Results
GHD (2020) GMA Garnet Port Gregory Mine Targeted *Caladenia bryceana* subsp. *cracens* survey and conservation listed flora survey of proposed haul road Targeted Orchid Survey	Lynton mine tenements	11 – 14 August 2020	Systematic transects	The field survey did not record any individuals of *Caladenia bryceana* subsp. *cracens* within VT02.
GMA Garnet Lynton Mine Expansion Biological Survey (GHD 2020)	Tenements M70/204, M70/1330 and M70/259.	8 - 12 December 2019	Field survey methods involved a combination of sampling quadrats and transects located in identified vegetation units and traversing the survey area by vehicle and foot. Quadrats (measuring 10 m x 10 m – area of 100 m^2) were located within each identified vegetation unit.	Sixty-four flora taxa (including subspecies and varieties) representing 26 families and 50 genera were recorded from the survey area during the field survey. This total comprised 49 native taxa and 15 introduced flora taxa. No EPBC Act or BC Act listed flora were recorded within the survey area. No Priority flora, as listed by the DBCA, were recorded within the survey area.
GMA Garnet Port Gregory Mine Mining Tenement M70/1380 Biological Survey (GHD 2019)	The survey area was located within mining tenement M70/1380, approximately 1,465 ha in size	Between July and August 2019	Six permanent quadrats were installed, including three within revegetation sites and remnant vegetation (reference sites) considered representative of pre-clearing vegetation	One hundred and sixty-five flora taxa (including subspecies and varieties) representing 61 families and 121 genera were recorded from the survey area. This total included 18 introduced flora One flora species (Senna planitiicola) considered to be an extension of its known range and has not been previously recorded within the Geraldton Sandplains IBRA however the species was recorded within a farming paddock and was considered to have been planted One EPBC Act / BC Act listed flora and three DBCA Priority listed flora species were identified within the survey area:

Citation	Location	Survey dates	Survey techniques	Flora Survey Results
				Caladenia bryceana subsp. cracens (Vulnerable – EPBC Act, Endangered – BC Act) Melaleuca huttensis (Priority 3) Anthocercis intricata (Priority 3) Diuris recurva (Priority 4)
GMA Garnet Mining Lease M70/926 Biological Survey (GHD 2016)	Within mining tenement M70/926, located approximately 7 km north of M70/1380	August 2016	The Survey Area was traversed on foot, and by vehicle. Three quadrats (10 m x 10 m), and scattered wandering transects were surveyed. Transect locations generally avoided obvious ecotonal zones between vegetation units and recently disturbed vegetation (e.g. through human/mechanical means or fire), where possible.	A total of 60 flora taxa from 28 families were recorded at the study location, of which 26 were introduced No threatened flora recorded
GMA Garnet Port Gregory Mine Targeted Flora Survey (GHD 2014)	Miining tenement M70/968	August 2014	GHD undertook systematic targeted search parallel transects in potential habitat for this species. Transects were walked at six metre intervals, and searches were undertaken three metres either side of each transect	No Threatened Flora was recorded during the survey Habitat for the threatened orchid was considered extremely marginal Evidence of disturbances such as wild pigs, which further reduced the likelihood of the species occurrence Two State-listed Priority species were recorded including 23 individual plants of *Melaleuca huttensis* (Priority 1) and 54 individual plants of *Anthocercis intricata* (Priority 3).
GMA Garnet Port Gregory Mine Tenement M70/968 Vegetation, Flora and Fauna Assessment (GHD 2013)	Mining tenement M70/968	August 2013	Field assessment methods involved a combination of sampling quadrat sites and traversing the Project Area to record plant species present (visible) at the time of the survey. The dominant	A total of 75 flora taxa from 39 families were recorded from the study location, No conservation significant communities or flora were present The study location was considered to be very marginal habitat for the Threatened

Citation	Location	Survey dates	Survey techniques	Flora Survey Results
			species were recorded in each stratum to assist in vegetation type mapping.	*Caladenia bryceana* subsp. *cracens*

3.4 Flora and vegetation

3.4.1 Regional biogeography

The survey area is located within the Geraldton Sandplains bioregion and Geraldton Hills sub-region as described by the Interim Biogeographic Regionalisation of Australia (IBRA).

This region comprises of sandy earths of an extensive undulating and lateritic sandplain mantling Permian to Cretaceous strata. This region occurs within the southern end of the Carnarvon Basin and the northern end of the Perth Basin, with exposed areas of Permian/Silurian siltstone and Jurassic sandstones mostly overlain by sandplains, alluvial plains and coastal limestone. The vegetation consists primarily of proteaceous heath with *Banksia* -York gum woodlands on alluvial plains and *Acacia* scrub on limestone (Desmond and Chant, 2002).

3.4.2 Broad vegetation mapping and extents

Broad scale (1:250,000) pre-European vegetation mapping of the survey area has been completed by Beard (1975) at an association level. The mapping indicates that the survey area intersects two broad vegetation associations (BVA):

– Low forest; *Acacia rostellifera: Acacia*, Rottnest pine, coastal moort or mixed tropical forest, *Acacia rostellifera, Callitris preissii, Eucalyptus lehmannii, E. cornuta* (association 371)

– Shrublands; *Acacia rostellifera* thicket (association 17).

The pre-European mapping has been adapted and digitised by Shepherd *et al.* (2002). The extent of the vegetation associations have been determined by the state-wide vegetation remaining extent calculations maintained by the DBCA (latest update March 2019 –Government of Australia (GoWA) 2020). As shown in Table 4, vegetation association 371 is below the 30% of the pre-European extent at state, IBRA bioregion and IBRA sub-region levels.

Table 4 Vegetation associations within the survey area (GoWA 2020)

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	Remaining within DBCA Managed lands (%)
371	State: WA	32,816.04	3,499.60	10.66	6.92
	IBRA Bioregion: Geraldton Sandplains	3,142,149.97	3,499.10	10.67	6.92
	Sub-region: Geraldton Hills	1,969,997.90	3,499.10	10.67	6.92
	LGA: Shire of Northampton	5,749.92	2,124.08	36.92	10.69
17	State: WA	76,633.84	67,605.49	88.22	13.06
	IBRA Bioregion: Geraldton Sandplains	54,078.08	45,159.85	83.51	13.44
	Sub-region: Geraldton Hills	49,605.04	42,016.28	84.70	13.26
	LGA: Shire of Northampton	49,549.89	41,939.33	84.64	13.29

3.4.3 Flora diversity

The *NatureMap* database (DBCA 2019) identified 233 flora taxa, representing 64 families and 153 genera previously recorded within 10 km of the survey area. This total comprised 199 native flora taxa and 34 naturalised (introduced) flora taxa. Dominant families recorded included Poaceae (32 taxa), Asteraceae (25 taxa) and Myrtaceae (40 taxa).

The *NatureMap* database search is provided in Appendix C

3.4.4 Significant flora

The EPBC Act PMST, *NatureMap* and DBCA Threatened, and Priority Flora databases (DBCA 2021b) identified the presence/potential presence of eight conservation significant flora taxa within 10 km of the survey area (Appendix C). The desktop searches recorded:

– One Threatened flora taxa listed under the EPBC Act and/or BC Act
– One Priority 1 taxa
– One Priority 2 taxa
– Four Priority 3 taxa
– One Priority 4 taxa.

The locations of conservation significant flora registered on the DBCA databases are mapped on Figure 2, Appendix A.

3.4.5 Conservation significant ecological communities

The PMST (DAWE 2021) did not identify any TECs listed under the EPBC Act within the study area. The DBCA TEC/PEC database (DBCA 2021a) identified two Priority 1 PECs within the study area, however none are known to occur within the survey area (Figure 2, Appendix A). The two PECs identified are (DBCA 2021a):

– Kalbarri Ironstone Community (Priority 1 PEC) – winter wet, mallee/Melaleuca over herbs. Dense shrubland when burnt. Surrounded by sandplain. Yerina springs and north Euardy Station. Z-bend loop, Junga Dam. The taxon *Eremophila microtheca* (previously declared rare flora) occurs in this community
– Shrubland of the Northampton Area, dominated by *Melaleuca* species over exposed Kockatea Shale (Priority 1 PEC) – Heath on breakaways located in Port Gregory, west of Northampton. Community includes priority taxa; *Ptilotus chortophytum* (P1), *Leucopogon* sp. Port Gregory, *Ozothamnus* sp. Northampton, *Gastrolobium propinquum* (P1), outlier of *Ptilotus helichrysoides*. Unusual geology (Kockatea Shale) outcropping at surface.

4. Field results

4.1 Flora and vegetation

4.1.1 Vegetation types

Three vegetation aligning with broad landforms were identified and described in the survey area, not including cleared areas for tracks:

– VT01 - *Acacia rostellifera* open woodland to woodland
– VT02 - *Melaleuca cardiophylla* shrubland to open shrubland
– VT03 - *Myoporum insulare* shrubland

The vegetation types are described in further detail in Table 5 and mapped in Figure 3, Appendix A. The vegetation types are similar to those recorded from tenement M70/204 (GHD 2019).

The pre-European broad vegetation mapping has BVA 371 and BVA 17 mapped within the survey area. VT01 and VT02 aligns more closely with BVA 17 (*Acacia rostellifera* thicket) rather than BVA 371 (Low forest; *Acacia rostellifera*). Beard and Burns (1976) describes BVA 371 as occurring on black clay bottomland soils with wattles exceeding 10 m in height with pure stands, with no *Melaleuca* sp. VT01 and VT02 do not align with these habitat characteristics and structural elements. BVA 17 *Acacia rostellifera* thicket occurs on shallow sandy soil and thin rocky soil on limestone (Beard and Burns 1976). VT01 and VT02 align with BVA 17 based on soil types and position in the landscape.

VT03 covers a small area that is more similar with BVA 125 (Salt lake, lagoon, clay pan) (Beard 1975) that describes the Hutt Lagoon (Beard 1975). While VT03 is not connected with Hutt Lagoon it has similar saline flats chenopod community.

4.1.2 Conservation significant vegetation communities

No TEC's listed under the EPBC Act or BC Act or PECs listed by DBCA were identified within the survey area during the field survey. VT03 *Myoporum insulare* shrubland does not represent an occurrence of the Subtropical and Temperate Coastal Saltmarsh TEC as it is not under regular or intermittent tidal influence or connection and does not have a connection to the sea with a physical barrier of George Grey Drive separating VT03 from Hutt Lagoon. VT03 therefore does not meet the required physical environment of the TEC (DSEWPaC 2013).

4.1.3 Other significant vegetation

No other vegetation considered significant as per EPA (2016) was recorded from the survey area.

Table 5 Vegetation types identified within the survey area

Vegetation Types	Vegetation type description and landform	Representative releve and total area (ha)	Representative photograph
VT01 – *Acacia rostellifera* open woodland to woodland	*Acacia rostellifera* open woodland to woodland over *Rhagodia preissii* subsp. *obovata, Pimelea microcephala* subsp. *microcephala, Rhagodia preissii* subsp. *obovata* and *Stylobasium spathulatum* open shrubland over **Avena barbata* and **Ehrharta longiflora* open grassland to grassland over **Lupinus cosentinii* open forbland. Other common species include *Alyogyne hakeifolia, Roepera apiculata, Hannafordia quadrivalvis* and *Salsola australis*. Occurs over lower slopes and low sandplain on brown to orange sands. Previously disturbed through historic clearing for farming and heavily disturbed by previous grazing and weed invasion.	GMA04R, GMA05R, GMA07R, GMA08R, GMA09R 73.86 ha	

Vegetation Types	Vegetation type description and landform	Representative releve and total area (ha)	Representative photograph
VT02 – *Melaleuca cardiophylla* shrubland to open shrubland	*Melaleuca cardiophylla, Grevillea argyrophylla, Alyxia buxifolia* and *Pimelea microcephala* subsp. *microcephala* open shrubland over **Avena barbata* open grassland to grassland over **Brassica tournefortii* scattered forbland. Other common species include *Acacia andrewsii, Exocarpos aphyllus, Tetragonia implexicoma* and *Roepera fruticulosa*. Areas that contain deeper soils *Acacia rostellifera* was also recorded. Occurs on upper mid slopes on white-brown sand with limestone outcropping. Disturbances include high grazing impacts from feral pigs and other native species (kangaroo).	GMA01R, GMA02R, GMA06R 32.62 ha	
VT03 – *Myoporum insulare* shrubland	*Myoporum insulare* open shrubland over *Tecticornia* sp. *Samolus repens* and *Atriplex cinerea* open chenopod shrubland over *Sporobolus virginicus* open grassland. Other common species include *Threlkeldia diffusa* and *Cyperus gymnocaulos.* Occurs on light brown clay on seasonally wet chenopod drainage flat.	GMA03R 0.49 ha	

Vegetation Types	Vegetation type description and landform	Representative releve and total area (ha)	Representative photograph
Cleared	Cleared areas devoid of native vegetation	2.98 ha	

4.1.4 Vegetation condition

The condition of the vegetation within the survey area ranged from Degraded to Completely Degraded. Native vegetation covered 106.98 ha and cleared areas equate to 2.98 ha. The extents of the vegetation condition within the survey area are detailed in Table 6 and mapped in Figure 4, Appendix A.

All areas were mapped as degraded, except for cleared areas. The majority of the survey area has undergone historical clearing (agriculture) with regrowth over some of these areas. The vegetation structure was largely intact, however, the groundstorey was highly altered with high covers of introduced species. Other disturbances include signs of high grazing impacts with diggings evident from wild pigs.

Table 6 Vegetation condition

Vegetation Condition	Extent in the survey area (ha) (%)
Cleared	2.98
Degraded	106.98

4.1.5 Flora diversity

Fifty-four flora taxa (including subspecies and varieties) representing 26 families and 50 genera were recorded from the survey area during the field survey. This total comprised 38 native taxa and 16 introduced flora taxa.

Dominant families recorded from the survey area included:

– Chenopodiaceae (8 taxa)
– Poaceae (6 taxa)
– Fabaceae (6 taxa).

The full list of flora identified within the survey area complied by species list by family is provided in Appendix D.

4.1.6 Introduced flora

Sixteen introduced flora species were recorded from the survey area. No introduced flora species recorded are listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) or Weed of National Significance (WoNS). All introduced flora species recorded are considered environmental weeds and all have been previously recorded on the Geraldton Sandplains bioregion.

4.1.7 Conservation significant flora

No conservation listed flora species were recorded within the survey area. The survey area was in Degraded condition with very high invasive weed cover throughout the survey area with significant wild pig grazing that has impacted on the habitat condition.

Likelihood of occurrence assessment

A likelihood of occurrence assessment was conducted post-field survey for all conservation significant flora taxa identified in the desktop assessment (Appendix D). This assessment took into account previous records, habitat requirements, habitat condition, efficacy of the survey, intensity of the survey, flowering times and any uniquely defining characteristics or interactions of species.

The likelihood of occurrence assessment post-field survey concluded that 29 species highly unlikely and 19 species unlikely to occur in the survey area.

4.1.8 Other significant flora

No collections were made of species considered to be flora of interest from the project areas, such as significant range extensions or collections of taxonomic interest representing potential new species.

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Appendices

Appendix A

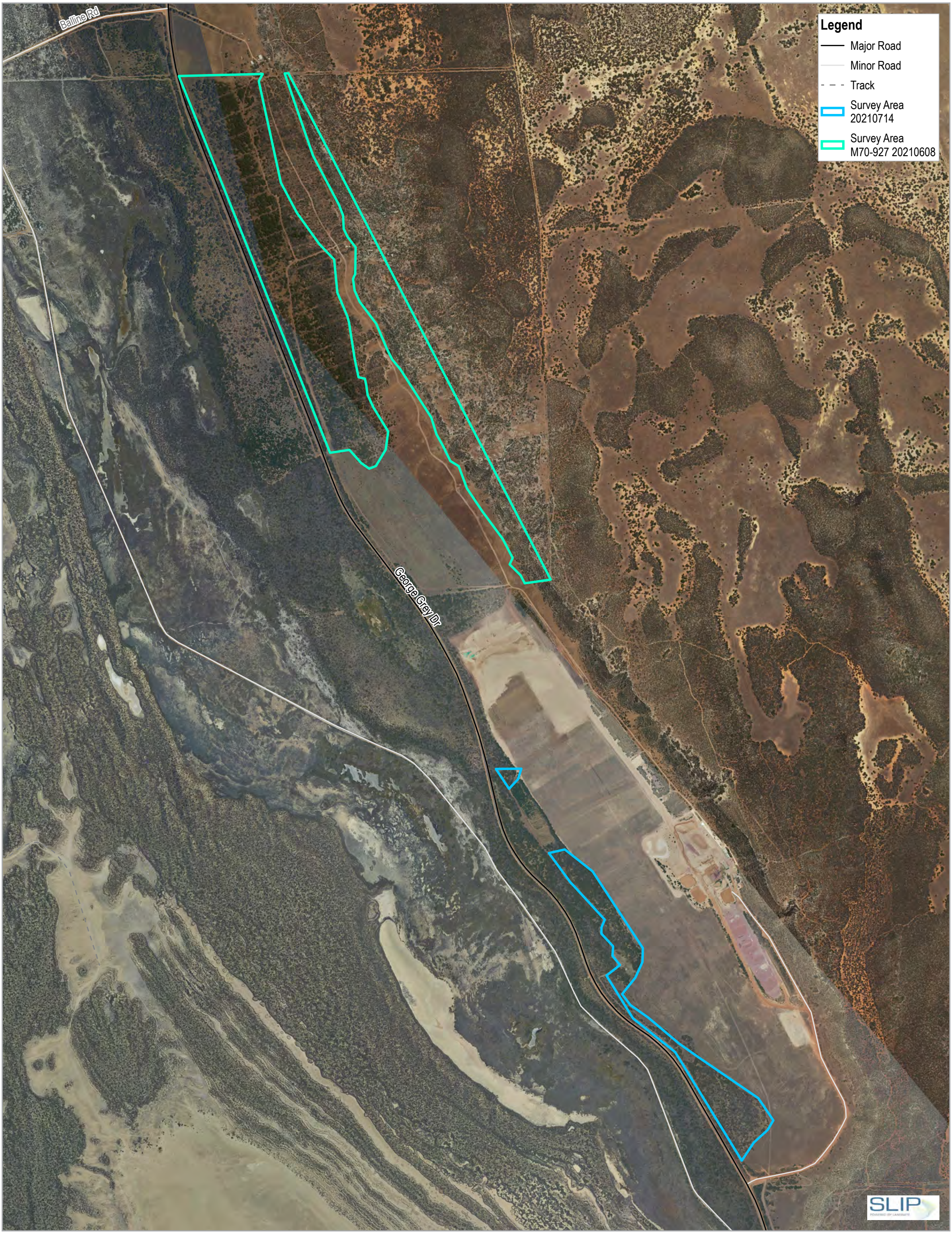
Figures

Figure 1 Survey area

Figure 2 Environmental constraints

Figure 3 Survey effort

Figure 4 Vegetation types and conditions



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Metres

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GMA Garnet Pty Ltd
Basic Flora and Vegetation Survey

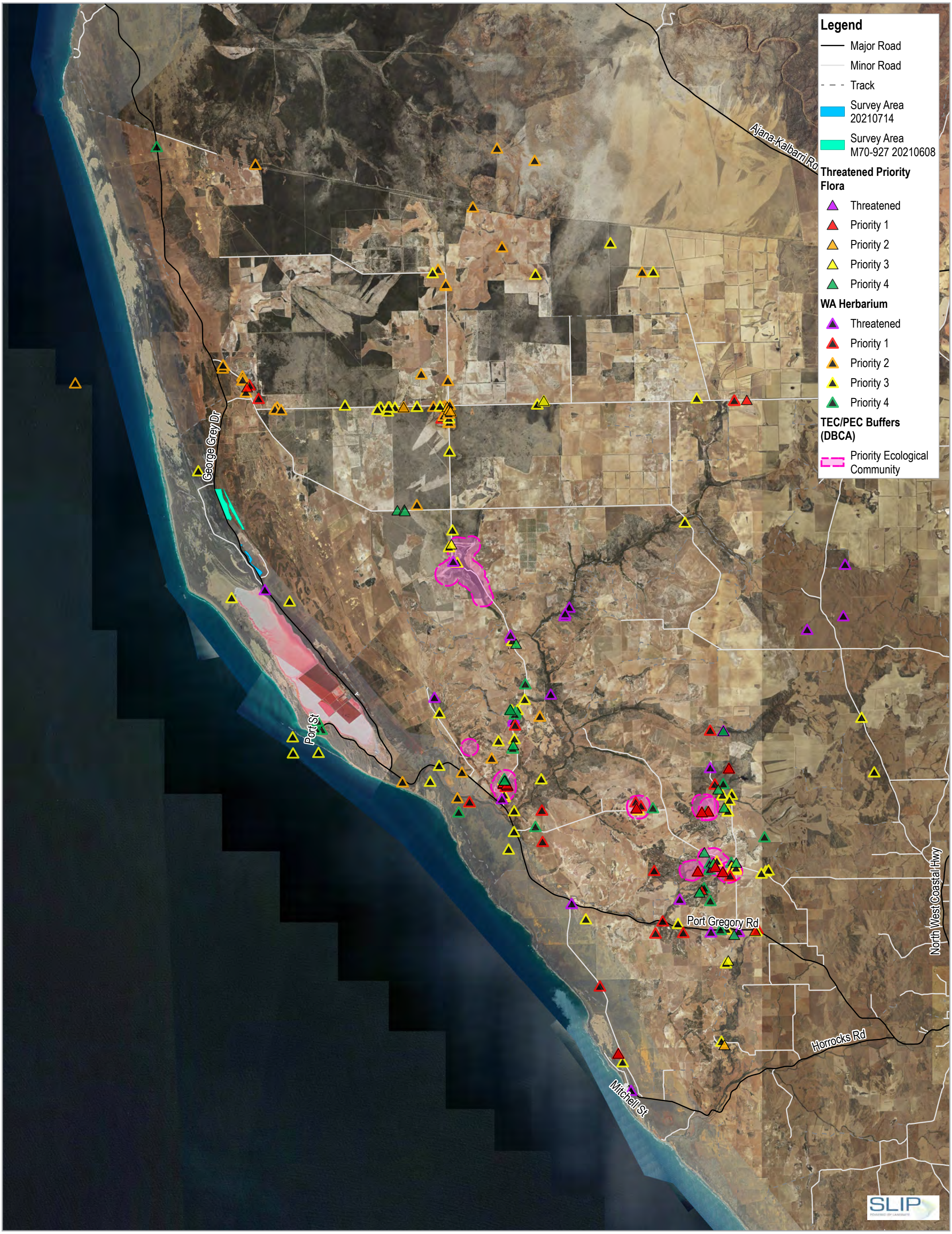
Survey Area

Project No. **12553427**
Revision No. **0**
Date **12/11/2021**

FIGURE 1

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Data source: Roads, WANow: Landgate / SLIP
OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri, accessed 20210916; Survey areas: GHD. Created by: ecastelblanco



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Basic Flora and Vegetation Survey

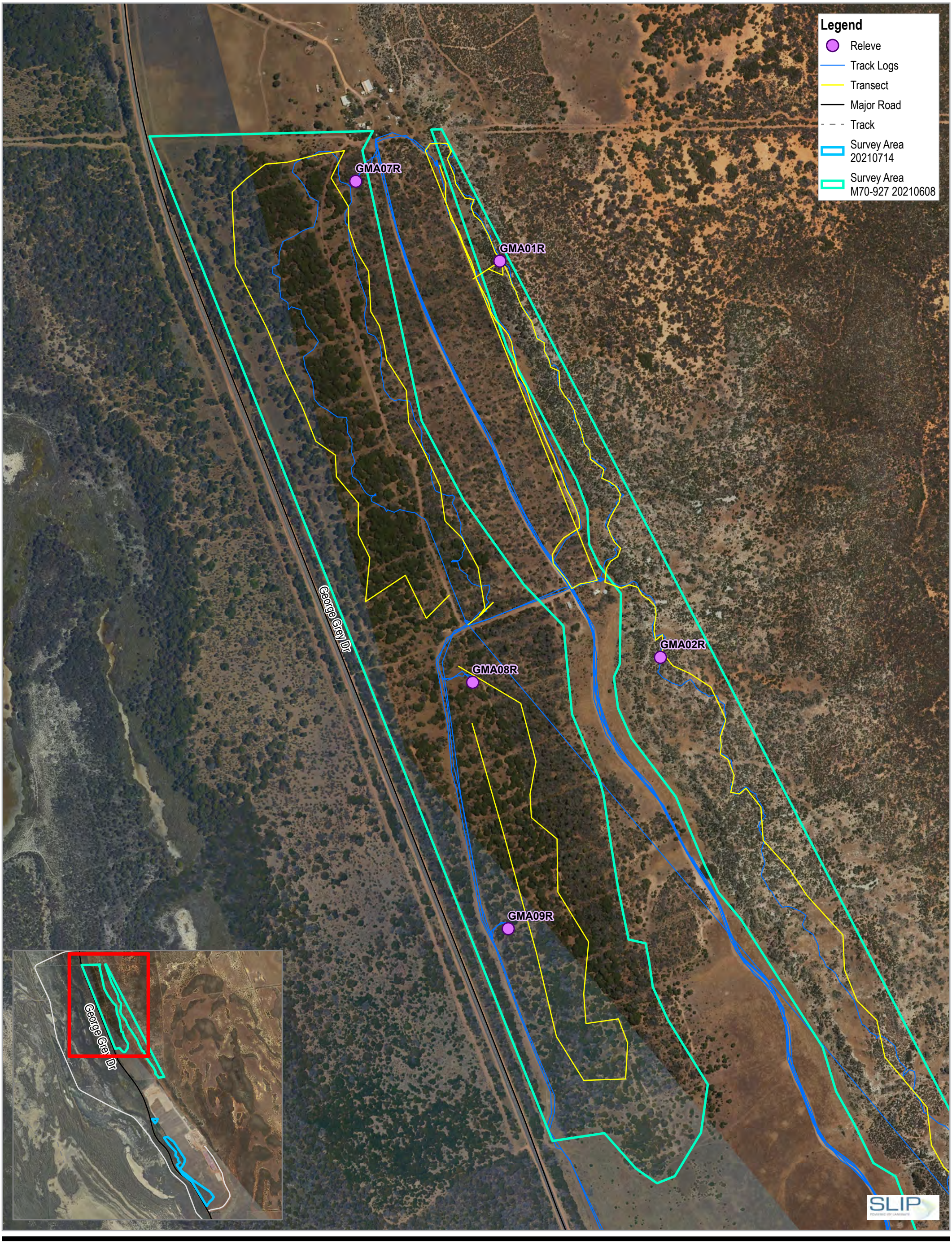
Environmental Constraints

Project No. **12553427**
Revision No. **0**
Date **12/11/2021**

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OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri, accessed 20210916; Survey area: GHD; TEC/PEC, WA Herbarium, TPFL: DBCA.
Created by: ecastelblanco



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Metres

Map Projection: Transverse Mercator
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Basic Flora and Vegetation Survey

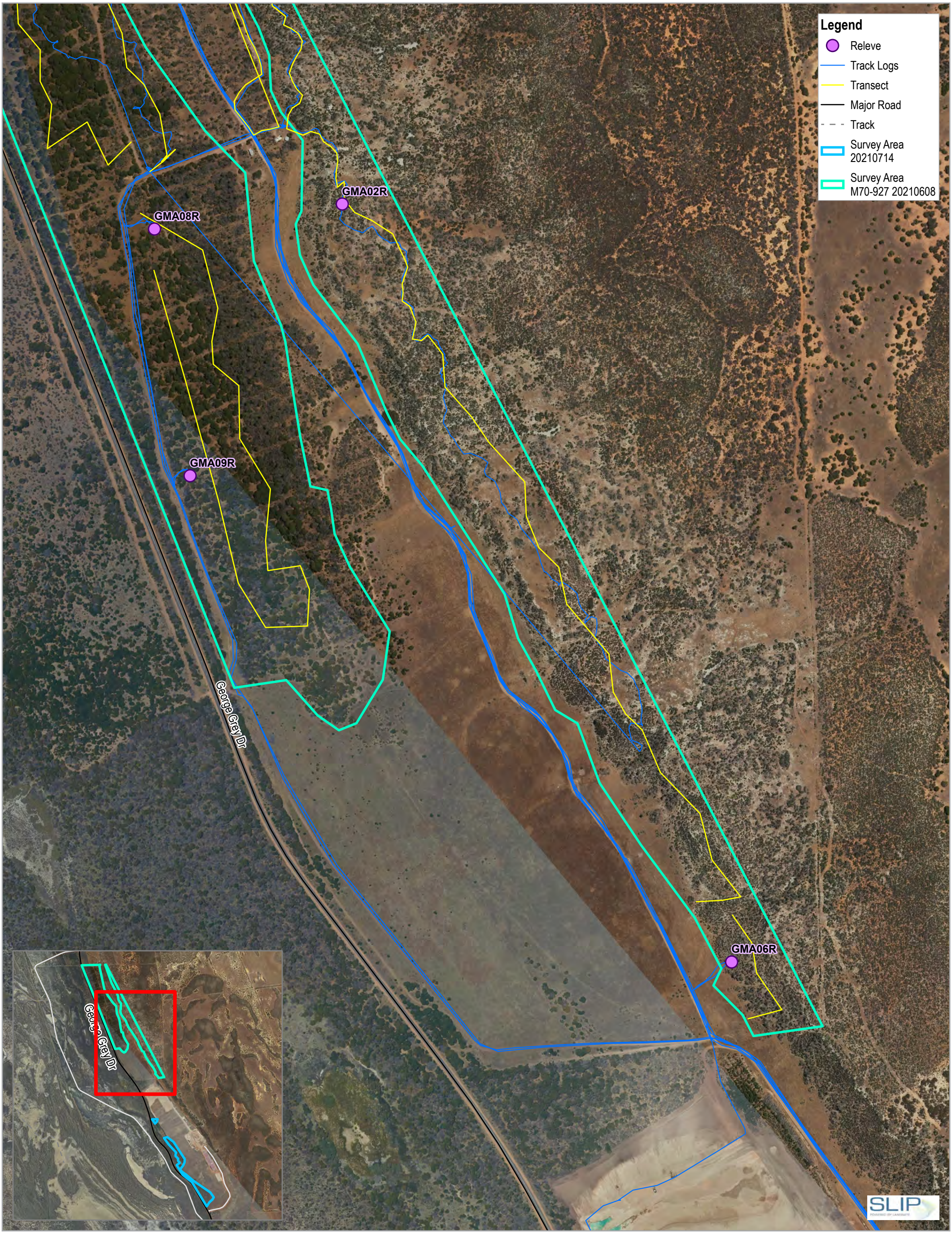
Survey Effort

Project No. **12553427**
Revision No. **0**
Date **12/11/2021**

FIGURE 3

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GMA Garnet Pty Ltd
Basic Flora and Vegetation Survey

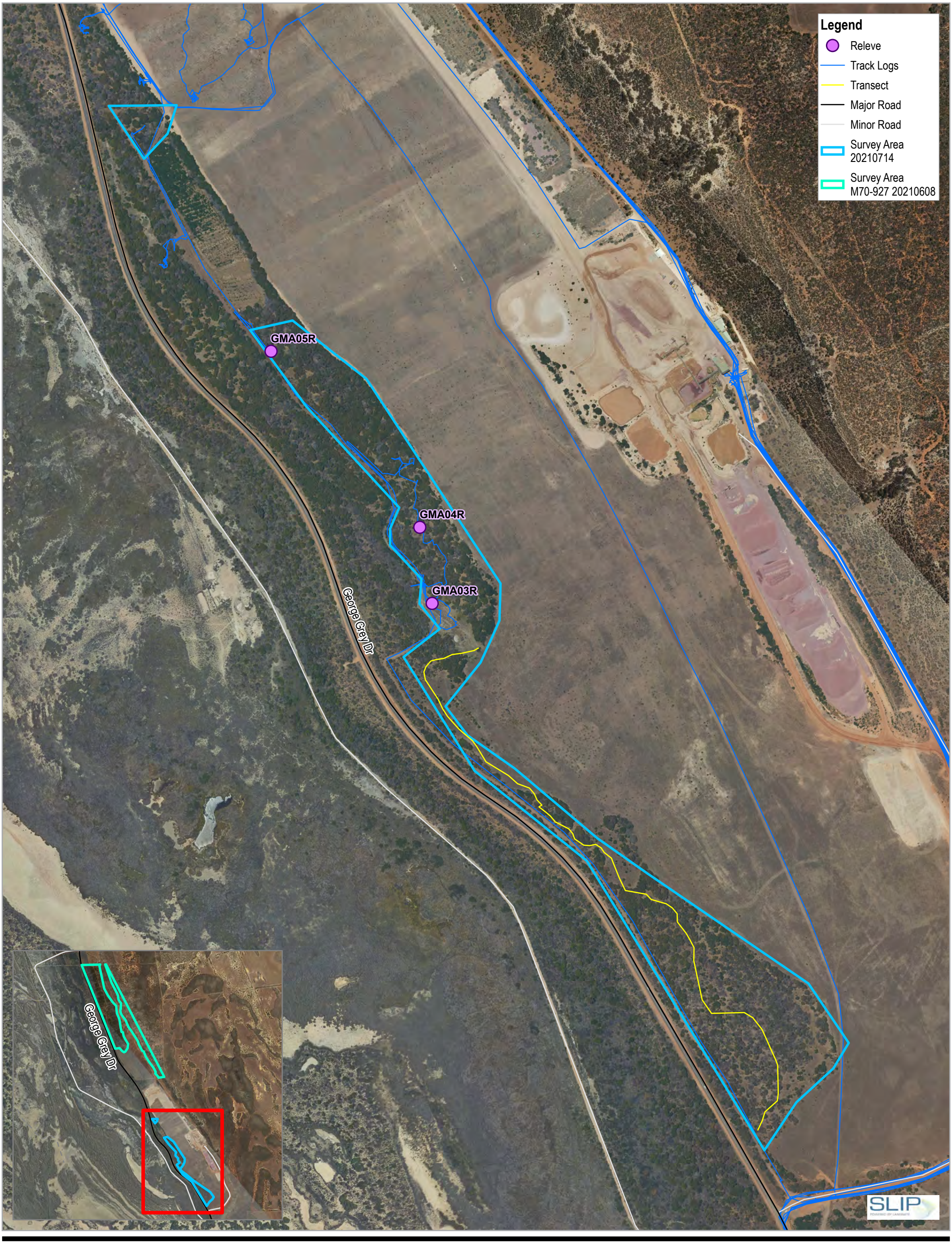
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Revision No. **0**
Date **12/11/2021**

FIGURE 3

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Map Projection: Transverse Mercator
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GMA Garnet Pty Ltd
Basic Flora and Vegetation Survey

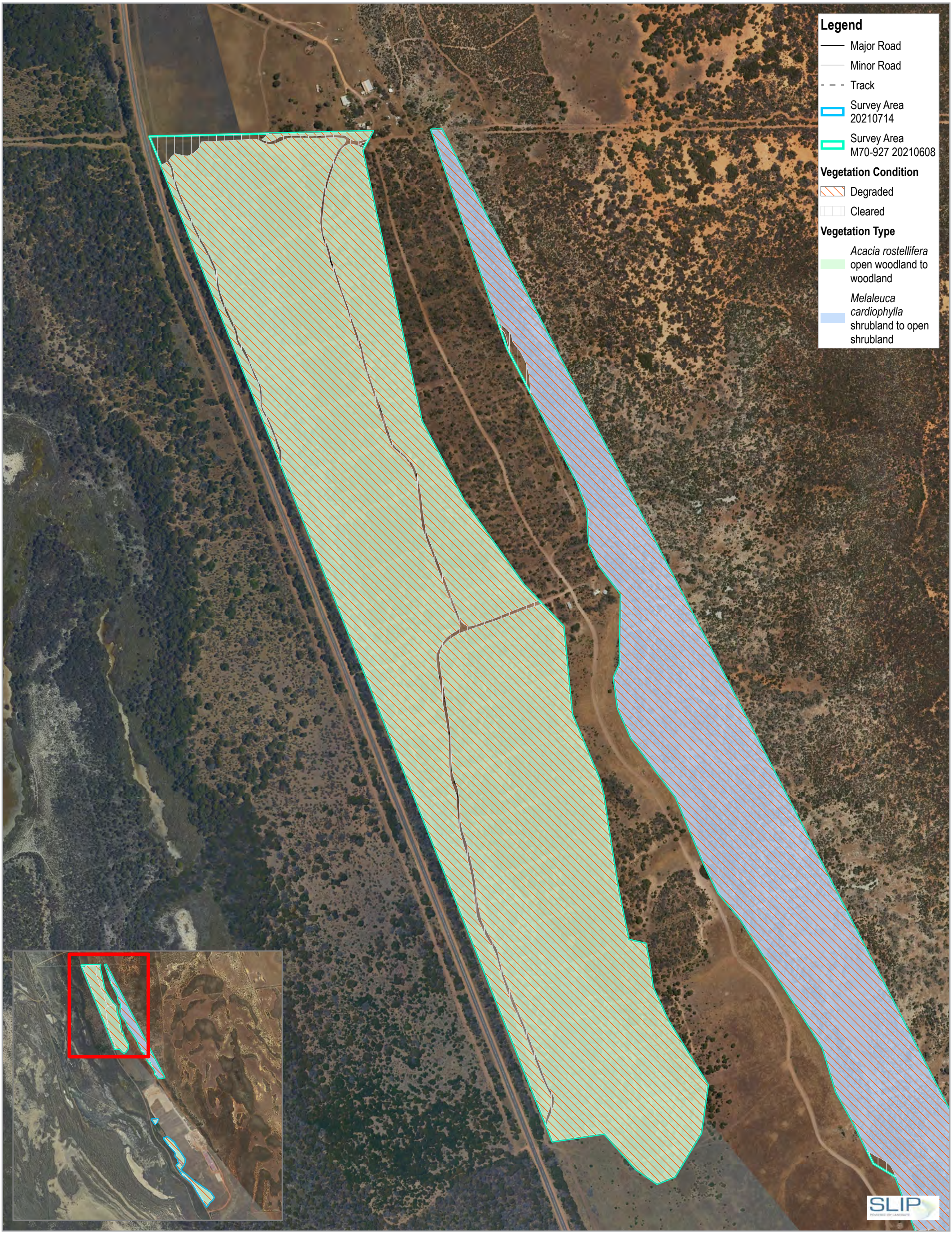
Survey Effort

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Date **12/11/2021**

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Basic Flora and Vegetation Survey

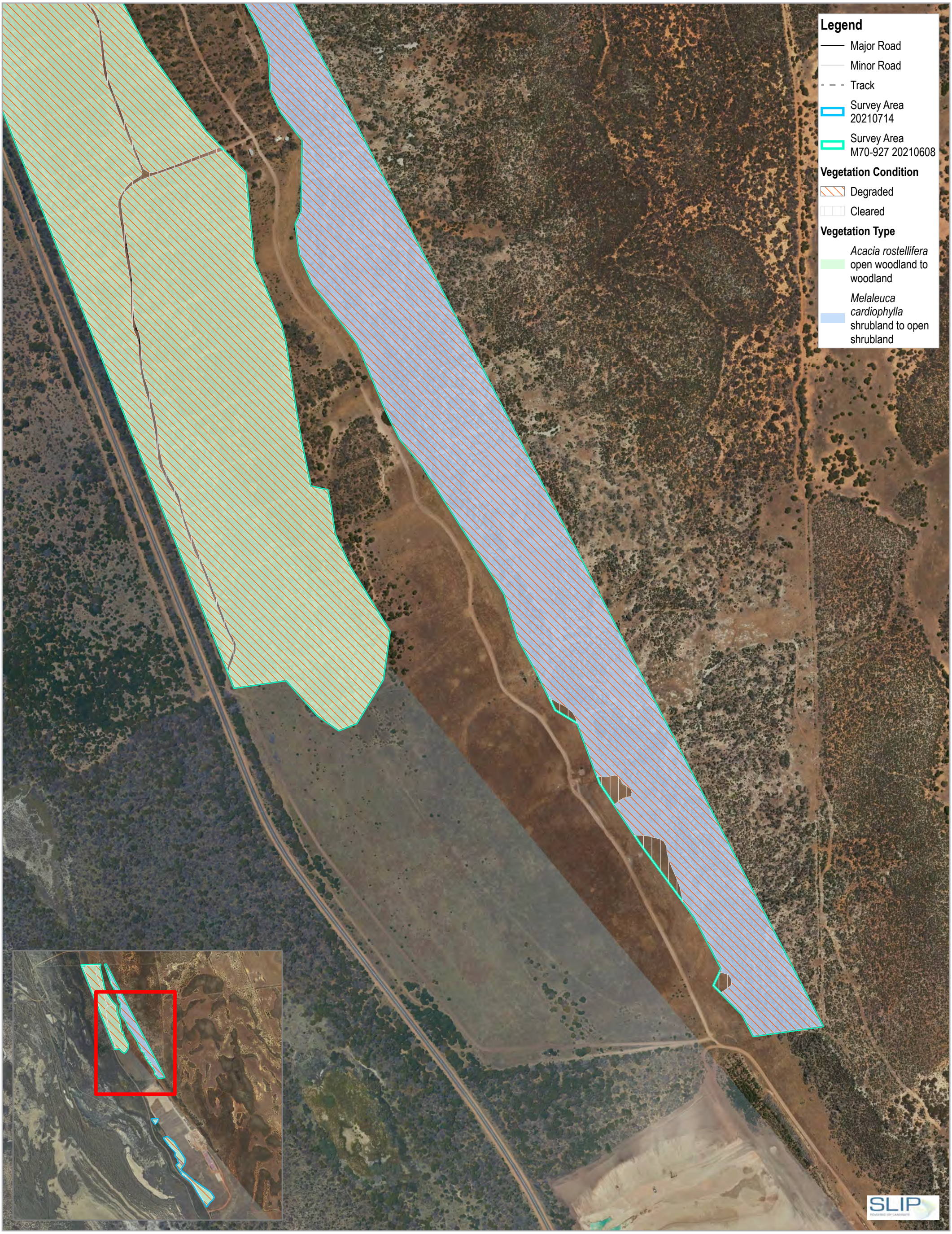
Project No. **12553427**
Revision No. **0**
Date **12/11/2021**

Vegetation Types and Conditions

FIGURE 4

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Metres

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Grid: GDA2020 MGA Zone 50

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GMA Garnet Pty Ltd
Basic Flora and Vegetation Survey

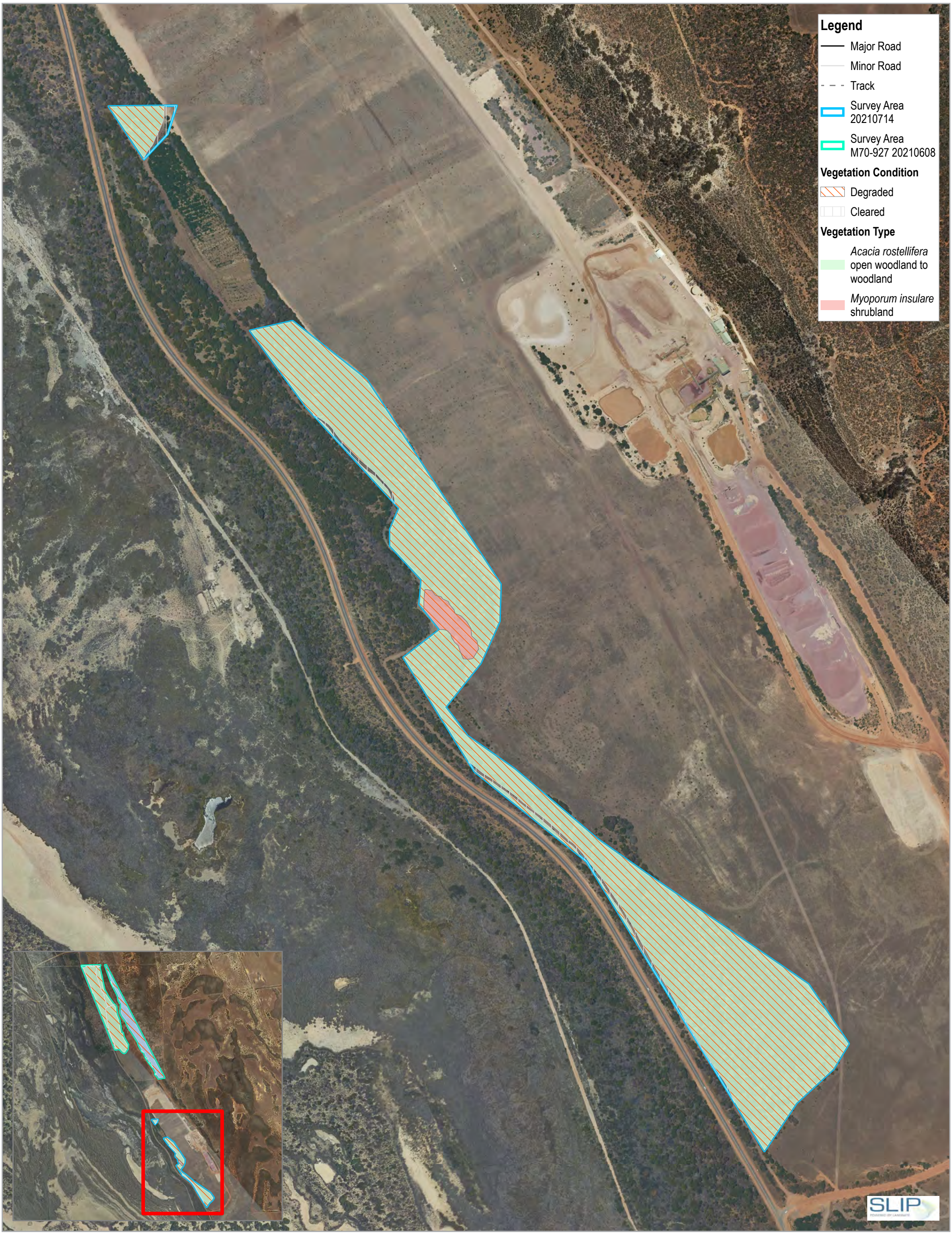
Vegetation Types and Conditions

Project No. **12553427**
Revision No. **0**
Date **12/11/2021**

FIGURE 4

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Map Projection: Transverse Mercator
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Basic Flora and Vegetation Survey

Project No. **12553427**
Revision No. **0**
Date **12/11/2021**

Vegetation Types and Conditions

FIGURE 4

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Appendix B

Relevant legislation, background information and conservation code

Relevant legislation

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

– Nationally threatened flora and fauna species and ecological communities
– Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of Agriculture, Water and the Environment (DAWE).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Water and Environment Regulation (DWER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DWER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

1. Native vegetation should not be cleared if it comprises a high level of biodiversity.
2. Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.
3. Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.
4. Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.
5. Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.
6. Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.
7. Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.
8. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.
9. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

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10. Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State *Biodiversity and Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation and protection of biodiversity and biodiversity components, as well as the promotion of the ecologically sustainable use of biodiversity components in Western Australia. The BC Act replaces both the repealed *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act), as well as their associated regulations. To attain the objectives of the BC Act, principles of ecological sustainable development have been established:

– Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
– If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
– The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
– The conservation of biodiversity and ecological integrity should be a fundamental consideration indecision-making
– Improved valuation, pricing and incentive mechanisms should be promoted.

The BC Act is administered by the Department of Biodiversity Conservation and Attractions (DBCA).

State *Biosecurity and Agriculture Management Act 2007*

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Primary Industries and Regional Development (DPIRD) and replace the repealed *Agriculture and Related Resources Protection Act 1976.* The main purposes of the BAM Act and its regulations are to:

– Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
– Manage the impact and spread of those pests already present in the state
– Safely manage the use of agricultural and veterinary chemicals
– Increased control over the sale of agricultural products that contain violative chemical residues.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

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DPIRD Categories for Declared Pests under the BAM Act

Control class code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

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Background information

Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the EP Act. The Table below outlines the aspects of areas declared as ESA in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005.

Aspects of ESAs

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the EPBC Act.
An area that is included on the Register of the National Estate (RNE), because of its natural values, under the *Australian Heritage Commission Act 1975* of the Commonwealth (the RNE was closed in 2007 and is no longer a statutory list – all references to the RNE were removed from the EPBC Act on 19 February 2012).
A defined wetland and the area within 50 m of the wetland. Defined wetlands include Ramsar wetlands, conservation category wetlands and nationally important wetlands.
The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
The area covered by a Threatened Ecological Community.
A Bush Forever Site listed in "Bush Forever" Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site is approved to be developed by the Western Australia Planning Commission.
The areas covered by the *Environmental Protection (Gnangara Mound Crown Land) Policy 1992*.
The areas covered by the *Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002.*
The areas covered by the lakes to which the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP Lakes) applies.
Protected wetlands as defined in the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998*.

Reserves and conservation areas

Department of Biodiversity, Conservation and Attractions managed lands and waters

DBCA manages lands and waters throughout Western Australia to conserve ecosystems and species, and to provide for recreation and appreciation of the natural environment. DBCA managed lands and waters include national parks, conservation parks and reserves, marine parks and reserves, regional parks, nature reserves, State forest and timber reserves. Access to, or through, some areas of DBCA managed lands may require a permit or could be restricted due to management activities. Proposed land use changes and development proposals that abut DBCA managed lands will generally be referred to DBCA throughout the assessment process.

Wetlands

Ramsar Wetlands (Wetlands of International Importance)

The Convention of Wetlands of International Importance was signed in 1971 at the Iranian town of Ramsar. The Convention has since been referred to as the Ramsar Convention. Ramsar Listed wetlands are "sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity … because of their ecological, botanical, zoological, limnological or hydrological importance" (DAWE 2020b). Once a Ramsar Listed Wetland is designated, the country agrees to manage its conservation and ensure its wise use.

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Under the Convention, wise use is broadly defined as “maintaining the ecological character of a wetland” (DAWE 2020b).

Nationally important wetlands

Wetlands of national significance are listed under the Directory of Important Wetlands in Australia. Nationally important wetlands are wetlands which meet at least one of the following criteria (DAWE 2020a):

– It is a good example of a wetland type occurring within a biogeographic region in Australia
– It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex
– It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail
– The wetland supports one percent or more of the national populations of any native plant or animal taxa
– The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level
– The wetland is of outstanding historical or cultural significance.

Vegetation extent and status

The National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia’s biological diversity is to be protected. This is the threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia’s Biological Diversity (ANZECC 2000).

The extent of remnant native vegetation in WA has been assessed by Shepherd et al. (2002) and the GoWA (2019), based on broadscale vegetation association mapping by Beard (various publications). The GoWA produces Statewide Vegetation Statistics Reports that are used for a number of purposes including conservation planning, land use planning and when assessing development applications. The reports are updated every 2-3 years.

Vegetation condition

The vegetation condition can be assessed in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (EPA 2016a). The scale recognises the intactness of vegetation and consists of six rating levels as outlined below.

Vegetation condition rating and scale for the South West and Interzone Botanical Provinces

Condition	South West and Interzone Botanical Provinces description
Pristine	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.

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Condition	South West and Interzone Botanical Provinces description
Completely Degraded	The structure of vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as ‘parkland cleared’ with the flora comprising weed or crop species with isolated native trees or shrubs.

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Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State BC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

Ecological communities

Significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act. The BC Act provides for the Minister to list an ecological community as a TEC (section 27), or as a collapsed ecological community (section 31) statutory listing of State TECs by the Minister. The legislation also describes statutory processes for preparing recovery plans for TECs, the registration of their critical habitat, and penalties for unauthorised modification of TECs.

Possible TECs that do not meet survey criteria are added to the DBCA Priority Ecological Community (PEC) List under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PECs are not listed under any formal Federal or State legislation, however, may be listed as TECs under the EPBC Act.

Codes and definitions for TECs listed under the EPBC Act and/or BC Act

Categories	Definition
Federal Government Conservation Categories (EPBC Act)	
Critically Endangered (CR)	An ecological community if, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Endangered (EN)	An ecological community if, at that time: – is not critically endangered; and – is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Vulnerable (VU)	An ecological community if, at that time: – is not critically endangered or endangered; and – is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Western Australia Conservation Categories (BC Act)	
Threatened Ecological Communities	
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

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Categories	Definition
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

Collapsed ecological communities

An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time –

– there is no reasonable doubt that the last occurrence of the ecological community has collapsed); or

– the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover –

- its species composition or structure; or
- its species composition and structure.

Section 33 of the BC Act provides for a collapsed ecological community to be regarded as a threatened ecological community if it is discovered in a state that no longer makes it eligible for listing as a collapsed ecological community.

Categories and definitions for PECs as listed by the DBCA

Category	
Priority 1	Poorly known ecological communities. Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Poorly known ecological communities. Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3	Poorly known ecological communities. – Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: – communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; – communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. – Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

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Category	
	– Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. – Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5	Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Other significant vegetation

Vegetation may be significant for a range of reasons other than a statutory listing. The EPA (2016a, b) states that significant vegetation may include vegetation that includes the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- A role as a refuge
- Providing an important function required to maintain ecological integrity of a significant ecosystem
- Local endemism in restricted habitats
- Novel combinations of taxa
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of a vegetation unit in 'pristine' condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range.

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

Flora and fauna

Significant flora and fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the BC Act can warrant referral to the DEE and/or the EPA.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for flora and fauna used in the EPBC Act align with the International Union for Conservation of Nature (IUCN) Red List criteria, which are internationally recognised as providing best practice for assigning the conservation status of species. The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

The State conservation level of flora and fauna species and their significance status also follows the IUCN Red List criteria. Under the BC Act flora and fauna can be listed as Threatened, Extinct and as Specially Protected species.

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Threatened species are those are species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such. The assessment of the conservation status of Threatened species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria. Specially protected species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as Threatened or Extinct species under the BC Act cannot also be listed as Specially Protected species.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

For the purposes of this assessment, all species listed under the EPBC Act, BC Act and DBCA Priority species are considered significant.

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Categories and definitions for EPBC Act and BC Act listed flora and fauna species

Conservation category	Definition
Threatened species	
Critically Endangered (CR)	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
Endangered (EN)	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines.
Vulnerable (VU)	Threatened species considered to be "facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.
Extinct species	
Extinct (EX)	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
Extinct in the Wild (EW)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).
Specially protected species	
Migratory (MI)	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.
Species of special conservation interest (conservation dependent fauna) (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Other specially protected fauna (OS)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Codes for DBCA listed Priority flora and fauna

Priority category	Definition
Priority 1	Poorly-known taxa Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy

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Priority category	Definition
	of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2	Poorly-known taxa Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3	Poorly-known taxa Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	Rare, Near Threatened and other taxa in need of monitoring – Rare: Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. – Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. – Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.

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Other significant flora

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than a statutory listing. The EPA (2016a, b) states that significant flora may include taxa that have/are:

– A keystone role in a particular habitat for Threatened or Priority flora or fauna species, or large populations representing a considerable proportion of the local or regional total population of a species
– Relictual status, being representation of taxonomic or physiognomic groups that no longer occur widely in the broader landscape
– New species or anomalous features that indicate a potential new species
– Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
– Unusual species, including restricted subspecies, varieties, or naturally occurring hybrids
– Local endemism (a restricted distribution) or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems).

Other significant fauna

Fauna species may be significant for a range of reasons other than those protected by international agreement or treaty, Specially Protected or Priority Fauna. Significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, or isolated outlying populations, or species which may be undescribed (EPA 2010).

Introduced plants (weeds)

Declared Pests

Information on species considered to be Declared Pests is provided under *State Biosecurity and Agriculture Management Act 2007.*

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

– Invasiveness
– Impacts
– Potential for spread
– Socio-economic and environmental values.

Australian state and territory governments have identified thirty-two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

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Appendix C

Desktop searches

EPBC Act PMST (10 km)

Naturemap Flora report (10 km)

Naturemap Fauna report (10 km

NatureMap
Mapping Western Australia's biodiversity

NatureMap flora report

Created By Guest user on 12/11/2021

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	114° 12' 05" E,28° 04' 39" S
Buffer	10km
Group By	Family

Area (ha)		31411.76
Taxa:	Naturalised	34
	Native	199
Endemics:		0
Families:		64
Genera:		153
Conservation Status:	-	225
	1	1
	3	3
	T	1
	2	2
	4	1
MS Status:	-	230
	PN	3
Rank:	-	209
	subsp.	19
	var.	5

Top Ten Families

		Species	Records
1.	Poaceae	22	32
2.	Asteraceae	21	25
3.	Myrtaceae	20	40
4.	Chenopodiaceae	13	17
5.	Malvaceae	11	36
6.	Fabaceae	11	14
7.	Proteaceae	10	12
8.	Orchidaceae	7	8
9.	Amaranthaceae	6	6
10.	Asparagaceae	6	7

Top Ten Genera

		Species	Records
1.	*Ptilotus*	6	6
2.	*Caladenia*	6	7
3.	*Hibbertia*	5	9
4.	*Melaleuca*	5	8
5.	*Calandrinia*	4	7
6.	*Waitzia*	4	4
7.	*Austrostipa*	4	5
8.	*Acacia*	4	6
9.	*Scholtzia*	4	16
10.	*Banksia*	3	3

[1] Endemic To Query Area

Name ID	Species	Conservation Status

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap CS flora report

Created By Guest user on 12/11/2021

Kingdom	Plantae
Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	114° 12' 05" E,28° 04' 39" S
Buffer	10km
Group By	Family

Family	Species	Records
Euphorbiaceae	1	1
Fabaceae	1	1
Malvaceae	2	12
Myrtaceae	2	12
Orchidaceae	1	1
Polygalaceae	1	1
TOTAL	**8**	**28**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Euphorbiaceae					
1.	19953	*Stachystemon nematophorus*		P4	
Fabaceae					
2.	14612	*Acacia latipes subsp. licina*		P3	
Malvaceae					
3.	40906	*Androcalva microphylla*		P2	
4.	5043	*Lasiopetalum oldfieldii*		P3	
Myrtaceae					
5.	19451	*Melaleuca huttensis*		P1	
6.	49123	*Scholtzia oleosa*		P2	
Orchidaceae					
7.	13618	*Caladenia elegans*		T	
Polygalaceae					
8.	4560	*Comesperma rhadinocarpum (Slender-fruited Comesperma)*		P3	

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

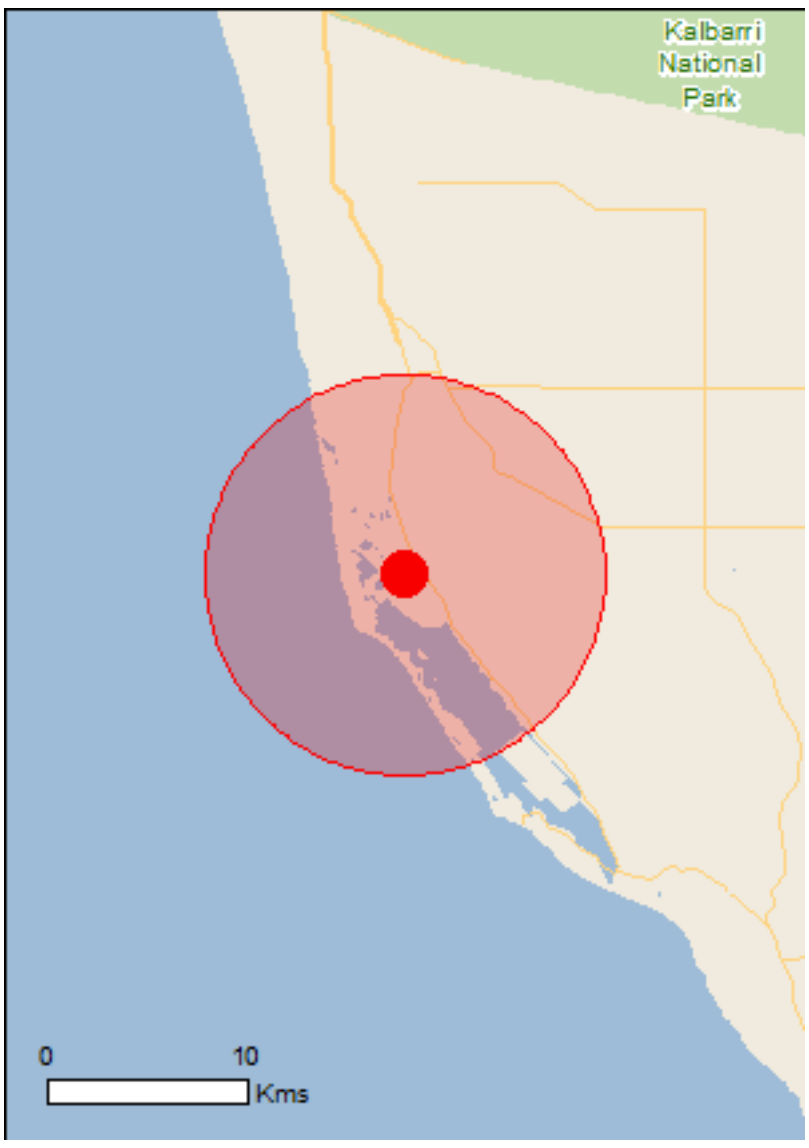
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 12/11/21 12:06:07

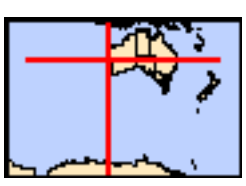
Summary
Details
Matters of NES
Other Matters Protected by the EPBC Act
Extra Information
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates

Buffer: 10.0Km



Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area
Other		
Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose	Vulnerable	Species or species

Name	Status	Type of Presence
Trapdoor Spider [66798]		habitat may occur within area
Plants		
Androcalva bivillosa		
Straggling Androcalva [87807]	Critically Endangered	Species or species habitat may occur within area
Caladenia bryceana subsp. cracens		
Northern Dwarf Spider-orchid [64556]	Vulnerable	Species or species habitat may occur within area
Caladenia elegans		
Elegant Spider-orchid [56775]	Endangered	Species or species habitat known to occur within area
Caladenia hoffmanii		
Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area
Diuris drummondii		
Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat may occur within area
Drummondita ericoides		
Morseby Range Drummondita [9193]	Endangered	Species or species habitat may occur within area
Eucalyptus cuprea		
Mallee Box [56773]	Endangered	Species or species habitat may occur within area
Stachystemon nematophorus		
Three-flowered Stachystemon [81447]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia		
Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species

Name	Threatened	Type of Presence
		area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area
Reptiles		
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Name	Status	Type of Presence
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
[Delphinus delphis](#) Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
[Eubalaena australis](#) Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
[Grampus griseus](#) Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area
[Stenella attenuata](#) Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
[Tursiops aduncus](#) Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
[Tursiops truncatus s. str.](#) Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Utcha Well	WA

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Hutt Lagoon System	WA

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Commonwealth marine environment within and	South-west
Western rock lobster	South-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-28.09145 114.19768

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D

Flora data

Flora species list

Quadrat data

Flora likelihood of occurrence

Flora species list

Family	Taxon	Status
Aphanopetalaceae	*Aphanopetalum clematideum*	
Apocynaceae	*Alyxia buxifolia*	
Asparagaceae	*Acanthocarpus preissii*	
Asparagaceae	*Thysanotus manglesianus*	
Asteraceae	*Helianthus annuus*	*
Asteraceae	*Hypochaeris glabra*	*
Asteraceae	*Urospermum picroides*	*
Asteraceae	*Sonchus oleraceus*	*
Brassicaceae	*Brassica tournefortii*	*
Brassicaceae	*Sisymbrium orientale*	*
Chenopodiaceae	*Atriplex cinerea*	
Chenopodiaceae	*Enchylaena tomentosa*	
Chenopodiaceae	*Salsola australis*	
Chenopodiaceae	*Samolus repens*	
Chenopodiaceae	*Threlkeldia diffusa*	
Chenopodiaceae	*Rhagodia preissii* subsp. *obovata*	
Chenopodiaceae	*Tecticornia* sp.	
Chenopodiaceae	*Tetragonia implexicoma*	
Convolvulaceae	*Convolvulus remotus*	
Cyperaceae	*Cyperus gymnocaulos*	
Euphorbiaceae	*Adriana tomentosa* var. *tomentosa*	
Euphorbiaceae	*Euphorbia terracina*	*
Fabaceae	*Acacia andrewsii*	
Fabaceae	*Acacia rostellifera*	
Fabaceae	*Bossiaea spinescens*	
Fabaceae	*Hardenbergia comptoniana*	
Fabaceae	*Lupinus cosentinii*	*
Fabaceae	*Medicago polymorpha*	*
Geraniaceae	*Erodium aureum*	*
Goodeniaceae	*Scaevola tomentosa*	
Lamiaceae	*Westringia dampieri*	
Malvaceae	*Alyogyne hakeifolia*	
Malvaceae	*Hannafordia quadrivalvis*	
Malvaceae	*Lasiopetalum angustifolium*	
Myrtaceae	*Eucalyptus obtusiflora*	
Myrtaceae	*Melaleuca campanae*	
Myrtaceae	*Melaleuca cardiophylla*	

Family	Taxon	Status
Poaceae	*Aristida* sp (insufficient material)	
Poaceae	*Avena barbata*	*
Poaceae	*Bromus diandrus*	*
Poaceae	*Cenchrus ciliaris*	*
Poaceae	*Ehrharta longiflora*	*
Poaceae	*Sporobolus virginicus*	
Primulaceae	*Lysimachia arvensis*	*
Proteaceae	*Grevillea argyrophylla*	
Rutaceae	*Diplolaena grandiflora*	
Santalaceae	*Exocarpos aphyllus*	
Scrophulariaceae	*Eremophila longifolia*	
Scrophulariaceae	*Myoporum insulare*	
Solanaceae	*Solanum nigrum*	*
Surianaceae	*Stylobasium spathulatum*	
Thymelaeaceae	*Pimelea gilgiana*	
Thymelaeaceae	*Pimelea microcephala* subsp *microcephala*	
Zygophyllaceae	*Roepera apiculata*	

Releve data

Site ID:	GMA_01	VT: 02	
Type:	Releve		
Date:	09/08/21		
Co-ordinates:	548524 E 12697650 N		
Landform and slope:	Limestone ridge, moderate slope		
Drainage:	Good		
Aspect:	West		
Soil colour & type:	Light brown sand		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing		
Leaf litter (%):	<2%		
Bare ground (%)	2-10%		



Site ID:	GMA_02	VT: 02	
Type:	Releve		
Date:	09/08/21		
Co-ordinates:	548821 E 12697949 N		
Landform and slope:	Limestone ridge, moderate slope		
Drainage:	Good		
Aspect:	West		
Soil colour & type:	Light brown sand		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing		
Leaf litter (%):	<2%		
Bare ground (%)	<2%		



Site ID:	GMA_03	VT: 03	
Type:	Releve		
Date:	09/08/21		
Co-ordinates:	550184 E 12699160 N		
Landform and slope:	Seasonally wet chenopod drainage flat.		
Drainage:	Seasonally wet, poor drainage		
Aspect:	Flat		
Soil colour & type:	Light brown clay		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing, near track, dam		
Leaf litter (%):	<2%		
Bare ground (%)	<2%		



Site ID:	GMA_04	VT: 01	
Type:	Releve		
Date:	12/08/21		
Co-ordinates:	550128 E 12699140 N		
Landform and slope:	Sandplain		
Drainage:	Good		
Aspect:	Flat		
Soil colour & type:	Light brown sand		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing, near track		
Leaf litter (%):	<2%		
Bare ground (%)	<2%		



Site ID:	GMA_05	VT: 01	
Type:	Releve		
Date:	12/08/21		
Co-ordinates:	549992 E 12698852 N		
Landform and slope:	Sandplain		
Drainage:	Good		
Aspect:	Flat		
Soil colour & type:	Light brown sand		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing, near track		
Leaf litter (%):	<2%		
Bare ground (%)	<2%		



Site ID:	GMA_06	VT: 02	
Type:	Releve		
Date:	12/08/21		
Co-ordinates:	549393 E 12698685 N		
Landform and slope:	Limestone ridge, moderate slope		
Drainage:	Good		
Aspect:	West		
Soil colour & type:	Light brown sand		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing		
Leaf litter (%):	2-10%		
Bare ground (%)	<2%		



Site ID:	GMA_07	VT: 01	
Type:	Releve		
Date:	13//08/21		
Co-ordinates:	548458 E 12697366 N		
Landform and slope:	Sandplain		
Drainage:	Good		
Aspect:	Flat		
Soil colour & type:	Light brown sand		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing, near track		
Leaf litter (%):	2-10%		
Bare ground (%)	<2%		



Site ID:	GMA_08	VT: 01	
Type:	Releve		
Date:	13/09/21		
Co-ordinates:	548830 E 12697571 N		
Landform and slope:	Sandplain		
Drainage:	Good		
Aspect:	Flat		
Soil colour & type:	Light brown sand		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing, near track		
Leaf litter (%):	2%		
Bare ground (%)	2-10%		



Site ID:	GMA_09	VT: 01	
Type:	Releve		
Date:	13/0921		
Co-ordinates:	549011 E 12698825 N		
Landform and slope:	Sandplain		
Drainage:	Good		
Aspect:	Flat		
Soil colour & type:	Light brown sand		
Vegetation condition:	Degraded		
Fire age & intensity:	Old >6 years		
Disturbances:	Weeds, grazing, near track		
Leaf litter (%):	2%		
Bare ground (%)	2-10%		



Flora likelihood of occurrence assessment guidelines

Likelihood of occurrence	Guideline
Likely	Species previously recorded within the study area and large areas of suitable habitat occur in the survey area.
Possible	Species previously recorded within the study area and areas of suitable habitat occur/may occur in the survey area.
Unlikely	Species previously recorded within the study area, but suitable habitat does not occur in the survey area, however, suitable search effort did not record the species.
Highly unlikely	Species not previously recorded within the study area, suitable habitat does not occur in the survey area and/or the survey area is outside the natural distribution of the species.
Other considerations	Intensity of survey, availability of access, growth form type, recorded flowering times, cryptic nature of species

Source information - desktop searches

PMST – DEE Protected Matters Search Tool (PMST) to identify flora listed under the EPBC Act potentially occurring within the study area

TPFL and WAHERB – records of threatened flora from TPFL and WAHERB database searches within the study area

NM – DBCA *NatureMap* (accessed September 2021)

Flora likelihood of occurrence assessment of conservation significant flora identified in the desktop assessment as potentially occurring within the study area

Table 7 [Insert Table Caption]

Family	Taxa	Status		Description and closest record information (if available) (WA Herbarium 2020, DBCA 2019)	Likelihood of occurrence
		EPBC	BC Act / DBCA		
Euphorbiaceae	*Stachystemon nematophorus*	Vu	P4	Woody, dense shrub, to 1.2 m high. Dry sand, sandy gravel over laterite, sandstone. Exposed rocky sites, disturbed ground. The nearest recorded is approximately 8 km east and south-east of the survey area.	Highly Unlikely – there is no suitable habitat for this species within the survey area.
Fabaceae	*Acacia latipes* subsp. *licina*		P3	Pungent shrub, 0.4-1.2 m high. White sand, granitic soils. Limestone hills, sandplains. Flowers yellow, June to September. The nearest record is approximately 200 m east of the survey area.	Unlikely – while there is suitable habitat within the survey area, suitable search effort did not record the species
Malvaceae	*Androcalva microphylla*		P2	Spreading recumbent dwarf shrub 30 cm x 100 cm. White flowers. White grey sand over sandstone. The nearest record is 10 km north of the survey area.	Unlikely – there is no suitable habitat within the survey area, suitable search effort did not record the species

Malvaceae	*Lasiopetalum oldfieldii*		P3	Shrub, 0.2-0.8 m high. Sandy soils. Flowers pink, August to October. The nearest record is less than 2 km west of the survey area.	Unlikely – there is suitable habitat within the survey area, however, suitable survey effort did not record this species
Myrtaceae	*Melaleuca huttensis*		P3	Erect shrub to 1.5 m high, flowers cream. Generally occurs on brown sand over laterite, but has been previously recorded in the survey area in orange, white and yellow sands on lower slopes of undulating plains and sandplains (GHD 2019). Flat plain. There area records located in M70/968, located less than 500 m east of the survey area (GHD 2014).	Unlikely – there is suitable habitat within the survey area, however, suitable survey effort did not record this species
Myrtaceae	Scholtzia oleosa		P3	Shrub to 1.5 m tall. Generally occurs on Low scrub and scrub. Associated species: *Acacia* sp., *All casuarina* sp., *Melaleuca* sp. The nearest record is 10 km north of the survey area.	Highly Unlikely – there is no suitable habitat for this species within the survey area.
Orchidaceae	*Caladenia elegans*	En	T	Tuberous, perennial, herb, 0.2-0.3 m high. Flowers yellow, July to August. Clayey loam. Winter-wet clay flats. The nearest record is approximately 35 metres from the northern end of the survey area.	Unlikely – while there is limited suitable habitat for this species within the survey area, suitable search effort did not record the species. The record of this species was recorded in 2009, and the land has since been dramatically altered.
Polygalaceae	*Comesperma rhadinocarpum*		P3	Perennial, herb. Flowers blue, October to November. Sandy soils. The nearest record is approximately 8 km north of the survey area.	Unlikely – while there is suitable habitat within the survey area, suitable search effort did not record the species



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Appendix B. Risk Assessment

The Australian and New Zealand Standard on Risk Management (AS/NZS 4360) defines risk as the product of the likelihood of an event occurring and its consequences. The risk matrix has been developed based on the AS/NZS 4360:2004 to assess the level of risk from activities undertaken in this project. To maximise the benefit of environmental management, human resources and other resources must be allocated to issues on a priority basis. It is generally accepted that the highest-risk issues receive the highest priority.

GMA implements the following mitigation strategy to help manage the risks, including:

- Avoid – avoid impacts where possible
- Minimise – if impacts cannot be avoided, minimise, and manage appropriately.
- Rectify – repair, rehabilitate and restore affected areas as soon as possible.
- Reduce – reduce affected areas through preservation and maintenance throughout the life of the mine.
- Offset – where negative impacts still occur, develop an offset package to achieve a net benefit.
- Each risk identified was assessed against the DMPE environmental factors, as shown in Table B1. Each factor was considered relevant throughout all phases of the project.

Table B1 Objectives for Environmental Factors

Factor	Objective
Biodiversity	To maintain representation, diversity, viability and ecological function at the species, population and community level.
Water Resources	To maintain the hydrological regimes, the quality and quantity of groundwater and surface water must be protected to the extent that existing and potential uses, including ecosystem maintenance, are protected.
Land and Soils	To maintain the quality of land and soils so that environmental values are protected.
Rehabilitation and Mine Closure	Mining activities are rehabilitated and closed in a manner to make them physically safe to humans and animals, geo-technically stable, geochemically non-polluting/non-contaminating, and capable of sustaining an agreed post-mining land use, without unacceptable liability to the State.

Table B2 Likelihood Descriptor

Descriptor	Frequency	Probability
Almost Certain	Twice or more per year	The event will occur during the Project/period under review.
		High number of known incidents.
Likely	Once per year	Event likely to occur during the Project/period under review.
		Regular incidents known
Possible	Once every 5 years	The event may occur in some instances during the Project/period under review.
		Occasional incidents are known.
Unlikely	Once in 10 years	The event is not likely to occur during the Project/period under review
		Some occurrences are known.
Rare	Once in 20 years	The event will occur in exceptional circumstances during the Project/period under review.
		Very few or no known occurrences.

Table B3 Consequence Descriptor

Factor	Insignificant	Minor	Moderate	Major	Severe
Biodiversity	Alteration or disturbance to an isolated area with no effect on habitat or ecosystem. Loss of an individual plant/animal of conservation significance.	Alteration or disturbance to <10% of a habitat or ecosystem resulting in a recoverable impact within 2 years. Loss of multiple plants/animals of conservation significance.	Alteration or disturbance to 10-40% of a habitat or ecosystem resulting in a recoverable impact within 2-5 years. Loss of <50% known local population of a plant/animal of conservation significance.	Alteration or disturbance to 40- 70% of a habitat or ecosystem resulting in a recoverable impact within 5-15 years. Loss of >50% known local population of plant/animal species, with possible loss of the entire local population.	Alteration or disturbance to >70% of a habitat or ecosystem resulting in a recoverable impact >15 years. Local loss of conservation of significant or listed species. Extinction of a species.
Water Resources	Negligible change to hydrological processes, water availability or water quality	Short-term modification of hydrological processes, water availability and quality within project tenure, but no change in beneficial use.	Medium-term modification of hydrological processes, water availability and water quality within project tenure, but no change in beneficial use. Short-term modification of hydrological processes, water availability and water quality outside project tenure, but no change in beneficial use.	Long-term modification of hydrological processes, water availability and water quality within project tenure, but no change in beneficial use. Medium-term modification of hydrological processes, water availability and water quality outside project tenure, with a change in beneficial use.	Long-term or permanent modification of hydrological processes, water availability or water quality outside project tenure, with impacts to water-dependent environmental value and/or change in beneficial use.
Land and Soils	Clean-up by site personnel was rectified immediately. Confined to the immediate area around the source.	Clean-up by site personnel, remediation within 1 year. Confined to the operational area.	Clean-up by site personnel, remediation within 1-3 years. Minor impact outside disturbance envelope or minor impact to soil stockpiles.	Clean-up requiring an external specialist, remediation within 3-10 years. Impact has migrated outside the disturbance envelope or contamination of soil stockpiles.	Clean-up requiring an external specialist. Remediation >10 years, or permanent residual impact. Impact outside the tenement boundary.

Factor	Insignificant	Minor	Moderate	Major	Severe
Rehabilitation and Mine Closure	The site is safe, stable, and non-polluting. Post mining land use is not adversely affected.	The site is safe, all major landforms are stable, and any stability or pollution issues are contained and require no residual management. Post mining land use is not adversely affected.	The site is safe, and any stability or pollution issues require minor, ongoing maintenance by the end land-user. Post-mining land use cannot proceed without some management.	The site cannot be considered safe, stable, or non-polluting without long-term management or intervention. Post-mining land use cannot proceed without ongoing management.	The site is unsafe, unstable and/or causing pollution or contamination that will cause an ongoing residual effect. Post-mining land use cannot be achieved.

Table B4 Risk Matrix

	Risk Matrix		Insignificant	Minor	Moderate	Major	Severe
Likelihood	5	Almost Certain	M	H	H	E	E
	4	Likely	M	M	H	H	E
	3	Possible	L	M	M	H	H
	2	Unlikely	L	L	M	H	H
	1	Rare	L	L	L	M	M

Table B5 Level of Consequence

Descriptor	Explanation
Low	Risk rating is based on subjective opinion or relevant experience. The baseline data/information has limitations, with only general conclusions possible, and further work is required.
Medium	Risk rating is based on similar conditions that have been observed previously. The baseline data/information has some gaps or requires minor further work.
High	Risk rating is based on testing, modelling or experiments. The baseline data/information are complete, and the analysis is appropriate for the level of data.

Table B6 Acceptability of Risk Level (Inherit)

Risk Level	Acceptability	Treatment
Extreme	Unacceptable	Risk will not be tolerated. Modification of the activity is required, and the Mining Proposal is amended.
High	May be acceptable, with specific risk treatments.	Risk may be tolerated with the application of high-reliability risk treatments. Environmental outcome / Closure objective required
Moderate	Acceptable, with relevant risk treatments.	Risk is tolerable with the application of appropriate risk treatments. Environmental outcome / Closure objective required.
Low	Acceptable	Risk is acceptable, but still requires industry best practice environmental management.

Appendix C. Dust Management Plan

Dust Management

Mining Australia Procedure

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1. Purpose and Scope

Dust can be generated through activities undertaken by GMA Garnet Pty Ltd (GMA). Dust Management provides guidance to successfully manage dust to ensure the impact on the environment and communities in which we operate is minimised.

This procedure details management measures to:

- Minimise the emission of dust associated with the operations
- Prevent negative impacts on sensitive receptors (the surrounding environment and local communities)
- Comply with relevant environmental legal and other requirements.

This procedure applies to all personnel employed by GMA and Sites.

2. Roles and Responsibilities

Role	Responsibilities
General Manager	• Accountable for ensuring adequate resources are available for the implementation and management of this procedure
Operations Manager	• Managing the implementation of this procedure for their Site
Supervisors/Superintendent	• Manage the implementation of the requirement of this procedure with their teams and areas of responsibility
Environmental Team	• Providing advice and assistance to the Division with the implementation of this Procedure. • Undertake monitoring of the requirements within this Procedure. • Periodic reporting of results internally and externally as defined under legislative requirements.

3. Definitions

Term	Definition
Aspect	Element of GMA's activities, products or services that can interact with the environment.
BoM	Bureau of Meteorology
Dust	Fine soil/material particles emitted into the atmosphere from mining and other activities.
Dust Exceedance	In the absence of environmental monitoring data, this could be dust above standard operating, that could impact sensitive receptors and that is more than just a once-off occurrence.
DWER	Department of Water and Environmental Regulations
Environment	Living things, their physical, biological and social surroundings, and interactions between these.
Environmental Impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's aspects.
EPA Licence	*Environment Protection Act 1986* Environmental Licence to Operate
Licenced premise	A place that is prescribed under the under the *Environment Protection Act 1986.*

Term	Definition
Risk	The probability (likelihood) of harm or damage occurring from exposure to a hazard, and the likely consequences of that harm or damage.
Sensitive Receptor	Locations, such as residential buildings or other premises, communities, flora, fauna or habitats, where health or property or environmental values may be affected by emissions above background levels.
Shall	The term "Shall" means mandatory.

4. Legal requirements

Port Gregory Site is an *Environmental Protection Act 1986* (EPA) –Licenced premise (L8561/2011/1). The Licence Premises includes Lynton (M70/204, M70/259, M70/968, M70/1330 and M70/1331), Hose (M70/856 and G70/171) and Utcha (M70/926 and M70/927).

Geraldton Site is also an EPA Licenced premise (L6145/1983/11). As a Licenced premise GMA is required to implement dust management measures to minimise dust and impacts to sensitive receptors. The management measures are outline in Section 5.

5. Process

5.1. Document and Communicate Dust Requirements

The requirements of this procedure and any project specific requirements shall be communicated to personnel involved in dust causing activities during the site inductions, pre-start meetings and during toolbox meetings. The Toolbox Topic: Dust can be used to communicate these requirements.

5.2. Plan Activities

Activities involving the generation of dust shall be planned to minimise emissions and impacts to sensitive receptors:

- Areas to be disturbed shall be identified, minimised and disturbance shall be a staged process as per the requirements outlined in Clearing and Ground Disturbance (HSE-172).
- Use hardstand areas to minimise dust emissions where feasible.
- Discuss activities that have the potential to generate high levels of dust at pre-start meetings and agree on reduction methods before undertaking works.
- Monitor daily weather forecasts for temperature and wind speed and communicate the forecast information to persons involved in dust generating and dust suppression activities, where there is a risk of impacting sensitive receptors. At the Port Gregory mine site monitor the wind station.

5.3. Minimise Dust during Operations

During operations dust shall be minimised by:

- Operating proactively subject to weather forecasting over a 24 hour period (refer to Appendix A.2.12).
- Monitoring Port Gregory wind station (refer to Appendix A.2.12).
- Maintaining roads throughout the Site, including watering the roads to maintain moisture on the surface of roads/haul routes
- Use of water trucks and/or water cannons to dampen areas identified as being potentially dust generating (sandy soils, soil stockpiles, unsealed access roads etc.). The dampening frequency shall be determined based on weather conditions and dust emissions (refer to Appendix A.2.12).
- Restricting all vehicles to dedicated roads and tracks

- Depending on the situation reduce speed limits to minimise dust generation.
- Introducing dust suppression additives where required and practicable
- Maintaining dust suppression systems on conveyor belts.
- Operating dust suppression sprinkler system at Geraldton as per SOP-40.
- Covering vehicles transporting soils off-site to minimise dust generation during transport.
- Implementing regular inspections and preventative maintenance strategies for dust control equipment.
- Maintaining adequate spares at the Site for critical items of control equipment, such as water pumps for dust suppression sprays, spray heads etc.
- Undertaking staged vegetation clearing to minimise open areas
- Undertaking vegetation rehabilitation as soon as practicable to reduce open areas
- Scheduling topsoil stripping to avoid periods of high winds from unfavourable directions relative to sensitive receptors (including George Grey Drive and Utcha Well Nature Reserve).
- Cease/suspending topsoil stripping operations during high wind conditions where there is a risk of dust affecting sensitive receptors.
- Dust suppressant applied proactively to overburden/topsoil stockpiles.
- Dust suppressant reapply proactively subject to visual inspection and weather forecasting.
- Cease activity causing visible dust lift-off where dust management measures have not prevented dust lift-off, and there is a risk of dust affecting sensitive receptors.

Alternative dust control measures, e.g. hydro-mulching, wind fencing, hard standing or chemical dust suppressants may be used and shall be investigated on a case by case basis to determine suitability before implementation.

Additional dust management measures for consideration are documented within Appendix A. Additional Dust Control Guidance.

5.3.1. Product Stockpile Management – Narngulu Operations

Release of fugitive from stockpiled material shall be minimised by:

- Operating dust suppression sprinkler system at Geraldton, as per SOP-40
- Keeping stockpile heights to a minimum. A stockpile shall not exceed the height of the top of the cab of the loader (generally 3 m).
- Scheduling of material cartage so that that stockpiling of material can be kept to a minimum
- Shaping stockpiles with a gentle slope to reduce erosion and sedimentation in the surrounding area
- Maintaining surrounding areas so they are kept free of material build up
- Maintaining an even surface around stockpiles, to reduce material spillage from the loader bucket when in operation
- Reducing loader bucket load volume, so that spillage does not occur.

5.3.2. Mid-West Ports GMA Sheds

The following dust management strategies shall be implemented:

- All trucks loads shall be covered, carting material to the Port.
- In the event the product shed is full, the Contractor shall seek authorisation from Mid West Ports Authority to load from outside the shed on commencement of ship loading.
- Sheds that are at capacity shall have the roller doors lowered until ship loading commences.
- Street sweeping contractor shall be engaged by the Contractor to mitigate the garnet outside the shed areas.

5.4. Undertake Monitoring

Monitoring activities and frequencies are summarised in the table below:

Monitoring Activity	Description of Monitoring Activity	Frequency	Responsibility
Report Exceedances	Any evidence of dust exceedances shall be reported to the Supervisor / Superintendent to enable it to be rectified.	Throughout operations	All Personnel
Inspection	Dust produced by work areas shall be inspected, and if dust levels could impact sensitive receptors, mitigation measures shall be put in place to reduce impact.	Daily	Supervisor/ Superintendents
Monitoring	Port Gregory (only) - Superintendent/Supervisors shall monitor the weather station located on the monitor in the lunch room.	Daily	Supervisor/ Superintendents
Monitoring	Monitoring of sensitive receptors	Mining in M70/926 between October and May.	Environmental Team

5.5. Report Incident or Complaint

If an incident occurs, or a complaint is received report, this needs to be reported in skytrust.

6. Training and Competency

Role	Type	Requirement
All Personnel	Awareness	Induction covering the requirements of this procedure.
Supervisors/Superintendents	Awareness	Completed Appendix A "Procedure Acknowledgement Form".

7. Supporting Documents

Document No.	Document Title or Information Source
	Environmental Toolbox Topic: Dust
SOP-40	Dust Suppression Sprinkler System

8. Related Documents

Document No.	Document Title or Information Source
HSE-172	Clearing and Ground Disturbance Procedure

9. References

Document No.	Document Title or Information Source
	Environmental Protection Act 1986
	Environmental Protection National Environmental Protection (Ambient Air Quality) Measure
	Environmental Protection (Unauthorised Discharges) Regulations 2004
	A Guideline for the Development and Implementation of a Dust Management Program (2008) Department of Environment and Conservation
	The dust suppression choice (23 May 2012) Mining Australia
	GHD (2020) GMA Garnet Dust and Noise Modelling. Air Quality Assessment.

10. Revision

Date	Revision	Created/ Amended By	Amendment	Approved By (Document Owner)
1/12/2020	A	Steven Petts	Draft Preliminary – Issued for Review	Ross Avard
15/02/2022	B	Steven Petts	Update plan	Ross Avard

Appendix A. Additional Dust Control Guidance

A.1. Factors Influencing the Levels of Dust and other Air Pollutants

The following factors influence the risk associated with dust and other air pollutants and should be considered when planning and undertaking works.

The soil type and properties of a site will have a considerable impact on the amount of dust generated. In general soils with a dominant particle size corresponding to gravel size or larger have less potential of becoming airborne than finer particles such as fine sand, silt and clay. However, soil may comprise a mixture of different soil particles, for example, fine contaminated dust, such as heavy metals, mixed with coarse particles.

An assessment of soil particle size distribution can help to determine the potential for particles to become airborne. As a general guide, particle sizes of 50µm or more tend not to become airborne.

Soil moisture content is also important. Dry or non-wetting soils are more likely to become air borne. A soil profile will also provide information on the different soil layers and their potential for particle lift off.

Sites with a larger exposed area are identified as having a greater dust generating potential.

The longer the project, the greater the dust risk as the potential for exposure increases.

The proximity of a site to sensitive receptors has a significant influence on the dust risk potential of a site. A site that is located close to sensitive receptors, such as, residential housing, children's day care, schools, hospitals, sports fields etc., will generally require more preventative measures compared to a site in an isolated remote location.

The direction of the prevailing winds can also influence the risk potential of a site for dust and other air pollutants. Suppose the prevailing winds (predominant wind direction) are blowing towards sensitive receptors. In that case, the risk potential increases because the sensitive receptors are more likely to be impacted then if the winds are blowing away from the sensitive receptors. The higher the wind speed, the greater the potential for dust lift. Daily and seasonal variation of wind speed and direction should be considered, refer to Appendix A.2.12.

The nature of works to be conducted will affect the dust levels, for example, land clearing and stockpiling may generate more dust than site levelling.

The topography of the Site may influence wind behaviour at the Site, which could impact the dispersion of dust and other air pollutants from the Site.

A.2. Dust Control Measures

A.2.1. Limit Cleared Areas and Maximise Vegetation

Before the commencement of any works and during the operation, as much vegetation as possible should be retained, including patches and strips to minimise dust. This can be done by implementing the following:

- Before any works commence, identify areas of vegetation cover that need to be retained.
- Protect this vegetation by fencing or blocking off from the rest of operations
- In other areas, maintain the original vegetation cover for as long as possible.
- Avoid clearing the entire area at once, instead clear areas as required in stages of the operation.

Retaining original trees, shrubs and grasses is one of the most efficient and effective ways of minimising dust emissions. Even low or sparse scrub can be very effective at dissipating wind velocity at the ground surface, where dust lift off occurs.

The following should be considered:

- Retain as much existing vegetation as possible

- If an area needs to be cleared, transplant established plants that must be disturbed to areas that need vegetation
- If trees and plants must be removed and it is not possible for them to be replanted, consider chipping and using the material as mulch – the advantage is that reseeding of original vegetation can occur. Where possible, restore vegetation that is native to the area to maximise plant success and improve environmental conditions.

A.2.2. Timing of Development and Development Staging

Activities with high dust-causing potential, such as topsoil stripping, should not be carried out near sensitive receptors during adverse wind conditions. When necessary, topsoil should be stripped in discrete sections, allowing buffer strips (windbreaks) between clearings.

Dust generated by bulk earthworks being performed during the summer months, particularly with sensitive receptors in proximity, can adversely impact the community/environment.

When planning the staging of developments, the impact on personnel including but not limited to the camp, offices, crib rooms and work areas should be taken into account in relation to the cleared areas and the prevailing winds.

A.2.3. Wind Barriers

Having appropriate wind barriers can be an effective measure for the control of dust over short distances. Wind barriers provide a positive visual impact and offer a protection against the movement and impact of dust on nearby land users. Wind barriers should be considered before commencement of works and when it is apparent that one is required during the next phase of the operation. Consider the following options when placing barriers to prevent dust emissions:

- Wind barriers are most effective when placed perpendicular to the direction of the prevailing wind but will have little or no effect when the wind direction is parallel.
- When choosing wind barriers, it has been observed that solid barriers provide significant reductions in wind velocity for relatively short leeward distances, whereas porous barriers provide smaller reductions in velocity for more extended distances.
- Wind barriers should be at least two metres high.

Windbreaks are barriers designed to slow the speed and redirect the flow of wind. These are not widely used but may be useful in some locations. Effective windbreaks do not stop the wind but break its forward movement, to slow it down. Good windbreaks will not create excessive turbulence or wind eddies.

Windbreak materials may include fences, berms and plants. Windbreaks are most useful when designed for specific wind directions. The effective zone of protection created by a windbreak is approximately 25 times its height, although maximum-protection wind reduction occurs in a range of five to eight times the height of the screen.

A.2.4. Earthmoving Management

Earth-moving activities have the potential to generate large amounts of dust. Planning earth-moving activities particularly at the start of an operation can reduce dust emissions by limiting the time the area is exposed. Options for dust control can include the following:

- Plan earth-moving so they are completed just prior to the time they are needed to limit the length of time ground is exposed
- Observe weather conditions and do not commence or continue earth moving if conditions are unsuitable e.g. under conditions of strong winds.
- Reduce off-site hauling via balanced cut and fill operations
- Pre-water areas to be disturbed.

A.2.5. Management of Material Stockpiles

Material stockpiles can generate large amounts of dust. Fine materials stored in stockpiles can be subject to dust pick-up. Materials being loaded onto conveyor belts or into trucks, rail cars or marine vessels are also potential sources of dust emissions. Dust emissions from material stockpiles can be minimised using the following processes:

- Locate stockpiles in sheltered areas where possible. Alternatively, stockpiles may be covered.
- Where stockpiles are located in open areas, limit the height and slope of the stockpiles to reduce wind pick up, orient stockpiles lengthwise into the wind so they offer the minimum cross-sectional area to prevailing winds, install wind barriers on three sides of the stockpile.
- Limit activity to the downwind side of the stockpile
- Limit drop heights from loading facilities and use closed conveyors where possible. Transfer points should also be minimised. Sprinkler systems could also be used on conveyor systems. Alternatively, dust collection systems, such as, cartridge or baghouse systems could be used instead of sprinklers, where moisture is of concern, for example, with mineral concentrates.

A.2.6. Watering Road

Moisture in the surface of dirt roads causes particles to stick together. The moisture content of dirt roads can be increased by watering the road surface. Depending on weather conditions, a single watering may be effective for hours. When water is applied alone, it provides a short-term reduction in dust. Regular, light watering is better than less frequent, heavy watering.

Watering assists with reducing dust lift off from roads and other traffic areas and during earthworks, to controlling dust during movement of materials such as loading/offloading and transportation of materials.

Watering is a very effective short-term measure; however, its efficiency decreases as wind velocity and evaporation rate increase. Dust emissions can be minimised using the following watering processes:

- The surface should be dampened to prevent dust from becoming airborne but should not be wet to the extent of producing run-off. Alternatively, wetting agents could be used, particularly for non-wetting soils.
- Watering is more effective when undertaken prior to strong breezes
- Use watering sprays on materials to be loaded and during loading.

The use of scheme water should be discouraged, and alternative supplies used whenever possible. However, care must be taken to ensure that the quality of water will not have adverse environmental impacts.

Real time automated response systems to turn on water cannon systems in response to dust levels or high wind speeds can be used. These can help save water by only turning on water cannons during the required conditions and help to reduce the possibility of operator error.

A.2.7. Reducing the Traffic and Speed

Vehicles travelling on unpaved roads stir up dust, reducing the number of vehicles or number of vehicle movements can reduce dust. Traffic can be reduced by restricting vehicle weight or type, ensuring vehicles are utilised with maximum passengers (as opposed to one car per person), or by limiting motor vehicle access to dirt roads.

Fast moving vehicles stir up dust. Studies show that particulate matter 10 micrometres or less in diameter (PM10) goes up with vehicle speed. Reducing speed from 65 kilometres per hour (km/h) to 30 km/h reduces dust emissions by 65%. Speed limit signs and enforcement can reduce speeds. Drainage channels across roads and speed bumps can reduce speeds. Speed bumps and drainage will only reduce dust on roadways, not the surrounds.

A.2.8. Improving Road Design

Good road drainage can reduce dust. If a road surface has poor drainage, puddles will form. Water floats the fine particles. With traffic, water and wind spreads the fines as mud or dust. Standing water next to a road may saturate the roadbed, resulting in potholes. When the fines are washed away, or blown away, the larger particles are left unanchored. These larger particles are pushed to the side of the road, resulting in a need for expensive road resurfacing. If a road is treated with a dust suppressant, the performance of the suppressant depends on the road shedding water and having a smooth driving surface.

A.2.9. Hydromulch

Hydromulch is a very effective measure for preventing dust lift-off from areas where bulk earthworks have been completed and little or no further vehicular or traffic is likely. It is a versatile tool, as the constituents of spray mulch can be varied to suit the requirements of the user and the project. The following processes for hydromulch can be utilised to reduce dust emissions:

- Vehicular and pedestrian access to treated areas should be restricted to prevent disturbance to the hydromulch layer
- Wind barriers placed in isolated locations or where long-term effectiveness is required to control access and achieve maximum benefit
- For short-term stabilisation, hydromulch without grass seed should be sufficient stabilisation.
- For longer-term stabilisation, hydromulch with grass seed and fertiliser should be included in the spray. Organic stabiliser can also be added to the mix to provide a more stable base for the germination of seeds.

Recommended application rates for hydromulch should be sought from suppliers to ensure that application rates and the constituents of the mulch are appropriate to the task.

A.2.10. Chemical Stabilisation

Chemical stabilisers provide immediate coverage and protection; they are effective in areas that receive little traffic or disturbance. They provide a longer-term solution compared to watering, although it may be necessary for the chemical ingredients to be evaluated about their environmental effects.

Chemical stabilisers work by binding the soil particles together to create an artificial crust on the soil surface that is less prone to disturbance by wind. The following options should be considered when using chemical stabilisers to reduce dust emissions:

- Physical barriers or other methods of preventing traffic access should be used to protect stabilised areas
- The manufacturer’s instructions should be followed to optimise performance.

These chemicals fall into several groups, such as petroleum-based, organic nonpetroleum, electrochemical stabilisers, and synthetic polymers.

A.2.11. Covering or Sealing Unpaved Surfaces

Applying gravel to a dirt road surface can reduce dust. Gravel provides a hard surface protecting soils from vehicle wheels. Gravel does not reduce the strength of air currents caused by vehicles themselves, so traffic can still blow loose soil particles into the air. Without a good road base of crushed aggregate, traffic will push surface gravel down into the ground, especially when the road is wet. If the road surface does not have enough fine material to cement the surface gravel in place, traffic will push the gravel away from the driving lanes.

To be effective over a long period of time, new gravel must be anchored to the road surface. This is done through incorporating gravel with aggregate mixes or soil adhesives. If gravel is lost by being pressed into soils beneath the road, then the use of geotextile fabrics may be necessary. These fabrics are constructed of

polymer threads with very high tensile strength and are available in designs that either form water barriers or allow water, but not fine soil, to migrate through.

Paving or bituminising is the most effective (and most expensive) method to control dust from unpaved roads. Asphalt and Portland concrete provide durable and effective surfaces that prevent the breakdown of soil surfaces. Paved roads may still accumulate dust as vehicles enter from unpaved roads.

A.2.12. Wind monitoring

Port Gregory Mine Site

Dust modelling undertaken by GHD (2020) shows the Port Gregory Mine Site is prone to dust lift-off when wind speeds exceed 5.5 m/s (30 to 39 km/hr). Under these conditions, wind erosion will be a high risk for dust emissions (GHD 2020). Wind directions that arcs between 45 and 180 degrees are likely to impact sensitive receptors. The weatherstation is displayed on the SCADA under the FPP and the borefield page. This shall be reviewed before undertaken activities such as clearing or planning for mining activities.

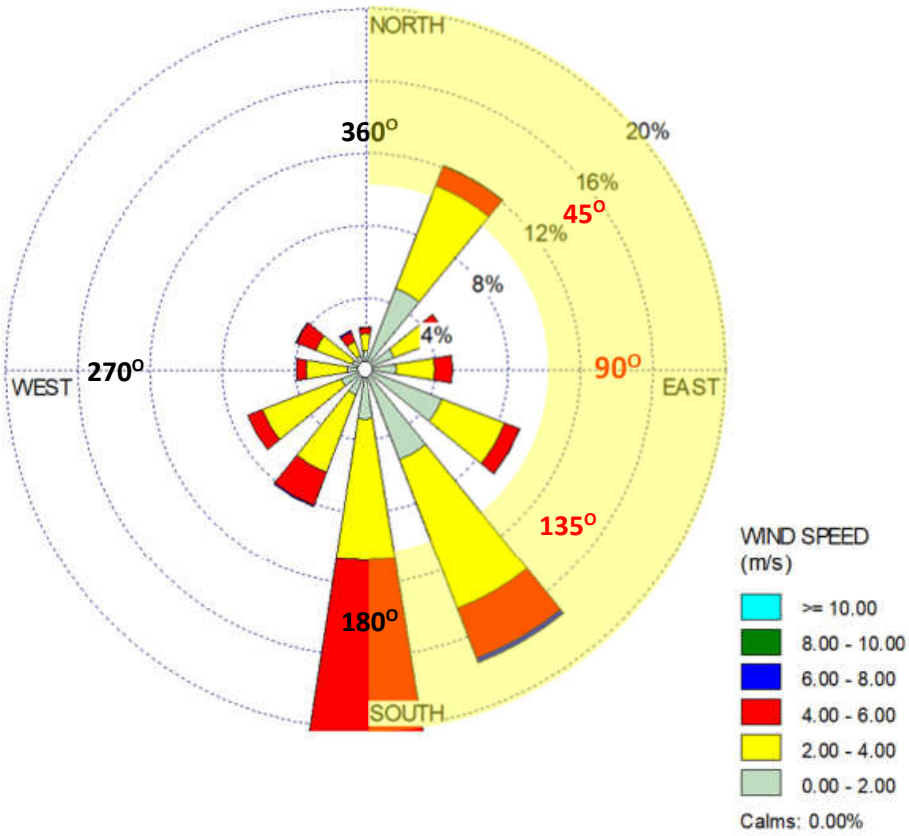


Figure 1 Geraldton Windrose

Geraldton Site

The dust lift-off threshold applicable to the Geraldton Site, are wind speeds greater than 5 to 6 m/s (30 to 39 km/hr). Under these conditions dust is likely to lead to dust breaching the licenced premises boundary.

Appendix B. Procedure Acknowledgement Form

This form shall be completed by personnel who have a responsibility identified in Section 2 Roles and Responsibilities, of this procedure.

I confirm that I have read and am aware of the requirements within this procedure:

PROJECT / FUNCTIONAL AREA	
PROJECT No	

Name	
Signature	
Date	

Return completed form to the Training Department for record keeping.

Appendix D. Fauna Desktop Assessment

Parameters of fauna likelihood of occurrence assessment

Assessment outcome	Description
Present	Species recorded during the field survey or from recent, reliable records from within or close proximity to the application area.
Likely	Species are **likely** to occur in the survey area where there is suitable habitat within the survey area and there are recent records of occurrence of the species in close proximity to the survey area. OR • Species known distribution overlaps with the survey area and there is suitable habitat within the application area.
Unlikely	Species assessed as **unlikely** include those species previously recorded within 10 km of the survey area however: • There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the application area. • The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the application area. OR • Those species that have a known distribution overlapping with the survey area however: • There is limited habitat in the survey area (i.e. the type, quality and quantity of the habitat is generally poor or restricted). The suitable habitat within the application area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the application area.
Highly unlikely	Species that are considered **highly unlikely** to occur in the survey area include: • Those species that have no suitable habitat within the survey area. • Those species that have become locally extinct, or are not known to have ever been present in the region of the application area.

NVCP Supporting Information

GMA Mining Australia

Fauna likelihood of occurrence assessment of conservation significant fauna identified in the desktop assessment as potentially occurring within the study area

Species	Status		Desktop Search			Ecology and habitat
	Federal	State	NM	DBCA Data	PMST	
Calidris ferruginea Curlew Sandpiper	Cr	Cr	X		X	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally, they are recorded around floodwaters (Higgins & Davies 1996). Curlew Sandpipers forage on mudflats and nearby shallow water. They forage at the edges of shallow pools and drains of intertidal mudflats and sandy shores. At high tide, they forage among low sparse emergent vegetation, such as saltmarsh, and sometimes forage in flooded paddocks or inundated saltflats. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh (Higgins & Davies 1996).
Calidris tenuirostris Great Knot	Cr	Cr	X			In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Great Knot rarely occurs on inland lakes and swamps. Typically, the Great Knot roosts in large groups in open areas, often at the waters edge or in shallow water close to feeding grounds (DotEE 2020).
Calyptorhynchus latirostris Carnaby's Cockatoo	En	En	X	X	X	Carnaby's Black-cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain salmon gum, wandoo, marri, jarrah and karri, and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species. Breeding activity is restricted to eucalypt woodlands mainly in the semiarid and subhumid interior, from Kalbarri in the north, Three Springs District south to the Stirling Range, west to Cockleshell Gully and east to Manmanning. The species has expanded its breeding range westward and south into the jarrah-marri forests of the Darling Scarp and into the tuart forests of the Swan Coastal Plain, including the Yanchep area, Lake Clifton and near Bunbury. It nests in trees older than 120-150 years (DotEE 2020).
Leipoa ocellata Malleefowl	Vu	Vu		X	X	The Malleefowl generally occurs in semi-arid areas of WA, in shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine Callitris woodlands, Acacia shrublands, paperbark, skheoak, Broombush *Melaleuca uncinata* vegetation, eucalypt woodlands, or coastal heathlands. Mostly they are found where there is sandy or gravel soil. The nest is a large mound of sand or soil and organic matter (Jones & Goth 2008; Morcombe 2011; Nevill 2013). In WA they are found from the southwest Nullarbor to Albany, north, and then

Species	Status		Desktop Search			Ecology and habitat
	Federal	State	NM	DBCA Data	PMST	
						west from Moore River up to Shark Bay, past Cue, across to Wiluna and east to the northern Victoria Desert south of the Blackstone Ranges (Nevill 2013; Pizzey & Knight 2012).
Pandion cristatus Osprey	Mi	IA	X	X	X	Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish, or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range but may also occur on low sandy, muddy or rocky shores and over coral cays. The distribution of the species around the northern coast (south-western WA to south-eastern NSW) appears continuous except for a possible gap at Eighty Mile Beach (DotEE 2020).
Apus pacificus Fork-tailed Swift	Mi	IA	X	X	X	The Fork-tailed Swift is widespread in coastal and sub-coastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. This species is almost exclusively aerial, flying less than 1 m to at least 300 m above ground. Occupies low to very high airspace over varied habitat, rainforest to semi-desert; most active just ahead of summer storm fronts. They do not breed in Australia (DotEE 2020)

NVCP Supporting Information

GMA Mining Australia

Species	Status		Desktop Search			Ecology and habitat
	Federal	State	NM	DBCA Data	PMST	
Pluvialis fulva Pacific Golden Plover	Mi	IA	X	X	X	In Australia the Pacific Golden Plover usually inhabits coastal habitats, on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as Sarcocornia, or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in saltworks. It is sometimes recorded on islands, sand and coral cays and exposed reefs and rocks. They are less often recorded in terrestrial habitats, but can be seen in habitats with short grass in paddocks, crops or airstrips, or ploughed or recently burnt areas. This species does not breed in Australia (DotEE 2020).
Falco peregrinus Peregrine Falcon		OS	X			The Peregrine Falcon is found on and near cliffs, gorges, timbered watercourses, riverine environments, wetlands, plains, open woodlands, and pylons and spires of buildings, though less frequently in desert regions (Morcombe 2011; Pizzey & Knight 2012). They are not common but can be found almost anywhere throughout WA and in the southwest, including particularly at Fitzgerald River, Stirling Range, Porongurup National Parks, Kondinin, and Peak Charles, with many more locations north of Perth (Nevill 2013).
Reptiles						
Egernia stokesii badia Western Spiny-tailed Skink	En	Vu			X	*Egernia stokesii badia* occurs in open eucalypt woodlands and Acacia-dominated shrublands in semi-arid to arid areas of south-western WA (Geraldton Sandplains and Yalgoo IBRA) and, depending on taxonomic clarification, around Shark Bay including Peron Penisula, Edel Land and Dirk Hartog Island (Geraldton Sandplain and Carnarvon IBRA). It tends to shelter in logs, in cavities in the trunks and branches of shrubs, as well as in houses and ruins, especially in accumulations of old corrugated iron (DEC 2012b).