Ravensthorpe Gold Project

Flora and Vegetation Management Plan

June 2019

Project Number: TE19017

DOCUMENT CONTROL

Version	Description	Date	Author	Reviewer
0	Draft for DWER	November 2018	APM	APM
0a	Internal Review	07/06/19	SS	GB
1a	Released to Client and DWER	07/06/19	SS	GB

Signature
 for P. Bennett, ACH Minerals Pty Ltd

Summary

Title of Proposal	Ravensthorpe Gold Project
Proponent Name	ACH Minerals Pty Ltd (ACH)
Ministerial Statement No.	Not applicable
Purpose of EMP	Requirement of Environmental Scoping Document (Item 10)
Key environmental factor	Flora and vegetation
Condition clause(s)	Not applicable
Key provisions (targets)	• Develop and implement a Ground Disturbance Permit (GDP) system prior to the commencement of construction (No clearing of PECs and Priority flora outside disturbance footprint) • Develop and implement a management plan for bridal creeper (*Asparagus asparagoides*) involving spraying of herbicide and scalping of heavily infested soils (Material reduction in the extent of bridal creeper within the Project Area) • Implement dust suppression measures during construction and operation, including fencing at key locations (Minimise impacts to vegetation health outside of approved disturbance) Note that dieback management is covered in a separate management plan.

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1 Context, Scope and Rationale

1.1 Proposal

ACH Minerals Pty Ltd (ACH) proposes to develop the Ravensthorpe Gold Project (the Project), located within the Fitzgerald subregion of the Esperance bioregion, as defined by the Interim Biogeographic Regionalisation for Australia. The Project is situated approximately 550 kilometres (km) southeast of Perth, and 17 km southeast of the town of Ravensthorpe, as shown in **Figure 1-1.**

The Project has an expected life of mine (LOM) of approximately 8 years and will comprise:

- Open pit and underground mining;
- Storage of waste rock in two permanent landforms;
- Processing of ore and storage of tailings in a permanent landform;
- Mine dewatering; and
- Supporting infrastructure.

The project footprint will be 244.7 ha which includes 49.3 ha of historical mining disturbance and additional native vegetation clearing of 195.4 ha (all within a Development Envelope of 428.4 ha).

The Project expects to produce almost 0.5 million ounces of gold, 0.4 million ounces of silver and over 11,300 tonnes (t) of copper.

The Project area contains both high quality native vegetation and historic mining legacies. Upon completion of the Project, it is proposed that the disturbed area, including the historic legacies, will be rehabilitated to native vegetation (apart from the pits, which will remain as voids).

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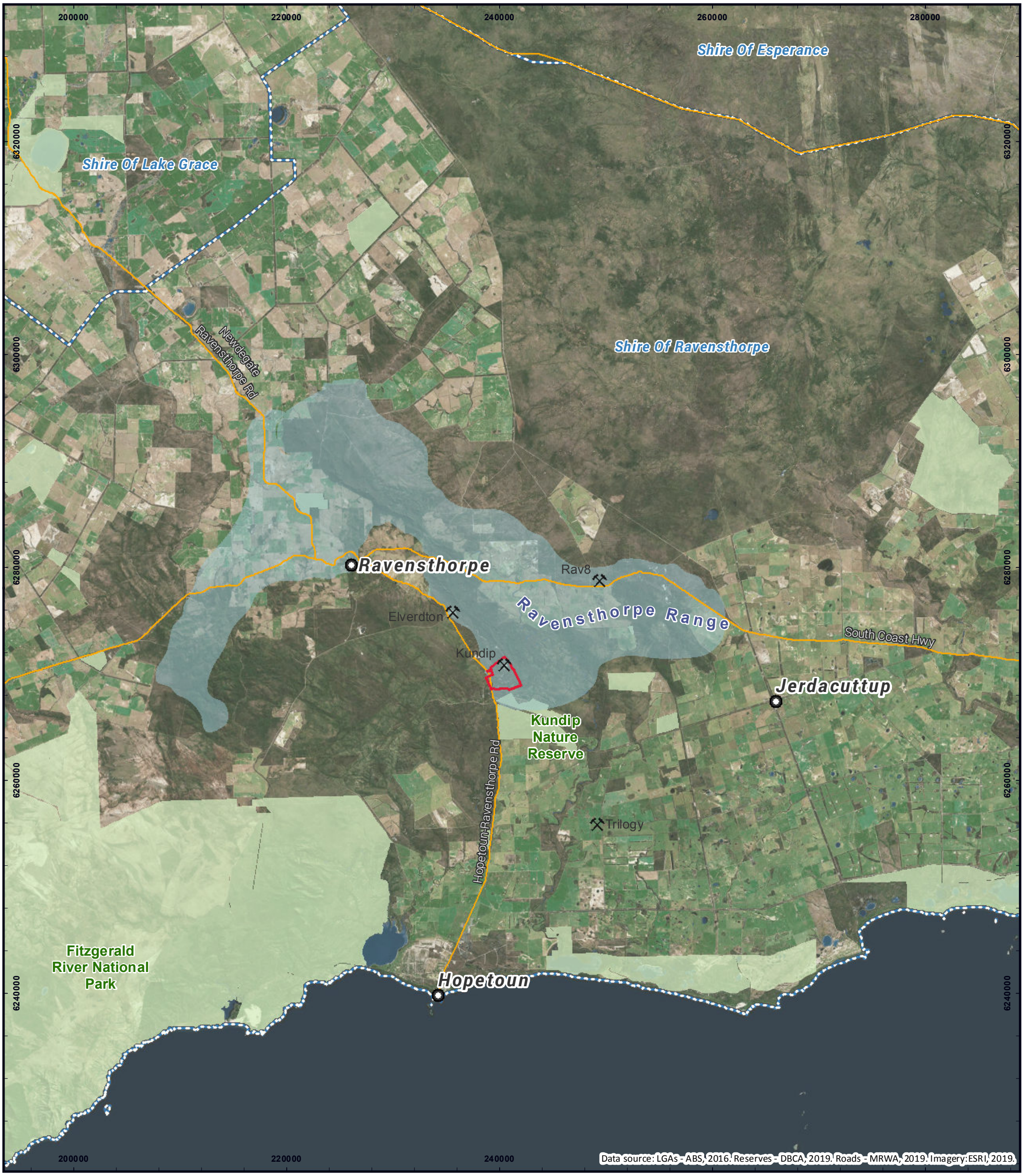


Ravensthorpe Gold Project Area

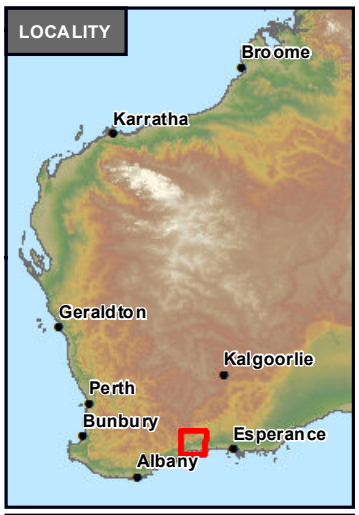
Local Government Area Boundary

Mine Site

DBCA Managed Lands

Townsite

Major Road



REGIONAL LOCATION

Ravensthorpe Gold Project ERD

ACH Minerals Pty Ltd

N

0 5 10 15 20 Km

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:350,000

Prepared:	F Walker
Reviewed:	G Barrett
Checked:	A Mack
Project No:	TE19017
Revision:	A
Date:	24/05/2019

Figure 1-1

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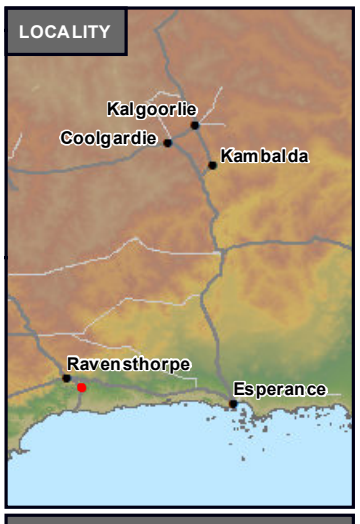
- Ravensthorpe Gold Project Area
- RGP Development Envelope

RGP Mine Activities

- Offices
- Site Support
- Magazine
- Mine Pit (Kaolin)
- Mine Pit (Harbour View)
- Mine Pit (Flag East)
- Mine Pit (Flag West)
- Waste Rock Landform (North)
- Waste Rock Landform (South)
- Topsoil Stockpile
- Fire Break
- Processing Plant Area
- Run-of-Mine
- Tailings Storage Facility
- Roads
- Water Storage Facility
- Water Transfer Facility



MINING ACT TENURE, DEVELOPMENT ENVELOPE AND DISTURBANCE FOOTPRINT

Ravensthorpe Gold Project ERD
ACH Minerals Pty Ltd

N
0 150 300 450 600 metres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:12,000

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Figure 1-2

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1.2 Key Environmental Factors

The environmental factor potentially impacted by the Project and the possible direct and indirect impacts of this factor, are listed in **Table 1-1**.

Table 1-1: Ravensthorpe Gold Project - environmental factor and potential impacts

Environmental Factor	Potential Impacts
Flora and Vegetation	The Project will directly impact flora and vegetation through clearing of land to establish the mine and infrastructure. Potential direct impacts will include: • Loss of native vegetation cover; • Decrease of populations of conservation significant flora; and • Decrease of extent of vegetation types of conservation significance. Potential indirect impacts to flora and vegetation resulting from the Project are outlined below: • Spread of existing weed infestations or introduction of new weed species; • Death of native vegetation due to infestation and spread of *Phytophthora cinnamomi* (dieback); • Increase of dust loads on vegetation arising from construction and mining activities, including vehicle movements and blasting; • Changes in the groundwater regime supporting groundwater-dependent vegetation; • Fragmentation of vegetation resulting in changes in microclimate; • Alteration of surface water flows; and • Altered fire regimes resulting in loss or reduced health and condition of native vegetation.

This Flora and Vegetation Management Plan (**FVMP**) does not cover potential impacts due to the infestation and spread of *Phytophthora cinnamomi* (dieback). This aspect has been addressed in the Ravensthorpe Gold Project - Dieback Management Plan.

1.3 Condition Requirement

This FVMP is a requirement of an Environmental Scoping Document and has been produced for the purpose of impact assessment. It has not been prepared to meet the requirements of any Ministerial Statement condition requirements.

1.4 Rationale and Approach

1.4.1 Survey and study findings

1.4.1.1 Survey effort

Considerable survey work has been conducted within the Project Area and across the Ravensthorpe Range over the past two decades.

Key past local and regional flora and vegetation studies are summarised in **Table 1-2** with locations of survey points or survey extent within the Project Area shown in **Figure 1-3**. The results of these studies have been used to inform the approach to site-specific surveys for the current proposal and to inform the current assessment.

Table 1-2: Key existing flora surveys and vegetation surveys – RGP and Ravensthorpe Range

Report Title	Report Author	Year	Survey	Scale
Kundip Mining Leases M74/41, 51, 53, & 135 and P74/153 – Vegetation and Flora Survey	G.F. Craig	2004	Declared Rare, Priority Flora and Vegetation Mapping Survey	Local
Kundip Mining Leases – *Pultenaea* and *Melaleuca*	G.F. Craig	2004 b	Targeted Declared Rare Flora Survey	Local
Kundip Haul Road – Declared Rare and Priority Flora Survey	G.F. Craig	2004 a	Declared Rare and Priority Flora Survey	Local
Kundip Mining Leases – Waste Dumps and Haul Road – Declared Rare and Priority Flora Surveys	G.F. Craig	2005	Declared Rare and Priority Flora Survey	Local
Kundip Mining Leases Monitoring Quadrat Survey	E. Hickman	2007	Vegetation Mapping Survey	Local
Vegetation of the Ravensthorpe Range: Mt Short to South Coast Highway	Craig *et al*.	2007	Vegetation Mapping Survey	Regional
Vegetation of the Ravensthorpe Range, Western Australia: Mt Short to Kundip, 1: 10,000 scale	Craig *et al*.	2008	Vegetation Mapping Survey	Regional
Floristic Survey of the Ravensthorpe Range 2007	Kern *et al*.	2008	Vegetation Mapping Survey	Regional
Kundip Mining Leases Additional Monitoring Quadrat Survey	E. Hickman	2009	Declared Rare and Priority Flora Survey	Local
Targeted and Regional Survey for *Melaleuca* sp. Kundip and *Melaleuca stramentosa*	N. McQuoid	2009	Targeted Priority Flora Survey	Regional
Floristic communities of the Ravensthorpe Range, Western Australia	Markey *et al*.	2012	Vegetation Mapping Survey	Regional

The Project Area has been well surveyed previously. A 2004 survey by Craig covered the Project Area and included vegetation mapping. Subsequent surveys by Craig (2004a and 2005) covered parts of the Project Area and targeted particular species of conservation significance. Hickman (2009) subsequently established 34 quadrats within the Project Area.

A regional survey covering the Ravensthorpe Range (Craig et al, 2008) included establishment of 200 quadrats across the Ravensthorpe Range, including several within the Project Area. Subsequent surveys (Markey et al 2012) added a further 66 quadrats across the Ravensthorpe Range.

As part of the current proposal, ACH commissioned a further round of survey work within the Project Area which was undertaken by APM Pty Ltd (**APM**). APM's work is summarised in **Table 1-3**.

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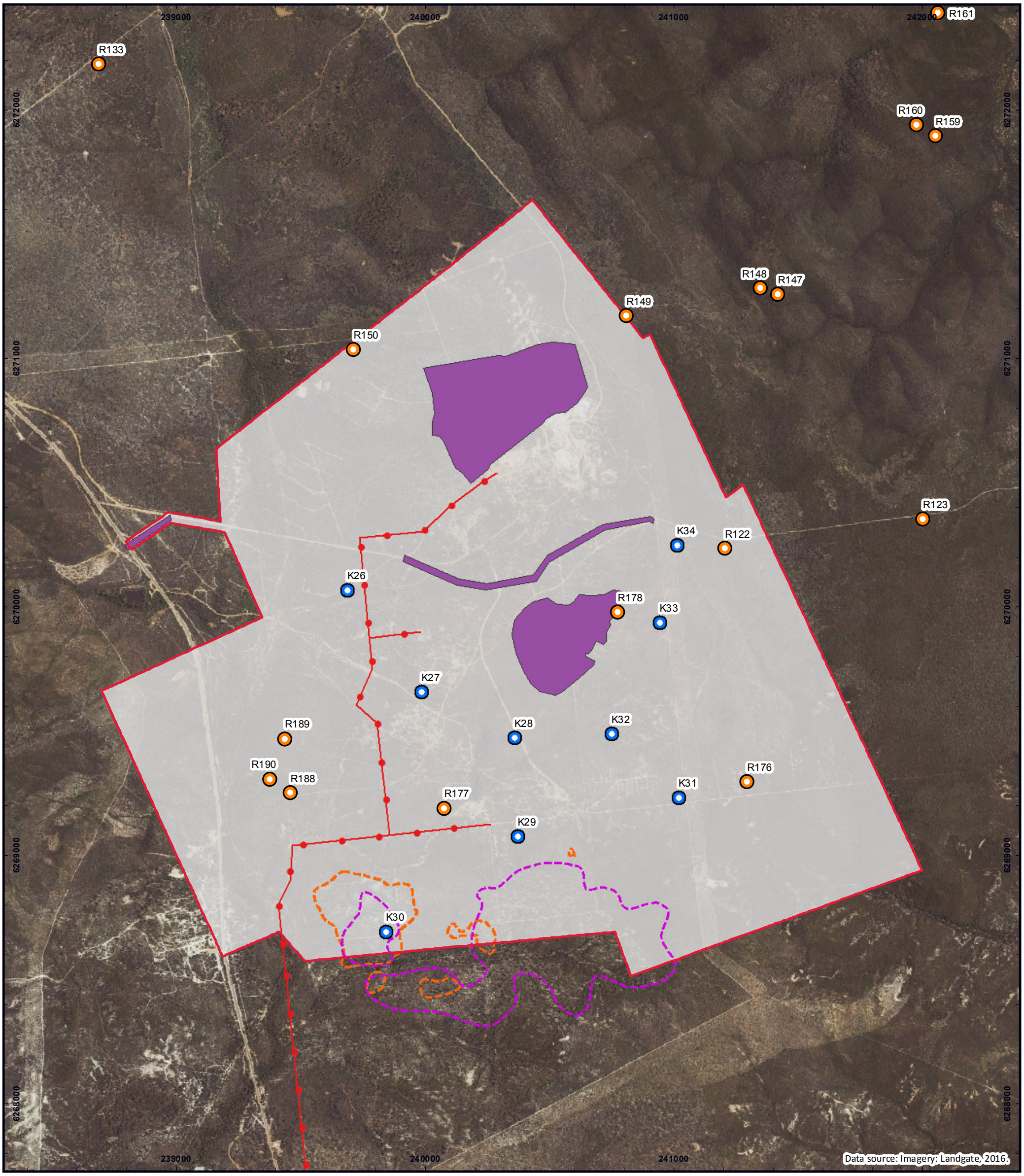

Ravensthorpe Gold Project Area

Vegetation and Flora Survey (Craig, 2004)

Survey Area

Targeted survey for Melaleuca sophisma and Pultenaea craigiana (Craig, 2004)

Pultenaea craigiana population

Melaleuca sophisma population

Targeted survey for DRF and Priority flora – waste dumps and haul road (Craig, 2005)

Survey Area

Floristic Survey of the Ravensthorpe Range (Kern, 2007)

Quadrat Location

Targeted survey for DRF and Priority flora – haul road (Hickman, 2007 and 2008)

Traverse

Kundip Mining Leases Additional Monitoring Quadrat Survey (Hickman, 2009)

Quadrat Location

PAST FLORA AND VEGETATION SURVEYS

Ravensthorpe Gold Project ERD

ACH Minerals Pty Ltd

N

0 200 400 600 800 metres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:15,000

Prepared:	F Walker
Reviewed:	G Barrett
Checked:	A Mack
Project No:	TE19017
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Figure 1 - 3

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Table 1-3: Flora and vegetation survey work undertaken for the current proposal

Date	Survey activities
August 2016	Ground-truth existing vegetation mapping (Craig 2004a), quantify the extent of historic and recent disturbances, commence a targeted flora survey for conservation significant flora species most likely to occur in habitats within the Project Area (including quadrat establishment and assessment) and opportunistic flora sampling.
May and October 2017	Targeted surveys used to gather comprehensive information on conservation significant flora and vegetation within the Project Area. Detailed surveys used to collect sufficient information to update the general flora and vegetation attributes of the Project Area and to accurately assess the value of flora and vegetation in both a local and regional context.
August 2018	Survey for *Hydrocotyle tuberculata* [1] and proteaceous and myrtaceous species within disturbed low-grade stockpiles at Kundip and at other locations outside of the Project Area.

APM's assessment used 67 quadrats within the Project Area and a further 28 quadrats outside the Project Area. The locations of the APM quadrats are shown in **Figure 1-4**. APM's full report is included here as **Appendix A**.

In WA, species of conservation significance are categorized. Species may be listed as Threatened or included on a non-statutory list pending possible future listing (**Table 1-4**) for a summary of the various categories).

Table 1-4: Conservation significant flora and vegetation – threat ranking

Ranking	Description
Threatened flora and ecological communities	Listed under the *Biodiversity Conservation Act 2016* (**BC Act**) as warranting special protection. Level of threat is ranked as critically endangered (CE), endangered (EN) or vulnerable (VU).
Priority flora and ecological communities	A non-statutory list maintained by the Department of Biodiversity Conservation and Attractions (**DBCA**). Priority species are considered to be of conservation significance – that is they may be rare or threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority flora list are assigned to one of four Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

[1] Formerly *Hydrocotyle* sp. Decipiens.

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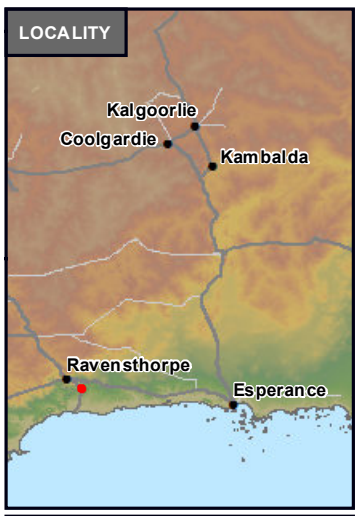
Data source: Tenements - DMIRS, 2019. Imagery: Landgate, 2016.

Ravensthorpe Gold Project Area

Quadrat (APM, 2018)

Quadrat (Hickman, 2007)

Quadrat (Hickman, 2009)



FLORA AND VEGETATION SURVEY QUADRATS

Ravensthorpe Gold Project ERD

ACH Minerals Pty Ltd

N

0 150 300 450 600 metres

Coordinate System: GDA 1994 MGA Zone 51,
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:12,000

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Revision:	A
Date:	24/05/2019

Figure 1-4

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1.4.1.2 Flora

Database searches and surveys returned a total of 312 species from 50 families within the Project Area. The families most represented were Myrtaceae (65) and Fabaceae (50) with the Proteaceae, Cyperaceae and Ericaceae families also featuring prominently.

The database searches identified five species listed as Threatened (T) under the BC Act. None of these taxa are known to occur in the Project Area although one – Acacia *rhamphophylla* – is known from the Kundip area (Markey et al 2009). No other taxa listed as threatened were recorded in surveys of the Project Area. *Acacia rhamphophylla* is also listed as Endangered under the EPBC Act. Based on the available data, the assessment concludes the five threatened species identified in the database searches are absent from the Project Area.

Database searches also identified a number of Priority-listed species within the Project Area and across the nearby Ravensthorpe Range. Priority species recorded in the database searches and the APM surveys within the Project Area are shown in **Figure 1-5** and **Table 1-5**.

Surveys recorded 17 weed species, the most serious and widespread of which is bridal creeper (*Asparagus asparagoides*), which is classified as a Weed of National Significance (**WONS**). Weed populations generally tended to be centred on areas of past disturbance (**Figure 1-6**), both inside and outside of the Development Envelope.

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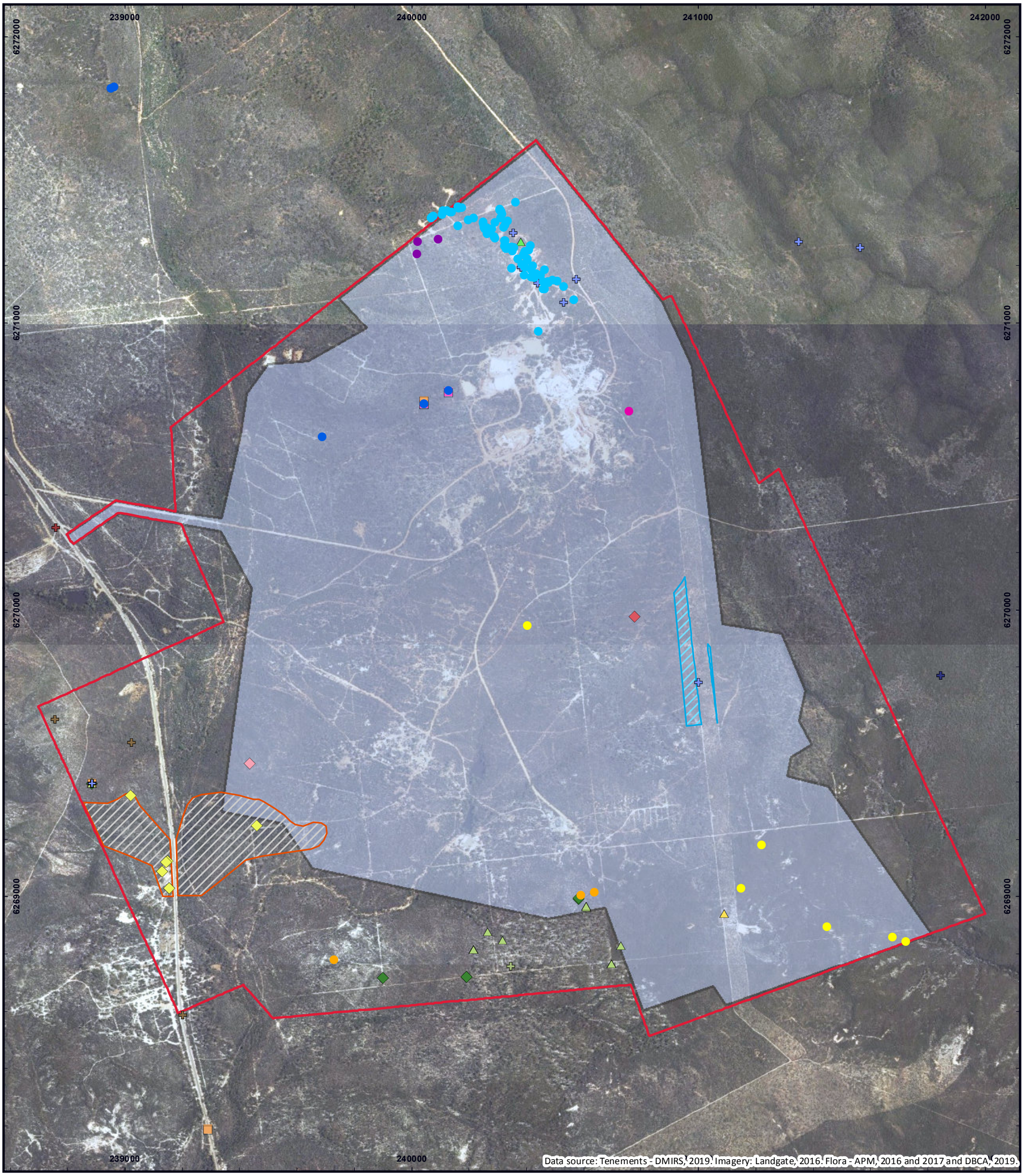


Calothamnus roseus (P1)
Hibbertia hamata (P3)
Hydrocotyle sp. Decipiens (G.J. Keighery 463) (P2)
Marianthus mollis (P4)
Melaleuca sophisma (P1)
Pultenaea craigiana (P3)
Stachystemon vinosus (P4)
Thysanotus parviflorus (P4)
Marianthus mollis population polygon
Calothamnus roseus population polygon

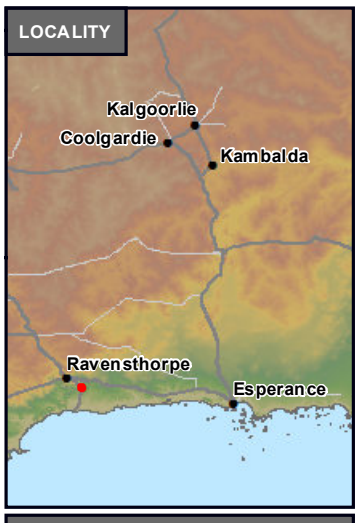
DBCA Records of Priority Flora

P1
- Acacia sp. Ravensthorpe Range (B.R. Maslin 5463)
- Calothamnus roseus
- Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)
- Lepidosperma sp. Mt Short (S. Kern et al. LCH 17510)
- Melaleuca sophisma

P2
- Hydrocotyle tuberculata

P3
- Thomasia sp. Hopetoun (K.R. Newbey 4896)
- Dampiera sp. Ravensthorpe (G.F. Craig 8277)
- Grevillea fulgens
- Pultenaea craigiana

P4
- Acacia argutifolia
- Eucalyptus desmondensis
- Eucalyptus stoatei
- Marianthus mollis
- Pultenaea calycina subsp. proxena
- Thysanotus parviflorus



CONSERVATION SIGNIFICANT FLORA

Ravensthorpe Gold Project ERD
ACH Minerals Pty Ltd

N
0 175 350 525 700 metres
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:13,000

Prepared:	F Walker
Reviewed:	G Barrett
Checked:	A Mack
Project No:	TE19017
Revision:	A
Date:	29/05/2019

Figure 1-5

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Table 1-5: Priority species recorded within the Project Area

Species	Priority listing	Database records	Field survey
Acacia sp. Ravensthorpe Range (B.R. Maslin 5463)	1	✓	
Calothamnus roseus	1	✓	✓
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	1	✓	
Lepidosperma sp. Mt Short (S. Kern et al. LCH 17510)	1	✓	
Melaleuca sophisma	1	✓	✓
Hydrocotyle tuberculata	2	✓	✓
Thomasia sp. Hopetoun (K.R. Newbey 4896)	2	✓	
Dampiera sp. Ravensthorpe (G.F. Craig 8277)	3	✓	
Grevillea fulgens	3	✓	
Pultenaea craigiana	3	✓	✓
Acacia argutifolia	4	✓	
Eucalyptus desmondensis	4	✓	
Eucalyptus stoatei	4	✓	
Marianthus mollis	4	✓	✓
Pultenaea calycina subsp. *proxena*	4	✓	
Stachystemon vinosus	4		✓
Thysanotus parviflorus	4		✓

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M74/63
M74/53
M74/180
M74/41
M74/135
L74/34
M74/51
L74/45
239000
240000
241000
242000
6272000
6271000
6270000
6269000
Data source: Tenements - DMIRS, 2019. Imagery: Landgate, 2016.

Ravensthorpe Gold Project Area
RGP Development Envelope
Areas of Weed Infestation

LOCALITY
Kalgoorlie
Coolgardie
Kambalda
Ravensthorpe
Esperance
0 90 180 270 360 km

AREAS OF WEED INFESTATION
Ravensthorpe Gold Project ERD
ACH Minerals Pty Ltd

N
0 150 300 450 600 metres
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:13,000

Prepared:	F Walker
Reviewed:	G Barrett
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Project No:	TE19017
Revision:	A
Date:	24/05/2019

Figure 1-6

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1.4.1.3 Vegetation and threatened and priority ecological communities

Vegetation

Beard et al (2013) mapped the original natural vegetation presumed to have existed prior to European settlement in Western Australia. **Figure 1-7** shows the vegetation occurring in and around the Project Area. The western and central parts of the Project Area is vegetated with a mallee: eucalypt shrubland that covers 6.3 million ha across the State. A section of the eastern part of the Project Area is mapped as mallee-heath and occurs along the southern portion of the Ravensthorpe Range. This vegetation type covers 1.5 million ha across the State.

At regional and local levels, Craig (2004a) mapped the Project Area (600 ha), whilst Craig *et al.* (2008) mapped two portions of the Ravensthorpe Range, one between Mt Short and Carlingup Road (5,300 ha), and one between Carlingup Road and South Coast Highway (600 ha). In addition, the vegetation from South Coast Highway to near Kundip (3,700 ha) was mapped as an extension of those two portions. Overall, Craig (2004a) and Craig *et al.* (2008) mapped approximately 10,200 ha of vegetation in the Ravensthorpe Range.

Subsequently, Markey et al (2012) also undertook a detailed study across the Ravensthorpe Range with the aim of producing "a classification of the vegetation communities on the Ravensthorpe Range based on floristic composition, in order to allow the regional context of proposed developments to be determined in a consistent and repeatable manner." They described 21 communities which showed broad agreement with the detailed mapping undertaken by Craig *et al.* (2008), except for one widespread upland unit that was floristically heterogeneous. As Markey et al. (2012) did not produce an available map of their updated vegetation descriptions, the Craig et al. (2008) mapping has been presented and discussed here (**Table 1-6**; **Figure 1-8**). A total of 25 vegetation communities fall within the Project Area.

APM mapped vegetation condition across the Project Area. The mapped categories are summarised in **Table 1-7**. Most of the Project Area contains vegetation that is in very good or better condition. Where identified, degraded vegetation is usually as a result of historical mining activity.

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235000 240000 245000

6275000 6270000 6265000

Data source: Imagery: Landgate, 2016. Pre-European Vegetation - Beard, J. S. et al, 2013.

Ravensthorpe Gold Project Area

RGP Development Envelope

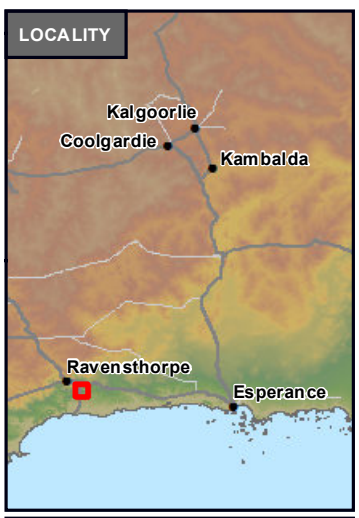
Pre-European Vegetation (Beard et al 2013)

16 Mallee: eucalypt shrubland (Eucalyptus eremophila, E. redunca, E. spp.)

17 Mallee-heath: mixed heath with scattered mallee e.g. tallerack (Eucalyptus pleurocarpa)

14 Thicket: wattle, casuarina and teatree (Acacia–Allocasuarina–Melaleuca alliance)

4 Woodland: Wheatbelt—York gum (Eucalyptus loxophleba), salmon gum (E. salmonophloia), etc



PRE-EUROPEAN VEGETATION

Ravensthorpe Gold Project ERD

ACH Minerals Pty Ltd

N

0 750 1,500 2,250 3,000 metres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:50,000

Prepared:	F Walker
Reviewed:	G Barrett
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Project No:	TE19017
Revision:	A
Date:	24/05/2019

Figure 1 - 7

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Table 1-6: Vegetation mapping (Craig et al 2008) – extent of vegetation types in Project Area

Craig Vegetation Community Code	Formal Community name	Total in the Project Area (ha)
Dcir	*Banksia cirsioides*: Proteaceous Mallee-heaths	1.8
East	*Eucalyptus astringens*: Mallet dominated system	21.3
Ecli	*Eucalyptus clivicola*: Mallet dominated system	11.9
Efal	*Eucalyptus falcata*: Proteaceous Mallee-heath	1.8
Efal/ Eple	*Eucalyptus falcata/ E. pleurocarpa*: Proteaceous Mallee-heath	151.5
Eflo/ Espp	*Eucalyptus flocktoniae/Eucalyptus* species	57.2
Eflo/ Esug	*Eucalyptus flocktoniae/ Eucalyptus phenax*	5.1
Eflo/ Mbra	*Eucalyptus flocktoniae/ Melaleuca bracteosa: Melaleuca* dominated	13.6
Eflo/ Mcuc	*Eucalyptus flocktoniae/ Melaleuca cucullata: Melaleuca* dominated	25.9
Eflo/ Mgor	*Eucalyptus flocktoniae/ Melaleuca* sp. Gorse (ASG 7224): *Melaleuca* dominated	15.4
Elep/ Mrig	*Eucalyptus leptocalyx/ Melaleuca rigidifolia*	9.7
Eocc	*Eucalyptus occidentalis*	48.6
Eole/ Mpau	*Eucalyptus oleosa* subsp. *corvina/ Melaleuca pauperiflora*	1.6
Epil	*Eucalyptus pileata*	0.3
Epla	*Eucalyptus platypus*	3.6
Epla/ Mcuc	*Eucalyptus platypus/ Melaleuca cucullata*	0.0
Epla/ Mhap	*Eucalyptus platypus/ Melaleuca haplantha*	4.8
Eple/ Bmed	*Eucalyptus pleurocarpa/ Banksia media*	32.1
Epro/ Mspp	*Eucalyptus proxima/ Melaleuca* species	13.7
Espo	*Eucalyptus sporadica*	9.3
Macu	*Melaleuca acuminata*	0.7
Mallee/ Mspp	*Eucalyptus species/ Melaleuca species*	55.4
Mosaic_Ecer_and_Ecli	*Eucalyptus cernua/ Eucalyptus clivicola*	44.0
Mstr	*Melaleuca stramentosa*	62.5
Mx	*Melaleuca* sp. Kundip	11.0
	Disturbed	14.2
	Total	**617.2**

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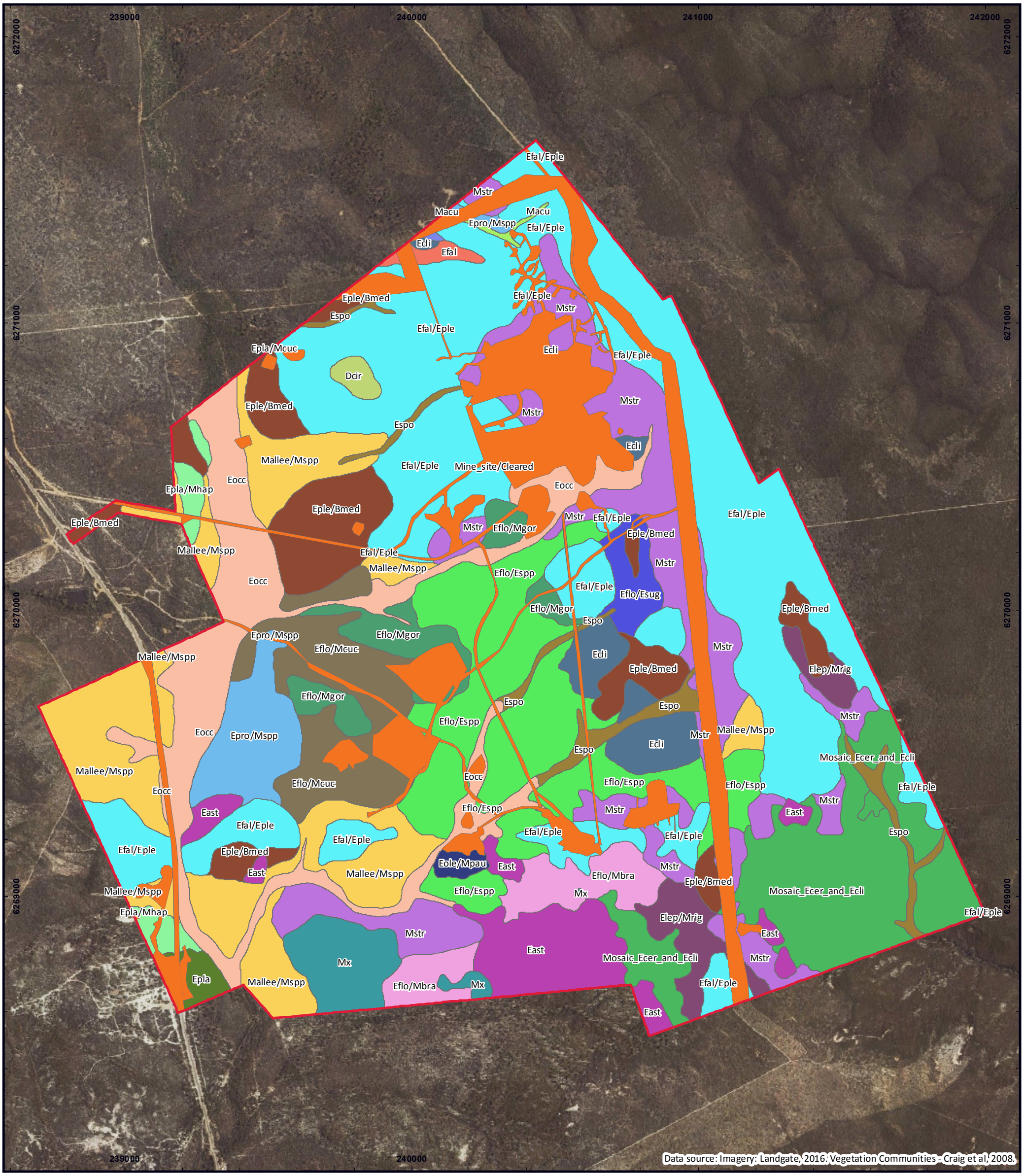
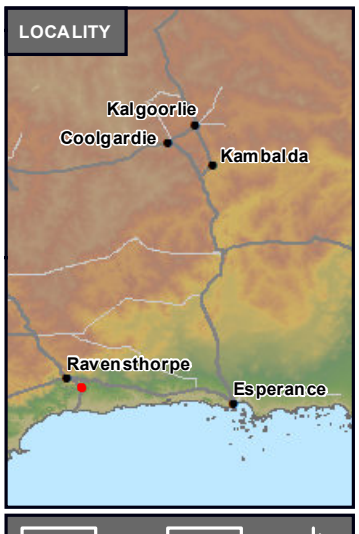


Ravensthorpe Gold Project Area

Vegetation Community

- Dcir
- East
- Ecli
- Efal
- Efal/Eple
- Eflo/Espp
- Eflo/Esug
- Eflo/Mbra
- Eflo/Mcuc
- Eflo/Mgor
- Elep/Mrig
- Eocc
- Eole/Mpau
- Epil
- Epla
- Epla/Mcuc
- Epla/Mhap
- Eple/Bmed
- Epro/Mspp
- Espo
- Macu
- Mallee/Mspp
- Mosaic/Ecer/Ecli
- Mstr
- Mx
- Completely Degraded



VEGETATION COMMUNITIES OF THE RGP AREA, CRAIG ET AL. (2008)

Ravensthorpe Gold Project ERD

ACH Minerals Pty Ltd

N

0 150 300 450 600 metres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:13,000

Prepared:	F Walker
Reviewed:	G Barrett
Checked:	A Mack
Project No:	TE19017
Revision:	A
Date:	30/05/2019

Figure 1-8

ACHMINERALS

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Table 1-7: Vegetation condition mapping (APM) – summary of the Project Area

Vegetation Condition	Comment	Total in the Project Area (ha)
Completely degraded	Primarily comprises access roads and old mine workings.	71.0
Good to degraded	Includes recent exploration works undertaken in a manner that allows regeneration.	3.7
Very good to excellent	Intact or more or less intact, with some areas pristine or approaching pristine.	542.5
	Total	**617.2**

A review of fire scar mapping (spanning back to 2007) was undertaken. The Project Area appears largely uninfluenced by fire although evidence of fires along the eastern and southern boundaries was apparent from 2007 and 2008.

Threatened and priority ecological communities

Database searches identified three Priority Ecological Communities (**PECs**) as potentially occurring in the Project Area:

- Very open Mallee over *Melaleuca sophisma*[2] dense heath (P1);
- Heath on Komatiite of the Ravensthorpe area (P3); and
- Proteaceae dominated Kwongkan shrublands of the Southeast Coastal Floristic Province of WA (P3).

Two PECs were known to occur within the Project Area while one - Heath on Komatiite of the Ravensthorpe area (P3) – was known to occur within 5 km of the Project Area. APM undertook a targeted search for the latter PEC. Key components of the PEC were not located and the 'komatiite' geology type does not occur within the Project Area. On this basis, the survey concludes the Heath on Komatiite of the Ravensthorpe area (P3) PEC does not occur in the Project Area.

Database searches also identified two Threatened Ecological Communities (**TECs**) listed under the EPBC Act as potentially occurring in the Project Area. These were:

- Proteaceae dominated Kwongkan shrublands of the Southeast Coastal Floristic Province of WA; and
- *Banksia laevigata – Banksia lemanniana* proteaceous thicket.

[2] Formerly known as *Melaleuca* sp. Kundip.

The former is analogous with the P3 PEC listed under the BC Act. The *Banksia laevigata – Banksia lemanniana* proteaceous thicket is known from small areas near the northern end of the Ravensthorpe Range. *Banksia laevigata* is not known from the Project Area – on this basis this TEC is very unlikely to occur within the Project Area.

APM reviewed the available vegetation mapping and used it to refine the distribution of PECs within the Project Area. Their mapping of Very open Mallee over *Melaleuca* sp. Kundip dense heath (P1) more or less aligned with boundaries identified in the database search. Distribution of the remaining PEC - Proteaceae dominated Kwongkan shrublands of the Southeast Coastal Floristic Province of WA (P3) – varied significantly as surveys identified that the dominant strata within many of the vegetation types are in fact not entirely Proteaceous (one of the primary factors which identifies the TEC/PEC), but instead are actually co-dominating myrtaceous, ericoid, restoid and proteoid taxa at low strata levels. To be considered and listed as the Kwongkan TEC/ PEC, there must be a projected cover value of Proteaceous species > 30% across all layers where the shrubland occurs (Department of the Environment, 2014). APM's mapping of PECs is shown in **Figure 1-9**.

1.4.2 Key assumptions and uncertainties

The following key assumptions underlie this plan:

- Surveys have adequately characterised the Project Area.
- The Project Area contains no Threatened flora.
- The Project Area contains 17 Priority-listed flora, three of which only occur outside the Development Envelope and will not be impacted by the Project.
- No species is restricted to the Project Area.
- The Project Area contains two PECs - Very open Mallee over *Melaleuca sophisma* dense heath PEC (P1) and Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of WA (P3).
- Distribution of individual plant species and vegetation types within the Project Area is well understood.
- Only one weed species – bridal creeper – poses a significant environmental risk. While other introduced species occur, none is a serious environmental weed. Most of the weed infestations mapped occur outside the Development Envelope.
- Minor changes to the Proposed Disturbance Footprint are possible to avoid or reduce impacts on particular values.

Uncertainties in regard to flora and vegetation are:

- Some taxonomic uncertainty for some collections of *Lepidosperma*.
- Plant numbers within the Project Area is not known with certainty for some species of Priority flora.
- Soil seed banks and the extent to which topsoil management will be effective in re-establishing Priority flora after mining is complete.
- Extent to which dieback is currently prevalent within the Project Area.
- Likely responses of individual species to an increase in foliar dust load.

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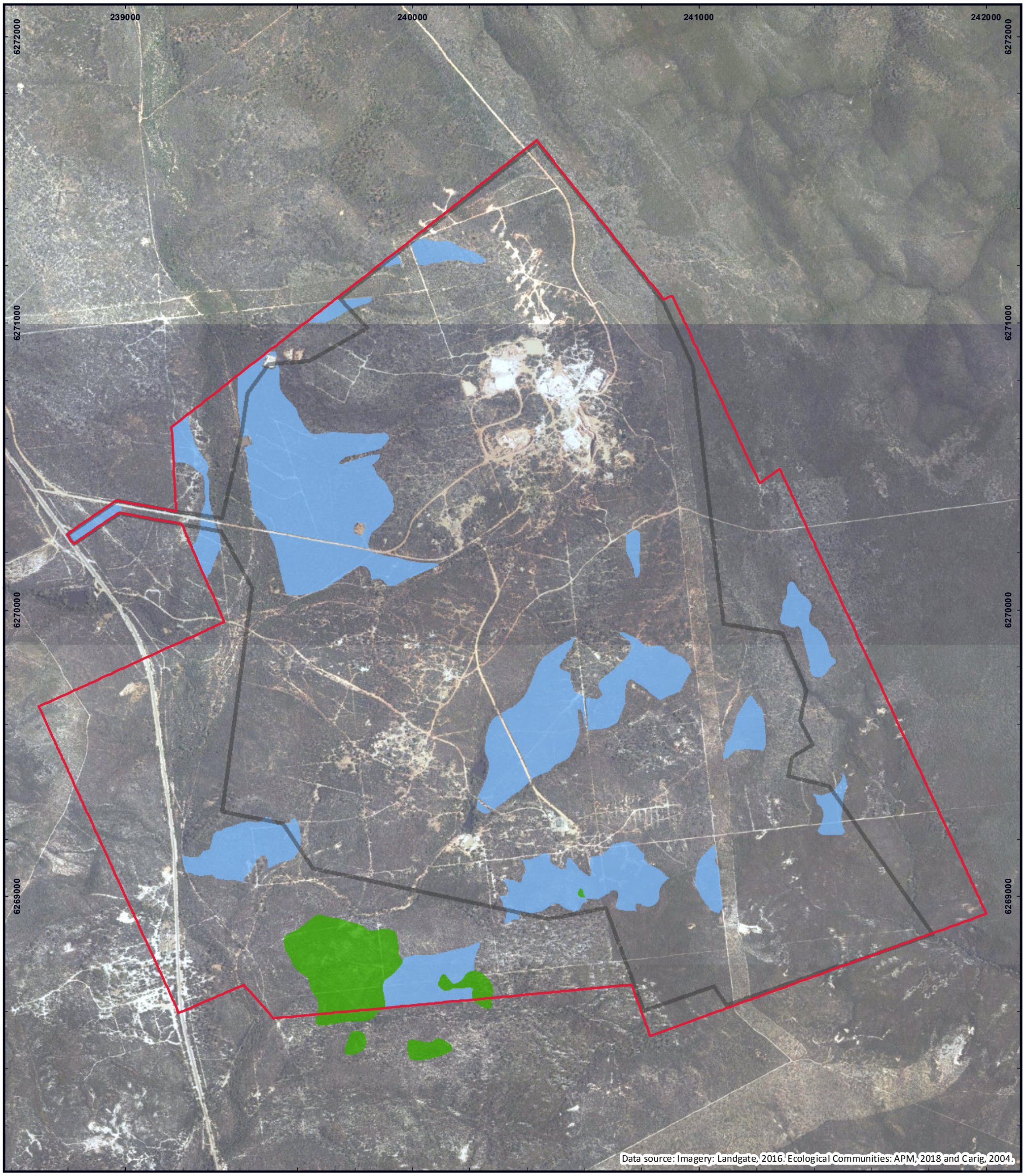
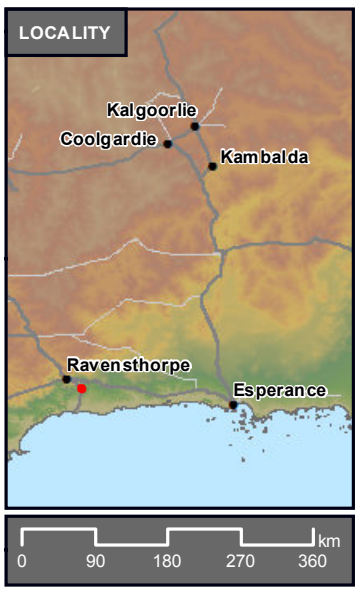


Ravensthorpe Gold Project Area

Development Envelope

Melaleuca sophisma dense heath (P1) (Craig, 2004)

Kwongkan Shrublands (P3) (APM, 2018)



PRIORITY ECOLOGICAL COMMUNITIES (BASED ON VEGETATION MAPPING)

Ravensthorpe Gold Project ERD

ACH Minerals Pty Ltd

N

0 150 300 450 600 metres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:13,000

Prepared:	F Walker
Reviewed:	G Barrett
Checked:	A Mack
Project No:	TE19017
Revision:	A
Date:	30/05/2019

Figure 1-9

ACHMINERALS

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1.4.3 Management approach

The management provisions set out in this document are based and developed around the mitigation hierarchy of avoid, minimise and rehabilitate to ensure impacts to flora and vegetation have been avoided or reduced to as low as reasonably practicable.

Potential impacts have been identified based on extensive experience in relation to mine site management. Many of the management provisions are commonly used in mine sites across Western Australia. Other provisions are tailored for the particular circumstances that occur at RGP.

1.4.4 Rationale of choice of provisions

Land clearing to establish the mine will unavoidably result in losses of some Priority flora and good quality vegetation. ACH has considered an approach whereby this impact is minimised through:

- 'Tweaking' of the disturbance footprint to avoid or minimise impacts where possible; and
- Using strict controls over land clearing activity to ensure it is undertaken in a manner that ensures there is no 'overclearing' and that indirect impacts are avoided.

Once land clearing has been undertaken, mining and related activities will be undertaken in close proximity to uncleared vegetation. A range of management provisions will be implemented to reduce the propensity for indirect impacts on uncleared vegetation due to dust, saline water overspray and other potential risks.

1.5 Index of Biodiversity Surveys for Assessments

The biological surveys supporting this FVMP were completed prior to the introduction of Index of Biodiversity Surveys for Assessments (IBSA) requirements. All future biodiversity survey reports submitted at any point in the assessment and compliance process under Part IV of the *Environment Protection Act 1986* will be accompanied by an IBSA data package.

2 Environmental Management Plan Provisions

This Chapter sets out management-based provisions for flora and vegetation, as detailed in Error! Not a valid bookmark self-reference..

Table 2-1: Provisions to meet objectives for Flora and Vegetation

Management actions	Management targets	Monitoring	Reporting
Environmental Factor: Flora and Vegetation **EPA Objective:** To protect flora and vegetation so that biological diversity and ecological integrity are maintained. **Outcome:** • No material impacts to TECs/ PECs or remaining undisturbed vegetation on site beyond impact of clearing approved under the Environmental Protection Act 1986 (WA). • No material loss of Priority flora from secondary impacts, on or adjacent to the disturbance envelope. **Key environmental values:** • Priority flora and Priority Ecological Communities • Conservation significant fauna habitat • Carnaby's Cockatoo potential foraging vegetation **Key impacts and risks:** Direct impacts: • Loss of native vegetation cover; • Decrease of populations of conservation significant flora; and • Decrease of extent of vegetation types of conservation significance. Indirect impacts: • Spread of existing weed infestations or introduction of new weed species; • Death of native vegetation due to infestation and spread of *Phytophthora cinnamomi*; (Not covered in this FVMP, see Dieback Management Plan) • Increase of dust loads on vegetation arising from construction and mining activities, including vehicle movements and blasting; • Fragmentation of vegetation resulting in changes in microclimate; • Alteration of surface water flows; and • Altered fire regimes resulting in loss or reduced health and condition of native vegetation.			
Management-based provisions			
Management actions	**Management targets**	**Monitoring**	**Reporting**
Vegetation clearing • Develop and implement a Ground Disturbance Permit (GDP) system prior to the commencement of construction • Spotter/GPS or environmental officer supervision when clearing adjacent to a TEC/PEC or priority flora • Clearly delineate areas to be cleared • Vegetation will be progressively cleared to prevent soil erosion, dust generation and weed introduction/ colonisation	No unauthorised clearing to take place No clearing to take place outside of the approved areas No clearing of PECs and Priority flora outside disturbance footprint No adverse impacts to vegetation health beyond areas approved for clearing No material introduction or spread of environmental weeds to disturbed areas	GDP data collection and Internal audits Survey data and aerial imagery Vegetation health monitoring Weed monitoring Internal audits (against approved design)	Annual Environmental Reports (DMIRS) Mine Rehabilitation Fund (DMIRS) Compliance Annual Report (DWER) Internal record keeping and reporting including incident reports

Management actions	Management targets	Monitoring	Reporting
Project layout • Design Project to avoid PECs and conservation significant flora to the extent practicable • Ground disturbance will be kept to the minimum necessary for development of the Project • Existing roads and previously cleared areas will be utilised where possible • Consider design options requiring minimum clearing • Minimise entry/exit points to the Project available to unauthorised users	No unnecessary clearing included in design No clearing of PECs and priority flora outside disturbance footprint Minimise likelihood of unauthorised access to PECs and Priority flora		
Weeds • Develop and implement a management plan for bridal creeper (*Asparagus asparagoides*) involving spraying of herbicide and scalping of heavily infested soils • Survey topsoil for weed content prior to recovery and discard any heavily contaminated soil • Implement spray program with care to avoid inadvertent impacts due to spray drift	Material reduction in the extent of bridal creeper within the Project Area	Bi-annual weed survey and control/removal where required Internal annual weed assessment detailing progress of weed management Ad-hoc internal reporting of weeds	Annual Environmental Reports (DMIRS) Compliance Annual Report (DWER) Internal record keeping and reporting including incident reports
Closure and rehabilitation • Topsoil, subsoil and vegetation will be stripped and stockpiled for use in rehabilitation (maximum height of 2m) • Topsoil will be the major source of seed for rehabilitated land • Local provenance seeds will be collected prior to native vegetation clearing • Where required, native seeds will be collected within a 20 km radius of the Project area to help supplement seed supplies	Seed and soil viability and quality is retained for future rehabilitation efforts Successful rehabilitation (germination of seeds) Minimal reduction of potential germination for priority and non-priority species Minimise topsoil storage period	Assess/survey stockpiles as they are constructed Material inventory maintained (topsoil, seed storage)	Annual Environmental Reports (DMIRS) Internal record keeping
Progressive rehabilitation • Cleared areas will be progressively rehabilitated where they are no longer required for mining activities	Rehabilitation as soon as practicable	Environmental Manager to maintain rehabilitation schedule and track progress against schedule Rehabilitation monitoring	Internal record keeping and reporting of quarterly and annual assessments Rehabilitation schedule, progress and non-conformances included in AER (DMIRS) Rehabilitation status and strategy updated in Mine Closure Plan revisions (DMIRS, every 3 years)
Fire minimisation and avoidance • Staff will be trained in the use of fire extinguishers • All vehicles will be fitted with fire extinguishers • Fire emergency response to be included as part of the induction and training process • Implement hot work permit system • Cigarette disposal units will be designated in approved smoking areas on site • Employees will not be permitted to smoke in vehicles • Vehicles will be required to remain on established tracks and roads only and no vehicles will idle over vegetation, regrowth or dry grass, in the summer months	Hot work permit system in place and operating No accidental fires caused by vehicles/cigarettes Increase awareness in management of fires and the potential causes and signs of risk No unplanned fires occurring as a result of mine activities	Monitoring achieved through incident reporting Incidents recorded in Incident Register. Vehicle pre-start records Induction training records Audit safe work controls for hot works	Annual Environmental Reports (DMIRS) Internal record keeping Internal audits

Management actions	Management targets	Monitoring	Reporting
Fire breaks and access roads • The existing firebreak will be maintained around the mine site boundary • Project access roads will be designed and maintained to facilitate the control of wild fires • Consultation and co-operation with local landholders and stakeholders (including local fire services and DBCA) regarding controlled burns and regarding maintaining clear access to the Project and the adjacent proposed Conservation Reserve and Kundip Nature Reserve • Fire breaks around service areas/ high risk areas will be created and maintained where hot works are being undertaken	No unplanned fires occurring as a result of mine activities Fire breaks maintained as an effective barrier	Internal monitoring of firebreak and project access	Internal record keeping Internal audits
Vegetation Health • Implement dust suppression measures during construction and operation, including fencing at key locations • Implement surface water control measures as per design • Implement progressive rehabilitation measures to control erosion • Implement vegetation monitoring program including investigations of any vegetation health decline • Changes to management strategy e.g. increased dust suppression, surface water controls etc. are to be informed by investigation following monitoring results.	Minimise impacts to vegetation health outside of approved disturbance No material loss of condition in PECs or Priority flora.	Vegetation will be visually monitored quarterly (including photographic documentation) along high risk areas to assess any reduction in vegetation health Additional vegetation health assessments through aerial imagery when available, likely annually Ad-hoc internal reporting of evidence of vegetation stress, weeds, dust generation and erosion	Annual Environmental Reports (DMIRS) Compliance Annual Report (DWER) Internal record keeping and reporting including incident reports

3 Adaptive Management and Review of the Flora and Vegetation Management Plan

Given the potential for negative direct and indirect impacts on priority flora, PECs and remaining undisturbed vegetation the management approach will remain adaptive. The FVMP management plan will be reviewed and revised under the following conditions:

- If monitoring results indicate that management targets are not being achieved;
- If new information is discovered during construction, operations or closure;
- Where any significant changes to project design or operation have occurred; and
- Where it has been longer than 12 months since the last revision.

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Appendix A: APM biological survey report