TENEMENT E74/683

Mt Stennet

Vegetation and Flora Survey

A report prepared for Medallion Metals Ltd
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November 2022

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Executive Summary

Medallion Metals Ltd plans to carry out exploration drilling on tenement E74/683 at the 'Mt Stennet' prospect, 5 km north of the old Kundip townsite on the west flank of the Ravensthorpe Range. Kundip is located adjacent to the Hopetoun-Ravensthorpe Road, 17 km south-east of Ravensthorpe and 31 km north of the coastal town of Hopetoun.

The Mt Stennet prospect lies within an Environmentally Sensitive Area as declared under the *Environmental Protection Act 1986*.

A vegetation and targeted flora survey was requested along six drill lines, 600-700 m long and 120 m apart.

Threatened and Priority Flora

The DBCA database search listed 30 conservation taxa, including two Threatened species within a 5 km radius of Kundip. The following taxa were found:

- *Daviesia megacalyx* (T) – one plant only
- *Lepidosperma* sp. Elverdton (R. Jasper et al. LCH 16844) (P1) – frequent and widespread
- *Lepidosperma* sp. Mt Chester (S. Kern et al. LCH 16596) (P1) – frequent and widespread
- *Goodenia phillipsiae* (P4) – one plant only.

It is recommended that *Lepidosperma* sp. Elverdton be removed from DBCA's Priority flora list until further taxonomic studies are carried out. It is morphologically indistinguishable from both P1 *Lepidosperma* sp. Maydon (S. Kern, R. Jasper, H. Hughes LCH 17844) and P1 *Lepidosperma* sp. Mt Short (S. Kern et al. LCH 17510). Recent surveys have shown that the complex is frequent and widespread in the Ravensthorpe System.

Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596) is recommended to be listed as Priority 4.

Vegetation

The vegetation in the survey area is lies within the Fitzgerald sub-region of the Esperance Plains Biogeographic region. Beard (1973) mapped two communities as part of the Ravensthorpe System:

- edSc – (Assoc #691) on the ridgetop 'Shrublands; *Dryandra quercifolia* & *Eucalyptus* spp. thicket'
- e_{27}Si – (Assoc #516) on the west-facing slope of the range 'Shrublands; mallee scrub, black marlock'.

Vegetation types were based on Craig et al (2008) with nine types identified and mapped in the survey area. The vegetation was in pristine condition, being very old growth and no weeds present. The survey followed old exploration drill lines which had largely overgrown, but were still visible to walk along particularly on the upper- and mid-slopes.

Threatened Ecological Community (TEC)

All six of the proposed drill lines pass through the EPBC Act listed TEC 'Proteaceae Dominated Kwongkan Shrublands of the southeast coastal province of Western Australia'. This community occurs on the upper slope/ridgetop of the survey area is typical of the laterites of the Ravensthorpe Range.

1. Introduction

Medallion Metals Ltd plans to carry out exploration drilling on tenement E74/683 at the 'Mt Stennet' prospect, 5 km north of the old Kundip townsite on the west flank of the Ravensthorpe Range. Kundip is located adjacent to the Hopetoun-Ravensthorpe Road, 17 km south-east of Ravensthorpe and 31 km north of the coastal town of Hopetoun (Fig 1).

The Mt Stennet prospect lies within an Environmentally Sensitive Area as declared under the *Environmental Protection Act 1986*.

A flora and vegetation survey was requested for six proposed drill lines, 600 – 700 m long and 120 m apart. The objectives of the survey include:

- review the conservation status of the vascular plant species by reference to Department of Biodiversity, Conservation and Attractions' (DBCA) Threatened and Priority flora list and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) [Commonwealth];
- targeted survey for Threatened and Priority flora;
- confirm native vegetation mapping of Craig et al (2008);
- determine condition of native vegetation communities;
- identify whether there are any Threatened or Priority Flora Ecological Communities;
- prepare an *Index of Biodiversity Surveys for Assessments* (IBSA) data package of the findings.

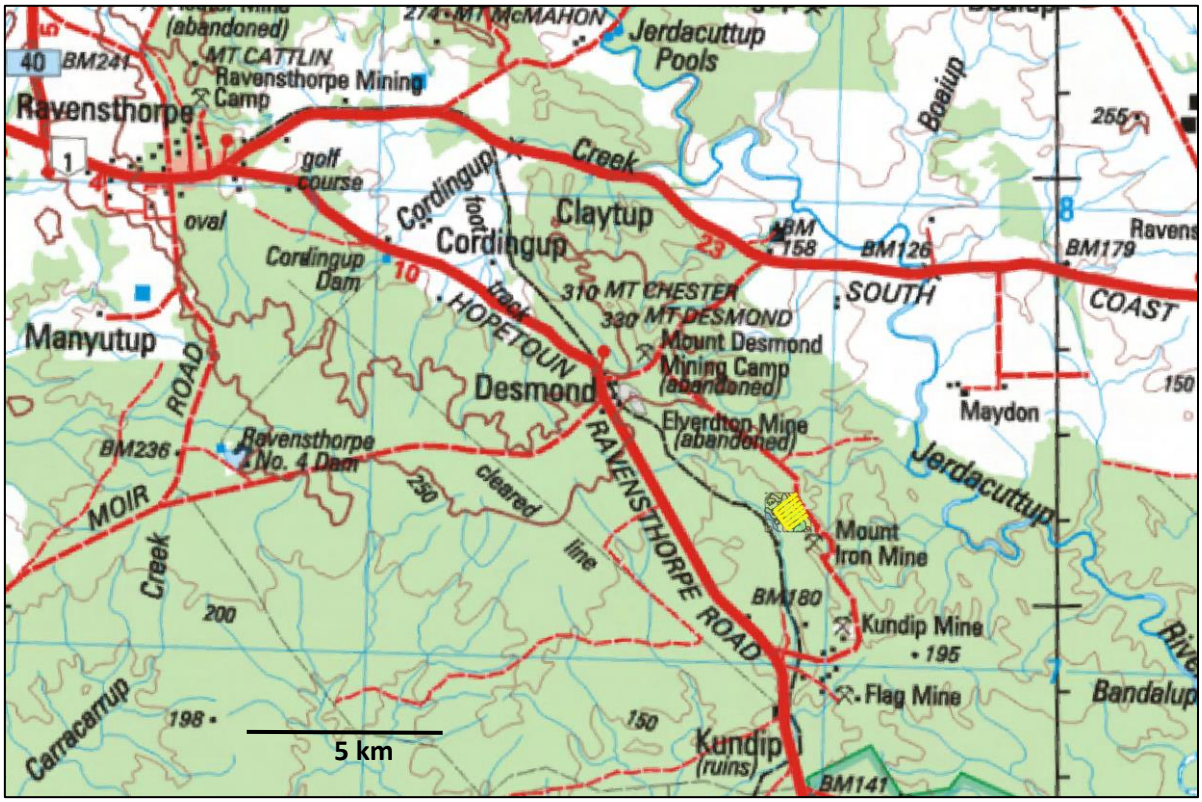

Figure 1 – Location of survey area (yellow lines)

1.1 Climate

Ravensthorpe lies in the 'dry mediterranean' bioclimatic region experiencing 5-6 dry months per year. Winters are cool and damp while summers are warm to hot.

Daily maximum temperatures at Ravensthorpe average from 29°C in January to 16°C in July, and daily minimum temperatures average 14°C in January-February and 7°C in July-September. Temperatures have reached as high as 46 °C in January-February and as low as – 1.0 to 0.0 °C between June and August (Bureau of Meteorology, 2020).

Rainfall in Ravensthorpe is variable and unreliable, with an average annual rainfall of 430 mm. Generally, about two-thirds of the annual rain falls in the six months between May and October as a result of cold fronts and occasional depressions. Summer rainfall comes mainly from thunderstorms associated with cyclones that have degenerated into rain-bearing depressions.

1.2 Soil-Landscape System

The survey area lies within the Ravensthorpe System of undulating low hills on Archaean greenstone of metasediments and ultramafics. Dominant soils are brown non-cracking clays and calcareous loamy earths with associated red shallow loams, sandy duplexes and ironstone gravel soils (Department of Agriculture and Food, 2006).

1.3 Geology

The Mt Stennet prospect lies on the western slopes of the Ravensthorpe Range, extending from the ridgetop at 230 m downslope to 170 m above sea level. They are part of the Archaean greenstones of the Ravensthorpe greenstone belt. The prospect includes the fault zone that divides two tectonic units – the Carlingup Terrane and Ravensthorpe Terrane.

The Chester Formation, which includes pelite, psammite and metamorphosed chemical sedimentary rocks, is found on the ridgetop, while mid-slope talc-carbonate ultramafics (Bandalup Ultramafics) are found. Both areas form part of the Carlingup Terrane (2958 ± 4 Ma).

Downslope a calc-alkaline volcanic association of the Annabelle volcanics forming part of the older Ravensthorpe Terrane (c. 2970 to 2980 Ma) occurs. The tonalite and volcanic rocks of the Ravensthorpe Terrane is where the main copper-gold mineralization occurs in the region (Witt 1998).

1.4 Pre-European Vegetation

The survey area lies in the South West Botanical Province and the Fitzgerald sub-region of the Esperance Plains Biogeographic Region (Cresswell and Thackway 1995) and is within the Ravensthorpe System described by Beard (1973). Beard mapped two vegetation communities over the survey area (note many of the following species names have since been updated):

- edSc – (Assoc #691) on the ridgetop 'Shrublands; *Dryandra quercifolia* & *Eucalyptus* spp. thicket' including *Eucalyptus preissiana, Eucalyptus lehmannii, Eucalyptus tetragona, Eucalyptus desmondensis*, *Dryandra quercifolia, Allocasuarina campestris, Melaleuca uncinate, Banksia lehmanniana, Calothamnus sp., Beaufortia squarrosa*.

- e_{27}Si – (Assoc #516) on the west-facing slope of the range 'Shrublands; mallee scrub, black marlock', including *Eucalyptus uncinata, Eucalyptus redunca, Eucalyptus flocktoniae, Eucalyptus incrassata, Eucalyptus conglobata, Banksia calyei, Hakea laurina, Hakea crassifolia, Hakea coymbosa, Melaleuca uncinata, Melaleuca thymoides*, and other *Melaleuca* spp.

2. Methods

2.1 Desktop

On 18 August 2020, a Department of Biodiversity, Conservation and Attractions' (DBCA) search was undertaken of (1) the Department's Threatened and Priority Flora database "TPFL" – coordinates are GDA94, and (2) the Western Australian Herbarium Specimen database "WAHERB"- for Threatened and Priority flora species opportunistically collected within a 15 km radius of Kundip, which includes the survey area. The list was clipped to a 5 km radius around the Mt Stennet survey site.

The Threatened and Priority Ecological Communities listed by both DBCA (2021) under the State's *Biodiversity Conservation Act 2016* (BC Act 2016) and under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were reviewed for their potential existence in the survey area.

Vegetation mapping of the Ravensthorpe Range by Craig et al (2008) was used to determine vegetation type. The floristic communities of the Ravensthorpe Range by Markey et al (2012) provided additional background information.

Although a number of biological studies have been undertaken in the Kundip surrounds since 2003 by several consultants including, but not limited to Outback Ecology (2003), Craig (2004, 2005, 2011, 2012, 2013, 2014, 2020) and Kern et al (2007), there are no known previous surveys specifically for the Mt Stennet site.

Landgate's SLIP platform was interrogated to determine whether the survey areas were within a Department of Water and Environmental Regulation's (DWER) Environmentally Sensitive Area where clearing regulations apply.

2.2 Field Survey

The vegetation and flora survey was carried out according to the Environmental Protection Authority's technical guide (EPA 2016). Surveys were carried out over two days, on the 19th and 20th November 2022. The days were cool (max 17°C max) with a moderate west to southwesterly winds and occasional showers on the first day.

The six proposed drill lines were surveyed on foot. A 20 m x 20 m non-permanent quadrat, in which all overstorey taxa were recorded, was established at 13 sites across the survey area. All of the understorey taxa were recorded in a nested 10 m x 10 m plot within the larger quadrat. Soil type, landform, vegetation condition (EPA 2015), vegetation structure, species present in each stratum (NVIS 2017), GPS location and photograph was documented for each relevé.

Locations of conservation taxa were marked as waypoints with a GPS (Garmin II) $\pm$ 4-6 m accuracy, using the Geocentric Datum Australia 1994 (GDA94). QGIS mapping software was used to prepare shapefiles.

Plant specimens were identified using the author's private herbarium, which has previously been verified in the Western Australian herbarium (PERTH), or the Ravensthorpe Regional herbarium. Plant species were recorded in a MAX V3 data table, a software program developed by DBCA which links datasets to the Census of Western Australian Plants master list.

2.3 Vegetation mapping

Vegetation association boundaries noted during the field survey were compared to the vegetation community mapping by Craig et al (2008). Areas on the periphery or outside of the survey area, retained the vegetation units as mapped by Craig et al (2008) to provide characterisation of the local area. Only those vegetation types that occur within the survey area are discussed in this report.

2.4 Survey limitations

The limitations to the survey are outlined in Table 1.

Table 1 – Limitations of survey

Possible Limitations	Constraints (Yes/No): Significant, Moderate Or Negligible	Comment
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	No	Dr Gillian Craig is a Senior Botanist who has carried out vegetation and flora surveys in the Shire of Ravensthorpe, including the Ravensthorpe Range, over the past 30 years.
Availability of contextual information at a regional and local scale	No	Published reports are available on the vegetation, geology and soil-landscape in the Shire.
Proportion of flora recorded and/or collected, any identification issues	No	All species were known to the botanist and could be identified with confidence.
Completeness (was the appropriate area fully surveyed - effort and extent)	No	The proposed drill lines were traversed on foot.
Remoteness and/or access problems	No	All sections of the study area were accessible by foot.
Survey timing, weather, season of survey	No	The survey was carried out in Spring 2022.
Disturbance that may have affected the results of survey such as fire, flood or clearing.	No	All vegetation was in pristine condition except where the drill lines had been cleared many years ago and, although overgrown, were still clearly visible.

3. Results

3.1 Threatened and Priority Flora

The DBCA database search listed 30 conservation taxa, including two Threatened species within a 5 km radius of the Mt Stennet prospect (Table 2). Review of the preferred habitat of these species using WAHERB and TPFL data, and the author's knowledge, found that more than half had the potential to occur in the survey area.

Table 2 – List of conservation taxa within a 5 km radius of survey area (WAHerb & TPFL 20/8/2020)

Taxon	ConsCode	Likelihood of Occurence
Acacia rhamphophylla	T	Possible, occurs on ridgetop near survey area
Daviesia megacalyx	T	Possible, occurs on ridgetop near survey area
Acacia besleyi	1	Unlikely, distributed closer to Ravensthorpe in drainage lines
Acacia sp. Ravensthorpe Range (B.R. Maslin 5463)	1	Possible, occurs on ridgetop near survey area
Calothamnus roseus	1	Possible, prefers stony ridgetops/ breakaways
Grevillea sulcata	1	Likely, known from area
Guichenotia apetala	1	Likely, occurs on lateritic ridgetop
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	1	Possible, known to occur near survey area
Lepidosperma sp. Hopetoun Road (S. Kern et al. LCH 16552)	1	Possible, known to occur near survey area
Lepidosperma sp. Mt Short (S. Kern et al. LCH 17510)	1	Possible, known to occur near survey area
Hydrocotyle tuberculata	2	Unlikely, occurs near drainage lines
Thomasia sp. Hopetoun (K.R. Newbey 4896)	2	Unlikely, occurs in winter-moist drainage areas
Banksia corvijuga	3	Unlikely, grows on lateritic hilltops closer to Ravensthorpe
Grevillea fulgens	3	Possible, occurs near survey area
Grevillea punctata	3	Likely, known from area
Micromyrtus navicularis	3	Unlikely, distributed closer to Ravensthorpe
Acacia argutifolia	4	Unlikely, prefers quartzite soil type
Acacia grisea	4	Unlikely, distributed closer to Ravensthorpe
Allocasuarina hystricosa	4	Unlikely, restricted to E side of Ravensthorpe Range
Banksia foliosissima	4	Possible, prefers lateritic ridgetops similar to survey area
Banksia laevigata subsp. laevigata	4	Possible, prefers lateritic ridgetops similar to survey area
Dampiera deltoidea	4	Possible, prefers stony ridgetops/ breakaways
Eucalyptus desmondensis	4	Unlikely, occurs on lower slopes, west of Steere River
Goodenia phillipsiae	4	Unlikely, occurs on lower slopes, west of Steere River
Goodenia stenophylla	4	Possible, disturbed lateritic hilltop
Grevillea fastigiata	4	Possible, occurs near survey area
Marianthus mollis	4	Likely, prefers lateritic ridgetop
Melaleuca penicula	4	Possible, prefers rocky soil
Pultenaea calycina subsp. proxena	4	Possible, known to occur near survey area
Thysanotus parviflorus	4	Possible, known from near survey area

Daviesia megacalyx, listed as Threatened (DBCA) and Endangered (EPBC Act), was found in the survey area. In addition, two Priority 1 *Lepidosperma* species and Priority 4 *Goodenia phillipsiae* were found as described below. Their locations are mapped (Fig 5) and GPS locations given in Appendix 1.

Daviesia megacalyx (Threatened and Endangered)

An erect shrub, 0.7-1.6 m high with bright green, lanceolate leaves. The pea flowers are yellow/orange and red/brown/pink. The species name refers to the distinctive, large calyx. Flowering is between August and September. Its preferred habitat is gravelly laterite on ridges and hillslopes of the Ravensthorpe Range.

Two disjunct populations, about 20 km apart, are known from the Ravensthorpe Range. The single plant found during the current survey would be at the southern limit of the southernmost population. The nearby area has been flagged to prevent disturbance during exploration activities.

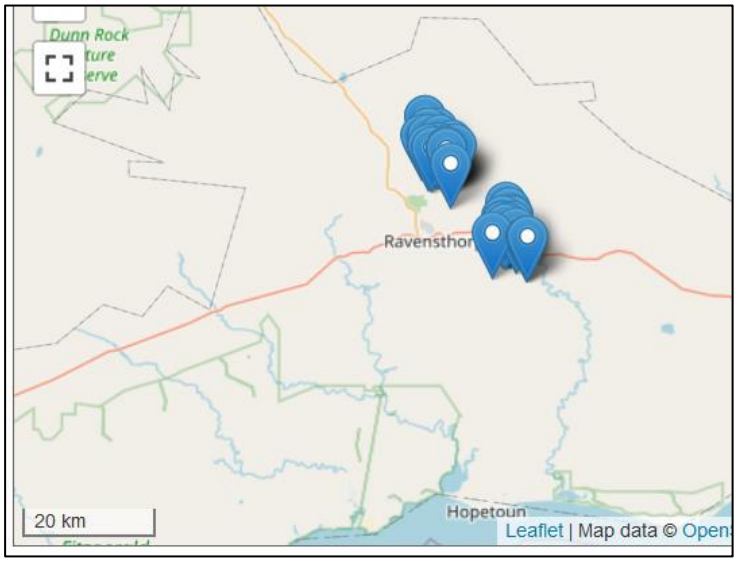

Plate 1 – *Daviesia megacalyx* pod
Figure 2 – Distribution of *Daviesia megacalyx* (Florabase 18/11/2022)

Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844) (P1)

A sedge to 65 cm tall, with flexible, erect culms 2-2.5 mm wide. Margins are evenly and continuously covered with fine red hairs. The inflorescence is relatively large, somewhat openly branching, with several branchlets with numerous spikelets. Sheath bases are dark brown and fibrous (Barrett et al, 2009).

Plate 2 - *Lepidosperma* sp. Elverdton: A – clump, B – inflorescence, C – base

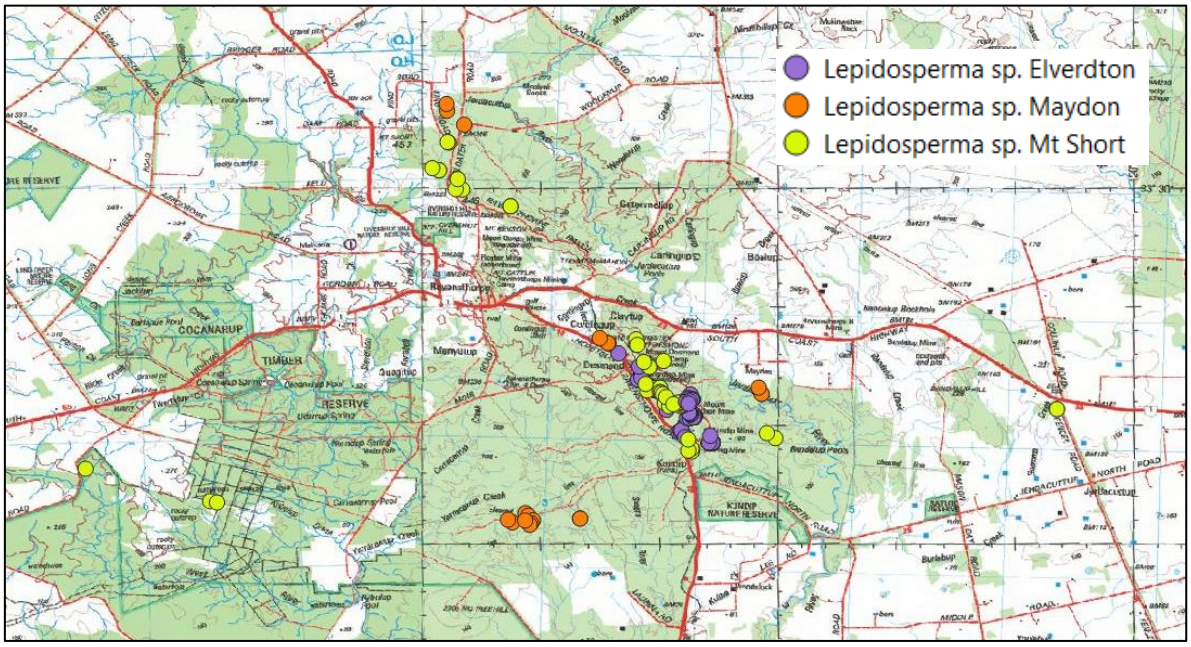

Figure 3 – Distribution of *Lepidosperma* sp. Elverdton and morphologically similar taxa

This putative species is known to occur from 1 km north of Elverdton Road to Kundip on the western slopes of the Ravensthorpe Range (Fig 2). Over 1600 clumps are estimated within the 9.5 km range (Kern et al 2008, Craig 2020b, 2021a).

During the current survey, six collections were made of this taxon, with no apparent correlation to a vegetation type. The extent of plants at each collection site was not determined, however the taxon is expected to be frequent throughout the survey area. Representative collections from this survey will be lodged in the WA Herbarium.

Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596) (P1)

A sedge to 35 cm tall, with stiff biconvex culms, 1-1.5 mm wide. Margins are smooth. Inflorescences are narrow with a few short branchlets with few spikelets. Sheath bases are dark brown and fibrous. This taxon is closely related to *L. gahnioides,* but has more robust spikelets and broader, more compressed culms (Barrett et al, 2009).

Plate 3 - *Lepidosperma* sp. Mt Chester: A – clump, B – inflorescence, C – base

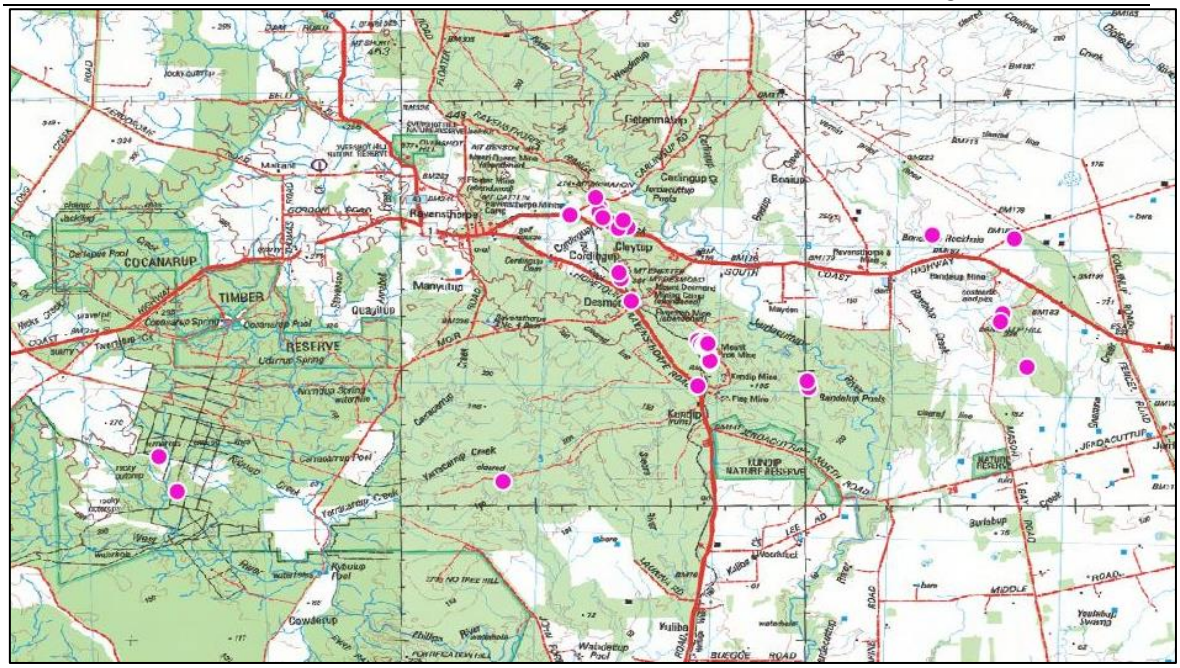

Figure 4 – Distribution of *Lepidosperma* sp. Mt Chester in the Ravensthorpe area

According to Barrett et al (2009) this putative species is poorly known, but probably not threatened. It is known from a range of sites in the central areas of the Ravensthorpe Range and east to Bandalup Hill, and from Munglinup. It is also known from south-east of Lake King. There are 17 collections in the WA herbarium. It is known from the nearby Kundip mining leases (Craig 2021). Representative collections from this survey will be lodged in the WA Herbarium.

During the current survey, *Lepidosperma* sp. Mt Chester was widespread across the survey area, being found in eight locations on the mid- and lower-slope in three vegetation units – *Eucalyptus flocktoniae* and mixed *Eucalyptus* species mallee shrubland [Eflo/Espp], *Eucalyptus proxima* mallee shrubland [Epro] and *Eucalyptus clivicola* open low forest [Ecli].

Goodenia phillipsiae (P4)

A semi-prostrate herb, to 20 cm tall x 15 cm wide, with bright yellow flowers. This species is a local endemic, mainly distributed east of Ravensthorpe to near Bandalup Hill and south-east to near Kundip. It is a disturbance opportunist.

A single plant of *G. phillipsiae* was recorded on the most southern drill line in a *Eucalyptus proxima* dominated mallee shrubland.

Plate 4 - *Goodenia phillipsiae*

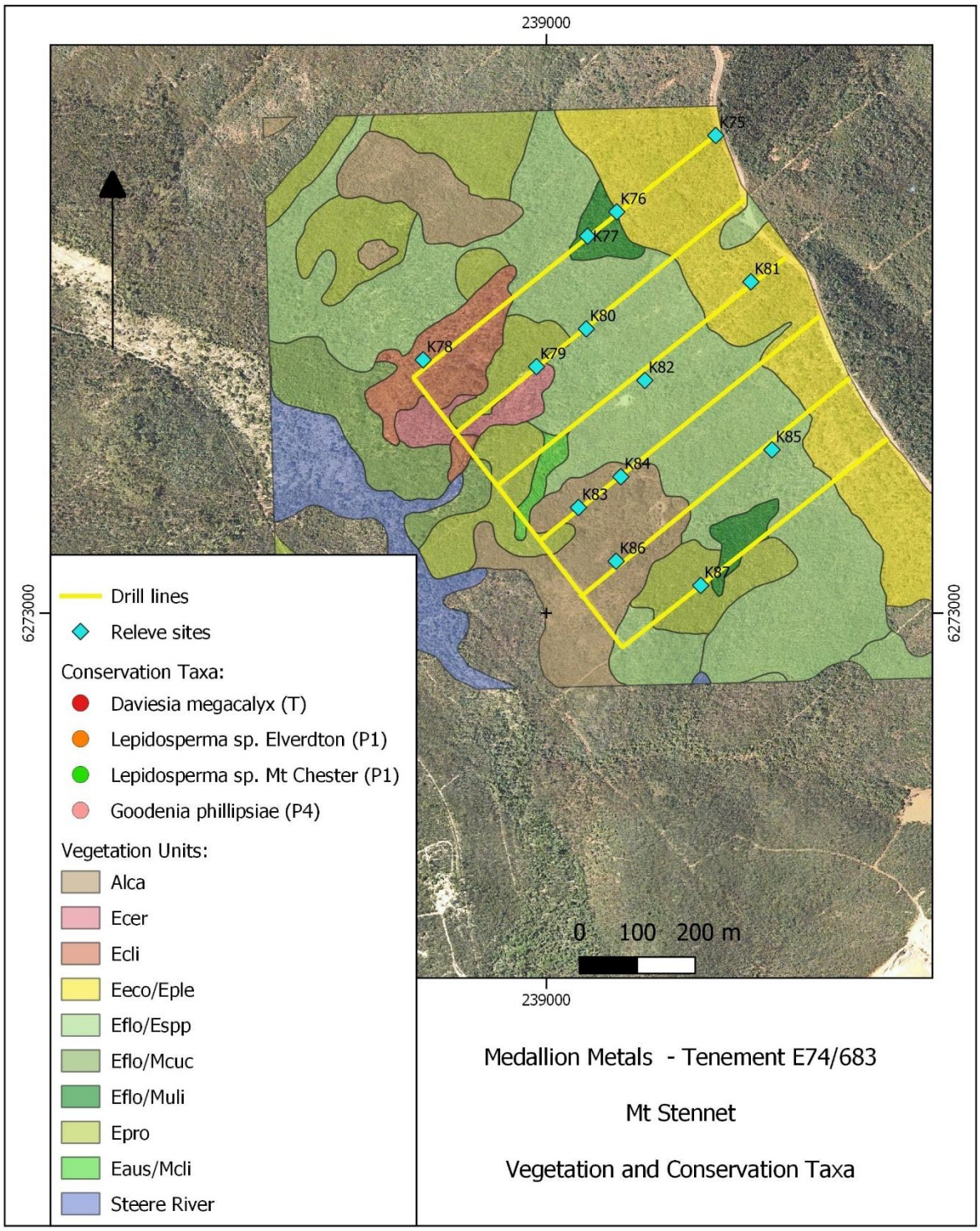

Figure 5 – Location of conservation taxa and vegetation units at Mt Stennet

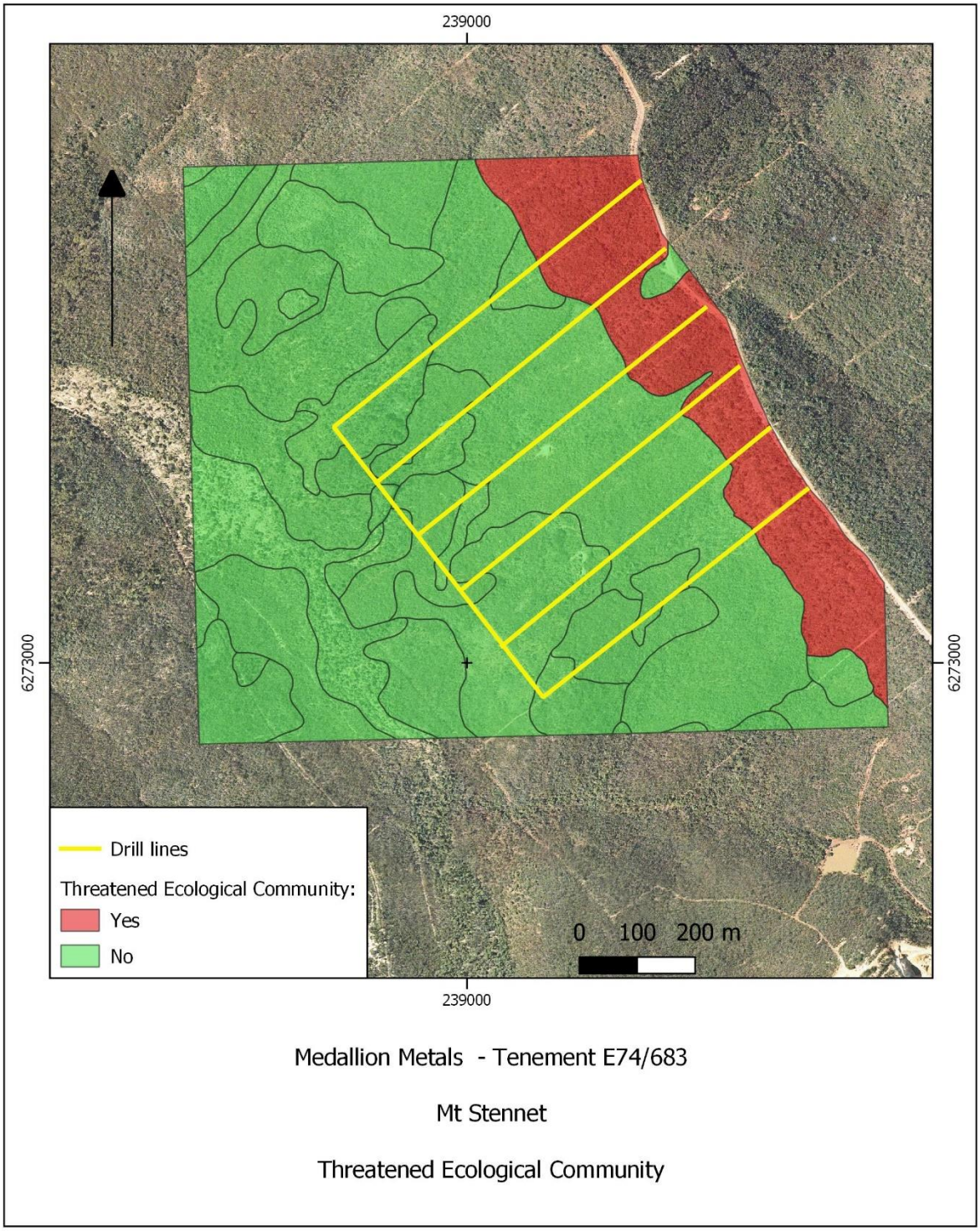

Figure 6 – Location of Threatened Ecological Community at Mt Stennet prospect

3.2 Vegetation types

Nine vegetation types were mapped along the proposed drill lines (Fig 5, Table 3). These correspond with Craig et al (2008), although a couple of vegetation types were amalgamated as species composition and structure were not observed to be significantly different within the survey area. Vegetation type descriptions with characteristic species and photos in Appendix 3.

Table 3 - Vegetation Units identified in the Mt Stennet survey area

Map Code	Vegetation Unit	TEC/PEC
1. Alca	*Allocasuarina campestris* shrubland	
2. Eaus/Mcli	*Eucalyptus austrina* mallee shrubland; *Melaleuca cliffortioides* heathland	
3. Ecer	*Eucalyptus cernua* open forest	
4. Ecli	*Eucalyptus clivicola* open forest	
5. Eeco/Eple	*Eucalyptus ecostata, E. pleurocarpa* mallee shrubland; *Banksia lemmaniana* heathland	EPBC Act Endangered TEC
6. Eflo/Espp	*Eucalyptus flocktoniae*, mixed *Eucalyptus* species mallee woodland	
7. Eflo/Mcuc	*Eucalyptus flocktoniae* mallee shrubland; *Melaleuca cucullata* shrubland	
8. Eflo/Muli	*Eucalyptus flocktoniae* mallee shrubland; *Melaleuca ulicoides* heathland	
9. Epro	*Eucalyptus proxima* mallee shrubland	

The lateritic ridgetop and upper slope with shallow soils was characterised by open *Eucalyptus ecostata, E. pleurocarpa* mallee shrubland and mixed proteaceous thicket dominated by *Banksia lemmaniana.*

The mid-slope ultra-mafic soils had a variety of *Eucalyptus* species, including *E. flocktoniae*, *E. phenax, E. proxima, E. suggrandis* and *E. phaenophylla.* Tall shrubs of *Melaleuca hamata* were typical. *Melaleuca ulicoides* formed dense patches in a few areas.

The lower slopes had a greater variety of vegetation types. Rocky granite soils formed on fresh rock supported *Allocasuarina campestris* shrubland and *Spartochloa scirpoidea* grassland. A narrow strip of *Melaleuca cliffortioides* heathland intersected one of the drill lines. Colluvium supported *Eucalyptus proxima* mallee shrubland with entanglements of *Cassytha melantha.* Soft red-brown loams grew low open forests of *Eucalyptus clivicola* and *E. cernua. Melaleuca cucullata* shrubland was found in deeper loams adjacent to drainage lines.

3.3 Threatened Ecological Community

The survey identified the 'Proteaceae Dominated Kwongkan Shrublands of the southeast coastal province of Western Australia' that is listed as an 'endangered' TEC under the EPBC Act. The *Eucalyptus ecostata/ E. pleurocarpa* mallee over *Banksia lemanniana* shrubland [Eeco/Eple] vegetation type had greater than 30% proteaceous cover, i.e. a diagnostic feature of the TEC.

All of the six proposed drill lines traversed the TEC on the upper slope/ridgetop of the survey area, i.e. where shallow, lateritic gravelly/stony soils were present (Fig 6).

3.4 Vegetation Condition

The vegetation in the survey area was in pristine condition and very old growth. Records suggest that there has been no fire for over 100 years. Old exploration lines have largely overgrown with native vegetation, but still visible on the upper- and mid-slopes. No weeds were present

Old mine shafts and costeens were present adjacent to three of the proposed drill lines.

Plate 5 – Old drill lines were overgrown but visible in the survey area

4. Discussion

4.1 Threatened and Priority Flora

The DBCA database search listed 30 conservation taxa, including two Threatened species within a 5 km radius of the Mt Stennet prospect. Review of the preferred habitat of these species found that more than half of these taxa had the potential to occur in the survey area. The Threatened *Daviesia megacalyx* was found near the ridgetop. Two Priority 1 *Lepidosperma* species, *L.* sp. Elverdton and *L.* sp. Mt Chester were frequent on the mid- and lower-slopes and one plant of P4 *Goodenia phillipsiae* was growing on the southernmost drill line.

The one plant of *Daviesia megacalyx,* found on the northernmost drill line on the lateritic breakaway on an old drill line, should be avoidable by future exploration activities. Surrounding plants have been pink flagged to clearly identify its presence.

The taxonomy of *Lepidosperma* in the Ravensthorpe region has been researched by Russell Barrett (2009) and he identified a number of putative taxa for Kern et al (2007) and Craig et al (2008). Further genetic work is required to clarify taxonomic differences within this difficult genus. In particular, there are at least three morphologically similar P1 *Lepidosperma* species, i.e. *L.* sp. Elverdton, *L.* sp. Maydon (S. Kern, R. Jasper, H. Hughes LCH 17844) and *L.* sp. Mt Short (S. Kern et al. LCH 17510). , all of which occur in the southern Ravensthorpe Range. Both the author and Michael Hislop at the WA Herbarium cannot separate these taxa, so identifications can only be considered tentative. Recent surveys have found the complex to be relatively common and widespread in the

Ravensthorpe System (Fig 3), so it is recommended that until further taxonomic work defines these taxa, they be removed from DBCA's Priority flora list.

Furthermore, *Lepidosperma* sp. Mt Chester is a diminutive plant that can be readily overlooked as it usually grows with other sedges, such as *Gahnia ancistrophylla* and *Netrostylis* sp. Mt Madden. It is widely distributed in the Ravensthorpe System (Fig 4); Priority 4 status is recommended.

4.2 Vegetation

The vegetation in the survey area forms part of the Ravensthorpe corridor which has been recognised as an important linkage between the Fitzgerald River National Park and Crown land east of the Vermin Proof Fence which extends to the southern Goldfields. The tenement is within a Environmentally Sensitive Area declared under the *Environmental Protection Act 1986*.

Beard (1973) mapped two vegetation communities, i.e. on the ridgetop 'Shrublands; *Dryandra quercifolia* & *Eucalyptus* spp. thicket' (edSc – Assoc #691) and on the slopes 'Shrublands; mallee scrub, black marlock' (e_{27}Si - Assoc #516). Nine vegetation types were identified along the proposed drill lines.

The vegetation was in pristine condition, except along old access tracks where the amount of regrowth varied from totally overgrown in the *Eucalyptus proxima* [Epro] mallee shrubland to a narrow track still traversable on foot (mainly on the mid- and upper-slopes). No weeds were present.

4.3 Threatened Ecological Community

The EPBC Act listed TEC 'Proteaceae Dominated Kwongkan Shrublands of the southeast coastal province of Western Australia' that occurs on the upper slope/ridgetop of the survey area is typical of the laterites of the Ravensthorpe Range. It is a large, heterogeneous mallee heath complex that is found between Mt Short and Mt Benson/ Mt McMahon in the north, and Mt Chester to Kundip in the south, covering nearly 3000 ha (Craig et al 2008). It is closely affiliated with the broad vegetation type 'Shrublands; *Dryandra quercifolia* & *Eucalyptus* spp. thicket' described by Beard (1973).

Acknowledgments

David Groombridge, Exploration Manager for Medallion Metals Ltd, facilitated the project. Thanks to the Ravensthorpe Regional Herbarium for use of their resources.

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Appendix 1

Location of Threatened and Priority Flora

Datum: GDA94

TaxonName	Cons Code	HerbRef	Count	Wpt	Latitude	Longitude
Daviesia megacalyx	T		1	3	-33.64521	120.18758
Goodenia phillipsiae	P4		1	80	-33.65048	120.18817
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1	GFC11387		1	-33.64464	120.1885
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1	GFC11396		21	-33.64714	120.18638
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1	GFC11398		29	-33.64797	120.18714
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1	GFC11399		38	-33.64987	120.18538
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1	GFC11403		53	-33.64814	120.19011
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1			54	-33.64825	120.19004
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1			55	-33.64821	120.18998
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1			56	-33.64826	120.19001
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1			59	-33.64861	120.18944
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1	GFC11406		61	-33.64949	120.18787
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	P1	GFC11410		72	-33.65111	120.18713
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1	GFC11391	0.75	7	-33.64607	120.18636
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		0.04	9	-33.64651	120.18549
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1	GFC11395	25	13	-33.6475	120.18385
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1	GFC11400	0.1	14	-33.64773	120.1837
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		0.5	48	-33.64781	120.18891
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		0.5	49	-33.64772	120.18898
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		0.5	50	-33.64771	120.18899
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1	GFC11408	0.04	68	-33.65002	120.18561
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		0.04	70	-33.65001	120.18568
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		6	74	-33.65074	120.18793
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		1	75	-33.65065	120.18798
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		2	76	-33.65064	120.18805
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		1	77	-33.65061	120.18795
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		1	79	-33.6505	120.18815
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		1	83	-33.65022	120.18871
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		1	84	-33.65031	120.18875
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		4	85	-33.64999	120.1889
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		2	86	-33.64994	120.18902
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		6	87	-33.6495	120.18997
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		4	88	-33.64951	120.19002
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	P1		9	89	-33.64941	120.19006

Appendix 2

Vegetation type descriptions

1. Allocasuarina campestris shrubland [Alca]

Description: *Allocasuarina campestris* shrubland; *Spartochloa scirpoidea* grassland
Soil: Orange to light brown sandy clay loam **Landform:** Lower slopes with fresh rock
Quadrat: K83, K84, K86
Regional Extent: Concordant with regional mapping unit "42. *Allocasuarina campestris* (Alca)" (Craig et al 2008) of which 106 ha has been mapped in the Ravensthorpe Range

Lifeform	% Cover	Characteristic taxa
Shrubs <2m	10-30%	*Allocasuarina campestris, Melaleuca hamata, Calothamnus quadrifidus, Melaleuca elliptica, Acacia sulcata* var. *platyphylla*
Ground	30-70%	*Spartochloa scirpoidea, Lepidosperma sp. Mt Benson*

2. *Eucalyptus austrina* open mallee shrubland; *Melaleuca cliffortioides* open heathland (Eaus/Mcli)

Description: *Eucalyptus austrina* open mallee shrubland; *Melaleuca cliffortioides* open heathland; *Lepidosperma diurnum* open sedgeland.
Soil: Red brown loamy sand with granitic stone. **Landform:** Rocky area with granitic influence.
Regional Extent: Concordant to regional mapping unit *"48. Eucalyptus sp. Ravensthorpe/ Melaleuca cliffortioides"* (Craig et al 2008) of which 95 ha has been mapped in the Ravensthorpe Range.

Description:

Lifeform	% Cover	Characteristic taxa
Mallee <10m	10-30%	*Eucalyptus austrina, E. suggrandis, E. phenax, E. uncinata*
Shrubs <1m	30-60%	*Melaleuca cliffortioides*
Ground	10-30%	*Gahnia ancistrophylla, Lepidosperma diurnum*

***3. Eucalyptus cernua* open forest (Ecer)**

Description: *Eucalyptus cernua* (mallet) open forest; isolated shrubs and sedges.
Soil: Brown sandy loam ± sandstone fragments. **Landform:** Sedimentary lower-slope
Regional Extent: Concordant to regional mapping unit *"14. Eucalyptus cernua (Ecer)"* (Craig et al 2008) of which 149 ha has been mapped in the Ravensthorpe Range.

Lifeform	% Cover	Characteristic taxa
Mallet <10m	30-70%	*Eucalyptus cernua, E. clivicola*
Shrubs <2m	<10%	*Melaleuca acuminata, M. cucullata, Dodonaea pinifolia*
Ground	10-30%	*Lepidosperma* sp. Ravensthorpe

***4. Eucalyptus clivicola* open forest (Ecli)**

Description: *Eucalyptus clivicola* (mallet) open forest; isolated shrubs and sedges.
Soil: Brown sandy loam ± sandstone fragments. **Landform:** Lower-slope
Quadrat: K78
Regional Extent: Concordant to regional mapping unit *"14. Eucalyptus clivicola (Ecli)"* (Craig et al 2008) of which 465 ha has been mapped in the Ravensthorpe Range.

Lifeform	% Cover	Characteristic taxa
Mallet <10m	30-70%	*Eucalyptus clivicola, E. flocktoniae*
Shrubs <2m	10-30%	*Melaleuca hamata, Gastrolobium parviflorum, Daviesia nematophylla, Lasiopetalum compactum*
Ground	30-70	*Gahnia ancistrophylla, Lepidosperma* sp. Ravensthorpe, *Netrostylis* sp. Mt Madden

***5. Eucalyptus ecostata/ E. pleurocarpa* mallee shrubland (Eeco/Eple) (TEC)**

Description: *Eucalyptus ecostata, E. pleurocarpa* mallee shrubland; *Banksia lemmaniana* shrubland.
Soil: Orange-brown clayey sand. **Landform:** Rdgetop, upper slope & breakaway.
Quadrat: K75, K81
Regional Extent: Concordant to regional mapping unit *"1. Eucalyptus falcata/ E. pleurocarpa* (*Efal/Eple)"* (Craig et al 2008) of which 2935 ha has been mapped in the Ravensthorpe Range.
Note the *Eucalyptus falcta (Efal)* that was mapped by Craig et al 2008 in the survey area, was amalgamated into the *Eeco/Eple* vegetation type.
This unit is considered to be Threatened Ecological Community under the EPBC Act 1999.

Lifeform	**% Cover**	**Characteristic taxa**
Mallee <10m	10-30%	*Eucalyptus falcata, E. pleurocarpa*
Shrubs >2m	30-70%	*Banksia lemmaniana, B. heliantha*
Shrubs <2m	10-30%	*Beaufortia schaueri, Calothamnus pinifolius, Taxandria spathulata*
Ground	<10%	*Gahnia ancistropylla, Lepidosperma* sp. Mt Benson, *Lepidosperma* sp. Cordingup

6. *Eucalyptus flocktoniae/ Eucalyptus* spp. mallee woodland (Eflo/ Espp)

Description: *Eucalyptus flocktoniae*; mixed *Eucalyptus* spp. mallee woodland
Soil: Orange to light brown sandy clay loam or loam **Landform:** Gentle to moderate mid- and lower slopes **Quadrat:** K76**,** K80, K85
Regional Extent: Concordant with regional mapping unit "17. *Eucalyptus flocktoniae/ Eucalyptus* species (Eflo/ Espp) " (Craig et al 2008) of which 184 ha has been mapped in the Ravensthorpe Range.
Note the *Eucalyptus suggrandis/Melaleuca* spp. *(Esug/Mspp)* that was mapped by Craig et al 2008 in the survey area, was amalgamated into the *Eflo/Espp* vegetation type.

Lifeform	% Cover	Characteristic taxa
Mallee <10m	30-70%	*Eucalyptus flocktoniae, E. phenax, E. suggrandis, E. phaenophylla, E. uncinata*
Shrubs >2m	10-30%	*Melaleuca hamata*
Shrubs <2m	10-30%	*Dodonaea pinifolia, Acacia ingrata, Coopernookia strophiolata, Boronia inornata, Gastrolobium parviflorum, Siegfriedia darwinioides, Lasiopetalum compactum, Melaleuca undulata*
Ground	30-70%	*Gahnia aristata, Lepidosperma* sp. Ravensthorpe, *Netrostylis* sp. Mt Madden

7. Eucalyptus flocktoniae open mallee woodland/ *Melaleuca cucullata* open shrubland (Eflo/ Mcuc)

Description: *Eucalyptus flocktoniae* open mallee woodland; *Melaleuca cucullata* open shrubland
Soil: Fine brown loam **Landform:** Low lying, winter-moist
Regional Extent: Concordant with regional mapping unit "53. *Eucalyptus flocktoniae/ Melaleuca cucullata* (Eflo/Mcuc)" (Craig et al 2008) of which 30 ha has been mapped in the Ravensthorpe

Lifeform	% Cover	Characteristic taxa
Mallee <10m	10-30%	*Eucalyptus flocktoniae, Eucalyptus pileata, Eucalyptus proxima*
Shrubs >2m	30-70%	*Melaleuca cucullata*
Ground	10-30%	*Austrostipa acrociliata, Gahnia aristata, Boronia inornata*

8. *Eucalyptus flocktoniae* open mallee woodland/ *Melaleuca ulicoides* heathland (Eflo/ Mgor)

Description: *Eucalyptus flocktoniae* mallee woodland; *Melaleuca ulicoides* heathland
Soil: Fine brown loam **Landform:** Mid slope
Quadrat: K77
Regional Extent: Concordant with regional mapping unit "36. *Eucalyptus flocktoniae/ Melaleuca sp. Gorse* (Eflo/ Mgor)" (Craig et al 2008) of which 188 ha has been mapped in the Ravensthorpe Range.

Lifeform	% Cover	Characteristic taxa
Mallee <10m	10-30%	*Eucalyptus flocktoniae*
Shrubs <2m	30-60%	*Melaleuca ulicoides, M. stramentosa, Gastrolobium parviflorum*
Ground	10-30%	*Gahnia aristata, Coopernookia polygalacea*

9. Eucalyptus proxima mallee shrubland (Epro)

Description: *Eucalyptus proxima* mallee shrubland; *Cassytha melantha* vineland

Soil: Orange brown sandy clay loam **Landform:** Gentle slope lower slope

Quadrat: K79

Regional Extent: Concordant with regional mapping unit "45. *Eucalyptus proxim* (Epro)" (Craig et al 2008) of which 50 ha has been mapped in the Ravensthorpe Range.

Lifeform	% Cover	Characteristic taxa
Mallee <10m	30-70%	*Eucalyptus proxima, Eucalyptus flocktoniae*
Shrubs <2m	<10%	*Acacia glaucoptera, Daviesia nematophylla, Boronia inornate, Coopernookia strophiolata*
Vine	30-70%	*Cassytha melantha*