



SMC: Blue Hills Mungada West and East (Tenements M59/595 and M59/596)
Infrastructure Areas; Targeted Flora Surveys June, July and September 2011



This document describes the vegetation and flora recorded during targeted flora surveys carried out for Sinosteel Midwest Corporation in June, July and September 2011 on tenements M59/595 and M59/596 at Mungada West and East at Blue Hills. It also discusses the significance of the flora and vegetation of the Infrastructure Areas surveyed and estimates impacts to the significant flora and vegetation of these areas.

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Summary

Introduction

- Sinosteel Midwest Corporation Limited was granted approval to mine direct shipping ore from Mungada West and East within its Blue Hills mining tenements under Ministerial Statement 811, published by the Environmental Protection Agency in November 2009.
- SMC wishes to increase the size of the pits and waste dumps at both Mungada West and East and also to construct associated infrastructure to support the two mine areas.
- A section 45c is to be lodged seeking approval to amend the areas approved at Blue Hills under MS 811.
- Maia Environmental Consultancy Pty Ltd was contracted to carry out a targeted flora survey over the approximately 44 ha of these additional areas (Infrastructure Areas).

Surveys

- Database and literature searches were carried out before the surveys.
- The targeted flora surveys were not carried out over the areas already surveyed for the original project approvals.
- The surveys were carried out by three botanists with experience of the flora and vegetation of the area on selected days between June 17-26, July 13-15 and September 14-27, 2011.
- The botanists surveyed the polygons walking transects from 10 to 15 m apart depending on the density of the vegetation and on the topography of the area being surveyed. Transects were also walked outside of the Infrastructure Areas to gather comparative data on numbers of significant flora species recorded within the Infrastructure Areas.
- Vegetation in quadrats was not assessed as Woodman Environmental Consulting has already mapped the vegetation on Gindalbie and SMC tenements at Blue Hills and Maia was able to use the data from this mapping.

Flora

- One hundred and seventy-nine taxa from 104 genera and 46 families were recorded from areas surveyed within and outside the Infrastructure Areas. The families with the highest number of taxa were Fabaceae (29), Asteraceae (24) and Myrtaceae (17). The genera with the highest number of taxa were *Acacia* (21), *Eremophila* (6), *Eucalyptus* and *Melaleuca* (5 each).
- *Dianella revoluta* var. *revoluta* was identified as a range extension in the Infrastructure Areas.
- No flora species protected by *Commonwealth Environment Protection and Biodiversity Conservation Act* were located in the Infrastructure Areas.
- One species protected by the *Wildlife Conservation Act* was located within the Infrastructure Areas – *Acacia woodmaniorum* (Vulnerable).
- Four Priority species were located within the Infrastructure Areas – *Lepidosperma* sp. Blue Hills (Priority 1), *Drummondita fulva*, *Micromyrtus trudgenii* and *Persoonia pentasticha* (all Priority 3).
- No weeds of national significance were located within the Infrastructure Areas.
- While not located within the Infrastructure Areas *Echium plantagineum* - (Patterson's Curse) – has been located around and within the existing pit and waste dump at Mungada East in previous surveys.
- One environmental weed species was recorded within the Infrastructure

Areas - *Arctotheca calendula*.

Vegetation

- Five of the floristic community types mapped by Woodman Environmental Consulting on Gindalbie and SMC tenements occur in the Infrastructure Areas: FCTs 1a, 12, 13 and 14 along with mosaics of FCTs 1a/2 and 4/17. Areas of degraded land were also mapped within the Infrastructure Areas.
- Vegetation condition in the Infrastructure Areas ranged from Degraded to Very Good. Disturbed areas included the existing pits and waste dumps at both Mungada East and Mungada West. Dust and rubbish were noted on and within the vegetation along an existing haul road, and there are more recent and old exploration sites in the area. The effects of goat grazing were also evident, particularly around the existing pits.
- The Priority 1 Blue Hills (Mount Karara / Mungada Ridge / Blue Hills) vegetation complexes (banded ironstone formation) priority ecological community is mapped over large areas of Blue Hills and some of the Infrastructure Areas fall within the boundaries of the PEC.

**Conservation
Significance and
Impacts – Flora**

- The regional and local conservation significance of the Threatened and Priority Flora species located in the Infrastructure Areas is summarised in Section 4.1 of this report.
- Estimated impact to each of the conservation significant flora species located within the new Infrastructure Areas is less than 7% and ranges from 0.01% (*Lepidosperma* sp. Blue Hills) to 6.53% (*Acacia woodmaniorum*).
- The cumulative impact to *Acacia woodmaniorum* (9.22%) and *Lepidosperma* sp. Blue Hills (0.14%) from SMC operations alone is estimated to be 10%; however when impacts from Gindalbie and SMC operations are estimated, the cumulative impacts are 12.59% to *A. woodmaniorum* and 68.8% to *Lepidosperma* sp. Blue Hills.

**Conservation
Significance and
Impacts –
Vegetation**

- The regional and local conservation significance of the vegetation of the Survey Corridor is summarised in Section 4.2 of this report.
- Potential impacts from the proposed works on land systems, significant flora and vegetation of the Infrastructure Areas are discussed in the report and summarised in Section 5.7.
- Impacts to FCTs from the new Infrastructure Areas only, and calculated using the area mapped within SMC's tenements (i.e. the local area) are all below 10%. When impacts to FCTs are calculated based on the wider area (the total area mapped by Woodman Environmental) they are all below 3%.
- Cumulative impact to the FCTs mapped within SMC's tenements are less than 16%. and when calculated based on the wider area, are all below 5%.
- When the cumulative impacts from both SMC and Gindalbie operations are calculated, they are higher and range from 5.88% to 65.08%.
- The cumulative impacts from SMC's pre-approved and new Infrastructure areas on the PEC will be 1.6%.

Conclusions

- The five significant flora species located within the Infrastructure Areas also occur outside the Infrastructure Areas in large numbers.
- The three significant FCTs of the Infrastructure Areas are also mapped outside the Infrastructure Areas.
- The highest estimated impact to a FCT or significant flora species is 15.87% when impact calculations are based on the local area (i.e. significant species

and FCTs occurring in SMC's tenements). These impacts become less than 5% when calculations are based on the wider area surveyed by Woodman and Maia on both Gindalbie and SMC tenements. Cumulative impacts from SMC and Gindalbie operations on *Acacia woodmaniorum* and *Lepidosperma* sp. Blue Hills are high at 12.59 and 68.82% respectively.

- Cumulative impacts from SMC and Gindalbie operations on the significant FCTs of the area are high at 10.85% (FCT12), 56.10% (FCT13) and 65.08% (FCT14).
- Cumulative impacts from SMC operations on the PEC will be 1.6%.
- Should approval be granted for the proposed expansion, and given the conservation significance of the vegetation and flora species of the Infrastructure Areas and surrounds, SMC should adhere to the management measures detailed in its Environmental Management Plan for the Blue Hills project. SMC should pay particular attention to: demarcation of clearing boundaries, the use of a ground disturbance permitting system, dust suppression measures, weed control procedures, restrictions on off road driving and fire prevention measures to reduce indirect impacts to the vegetation and flora of the PEC from the proposed activities.

SMC: Blue Hills Mungada West and East (Tenements M59/595 and M59/596) Infrastructure Areas

TARGETED FLORA SURVEY JUNE, JULY AND SEPTEMBER 2011

1 INTRODUCTION

1.1 Background

Sinosteel Midwest Corporation Limited (SMC) was granted approval to mine direct shipping ore from Mungada West and East within its Blue Hills mining tenements under Ministerial Statement (MS) 811, published by the Environmental Protection Agency (EPA) in November 2009. However, SMC wishes to increase the size of the pits and waste dumps at both Mungada West and East and also to construct associated infrastructure to support the two mine areas. A section 45c is to be lodged with the EPA seeking approval to amend the areas approved under MS 811.

Under Schedule 1 of MS 811 the following original areas were approved (EPA, 2009):

- Mine haematite from an area of 5.3 ha on Mining Lease 59/595 at Mungada West in the Shire of Perenjori and construct one waste dump; and
- Mine haematite from an area of 6.4 ha on Mining Lease 59/596 at Mungada East in the Shire of Perenjori and construct one waste dump.

At Mungada East the vegetation clearing is a maximum of 18.8 ha and the pre-disturbed area is 6.4 ha while at Mungada West vegetation clearing is a maximum of 22 ha and the pre-disturbed area is 5.3 ha (EPA, 2009).

Mungada West and East at Blue Hills are located approximately 60 km north-east of Perenjori and 85 km east of Morawa (Figure 9.1, Section 9).

1.2 Project Scope of Work

Maia Environmental Consultancy Pty Ltd (Maia) was contracted to carry out a targeted flora survey over the approximately 44 ha of the additional areas at Blue Hills (Infrastructure Areas). The targeted flora survey was not carried out over the areas already surveyed by Ecologia (2008a) for the original project approvals (Figure 9.2, Section 9).

2 BACKGROUND INFORMATION

2.1 Database and Literature Searches

Before carrying out the survey, searches were conducted of the following databases:

- EPBC Act Protected Matters Search Tool (DSEWPaC, 2011a);
- NatureMap (DEC, 2011a).

The following co-ordinates were used for the searches:

- -29 07 35 S, 116 52 35 E (GDA94. MGA50).

A 20 km radius buffer was used around the coordinates for the NatureMap search and a 10 km radius buffer when using the Protected Matters Search Tool.

Available literature was also searched for conservation significant flora previously recorded in the area.

The results of the database searches are discussed in Section 2.3. A list of conservation significant flora species produced by the database searches and included in other reports on surveys carried out in the area is included as Table A1.1 (Appendix 1).

2.2 Survey Method

The surveys were carried out by three botanists with experience of the flora and vegetation of the area between June 17-26, July 13-15 and selected days between September 14-27, 2011. Shape files for the areas to be surveyed were supplied to Maia before going to site and uploaded onto handheld GPSs. The areas surveyed are shown in Figure 9.2, Section 9.

The botanists surveyed the polygons walking transects from 10 to 15 m apart depending on the density of the vegetation and on the topography of the area being surveyed. Transects were also walked outside of the Infrastructure Areas to gather comparative data on numbers of significant flora species recorded within the Infrastructure Areas. Transects outside the Infrastructure Areas were chosen based on the habitats within which conservation significant flora species were recorded in the Infrastructure Areas.

Before carrying out the surveys, the botanists familiarised themselves with the known conservation significant flora species of the area; while carrying out the surveys the botanists targeted conservation significant flora and weed species. Locations of known and potential conservation significant flora and weed species were recorded on a GPS and their numbers counted. Specimens of each conservation significant species encountered during the survey were collected for post-survey taxonomic verification.

Notes were made on the vegetation and its condition within the Infrastructure Areas and photographs were taken; however, vegetation in quadrats was not assessed as Woodman Environmental Consulting (Woodman, 2008) has already mapped the vegetation on Gindalbie's and SMC's tenements and Maia was able to use the data from this mapping.

2.3 Conservation Significant Species Previously Recorded at Blue Hills

The Blue Hills Ranges are located in the Yalgoo Bioregion. Currently, 13 records exist for Threatened species and 171 records for Priority Flora species in the Yalgoo Bioregion (FloraBase, 2012).

Three Threatened species have been recorded previously at Blue Hills. Two of these (*Acacia woodmaniorum* and *Stylidium* sp. Yalgoo (D. Coultas et al. Opp 01)) have been recorded either within or close to SMC's tenements at Blue Hills during previous surveys carried out in the area (Markey & Dillon, 2008; Ecologia, 2007; Woodman Environmental Consultants, 2008) (Table A1.1, Appendix 1).

The annual species *Stylidium* sp. Yalgoo has been recorded at locations outside the boundary of SMC's tenements.

Thirty-three Priority Flora species including nine Priority 1 species, four Priority 2 and 20 Priority 3 species have been recorded previously at or adjacent to Blue Hills (Table A1.1, Appendix 1).

The DEC recorded 14 currently listed Priority Flora species during its survey of the central extent of the Tallering Land System (Markey & Dillon, 2008) (Table A1.1, Appendix 1).

Twenty-one currently listed Priority Flora species were recorded by Woodman Environmental Consulting (2008) during multiple surveys around Blue Hills (Table A1.1, Appendix 1). Thirteen of these 21 species were recorded within SMC tenements.

Ecologia (2007) recorded six Priority Flora species during a targeted flora survey of proposed exploration drilling areas at Blue Hills and one Priority Flora species during a targeted flora survey of areas proposed for a hydrological drilling programme at Blue Hills (Table A1.1, Appendix 1) (Ecologia, 2008b).

2.4 Land Systems

The Department of Agriculture and Food Western Australia (DAFWA) produced an inventory and condition survey of the Sandstone-Yalgoo-Paynes Find area of Western Australia and mapped the land systems (LS) occurring in the area (Payne *et al.*, 1998). Two LS occur within the Infrastructure Areas and these and associated land forms and vegetation are described in Table 2.1.

Table 2.1: Land Systems, Landforms and Vegetation of the Infrastructure Areas

Land System	Landform and Vegetation
Tallering	Prominent ridges and hills of banded ironstone, dolerite and sedimentary rocks supporting bowgada and other acacia shrublands.
Yowie	Sandy plains supporting shrublands of mulga and bowgada with patchy wanderrie grasses.

2.5 Beard's Vegetation Mapping

Blue Hills is located in the Yalgoo Subregion of the Austin Botanical District within the Eremaean Botanical Province (Beard, 1976). The vegetation of the Infrastructure Areas was mapped as part of the Murchison Region mapping at a scale of 1:1 000 000 by Beard (1976), and the Infrastructure Areas are located in the southern Murchison Region. Beard's vegetation mapping has been digitised and updated by DAFWA (2010). The vegetation within the Infrastructure Areas has been mapped into two broad structural vegetation associations (Table 2.2).

Table 2.2: Vegetation Associations Mapped By Beard in the Infrastructure Area

Beard Code	Vegetation Association Code	Broad Floristic Formation (NVIS Level 3)	Sub-association Description (NVIS Level 6)
a9,14Si	358.5	<i>Acacia</i> open shrubland	<i>Acacia ramulosa</i> , <i>Acacia quadrimarginea</i> , <i>Acacia acuminata</i> , <i>Hakea preissii</i> and <i>Dodonaea inaequifolia</i> Tall Open Shrubland
e6,22Lr a9,19Si	355.2	<i>Acacia</i> open shrubland	<i>Eucalyptus loxophleba</i> and/or <i>Eucalyptus oleosa</i> Isolated Low Trees with <i>Acacia aneura</i> and <i>Acacia ramulosa</i> Tall Open Shrubland

Note: NVIS = National Vegetation Information Systems (ESCAVI, 2003).

The Austin Botanical District is dominated by low mulga (*Acacia aneura*) woodland on the plains and reduced to *Acacia* scrub on the hills (Beard, 1976). The vegetation of the hills is dominated by shrublands of *Acacia aneura*, *Acacia quadrimarginea*, *Acacia ramulosa* and *Acacia grasbyi* over *Senna* and *Eremophila* shrubs.

The Government of Western Australia (2010) has calculated the pre-European extent of Beard's vegetation units, the current extent of Beard's vegetation units, how much of each association lies in reserves and how much in pastoral leases managed by the Department of Environment and Conservation (DEC). The data for the vegetation associations of the Infrastructure Areas are included in Table 2.3.

More than 50% of these two vegetation associations is currently represented in reserves or pastoral leases. More than 77% and 99% (respectively) of Beard's units a9,14Si and e6,22Lr a9,19Si currently remain (Government of Western Australia, 2010).

Table 2.3: Beard's Vegetation Associations of the Infrastructure Areas - Past and Current Extent and Reservation Status

Beard Code (and Vegetation Association Code)	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)	IUCN class 1-4 Reserves + Former Leasehold	Pastoral Leases Managed by DEC (%)
a9,14Si (358.5)	4,945.37	3,828.23	77.41	50.50	95.81
e6,22Lr a9,19Si (355.2)	23,534.94	23,521.70	99.94	73.67	73.67

2.6 Vegetation of the Study Area and Surrounds

Bennett Consulting Ecologists (2004) carried out a flora and vegetation survey of SMC's Blue Hills tenements for ATA in October 2003. Bennett assessed 29 quadrats and 13 relevés and mapped 15 vegetation associations over the two tenements (Figure 9.3, Section 9). Bennett's vegetation descriptions have been updated using National Vegetation Information System (NVIS) methodology at the association level, Level 5 (Table 2.4).

Table 2.4: Vegetation Associations Mapped at Blue Hills by Bennett Consulting Ecologists (2004)

Vegetation Code	Habitat	Vegetation Association (NVIS Level 5)
AaPo	Hills and slopes	Tall Shrubland of <i>Acacia ramulosa</i> var. <i>ramulosa</i> with a Low Sparse Shrubland of <i>Philotheca sericea</i> and Sparse Forbland of Asteraceae species.
Aan	Hills and slopes	Sparse Tall Shrubland of <i>Acacia aneura</i> with a Sparse Low Shrubland of <i>Philotheca sericea</i> .
ApCp	Hills and slopes	Sparse Tall Shrubland of <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , <i>Calycopeplus pauciflorus</i> , <i>Melaleuca nematophylla</i> and <i>Acacia</i> species.
Arr	Hills and slopes	Tall Shrubland of <i>Acacia ramulosa</i> var. <i>ramulosa</i> with a Sparse Low Shrubland of <i>Philotheca sericea</i> and Open Forbland of Asteraceae species.
Deg	Degraded	Degraded areas, mined previously.
EL	Calcrete	Open Low Woodland to Low Woodland of <i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i> with a Low Shrubland of <i>Logania</i> sp.
Ek	Sandy flats	Open Mallee Forest of <i>Eucalyptus kochii</i> subsp. <i>plenissima</i> and <i>Eucalyptus ewartiana</i> with a Tall Shrubland of <i>Acacia ramulosa</i> var. <i>ramulosa</i> and Sparse Forbland of Asteraceae species.
EI	Hills and slopes	Low Woodland to Low Open Forest of <i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i> with a Chenopod Shrubland of Chenopodiaceae species.
Ele	Hills and slopes	Mallee Woodland of of <i>Eucalyptus leptopoda</i> with a Sparse Tall Shrubland of <i>Acacia ramulosa</i> var. <i>ramulosa</i> +/- <i>Acacia aneura</i> and Open Forbland of mixed species.
Ew	Hills and slopes	Mallee Woodland of of <i>Eucalyptus ewartiana</i> with a Sparse Tall Shrubland of <i>Acacia ramulosa</i> var. <i>ramulosa</i> and Open Forbland of Asteraceae species.
Ma	Calcrete	Sparse Tall Shrubland to Tall Shrubland of <i>Melaleuca</i> aff. <i>acuminata</i> subsp. <i>websteri</i> with an Open Forbland of Asteraceae species.
MaEL	Calcrete	Tall Shrubland of <i>Melaleuca</i> aff. <i>acuminata</i> subsp. <i>websteri</i> with Scattered Low Trees of <i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i> and Open Forbland of mixed species.
MnEw	Hills and slopes	Tall Shrubland of <i>Melaleuca nematophylla</i> and <i>Acacia ramulosa</i> var. <i>ramulosa</i> with an Open Low Shrubland of <i>Philotheca sericea</i> , Open Forbland of Asteraceae species and Scattered Low Mallee Trees of <i>Eucalyptus ewartiana</i> .
Mu	Hills and slopes	Tall Shrubland of <i>Acacia ramulosa</i> , <i>Acacia burkitti</i> , <i>Melaleuca leiocarpa</i> and <i>Melaleuca uncinata</i> with an Open Forbland of Asteraceae species.
Tr	Hills and slopes	Closed Low Shrubland of <i>Thryptomene ramulosa</i> with Scattered Shrubs of <i>Acacia</i> species and Scattered Forbs of mixed species.

Note: Bennett's vegetation descriptions have been updated using the NVIS methodology at the Association Level (Level 5); at this level up to three strata and a maximum of three taxa per stratum are used to describe the association (ESCAVI, 2003).

More recently Woodman Environmental Consulting (2008) mapped three vegetation Super Groups and 23 Floristic Community Types (FCTs) between Mt Karara and Mungada Ridge (Table 2.5). Fourteen of the FCTs are mapped on SMC's Blue Hills tenements: FCT1a, 1b, 2, 3, 7b, 7c, 8, 10a, 11, 12, 13, 14, 15 and FCT16 (Figure 9.4, Section 9). Woodman also mapped mosaics of FCTs 1a/2, 4/17 and 11/9 within the tenements as well as degraded areas. Woodman rated the following FCTs as having the highest conservation significance (i.e. rated 5 on a scale of 1 to 5): FCT8, 11, 12 and FCT13 and the mosaic of FCT11/9. This was followed by FCT14, 10a, 10b, 9 and FCT4 and the mosaic of FCT4/17, which were ranked as 4 by Woodman. These ratings were based on the restricted habitat and the higher number of Priority species found within those FCTs. Four of the highly significant FCTs (FCT8, 11, 12 and FCT13) occur within SMC's Blue Hills tenements along with two of the next highest – FCT14 and 10a and the mosaic of FCT4/17.

Of these, FCT 13 is considered to be of high conservation significance by the EPA, as the community is regionally restricted and would be impacted by mining resulting in fragmentation of the community (EPA, 2009).

Four FCTs and two mosaics (FCT 1a, 12, 13, 14, 1a/2 and 4/17 - highlighted grey in Table 2.5) plus land mapped as degraded occur within the Infrastructure Areas (Figure 9.4, Section 9).

Table 2.5: FCTs on SMC's Blue Hills Tenements - Woodman Environmental Consulting (2008)

Code	Floristic Community Types
1a	Open Woodland of <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> with Open Shrubland dominated by <i>Acacia tetragonophylla</i> and <i>A. obtecta</i> over chenopod species including <i>Sclerolaena fusiformis</i> , <i>Sclerolaena diacantha</i> and <i>Rhagodia drummondii</i> on flats and drainage depressions.
1b	Shrubland dominated by <i>Acacia</i> species including <i>Acacia burkittii</i> , <i>A. tetragonophylla</i> and <i>A. inceana</i> subsp. <i>conformis</i> over mixed species including <i>Eremophila pantonii</i> , <i>Solanum nummularium</i> and <i>Rhagodia drummondii</i> on flats with occasional ironstone/granite gravels.
2 (in mosaic)	Open Woodland of <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> and/or <i>E. striatocalyx</i> subsp. <i>striatocalyx</i> over Shrubland of mixed species including <i>Acacia erinacea</i> , <i>Eremophila pantonii</i> and <i>Senna stowardii</i> over mixed species including <i>Sclerolaena fusiformis</i> and <i>Scaevola spinescens</i> on flats and rocky lower slopes with ironstone gravels.
3	Open Woodland of <i>Eucalyptus kochii</i> subsp. <i>?plenissima</i> or Shrubland of <i>Acacia tetragonophylla</i> , <i>A. burkittii</i> and <i>A. assimilis</i> subsp. <i>assimilis</i> over mixed species including <i>Rhagodia drummondii</i> , <i>Scaevola spinescens</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> and <i>Eremophila clarkei</i> on flats to mid slopes with ironstone gravels and rarely banded ironstone formations (BIF).
4 (in mosaic)	Shrubland dominated by <i>Acacia ramulosa</i> subsp. <i>ramulosa</i> over sparse mixed species on flats and slopes.
7b	Woodland of <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> over <i>Muehlenbeckia florulenta</i> , <i>Teucrium racemosum</i> and <i>Sclerolaena fusiformis</i> on open drainage depression.
7c	Open Woodland of <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> or <i>Eucalyptus striatocalyx</i> subsp. <i>striatocalyx</i> or Shrubland of <i>Melaleuca lateriflora</i> over chenopod species including <i>Sclerolaena diacantha</i> , <i>Maireana carnososa</i> and <i>M. thesioides</i> on drainage depressions and lower slopes.
8	Shrubland of mixed <i>Acacia</i> species, including <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>A. ramulosa</i> subsp. <i>ramulosa</i> and <i>A. burkittii</i> , and <i>Melaleuca nematophylla</i> and <i>Calycopeplus paucifolius</i> with occasional <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> and <i>Callitris columellaris</i> , over mixed species including <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , <i>E. clarkei</i> , <i>Philotheca sericea</i> , <i>Prostanthera magnifica</i> and <i>Aluta aspera</i> subsp. <i>hesperia</i> on upper slopes and crests with BIF outcropping.

Code	Floristic Community Types
9 (in mosaic)	Shrubland of mixed <i>Acacia</i> species, including <i>Acacia umbraculiformis</i> ms, <i>A. tetragonophylla</i> and <i>A. assimilis</i> subsp. <i>assimilis</i> , and occasional <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> over mixed species including <i>Eremophila clarkei</i> , <i>E. latrobei</i> subsp. <i>latrobei</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> , <i>P. sericea</i> , <i>Xanthosia bungei</i> and <i>Mirbelia bursarioides</i> ms on midslopes to crests with BIF or cherty soils.
10a	Dense Shrubland of mixed <i>Acacia</i> species including <i>A. tetragonophylla</i> and <i>A. exocarpoides</i> , and <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> with occasional <i>Eucalyptus petraea</i> over mixed species including <i>Calycopheplus paucifolius</i> , <i>Dodonaea inaequifolia</i> , <i>Philotheca sericea</i> and occasional <i>Acacia woodmaniorum</i> (Threatened) on upper slopes to crests on BIF.
11	Shrubland of <i>Acacia</i> species dominated by <i>A. umbraculiformis</i> ms over mixed species including <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Mirbelia bursarioides</i> ms, <i>Philotheca sericea</i> , <i>Micromyrtus trudgenii</i> (Priority 3) on lower slopes to upper slopes with ironstone gravels and occasional BIF.
12	Shrubland of <i>Acacia</i> species including <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>Acacia ramulosa</i> subsp. <i>ramulosa</i> , <i>Acacia exocarpoides</i> and <i>Acacia sibina</i> over mixed species including <i>Hibbertia arcuata</i> , <i>Calycopheplus paucifolius</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> on flats to mid-upperslopes with ironstone gravels.
13	Dense Shrubland of <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> with <i>Melaleuca nematophylla</i> over <i>Grevillea paradoxa</i> , <i>Xanthosia bungei</i> and <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (Priority 1) on mid-upper slopes on BIF.
14	Shrubland of <i>Acacia</i> species including <i>A. assimilis</i> subsp. <i>assimilis</i> and <i>Acacia ramulosa</i> subsp. <i>ramulosa</i> and <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> with emergent <i>Eucalyptus leptopoda</i> subsp. <i>elevata</i> over mixed species including <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Prostanthera magnifica</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> on slopes and ridges.
15	Shrubland of mixed <i>Acacia</i> species including <i>A. burkittii</i> , <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>A. latior</i> ms and <i>A. sibina</i> with <i>Melaleuca hamata</i> over <i>Eremophila</i> spp., <i>Malleostemon tuberculatus</i> and <i>Philotheca deserti</i> subsp. <i>deserti</i> on flats and lower slopes.
16	Shrubland of <i>Acacia</i> species dominated by <i>A. latior</i> ms and <i>Melaleuca leiocarpa</i> with emergent <i>Eucalyptus leptopoda</i> var. <i>arctata</i> over mixed species including <i>Wrixonia prostantheroides</i> , <i>Enekbatus stowardii</i> ms, <i>Aluta aspera</i> subsp. <i>hesperia</i> and <i>Hibbertia stenophylla</i> on flats to mid slopes.
17 (in mosaic)	Shrubland of <i>Acacia</i> species dominated by <i>A. sibina</i> and <i>A. latior</i> ms with <i>Melaleuca hamata</i> and / or <i>Melaleuca leiocarpa</i> with emergent <i>Eucalyptus ewartiana</i> on flats.

Markey & Dillon (2008) undertook a quadrat based survey on the flora and floristic communities of several ironstone ranges and outcrops on the central Tallering Land System as part of a series of surveys on the flora and vegetation of the banded iron formations of the Yilgarn Craton undertaken by the DEC. Twenty quadrats were assessed on Windanning Hill along with an additional 83 quadrats surveyed on other hills of the central Tallering System. Of the five main groups and eight FCTs described by Markey and Dillon (2008), five occur in the Mungada area (Communities 1b, 2, 3, 4a, 5b) (Table 2.6).

Table 2.6: FCTs Described By Markey And Dillon (2008)

Code	Floristic Community Type
1b	Speciose shrublands on the shallow, loamy soils of hillslopes and isolated ridges of the survey area. <i>Acacia</i> (<i>A. sibiana</i> , <i>A. ramulosa</i> var. <i>ramulosa</i>) and <i>Allocasuarina</i> dominated shrublands and thickets over a rich shrub understorey, and often with emergent trees of <i>Eucalyptus</i> and <i>Melaleuca leiocarpa</i> .

Code	Floristic Community Type
2	Tall shrublands of <i>Allocasuarina acutivalvis</i> , <i>Melaleuca nematophylla</i> , <i>Grevillea paradoxa</i> and <i>Gastrolobium laytonii</i> and the low shrubs <i>Aluta aspera</i> subsp. <i>hesperia</i> , and <i>Xanthosia bungei</i> .
3	Sparse shrublands on the crests and moderately steep slopes of low escarpments, ridges and outcrops of BIF. Characteristic species include <i>Stylidium longibracteatum</i> , <i>Micromyrtus trudgenii</i> (P3) and <i>Calytrix uncinata</i> (P3). <i>Acacia aulacophylla</i> , <i>Eremophila glutinosa</i> , <i>Melaleuca hamata</i> (rarely encountered, with both occurrences in this community type), <i>Austrodanthonia caespitosa</i> , <i>Mirbelia bursarioides</i> , <i>Cheiranthra filifolia</i> var. <i>simplicifolia</i> , <i>Drummondita fulva</i> (P3), <i>Prostanthera patens</i> and <i>Thryptomene costata</i> are significant indicator species.
4a	Open stands of <i>Callitris collumelaris</i> and sparse shrublands on steep, rocky or boulder-strewn ridges, cliffs and tors with shallow loamy soils. Notable and significant indicator species include the shrubs <i>Calycopeplus pauciflorus</i> , <i>Dodonaea petiolaris</i> and <i>Dodonaea viscosa</i> , the rockferns, <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> , <i>Cheilanthes lasiophyllum</i> and <i>Pleurosorus rutifolius</i> and the herbaceous <i>Isotoma petraea</i> .
5b	Lowland open <i>Eucalyptus</i> woodlands and <i>Acacia ramulosa</i> var. <i>ramulosa</i> shrublands over sparse shrubs of <i>Senna</i> , <i>Ptilotus obovatus</i> var. <i>obovatus</i> , <i>Scaevola spinescens</i> and chenopods. Located on gently sloping – flat lower slopes and outwash plains, on deeper red earths. Significant indicator species include <i>Eucalyptus kochii</i> subsp. <i>amaryssia</i> , <i>Maireana planifolia</i> x <i>villosa</i> , <i>Olearia humilis</i> , and the two characteristic species of <i>Senna</i> , <i>S. charlesiana</i> and <i>S. artemisioides</i> subsp. <i>filifolia</i> .

3 RESULTS

3.1 Species Recorded

One hundred and seventy-nine taxa from 104 genera and 46 families were recorded from the areas surveyed both within and outside the Infrastructure Areas. The families with the highest number of taxa were Fabaceae (29), Asteraceae (24) and Myrtaceae (17). The genera with the highest number of taxa were *Acacia* (21), *Eremophila* (6), *Eucalyptus* and *Melaleuca* (5 each).

Approximately 37% of the species were identified from flowering material, 13% from fruiting material and 9% from both flowering and fruiting material. Annual taxa comprise 29% of the species list and perennial taxa 71%.

The identity of a *Lepidium* sp. could not be confirmed due to a lack of reproductive material.

Acacia aneura varieties are under taxonomic revision and some of the specimens collected have been listed as *Acacia aneura*.

A list of the vascular flora species recorded is provided as Table A2.1, Appendix 2.

3.2 Range Extensions

Species have a typical range which is indicated by their known distribution records. Sometimes species are recorded during surveys which have not been previously located in the area; these species are described as range extensions. In many cases a range extension reflects a lack of surveys in a particular area or lack of submissions of flora records to the Western Australian herbarium as opposed to being a true range extension.

- One species, *Dianella revoluta* var. *revoluta*, was identified as a range extension in the Infrastructure Areas. *Dianella revoluta* var. *revoluta* is 400 km north of its closest record near Corrigin (Avon Wheatbelt Bioregion). This species is widely spread across the south-west of Australia (FloraBase, 2011).

3.3 Conservation Significant Flora

3.3.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

Some flora species are protected under Commonwealth legislation based on the perceived levels of threat to the species population at a national level. These species are placed within one of six conservation categories (Table A3.1, Appendix 3) and four of these categories are specially protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act (EPBC Act)* (DSEWPaC, 2011b).

The search using the *EPBC Act* Protected Matters Search Tool indicated that three flora species protected by the *EPBC Act*, including the species habitat, have the potential to occur in the Infrastructure Areas and surrounds: *Eremophila viscida* (Endangered), *Hybanthus cymulosus* (Critically Endangered) and *Pityrodia axillaris* (Critically Endangered).

- No flora species protected by the *EPBC Act* were located in the Infrastructure Areas.

3.3.2 Western Australian Wildlife Conservation Act (1950-1979)

All flora species native to Western Australia are protected under the State's *Wildlife Conservation Act (WC Act)*. The Minister for the Environment may declare species of flora to be protected by the *WC Act* if they

are considered to be in danger of extinction, rare or otherwise in need of special protection: Schedules 1 and 2 deal with those species that are declared as Threatened and Presumed Extinct respectively (DEC, 2011b).

In Western Australia the term Threatened Flora is applied to extant Declared Rare Flora (DRF) and Presumed Extinct Flora to extinct DRF (DEC, 2011b and defined in Table A3.2, Appendix 3). The most recent DRF list was published in February 2012 (Government of Western Australia, 2012).

Currently, 13 records exist for Threatened Flora species in the Yalgoo Bioregion (FloraBase, 2012). Of these records, three species listed under the *WC Act* are known to occur within or in the vicinity of the SMC's tenements: *Acacia woodmaniorum* (Vulnerable), *Eucalyptus synandra* (Vulnerable) and *Stylidium* sp. Yalgoo (Vulnerable).

- *Acacia Woodmaniorum* was recorded in high numbers on the south facing slopes of the Mungada East ridge and Mungada East pit and in lower numbers in previously disturbed areas around the existing Mungada West pit. *A. woodmaniorum* was recorded within the Infrastructure Areas and also in the areas surveyed outside. A description for and photographs of *A. woodmaniorum* are included below and locations are shown on Figure 9.5, Section 9.
- *Stylidium* sp. Yalgoo was targeted during the September 2011 survey, however, none were located within the Infrastructure Areas or in any transects and polygons walked outside the Infrastructure Areas but within SMC's tenements.

***Acacia woodmaniorum* (Threatened Flora)**

A. woodmaniorum is a prickly, hard shrub growing up to 2 m high on the southern faces of hill slopes and crests of banded ironstone and laterite (Plate 3.1). The branches are intricate and the marginal nerve is red in younger leaves (phyllodes) but ages to yellow on older leaves (Plates 3.2 and 3.3). The bark is grey and slightly rough. *A. woodmaniorum* produces yellow flowers during July (Plate 3.2) (FloraBase, 2011) and the pods produced after flowering are narrowly oblong and flat but slightly rounded over the seeds (Plate 3.3) (Maslin & Buscumb, 2007).

One thousand nine hundred and sixty-six *A. woodmaniorum* plants were recorded within the Infrastructure Areas (Figure 9.5a and b, Section 9). The co-ordinates for these plants are not included in this report but have been supplied to SMC separately.



Plate 3.1: Growth habit



Plate 3.2: Close-up of leaves and flowers



Plate 3.3: Close-up of leaves and pods

3.3.3 Priority Flora

Because of the large Western Australian flora, many species are known from only a few collections, or a few sites, and have not been adequately surveyed. Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List 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. 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 list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5 (DEC, 2011b).

Definitions for each of the categories discussed above are included in Table A3.3, Appendix 3. The most recent Priority Flora List was published in September 2010 (Smith, 2010).

FloraBase (2012) lists 171 Priority Flora species for the Yalgoo Bioregion. The NatureMap search indicated that 31 Priority species have been recorded at or in the vicinity of the areas surveyed. These records include: nine Priority 1 species, four Priority 2 species and 18 Priority 3 species (Table A1.1, Appendix 1).

Two additional Priority species were listed in reports on other surveys carried out in the area (Table A1.1, Appendix 1) bringing the total to 33.

- Four Priority Flora species were located in the Infrastructure Areas: *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (Priority 1), *Drummondita fulva*, *Micromyrtus trudgenii* and *Persoonia pentasticha* (all Priority 3).
- Three additional Priority Flora species (*Acacia karina*, *Calotis* sp. Perrinvale Station and *Micromyrtus acuta* – Priority 2, Priority 3 and Priority 3 respectively), and one species of interest (*Baekkea* sp. Blue Hills) were located outside the Infrastructure Areas when walking transects and polygons (Table A2.1, Appendix 2).

Descriptions for and photographs of the Priority Flora species recorded within the Infrastructure Areas follow and their locations are listed in Table A4.1, Appendix 4 and shown on Figure 9.6, Section 9. Details on known recorded locations for the species are included in Table A1.1, Appendix 1 (species shaded grey). The coordinates for these plants are included as Table A4.1, Appendix 4.

***Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (Priority 1)**

L. sp. Blue Hills is a sedge growing to 0.5 m on hill slopes, breakaways and rocky outcrops of laterite, granite, banded ironstone and sandstone rock (Plate 3.4). *L. sp. Blue Hills* produces brown flowers during September (Plate 3.5) (FloraBase, 2011).

Five *L. sp. Blue Hills* plants were located within the Infrastructure Areas (Figure 9.6).



Plate 3.4: Growth habit



Plate 3.5: Close-up of leaves and flowers

***Drummondita fulva* (Priority 3)**

D. fulva is an erect, branching shrub growing to 1.5 m on lower hill slopes and hill crests of banded ironstone and associated meta-sedimentary rock (Plate 3.6). The branchlets are smooth with glandular ridges. The fleshy leaves are club-shaped and green with a terminal reddish-brown tip (Plate 3.7). *D. fulva* produces red flowers from September to October (FloraBase, 2011).

Fifty-five plants were recorded within the Infrastructure Areas (Figure 9.6).



Plate 3.6: Growth habit



Plate 3.7: Close-up of leaves and flower bud

***Micromyrtus trudgenii* (Priority 3)**

M. trudgenii is an erect, open, straggly weeping shrub growing to 2 m high on hill slopes and ridges of quartz, basalt, dolerite and banded ironstone (Plate 3.8). The leaves are 4-9 mm and are densely arranged on the smaller branchlets (Plate 3.9) (Rye, 2007). *M. trudgenii* produces yellow flowers from June to October (FloraBase, 2011).

Six hundred and nine plants were recorded within the Infrastructure Areas (Figure 9.6).



Plate 3.8: Growth habit



Plate 3.9: Close-up of leaves and flowers

***Persoonia pentasticha* (Priority 3)**

P. pentasticha is an erect, spreading shrub growing to 1.8 m on lower hill slopes and outcrops of granite, haematite or banded ironstone (Plate 3.10). The terete leaves are simple, folded and are covered with short simple curled hairs. *P. pentasticha* produces yellow flowers from August to November (Plate 3.11) (FloraBase, 2011).

Eleven plants were recorded within the Infrastructure Areas (Figure 9.6).



Plate 3.10: Growth habit



Plate 3.11: Close-up of leaves and flowers

3.4 Introduced Flora

A weed is defined in the Australian Weeds Strategy (DEWR, 2007) as ‘a plant which has, or has the potential to have, a detrimental effect on economic, social or conservation values’. Weeds can include species that have proliferated in bushland without direct human intervention or assistance (referred to as naturalised alien species).

3.4.1 Weeds of National Significance

In 1998, Australian governments endorsed a framework to identify which weed species could be considered to be Weeds of National Significance (WONS) within an agricultural, forestry and environmental context. Seventy-one weed species were nominated for ranking as WONS and 20 were accepted (DEC, 2011c). The criteria used to determine WONS were: the invasiveness of the weed species, the weed’s impact, the potential spread of the species, and the socio-economic and environmental values of the weed (Australian Government, 2011).

The *EPBC Act* Protected Matters Search Tool indicated that no WONS have been recorded in the area.

- No WONS were located during the survey.

3.4.2 Agriculture and Related Resources Protection Act 1976

Plants which adversely affect agriculture (or have the potential to) are known as Declared Plants and are listed as one or more of five priority category weeds under the *Agriculture and Related Resources Protection Act 1976* (DAFWA, 2011). The priority categories (Appendix 5) define the control mechanisms for these weeds.

A Declared Plants search (DAFWA, 2011) indicated that 86 Declared Plants are listed for the Morawa and Perenjori areas.

No Declared Plants were listed in the results from the search using the *EPBC Act* Protected Matters Search Tool. The NatureMap search listed two Declared Plants that have been recorded within the search area: *Echium plantagineum* (Paterson’s Curse) and *Galium aparine* (Goosegrass).

- No Declared Plants were located within the Infrastructure Areas, however large numbers of *Echium plantagineum* (Paterson’s Curse) were recorded by Ecologia during a survey in 2006 on disturbed areas of the lower slopes of the old Mungada East mining pit (EPA, 2009).

3.4.3 Environmental Weeds

Environmental weeds are not known to pose a threat to agriculture, but are known to be invasive colonisers that can threaten the health of native vegetation.

The *EPBC Act* Protected Matters Search Tool indicated that one invasive species (weed) could occur in the area: *Cenchrus ciliaris* (Buffel-grass).

The NatureMap search listed 33 weed species that have been recorded in the area.

- One environmental weed was located within the Infrastructure Areas - *Arctotheca calendula* (Figure 9.7, Section 9).
- A further nine environmental weeds (*Brassica tournefortii*, *Cleretum papulosum* subsp. *papulosum*, *Cuscuta planiflora*, *Erodium cicutarium*, *Lamarckia aurea*, *Lysimachia arvensis*, *Pentaschistis airoides* subsp. *airoides*, *Rostraria pumila* and *Sonchus oleraceus*) were located while walking transects and polygons in the wider area (Table A2.1, Appendix 2) (Figure 9.7, Section 9).

In Western Australia the Environmental Weed Strategy for Western Australia (EWSWA) (CALM, 1999) provides details of management priorities and general control measures and monitoring for environmental weeds. Environmental weeds are plants that establish themselves in natural ecosystems (marine, aquatic and terrestrial) and proceed to modify natural processes, usually adversely resulting in the decline of the communities they invade. Many environmental weeds are successfully invading WA ecosystems (DEC, 2011d).

The EWSWA is still relevant but Appendix 3 of the document - the 'List of Environmental Weed Species of Actual and Potential Significance in WA' is now out of date and the Invasive Plant Prioritisation Process for DEC has been developed (DEC, 2011e). The process encourages consideration of a species-led and site-led approach to control the threat of environmental weeds within WA. Workshops have been held in each DEC Region to prioritise weed species according to their threat to the natural environment and these weed assessments are now available. The Midwest Region weed assessment spread-sheet lists 65 environmental weeds for the Yalgoo Bioregion. Most of the weeds listed are rated for their invasiveness, distribution and ecological (environmental) impacts (DEC, 2011f) among other attributes. The invasiveness, distribution and ecological impact rankings for *Arctotheca calendula* are listed in Table 3.1 along with its EWSWA.

Table 3.1: Weeds in the Infrastructure Areas

Species (Common Name)	Invasiveness	Current Distribution	Ecological Impact	EWSWA Rating
<i>Arctotheca calendula</i> (Cape Weed)	Rapid	Extensive	High	Moderate

Ten *Arctotheca calendula* plants were recorded at the following location: 488895 mE, 6776315 mN (GDA94, 50J).

3.5 Vegetation

Woodman Environmental mapped 14 FCTs within SMC's tenements and those recorded in the Infrastructure Areas are described and shown in Table 3.2. The photographs were taken by Maia to provide a visual representation of the described units.

Table 3.2: Woodman’s Floristic Community Types (FCT) of the Infrastructure Areas

Code	FCT	Conservation Significant Flora Recorded in FCT	Photograph
1a	<p>Open Woodland of <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> with Open Shrubland dominated by <i>Acacia tetragonophylla</i> and <i>A. obtecta</i> over chenopod species including <i>Sclerolaena fusiformis</i>, <i>Sclerolaena diacantha</i> and <i>Rhagodia drummondii</i> on flats and drainage depressions.</p>	<p><i>Persoonia pentasticha</i> (Priority 3) recorded in mosaic with FCT 2.</p>	
2	<p>Open Woodland of <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> and/or <i>E. striatocalyx</i> subsp. <i>striatocalyx</i> over Shrubland of mixed species including <i>Acacia erinacea</i>, <i>Eremophila pantonii</i> and <i>Senna stowardii</i> over mixed species including <i>Sclerolaena fusiformis</i> and <i>Scaevola spinescens</i> on flats and rocky lower slopes with ironstone gravels.</p>	<p><i>Persoonia pentasticha</i> (Priority 3).</p>	

Code	FCT	Conservation Significant Flora Recored in FCT	Photograph
4	Shrubland dominated by <i>Acacia ramulosa</i> subsp. <i>ramulosa</i> over sparse mixed species on flats and slopes.	<i>Acacia woodmaniorum</i> (Threatened), <i>Drummondita fulva</i> (Priority 3), and <i>Micromyrtus trudgenii</i> (Priority 3) recorded in mosaic with FCT 17.	
12	Shrubland of <i>Acacia</i> species including <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>Acacia ramulosa</i> subsp. <i>ramulosa</i> , <i>Acacia exocarpoides</i> and <i>Acacia sibina</i> over mixed species including <i>Hibbertia arcuata</i> , <i>Calycopeplus paucifolius</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> on flats to mid-upperslopes with ironstone gravels.	<i>Acacia woodmaniorum</i> (Threatened), <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (P1), <i>Drummondita fulva</i> (Priority 3), <i>Micromyrtus trudgenii</i> (Priority 3), and <i>Persoonia pentasticha</i> (Priority 3).	

Code	FCT	Conservation Significant Flora Recored in FCT	Photograph
13	Dense Shrubland of <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> with <i>Melaleuca nematophylla</i> over <i>Grevillea paradoxa</i> , <i>Xanthosia bungei</i> and <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (Priority 1) on mid-upper slopes on BIF.	<i>Acacia woodmaniorum</i> (Threatened), <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (P1), <i>Drummondita fulva</i> (Priority 3), <i>Micromyrtus trudgenii</i> (Priority 3), and <i>Persoonia pentasticha</i> (Priority 3).	
14	Shrubland of <i>Acacia</i> species including <i>A. assimilis</i> subsp. <i>assimilis</i> and <i>Acacia ramulosa</i> subsp. <i>ramulosa</i> and <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> with emergent <i>Eucalyptus leptopoda</i> subsp. <i>elevata</i> over mixed species including <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Prostanthera magnifica</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> on slopes and ridges.	<i>Acacia woodmaniorum</i> (Threatened), <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (P1), <i>Drummondita fulva</i> (Priority 3), and <i>Micromyrtus trudgenii</i> (Priority 3).	
17	Shrubland of <i>Acacia</i> species dominated by <i>A. latior</i> ms and <i>Melaleuca leiocarpa</i> with emergent <i>Eucalyptus leptopoda</i> var. <i>arctata</i> over mixed species including <i>Wrixonia prostantheroides</i> , <i>Enekbatus stowardii</i> ms, <i>Aluta aspera</i> subsp. <i>hesperia</i> and <i>Hibbertia stenophylla</i> on flats to mid slopes.	<i>Acacia woodmaniorum</i> (Threatened), <i>Drummondita fulva</i> (Priority 3), and <i>Micromyrtus trudgenii</i> (Priority 3) recorded in mosaic with FCT 4.	FCT 17 was not located in the Infrastructure Areas surveyed.

The Majority of Woodman's FCTs mapped in the Infrastructure Areas accurately represented those observed on the ground. Vegetation with FCT 17's dominant species (*Acacia latior*, *Wrixonia prostantheroides*, and *Enekbatus stowardii*) did not occur in the Infrastructure Areas. However Woodman mapped FCT 17 as a mosaic with FCT 4, which occurred on the plains and footslopes of the Infrastructure Areas, and FCT 4 rather than FCT 17 occurs in the Infrastructure Areas.

3.6 Vegetation Condition

Vegetation condition was assessed using the scale outlined in the Government of Western Australia (2000) Bush Forever documentation. The general condition of the vegetation within the Infrastructure Areas ranged from Degraded to Very Good. There are obvious signs of disturbance as there are existing pits and waste dumps at both Mungada East and Mungada West. Dust and rubbish were evident on and within the vegetation along an existing haul road, and there are current and old exploration sites within the Infrastructure Areas. The effects of goat grazing were also evident, particularly around the existing pits.

3.7 Ecological Communities

Some ecological communities are protected by Commonwealth and State legislation (Threatened Ecological Communities; TECs), while others are listed as Priority Ecological Communities (PECs) while their significance is being assessed prior to being listed as a TEC. The conservation significance rankings for TECs and PECs are detailed in Table A3.4 and Table A3.5, Appendix 3.

- One Priority 1 PEC is listed as occurring at Blue Hills – Blue Hills (Mount Karara / Mungada Ridge / Blue Hills) vegetation complexes (banded ironstone formation) (DEC, 2011g).

The separate mapped areas of the PEC are shown on Figure 9.1 and the boundaries of the section of the PEC around the Infrastructure Areas are shown on Figure 9.2, Section 9. Approximately half of the Infrastructure Areas lie within the boundaries of the PEC.

4 CONSERVATION SIGNIFICANCE

The conservation significance of the flora and vegetation of the Infrastructure Areas is discussed below. Significance is assessed at regional and local scales.

4.1 Conservation Significance: Flora

One Threatened Flora species and four Priority Flora species were recorded in the Infrastructure Areas: *Acacia woodmaniorum* (Threatened, Vulnerable), *Lepidosperma* sp. Blue Hills (Priority 1), *Drummondita fulva*, *Micromyrtus trudgenii* and *Persoonia pentasticha* (all Priority 3).

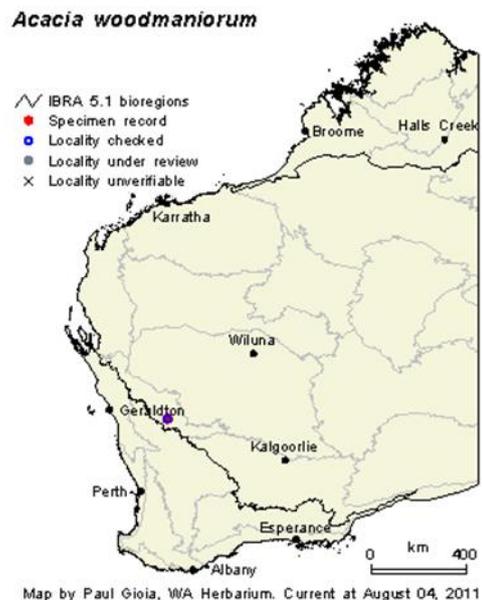
4.1.1 Regional Significance

Significance ratings (low, moderate or high) of the plants recorded in the Infrastructure Areas are based on the bioregional distribution and the number and spread of FloraBase records for each species.

Fifteen *Acacia woodmaniorum* (Threatened) records are listed on FloraBase and its distribution is limited to the Blue Hills (BH) Range in the Murchison (FloraBase, November 2011). This species is found in large numbers primarily on the rocky crests and slopes of the Blue Hills Range. However, it also grows in disturbed areas inside and adjacent to the existing Mungada West and East pits.

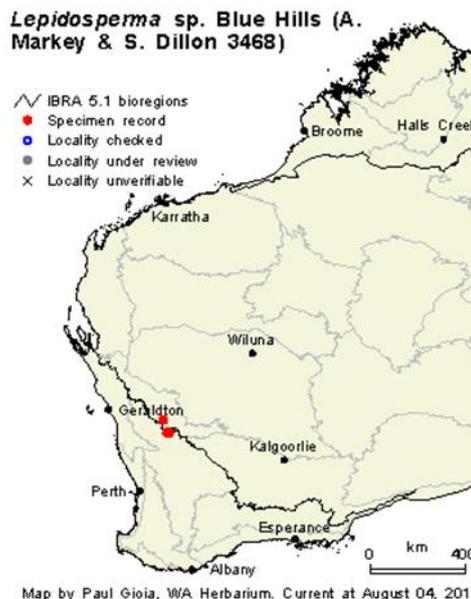
As a Threatened (Vulnerable) species *A. woodmaniorum* is considered to be facing a high risk of extinction in the wild.

Given its limited distribution (Yalgoo Bioregion) and listing as a Threatened Flora species its regional significance is high.



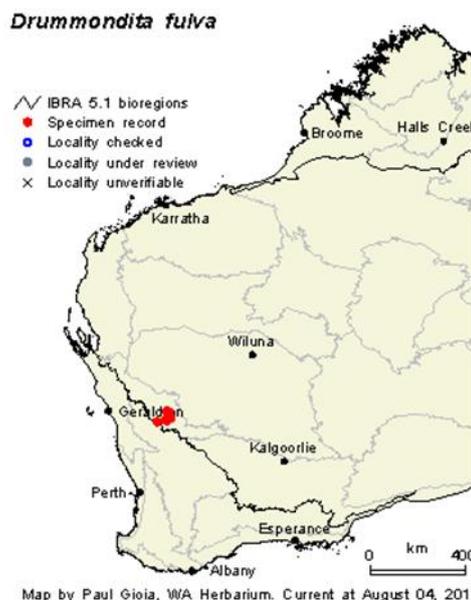
Six *Lepidosperma* sp. Blue Hills (Priority 1) records are listed on FloraBase and its distribution is limited to Charles Darwin Reserve NE of Wubin and Mt Karara at BH Range (FloraBase, November 2011). The species is found in relatively large numbers and it tends to be habitat specific to the rocky hills and midslopes.

As a Priority 1 species *L. sp. Blue Hills* is poorly known. Given its limited regional distribution (Yalgoo and Avon Wheatbelt bioregions) and habitat specificity it has high regional conservation significance.



Fifteen *Drumondita fulva* (Priority 3) records are listed on FloraBase and its distribution is limited to Windaning Hill, Oxiana Golden Grove, Blue Hills Range, BH Range Minjar Hill, Warriedar Hill, BH Range Jasper Hill (FloraBase, November 2011).

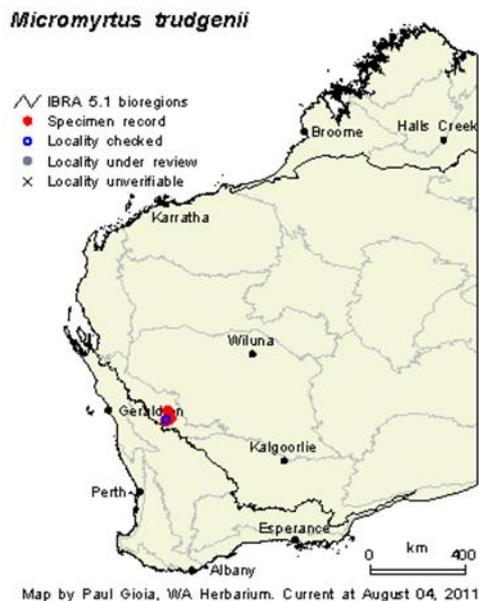
This species is found in relatively large numbers and occurs across a number of habitats at Blue Hills (low lateritic hills, rocky ironstone outcrops, minor rocky gullies and on the flats). As a Priority 3 species *D. fulva* is poorly known and as it has a limited distribution (appears to be only Yalgoo Bioregion) is rated as having high regional conservation significance.



Twenty-nine records for *Micromyrtus trudgenii* (Priority 3) are listed on FloraBase and its distribution is limited to Damperwah Hills Karara Station, Mt Mulgine, Warriedar Station, St Patricks, Arsenic Hill, Bentley, Riley, near Mungada, Mungada Ridge, BH Range, BH Range Minjar Hill, BH Range Warriedar Hill, BH Range Jasper Hill, BH Range Windaning Hill, 20 km south of Golden Grove Mine, Golden Grove mine site and Gossan Hill (FloraBase, November 2011).

M. trudgenii occurs in high numbers and is generally found on rocky slopes and hill crests but is also recorded in lower numbers on the outwash flats. As a Priority 3 species *M. trudgenii* is poorly known.

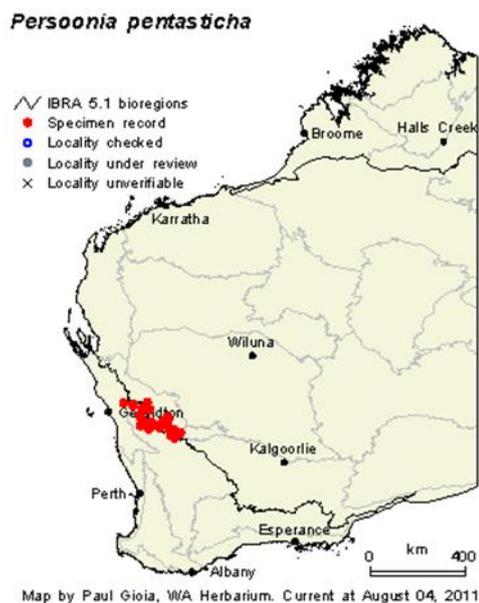
While it has a limited distribution (Yalgoo Bioregion) it is recorded in high numbers across the BH Range and is considered to be moderately conservation significant regionally.



Forty-one records for *Persoonia pentasticha* (Priority 3) are listed on FloraBase and localities include Koolanooka Hills, Charles Darwin Reserve, Barrabarra Nature Reserve, Mt Gibson, Damperwah Hills, Perenjori Hills, Billerangera Hills, Mugga Mugga Hill, Mungada Ridge, BH Range, Extension Hill, Warriedar Station, Mt Gibson Station, 70 km NE of Wubin, East Yuna Nature Reserve and West Perenjori Nature Reserve (FloraBase, November 2011).

P. pentasticha has a scattered distribution and is found in low numbers on the flats and footslopes of the hills of the Range.

P. pentasticha has a relatively wide distribution in the Midwest (in the Yalgoo, Avon Wheatbelt and Geraldton Sandplains bioregions) and is considered to have low regional conservation significance.



Mapping by Paul Gioia. Image used with the permission of the Western Australian Herbarium, Department of Environment and Conservation (<http://florabase.dec.wa.gov.au/help/copyright>). Accessed on Wed, 30 December 2011.

4.1.2 Local Significance

The local conservation significance of these species in the Infrastructure Areas is discussed below. Significance ratings (low, moderate or high) are based on the number of locations recorded within the Infrastructure Areas relative to those in the local area i.e. SMC's tenements. Locations recorded within and outside the Infrastructure Areas are a combination of Maia's survey records and Woodman's, which were supplied to SMC by Gindalbie. Maps showing the distribution of the significant flora species recorded within the Infrastructure Areas and in the wider areas surveyed are shown in Figure 9.8 and Figure 9.9 (Section 9).

Acacia woodmaniorum was recorded at 9,544 locations overall and 1,028 of these locations were within the Infrastructure Areas. As the plants of the Infrastructure Areas comprise approximately 11% of the local distribution these *A. woodmaniorum* are considered to be locally highly conservation significant.

Lepidosperma sp. Blue Hills was recorded at 751 locations overall and at two locations within the Infrastructure Areas. As the plants within the Infrastructure Areas comprise approximately 0.03% of the local distribution, these populations of *L. sp. Blue Hills* are considered to have low local conservation significance.

Drummondita fulva was recorded at 692 locations overall and at 21 locations within the Infrastructure Areas. As the plants within the Infrastructure Areas comprise approximately 0.03% of the local distribution, these populations of *D. fulva* of the area have low local conservation significance.

Micromyrtus trudgenii was recorded at 1,697 locations overall and at 106 locations within the Infrastructure Areas. As the plants within the Infrastructure Areas comprise approximately 6.2% of the local distribution, these populations of *M. trudgenii* have low to moderate local conservation significance.

Persoonia pentasticha was recorded at 108 locations overall and at two locations within the Infrastructure Areas. As the plants within the Infrastructure Areas comprise approximately 1.85% of the local distribution, these populations of *P. pentasticha* have low local conservation significance.

4.1.3 Summary of Regional and Local Significance: Flora

Table 4.1 provides a summary of the regional and local significance of the conservation significant species recorded within the Infrastructure Areas.

Table 4.1: Regional and Local Significance of the Priority Flora Recorded in the Infrastructure Areas

Species	Conservation Rank	Regional Significance	Local Significance
<i>Acacia woodmaniorum</i>	T	High	High
<i>Lepidosperma</i> sp. Blue Hills	P1	High	Low
<i>Drummondita fulva</i>	P3	High	Low
<i>Micromyrtus trudgenii</i>	P3	Moderate	Low-Moderate
<i>Persoonia pentasticha</i>	P3	Low	Low

T = Threatened Flora species; P1 and P3 = Priority 1 and Priority 3 species.

4.2 Conservation Significance: Vegetation

The regional and local significance of the vegetation units of the Infrastructure Areas is discussed in the following sub-sections.

4.2.1 Regional Significance

The regional significance of the land systems (LS), Beard's vegetation associations and Woodman's vegetation associations of the Infrastructure Areas is considered below.

4.2.1.1 LAND SYSTEMS

The extent of each LS in the Infrastructure Areas is listed in Table 4.2.

Table 4.2: Land Systems of the Infrastructure Areas

Land System (LS)	Habitat Description	Area in WA (ha)	Area in SMC Tenements (ha)	Area in Infra. Areas (ha)	Area in SMC Tenements in Infra. Areas (%)	Area in WA in Infra. Areas (%)
Tallering	Prominent ridges and hills of banded ironstone, dolerite and sedimentary rocks supporting bowgada and other acacia shrublands.	32,900	462.23	16.53	3.58	0.05
Yowie	Sandy plains supporting shrublands of mulga and bowgada with patchy wanderrie grasses.	918,900	396.98	27.68	6.97	0.0007

The condition summary for the Tallering LS was assessed as 69% good and 31% fair, while that of the Yowie LS was 50% good, 36% fair and 14% poor condition (Payne *et al.*, 1998).

The extent of the LS in the Sandstone-Yalgoo-Paynes Find area ranges from 400 ha to 918,900 ha. The Tallering LS is therefore one of the least extensive mapped in that area. While the Tallering LS is mapped over a relatively small area it has a relatively wide distribution (from Yalgoo in the north almost to Paynes Find in the south and from, Karara Station in the west to just east of Warriedar Station in the east). Therefore, the Tallering LS of the Infrastructure Areas has moderate regional significance.

The Yowie LS is the largest mapped in that area and it has a widespread distributed in the Sandstone-Yalgoo-Paynes Find area. As a result the Yowie LS in the Infrastructure Areas is of low regional significance.

4.2.1.2 BEARD'S VEGETATION MAPPING

The Infrastructure Areas lie within two of Beard's mapped units and these are listed in Table 4.3.

Table 4.3: Beard's Vegetation Mapping in the Infrastructure Areas

Vegetation Association (and Code)	Sub-Association Description (NVIS Level 6)	Current Area in WA (ha)	Area in SMC Tenements (ha)	Area in Infra. Areas (ha)	Percent of SMC Tenements in Infra. Areas	Percent of WA Extent in Infra. Areas
a9,14Si (358.5)	<i>Acacia ramulosa</i> , <i>Acacia quadrimarginea</i> , <i>Acacia acuminata</i> , <i>Hakea preissii</i> and <i>Dodonaea inaequifolia</i> Tall Open Shrubland	3,828	548	41.47	7.57	1.08
e6,22Lr a9,19Si (355.2)	<i>Eucalyptus loxophleba</i> and/or <i>Eucalyptus oleosa</i> Isolated Low Trees with <i>Acacia aneura</i> and <i>Acacia ramulosa</i> Tall Open Shrubland	23,522	571	2.74	0.48	0.01

Note: NVIS = National Vegetation Information Systems (ESCAVI, 2003).

Vegetation association a9,14Si is mapped over a relatively small area of the Murchison and it has a narrow distribution. Because of this and its cover in the Infrastructure Areas it is rated as having moderate regional significance.

Vegetation association e6,22Lr a9,19Si is mapped over a larger area of the Murchison. It has a wider distribution and because of its size and distribution the regional conservation significance of its cover in the Infrastructure Areas is rated as low.

4.2.1.3 WOODMAN FLORISTIC COMMUNITY TYPES

Woodman ranked those FCTs that were regarded as being regionally restricted as 3, 4 and 5 on a scale of 1 to 5. The FCTs mapped by Woodman on SMC's tenements with the highest significance ranking (5) are: FCT 8, 11, 12 and FCT 13. Those ranked as a four are: FCT 4, 9, 10a, 10b and FCT 14. Those ranked as a 3 are: 7c and 7b. Of these, FCTs 12, 13 and 14 occur within the Infrastructure Areas along with a mosaic of FCTs 4/17.

4.2.2 Local Significance

Local significance is based on the cover of the land systems / vegetation associations in the Infrastructure Areas compared with that in SMC's tenements as a whole. Local significance is rated as high, moderate or low.

4.2.2.1 LAND SYSTEMS

Given the small percentage of the Tallering and Yowie LS that occur in the Infrastructure Areas compared with that mapped in the surrounding area (less than 7%; Table 4.2) the local significance of these LS in the Infrastructure Areas is rated as low.

4.2.2.2 BEARD'S VEGETATION ASSOCIATIONS

Given the small percentage of the two vegetation associations mapped by Beard that occur in the Infrastructure Areas compared with that mapped in SMC's tenements (less than 8%; Table 4.3) the local significance of these vegetation associations in the Infrastructure Areas is rated as low.

4.2.2.3 WOODMAN'S FLORISTIC COMMUNITY TYPES

The local significance of the FCTs of the Infrastructure Areas is based on the FCT's cover in the Infrastructure Areas, on the proportion of the FCT's area that occurs within the Infrastructure Areas and SMC's tenement, the number of significant species located within each FCT, and the regional significance of the FCT.

Table 4.4: Local Significance of FCTs in Infrastructure Areas

FCT	Area Mapped in Infra. Areas (ha)	Area Mapped in SMC Tenements (ha)	Infra. Areas FCTs as a Proportion of Area Mapped in SMC Tenements (%)	<i>Ac wood</i> (T)	<i>Lep. sp. BH</i> (P1)	<i>D f</i> (P3)	<i>M t</i> (P3)	<i>P p</i> (P3)	Total No. Signif. Flora Species	Local Significance
1a	0.51	38.63	0.06						0	Low
1a/2	18.1	195.68	2.30					Yes	1	Low
4/17	6.40	132.55	0.81			Yes	Yes		2	Low
12	15.53	359.48	1.97	Yes	Yes	Yes	Yes	Yes	5	Moderate
13	2.02	35.41	0.26	Yes	Yes	Yes	Yes	Yes	5	Moderate
14	0.25	11.09	0.03	Yes	Yes	Yes	Yes		4	Moderate
Degraded	1.42	14.44	0.18	Yes					1	Not ranked
Total	44.21	787.28	5.62	4	3	4	4	3		

Note: FCT = floristic community type, *Ac wood* = *Acacia woodmaniorum*, *Lep sp. BH* = *Lepidosperma sp. Blue Hills*, *D f* = *Drummondita fulva*, *M t* = *Micromyrtus trudgenii*, *P p* = *Persoonia pentasticha*.

As the proportional representation of the FCTs of the Infrastructure Areas in SMC's tenements is very low (< 2.5%) the local significance of the FCTs occurring in the Infrastructure Areas is rated as low to moderate. Five significant species, including a Threatened species, were recorded in two of the FCTs and four significant species including a Threatened species in one of the FCTs and, even though the relative area of these FCTs is very low (0.03% to 1.97%), the presence of the Threatened species has prompted the moderate local significance rating.

4.2.3 Summary of Regional and Local Significance: Vegetation

The regional and local significance rankings (low, moderate or high) of the land systems and vegetation of the Infrastructure Areas (as discussed in the previous sections) are summarised in Table 4.5.

Table 4.5: Regional and Local Significance of the Vegetation of the Infrastructure Areas

Land Systems, Beard's Vegetation Associations and FCTs Mapped by Woodman	Regional Significance	Local Significance
Land Systems		
Tallering	Moderate	Low
Yowie	Low	Low
Beard's Vegetation Associations		
a9,14Si (358.5)	Low	Low
e6,22Lr a9,19Si (355.2)	Low	Low
Woodman's FCTs		
1a	Low	Low
1a/2	Low	Low
4/17	High	Low
12	High	Moderate
13	High	Moderate
14	High	Moderate
D	Not ranked	Not ranked

4.3 Conservation Significance: Ecosystems

Parts of the Infrastructure Areas lie within the Priority 1 PEC at Blue Hills and therefore are regionally highly significant.

While the PEC covers a large area (approximately 2,195 ha), and the area of the Infrastructure Areas intersecting the PEC is small (approximately 18 ha) the local significance of the PEC in the Infrastructure Areas is considered to be moderate to high based on its listing as a PEC.

5 IMPACTS

5.1 Impacts to Conservation Significant Species

Estimated impact to the five conservation significant flora species recorded within the Infrastructure Areas is summarised in Table 5.1.

These calculations have been carried out using the numbers of plants of each species located within the Infrastructure Areas and those located on SMC and Gindalbie tenements by both Maia and Woodman Environmental Consulting outside the Infrastructure Areas.

Maia and Woodman significant species locations were plotted together and when two points overlapped only one set of data was used in the counts for each species. The whole of the Infrastructure Areas was surveyed during the targeted flora surveys, while a sub-sample of the surrounding areas was surveyed. Therefore, actual impacts will be less than those presented in Table 5.1, as all occurrences of the five significant species in the surrounding areas will not have been located. Although, as a result of the targeted flora surveys carried out along Mungada Ridge (the habitat preferred by *Acacia woodmaniorum*) the total numbers recorded for that species should more accurately reflect those actually occurring in the wider area.

The distribution of *Acacia woodmaniorum* in the wider area is shown in Figure 9.8 (Section 9) and the Priority Flora recorded in Figure 9.9 (Section 9).

Estimated impact to each of the conservation significant flora species from the new Infrastructure Areas is less than 7% and ranges from 0.01% (*Lepidosperma* sp. Blue Hills) to 6.53% (*Acacia woodmaniorum*) (Table 5.1).

Estimated cumulative impact to *Acacia woodmaniorum* and *Lepidosperma* sp. Blue Hills from the pre-approved areas, new Infrastructure Areas and from Gindalbie's operations are listed in Table 5.2. The counts of *Acacia woodmaniorum* in this table are based on Maia and Woodman data. The counts for *Lepidosperma* sp. Blue Hills are based on Maia's data and the data provided in Gindalbie's Public Environmental Review (PER) because Woodman's data had fewer plants listed.

The estimated cumulative impacts to *Acacia woodmaniorum* and *Lepidosperma* sp. Blue Hills from SMC operations alone will be less than 10%, however, when Gindalbie operations are taken into consideration, the cumulative impacts increase to 12.59% and 68.82% respectively.

Table 5.1: Estimated Impacts to Conservation Significant Flora in the new Infrastructure Area

Species	Conservation Rank	No. of Plants Recorded within the Infrastructure Areas	All Plants Recorded by Woodman and Maia	Impact (%)
<i>Acacia woodmaniorum</i>	T	1,966	30,103	6.53
<i>Lepidosperma sp. Blue Hills</i>	P1	5	*52,769	0.01
<i>Drummondita fulva</i>	P3	55	4,118	1.34
<i>Micromyrtus trudgenii</i>	P3	609	12,258	4.97
<i>Persoonia pentasticha</i>	P3	11	225	4.89

T = Threatened Flora species; P1 and P3 = Priority 1 and Priority 3 species.

*This count has been taken from the PER report as it differs greatly from the Woodman data supplied to Maia by Gindalbie.

Table 5.2: Estimated Cumulative Impacts to *Acacia woodmaniorum* and *Lepidosperma sp. Blue Hills*

Species	Rank	No. of Plants Recorded within Infra. Areas	No. of Plants in Approved Areas (Ecologia, 2008)	Estimated Total No. of Plants in all Impact Areas	No. of Plants estimated to be Impacted by Gindalbie	All Plants Recorded by Woodman and Maia	Cumulative Impact (%) - SMC	Estimated Total No. of Plants in SMC and Gindalbie Infrastructure to be impacted	Cumulative Impact (%) - SMC and Gindalbie
<i>Acacia woodmaniorum</i>	T	1,966	811	2,777	1,012	30,103	9.22	3,789	12.59
<i>Lepidosperma sp. Blue Hills</i>	P1	5	2	7	36,310	*52,769	0.14	36,317	68.82

T = Threatened Flora species; P1 = Priority 1 species.

*This count has been taken from the PER report as it differs greatly from the Woodman data supplied to Maia by Gindalbie.

5.2 Impacts to Vegetation

Impacts to the vegetation of the area have been calculated using the area of the land systems (Payne *et al.*, 1998), Beard (1976) and Woodman Environmental Consulting (2008) mapping. Calculations are based on areas of these units mapped within: WA, the tenements mapped by Woodman (both SMC and Gindalbie's), SMC's tenements only, and within the Infrastructure Areas.

5.3 Impacts to Land Systems

Estimated impacts to the two LS of the Infrastructure Areas are detailed in Table 5.3. Local impact has been calculated using LS cover in the Infrastructure Areas and in SMC's tenements while regional impact has been calculated using LS cover in the Infrastructure Areas and in WA.

Table 5.3: Impacts to Land Systems

Land System	Extent in WA (ha)	Extent within SMC Tenements (ha)	Extent within Infrastructure Areas (ha)	Local Impact (%)	Regional Impact (%)
Tallering	32,900	462.23	16.53	3.58	0.050
Yowie	918,900	396.98	27.68	6.97	0.003

Local impacts to the two LS of the Infrastructure Areas are estimated to be low (less than 7%) and regional impacts to be very low (less than 0.1%).

5.4 Impacts to Beard's Vegetation Associations

Estimated impacts to Beard's vegetation associations of the Infrastructure Areas are detailed in Table 5.4. Local impact has been calculated using Beard vegetation association cover in the Infrastructure Areas and in SMC's tenements while regional impact has been calculated using Beard vegetation association cover in the Infrastructure Areas and in WA.

Table 5.4: Beard's Vegetation Associations

Vegetation Association (and Code)	Current Extent (ha)	Extent within SMC Tenements (ha)	Extent within Infrastructure Areas (ha)	Local Impact (%)	Regional Impact (%)
a9,14Si (358.5)	3,828	548	41.47	7.567	1.083
e6,22Lr a9,19Si (355.2)	23,522	571	2.74	0.479	0.012

Local impacts are estimated to be low (less than 8%) while regional impacts are very low (less than 0.5%).

Currently, 77.41% of association a9,14Si remains (see Table 2.3, Section 2) and the proposed works would reduce this to 76.33%. Similarly, 99.94% of e6,22Lr a9,19Si remains and this would reduce to 99.93% as a result of the proposed works.

5.5 Impacts to FCTs

Estimates of impacts to the mapped vegetation units of the area were not included in the original PER documentation; however, the EPA mentioned potential impacts to Woodman’s floristic community types (FCTs) mapped within the Project Area (EPA, 2009). Impacts to the new Infrastructure Areas have therefore been estimated using Woodman’s vegetation mapping over SMC tenements only and also over both SMC and Gindalbie’s tenements (the wider area) (Table 5.5).

Table 5.5: Impacts to Floristic Community Types (FCTs) in the New Infrastructure Areas

FCT	Total Wider Area Mapped (ha)	Area Within SMC Tenements (ha)	Area Within New Infra. Areas (ha)	Impact Based on the Wider Area (%)	Impact Based on SMC Tenements (%)
1a	796.21	38.63	0.51	0.06	1.32
1a/2	3488.35	195.68	18.10	0.52	9.25
1b	1578.00	186.88	0	0.00	0.00
2	1262.94	121.92	0	0.00	0.00
3	933.34	35.66	0	0.00	0.00
4	256.51	0.00	0	0.00	0.00
4/17	472.35	132.55	6.40	1.35	4.83
5a	292.15	0.00	0	0.00	0.00
5b	142.70	0.00	0	0.00	0.00
6	5.39	0.00	0	0.00	0.00
7a	93.29	0.00	0	0.00	0.00
7b	54.32	11.55	0	0.00	0.00
7c	173.42	17.40	0	0.00	0.00
7d	3.16	0.00	0	0.00	0.00
8	386.61	4.76	0	0.00	0.00
9	150.42	0.00	0	0.00	0.00
10a	44.32	0.67	0	0.00	0.00
10b	46.52	0.00	0	0.00	0.00
11	218.66	3.42	0	0.00	0.00
11/9	226.41	7.42	0	0.00	0.00
12	643.33	359.48	15.53	2.41	4.32
13	258.11	35.41	2.02	0.78	5.70
14	324.10	11.09	0.25	0.08	2.25
15	1394.27	4.39	0.00	0.00	0.00
15/16	105.95	0.00	0.00	0.00	0.00
15/16/18	1261.85	0.00	0.00	0.00	0.00
16	1513.28	19.87	0.00	0.00	0.00
Claypan	11.32	0.00	0.00	0.00	0.00
Degraded	14.44	14.44	1.42	9.83	9.83
Total area (ha) / Overall impact (%)	16151.71	1201.22	44.21	0.27	3.68

Note: Rows highlighted orange indicate FCTs ranked as most highly conservation significant by Woodman Environmental Consulting and those highlighted green as next highest conservation significant.

5.5.1 Impacts from the New Infrastructure Areas

Impacts to FCTs in the new Infrastructure Areas calculated using the area mapped within SMC's tenements alone (the local area), range between 1.32% (FCT 1a) and 9.25% (1a/2) (excluding the degraded area). Impact to the areas mapped as degraded is estimated to be the highest at 9.83%, followed by the mosaic FCT 1a/2 (9.25%) which has low significance. Impact to FCT 13 (the most significant FCT) is 5.70%.

When impacts are calculated based on the wider area they range from 0.06% (FCT 1a) to 2.41% (FCT 12) (excluding the areas mapped as degraded). Impact to the already degraded areas is estimated to be highest at 9.83%. Impact to FCT 13 (the most significant FCT) is 0.78%.

5.5.2 Cumulative Impacts

Cumulative impacts from SMC (the pre-approved areas and the new Infrastructure Areas) and Gindalbie operations are listed in Table 5.6.

Cumulative impact to the FCTs based on the area mapped within SMC's tenements ranges from 3.26% (FCT 14) to 15.87% (FCT 13). When impacts are calculated based on the wider area (i.e. the total area mapped by Woodman), the impacts are lower and range from 0.11% (FCT 14) to 4.54% (FCT 12). Cumulative impact to FCT 13 (the most significant FCT) is 2.18%.

When the impact from both SMC and Gindalbie operations is calculated, the impacts are much higher and range from 5.88% (FCT 4/17) to 65.08% (FCT 14). Cumulative impact to FCT 13 (the most significant FCT) is 56.10%.

Table 5.6: Cumulative Impacts to FCTs of Infrastructure Areas from SMC and Gindalbie Operations

FCT	Extent in the Wider Area (ha)	Extent in SMC Tenements (ha)	Extent in SMC New Infra. Areas (ha)	Extent in SMC Pre-Approved Areas (ha)	Total Area to be Impacted by SMC (ha)	Total Area to be Impacted by SMC (%)	Total Impact to FCTs of the Wider Area by SMC (%)	Total Area Impacted by Gindalbie (ha)*	Total Area Impacted by Gindalbie (%)*	Cumulative Impact to FCTs by SMC and Gindalbie of the Wider Area (ha)	Cumulative Impact to FCTs by SMC and Gindalbie of the Wider Area (%)
1a	796.21	38.63	0.51	2.31	2.82	7.29	0.35	77.10	9.69	79.92	10.04
1a/2	3488.35	195.68	18.1	5.74	23.84	12.18	0.68	606.20	17.41	630.04	18.06
4/17	472.35	132.55	6.4	14.08	20.48	15.45	4.34	7.28	1.56	27.76	5.88
12	643.33	359.48	15.53	13.65	29.18	8.12	4.54	40.59	6.32	69.77	10.85
13	258.11	35.41	2.02	3.6	5.62	15.87	2.18	139.18	53.92	144.80	56.10
14	324.1	11.09	0.25	0.11	0.36	3.26	0.11	210.57	64.97	210.93	65.08
Degraded	14.44	14.44	1.42	11.86	13.28	91.95	91.95	0	0	13.28	91.95
Total area (ha) / Overall impact (%)	16151.71	1201.22	44.21	51.35							

Note: Rows highlighted orange indicate FCTs ranked as most highly conservation significant (ranking of 5) by Woodman Environmental Consulting and those highlighted green as next highest conservation significant (ranking of 4).

*The total area impacted by Gindalbie’s Karara Iron Ore Project (KIOP), Mungada Iron Ore Project (MIOP) and the Joint Infrastructure Areas between KIOP and MIOP.

5.6 Impacts to PEC

The total area of the PEC is 2194.5 ha and the Infrastructure Areas will impact 17.75 ha of its mapped extent. Therefore the estimated impact to the PEC from the Infrastructure Areas is 0.81%. The previously approved areas impact 17.31 ha (0.78%) of the PEC and therefore cumulative impacts to the PEC from SMC operations will be 1.6%. The cumulative impacts on the PEC from both SMC and Gindalbie operations cannot be assessed as Maia does not have information on the area of the PEC to be impacted by the Karara Iron Ore Project.

5.7 Summary of Impact to Significant Species and FCTs

Impact to the FCTs and the significant species recorded in the Infrastructure Areas are summarised below.

- Significant flora species

Impact to each of the conservation significant flora species located within the new Infrastructure Areas is estimated to be less than 7% and ranges from 0.01% (*Lepidosperma* sp. Blue Hills) to 6.53% (*Acacia woodmaniorum*) (based on their numbers in SMC's tenements).

Cumulative impact from both SMC's pre-approved area and the new Infrastructure Areas to *Acacia woodmaniorum* (Threatened) and *Lepidosperma* sp. Blue Hills (Priority 1) is 9.22% and 0.14% respectively.

Cumulative impact from both SMC and Gindalbie operations to *Acacia woodmaniorum* (Threatened) and *Lepidosperma* sp. Blue Hills (Priority 1) is 12.59% and 68.82% respectively.

- Land systems

Local impact to the two LS of the Infrastructure Areas (Tallering and Yowie) is estimated to be low (less than 7%) and regional impact to be very low (less than 0.1%).

- Beard's vegetation associations

Local impact to the two vegetation associations of the Infrastructure Areas (a9,14Si and e6,22Lr a9,19Si) is estimated to be low (less than 8%) while regional impacts are estimated to be very low (less than 2%).

Currently, 77.41% of association a9,14Si remains and the proposed works would reduce this to 76.33%. Similarly, 99.94% of e6,22Lr a9,19Si remains and this would reduce to 99.93% as a result of the proposed works.

- Woodman's FCTs

Impacts to FCTs in the new Infrastructure Areas calculated using the area mapped within SMC's tenements alone (the local area), range between 1.32% (FCT 1a) and 9.25% (FCT 1a/2) (excluding the area mapped as degraded). Impact to the area mapped as degraded is estimated to be the highest at 9.83%, followed by the mosaic FCT 1a/2 (9.25%) which has low significance. Impact to FCT 13 (the most significant) is 5.70%.

When impacts are calculated based on the wider area they range from a low of 0.06% (FCT 1a) to a high of 2.41% (FCT 12) (excluding the areas mapped as degraded). Impact to the already degraded areas is estimated to be highest at 9.83%. Impact to FCT 13 (the most significant FCT) is 0.78%.

Cumulative impact from SMC's already approved areas and the Infrastructure Areas to the FCTs mapped within SMC's tenements ranges from 3.26% (FCT 14) to 15.87% (FCT 13). When calculated

based on the wider mapped area impacts are lower and range from 0.11% (FCT 14) to 4.54% (FCT 12). Cumulative impact to FCT 13 (the most significant FCT) is 2.18%.

When the cumulative impact of both SMC and Gindalbie operations on the FCTs are estimated they range from a low of 5.88% (FCT 4/17) to a high of 65.08% (FCT 14). Cumulative impact to FCT 13 (the most significant FCT) is 56.10%.

- Blue Hills PEC

The estimated cumulative impact on the PEC from the combined SMC operations is 1.6%.

6 CONCLUSIONS

The five significant flora species located within the Infrastructure Areas also occur outside the Infrastructure Areas in large numbers and the local significance of the recorded plants is rated as low to high. Based on the records from the wider area (i.e. Gindalbie and SMC tenements), impact to the significant flora species from the new Infrastructure Areas is estimated to be less than 7%. Cumulative impact to *Acacia woodmaniorum* (Threatened) and *Lepidosperma* sp. Blue Hills (Priority 1) from SMC's pre-approved and new Infrastructure Areas is estimated to be less than 10%. Cumulative impact from SMC and Gindalbie operations to *Acacia woodmaniorum* (Threatened) and *Lepidosperma* sp. Blue Hills (Priority 1) is estimated to be 12.59% and 68.82% respectively.

Impact to the FCTs in the new Infrastructure Areas (calculated using the area mapped within SMC's tenements alone i.e. the local area) is less than 10%. When impacts are calculated based on the wider area they are less than 3% (excluding the degraded area).

Cumulative impact from SMC's operations to each of the FCTs mapped within SMC's tenements is below 16%,. When calculated based on the wider area the impact to each is less than 5%.

Cumulative impact from both SMC and Gindalbie operations range from 5.88% to 65.08%.

Impact to the Priority 1 PEC from proposed and approved SMC operations is estimated to be 1.6%.

Vegetation condition in the Infrastructure Areas is considered to be Degraded to Very Good and the effects of goats and earlier exploration and mining activities are apparent.

Given the conservation significance of the vegetation and flora species of the Infrastructure Areas and surrounds, SMC should adhere to the management measures detailed in its Environmental Management Plan for the Blue Hills project. SMC should pay particular attention to: demarcation of clearing boundaries, the use of a ground disturbance permitting system, dust suppression measures, weed control procedures, restrictions on off road driving and fire prevention measures.

7 PROJECT TEAM

The survey, plant identifications and reporting were carried out by the botanists listed in Table 7.1.

Table 7.1: Project Team

Project Team			
Name	Qualification	Project Role	DEC Flora License Number
Scott Hitchcock	BSc	Botanist – field and report	SL009425 (exp. April 2012)
Melissa Hay	BSc	Botanist - field	SL009572 (exp. July 2012)
Pali Jayasekara	PhD	Botanist - field and taxonomist	SL009424 (exp. April 2012)
Rochelle Haycock	BSc	Botanist - report	Not applicable
Christina Cox	PhD	Botanist - report	Not applicable

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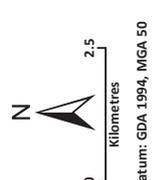
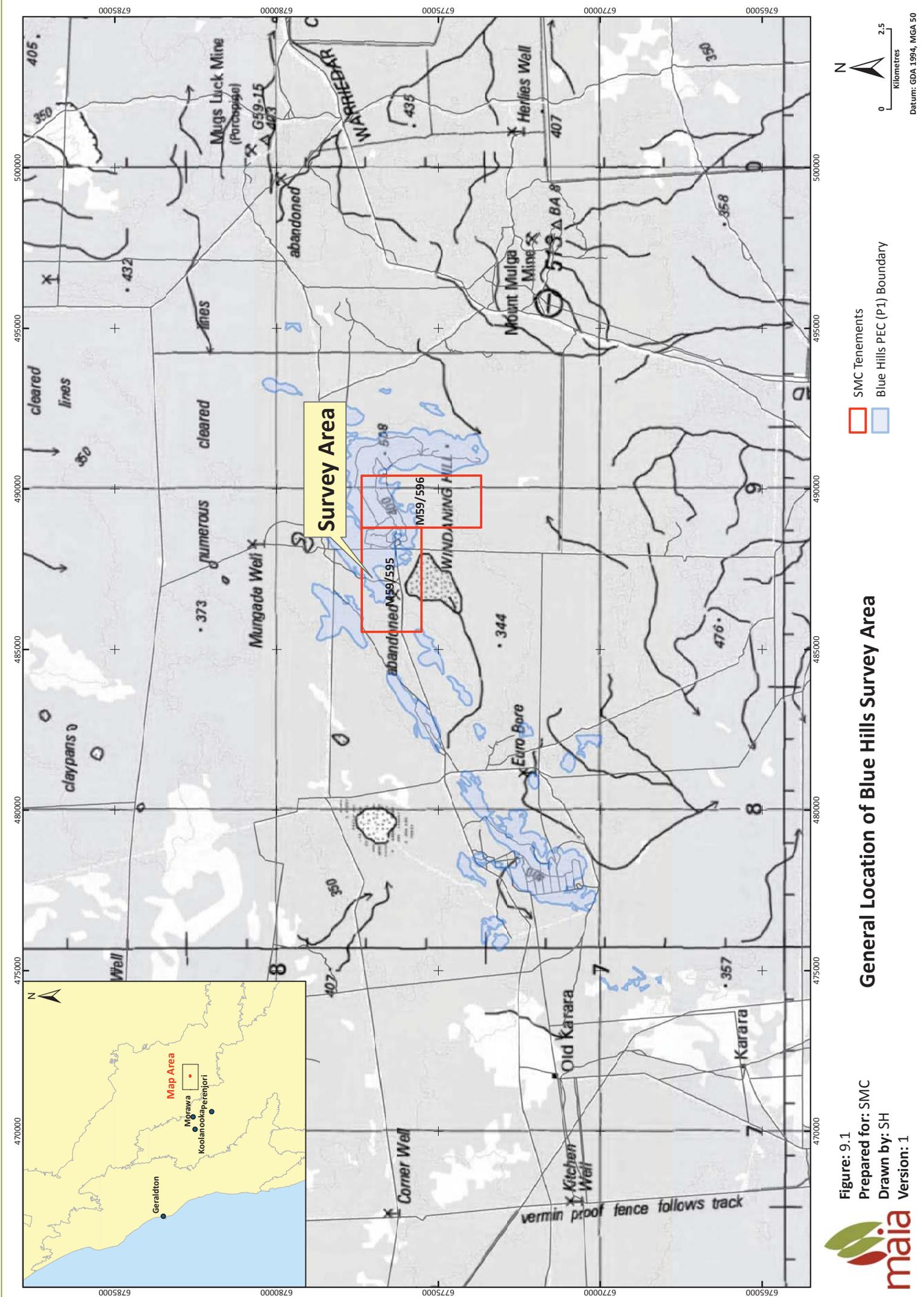
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9 FIGURES



- SMC Tenements
- Blue Hills PEC (P1) Boundary

General Location of Blue Hills Survey Area

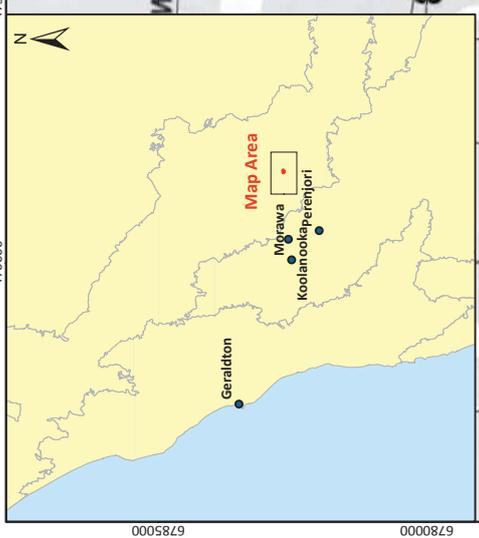


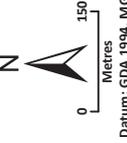
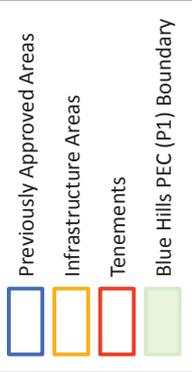
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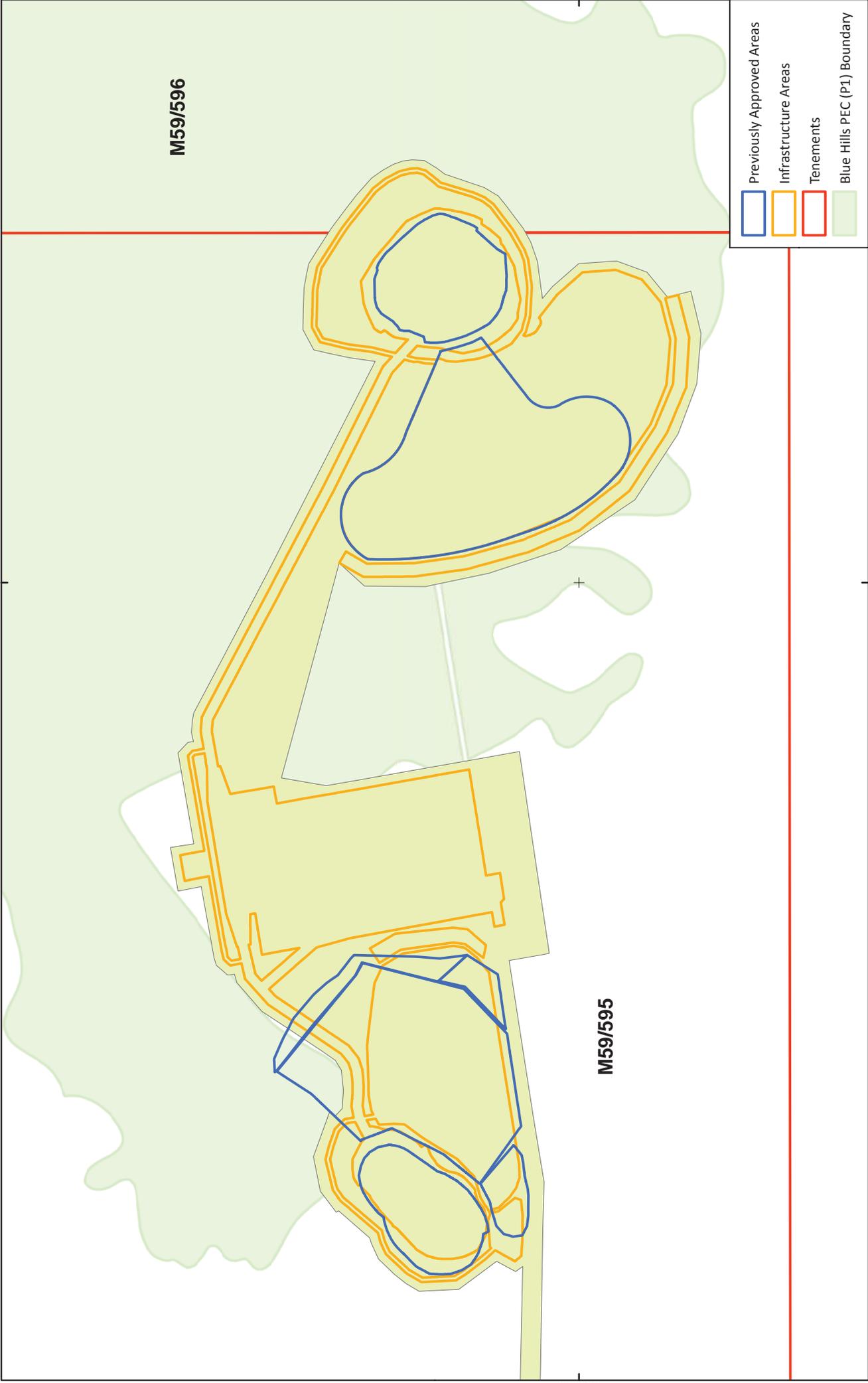
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Datum: GDA 1994, MGA 50



6776000

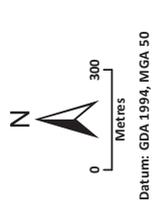
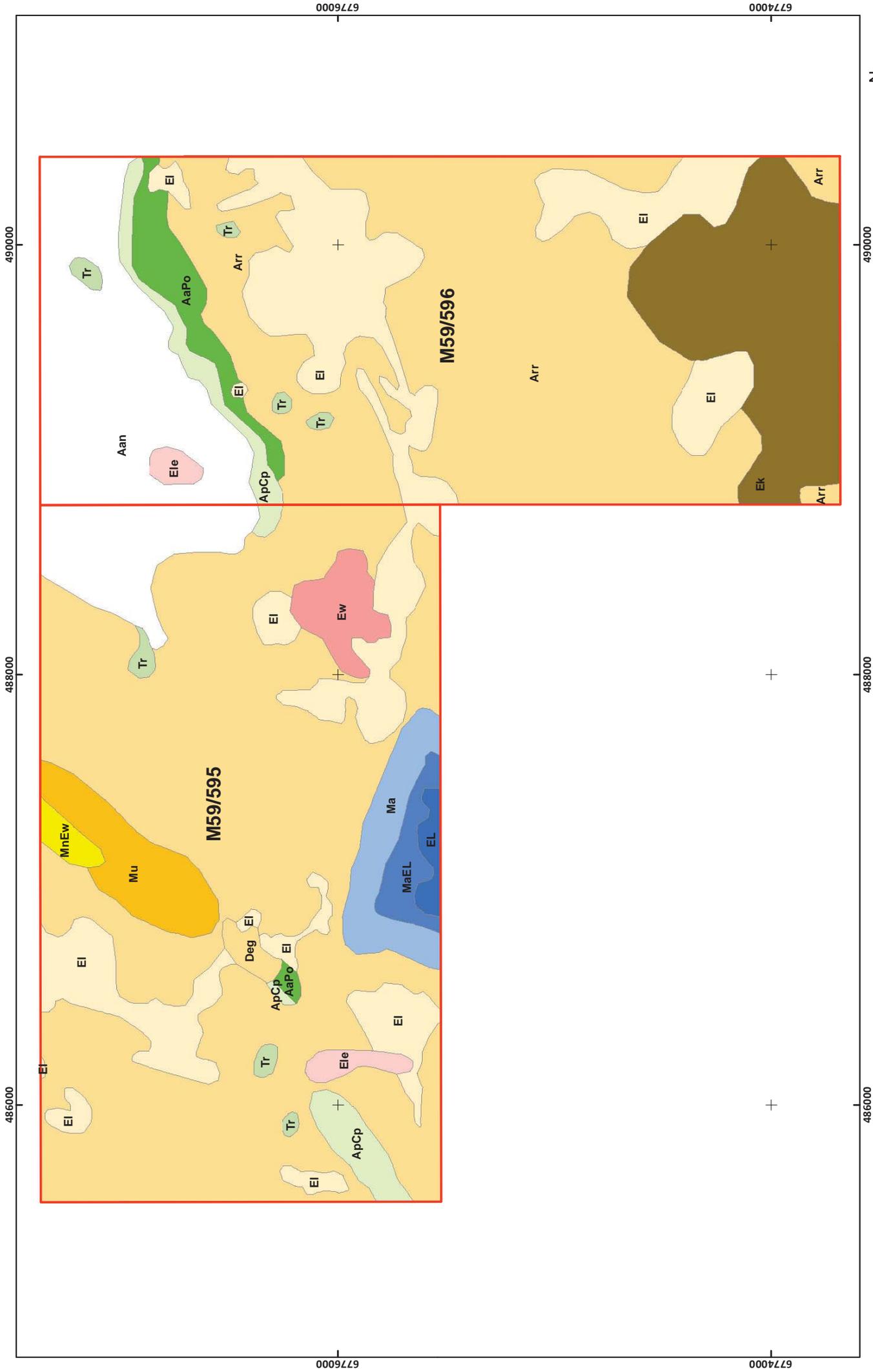
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Blue Hills Mungada West and East Survey Areas



SMC Tenements

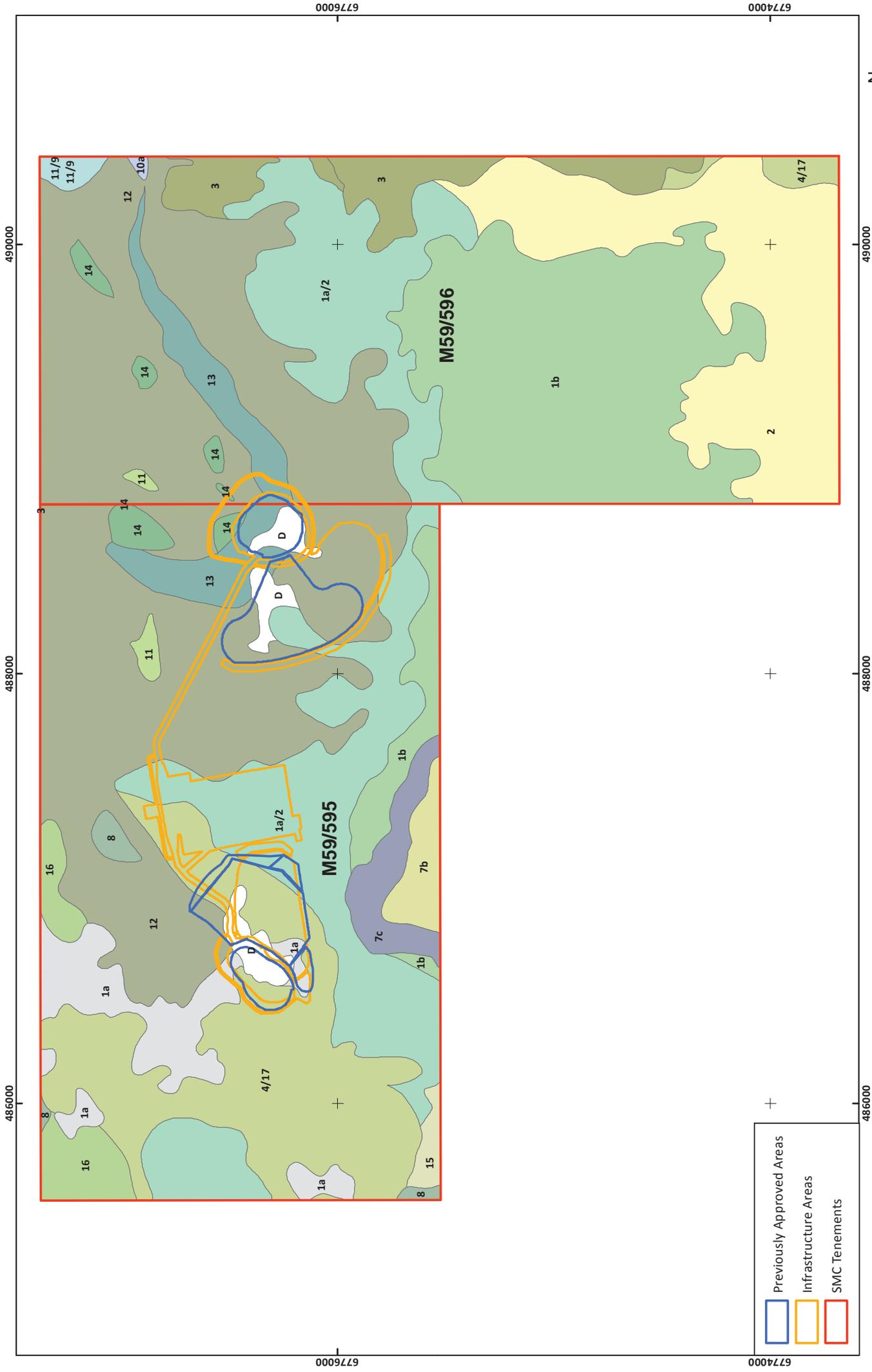
(For Descriptions of the Vegetation Codes Refer to Table 2.4, Section 2)

Bennett's Vegetation Mapping

SMC Tenements

Figure: 9.3
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(For Descriptions of the Vegetation Codes
Refer to Table 2.5, Section 2)

Woodman's Vegetation Mapping SMC Tenements

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Drawn by: SH
Version: 1



Datum: GDA 1994, MGA 50

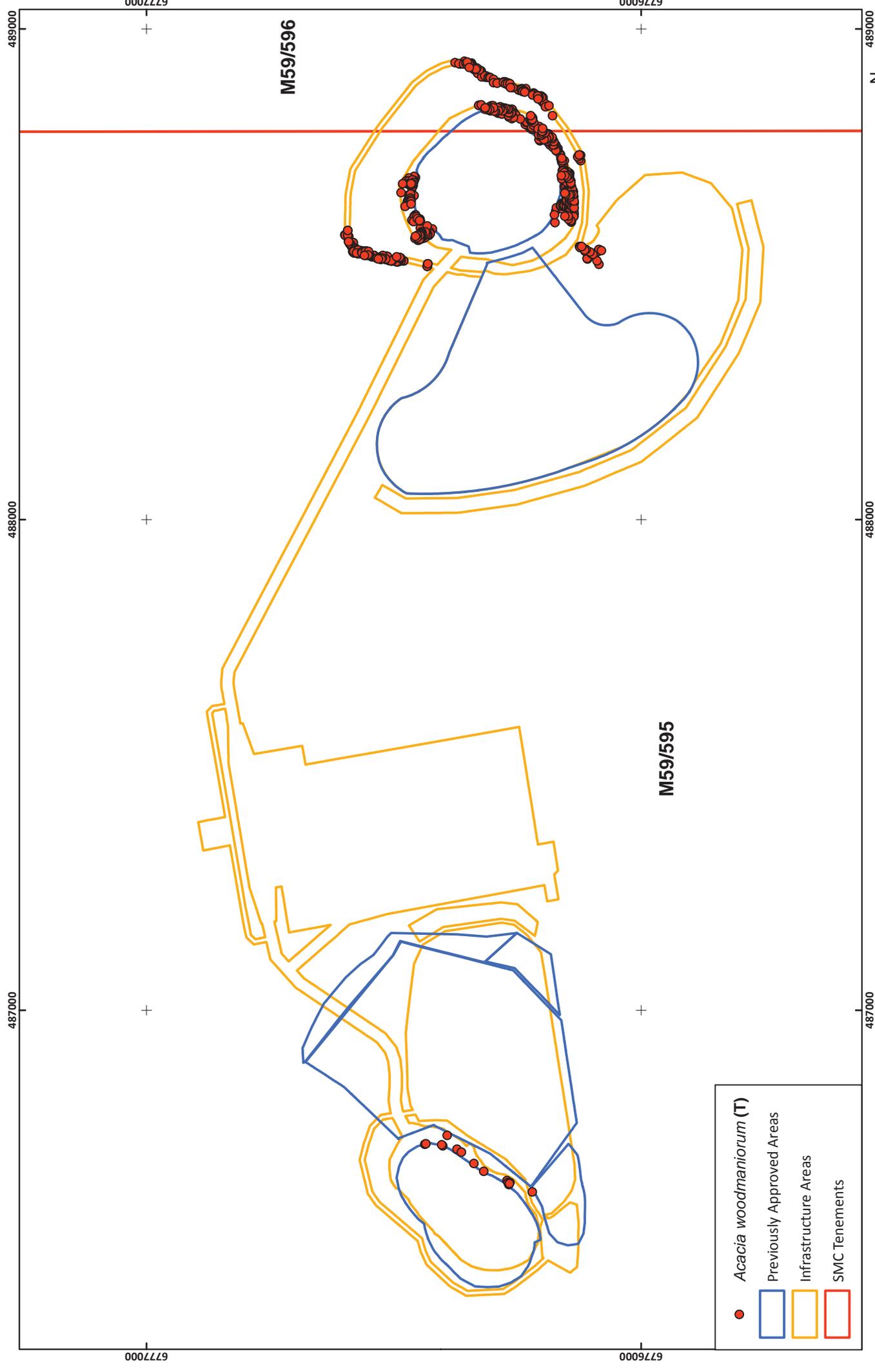
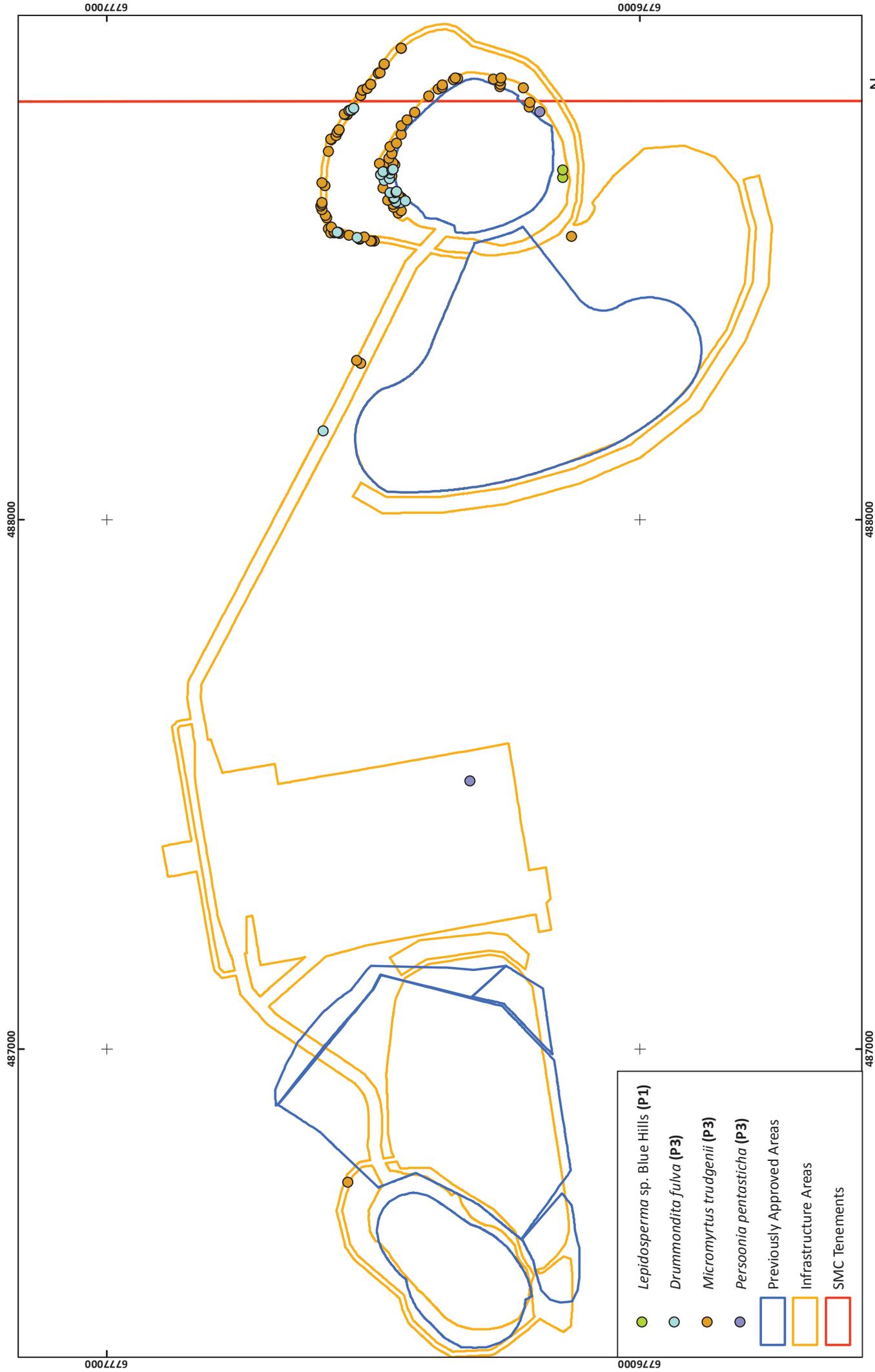


Figure: 9.5a
Acacia woodmaniorum Recorded in Infrastructure Areas

Prepared for: SMC
 Drawn by: SH
 Version: 1





Priority Flora Recorded Inside the Infrastructure Areas

Figure: 9.6a
 Prepared for: SMC
 Drawn by: SH
 Version: 1



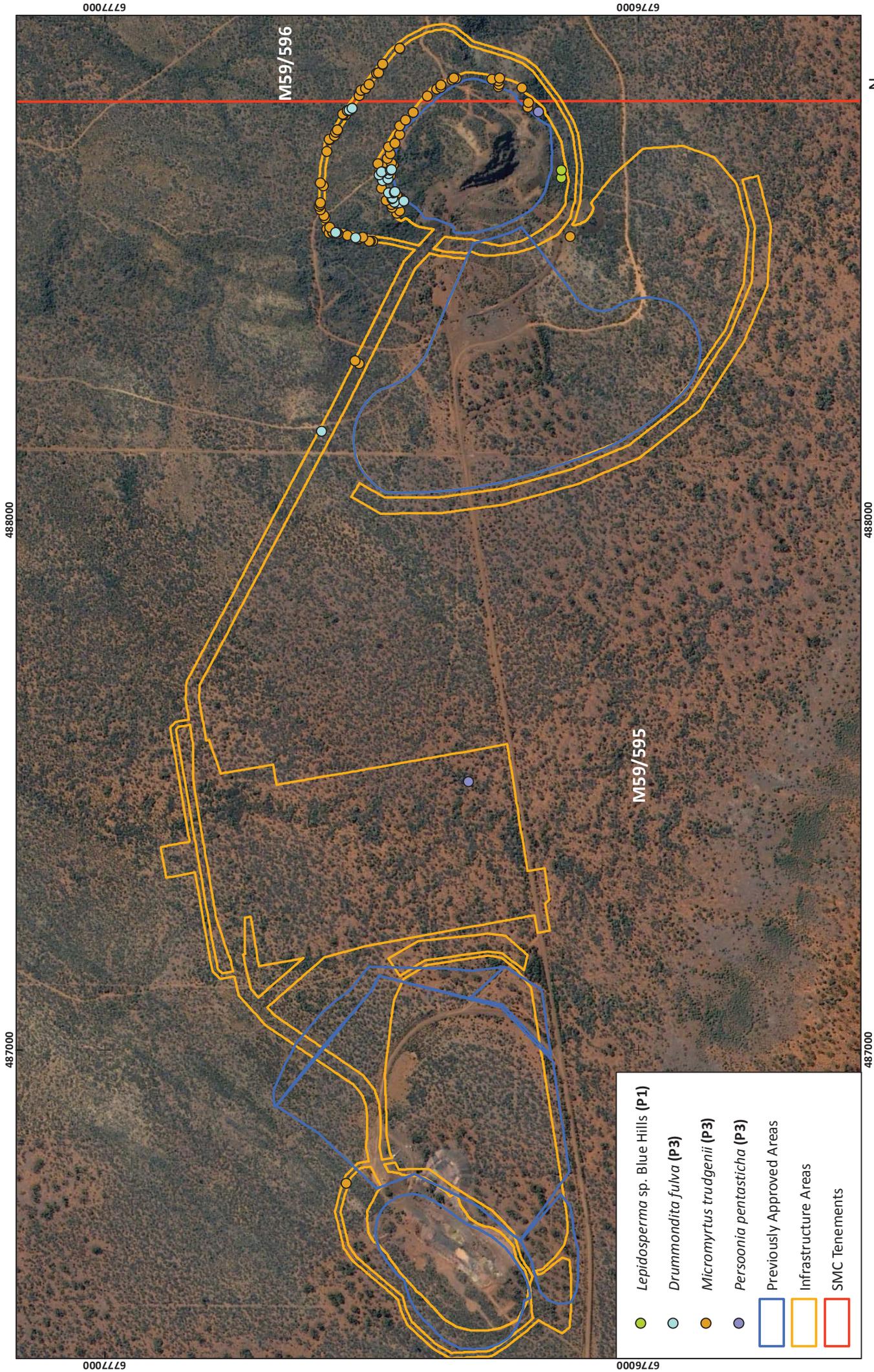
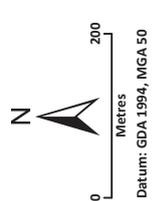
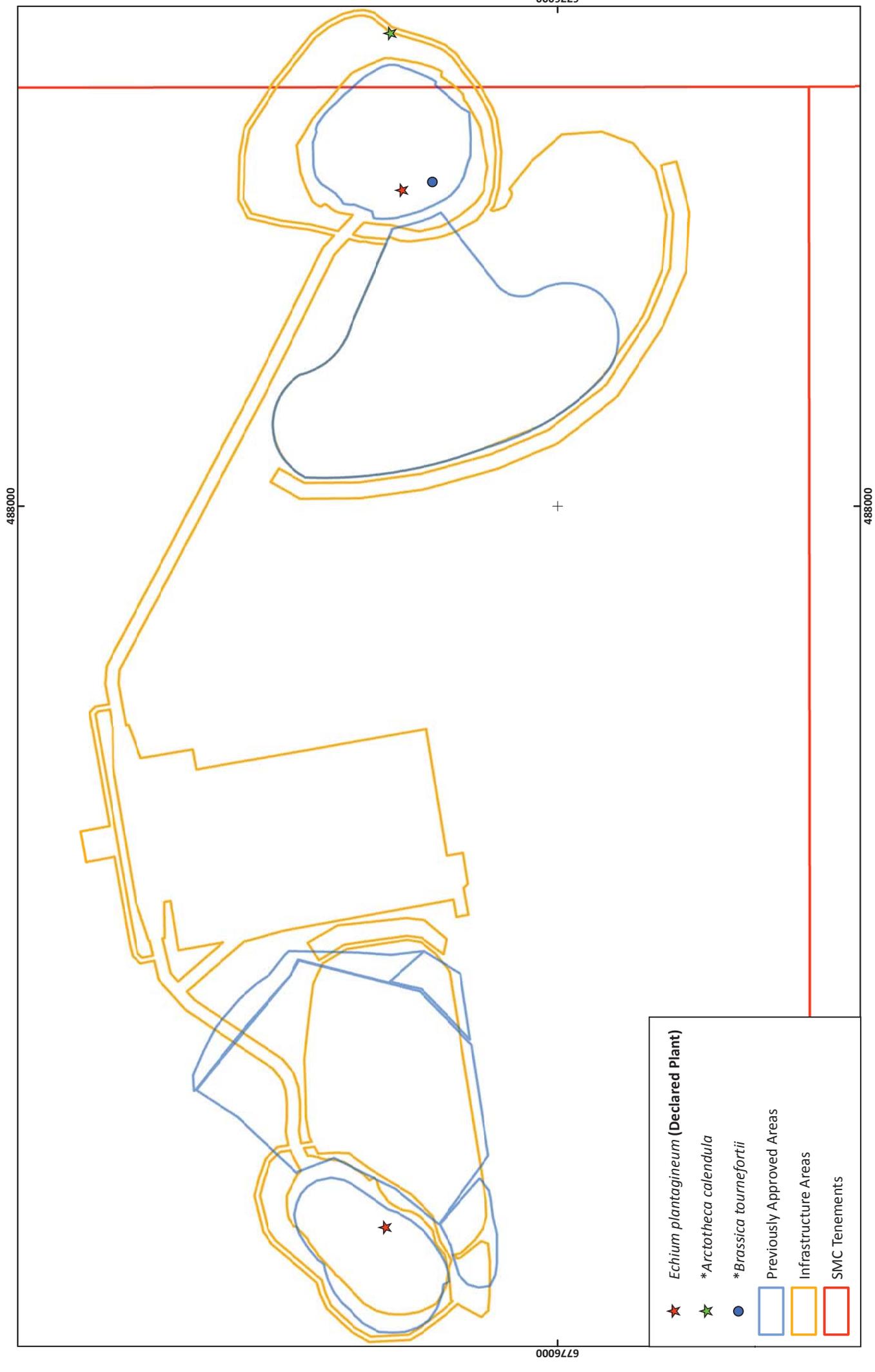


Figure: 9.6b
Priority Flora Recorded Inside the Infrastructure Areas

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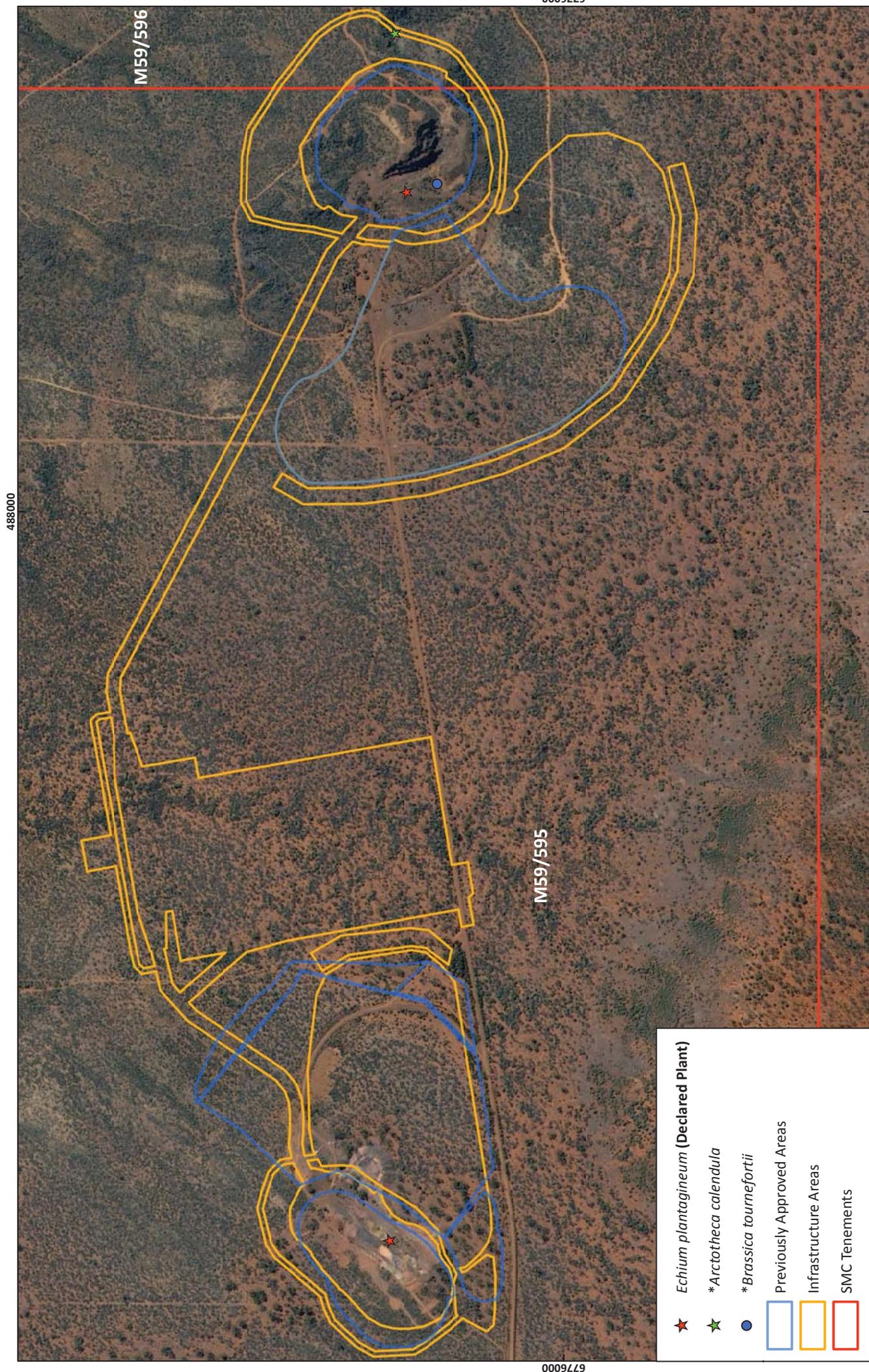




Weed Species Recorded Within the Infrastructure and Previously Approved Areas

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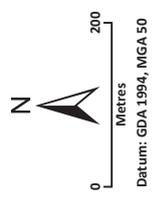


- ★ *Echium plantagineum* (Declared Plant)
- ★ **Arctotheca calendula*
- **Brassica tournefortii*
- Previously Approved Areas
- Infrastructure Areas
- SMC Tenements



Figure: 9.7b
 Prepared for: SMC
 Drawn by: SH
 Version: 1

**Weed Species Recorded Within the Infrastructure
 and Previously Approved Areas**



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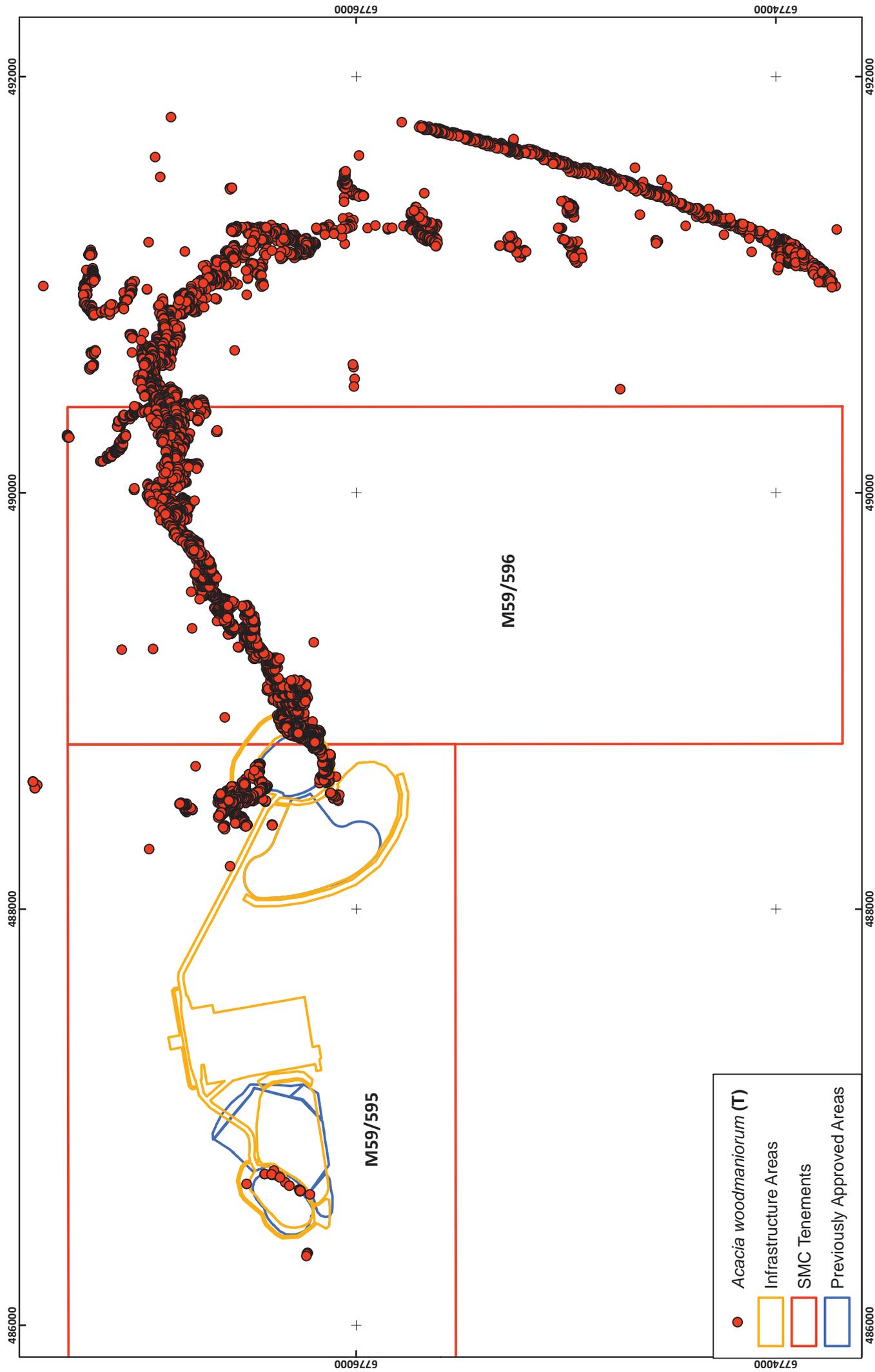
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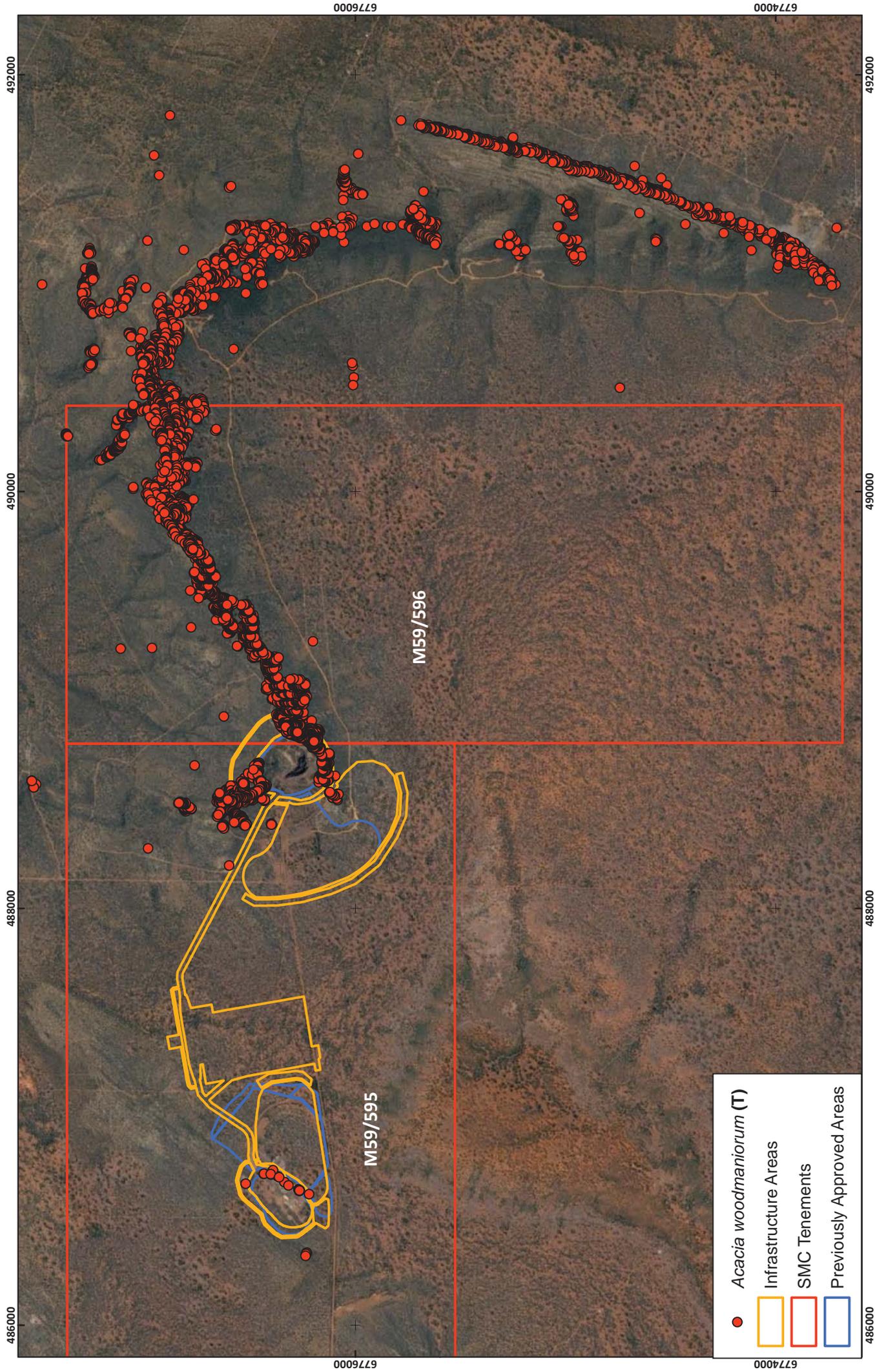
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Acacia woodmaniorum (T) Recorded in the Wider Area

Figure: 9.8a
 Prepared for: SMC
 Drawn by: SH
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Acacia woodmaniorum (T) Recorded in the Wider Area

Figure: 9.8b
 Prepared for: SMC
 Drawn by: SH
 Version: 1



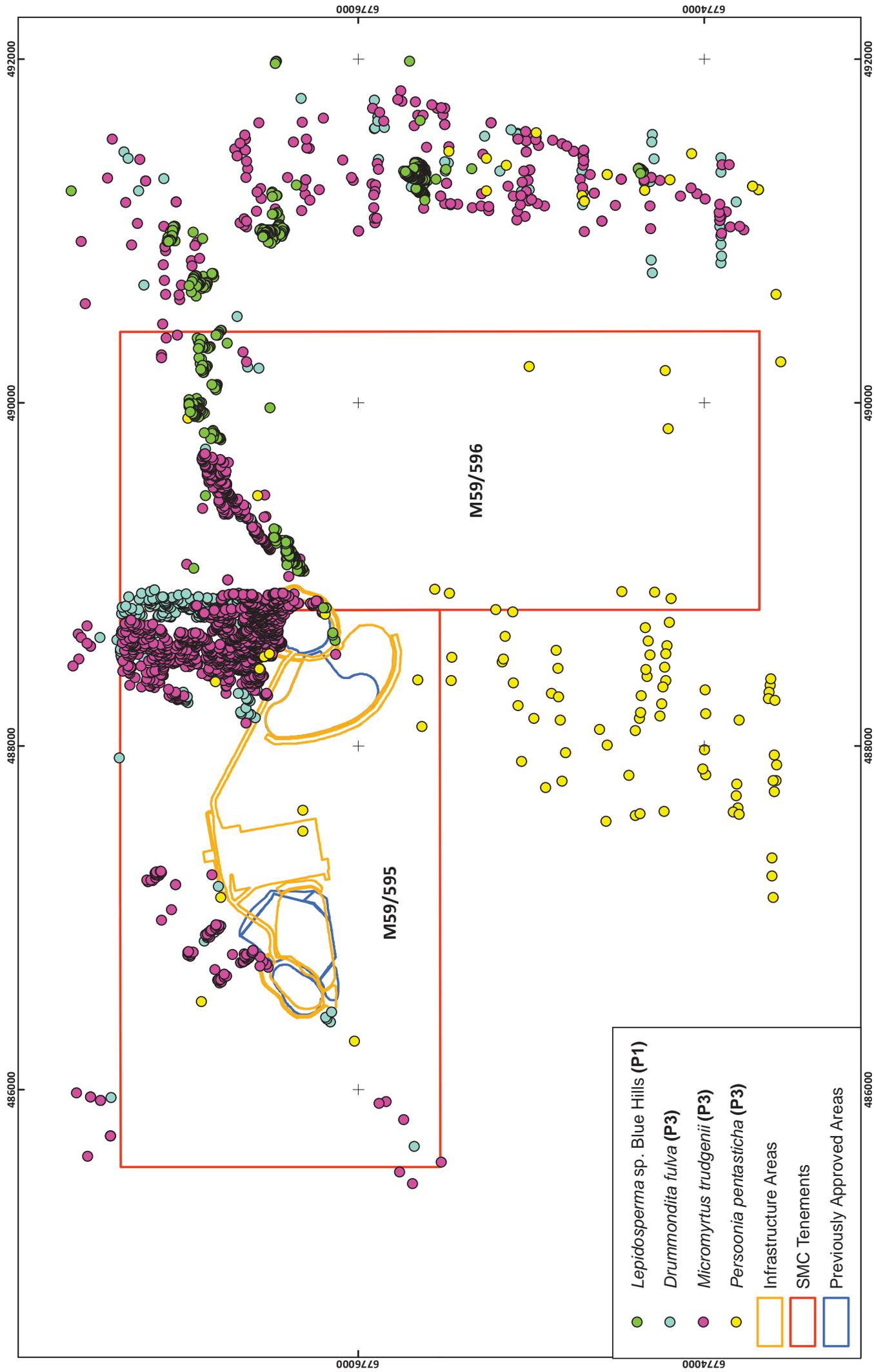
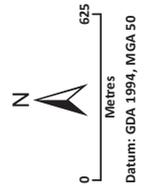
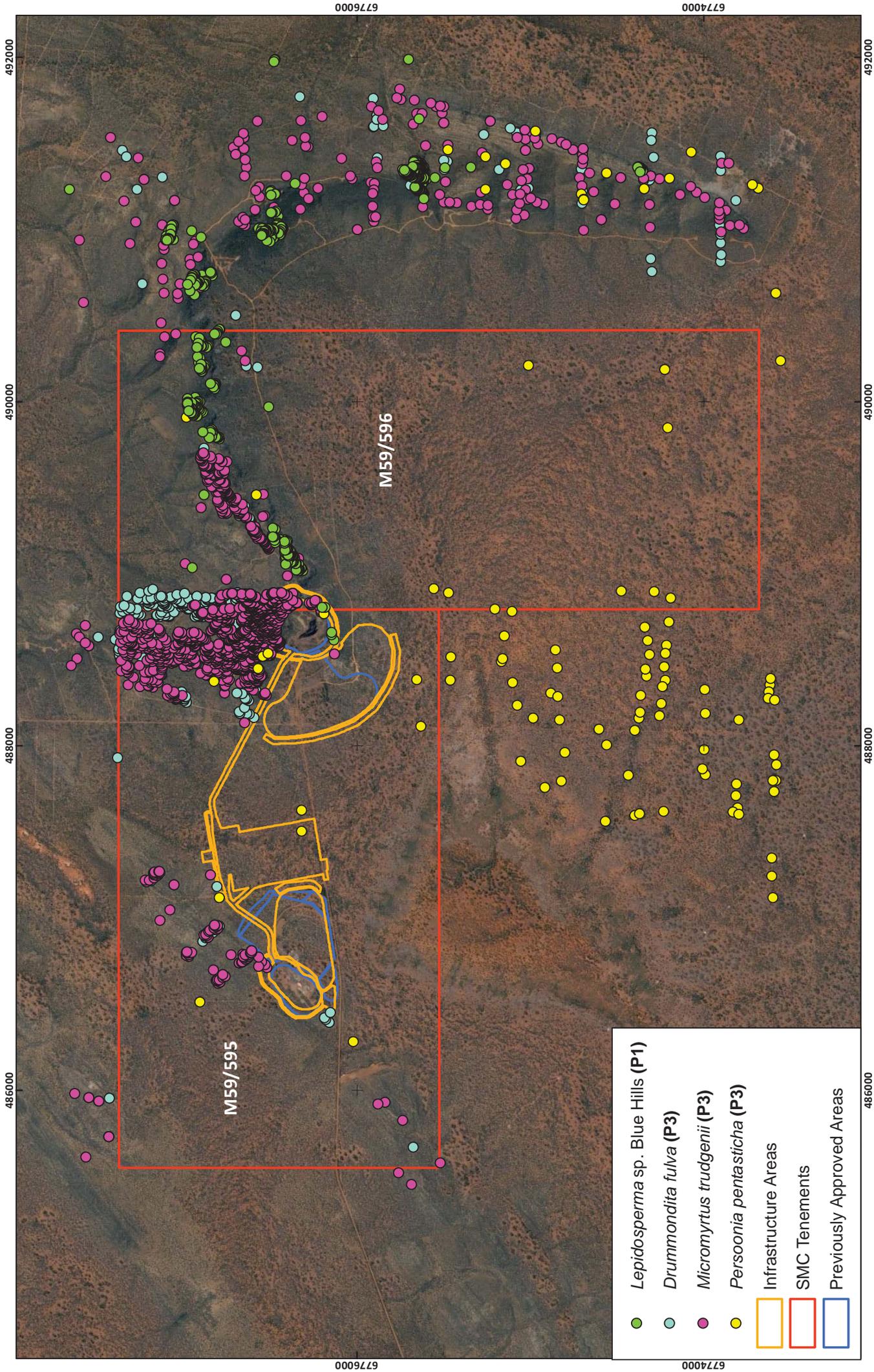


Figure: 9.9a
 Prepared for: SMC
 Drawn by: SH
 Version: 1



Priority Flora Recorded in the Wider Area



Priority Flora Recorded in the Wider Area

- *Lepidosperma* sp. Blue Hills (P1)
- *Drummondita fulva* (P3)
- *Micromyrtus trudgenii* (P3)
- *Persoonia pentasticha* (P3)
- Infrastructure Areas
- SMC Tenements
- Previously Approved Areas

Figure: 9.9b
 Prepared for: SMC
 Drawn by: SH
 Version: 1



Appendix 1: Results of Database and Literature Searches

Table A1.1: Conservation Significant Flora Species at and in the Vicinity of Blue Hills (Mungada West and East)

Species	Rank	Flowering	Habitat	Nearest Recorded Locations (FloraBase, 2011)	Possibility of Occurrence	Source
<i>Eremophila viscida</i>	EPBC Act Endangered and WC Act Schedule 1	September to November	Granitic soils, sandy loam. Stony gullies, sandplains.	North of Wongan Hills, Chiddarcooping Nature Reserve, Barnong Conservation Park, West of Mullewa –Wubin Road, Pindar, South-East of Pithara, Geelakin Rock, South of and Mukinbudin, West-North-West Bullfinch, North of and Westonia, West of Merredin, North-North-West of Latham, North-East of Carnamah, between Tardun and Wilroy, Baandee, Koorda, Kondut, Nungarin, Ballidu, Boodarockin, Kununoppin,	Unlikely	EPBC Act Protected Matters Search Tool
<i>Hybanthus cymulosus</i>	EPBC Act Critically Endangered and WC Act Schedule 1	May to July	Clay, rocky loam clay. Small dry creekline with rocky red/brown loam over greenstone. Drainage line on slope to rocky hills, dolerite, banded ironstone. Loamy soil on plain.	Mount Gibson, Mount Singleton, Ninghan, Wubin.	Unlikely	EPBC Act Protected Matters Search Tool
<i>Pityrodia axillaris</i>	EPBC Act Critically Endangered and WC Act Schedule 1	July to December	Sandy soils. Plains.	North of Wubin, West of Bunjil, West of Mullewa-Wubin Road, Maya, Buntine, Caron Nature Reserve, South-South-East of Perenjori, Latham, Lake Moore, Pithara, Gnangara.	Unlikely	EPBC Act Protected Matters Search Tool

Species	Rank	Flowering	Habitat	Nearest Recorded Locations (FloraBase, 2011)	Possibility of Occurrence	Source
<i>Acacia woodmaniorum</i>	WC Act Schedule 1, T	July	Skeletal red silt, red-brown soil, banded ironstone, laterite. Slopes, sides of hills, crests of ridges, ranges, disturbed overburden of mine sites.	Mungada Ridge (Karara Station, Lochada Station), Jasper Hill, Windaning Hill (Blue Hills Range).	Numerous locations recorded within the area surveyed.	NM, ecologia (2007), Markey & Dillon (2008), Woodman Environmental Consultants (2008)
<i>Eucalyptus synandra</i>	WC Act Schedule 1, T	August and December to March	Sandy & lateritic soils.	Wialki, John Forest Lookout, Badja Station, Ninghan, Morawa, Beacon, North of Koorda, N Kadji Kadji, Emu Fence Track (Karara Station), Mount Gibson, Mount Marshall, Karroun Hill, Jingymia, Gutha.	Possible	NM
<i>Stylidium</i> sp. Yalgoo (D. Coultas et al. Opp 01)	WC Act Schedule 1, T	September to October	Granite outcrop, possibly on shalestone/ironstone outcrops.	Karara Station, Warriedar Station, Badja Station, Mungada Ridge, Golden Grove.	Possible	NM, Woodman (2008)
<i>Acacia sulcaticaulis</i>	P1	Not Available	Slopes of brown clay loam over granite and quartz, greenstone. Rocky creekline.	Mount Mulgine, Warriedar Station.	Unlikely	NM
<i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100)	P1	Not Available	Plain – red clay, slopes of brown clay loam over basalt, rocky hill with skeletal silty clay loam over granite/greenstone, dolerite hill slope.	Mount Mulgine, Warriedar Station, Karara Station, North-West of Paynes Find, North-East of Perenjori.	Unlikely	NM
<i>Chamelaucium</i> sp. Yalgoo (Y. Chadwick 1816)	P1	Not Available	Granite outcrops.	Yalgoo, South of Yalgoo, Wurarga.	Unlikely	NM, Woodman Environmental Consultants (2008)
<i>Eucalyptus jutsonii</i> subsp. <i>kobela</i>	P1	Not Available	Deep yellow to orange sand. Broad and subdued rises high in the landscape.	Karara Station.	Unlikely	NM

Species	Rank	Flowering	Habitat	Nearest Recorded Locations (FloraBase, 2011)	Possibility of Occurrence	Source
<i>Gunniopsis divisa</i>	P1	August	Banded ironstone slopes, laterite, loam, quartz. Roadsides.	Mount Barloweerie, Wooleen Station, South of Murchison River (Mullewa-Murchison Settlement Road), Mungada, Jack Hills, Mount Karara, Woolgorong Station, Murgoo Station, Meeberrie.	Possible	NM, Markey & Dillon (2008), Woodman Environmental Consultants (2008)
<i>Hydrocotyle</i> sp. Warriedar (P.G. Wilson 12267)	P1	September	Red loam. Along creek embankment, rocky valley floor.	Warriedar-Coppermine Road, Yalgoo, Blue Hills, Mount Gibson Sanctuary, Warriedar Station.	Unlikely	NM
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	P1	Not Available	Breakaway, laterite and sandstone. Creek bank. Granite outcrop. Slope of laterised haematite and banded ironstone.	Charles Darwin Reserve, Mount Karara.	Located in the vicinity of the Survey Area	NM, Woodman Environmental Consultants (2008)
<i>Millotia dimorpha</i>	P1	September	Red loamy soils. Dolerite, haematite and banded ironstone slope.	Koolanooka Hills, Perenjori Hills, Mount Karara, Kadji Kadji,	Likely, previously recorded on the flats between hills	NM, Markey & Dillon (2008), Woodman Environmental Consultants (2008)
<i>Rhodanthe collina</i>	P1	August to October	Loam. Rocky hills. Banded ironstone slopes, haematite, quartz, laterite.	Mungada, Koolanooka Hills, Blue Hills Range, Yandanoo Hills, Jasper Hill, Windaning Hill, Warriedar Station, Mongers Lake, Mount Gibson, Mingenew Hill.	Likely, previously recorded in the area	NM, Markey & Dillon (2008), Woodman Environmental Consultants (2008)
<i>Acacia diallaga</i>	P2	Not Available	Hillslopes, basalt outcropping.	Mount Mulgine, Warriedar Station, Karara Station.	Possible	NM
<i>Acacia karina</i>	P2	Not Available	Red-brown silty clay loam with ironstone pebbles, banded ironstone, shalestone. Rocky slopes.	Mount Gibson, Karara Ridge, Mount Mulgine, Karara Station, Damperwah Hills, John Forrest Lookout, Warriedar Station, Mungada Ridge, Windaning	Likely, located in the vicinity of the Study Area on the southern slopes of	NM, Markey & Dillon (2008), Woodman Environmental Consultants

Species	Rank	Flowering	Habitat	Nearest Recorded Locations (FloraBase, 2011)	Possibility of Occurrence	Source
				Hill, Wylacoppin Hill, Mount Singleton.	Mungada East	(2008)
<i>Calandrinia kalanniensis</i>	P2	November to January	Shallow brown clay, often gritty, derived from eroded granite. Rocky outcrops, herb fields.	Mungada, North-East of Mukinbudin, Yanneymooning Nature Reserve, Petrudor Rocks, Hughden Rock, Xantippe Rock.	Unlikely	NM, Woodman (2008)
<i>Calandrinia</i> sp. Warriedar (F. Obbens 04/09)	P2	Not Available	Gentle slope. Red brown clay loam (shallow gritty with some lateritic stones). Granite basement rock.	South of Mt Warriedar, Warriedar Station, Karara Station.	Possible	NM
<i>Austrostipa blackii</i>	P3	September to November	Granite breakaway. Hillcrest of banded ironstone, haematite and sedimentary rocks. Seasonal creekline. Plain with brown loam. Basalt Hill.	Charles Darwin Reserve, Yandanoo Hills, Windaning Hill, Koolanooka Hills, Beverley Airfiels Reserve, Dalwallinu Town Reserve, Tutanning Nature Reserve, Widgiemooltha, Ennuin Station, Hunt Range, Jaurdi Station.	Possible	NM, Markey & Dillon (2008), Woodman Environmental Consultants (2008)
<i>Bossiaea</i> sp. Jackson Range (G. Cockerton & S. McNee LCS 13614)	P3	Not Available	Granite breakaway. Laterite/duricrust breakaway. Red sandy loam soil. Banded ironstone hill.	Emu Fence Road, Kawana Homestead, Crown reserve between Karara and Warriedar Stations, Charles Darwin Reserve, Mt Jackson Range, White Wells Homestead.	Unlikely	NM
<i>Calotis</i> sp. Perrinvale Station (R.J. Cranfield 7096)	P3	Not Available	Banded ironstone outcrop, slope and hillcrest. Granite slope.	Mount Richardson, Karara Station, Charles Darwin Reserve, Golden Grove, Gnows Nest Range, Badja Station (Blue Hills Range), Minjar Hill, Mount Karara, Jasper Hill, Windaning Hill, Perrinvale Station, Cue.	Possible	NM, Markey & Dillon (2008), Woodman Environmental Consultants (2008)
<i>Calytrix uncinata</i>	P3	August to November	White or red sand, sandy clay. Granite or sandstone breakaways, rocky rises.	Bulga Downs Station, Wanjarri Nature Reserve, Leinster, Gnows Nest Range, South-West	Possible	Markey & Dillon (2008)

Species	Rank	Flowering	Habitat	Nearest Recorded Locations (FloraBase, 2011)	Possibility of Occurrence	Source
			Banded ironstone and laterite.	of Wiluna, Murdaburia Hill, Booylgoo Range, Joyners Find Greenstone Belt, Yakabindie Station, Blue Hills Range, North of Meekatharra, Golden Grove, Cogla Downs Station, Maranalgo Station, Mount Keith, Nambi Station, Youno Downs, Teutonic, Mount Magnet.		
<i>Cyanicula fragrans</i>	P3	August to September	Red loam. Flat granite outcrops. Creekline.	Badja Station, Moonagin Hills, Bimbijy Station, Mourobra, Mount Singleton, Lake Moore, West-South-West of Paynes Find.	Unlikely	NM
<i>Dicrasyllis linearifolia</i>	P3	November to December	Red sand. Yellow sand. Sandplain.	Mount Mulgine, Warriedar Station, Shark Bay, Muggon Station, Eurardy Station, East of Pindar, Byro Station, Burnerbinmah Station, North-West of Murchison Settlement, Toolonga Nature Reserve, Meka Station, Iona Station, South of Billabong Roadhouse, Meadow Station, North of Overlander Roadhouse, Binnu,	Unlikely	NM
<i>Drummondita fulva</i>	P3	September to October	Skeletal, shallow, acidic soils of orange-red or red-brown sandy loams and clayey silts. Footslopes, lower to upper slopes and hillcrests.	Windaning Hill, Oxiana Golden Grove, Badja Station, Minjar Hill, Warriedar Station, Jasper Hill, Lochada Station.	Located in the Study Area.	NM, Markey & Dillon (2008), Woodman Environmental Consultants (2008)
<i>Grevillea globosa</i>	P3	January, June and November	Red loam, yellow sand.	Damperwah Hills, Fields Find, Mungada, Mt Karara, Golden Grove, Gossan Hill, Wuraga	Unlikely	ecologia (2007), NM, Woodman Environmental

Species	Rank	Flowering	Habitat	Nearest Recorded Locations (FloraBase, 2011)	Possibility of Occurrence	Source
				Road, Yuin, South-West of Paynes Find, Pindar, South-West of Yalgoo.		Consultants (2008)
<i>Grevillea scabrada</i>	P3	July	In gravelly soil, or loam, or clay; occupying ironstone gravelly plain, winter-wet areas.	Bullajungadeah Hills, Mt Gibson, Mungada, Minjar, Ninghan Station, Mount Singleton, Fields Find, Karara Station, Mount Mulgine, North of Wubin,	Possible	ecologia (2007), NM, Woodman Environmental Consultants (2008)
<i>Grevillea subtiliflora</i>	P3	April and July to September	Red-brown loam. Bouldery slope. Valley floor. Brown loam over dolerite slope. Undulating plain with red clay loam.	Warriedar Station, Minjar, Mount Singleton, Mount Gibson Station, South-West of Paynes Find, North of Wubin, Paynes Find.	Unlikely	NM, Woodman Environmental Consultants (2008)
<i>Gunniopsis rubra</i>	P3	September	Sandy loam. Slope. Hillcrest of haematite and quartz. Hillslope and crest of banded ironstone. Close to valley bottom. Base of granitic breakaway. White sandy soils.	Charles Darwin Reserve, Badja Station, Perenjori Hills, Mount Karara, Red Hill, North-East of Narembeen, North-West of Bencubbin, East of Nungarin, North of Cunderdin, Kalannie, Quairading Shire Reserve, Dalwallinu Town Reserve, Buntine Nature Reserve, Snake Gully Nature Reserve, Lake Champion Nature Reserve, Ennuin.	Possible	NM, Markey & Dillon (2008), Woodman (2008)
<i>Melaleuca barlowii</i>	P3	April	Yellow-brown sand or red-brown clay loam. Roadside reserves, shrubland. Hillslope of banded ironstone and dolerite.	Mullewa, West of Dalwallinu, Perenjori Hills, Mungada, Koolanooka Hills, West of Pindar, East of Latham, West-North-West of Morawa, Yandanooka, Tardun, Karara Station, Kalannie, Carnamah.	Possible	Woodman Environmental Consultants (2008)

Species	Rank	Flowering	Habitat	Nearest Recorded Locations (FloraBase, 2011)	Possibility of Occurrence	Source
<i>Micromyrtus acuta</i>	P3	July to October	Grey-tan silty fine to coarse sand, laterite, granite. Rock outcrops. Ironstone and banded ironstone hillslopes.	Mount Mulgine, Pinyalling Hill, Damperwah Hills, Warriedar Station, Jasper Hill, Windaning Hill, Lake Monger Lookout, White Wells Station, South-West of Paynes Find.	Likely, recorded in large numbers on the crest and weathered slopes of Mungada East.	ecologia (2007), Markey & Dillon (2008), NM, Woodman Environmental Consultants (2008)
<i>Micromyrtus trudgenii</i>	P3	June to October	Red-brown loamy clay, yellow-brown soils, gravel, siltstone, quartz, basalt, banded ironstone, dolerite. Tops and slopes of hills and ridges.	Karara Station, Mt Mulgine, St Patricks, Arsenic Hill, Mungada, Badja Station, Minjar Hill, Warreidar Station, Jasper Hill, Golden Grove, Gossan Hill, West of Paynes Find.	Located in the Study Area.	ecologia (2007, 2008), NM, Markey & Dillon (2008), Woodman Environmental Consultants (2008)
<i>Persoonia pentasticha</i>	P3	August to November	Sand, loam. Base of granite outcrops. Rocky slopes of haematite and laterite. Drainage line. Hillslope of banded ironstone and laterite.	Morawa, Charles Darwin Reserve, Barrabarra Nature Reserve, Mt Gibson, Damperwah Hills, Mugga Mugga Hill, Mungada, Badja Station, Koolanooka Hills, Extension Hill, Warriedar Station, Minjar, East Yuna Reserve, West Perenjori Nature Reserve, Pindar, Morawa, North of Wubin.	Located in the Study Area.	Bennett (2004), ecologia (2007), Markey & Dillon (2008), NM, Woodman Environmental Consultants (2008)
<i>Petrophile pauciflora</i>	P3	September	Decaying & dissected granite breakaways.	Yilgarn, Damperwah Hills, Karara Station, Lochada Station, North of Cue, Woolgorong, North of Mount Magnet, Kalli Station, Pindarbunna Station, Bimbijy Station, South-East of Mileura.	Unlikely	NM
<i>Polianthion collinum</i>	P3	May to July	Red clay loam between blocks of banded ironstone. Low hills	Warriedar Station, Arsenic Hill, Mungada, Windaning Hill,	Possible	Markey & Dillon (2008), NM,

Species	Rank	Flowering	Habitat	Nearest Recorded Locations (FloraBase, 2011)	Possibility of Occurrence	Source
			and slopes.	Karara Station, Gossan Hill.		Woodman Environmental Consultants (2008)
<i>Psammomoya implexa</i>	P3	August to October	Stony rises. Banded ironstone and laterite slope.	Charles Darwin Reserve, Karara Station, Jasper Hill, Mullewa, Pintharuka, Lake Mollerin Nature Reserve, Gabyon Station, Ninghan, Wilroy.	Possible	ecologia (2007), Markey & Dillon (2008), NM
<i>Spartothamnella</i> sp. Helena & Aurora Range (P.G. Armstrong 155-109)	P3	Not Available	Plain with orange sandy loam. Slope of banded ironstone, calcrete and quartz. Ironstone range. Sandplain.	Hospital Rocks, Diemals Station, Pigeon Rocks, Koolyanobbing RRange, North Yerilgee Greenstone Belt, Johnston Range, Jackson Range, Die Hardy Range, Helena and Aurura Range, Remlap Station, Blue Hills Range.	Possible	NM, Woodman Environmental Consultants (2008)
<i>Stenanthemum poicilum</i>	P3	May to June and September to November	Red clay or sandy clay, loam. Yellow sandy loam flat. Creekline. Slope of basalt. Banded ironstone and chert outcrop. Haematite.	Charles Darwin Reserve, Mount Mulgine, Canna Reserve, Warriadar Station, Perenjori Hills, Koolanooka Hills, White Wells Station. Jasper Hill. Wilroy Reserve.	Possible	Bennett (2004), NM, Woodman Environmental Consultants (2008)

NM= NatureMap (DEC, 2011a), T = Threatened (Declared Rare) Species, P1 = Priority 1, P2 = Priority 2, P3 = Priority 3, P4 = Priority 4. Rows shaded grey indicate conservation significant species recorded within Infrastructure Areas.

Appendix 2: Flora Species Recorded

Table A2.1: Species Recorded Within and in the Vicinity of the Infrastructure Areas

Family	Species	Other Surveys	Infrastructure Areas
Aizoaceae	*Cleretum papulosum subsp. papulosum	•	
	<i>Gunniopsis septifraga</i>		•
	<i>Tetragonia moorei</i>	•	•
Amaranthaceae	<i>Ptilotus gaudichaudii</i>	•	
	<i>Ptilotus obovatus</i>	•	
	<i>Ptilotus obovatus</i> var. <i>obovatus</i>	•	
Apiaceae	<i>Daucus glochidiatus</i>		•
	<i>Platysace cirrosa</i>	•	
	<i>Xanthosia bungei</i>	•	
Apocynaceae	<i>Alyxia buxifolia</i>	•	
Araliaceae	<i>Hydrocotyle pilifera</i> var. <i>glabrata</i>	•	
	<i>Trachymene ornata</i>	•	
Asparagaceae	<i>Arthropodium dyeri</i>	•	
	<i>Chamaexeros macranthera</i>	•	•
	<i>Thysanotus manglesianus</i>	•	
	<i>Thysanotus speckii</i>	•	
Asteraceae	<i>Actinobole uliginosum</i>		•
	*Arctotheca calendula	•	•
	<i>Bellida graminea</i>		•
	<i>Blennospora drummondii</i>	•	
	<i>Brachyscome ciliaris</i>	•	
	<i>Calocephalus knappii</i>	•	
	<i>Calocephalus multiflorus</i>	•	
	<i>Calotis hispidula</i>	•	•
	<i>Calotis multicaulis</i>		•
	Calotis sp. Perrinvale Station (R.J. Cranfield 7096) (P3)	•	
	<i>Feldstonia nitens</i>	•	
	<i>Lawrencella rosea</i>	•	
	<i>Lemooria burkittii</i>	•	
	<i>Minuria cunninghamii</i>	•	
	<i>Myriocephalus occidentalis</i>		•
	<i>Olearia pimeleoides</i>	•	
	<i>Podolepis lessonii</i>	•	
	<i>Pogonolepis muelleriana</i>	•	
	<i>Rhodanthe polycephala</i>		•
	<i>Schoenia cassiniana</i>	•	•
	<i>Schoenia filifolia</i> subsp. <i>filifolia</i>	•	
	<i>Senecio glossanthus</i>		•
	*Sonchus oleraceus	•	
<i>Waitzia acuminata</i> var. <i>acuminata</i>	•		
Boraginaceae	Echium plantagineum (DP)	•	
Boryaceae	<i>Borya sphaerocephala</i>	•	
Brassicaceae	*Brassica tournefortii	•	
	<i>Lepidium</i> sp.	•	
	<i>Stenopetalum anfractum</i>		•
Campanulaceae	<i>Isotoma petraea</i>	•	
	<i>Lobelia winfridae</i>	•	

Family	Species	Other Surveys	Infrastructure Areas
Casuarinaceae	<i>Allocauarina acutivalvis</i> subsp. <i>prinsepiana</i>	•	
Chenopodiaceae	<i>Enchylaena tomentosa</i>	•	
	<i>Maireana appressa</i>		•
	<i>Maireana glomerifolia</i>		•
	<i>Maireana thesioides</i>	•	
	<i>Maireana villosa</i>	•	
	<i>Rhagodia drummondii</i>	•	
	<i>Rhagodia preissii</i>	•	
	<i>Sclerolaena cuneata</i>	•	
	<i>Sclerolaena densiflora</i>	•	
	<i>Sclerolaena diacantha</i>	•	
Colchicaceae	<i>Wurmbea densiflora</i>		•
Cuscutaceae	*Cuscuta planiflora	•	
Cyperaceae	Lepidosperma sp. Blue Hills (A. Markey & S. Dillon 3468) (P1)	•	•
Dilleniaceae	<i>Hibbertia arcuata</i>	•	
Dioscoreaceae	<i>Dioscorea hastifolia</i>	•	
Droseraceae	<i>Drosera macrantha</i>	•	
Ericaceae	<i>Astroloma serratifolium</i>	•	
Euphorbiaceae	<i>Calycopeplus paucifolius</i>	•	
Fabaceae	<i>Acacia acuaria</i>	•	
	<i>Acacia acuminata</i>	•	
	<i>Acacia aneura</i> (Complex)	•	
	<i>Acacia anthochaera</i>	•	•
	<i>Acacia assimilis</i> subsp. <i>assimilis</i>	•	
	<i>Acacia aulacophylla</i>	•	
	<i>Acacia coolgardiensis</i>	•	
	<i>Acacia effusifolia</i>	•	
	<i>Acacia exocarpoides</i>	•	
	<i>Acacia kalgoorliensis</i>		•
	Acacia karina (P2)	•	
	<i>Acacia longiphylloidea</i>	•	•
	<i>Acacia murrayana</i>	•	
	<i>Acacia obtecta</i>	•	•
	<i>Acacia quadrimarginea</i>	•	
	<i>Acacia ramulosa</i> var. <i>linophylla</i>	•	
	<i>Acacia ramulosa</i> var. <i>ramulosa</i>	•	
	<i>Acacia sibina</i>		•
	<i>Acacia stereophylla</i> var. <i>stereophylla</i>	•	
	<i>Acacia tetragonophylla</i>	•	
	Acacia woodmaniorum (T)	•	•
	<i>Gastrolobium laytonii</i>	•	
	<i>Mirbelia bursarioides</i>	•	
	<i>Mirbelia depressa</i>	•	
	<i>Mirbelia microphylla</i>	•	
	<i>Mirbelia spinosa</i>	•	
	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	•	
	<i>Senna glutinosa</i>	•	
	<i>Senna stowardii</i>	•	

Family	Species	Other Surveys	Infrastructure Areas
Frankeniaceae	<i>Frankenia laxiflora</i>		•
Geraniaceae	*<i>Erodium cicutarium</i>	•	
	<i>Erodium cygnorum</i>	•	
Goodeniaceae	<i>Brunonia australis</i>	•	
	<i>Goodenia berardiana</i>		•
	<i>Goodenia occidentalis</i>	•	
	<i>Scaevola spinescens</i>	•	
	<i>Velleia discophora</i>	•	
Haloragaceae	<i>Glischrocaryon flavescens</i>	•	
Hemerocallidaceae	<i>Dianella revoluta</i> var. <i>revoluta</i> (RE)	•	
Lamiaceae	<i>Hemigenia brachyphylla</i>	•	
	<i>Microcorys</i> sp. Mt Gibson (S. Patrick 2098)	•	
	<i>Prostanthera althoferi</i> subsp. <i>althoferi</i>		•
	<i>Prostanthera campbellii</i>	•	
	<i>Prostanthera magnifica</i>	•	
	<i>Prostanthera patens</i>	•	
Loranthaceae	<i>Amyema preissii</i>	•	
Malvaceae	<i>Brachychiton gregorii</i>	•	
	<i>Keraudrenia velutina</i> subsp. <i>velutina</i>	•	
	<i>Sida</i> sp. dark green fruit (S. van Leeuwen 2260)	•	
	<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	•	
Myrtaceae	<i>Aluta aspera</i> subsp. <i>hesperia</i>	•	•
	<i>Baeckea</i> sp. Blue Hills (SOI)	•	
	<i>Eucalyptus ewartiana</i>	•	
	<i>Eucalyptus kochii</i> subsp. <i>borealis</i>	•	
	<i>Eucalyptus leptopoda</i> subsp. <i>arctata</i>	•	
	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	•	
	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>	•	
	<i>Melaleuca acuminata</i>		•
	<i>Melaleuca leiocarpa</i>	•	
	<i>Melaleuca nematophylla</i>	•	
	<i>Melaleuca radula</i>	•	
	<i>Melaleuca uncinata</i>	•	
	<i>Micromyrtus acuta</i> (P3)	•	
	<i>Micromyrtus trudgenii</i> (P3)	•	•
	<i>Thryptomene costata</i>	•	
	<i>Thryptomene cuspidata</i>	•	
	<i>Thryptomene decussata</i>	•	
Poaceae	<i>Austrostipa elegantissima</i>	•	
	<i>Austrostipa scabra</i>		•
	<i>Bromus arenarius</i>	•	
	<i>Enneapogon caeruleus</i>	•	
	<i>Eriachne pulchella</i> subsp. <i>dominii</i>	•	
	*<i>Lamarckia aurea</i>	•	
	*<i>Pentaschistis airoides</i>	•	
	*<i>Rostraria pumila</i>	•	
Polygonaceae	<i>Muehlenbeckia florulenta</i>		•
Portulacaceae	<i>Calandrinia eremaea</i>	•	
	<i>Calandrinia</i> sp. Blackberry (D.M. Porter 171)		•

Family	Species	Other Surveys	Infrastructure Areas
Primulaceae	*Lysimachia arvensis	•	
Proteaceae	<i>Grevillea acacioides</i>	•	
	<i>Grevillea eriostachya</i>	•	
	<i>Grevillea extorris</i>		•
	<i>Grevillea nematophylla</i> subsp. <i>nematophylla</i>	•	
	<i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i>	•	
	<i>Hakea recurva</i> subsp. <i>recurva</i>	•	
	Persoonia pentasticha (P3)	•	
Pteridaceae	<i>Cheilanthes austrotenuifolia</i>	•	
	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	•	
Rhamnaceae	<i>Cryptandra imbricata</i>	•	
Rutaceae	Drummondita fulva (P3)	•	•
	<i>Philotheca brucei</i> subsp. <i>brucei</i>	•	
	<i>Philotheca deserti</i>	•	
	<i>Philotheca deserti</i> subsp. <i>deserti</i>	•	•
	<i>Philotheca sericea</i>	•	•
Santalaceae	<i>Exocarpos aphyllus</i>	•	
	<i>Santalum acuminatum</i>	•	
Sapindaceae	<i>Dodonaea adenophora</i>	•	
	<i>Dodonaea petiolaris</i>	•	•
	<i>Dodonaea rigida</i>	•	
Scrophulariaceae	<i>Eremophila clarkei</i>	•	
	<i>Eremophila exilifolia</i>	•	
	<i>Eremophila glutinosa</i>	•	
	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	•	
	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>	•	•
	<i>Eremophila serrulata</i>		•
Solanaceae	<i>Nicotiana cavicola</i>	•	
	<i>Solanum ellipticum</i>	•	
	<i>Solanum lasiophyllum</i>	•	
	<i>Solanum nummularium</i>	•	
	<i>Solanum orbiculatum</i>	•	
Stylidiaceae	<i>Levenhookia leptantha</i>	•	
Thymelaeaceae	<i>Pimelea microcephala</i> subsp. <i>microcephala</i>	•	
Urticaceae	<i>Parietaria cardiostegia</i>	•	

Nomenclature as per Western Australian Herbarium, FloraBase website, November 2011. Note: T = Threatened (Declared Rare) species, P1 = Priority 1 species, P3 = Priority 3 species, * = Environmental Weed, DP = Declared plant, RE = Range extension species.

Appendix 3: Conservation Significance – Flora and Ecological Communities

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Table A3.1: Categories and definitions for Rare Flora

Category	Definition
Extinct*	A native species is eligible to be included in the extinct category if there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category if: <ul style="list-style-type: none"> a) it is only known to survive in cultivation, in captivity or as a naturalized population well outside its past range; or b) if it has not been recorded in its known and/ or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered	A native species is eligible to be included in the critically endangered category if it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	A native species is eligible to be included in the endangered category if: <ul style="list-style-type: none"> a) if it is not critically endangered; and b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A native species is eligible to be included in the vulnerable category if: <ul style="list-style-type: none"> a) if it is not critically endangered or endangered; and b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation dependent*	A native species is eligible to be included in the conservation dependent category if: <ul style="list-style-type: none"> a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or b) the following subparagraphs are satisfied; <ul style="list-style-type: none"> (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.
*Note: Species listed as 'conservation dependent' and 'extinct' are not matters of national environmental significance and therefore do not trigger the EPBC Act.	

Source: DSEWPC, 2011b.

Western Australian Wildlife Conservation Act 1950

Table A3.2: Categories and definitions for Rare Flora

Category	Definition
<p>T: Threatened Flora (Declared Rare Flora – Extant)</p>	<p>Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the Wildlife Conservation Act 1950).</p> <p>Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:</p> <ul style="list-style-type: none"> • CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild • EN: Endangered – considered to be facing a very high risk of extinction in the wild • VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
<p>X: Presumed Extinct Taxa (Declared Rare Flora – Extinct)</p>	<p>Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950).</p> <p>Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List 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 list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.</p>

Source: DEC, 2011b.

Table A3.3: Categories and definitions for Priority Flora

Category	Definition
1: Priority One: Poorly-known species	Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2: Priority Two: Poorly-known species	Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
3: Priority Three: Poorly-known species	Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities 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 localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4: Priority Four: Rare, Near Threatened and other species in need of monitoring	<p>a. Rare. Species 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 species are usually represented on conservation lands.</p> <p>b. Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>c. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
5: Priority Five: Conservation Dependent species	Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Source: DEC, 2011b.

Table A3.4: Categories, definitions and criteria for Threatened Ecological Communities (TEC)

Category	Definition and Criteria
Presumed Totally Destroyed (PD)	<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats; or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed.</p>
Critically Endangered (CR)	<p>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.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <ul style="list-style-type: none"> • (i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); • (ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ul style="list-style-type: none"> • (i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); • (ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; • (iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>

Category	Definition and Criteria
Endangered (EN)	<p>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.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):</p> <p>A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):</p> <ul style="list-style-type: none"> • (i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); • (ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ul style="list-style-type: none"> • (i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); • (ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; • (iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. <p>C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p>
Vulnerable (VU)	<p>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.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</p> <p>B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a</p>

Category	Definition and Criteria
	<p>few locations.</p> <p>C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.</p>

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or 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.

Table A3.5: Categories, definitions and criteria for Priority Ecological Communities (PEC)

Category	Definition and Criteria
Priority One: Poorly-known ecological communities	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. 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 Two: Poorly-known ecological communities	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent 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 Three: Poorly-known ecological communities	<p>(i) 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:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>(iii) Communities made up of large, and/or widespread occurrences, that may or 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.</p> <p>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</p>

Category	Definition and Criteria
	defined, and known threatening processes exist that could affect them.
Priority Four: Adequately known ecological communities	<p>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.</p> <p>(a) 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.</p> <p>(b) 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.</p> <p>(c) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority Five: 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.

Source for Tables A4.4 and A4.5: DEC, 2010.

Appendix 4: Priority Flora Locations

Table A4.1: Locations of Priority Flora Recorded within the Infrastructure Areas (GDA94, MGA50).

Species	Easting (mE)	Northing (mN)	No. Plants
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (P1)	488648	6776145	4
	488662	6776145	1
<i>Drummondita fulva</i> (P3)	488169	6776594	1
	488535	6776530	1
	488545	6776567	1
	488600	6776453	1
	488601	6776449	1
	488602	6776457	1
	488604	6776440	7
	488608	6776462	2
	488609	6776461	1
	488619	6776460	6
	488619	6776468	7
	488621	6776457	3
	488622	6776456	2
	488643	6776479	3
	488646	6776469	1
	488656	6776468	1
	488662	6776465	3
	488664	6776463	7
	488775	6776541	2
	488776	6776542	2
	488779	6776537	2
<i>Micromyrtus trudgenii</i> (P3)	488551	6776584	26
	488820	6776263	26
	488537	6776128	26
	486749	6776548	20
	488297	6776523	3
	488302	6776531	2
	488528	6776498	6
	488528	6776503	2
	488528	6776505	8
	488531	6776526	3
	488533	6776526	2
	488534	6776524	10
	488536	6776517	1
	488539	6776545	1
	488542	6776563	6
	488543	6776573	8
	488544	6776580	1
	488545	6776565	5
	488545	6776573	8
	488546	6776573	6
	488554	6776578	1
	488572	6776587	1
	488576	6776589	3
	488581	6776453	1

Species	Easting (mE)	Northing (mN)	No. Plants
<i>Micromyrtus trudgenii</i> (P3)	488585	6776447	10
	488588	6776596	1
	488592	6776462	20
	488594	6776598	6
	488597	6776463	2
	488597	6776596	6
	488601	6776596	7
	488602	6776457	3
	488604	6776440	3
	488604	6776445	6
	488604	6776456	10
	488605	6776473	3
	488608	6776462	3
	488609	6776446	10
	488609	6776461	5
	488613	6776451	30
	488615	6776453	10
	488619	6776460	20
	488619	6776468	4
	488622	6776456	10
	488628	6776482	3
	488633	6776591	6
	488638	6776596	4
	488646	6776469	2
	488647	6776474	1
	488651	6776465	2
	488664	6776463	3
	488671	6776478	6
	488672	6776460	4
	488676	6776463	2
	488684	6776471	2
	488693	6776465	6
	488698	6776584	2
	488706	6776468	6
	488713	6776456	2
	488720	6776579	1
	488721	6776580	1
	488727	6776570	1
	488730	6776447	6
	488734	6776566	1
	488734	6776567	1
	488738	6776564	2
	488738	6776564	2
	488746	6776448	8
	488757	6776437	7
	488767	6776549	6
	488767	6776549	6
	488767	6776553	5
	488768	6776554	5

Species	Easting (mE)	Northing (mN)	No. Plants
<i>Micromyrtus trudgenii</i> (P3)	488771	6776422	7
	488775	6776546	15
	488775	6776546	15
	488779	6776537	15
	488781	6776207	10
	488790	6776206	6
	488802	6776396	3
	488803	6776524	10
	488803	6776524	10
	488813	6776519	1
	488813	6776520	1
	488815	6776378	3
	488816	6776511	2
	488817	6776511	2
	488818	6776219	2
	488819	6776371	2
	488823	6776371	1
	488824	6776262	3
	488824	6776505	2
	488824	6776505	2
	488831	6776263	10
	488833	6776350	5
	488834	6776275	10
	488835	6776342	4
	488836	6776260	1
	488836	6776346	3
	488845	6776490	1
	488845	6776490	1
	488846	6776487	2
	488862	6776479	1
	488863	6776479	1
	488892	6776448	5
	488893	6776448	5
<i>Persoonia pentasticha</i> (P3)	488772	6776188	1
	487507	6776319	10

Note: P1 = Priority 1 species, P3 = Priority 3 species.

Appendix 5: Declared Plants Control Codes

Agriculture and Related Resources Protection Act 1976

Table A5.1: Codes and controls for Declared Plants

Code	Controls
Priority One – Prohibits movement	The movement of plants or their seeds is prohibited within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
Priority Two – Aims to eradicate infestation	Treat all plants to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and /or machinery.
Priority Three - Aims to control infestation by reducing area and/or density of infestation	<p>The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.</p> <p>Treat to destroy and prevent seed set all plants:</p> <ul style="list-style-type: none"> • within 100 m inside of the boundaries of the infestation; • within 50 m of roads and high water mark on waterways; • within 50 m of sheds, stock yards and houses. <p>Treatment must be done prior to seed set each year.</p> <p>Of the remaining infested area:</p> <ul style="list-style-type: none"> • Where plant density is 1-10 per ha treat 100% of infestation. • Where plant density is 11-100 per ha treat 50% of infestation. • Where plant density is 101-1000 per ha treat 10% of infestation. <p>Properties with less than 2 ha of infestation must treat the entire infestation.</p> <p><u>Additional areas may be ordered to be treated.</u></p>
Priority Four - Aims to prevent infestation spreading beyond existing boundaries of infestation	<p>The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.</p> <p>Treat to destroy and prevent seed set all plants:</p> <ul style="list-style-type: none"> • within 100 m inside of the boundaries of the infested property; • within 50 m of roads and high water mark on waterways; • within 50 m of sheds, stock yards and houses. <p>Treatment must be done prior to seed set each year. Properties with less than 2 ha of infestation must treat the entire infestation.</p> <p>Additional areas may be ordered to be treated.</p>
Priority Five - Control on public land	Infestations on public land must be controlled.

Source: DAFWA, 2011.