

Figure 5-2a
Conservation significant
flora recorded in the
study area
(Muecha North)


 Study area

Status

 Priority 2

 Priority 3

 Priority 4

 Threatened /
Protected Flora

Species code

Adsa - *Acacia drummondii* subsp. *affinis*

Df - *Darwinia foetida*

Ec - *Eucalyptus caesia*

Ss - *Stylidium squamellosum*

Vlsl - *Verticordia lindleyi* subsp. *lindleyi*

Vsvl - *Verticordia serrata* var. *linearis*

0 0.15 0.3 0.6 Kilometres
 1:20,000

Client: Jacobs
 Project: Great Northern Highway –
 Muecha to Wubin (Stage 2) Upgrades
 Author: G. Wells
 Date: 12/9/2015

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994

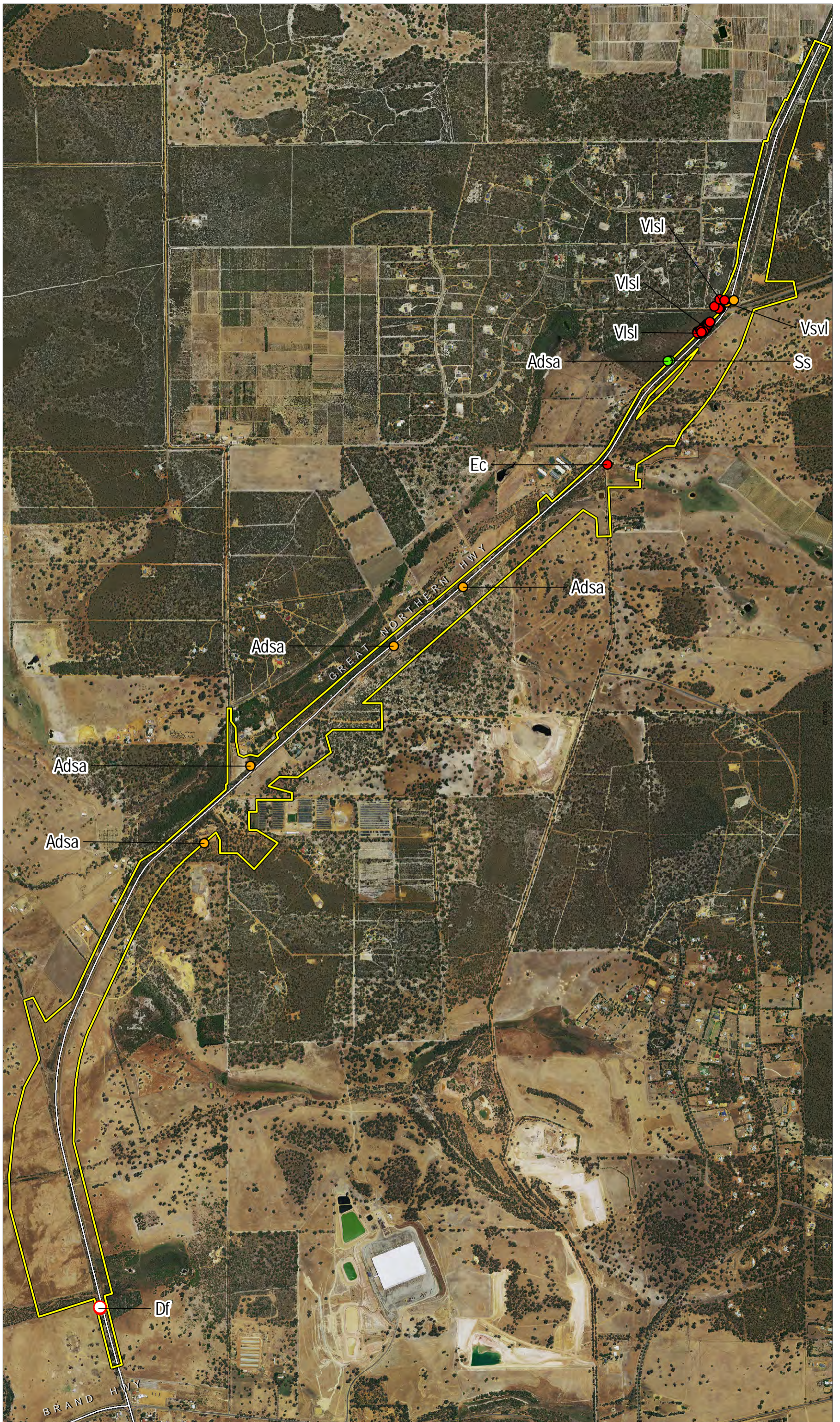



Figure 5-2b
Conservation significant
flora recorded in the
study area
(Chittering)

 Study area

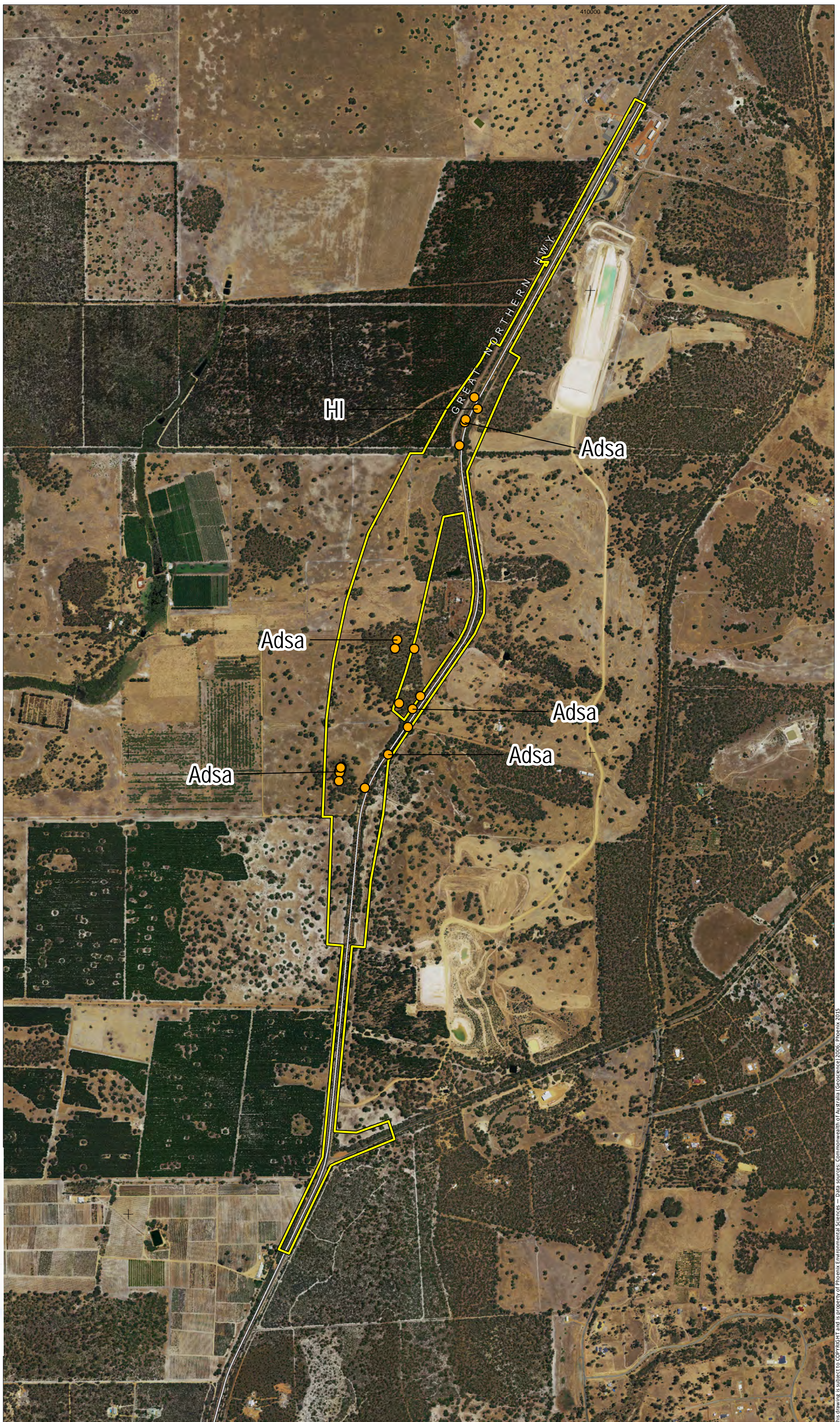
Status

 Priority 3

Species

Adsa - *Acacia drummondii* subsp. *affinis*

Hl - *Haemodorum loratum*



0 0.1 0.2 0.4 Kilometres
 1:15,000

Client: Jacobs
 Project: Great Northern Highway –
 Muchea to Wubin (Stage 2) Upgrades
 Author: G. Wells
 Date: 9/12/2015

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994



5.3.1.2 Introduced flora


A total of 51 introduced flora species were recorded in the study area (Appendix 4). All species recorded have wide distributions in WA and there were no apparent range extensions for any of them.

Three of the introduced species are declared plants (Table 5-12; Figure 5-3).




Table 5-12 Declared plants recorded in the study area

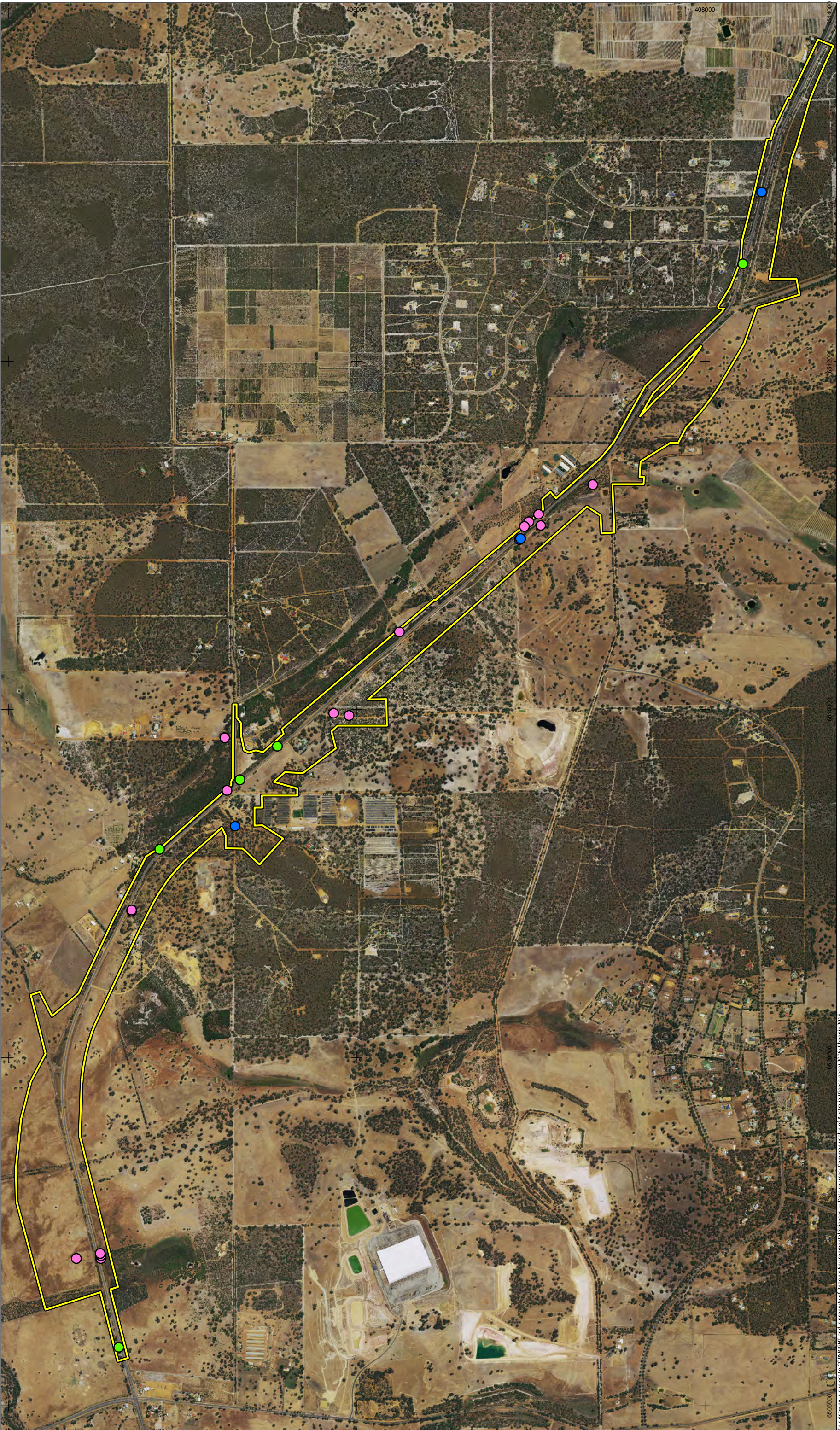
Species	No. locations	Study area	No. plants
* <i>Asparagus asparagoides</i>	5	Muchea North	6
* <i>Echium plantagineum</i>	4	Muchea North	10
* <i>Moraea miniata</i>	17	Muchea North	>200
* <i>Echium plantagineum</i>	2	Chittering	2
* <i>Moraea miniata</i>	2	Chittering	>100

Figure 5-3a
Declared plants recorded
in the study area
(Muchoa North)

 Study area

Species

-  **Asparagus asparagoides*
-  **Echium plantagineum*
-  **Moraea miniata*




0 0.15 0.3 0.6 Kilometres
 1:20,000

Client: Jacobs
 Project: Great Northern Highway –
 Muchoa to Wubin (Stage 2) Upgrades
 Author: A. Leung
 Date: 17/12/2015



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994

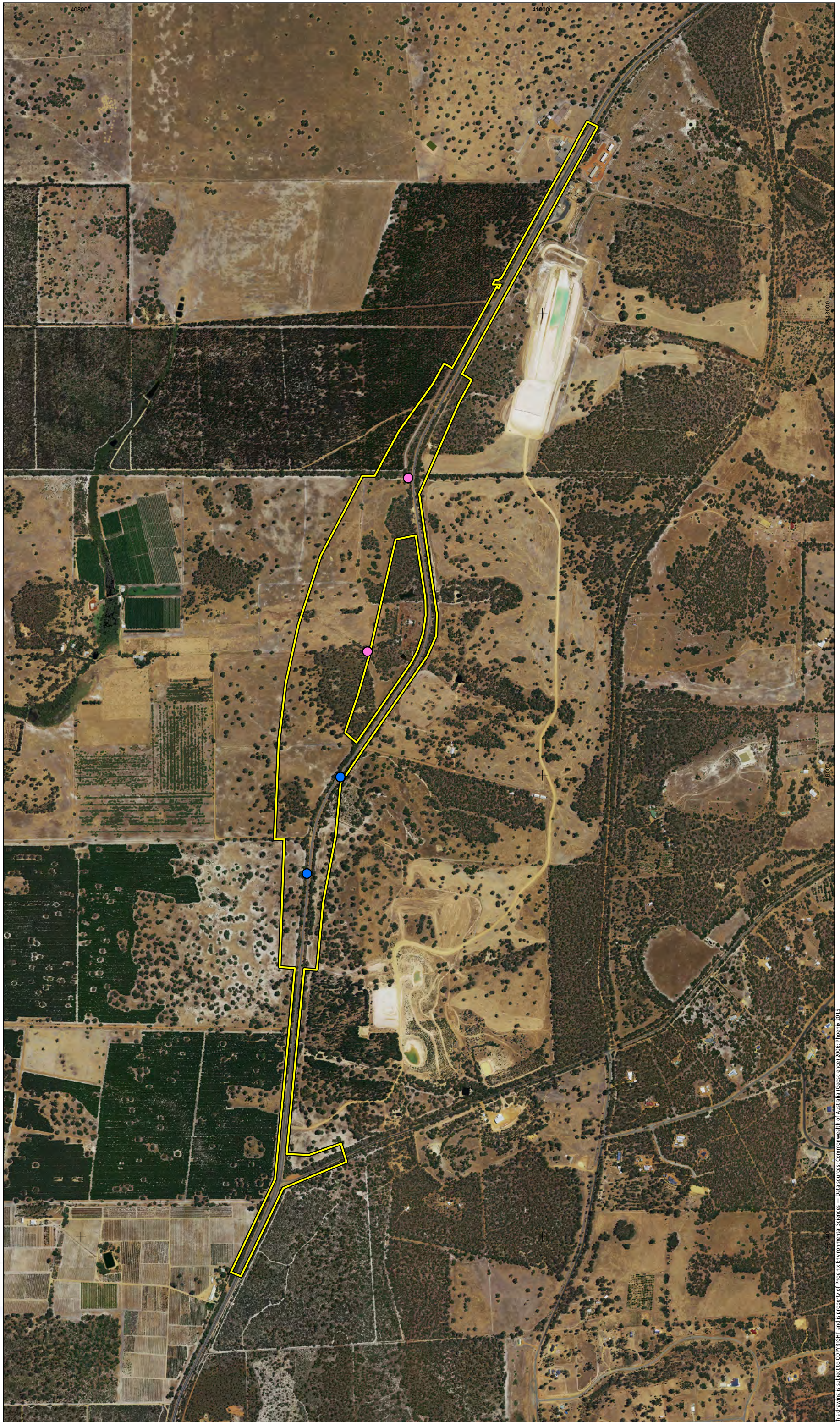


Figure 5-3b
Declared plants recorded
in the study area
(Chittering)

 Study area

Species

-  **Echium plantagineum*
-  **Moraea miniata*



0 0.1 0.2 0.4 Kilometres
 1:15,000

Client: Jacobs
 Project: Great Northern Highway –
 Muchea to Wubin (Stage 2) Upgrades
 Author: G.Wells
 Date: 21/12/2015

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994



5.3.1.3 Range extensions

The records from the study area did not represent a range extension for any of the flora identified.

5.3.1.4 Vegetation associations

A total of 19 vegetation associations were defined in the study area (Table 5-13). The number of vegetation associations exceeds the five mapped by Shepherd *et al.* (2002) on the regional scale (Figure 4-4). Current mapping on a local scale (Figure 5-4) has resulted in the delineation of a greater number of vegetation associations for the study area and is to be expected.

Broadly, the vegetation associations recorded represent mid forests, low to mid woodlands and shrublands. Areas described as the road (GNH), cleared (e.g. townships, driveways, side roads), cleared and planted (re-vegetated with mostly non-native species), pasture, pasture and cleared (homesteads within agricultural areas) accounted for 54% of the study area.

Table 5-13 Vegetation associations recorded in the study area

Code	Vegetation description as per Shepherd <i>et al.</i> 2002	Quadrat ¹	Vegetation description (current survey)
4	Medium woodland; Marri & Wandoo	MNP2014	Mid <i>Corymbia calophylla</i> and <i>Eucalyptus wandoo</i> woodland over mid <i>Xanthorrhoea preissii</i> sparse shrubland over isolated low mixed shrubs, grasses and forbs.
23	Low woodland; Jarrah-Banksia	MNP2015	Low <i>Banksia attenuata</i> , <i>B. menziesii</i> and <i>Eucalyptus marginata</i> woodland over mid <i>Daviesia triflora</i> and <i>Xanthorrhoea preissii</i> open shrubland over sparse low mixed shrubland and isolated low mixed tussock grasses, sedges and forbs.
		MNP2018	Low <i>Eucalyptus marginata</i> open woodland over tall <i>Banksia attenuata</i> and <i>B. menziesii</i> shrubland over low <i>Eremaea pauciflora</i> , <i>Philotheca spicata</i> and <i>Macrozamia riedlei</i> open shrubland over low <i>Desmocladius flexuosus</i> and <i>Mesomelaena pseudostygia</i> open sedgeland and isolated low mixed tussock grasses and forbs.
27	Low woodland; paperbark (<i>Melaleuca</i> sp.)	M1.9a	Low <i>Melaleuca raphiophylla</i> and <i>M. viminea</i> subsp. <i>viminea</i> woodland over sparse mid <i>Acacia saligna</i> , * <i>Tamarix parviflora</i> and <i>Jacksonia furcellata</i> shrubland over tall * <i>Chasmanthe floribunda</i> and * <i>Typha orientalis</i> sedgeland over isolated low <i>Acacia pulchella</i> var. <i>pulchella</i> and <i>Hypocalymma angustifolium</i> shrubs over mid open * <i>Eragrostis curvula</i> , * <i>Polypogon monspeliensis</i> and * <i>Lolium rigidum</i> tussock grassland over isolated * <i>Cotula coronopifolia</i> , * <i>Sonchus oleraceus</i> and * <i>Trifolium arvense</i> forbs.
37	Shrublands; tea-tree thicket	M1.31	Tall open <i>Melaleuca hamata</i> heathland over low * <i>Juncus hybridus</i> , <i>Schoenus plumosus</i> and <i>Isolepis cernua</i> var. <i>setiformis</i> sedgeland with low to mid open * <i>Polypogon monspeliensis</i> , * <i>Brachypodium distachyon</i> and * <i>Avena barbata</i> grassland and low open * <i>Trifolium arvense</i> and * <i>Lysimachia arvensis</i> forbland.
48	Shrublands; scrub-heath	M1.27a	Low isolated <i>Corymbia calophylla</i> trees over a tall <i>Melaleuca hamata</i> , <i>Kunzea micrantha</i> and * <i>Leptospermum laevigatum</i> heathland over low to mid open <i>Leptospermum erubescens</i> , <i>Verticordia densiflora</i> var. <i>densiflora</i> and <i>Adenanthos cygnorum</i> heathland over mid open * <i>Eragrostis curvula</i> , <i>Ehrharta calycina</i> and <i>Neurachne alopecuroidea</i> tussock grassland and tall open























Code	Vegetation description as per Shepherd <i>et al.</i> 2002	Quadrat ¹	Vegetation description (current survey)
			<i>Hypolaena exsulca</i> , <i>Desmocladius flexuosus</i> and <i>Mesomelaena tetragona</i> sedgeland with low isolated mixed forbs.
49	Shrublands; mixed heath	M1.11a	Isolated mid <i>Eucalyptus drummondii</i> x <i>rudis</i> trees over mid open <i>Hypocalymma angustifolium</i> and <i>Verticordia densiflora</i> var. <i>densiflora</i> heathland over isolated low <i>Leptospermum erubescens</i> and <i>Petrophile linearis</i> shrubs over a mid open * <i>Eragrostis curvula</i> and * <i>Briza minor</i> tussock grassland with isolated mid <i>Mesomelaena tetragona</i> sedges and low isolated * <i>Ursinia anthemoides</i> , * <i>Arctotheca calendula</i> and * <i>Trifolium arvense</i> forbs.
946	Medium woodland; Wandoo	M1.32	Low <i>Eucalyptus wandoo</i> woodland over isolated mid <i>Xanthorrhoea preisii</i> shrubs over a low open <i>Hypocalymma angustifolium</i> , <i>Verticordia plumosa</i> and <i>Dampiera linearis</i> shrubland over a low <i>Desmocladius flexuosus</i> and <i>Centrolepis aristata</i> sedgeland with isolated low <i>Neurachne alopecuroidea</i> , * <i>Briza maxima</i> and * <i>B. minima</i> tussock grasses and low isolated <i>Drosera gigantea</i> forbs.
949	Low woodland; Banksia	MNP2002	Tall <i>Adenanthos cygnorum</i> , <i>Banksia menziesii</i> and <i>Nuytsia floribunda</i> open shrubland over low open <i>Calothamnus sanguineus</i> , <i>Daviesia triflora</i> and <i>Hibbertia hypericoides</i> shrubland over low <i>Mesomelaena pseudostygia</i> sparse sedgeland.
965	Medium woodland; Jarrah & Marri	MNP2003	Mid <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> woodland over mid <i>Xanthorrhoea preissii</i> sparse shrubland over low mixed shrubland (<i>Hibbertia</i> spp. prominent) over isolated low <i>Lepidosperma calcicola</i> and <i>Mesomelaena pseudostygia</i> sedges and isolated low <i>Stylidium</i> spp. forbs.
		MNP2006	Mid <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> woodland over tall <i>Adenanthos cygnorum</i> and <i>Banksia menziesii</i> shrubland over mid <i>Xanthorrhoea preissii</i> sparse shrubland over low mixed shrubland with <i>Hibbertia</i> spp. prominent over isolated low <i>Mesomelaena pseudostygia</i> , <i>Lepidosperma squamatum</i> and <i>Hypolaena exsulca</i> sedges and isolated low mixed forbs.
		CHP2006	Mid <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> woodland over mid <i>Adenanthos cygnorum</i> and <i>Xanthorrhoea preissii</i> open shrubland over isolated low <i>Acacia pulchella</i> shrubs and isolated low <i>Hypolaena exsulca</i> and <i>Mesomelaena pseudostygia</i> sedges and mixed forbs.
		CHP2007	Mid <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> woodland over mid <i>Xanthorrhoea preissii</i> sparse shrubland over mixed low grasses and forbs.
		CHP2008	Mid <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> woodland over mid <i>Xanthorrhoea preissii</i> sparse shrubland over low mixed open shrubland and low isolated grasses, sedges and herbs.

Code	Vegetation description as per Shepherd <i>et al.</i> 2002	Quadrat ¹	Vegetation description (current survey)
968	Medium woodland; Jarrah, Marri & Wandoo	CHP2003	Mid <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> and <i>E. wandoo</i> woodland over mid <i>Xanthorrhoea preissii</i> open shrubland over low <i>Gastrolobium dilatatum</i> , <i>Acacia drummondii</i> and <i>Labichea lanceolata</i> subsp. <i>lanceolata</i> shrubland over isolated low <i>Neurachne alopecuroidea</i> and * <i>Pentameris airoides</i> grasses and <i>Lepidosperma calcicola</i> sedges and isolated low mixed forbs.
975	Low woodland; Jarrah	M1.33a	Isolated mid <i>Corymbia calophylla</i> trees over a low <i>Eucalyptus marginata</i> woodland over isolated tall <i>Adenanthos cygnorum</i> shrubs over isolated mid <i>Jacksonia floribunda</i> and <i>Xanthorrhoea preissii</i> shrubs low isolated <i>Desmocladius flexuosus</i> , <i>Chordifex sinuosus</i> and <i>Mesomelaena pseudostygia</i> sedges with isolated low * <i>Ehrharta calycina</i> and * <i>Briza maxima</i> tussock grasses and low sparse <i>Conostylis candicans</i> , <i>Dasyopogon bromeliifolius</i> and * <i>Ursinia anthemoides</i> forbland.
992	Medium forest; Jarrah & Wandoo (<i>Eucalyptus wandoo</i>)	CHP2002	Mid <i>Eucalyptus wandoo</i> and <i>E. marginata</i> open forest over mid <i>Xanthorrhoea preissii</i> open shrubland over low <i>Lechenaultia biloba</i> , <i>Banksia dallanneyi</i> var. <i>dallanneyi</i> , <i>Gastrolobium dilatatum</i> and <i>Conostylis setosa</i> open shrubland over isolated low * <i>Briza maxima</i> and <i>Neurachne alopecuroidea</i> tussock grasses and isolated low <i>Mesomelaena tetragona</i> and <i>Desmocladius fasciculatus</i> sedges.
999	Medium woodland; Marri	M1.23	Mid <i>Corymbia calophylla</i> open forest, over isolated low <i>Nuytsia floribunda</i> trees over low <i>Lechenaultia biloba</i> , <i>Jacksonia sternbergiana</i> and <i>Acacia pulchella</i> shrubland over low open <i>Hypolaena exsulca</i> and <i>Desmocladius flexuosus</i> sedgeland with isolated low <i>Dasyopogon bromeliifolius</i> , <i>Lomandra sericea</i> and * <i>Freesia alba x leichtlinii</i> forbs.
		M1.14a	Mid <i>Corymbia calophylla</i> open forest over a mid <i>Allocasuarina humilis</i> and <i>Xanthorrhoea preisii</i> shrubland over low sparse <i>Phyllanthus calycinus</i> , <i>Acacia pulchella</i> var. <i>pulchella</i> and <i>Gompholobium tomentosum</i> shrubland, over low open <i>Neurachne alopecuroidea</i> , * <i>Ehrharta calycina</i> and * <i>Eragrostis curvula</i> tussock grassland with isolated low <i>Desmocladius flexuosus</i> and <i>Mesomelaena pseudostygia</i> sedges and low isolated * <i>Gladiolus caryophyllaceus</i> , <i>Burchardia congesta</i> and <i>Conostylis candicans</i> subsp. <i>candicans</i> forbs.
1003	Medium forest; Jarrah, Marri & Wandoo	MNP2007	Mid <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> and <i>E. wandoo</i> open forest over mid <i>Allocasuarina humilis</i> and <i>Xanthorrhoea preissii</i> shrubland over low mixed sparse shrubland isolated low <i>Lepidosperma calcicola</i> and <i>Desmocladius fasciculatus</i> sedges and isolated low mixed forbs.
1006	Medium woodland; Jarrah, Wandoo & powderbark	MNP2008	Mid <i>Eucalyptus accedens</i> , <i>E. marginata</i> and <i>E. wandoo</i> open forest over mid <i>Xanthorrhoea preissii</i> open shrubland over low sparse mixed sedgeland, low isolated <i>Neurachne alopecuroidea</i> tussock grasses and isolated low mixed forbs.
1008	Medium open woodland; Marri	M1.30a	Mid <i>Corymbia calophylla</i> woodland over isolated mid <i>Xanthorrhoea preissii</i> shrubs over isolated low <i>Phyllanthus calycinus</i> shrubs over low to mid * <i>Ehrharta calycina</i> , * <i>Eragrostis curvula</i> , * <i>Brachypodium distachyon</i> and * <i>Cenchrus clandestinus</i> tussock grassland with isolated low <i>Mesomelaena pseudostygia</i> , <i>M. tetragona</i> and <i>Lepidobolus preissianus</i> sedges and low

Code	Vegetation description as per Shepherd <i>et al.</i> 2002	Quadrat ¹	Vegetation description (current survey)
			sparse <i>Conostylis setigera</i> subsp. <i>setigera</i> and * <i>Hypochaeris glabra</i> forbland.
		MNP2011	Low <i>Corymbia calophylla</i> and <i>Nuytsia floribunda</i> open woodland over mid <i>Xanthorrhoea preissii</i> sparse shrubland over low Poaceae sp. sparse tussock grassland and isolated low mixed forbs.
1017	Medium open woodland; Jarrah & Marri, with low woodland; Banksia	M1.8	Mid <i>Corymbia calophylla</i> open forest, over low open <i>Banksia attenuata</i> and <i>Banksia grandis</i> woodland over mid to tall * <i>Chasmanthe floribunda</i> , <i>Mesomelaena pseudostygia</i> and <i>Chordifex sinuosus</i> sedgeland and low * <i>Ehrharta longiflora</i> , * <i>E. calycina</i> and * <i>Eragrostis curvula</i> tussock grassland with isolated * <i>Asparagus asparagoides</i> vines.
		M1.35	Mid open <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> forest over tall open <i>Adenanthos cygnorum</i> , <i>Banksia menziesii</i> and <i>Callitris pyramidalis</i> shrubland over isolated mid <i>Xanthorrhoea preissii</i> shrubs over low isolated <i>Eremaea pauciflora</i> var. <i>pauciflora</i> shrubs over low isolated <i>Chordifex sinuosus</i> and <i>Mesomelaena pseudostygia</i> sedges with isolated low * <i>Ehrharta calycina</i> , * <i>Briza maxima</i> and * <i>Pentameris airoides</i> subsp. <i>airoides</i> tussock grasses and low isolated <i>Conostylis setigera</i> subsp. <i>setigera</i> forbs.
		M1.21	Mid <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> woodland over open mid <i>Banksia sessilis</i> , <i>Daviesia divaricata</i> and <i>Xanthorrhoea preissii</i> shrubland over low sparse <i>Verticordia densiflora</i> var. <i>densiflora</i> , <i>Astroloma macrocalyx</i> and <i>Synaphea gracillima</i> heathland over low isolated <i>Mesomelaena pseudostygia</i> , <i>Lepidobolus preissianus</i> and <i>Chordifex sinuosus</i> sedges with low <i>Conostylis setigera</i> subsp. <i>setigera</i> , <i>Waitzia suaveolens</i> var. <i>suaveolens</i> and * <i>Ursinia anthemoides</i> forbs.
1019	Medium sparse woodland; Jarrah & Marri	MNP2012	Low <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> open woodland over low <i>Hibbertia hypericoides</i> , <i>Lechenaultia biloba</i> and <i>Xanthorrhoea preissii</i> open shrubland over isolated low <i>Neurachne alopecuroidea</i> tussock grasses and isolated low mixed forbs.
1027	Mosaic: Medium open woodland; Jarrah & Marri, with low woodland; Banksia/ Medium sparse woodland; Jarrah & Marri	MNP2013	Low <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> woodland over low isolated mixed shrubs, low <i>Mesomelaena pseudostygia</i> sparse sedgeland and isolated low mixed forbs.

¹ Quadrats starting with 'M' are located in Muchea North study area, quadrats starting with 'CH' are located in Chittering study area.

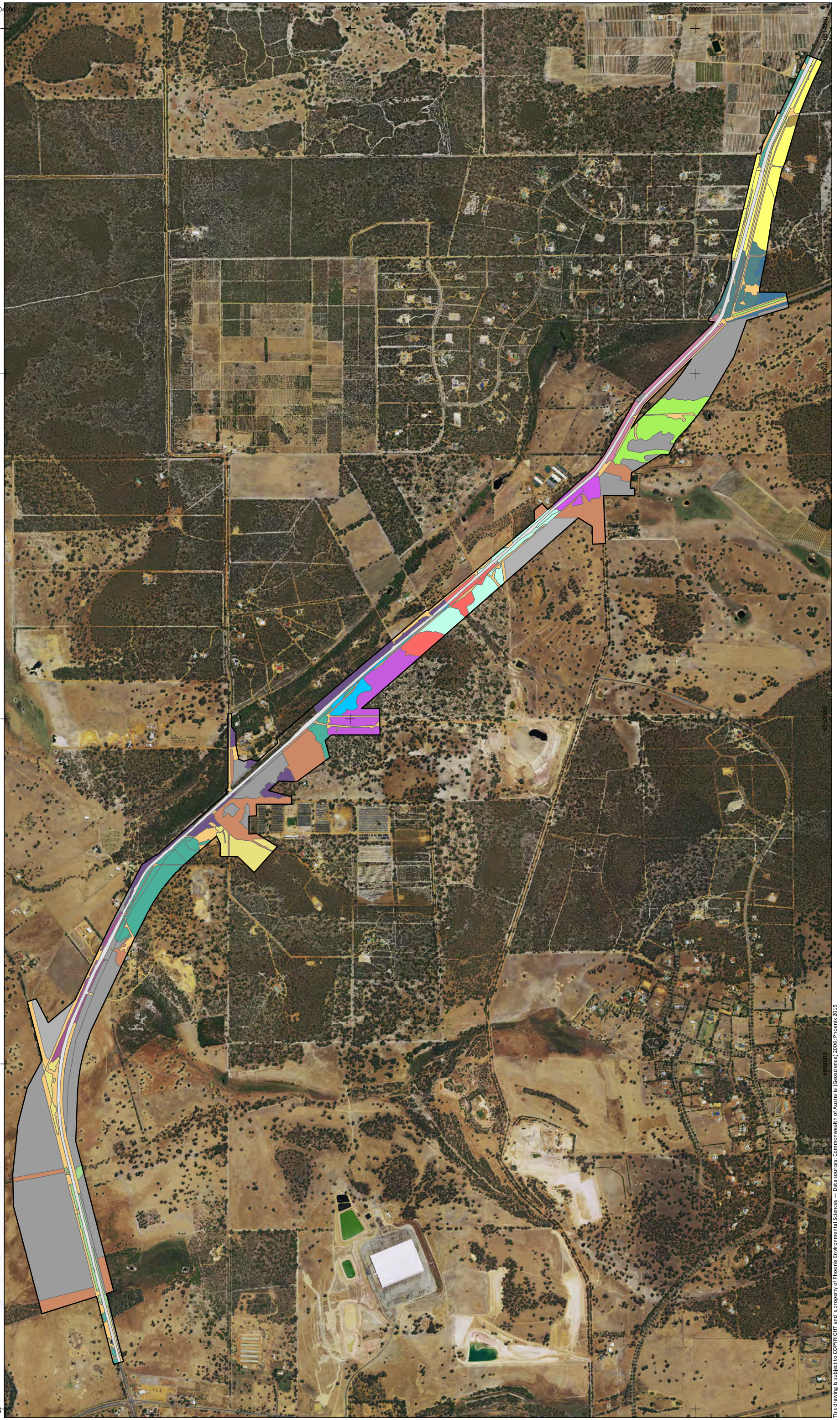
Figure 5-4a
Vegetation associations
in the study area
(Muechea North)

-  Study area
- Vegetation Association**
-  1003
-  1006
-  1008
-  1017
-  1019
-  1027
-  27
-  37
-  4
-  48
-  49
-  946
-  949
-  965
-  975
-  999
-  Cleared
-  Cleared and Planted
-  GNH
-  Pasture
-  Pasture and Cleared

0 0.15 0.3 0.6 Kilometres
 1:20,000











Client: Jacobs
 Project: Great Northern Highway –
 Muechea to Wubin (Stage 2) Upgrades
 Author: G Wells
 Date: 17/12/2015

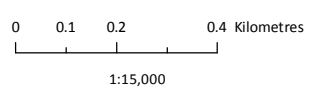
Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994



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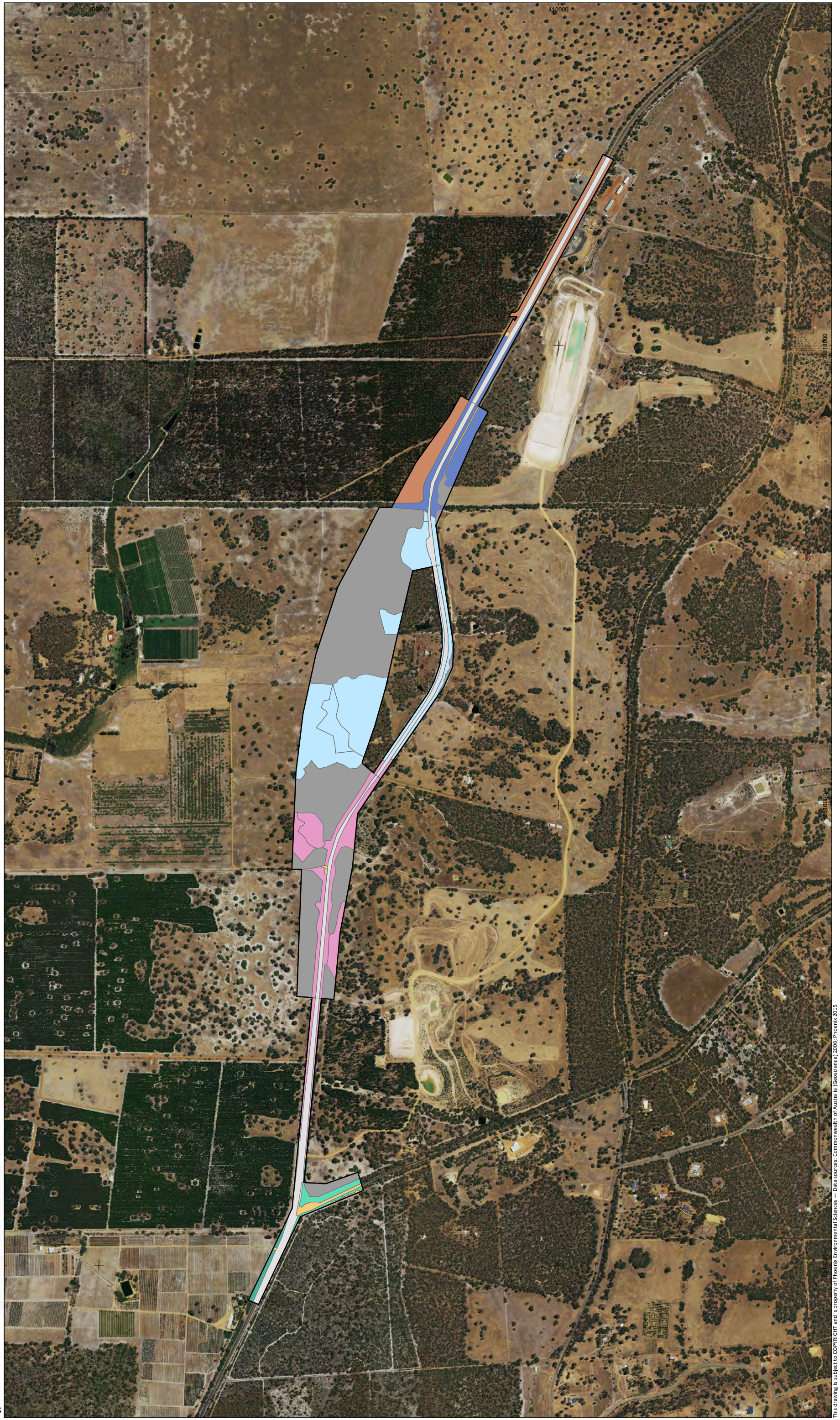
Figure 5-4b
Vegetation associations
in the study area
(Chittering)

-  Study area
- Vegetation Association**
-  1017
-  23
-  965
-  968
-  992
-  Cleared
-  Cleared and Planted
-  GNH
-  Pasture and Cleared



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5.3.1.5 Vegetation condition

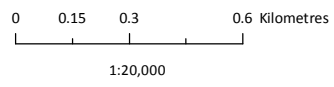
The condition of vegetation within the study area ranged from completely degraded to pristine with 70.6% described as completely degraded to degraded, 19.2% very good to good, and 10.2% as excellent to pristine (Table 5-14). The condition varied both between and within Muchea North and Chittering (Figure 5-5).

Table 5-14 Proportion of vegetation in study area by condition rating

Condition	Area (ha)	% of study area
Completely Degraded (includes existing GNH – paved road and gravel shoulders and cleared paddocks)	185.72	61.37
Degraded	27.98	9.25
Good	22.31	7.37
Very Good	35.69	11.79
Excellent	24.48	8.09
Pristine	6.43	2.13

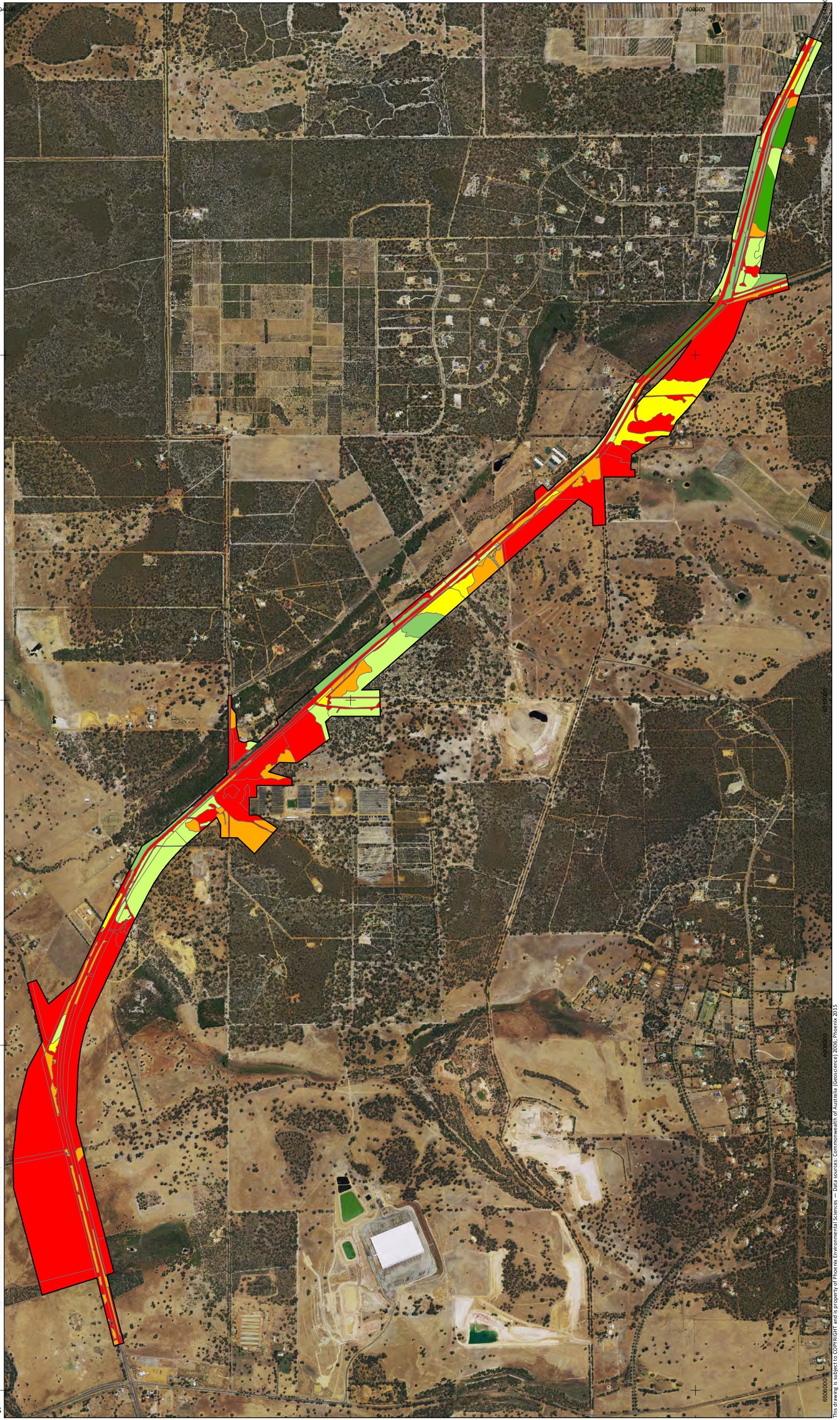
Figure 5-5a
Vegetation condition
in the study area
(Muchoa North)

-  Study area
- Vegetation condition**
-  Completely Degraded
-  Degraded
-  Good
-  Very Good
-  Excellent
-  Pristine









Client: Jacobs
 Project: Great Northern Highway – Muchoa to Wubin (Stage 2) Upgrades
 Author: A. Leung
 Date: 17/12/2015

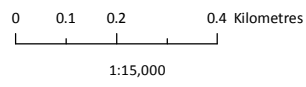
Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994



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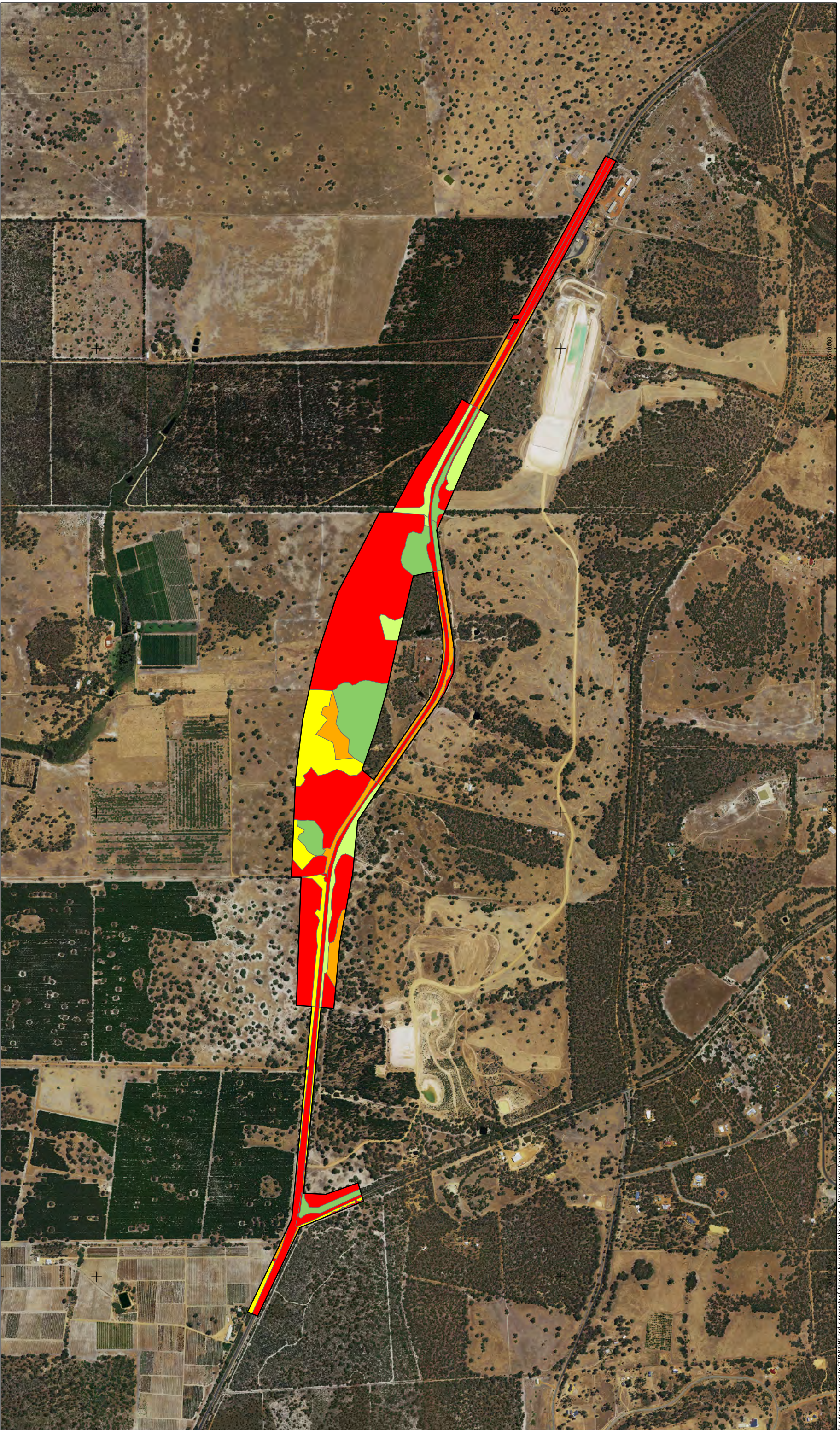
Figure 5-5b
Vegetation condition in
the study area
(Chittering)

-  Study area
- Vegetation condition**
-  Completely Degraded
-  Degraded
-  Good
-  Very Good
-  Excellent



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 Author: A. Leung
 Date: 17/12/2015

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5.3.1.6 Threatened and priority ecological communities

None of the vegetation associations recorded in the study area were considered representative of any Commonwealth or State listed TECs, or any State listed PECs.

5.3.1.7 Local and regional significance of vegetation

Local context

Nine of the vegetation associations defined in the study area may be considered locally significant as they represent habitat for Threatened, Protected or Priority Flora (Table 5-15). The areas of vegetation recorded to be in excellent or pristine condition may also be considered locally significant as they represent patches of comparatively high native species diversity surrounded by highly impacted vegetation.

It may also be considered that representation of less than one percent of a survey area by a vegetation association defines limited representation within the local context. On this basis, when assessing at the scale of the entire study area and including all completely degraded areas (cleared, revegetated and pasture), seven of the 19 vegetation associations (23, 27, 37, 48, 49, 949 and 1003) may be considered locally significant. The percentage of representation of these within the study area varied from 0.11% to 0.81% (Table 5-16).

Table 5-15 Vegetation associations considered locally conservation significant due to the presence of conservation significant flora

Vegetation code	Species recorded ¹	Survey area/s
48	<i>Acacia drummondii</i> subsp. <i>affinis</i> (P3)	Muchea North, Chittering
946	<i>Stylidium squamellosum</i> (P2) <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i> (P4)	Muchea North
965	<i>Acacia drummondii</i> subsp. <i>affinis</i> (P3)	Chittering
968	<i>Acacia drummondii</i> subsp. <i>affinis</i> (P3)	Chittering
975	<i>Verticordia serrata</i> var. <i>linearis</i> (P3)	Muchea North
992	<i>Haemodorum loratum</i> (P3)	Chittering
999	<i>Acacia drummondii</i> subsp. <i>affinis</i> (P3)	Muchea North
1003	<i>Darwinia foetida</i> (CE EPBC Act, S2 WC Act)	Muchea North
1019	<i>Acacia drummondii</i> subsp. <i>affinis</i> (P3)	Muchea North

Table 5-16 Extent and status of vegetation associations recorded in the study area

Code	Description	Extent in study area (ha)	% of study area	Pre-European extent ¹ (ha)	Current extent ¹ (ha)	% remaining ¹	Status ²
4	Medium woodland; Marri & Wandoo	5.50	1.82	1,054,279	293,983	28	VU
23	Low woodland Jarrah and Banksia	1.29	0.43	41,063	30,082	73	LC
27	Low woodland; paperbark (<i>Melaleuca</i> sp.)	1.90	0.63	130,385	92,803	71	LC
37	Shrublands; tea-tree thicket	2.13	0.70	39,297	24,761	63	LC
48	Shrublands; scrub- heath	2.44	0.81	30,814	11,970	39	D
49	Shrublands; mixed heath	1.99	0.66	52,492	26,136	50	D
946	Medium woodland; Wandoo	4.12	1.36	53,225	14,145	27	VU
949	Low woodland Banksia	0.32	0.11	218,194	123,249	56	LC
965	Medium forest; Jarrah-Marri	19.79	6.54	9,356	5,182	55	LC
968	Medium woodland; Jarrah, Marri and Wandoo	17.60	5.82	296,878	95,826	32	D
975	Low woodland; Jarrah	4.77	1.58	17,276	15,570	90	LC
992	Medium forest Jarrah and Wandoo	5.30	1.75	122,049	31,783	26	VU
999	Medium woodland; Marri	9.92	3.28	115,707	13,035	11	VU
1003	Medium forest Jarrah, Marri and Wandoo	1.78	0.59	20,109	8,975	45	D
1006	Medium woodland Jarrah, Wandoo and powderbark	8.41	2.78	44,908	21,813	49	D
1008	Medium open woodland; Marri	6.08	2.01	4,592	1,145	25	VU
1017	Medium open woodland; Jarrah & Marri, with low woodland; Banksia	11.54	3.81	17,528	11,534	66	LC
1019	Medium sparse woodland Jarrah and Marri	4.18	1.38	804	385	48	D
1027	Mosaic Medium open woodland Jarrah-Marri with low woodland Banksia/medium sparse woodland Jarrah-marri	7.84	2.59	39,809	23,312	59	LC

¹ Source – DPaW (2014a). ² VU – vulnerable, D – depleted, LC – least concern.

Regional context

A review of the proportion of pre-European extent remaining for each vegetation association recorded identified five as vulnerable, six as depleted and eight of least concern (Table 5-16). The vulnerable vegetation associations (4, 946, 992, 999 and 1008) may be considered regionally conservation significant as less than 30% of the pre-European extent remains.

5.3.2 Fauna and fauna habitat

5.3.2.1 Fauna habitats


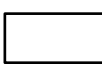


Seven fauna habitat types were defined for the study area, including five habitats comprising remnant native vegetation (Figure 5-6):

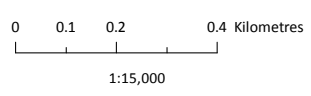
- cleared (agriculture, road, infrastructure) (163.4 ha, 53.95%)
- woodland (Jarrah, Marri, Wandoo and/or banksia) (106.8 ha, 35.28%)
- cleared and revegetated non-native woodland mosaic (22.4 ha, 7.40%)
- shrubland (low heath/scrub) (4.4 ha, 1.46%)
- shrubland (thicket) (2.1 ha, 0.70%)
- woodland (paperbark or sheoak) (1.9 ha, 0.63%)
- forest (Jarrah and/or Marri) (1.8 ha, 0.59%).

The majority of the study area (61.35%) comprised cleared areas, represented by agriculture, roads and other infrastructure, and cleared and revegetated non-native woodlands. Jarrah/Marri woodland was the most abundant habitat with lower woodland and shrublands present in small extents.

Fauna habitat quality was variable, ranging from completely degraded areas offering little habitat value to good quality habitat. Good quality fauna habitat was recorded in woodland habitats of Muchea North that are contiguous with larger pockets of native vegetation. These habitats were also identified as having potential ecological linkage value. Elsewhere, the habitat was generally of low value to fauna due to the vegetation degradation, narrowness and fragmentation of remnant vegetation within the study area.

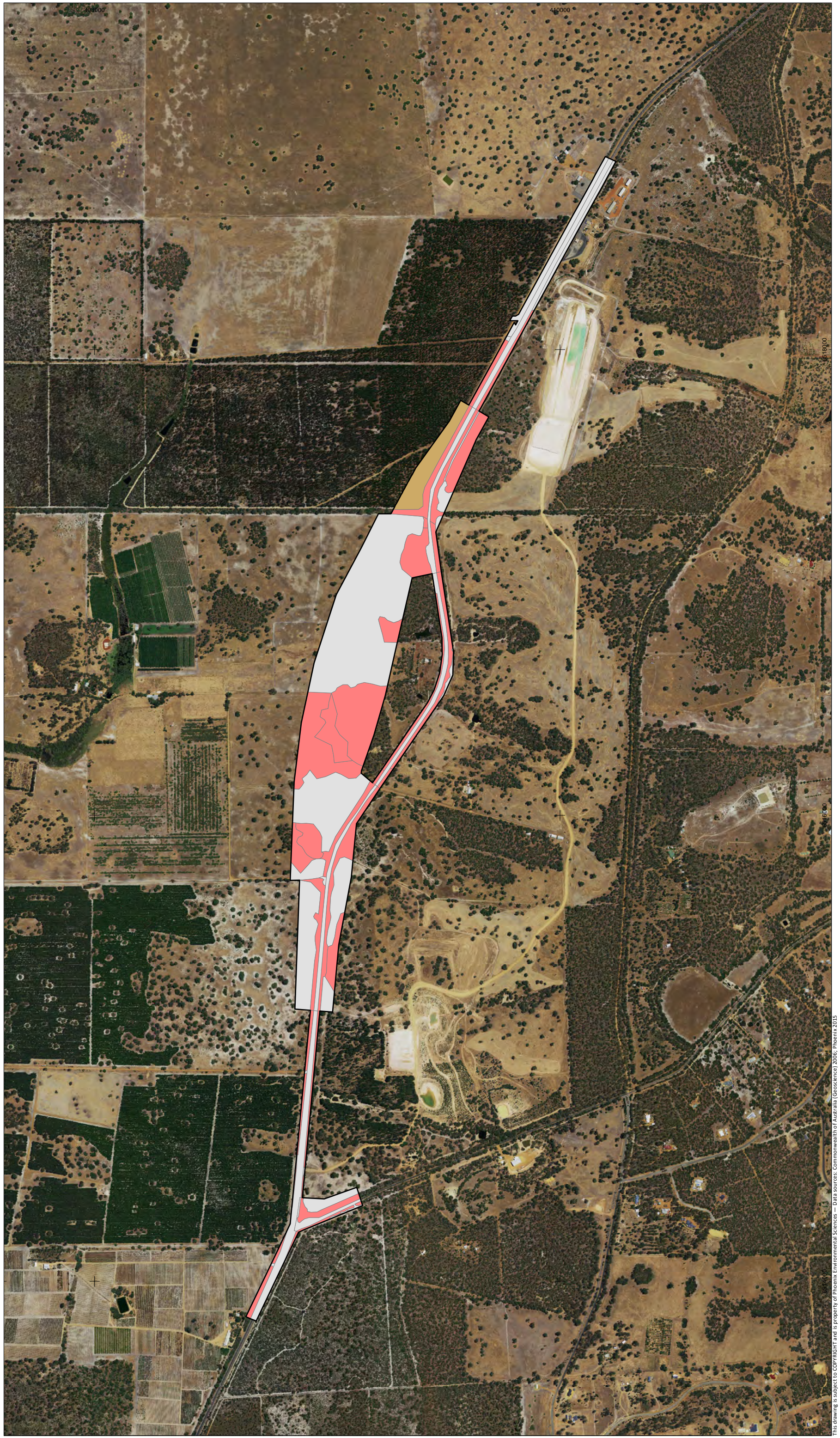
Figure 5-6b
Fauna habitats in the
study area
(Chittering)

-  Study area
- Fauna**
-  Cleared
(agriculture, road, infrastructure)
-  Cleared and revegetated non-native woodland mosaic
-  Woodland (Jarrah, Marri, Wandoo and/or Banksia)



Client: Jacobs
 Project: Great Northern Highway –
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 Author: G Wells
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 Datum: GDA 1994



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5.3.2.2 Conservation significant fauna

Carnaby’s Black Cockatoo was recorded on numerous occasions in the Muchea North study area during the surveys. The species was recorded from direct sightings and evidence (residues) of feeding (Figure 5-7). Evidence of feeding was noted to be extensive at some locations, particularly in those areas with *Corymbia calophylla* and *Banksia attenuata*.

An assessment of the likelihood of occurrence of all potential conservation significant species identified in the desktop review was undertaken for Muchea North and Chittering based on known distribution, habitat preferences, desktop records and habitats present. Distributions and habitat preferences for each of the species is provided in Table 5-17.

Many of the species are unlikely to occur within the survey area mainly due to lack of suitable habitat (degradation, fragmentation and habitat too small in size); however, some may occur in the larger areas of remnant vegetation, particularly where connectivity to larger areas of native vegetation occurs.

Table 5-17 Distribution and habitat preferences of conservation significant species identified from the desktop review

Species	Distribution and habitat preferences
Invertebrates	
<i>Idiosoma nigrum</i> (Shield-backed Trapdoor Spider)	Northern Avon Wheatbelt, Yalgoo, Geraldton Sandplain, Murchison. <i>Acacia</i> (mulga) and <i>Eucalyptus</i> woodlands on heavy clay or granitic soils, often in or near southern-exposed drainage lines (Main 2003; Minister for the Environment 2013).
<i>Leioproctus contrarius</i> (Bee)	Swan Coastal Plain, Geraldton Sandplain. Dependent on flowers of Goodeniaceae and possibly <i>Lechenaultia stenosepala</i> (Bamford 2003).
<i>Parartemia contracta</i> (Fairy Shrimp)	Southern Avon Wheatbelt and adjacent areas in the northern Wheatbelt, Mallee. Acidophile (acidic lakes) (Timms <i>et al.</i> 2009) and halophile (80-240 ppt) (salt lakes) (Timms 2012).
<i>Throscodectes xederoides</i> (Mogumber Bush Cricket)	<i>Banksia</i> and <i>Dryandra</i> dominated vegetation on white sands. Only known from type locality, 12 km west-north-west of Mogumber (Rentz 1985).
Reptiles	
<i>Pseudemydura umbrina</i> (Western Swamp Tortoise)	Only two populations remain, Twin Swamp and Ellen Brook Nature Reserves, on the Swan Coastal Plain (Burbidge 1981; EPA 2006b). Occurs in shallow, ephemeral winter-wet swamps on clay or sand over clay soils. Requires suitable aestivation refuges nearby (EPA 2006b). Due to the small amount of habitat available to the species any development or change in land use that will reduce or degrade the habitat area would be detrimental to its long term survival (EPA 2006b).
<i>Egernia stokesii badia</i> (Western Spiny-tailed Skink)	The <i>Egernia stokesii</i> species-group has a widespread but disjunct distribution across semi-arid Australia (DEC 2012a). In the wheatbelt of WA <i>E. s. badia</i> occurs in woodlands of York Gum, gimlet and Salmon Gum on clay soils, predominantly within the Avon Wheatbelt IBRA bioregion (Cogger <i>et al.</i> 1993; Thackway & Cresswell 1995b). The smallest remnant from which the species has been found to persist is 1 ha in size, however it appears to be absent from many areas of suitable woodland <5 ha in size.

Species	Distribution and habitat preferences
	<i>E. s. badia</i> principally uses fallen logs to shelter, but tree stumps and human-created habitats (such as abandoned buildings, wood heaps, piles of corrugated iron and railway sleepers, and building rubble) are also used.
<i>Aspidites ramsayi</i> (Woma Python)	Two WA populations are known; a northern population from the Pilbara coast north to the Eighty Mile Beach and a southern population from Cape Peron south and east to the eastern Goldfields region (Storr <i>et al.</i> 2002). Recorded in many different habitats and preference is not known.
<i>Neelaps calonotos</i> (Black-striped Snake)	Restricted to the sandy coastal strip of the Swan Coastal Plain between Mandurah and Lancelin, with some records existing inland at Gingin, Bullsbrook and Caversham (Storr <i>et al.</i> 2002). Primarily occurs on dunes and sand-plains vegetated with heaths and Banksia woodlands (Ismar <i>et al.</i> 2010).
Birds	
<i>Leipoa ocellata</i> (Malleefowl)	Found across the southern half of the Australian continent. In WA, mostly occurs south of a line from Shark Bay to the Nullarbor Plain (Benshemesh <i>et al.</i> 2008; Parsons 2008; Parsons <i>et al.</i> 2008). Typically found in mallee woodlands but also in <i>Eucalyptus</i> woodlands and shrublands (Benshemesh <i>et al.</i> 2008; Parsons 2008; Parsons <i>et al.</i> 2008).
<i>Oxyura australis</i> (Blue-billed Duck)	Endemic to south-eastern and south-western Australia. Prefers the deep water (fresh to saline) of large, permanent wetlands (including reservoirs, sewerage ponds, rivers salt lakes and saltpans) and swamps, generally with dense aquatic vegetation (Pizzey & Knight 2012).
<i>Apus pacificus</i> (Fork-tailed Swift)	Widespread migratory species that overwinters in Australia; found across most of WA. Mostly found over inland plains, and also above foothills, in coastal areas and over settlements. Occurs in a wide range of dry or open habitats, including riparian woodlands, tea-tree swamps, low scrub, heathland, saltmarsh, grassland and spinifex sandplains, open farmland and inland and coastal sand-dunes (DSEWPac 2011).
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	Occurs in freshwater or brackish swamps with dense vegetation. They can occasionally feed in more open habitats, often at night (McKilligan 2005). The species is habitat selective and requires particular conditions to inhabit a wetland (Garnett & Crowley 2000)
<i>Ardea modesta</i> (Eastern Great Egret)	Occurs throughout Australia except the arid regions but is more common in wetter areas. Uses a variety of wetlands including fresh, saline, permanent and ephemeral. Migrates to breeding areas in winter and spring. Breeds in colonies in trees over water (Pizzey & Knight 2012).
<i>Ardea ibis</i> (Cattle Egret)	Occurs throughout most of Australia except in the arid interior. Preferred habitats include moist or inundated pastures, open wetlands and mudflats. Adaptable to human altered environments (Pizzey & Knight 2012).
<i>Plegadis falcinellus</i> (Glossy Ibis)	Common and widespread throughout Australia except in the arid interior. Preferred habitats include open wetlands and pastures and mudflats (Pizzey & Knight 2012).
<i>Falco peregrinus</i> (Peregrine Falcon)	A widespread species occurring across Australia and with a large foraging range. In WA, it can be rare or scarce to moderately common. Preferred habitat includes cliffs and wooded watercourses. Nesting occurs mainly on cliff ledges, granite outcrops, quarries and in trees with old raven or Wedge-tailed Eagle nests (Johnstone & Storr 1998).