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6127800 6127600 6127400 6127200 6127000 6126800 6126600 6126400 6126200 6126000 6125800 6125600

N

0 50 100 200 300
Metres

Survey Effort
Survey Area

Map 4E: Survey Effort Derived from GPS Track Logs, Albany Ring Road.

Map produced by Damien Rathbone on 20/01/2020.
Report Reference: Rathbone, DA & Gilfillan, S (2020). Biological Survey: Albany Ring Road. Unpublished report by Southern Ecology for Main Roads Western Australia (SE1810).
Map Projection: Transverse Mercator Horizontal Datum GDA 1994
Grid: MGA Zone 50 Map Size: A3 Scale 1:6,000

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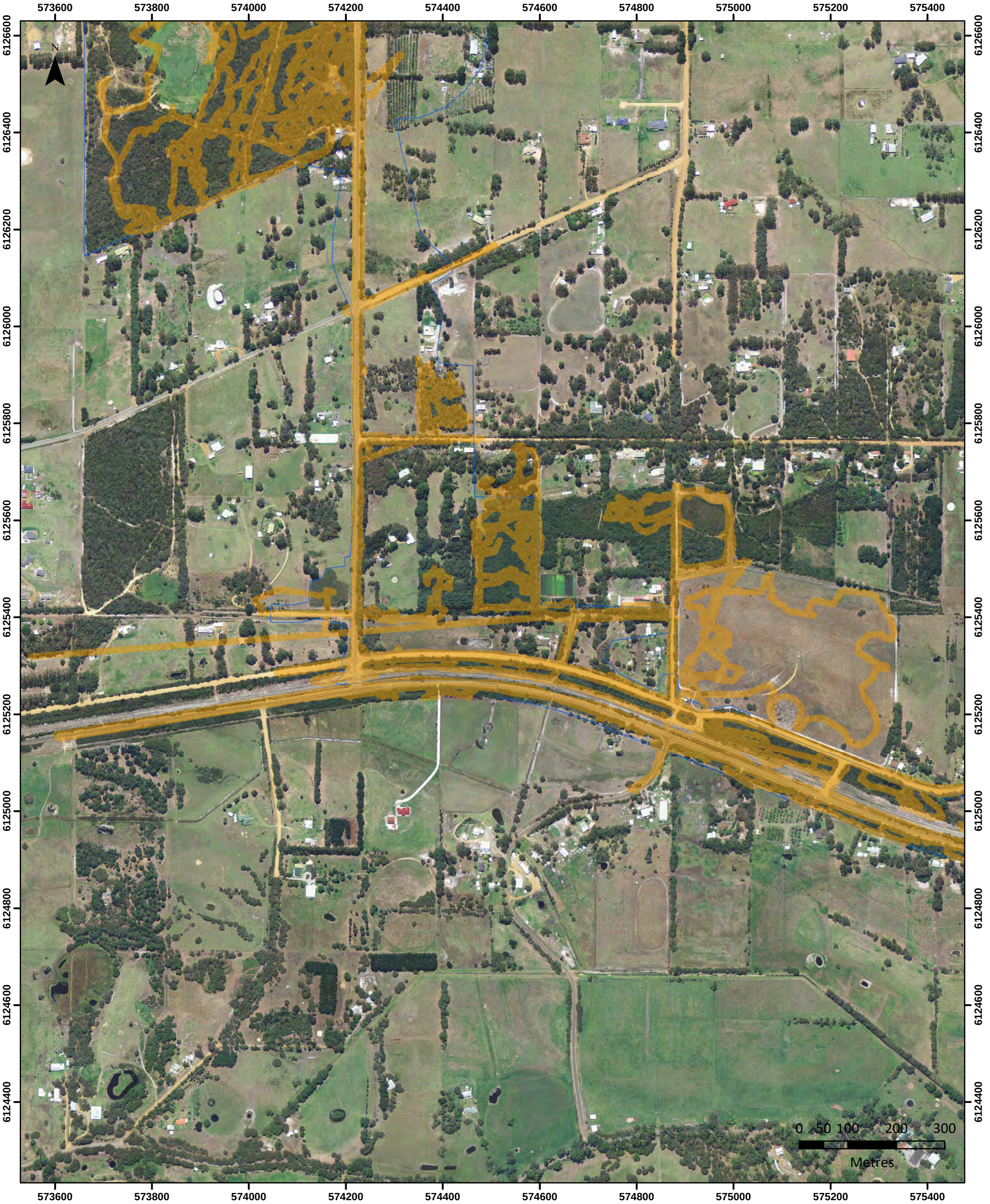

Map 5E: Survey Effort Derived from GPS Track Logs, Albany Ring Road.

Survey Effort

Survey Area

Map produced by Damien Rathbone on 20/01/2020.
Report Reference: Rathbone, DA & Gilfillan, S (2020). Biological Survey: Albany Ring Road. Unpublished report by Southern Ecology for Main Roads Western Australia (SE1810).
Map Projection: Transverse Mercator Horizontal Datum GDA 1994
Grid: MGA Zone 50 Map Size: A3 Scale 1:6,000

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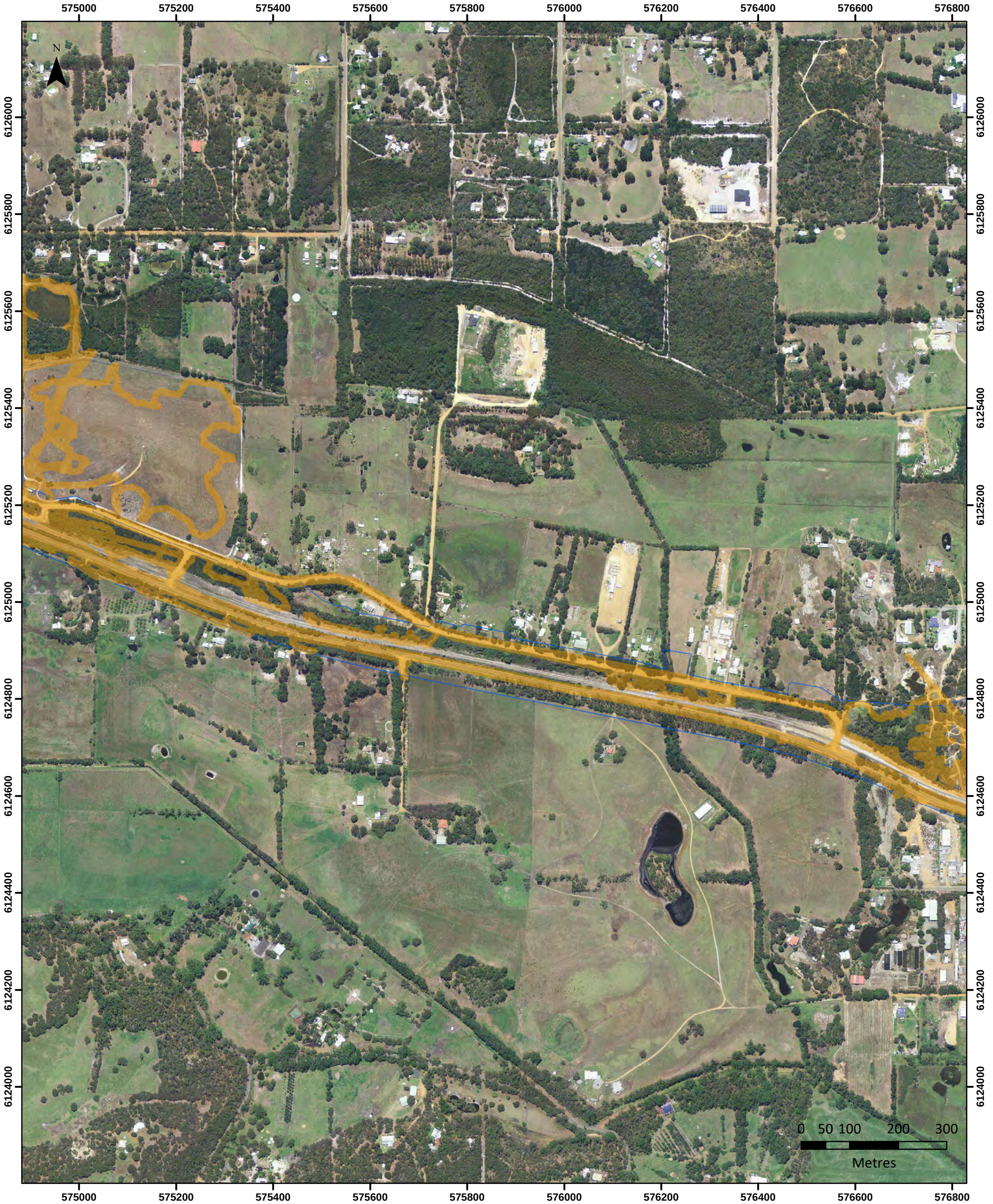

Survey Effort

Survey Area

Map 6E: Survey Effort Derived from GPS Track Logs, Albany Ring Road.

Map produced by Damien Rathbone on 20/01/2020.
Report Reference: Rathbone, DA & Gilfillan, S (2020). Biological Survey: Albany Ring Road. Unpublished report by Southern Ecology for Main Roads Western Australia (SE1810).
Map Projection: Transverse Mercator Horizontal Datum GDA 1994
Grid: MGA Zone 50 Map Size: A3 Scale 1:6,000

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Survey Effort

Survey Area

Map 7E: Survey Effort Derived from GPS Track Logs, Albany Ring Road.

Map produced by Damien Rathbone on 20/01/2020.
Report Reference: Rathbone, DA & Gilfillan, S (2020). Biological Survey: Albany Ring Road. Unpublished report by Southern Ecology for Main Roads Western Australia (SE1810).
Map Projection: Transverse Mercator Horizontal Datum GDA 1994
Grid: MGA Zone 50 Map Size: A3 Scale 1:6,000

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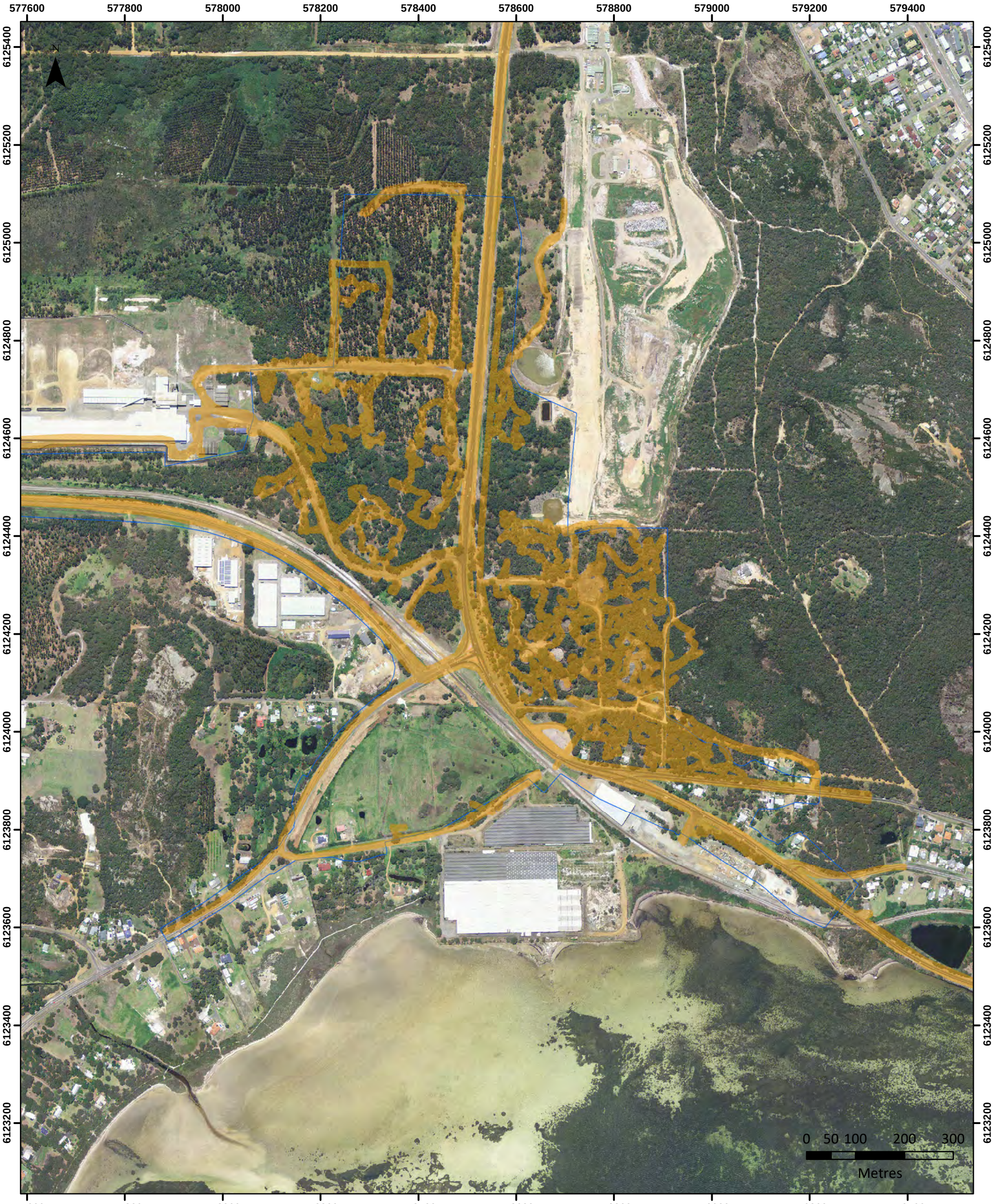

Survey Effort

Survey Area

Map 8E: Survey Effort Derived from GPS Track Logs, Albany Ring Road.

Map produced by Damien Rathbone on 20/01/2020.
Report Reference: Rathbone, DA & Gilfillan, S (2020). Biological Survey: Albany Ring Road. Unpublished report by Southern Ecology for Main Roads Western Australia (SE1810).
Map Projection: Transverse Mercator Horizontal Datum GDA 1994
Grid: MGA Zone 50 Map Size: A3 Scale 1:6,000

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10 APPENDIX C - Plant Taxa Inventory

Table C1: Vascular plant taxa recorded opportunistically in the Survey Area. Nomenclature and status according WAH (1998-), DotEE (2017b) and DPIRD (2018). *denotes weed taxon.

Family	Taxon (Status)
Anarthriaceae	*Anarthria gracilis*
	Anarthria laevis
	Anarthria prolifera
	Anarthria scabra
	Lyginia barbata
Apiaceae	**Foeniculum vulgare*
	Actinotus omnifertilis
	Centella asiatica
	Daucus glochidiatus
	Xanthosia huegelii
	Xanthosia rotundifolia
	Xanthosia singuliflora
Araceae	**Zantedeschia aethiopica* (Declared Pest)
Asparagaceae	**Asparagus asparagoides* (WONS)
	**Asparagus declinatus*
	Chamaescilla corymbosa
	Lomandra micrantha
	Lomandra pauciflora
	Lomandra purpurea
	Lomandra sericea
	Thysanotus gracilis
	Thysanotus isantherus (P4)
	Thysanotus multiflorus
	Thysanotus sparteus
	Thysanotus thyrsoideus
Asteraceae	**Conyza bonariensis*
	**Sonchus oleraceus*
	**Taraxacum khatoonae*
	Lagenophora huegelii
	Millotia tenuifolia
	Senecio minimus
Boryaceae	*Borya sphaerocephala*
Campanulaceae	*Lobelia anceps*
	Lobelia heterophylla
Caryophyllaceae	**Petrorhagia dubia*
	**Sagina maritima*
Casuarinaceae	*Allocasuarina fraseriana*
	Allocasuarina humilis
Centrolepidaceae	*Aphelia brizula*
Cephalotaceae	*Cephalotus follicularis*
Chenopodiaceae	*Rhagodia preissii*
Cyatheaceae	**Cyathea cooperi*
Cyperaceae	*Baumea acuta*
	Baumea arthrophylla
	Baumea juncea
	Baumea rubiginosa
	Cyathochaeta avenacea
	Cyathochaeta equitans
	Evandra aristata
	Gymnoschoenus anceps
	Isolepis cernua
	Lepidosperma angustatum
	Lepidosperma drummondii
	Lepidosperma gladiatum
	Lepidosperma hopperi
	Lepidosperma striatum
	Lepidosperma tenue
	Mesomelaena graciliceps
	Mesomelaena tetragona
	Schoenus acuminatus
	Schoenus caespititius
	Schoenus cruentus
	Schoenus multiglumis
	Schoenus obtusifolius
	Schoenus sp. infertile
	Schoenus sp. striate
	Tetraria octandra
	Tetraria sp. Jarrah Forest (R. Davis 7391)
	Tricostularia neesii
Dasypogonaceae	*Dasypogon bromeliifolius*
	Kingia australis
Dennstaedtiaceae	*Histiopteris incisa*
	Pteridium esculentum
Dilleniaceae	*Hibbertia cuneiformis*
	Hibbertia cunninghamii
	Hibbertia diamesogenos
	Hibbertia furfuracea
	Hibbertia microphylla
Droseraceae	*Drosera erythrorhiza*
	Drosera glanduligera
	Drosera menziesii
	Drosera pallida
	Drosera pulchella
	Drosera stolonifera
Elaeocarpaceae	*Tetratheca affinis*
	Tremandra diffusa
	Tremandra stelligera
Ericaceae	*Andersonia* sp. Jamesii (J. Liddelow 84) (P4)
	Andersonia sprengelioides
	Astroloma pallidum
	Brachyloma baxteri
	Cosmelia rubra
	Leucopogon assimilis
	Leucopogon australis
	Leucopogon glabellus
	Leucopogon obovatus subsp. *obovatus*
	Leucopogon obovatus subsp. *revolutus*
	Leucopogon pendulus
	Leucopogon verticillatus
	Sphenotoma capitata
	Sphenotoma squarrosa
Euphorbiaceae	**Ricinus communis*

Family	Taxon (Status)
Fabaceae	**Acacia baileyana*
	**Acacia longifolia*
	**Acacia melanoxylon*
	**Acacia paradoxa*
	**Chamaecytisus palmensis*
	**Dipogon lignosus*
	**Ornithopus compressus*
	**Psoralea pinnata*
	**Trifolium angustifolium*
	**Trifolium arvense*
	**Ulex europaeus* (WONS)
	Acacia alata
	Acacia browniana var. *browniana*
	Acacia crassiuscula
	Acacia divergens
	Acacia drummondii
	Acacia myrtifolia
	Acacia pentadenia
	Bossiaea dentata
	Bossiaea linophylla
	Callistachys lanceolata
	Callistachys sp. south-coast variant (M. Carter 180)
	Chorizema reticulatum
	Gastrolobium bilobum
	Gastrolobium sericeum
	Gompholobium knightianum
	Gompholobium polymorphum
	Hardenbergia comptoniana
	Hovea elliptica
	Hovea trisperma
	Isotropis cuneifolia
	Jacksonia horrida
	Paraserianthes lophantha
	Pultenaea verruculosa
	Sphaerolobium grandiflorum
	Sphaerolobium hygrophilum
	Sphaerolobium medium
	Sphaerolobium vimineum
Gentianaceae	**Centaurium erythraea*
Geraniaceae	**Pelargonium capitatum*
Goodeniaceae	*Dampiera leptoclada*
	Dampiera linearis
	Dampiera loranthifolia
	Dampiera pedunculata
	Diaspasis filifolia
	Goodenia coerulea
	Scaevola striata
Haemodoraceae	*Anigozanthos flavidus*
	Conostylis setigera
	Haemodorum laxum
	Haemodorum spicatum
Haloragaceae	*Gonocarpus diffusus*
	Trihaloragis hexandra subsp. *hexandra*

Family	Taxon (Status)
Hemerocallidaceae	*Agrostocrinum hirsutum*
	Caesia micrantha
	Dianella revoluta
	Johnsonia lupulina
	Stypandra glauca
	Tricoryne elatior
	Tricoryne humilis
Hydrocharitaceae	*Ottelia ovalifolia*
Iridaceae	**Freesia alba x leichtlinii*
	**Gladiolus undulatus*
	**Moraea setifolia*
	**Romulea rosea*
	**Watsonia meriana* var. *bulbillifera*
	Patersonia limbata
	Patersonia occidentalis
	Patersonia umbrosa var. *umbrosa*
Juncaceae	**Juncus articulatus*
	**Juncus capitatus*
	Juncus caespiticius
	Juncus pallidus
	Juncus planifolius
	Luzula meridionalis
Lauraceae	*Cassytha racemosa*
Lentibulariaceae	*Utricularia multifida*
Lindsaeaceae	*Lindsaea linearis*
Loganiaceae	*Orianthera serpyllifolia* subsp. *serpyllifolia*
Loranthaceae	*Nuytsia floribunda*
Lythraceae	**Lythrum hyssopifolia*
Malvaceae	*Thomasia angustifolia*
	Thomasia purpurea
Myrtaceae	**Eucalyptus botryoides*
	**Eucalyptus cladocalyx*
	**Eucalyptus globulus*
	**Eucalyptus robusta*
	**Leptospermum laevigatum*
	Agonis flexuosa
	Agonis theiformis
	Astartea corniculata
	Astartea glomerulosa
	Astartea scoparia
	Astartea sp.
	Beaufortia decussata
	Beaufortia sparsa
	Callistemon glaucus
	Corymbia calophylla
	Corymbia ficifolia (planted)
	Darwinia oederoides
	Eucalyptus conferruminata (planted)
	Eucalyptus cornuta
	Eucalyptus gomphocephala (planted)
	Eucalyptus marginata
	Eucalyptus megacarpa
	Eucalyptus patens
	Eucalyptus salubris (planted)

Family	Taxon (Status)
	Eucalyptus staeri
	Eucalyptus marginata x staeri
	Homalospermum firmum
	Hypocalymma cordifolium
	Hypocalymma scariosum
	Kunzea baxteri (planted)
	Melaleuca diosmifolia (planted)
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca thymoides
	Pericalymma spongiocaule
	Taxandria juniperina
	Taxandria linearifolia
	Taxandria marginata
	Taxandria parviceps
	Verticordia plumosa
Olacaceae	*Olax benthamiana*
Orchidaceae	**Disa bracteata*
	Caladenia flava
	Cryptostylis ovata
	Diuris sp.
	Elythranthera brunonis
	Lyperanthus serratus
	Microtis media
	Prasophyllum brownii
	Prasophyllum macrostachyum
	Pterostylis vittata
	Thelymitra canaliculata
	Thelymitra crinita
	Thelymitra granitora
	Thelymitra macrophylla
	Thelymitra sp.
Orobanchaceae	**Parentucellia latifolia*
Oxalidaceae	**Oxalis incarnata*
	**Oxalis purpurea*
	**Oxalis violacea*
Phytolaccaceae	**Phytolacca octandra*
Pinaceae	**Pinus pinaster*
	**Pinus radiata*
Pittosporaceae	**Pittosporum undulatum*
	Billardiera fusiformis
	Billardiera heterophylla
	Billardiera variifolia
Plantaginaceae	**Plantago lanceolata*
	Veronica plebeia
Poaceae	**Aira caryophyllea*
	**Anthoxanthum odoratum*
	**Avena barbata*
	**Briza maxima*
	**Briza minor*
	**Cenchrus clandestinus*
	**Cortaderia selloana*
	**Holcus lanatus*
	**Lolium perenne*

Family	Taxon (Status)
	Amphipogon amphipogonoides
	Amphipogon laguroides
	Austrostipa mollis
	Microlaena stipoides
	Neurachne alopecuroidea
	Poa porphyroclados
	Rytidosperma setaceum
	Tetrarrhena laevis
Polygalaceae	*Comesperma confertum*
	Comesperma virgatum
Proteaceae	*Adenanthos obovatus*
	Banksia grandis
	Conospermum caeruleum
	Grevillea occidentalis
	Grevillea pilulifera
	Grevillea pulchella
	Hakea amplexicaulis
	Hakea ceratophylla
	Hakea drupacea
	Hakea elliptica
	Hakea ferruginea
	Hakea florida
	Hakea lasiantha
	Hakea linearis
	Hakea oleifolia
	Hakea ruscifolia
	Hakea trifurcata
	Persoonia elliptica
	Persoonia graminea
	Persoonia longifolia
	Petrophile divaricata
	Petrophile diversifolia
	Petrophile squamata
	Stirlingia tenuifolia
	Synaphea gracillima
	Synaphea incurva (P3)
Ranunculaceae	*Clematis pubescens*
Restionaceae	*Chordifex isomorphus*
	Chordifex laxus
	Desmocladus fasciculatus
	Desmocladus flexuosus
	Empodisma gracillimum
	Hypolaena fastigiata
	Leptocarpus denmarkicus
	Leptocarpus scariosus
	Leptocarpus tenax
	Leptocarpus tephrinus
	Lepyrodia hermaphrodita
	Loxocarya cinerea
	Tremulina tremula
Rhamnaceae	*Spyridium globulosum*
	Trymalium odoratissimum
Rosaceae	**Cotoneaster glaucophyllus*
	**Rubus species complex* (WONS)

Family	Taxon (Status)
Rubiaceae	**Coprosma repens*
	Opercularia hispidula
Rutaceae	*Boronia crassipes* (P3)
	Boronia crenulata
	Boronia juncea subsp. *laniflora*
	Boronia spathulata
	Rhadinothamnus anceps
Sapindaceae	*Dodonaea ceratocarpa*
	Dodonaea viscosa
Schizaeaceae	*Schizaea fistulosa*
Solanaceae	**Solanum laciniatum*
	Anthocercis viscosa
Stylidiaceae	*Levenhookia dubia*
	Stylidium despectum
	Stylidium imbricatum
	Stylidium luteum
	Stylidium plantagineum
	Stylidium pygmaeum
	Stylidium spathulatum
Thymelaeaceae	*Pimelea rosea* subsp. *rosea*
Typhaceae	*Typha orientalis*
Verbenaceae	**Lantana camara* (WONS)
Xanthorrhoeaceae	*Xanthorrhoea platyphylla*
Xyridaceae	*Xyris lacera*
	Xyris lanata

11 APPENDIX D - Floristic Quadrat Data

Quadrat: 1
Date: 22/11/2017
Description: Hill crest with laterite gravel and white sand
Mapping Unit: *Hakea* spp. Shrubland/Woodland Complex
Vegetation Condition: Very Good
Location: 574224mE 6126834mN
Photo:

Floristics:

Upper (<10m, 30-70%): *Eucalyptus staeri.*
Middle 1 (2-4m, 30-70%): **Acacia longifolia, *Leptospermum laevigatum, *Psoralea pinnata, Hakea ferruginea, Hakea lasiantha.*
Middle 2 (<2m, 10-30%): *Acacia browniana* var. *browniana, Acacia myrtifolia, Agonis theiformis, Grevillea pilulifera, Xanthorrhoea platyphylla, Leucopogon obovatus* subsp. *obovatus, Leucopogon verticillatus, Petrophile squamata, Taxandria parviceps.*
Ground (<1m, 10-30%): *Dasypogon bromeliifolius, Desmocladus fasciculatus, Anarthria prolifera, Anarthria scabra, Agrostocrinum hirsutum, Amphipogon amphipogonoides, Anarthria gracilis, Billardiera heterophylla, Billardiera variifolia, Chordifex laxus, Conostylis setigera, Cyathochaeta avenacea, Dampiera pedunculata, Drosera menziesii, Hibbertia microphylla, Hovea trisperma, Lepyrodia hermaphrodita, Levenhookia dubia, Lomandra micrantha* subsp. *teretifolia, Lomandra sericea, Mesomelaena tetragona, Schoenus acuminatus, Sphenotoma capitata, Synaphea gracillima, Tetraria octandra, Tricoryne humilis, Xanthosia huegelii, *Anthoxanthum odoratum, *Gladiolus undulatus.*

Quadrat: 2
Date: 22/11/2017
Description: Hill crest with white sand with laterite gravel
Mapping Unit: *Hakea* spp Shrubland/Woodland Complex
Vegetation Condition: Excellent
Location: 574145mE, 6126849mN
Photo:

Floristics:

Upper: (<10m, 10-30%) *Eucalyptus marginata x staeri.*
Middle: (1-2m, 10-30%) *Acacia myrtifolia, Agonis theiformis, Allocasuarina humilis, Beaufortia decussata, Petrophile diversifolia, Xanthorrhoea platyphylla, Leucopogon obovatus* subsp. *obovatus, Hakea ceratophylla, Hakea ferruginea, *Leptospermum laevigatum.*
Ground: (1m, 30-70%) *Acacia browniana* var. *browniana, Acacia drummondii, Amphipogon amphipogonoides, Anarthria gracilis, Anarthria prolifera, Andersonia* sp. Jamesii (J. Liddelow 84), *Billardiera variifolia, Boronia spathulata, Cassytha racemosa, Chordifex laxus, Chorizema reticulatum, Conostylis setigera, Cyathochaeta avenacea, Dampiera loranthifolia, Dasypogon bromeliifolius, Desmocladus fasciculatus, Goodenia coerulea, Grevillea pilulifera, Haemodorum laxum, Hibbertia microphylla, Hovea trisperma, Lepidosperma angustatum, Lepidosperma drummondii, Lepyrodia hermaphrodita, Lindsaea linearis, Lomandra sericea, Mesomelaena tetragona, Pericalymma spongiocaule, Pultenaea verruculosa, Schoenus acuminatus, Schoenus sp. striate, Sphaerolobium grandiflorum, Sphenotoma capitata, Stirlingia tenuifolia, Taxandria parviceps, Tetraria octandra, Thelymitra crinita, Tremulina tremula, Xanthosia huegelii, Xanthosia singuliflora.*

Quadrat: 3
Date: 22/11/2017
Description: Small perched wetland (potentially artificial due to gravel extraction) peat over sand
Mapping Unit: Mapped within *Hakea* spp Shrubland/Woodland Complex
Vegetation Condition: Very Good
Location: 574095mE, 6126841mN
Photo:

Floristics:

Upper: (2-4m, >70%) *Taxandria linearifolia, Taxandria parviceps, Acacia myrtifolia, Allocasuarina fraseriana, Callistemon glaucus, Hakea ferruginea, Homalospermum firmum, Leucopogon obovatus* subsp. *revolutus.*

Ground: (<1m, 10-30%) *Billardiera heterophylla, Dampiera leptoclada, Drosera pulchella, Gymnoschoenus anceps, Lepidosperma angustatum, Lepidosperma striatum, Lomandra sericea, Mesomelaena tetragona, Thysanotus sparteus, Xanthosia huegelii, *Acacia longifolia, *Gladiolus undulatus.*

Quadrat: 4
Date: 22/11/2017
Description: Hill crest with grey sand
Mapping Unit: Jarrah/Marri/Sheoak Laterite Forest
Vegetation Condition: Excellent
Location: 574185mE 6126657mN
Photo:

Floristics:

Upper: (>10m, 10-30%) *Eucalyptus marginata*

Middle: (2m, 10-30%) *Beaufortia decussata, Leucopogon obovatus* subsp. *obovatus, Leucopogon verticillatus, Acacia browniana* var. *browniana, Agonis theiformis, Allocasuarina fraseriana.*

Ground: (<1m, 30-70%) *Anarthria scabra, Cyathochaeta avenacea, Dampiera leptoclada, Dasypogon bromeliifolius, Desmocladus fasciculatus, Drosera pallida, Hibbertia cunninghamii, Lindsaea linearis, Logania serpyllifolia* subsp. *serpyllifolia, Lomandra pauciflora, Lomandra sericea, Patersonia umbrosa* var. *umbrosa, Synaphea gracillima, Tetraria octandra, Thelymitra macrophylla, Xanthorrhoea platyphylla, *Acacia longifolia.*

Quadrat: 5
Date: 22/11/2017
Description: Upper hill slope with grey sand
Mapping Unit: Jarrah/Marri/Sheoak Laterite Forest
Vegetation Condition: Very Good
Location: 573739mE 6126842mN
Photo:

Floristics:

Upper: (>10m, 30-70%) *Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana.*

Middle: (2m, 10-30%) *Agonis theiformis, Acacia browniana* var. *browniana, Petrophile diversifolia, Beaufortia decussata, Leucopogon obovatus* subsp. *obovatus, Leucopogon verticillatus, Xanthorrhoea platyphylla.*

Ground: (<1m, 30-70%) *Agrostocrinum hirsutum, Anarthria scabra, Billardiera variifolia, Bossiaea linophylla, Conostylis setigera, Cyathochaeta avenacea, Dasypogon bromeliifolius, Desmocladus fasciculatus, Gompholobium knightianum, Hakea amplexicaulis, Logania serpyllifolia, Lomandra sericea, Patersonia umbrosa* var. *umbrosa, Stylidium plantagineum, Tetraria octandra, Tetraria* sp. Jarrah Forest (R. Davis 7391).

Quadrat: 6
Date: 22/11/2017
Description: Middle hill-slope with grey sand
Mapping Unit: Jarrah/Marri/Sheoak Laterite Forest
Vegetation Condition: Very Good/Excellent
Location: 573757mE 6126236mN
Photo:

Floristics:

Upper: (>10m, 30-70%) *Eucalyptus marginata, Allocasuarina fraseriana.*

Middle: (>2m, 10-30%) *Banksia grandis, Bossiaea linophylla, Acacia myrtifolia, Agonis theiformis, Leucopogon obovatus, Leucopogon verticillatus, Melaleuca thymoides, Taxandria parviceps, Kingia australis.*

Ground: (<1m, 30-70%) *Anarthria scabra, Anarthria prolifera, Billardiera heterophylla, Conospermum caeruleum, Cyathochaeta equitans, Dasypogon bromeliifolius, Johnsonia lupulina, Lepidosperma angustatum, Opercularia hispidula, Patersonia umbrosa* var. *umbrosa, Persoonia longifolia, Schoenus multiglumis, Xanthosia rotundifolia, *Holcus lanatus.*

Quadrat: 7
Date: 22/11/2017
Description: Middle hill-slope with grey sand
Mapping Unit: Jarrah/Marri/Sheoak Laterite Forest
Vegetation Condition: Very Good/Excellent
Location: 573942mE 6126424mN
Photo:

Floristics:

Upper: (<10m, 30-70%) *Eucalyptus marginata, Allocasuarina fraseriana, Agonis flexuosa.*

Middle: (2m, 10-30%) *Bossiaea linophylla, Beaufortia decussata, Leucopogon obovatus.*

Ground: (<1m, 30-70%) *Amphipogon amphipogonoides, Anarthria prolifera, Anigozanthos flavidus, Billardiera variifolia, Caesia micrantha, Cyathochaeta avenacea, Dasypogon bromeliifolius, Hibbertia cunninghamii, Lepidosperma angustatum, Lepidosperma angustatum, Lindsaea linearis, Lomandra pauciflora, Lomandra sericea, Opercularia hispidula, Patersonia umbrosa* var. *umbrosa, Scaevola striata, Schoenus multiglumis, Xanthosia rotundifolia.*

Quadrat: 8
Date: 22/11/2017
Description: Middle hill-slope with grey sand
Mapping Unit: Jarrah/Sheoak/*E. staeri* Sandy Woodland
Vegetation Condition: Very Good/Excellent
Location: 574188mE 6126436mN
Photo:

Floristics:

Upper: (<10m, 30-70%) *Eucalyptus marginata, Allocasuarina fraseriana.*

Middle: (2m, 10-30%) *Beaufortia decussata, Acacia browniana* var. *browniana, Agonis theiformis, Leucopogon obovatus, Xanthorrhoea platyphylla, Persoonia longifolia.*

Ground: (<1m, 30-70%) *Anarthria scabra, Cyathochaeta avenacea, Dasypogon bromeliifolius, Drosera menziesii, Lepidosperma angustatum, Opercularia hispidula, Patersonia umbrosa* var. *umbrosa, Tetraria octandra, Thelymitra crinita, Xanthosia rotundifolia.*

Quadrat: 9
Date: 23/11/2017
Description: Middle hill-slope. Outcropping granite boulders
Mapping Unit: Marri/Jarrah Forest/Peppermint Woodland
Vegetation Condition: Very Good
Location: 578825mE 6124018mN
Photo:

Floristics:

Upper: (>10m, 30-70%) *Corymbia calophylla, Eucalyptus marginata, Agonis flexuosa.*

Middle: (2m, 10-30%) *Acacia alata, Agonis theiformis, Bossiaea linophylla, Hovea elliptica, Leucopogon obovatus, Xanthorrhoea platyphylla, *Pittosporum undulatum.*

Ground: (<1m, 30-70%) *Billardiera variifolia, Lepidosperma tenue, Loxocarya cinerea, Opercularia hispidula, Tetrarrhena laevis, Tremandra stelligera, Xanthosia rotundifolia, *Anthoxanthum odoratum, *Asparagus asparagoides, *Briza maxima, *Holcus lanatus, *Lythrum hyssopifolia, *Sonchus oleraceus, *Taraxacum khatoonae.*

Quadrat: 10
Date: 23/11/2017
Description: Granite outcrop
Mapping Unit: *Taxandria marginata* Granite Shrubland
Vegetation Condition: Very Good
Location: 578848mE 6124117mN
Photo:

Floristics:

Upper: (2-3m, 10-30%) *Taxandria marginata, Acacia crassiuscula, Anthocercis viscosa.*

Ground: (<1m, 10-30%) *Lepidosperma hopperi, Lepidosperma tenue, Patersonia limbata, Stypandra glauca, Diuris sp., Drosera stolonifera, Juncus pallidus, *Aira caryophyllea, *Anthoxanthum odoratum, *Briza maxima, *Briza minor, *Ornithopus compressus, *Psoralea pinnata, *Watsonia meriana* var. *bulbillifera.*

Quadrat: 11
Date: 23/11/2017
Description: Granite boulders, brown loamy sand
Mapping Unit: Marri/Jarrah Coastal Hills Forest
Vegetation Condition: Very Good/Excellent
Location: 578868mE 6124198mN
Photo:

Floristics:

Upper: (>10m, 10-30%) *Corymbia calophylla, Eucalyptus cornuta, Agonis flexuosa.*

Middle: (2-4m, 10-30%) *Bossiaea linophylla, Clematis pubescens, Gastrolobium bilobum, Leucopogon obovatus* subsp. *obovatus, Hovea elliptica.*

Ground: (<1m, 30-70%) *Hibbertia cunninghamii, Lepidosperma tenue, Loxocarya cinerea, Microlaena stipoides, Opercularia hispidula, Poa porphyroclados, Stypandra glauca, Tetrarrhena laevis, Thomasia angustifolia, Tremandra stelligera, Xanthorrhoea platyphylla, *Anthoxanthum odoratum, *Asparagus asparagoides, *Avena barbata, *Briza maxima, *Lythrum hyssopifolia.*

Quadrat: 12
Date: 23/11/2017
Description: Granite boulders, dark brown loamy sand
Mapping Unit: Marri/Jarrah Coastal Hills Forest
Vegetation Condition: Very Good
Location: 578863mE 6124350mN
Photo:

Floristics:

Upper: (>10m, 10-30%) *Corymbia calophylla, Eucalyptus cornuta.*

Middle: (2m, 10-30%) *Acacia myrtifolia, Gastrolobium bilobum, Hibbertia cuneiformis, Hibbertia furfuracea, Hovea elliptica, Rhagodia preissii, Leucopogon obovatus* subsp. *obovatus.*

Ground: (<1m, 10-30%) *Billardiera heterophylla, Clematis pubescens, Daucus glochidiatus, Lepidosperma tenue, Loxocarya cinerea, Microlaena stipoides, Opercularia hispidula, Poa porphyroclados, Tetraria octandra, Tremandra stelligera, *Anthoxanthum odoratum, *Asparagus asparagoides, *Watsonia meriana* var. *bulbillifera.*

Quadrat: 13
Date: 23/11/2017
Description: Granite outcrop, brown loamy sand.
Mapping Unit: *Leucopogon assimilis* Granite Shrubland
Vegetation Condition: Very Good/Excellent
Location: 578796mE 6124359mN
Photo:

Floristics:

Upper: (2m, 30-70%) *Dodonaea ceratocarpa, Eucalyptus cornuta, Gastrolobium bilobum, Leucopogon obovatus* subsp. *obovatus, Leucopogon pendulus, Leucopogon Verticordia plumosa, assimilis*.

Ground: (<1m, 30-70%) *Andersonia sprengelioides, Austrostipa mollis, Billardiera heterophylla, Borya sphaerocephala, Hibbertia diamesogenos, Lepidosperma tenue, Luzula meridionalis, Microlaena stipoides, Neurachne alopecuroidea, Schoenus sp. infertile, Stypandra glauca, *Acacia longifolia, *Anthoxanthum odoratum, *Briza maxima, *Briza minor, *Centaurium erythraea, *Ornithopus compressus, *Parentucellia latifolia, *Romulea rosea, *Trifolium arvense.*

Quadrat: 14
Date: 23/11/2017
Description: Granite outcrop margin, brown loamy sand
Mapping Unit: *Taxandria marginata/ Gastrolobium bilobum* Granite Shrubland
Vegetation Condition: Very Good/Excellent
Location: 578781mE 6124287mN
Photo:

Floristics:

Upper: (>10m, <10%) *Eucalyptus cornuta.*

Middle: (2m, 10-30%) *Dodonaea ceratocarpa, Gastrolobium bilobum, Hibbertia furfuracea, Leucopogon obovatus* subsp. *obovatus, Pimelea rosea* subsp. *rosea, Rhagodia preissii.*

Ground: (<1m, 30-70%) *Billardiera heterophylla, Lepidosperma tenue, Loxocarya cinerea, Stypandra glauca, *Acacia longifolia, *Anthoxanthum odoratum, *Briza maxima, *Briza minor, *Parentucellia latifolia, *Plantago lanceolata, *Trifolium angustifolium, *Trifolium arvense, *Watsonia meriana* var. *bulbillifera.*

Quadrat: 15
Date: 23/11/2017
Description: Hill slope with light grey sand
Mapping Unit: Marri/Jarrah Forest/Peppermint Woodland
Vegetation Condition: Very Good
Location: 578746mE 6124229mN
Photo:

Floristics:

Upper: (>10m, 30-70%) *Corymbia calophylla, Eucalyptus cornuta.*

Middle: (2m, 30-70%) *Leucopogon obovatus* subsp. *obovatus, Agonis theiformis, Bossiaea linophylla, *Acacia longifolia, *Psoralea pinnata.*

Ground: (<1m, 10-30%) *Anigozanthos flavidus, Hibbertia cuneiformis, Hibbertia furfuracea, Lepidosperma gladiatum, Loxocarya cinerea, Opercularia hispidula, Pteridium esculentum, Tetraria octandra, *Anthoxanthum odoratum, *Asparagus asparagoides, *Cenchrus clandestinus, *Cenchrus clandestinus, *Gladiolus undulatus, *Holcus lanatus, *Pelargonium capitatum, *Taraxacum khatoonae.*

Quadrat: 16
Date: 23/11/2017
Description: Wetland, peat over sand
Vegetation Condition: Very Good
Mapping Unit: *Homalospermum firmum/Callistemon glaucus* Peat Thicket
Location: 575182mE 6125118mN
Photo:

Floristics:

Upper: (4m, >70%) *Eucalyptus marginata, Homalospermum firmum, Beaufortia sparsa, Adenanthos obovatus, Astartea scoparia., Bossiaea linophylla, Leucopogon australis, *Acacia longifolia.*

Ground: (<1m, 10-30%) *Gastrolobium sericeum, Anarthria prolifera, Anarthria scabra, Anigozanthos flavidus, Austrostipa mollis, Billardiera heterophylla, Cyathochaeta avenacea, Hypolaena fastigiata, Johnsonia lupulina, Lomandra pauciflora, Meeboldina scariosa, Tricoryne elatior, Tricoryne elatior, Xyris lanata, *Watsonia meriana* var. *bulbillifera.*

Quadrat: 17
Date: 23/11/2017
Description: Wetland, peat over sand
Mapping Unit: *Homalospermum firmum/Callistemon glaucus* Peat Thicket
Vegetation Condition: Very Good
Location: 574417mE 6125317mN
Photo:

Floristics:

Upper: (4m, >70%) *Homalospermum firmum, Beaufortia sparsa, Callistachys lanceolata, Astartea sp., Taxandria juniperina, Taxandria linearifolia, *Eucalyptus globulus.*

Ground: (<1m, 30-70%) *Empodisma gracillimum, Acacia divergens, Hypocalymma cordifolium, Lepidosperma striatum, Lobelia heterophylla, Meeboldina scariosa, Opercularia hispidula, Patersonia occidentalis, Patersonia umbrosa* var. *umbrosa, Anarthria prolifera, Pteridium esculentum, *Watsonia meriana* var. *bulbillifera.*

Quadrat: 18
Date: 23/11/2017
Description: Wetland, grey sand
Mapping Unit: *Evandra aristata* Sedgeland
Vegetation Condition: Very Good
Location: 574971mE 6125166mN
Photo:

Floristics:

Upper: (4m, <10%) *Nuytsia floribunda.*

Middle: () *Beaufortia sparsa, Evandra aristata.*

Ground: () *Amphipogon laguroides, Anarthria laevis, Anarthria prolifera, Anarthria scabra, Acacia myrtifolia, Adenanthos obovatus, Agonis flexuosa, Billardiera heterophylla, Boronia crenulata, Boronia spathulata, Dampiera linearis, Dasypogon bromeliifolius, Gymnoschoenus anceps, Homalospermum firmum, Hypocalymma strictum, Hypolaena fastigiata, Jacksonia horrida, Lyginia barbata, Melaleuca thymoides, Opercularia hispidula, Patersonia limbata, Schoenus cruentus, Sphenotoma capitata, Taxandria parviceps, Xyris lanata, *Leptospermum laevigatum.*

Quadrat: 19
Date: 23/11/2017
Description: Granite outcrop, brown loamy sand.
Mapping Unit: *Taxandria marginata* Granite Shrubland
Vegetation Condition: Degraded/Good
Location: 576814mE 6124669mN
Photo:

Floristics:

Upper: (<10m, 10-30%) *Corymbia calophylla, Agonis flexuosa.*

Middle: (2m, 10-30%) *Agonis theiformis, Bossiaea linophylla, Dodonaea ceratocarpa, Hibbertia furfuracea, Lomandra pauciflora, Loxocarya cinerea, Microlaena stipoides, Stypandra glauca, Tetraria octandra, Tremandra stelligera.*

Ground: (<1m, 10-30%) **Anthoxanthum odoratum, *Asparagus asparagoides, *Avena barbata, *Briza maxima, *Freesia alba x leichtlinii, *Gladiolus undulatus, *Lythrum hyssopifolia, *Watsonia meriana* var. *bulbillifera, Astroloma pallidum, Austrostipa mollis, Billardiera variifolia, Cyathochaeta avenacea, Desmocladus fasciculatus, Dianella revoluta, Lepidosperma tenue, Leucopogon obovatus* subsp. *obovatus, Xanthorrhoea platyphylla.*

Quadrat: 20
Date: 23/11/2017
Description: Swale adjacent to granite outcrop, brown loam
Mapping Unit: Marri/Jarrah Forest/Peppermint Woodland
Vegetation Condition: Very Good
Location: 576759mE 6124635mN
Photo:

Floristics:

Upper: (<10m, 30-70%) *Corymbia calophylla, Eucalyptus marginata, Agonis flexuosa.*

Middle: (2m, 30-70%) *Agonis theiformis, Bossiaea linophylla, Hibbertia cuneiformis, Leucopogon obovatus* subsp. *obovatus, Leucopogon verticillatus.*

Ground: (<1m, 30-70%) *Anarthria scabra, Billardiera heterophylla, Dasypogon bromeliifolius, Hardenbergia comptoniana, Hypolaena fastigiata, Lomandra purpurea, Loxocarya cinerea, Patersonia umbrosa* var. *umbrosa, Pteridium esculentum, Schoenus multiglumis, Tremandra diffusa, *Anthoxanthum odoratum, *Asparagus asparagoides, *Oxalis purpurea, *Oxalis violacea, *Pelargonium capitatum, *Taraxacum khatoonae, *Watsonia meriana* var. *bulbillifera.*

Quadrat: 21
Date: 24/11/2017
Description: Middle hill-slope, grey sand
Mapping Unit: Jarrah/Sheoak/E.staeri Sandy Woodland
Vegetation Condition: Excellent
Location: 574326mE 6127589mN
Photo:

Floristics:

Upper: (<10m, 30-70%) *Eucalyptus marginata, Corymbia calophylla.*

Middle: (2m, 30-70%) *Agonis theiformis, Banksia grandis, Beaufortia decussata, Persoonia elliptica, Xanthorrhoea platyphylla, Acacia browniana* var. *browniana, Bossiaea linophylla, Hakea florida, Kingia australis, Leucopogon obovatus* subsp. *obovatus, Leucopogon verticillatus.*

Ground: (<1m, 30-70%) *Anarthria prolifera, Billardiera variifolia, Desmocladus fasciculatus, Gompholobium polymorphum, Hibbertia cunninghamii, Johnsonia lupulina, Lepidosperma angustatum, Lomandra pauciflora, Lomandra sericea, Opercularia hispidula, Patersonia umbrosa* var. *umbrosa, Tetraria octandra, Tetraria* sp. Jarrah Forest (R. Davis 7391), *Xanthosia rotundifolia.*

Quadrat: 22
Date: 24/11/2017
Description: Wetland, peat over sand
Mapping Unit: *Homalospermum firmum/Callistemon glaucus* Peat Thicket
Vegetation Condition: Excellent
Location: 574397mE 6127513mN
Photo:

Floristics:

Upper: (>2m, 30-70%) *Callistemon glaucus, Beaufortia sparsa, Taxandria parviceps.*

Ground: (<1m, 30-70%) *Anarthria scabra, Baumea rubiginosa, Cephalotus follicularis, Drosera pulchella, Empodisma gracillimum, Gymnoschoenus anceps, Histiopteris incisa, Homalospermum firmum, Leptocarpus tenax, Schizaea fistulosa, Schoenus multiglumis, Sphaerolobium vimineum, Xanthosia rotundifolia, Xyris lanata, *Rubus anglocandicans, Eucalyptus marginata.*

Quadrat: 23
Date: 24/11/2017
Description: 5 x 20 m dimensions. Wetland around artificial dam
Mapping Unit: *Homalospermum firmum/Callistemon glaucus* Peat Thicket
Vegetation Condition: Excellent
Location: 574400mE 6127491mN
Photo:

Floristics:

Upper: (2m, 10-30%) *Callistemon glaucus, Hakea florida, Taxandria linearifolia.*

Ground: (<1m, 10-30%) *Baumea rubiginosa, Cassytha racemosa, Diaspasis filifolia, Drosera pallida, Drosera pulchella, Empodisma gracillimum, Gymnoschoenus anceps, Lepidosperma striatum, Leptocarpus tenax, Meeboldina scariosa, Sphaerolobium vimineum, Stylidium pygmaeum, Thelymitra canaliculata, Xyris lanata, *Anthoxanthum odoratum, *Cortaderia selloana.*

Quadrat: 24
Date: 24/11/2017
Description: Wetland. Peat over sand
Mapping Unit: *Homalospermum firmum/Callistemon glaucus* Peat Thicket
Vegetation Condition: Excellent
Location: 574452mE 6127424mN
Photo:

Floristics:

Upper: (2m, 10-30%) *Callistemon glaucus, Homalospermum firmum, Boronia crassipes, Taxandria linearifolia.*

Ground: (>1m, >70%) *Acacia divergens, Dampiera leptoclada, Diaspasis filifolia, Drosera menziesii, Empodisma gracillimum, Lepidosperma striatum, Leptocarpus tenax, Meeboldina tephrina* ms, *Schoenus multiglumis, Sphaerolobium vimineum, *Holcus lanatus.*

Quadrat: 25
Date: 24/11/2017
Description: Lower hill-slope, grey sand
Mapping Unit: Jarrah/Sheoak/*E. staeri* Sandy Woodland
Vegetation Condition: Very Good/Excellent
Location: 574300mE 6127524mN
Photo:

Floristics:

Upper: (<10m, 30-70%) *Corymbia calophylla, Eucalyptus marginata.*

Middle: (2m, 30-70%) *Agonis theiformis, Banksia grandis, Beaufortia decussata, Bossiaea linophylla, Hakea ruscifolia, Hibbertia cuneiformis, Leucopogon obovatus* subsp. *obovatus, Leucopogon verticillatus, Persoonia longifolia, Xanthorrhoea platyphylla.*

Ground: (<1m, 30-70%) *Amphipogon amphipogonoides, Anarthria prolifera, Desmocladus fasciculatus, Drosera pallida, Haemodorum spicatum, Lepidosperma angustatum, Mesomelaena graciliceps, Opercularia hispidula, Patersonia umbrosa* var. *umbrosa, Scaevola striata, Tetraria octandra, Tricostularia neesii, Xanthosia rotundifolia.*

Quadrat: 26
Date: 27/11/2017
Description: Wetland, peat over sand
Mapping Unit: *Homalospermum firmum/Callistemon glaucus* Peat Thicket
Vegetation Condition: Excellent
Location: 574270mE 6127433mN
Photo:

Floristics:

Upper: (4m, 30-70%) *Callistemon glaucus, Hakea linearis, Taxandria juniperina, Taxandria linearifolia, *Psoralea pinnata.*

Ground: (<1m, >70%) *Baumea acuta, Baumea rubiginosa, Diaspasis filifolia, Drosera menziesii, Empodisma gracillimum, Gymnoschoenus anceps, Leptocarpus tenax, Schoenus multiglumis, Sphaerolobium vimineum, Thysanotus sparteus, Xyris lanata, *Holcus lanatus, *Rubus anglocandicans.*

Quadrat: 27
Date: 27/11/2017
Description: Wetland, peat over sand
Mapping Unit: *Homalospermum firmum*/*Callistemon glaucus* Peat Thicket
Vegetation Condition: Excellent
Location: 574254mE 6127408mN
Photo:

Floristics:

Upper: (3m, 30-70%) *Callistemon glaucus, Homalospermum firmum, Boronia crassipes.*

Ground: (1m, >70%) *Acacia divergens, Baumea rubiginosa, Dampiera leptoclada, Empodisma gracillimum, Gymnoschoenus anceps, Leptocarpus tenax, Schoenus multiglumis, Xyris lanata.*

Quadrat: 28
Date: 27/11/2017
Description: Wetland peat over sand. ex.
Mapping Unit: *Homalospermum firmum*/*Callistemon glaucus* Peat Thicket
Vegetation Condition: Excellent
Location: 574566mE 6127504mN
Photo:

Floristics:

Upper: (3m, 30-70%) *Callistemon glaucus, Homalospermum firmum, Cosmelia rubra, Taxandria linearifolia.*

Ground: (1m, >70%) *Acacia divergens, Astartea corniculata, Baumea acuta, Baumea rubiginosa, Dampiera leptoclada, Drosera menziesii, Empodisma gracillimum, Gymnoschoenus anceps, Leptocarpus tenax, Schoenus multiglumis, Xyris lanata, *Rubus anglocandicans.*

Quadrat: 29
Date: 27/11/2017
Description: Wetland, peat over sand
Mapping Unit: *Homalospermum firmum/Callistemon glaucus* Peat Thicket
Vegetation Condition: Excellent
Location: 574307mE 6127407mN
Photo:

Floristics:

Upper: (2m, 30-70%) *Callistemon glaucus, Homalospermum firmum, Taxandria linearifolia, Boronia crassipes.*

Ground: (1m, >70%) *Acacia divergens, Baumea rubiginosa, Empodisma gracillimum, Gymnoschoenus anceps, Leptocarpus tenax, Schoenus multiglumis, Sphaerolobium vimineum.*

Quadrat: 30
Date: 28/11/2017
Description: Wetland, peat over sand
Mapping Unit: *Taxandria juniperina* Closed Forest
Vegetation Condition: Very Good
Location: 574485mE 6125533mN
Photo:

Floristics:

Upper: (10m, >70%) *Taxandria juniperina, Homalospermum firmum.*

Ground: (<1m, <10%) *Acacia divergens, Baumea acuta, Lepidosperma striatum, Leptocarpus scariosus, Tetrarrhena laevis, *Acacia melanoxylon, *Anthoxanthum odoratum*.

Quadrat: 31
Date: 28/11/2017
Description: Wetland, peat over sand. Firebreak
Mapping Unit: *Taxandria juniperina* Closed Forest
Vegetation Condition: Very Good
Location: 574591mE 6125459mN
Photo:

Floristics:

Upper: (10m, 30-70%) *Taxandria juniperina, Rhadinothamnus anceps,*

Ground: (<1m, <10%) *Aphelia brizula, Baumea acuta, Chamaescilla corymbosa, Drosera pulchella, Isolepis cernua, Lobelia heterophylla, Microtis media, Prasophyllum macrostachyum, Thelymitra* sp., *Utricularia bifida, *Acacia longifolia, *Anthoxanthum odoratum, *Briza maxima, *Briza minor, *Gladiolus undulatus.*

Quadrat: 32
Date: 28/11/2017
Description: Middle hill-slope, grey sand with laterite gravel
Mapping Unit: *Hakea* spp Shrubland/Woodland Complex
Vegetation Condition: Very Good/Excellent
Location: 573977mE 6126876mN
Photo:

Floristics:

Upper: (<10m, 10-30%) *Eucalyptus marginata, Allocasuarina fraseriana.*

Middle: (2m, 10-30%) *Hakea ferruginea, Taxandria parviceps, Agonis theiformis, Acacia browniana* var. *browniana, Acacia myrtifolia, Grevillea pilulifera, Xanthorrhoea platyphylla.*

Ground: (<1m, 30-70%) *Anarthria gracilis, Anarthria prolifera, Anarthria scabra, Billardiera heterophylla, Boronia spathulata, Cyathochaeta avenacea, Dampiera loranthifolia, Dasypogon bromeliifolius, Desmocladus fasciculatus, Haemodorum laxum, Hibbertia microphylla, Hovea trisperma, Lepidosperma drummondii, Lomandra sericea, Mesomelaena tetragona, Patersonia umbrosa* var. *umbrosa, Sphaerolobium medium, Tetraria octandra, Tetraria* sp. Jarrah Forest (R. Davis 7391), *Thysanotus sparteus, Xanthosia rotundifolia.*

12 APPENDIX E - Likelihood of Occurrence Analysis

A post-survey likelihood of occurrence of all conservation significant species (flora and fauna) was assessed based on the presence of suitable habitat and survey effectiveness (see section 3.3).

Table E1. Likelihood of occurrence of conservation significant flora recorded in the vicinity of the Survey Area (<10 km). NM = Naturemap, PMST = Protected Matters Search Tool, WAHERB = Western Australia Herbarium Database, TPFL = Threatened and Priority Flora Database.

Status, Taxon [FAMILY]	Data source	Description, Habitat & Distribution	Habitat Suitability in the Survey Area	Post -Survey Likelihood of Occurrence and Survey Effectiveness
T (Previously considered extinct) *Acacia prismifolia* [Fabaceae]	NM, WAHERB	Shrub, 0.15-0.5 m high. Rocky slopes. Laterite gravel pit in road verge.	Habitat preferences poorly understood for this taxon recently rediscovered near Cranbrook. Generally, habitats in Survey Area are not considered suitable.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
T *Banksia brownii* [Proteaceae]	NM, PMST, WAHERB, TPFL	Bushy, non-lignotuberous shrub or tree (small), 1-6 m high. Flowers cream & brown/orange-red, Mar to Jul. Sand over laterite, gravel, loam over granite. In gullies.	Potential habitat around Mt Melville, however highly impacted by Phytophthora and weeds.	Unlikely. Very conspicuous shrub and no survey limitations would have prevented detection if present in the Survey Area.
T *Banksia goodii* [Proteaceae]	NM, PMST, WAHERB, TPFL	Lignotuberous, prostrate shrub, ca 0.2 m high. Flowers orange-brown-red, May or Nov. White or grey sand over laterite.	Potential habitat in Unit 13, however highly impacted by Phytophthora and weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
T *Banksia verticillata* [Proteaceae]	NM, PMST, WAHERB, TPFL	Non-lignotuberous shrub or tree (rarely), 1.3-6 m high. Flowers yellow-orange, Jan to Apr. Sandy loam. On or beside granite outcrops.	Potential habitat around Mt Melville, however highly impacted by Phytophthora and weeds.	Unlikely. Very conspicuous shrub and no survey limitations would have prevented detection if present in the Survey Area.
T *Caladenia harringtoniae* [Orchidaceae]	NM, PMST, WAHERB, TPFL	Tuberous, perennial, herb, 0.2-0.4 m high. Flowers pink, Oct to Nov. Sandy loam. Winter-wet flats, margins of lakes, creeklines, granite outcrops. Generally, more abundant after fire.	Potential habitat around Mt Melville, however is long unburnt and highly impacted by weeds.	Possible. Survey was appropriately timed, however may emerge after fire.
T *Caladenia granitora* [Orchidaceae]	PMST	Tuberous, perennial, herb, 0.2-0.35 m high. Fl. cream & white & red, Oct to Nov. Shallow soil crevices on granite. Coastal areas.	Potential habitat around granites on Mt Melville, however no actual records in the Study Area.	Unlikely. Known from coastal granites east of the Study Area. Survey was appropriately timed to detect if present.
T *Chordifex abortivus* [Restionaceae]	NM, PMST, WAHERB	Rhizomatous, erect perennial, herb, to 0.5 m high. Flowers brown, Sep to Oct. Sand. Low rises & undulating areas.	Has the potential to occur in a wide range of habitats.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
T *Conostylis misera* [Haemodoraceae]	NM, PMST, WAHERB	Rhizomatous, tufted perennial, grass-like or herb, 0.05-0.18 m high. Flowers yellow, Oct to Nov. White or grey sand, sandy loam. Winter-wet flats.	Generally known from wet habitat further inland than Survey Area.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
T *Diuris drummondii* [Orchidaceae]	PMST	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps. Generally, more abundant after fire.	Known from black sand over granite (Torndirrup NP). Habitat in Survey Area is degraded and impacted by weeds.	Unlikely. Limited suitable habitat in Survey Area, however may emerge after fire.
T *Drakaea micrantha* [Orchidaceae]	NM, PMST, WAHERB, TPFL	Tuberous, perennial, herb, 0.15-0.3 m high. Flowers red & yellow, Sep to Oct. White-grey sand.	Potential habitat in in moist areas in Unit 13 and in Taxandria thickets, however generally occurs further inland and west of the Survey Area.	Unlikely. Survey was appropriately timed to detect if present, however may emerge after fire.
T *Isopogon uncinatus* [Proteaceae]	NM, PMST, WAHERB, TPFL	Tufted spreading or prostrate, non-lignotuberous shrub, 0.05-0.4 m high. Flowers yellow/cream, Oct to Nov. Loam or sand on granite, peaty sand. Swampy depressions, hillslopes.	Potential habitat around Mt Melville, however highly impacted by Phytophthora and weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.

Status, Taxon [FAMILY]	Data source	Description, Habitat & Distribution	Habitat Suitability in the Survey Area	Post -Survey Likelihood of Occurrence and Survey Effectiveness
T *Kennedia glabrata* [Fabaceae]	PMST	Prostrate shrub, 0.05-0.5 m high, to 5 m wide. Fl. red, Aug to Nov. Soil pockets, sandy soils. Granite outcrops.	Potential habitat around granites on Mt Melville, however no actual records in the Study Area.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
T *Sphenotoma drummondii* [Ericaceae]	PMST	Tufted shrub, 0.15-0.5 m high. Fl. white, Sep to Dec. Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks.	Potential habitat around granites on Mt Melville, however no actual records in the Study Area.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
T *Verticordia fimbrilepis* subsp. *australis* [Malvaceae]	NM, PMST, TPFL	Slender shrub, 0.2-0.4 m high. Flowers pink, Oct to Dec. Shallow sand, clay loam. Granite outcrops.	Potential habitat around Mt Melville, however highly impacted by Phytophthora and weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P1 *Caladenia evanescens* [Orchidaceae]	NM, WAHERB	Tuberous, perennial, herb, 0.15-0.2 m high. Flowers green-cream-yellow, Nov. Sand. Consolidated sand dunes.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P1 *Coleanthera coelophylla* [Ericaceae]	WAHERB	Erect shrub, 0.3-0.6 m high. Flowers pink/white, Sep to Nov. Gravelly sandy soils.	Known to occur further inland. Record in Study Area has low geo-accuracy.	Unlikely. Survey Area is considered outside the range of this taxon. Survey was appropriately timed to detect if present.
P1 *Drosera paleacea* [Droseraceae]	NM	Fibrous-rooted, rosetted perennial, herb, to 0.03 m high, to 0.015 m wide. Fl. white-cream, Sep to Dec or Jan. White sand, sandy clay.	Recently recorded from Banksia littoralis swamp in the Torndirrup area.	Possible. Other wetlands in Survey Area may be suitable. Survey was appropriately timed to detect if present, however may be more abundant after disturbance such as fire or slashing.
P1 *Prasophyllum paulinae* [Orchidaceae]	NM, WAHERB	Tuberous, perennial, herb, 0.15-0.4 m high. Fl. green-purple-red, Sep to Nov. Black, peaty soils. Swamps.	Recorded from *Taxandria/Homalospermum* swamp in Survey Area.	Known habitat present. Survey was appropriately timed to detect; however, it requires fire to germinate.
P1 *Thomasia multiflora* [Malvaceae]	NM, WAHERB	Spreading shrub, 0.3-1 m high, to 2 m wide. Flowers pink-purple, Sep to Oct. Black sand. Seasonally wet areas, granite outcrops.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. *Thomasia purpurea* (common congener) was present in suitable habitat within Survey Area.
P1 *Thomasia purpurea x solanacea* [Malvaceae]	NM, WAHERB, TPFL	Shrub, 0.5-0.8 m high. Flowers pink-purple, Nov to Dec or Jan. Grey sand over limestone. Creek sides.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P2 *Agrostocrinum scabrum* subsp. *littorale* [Hemerocallidaceae]	NM, WAHERB	Rhizomatous, perennial, herb, to 0.15 m high. Flowers blue, Oct to Nov. Shallow granite loams. Coastal slopes.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P2 *Astartea transversa* [Myrtaceae]	NM, WAHERB	Spreading shrub to 0.5 m. Flowers pink to white in April-May. Grey sand, wetlands/winter wet.	Suitable habitat in Unit 47.	Unlikely. Survey conducted outside flowering time (autumn), however is a distinctive shrub likely to be detected if present.
P2 *Conospermum quadripetalum* [Proteaceae]	NM, WAHERB, TPFL	Diffuse, straggly shrub, 0.3-1 m high. Fl. blue/white, Sep to Nov. Sandy clay, grey sand. Flats behind coastal hills.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P2 *Conospermum spectabile* [Proteaceae]	NM, WAHERB	Erect, compact shrub, 0.5-0.8 m high. Flowers white & blue, Oct to Nov. Sandy soils.	Generally, occurs further inland.	Unlikely. Survey appropriately timed and is a distinctive shrub likely to be detected if present.
P2 *Gyrostemon thesioides* [Gyrostemonaceae]	NM, WAHERB, TPFL	Straggling, decumbent shrub, to 0.7 m high. Flowers red-orange-yellow/yellow-green, Nov. Sand over limestone. Consolidated coastal dunes.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P2 *Isopogon buxifolius* var. *buxifolius* [Proteaceae]	NM, WAHERB	Upright shrub, 0.45-1 m high. Flowers pink-cream, Jul to Dec. Grey sand. Swampy areas.	Suitable habitat in Unit 47.	Unlikely. Survey appropriately timed and is a distinctive shrub likely to be detected if present.
P2 *Leucopogon bracteolaris* [Ericaceae]	NM, WAHERB	Shrub, 0.25-1 m high. Flowers white, Feb or May or Jul or Oct. Stony sand, gravelly loam.	Generally known from the Stirling Range. Record in Study Area is a geospatial error.	Unlikely. Survey Area is considered outside the range of this taxon.
P2 *Leucopogon cymbiformis* [Ericaceae]	NM, WAHERB	Dense, erect or spreading shrub, 0.1-0.6(-0.8) m high. Flowers white, Jul to Nov or Feb to Mar.	Wide range of suitable habitats	Unlikely. Survey appropriately timed and is a distinctive shrub likely to be detected if present.

Status, Taxon [FAMILY]	Data source	Description, Habitat & Distribution	Habitat Suitability in the Survey Area	Post -Survey Likelihood of Occurrence and Survey Effectiveness
		White/grey or yellow sand, lateritic gravelly soils. Sandplains, wet flats, foothills.		
P2 *Schoenus* sp. Grassy (E. Gude & J. Harvey 250) [Cyperaceae]	NM, WAHERB	Rhizomatous, perennial, grass-like or herb (sedge), to 0.7 m high. Fl. yellow. Black silt. Swamps.	Potentially suitable habitat in Unit 47, 49 or 59.	Possible. Not detected in wetlands in Survey Area, however may be difficult to detect if present in low numbers.
P2 *Stenanthemum sublineare* [Rhamnaceae]	NM,	Erect shrub, to 0.1 m high. Fl. green, Oct to Dec. Littered white sand. Coastal plain.	Potential habitat in Eucalypt woodlands (12, 13, 10).	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P2 *Stylidium articulatum* [Stylidiaceae]	NM, WAHERB	Rosetted perennial, herb, 0.15-0.25 m high, Leaves erect to spreading, oblanceolate, 3-8 cm long, 5-14 mm wide, apex subacute to acute, glabrous. Scape glandular in upper half. Inflorescence paniculate. Flowers pink, Nov to Dec. Sandy loam, granite. Hills, coastal heath.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P2 *Stylidium falcatum* [Stylidiaceae]	NM, WAHERB, TPFL	Perennial, herb, 0.15-0.35(-0.6) m high. Flowers white, Oct to Nov. Sand, gravelly clay loam. Plains, lateritic ridges.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P2 *Thelymitra variegata* [Orchidaceae]	NM, WAHERB	Tuberous, perennial, herb, 0.1-0.35 m high. Flowers orange & red & purple & pink, Jun to Sep. Sandy clay, sand, laterite.	Potential habitat in sandy Eucalypt woodlands (Unit 13).	Unlikely. Habitat not highly suitable, survey appropriately timed to be detected if present.
P3 *Acacia ataxiphylla* subsp. *ataxiphylla* [Fabaceae]	NM, WAHERB	Prostrate, sprawling shrub, 0.15-0.5 m high, to 1 m wide. Flowers yellow, Nov to Dec or Jan. Gravelly clay loam, white/grey sand. Flats, roadsides.	Wide range of suitable habitats	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P3 *Andersonia auriculata* [Ericaceae]	NM, WAHERB, TPFL	Erect or spreading shrub, 0.1-0.3(-0.5) m high. Flowers white & blue, Apr to Oct. Grey or peaty sand, often over laterite. Swampy areas, granite outcrops.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P3 *Andersonia setifolia* [Ericaceae]	NM, WAHERB	Decumbent to erect, cushion-forming shrub, 0.05-0.15 m high. Flowers red/white, Jun to Oct. Sandy & gravelly soils. Hillslopes & breakaways.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P3 *Andersonia* sp. Mitchell River [Ericaceae]	NM	Low, spreading, cushion-like shrub, 0.05-0.4 m high. Fl. blue/blue-white-pink, Jun to Sep. Grey sand over laterite or granite.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P3 *Austrostipa mundula* [Poaceae]	NM, WAHERB	Perennial caespitose grass to 0.5m. Grey sand.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P3 *Boronia crassipes* [Rutaceae]	NM, WAHERB	Erect, spindly shrub, 0.5-2 m high. Flowers red-pink, Aug to Sep. Sand, peaty sand. Winter-wet swamps, creeklines.		Present (See section 4.2.4)
P3 *Caustis* sp. Boyanup [Cyperaceae]	WAHERB	Rhizomatous, clumped perennial, grass-like or herb (sedge), 0.7-1 m high. White or grey sand.	Mike Hislop (Western Australian Herbarium) has indicated the taxonomy of this entity is poorly supported.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P3 *Chorizema carinatum* [Fabaceae]	NM, WAHERB	Erect or spreading shrub, 0.1-0.6 m high. Flowers yellow, Oct to Dec. Sand, sandy clay.	Potential habitat in laterite woodlands (12, 31)	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P3 *Corybas abditus* [Orchidaceae]	NM, WAHERB	Tuberous, perennial, dwarf herb, 0.01-0.02 m high. Fl. red-purple, Oct to Nov. Black peaty soils. Winter-wet swamps.	Potentially suitable habitat in wetland Units 47, 49 or 59.	Unlikely. Survey appropriately timed to be detected if present.

Status, Taxon [FAMILY]	Data source	Description, Habitat & Distribution	Habitat Suitability in the Survey Area	Post -Survey Likelihood of Occurrence and Survey Effectiveness
P3 *Juncus meianthus* [Juncaceae]	NM, TPFL	Tufted perennial, herb, 0.05-0.2 m high, to 0.4 m wide. Flowers brown, Nov to Dec or Jan. Black sand, sandy clay. Creeks, seepage areas.	Wide range of suitable habitats.	Unlikely. Survey appropriately timed, however may be difficult to detect if in low numbers.
P3 *Lachnagrostis billardierei* subsp. *billardierei* [Poaceae]	NM, WAHERB	Annual, herb. Fl. purple/green, Dec. Sand over granite. Hilltops. Melaleuca cuticularis.	No suitable habitat in the Survey Area.	Unlikely. No suitable habitat present.
P3 *Leucopogon altissimus* [Ericaceae]	NM, WAHERB	Erect shrub to 2 m high. Inflorescence pendulous, flowers creamy - white. Grey or brown sandy loam over granite.	Generally, occurs east of the Survey Area.	Unlikely. Survey Area outside taxon's range.
P3 *Melaleuca ringens* [Myrtaceae]	WAHERB	Bushy shrub, 0.4-2.5 m high. Fl. cream-yellow, Sep to Oct. Sand. Limestone ridges & clifftops.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P3 *Poa billardierei* [Poaceae]	NM, WAHERB, TPFL	Tussock grass to 0.5 m. Foredunes, drift sands.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P3 *Synaphea incurva* [Proteaceae]	NM, WAHERB, TPFL	Clumped, spreading shrub. Flowers yellow, Sep to Nov. Gravelly loam, sandy soils. Slopes.		Present (See section 4.2.4)
P3 *Synaphea preissii* [Proteaceae]	NM, WAHERB	Erect, low shrub, 0.15-0.4 m high. Flowers yellow, Jul to Nov. Sand, gravelly loam.	Suitable habitat in lateritic soils (Unit 12, 31)	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P3 *Verticordia endlicheriana* var. *angustifolia* [Myrtaceae]	NM, WAHERB	Erect shrub, 0.3-0.5 m high. Flowers yellow, Oct to Nov. Sandy clay. Granite outcrops.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P4 *Adenanthos x cunninghamii* [Proteaceae]	NM, WAHERB, TPFL	Erect open shrub, 1-3 m high. Flowers red/pink-red, Mar or Sep to Oct. Grey sand. Coastal dunes & sandplains.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P4 *Andersonia* sp. Jamesii (J. Liddelow 84) [Ericaceae]	NM, WAHERB, TPFL	Shrub, 0.5 m high x 0.1 m wide. Perennial, erect, open. Flowers pink / blue. Sandy clay, laterite.		Present (See section 4.2.4)
P4 *Banksia seneciifolia* [Proteaceae]	NM, WAHERB	Columnar,non-lignotuberous shrub, 0.6-1 m high. Fl. cream-yellow-brown, Jun or Aug. Sandy loam, sand. Rocky hillslopes.	Suitable habitat in lateritic soils (Unit 12, 31)	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P4 *Banksia serra* [Proteaceae]	NM, WAHERB	Erect, slender, non-lignotuberous shrub, 1-4(-7) m high. Flowers yellow/cream-green, Jul to Sep. Gravel, sand or clay loam over laterite. Hillslopes.	Suitable habitat in lateritic soils (Unit 12, 31)	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P4 *Corybas limpidus* [Orchidaceae]	NM, WAHERB	Tuberous, perennial, dwarf herb, 0.01 m high. Flowers red & green, Aug to Sep. Sand. Coastal dunes.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P4 *Drosera fimbriata* [Droseraceae]	NM, WAHERB, TPFL	Erect tuberous, perennial, herb, 0.05-0.15 m high. Flowers white, Sep to Oct. Deep white sand (often in Banksia shrublands), granite.	No suitable habitat (white sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P4 *Gahnia sclerioides* [Cyperaceae]	NM, WAHERB, TPFL	Lax, slender rhizomatous, perennial, grass-like or herb (sedge), 0.3-0.9 m high. Loam, sandy soils. Moist shaded situations.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P4 *Gonocarpus pusillus* [Haloragaceae]	NM, WAHERB	Prostrate annual, herb, 0.05-1.2 m high. Flowers green/yellow-red, Nov to Dec. Grey sandy clay. Winter-wet swamps.	Potentially suitable habitat in Unit 46, 47.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P4 *Gonocarpus simplex* [Haloragaceae]	NM, WAHERB, TPFL	Tufted perennial, herb, 0.2-0.6 m high. Fl. green/red-brown, Nov to Dec. Peaty sand. Swamps,	Potentially suitable habitat in Unit 46, 47.	Possible. Suitable habitat present, however none are recently burnt.

Status, Taxon [FAMILY]	Data source	Description, Habitat & Distribution	Habitat Suitability in the Survey Area	Post -Survey Likelihood of Occurrence and Survey Effectiveness
		seasonally inundated areas. Prolific after fire.		
P4 *Kunzea pauciflora* [Myrtaceae]	NM	Erect, compact shrub, (0.35-)0.5-1.2(-1.5) m high. Fl. pink, Aug to Nov.	Record in Survey Area is a geospatial error.	Unlikely. Survey Area is outside the taxon's range.
P4 *Laxmannia jamesii* [Asparagaceae]	WAHERB, TPFL	Tufted, stilt-rooted perennial, herb, 0.05-0.2 m high. Flowers red & white, May to Jul. Grey sand. Winter-wet locations.	Potential habitat in moist sandy soils (13, 46).	Possible. Not detected in wetlands in Survey Area, however may be difficult to detect if present in low numbers and not surveyed in peak flowering time.
P4 *Lepidium pseudotasmanicum* [Brassicaceae]	NM, WAHERB	Erect annual or biennial, herb, 0.2-0.4(-1) m high. Flowers white-green, Feb or Dec. Loam, sand.	Wide range of suitable habitats	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P4 *Lysinema lasianthum* [Ericaceae]	NM, WAHERB, TPFL	Spindly shrub, 0.25-0.7 m high. Flowers white-cream, Jul to Nov. Swamps, seasonally wet areas.	Potential habitat in moist sandy soils (13, 46).	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P4 *Microtis pulchella* [Orchidaceae]	NM, WAHERB	Tuberous, perennial, herb, 0.12-0.25 m high. Flowers white, Nov to Dec or Jan. Peaty sand. Winter-wet swamps. Prolific after fire.	Potential habitat in wetlands (46, 47).	Possible. The absence of recent fire may have affected detection.
P4 *Microtis quadrata* [Orchidaceae]	NM, WAHERB	Erect herb with tuber, 0.4 m high. Greenish flowers. Grey sandy clay. Wet areas. Prolific after fire.	Potential habitat in wetlands (46, 47).	Possible. The absence of recent fire may have affected detection.
P4 *Myosotis australis* [Boraginaceae]	WAHERB	Erect or procumbent annual, herb, up to 0.3 m high. Fl. white/blue, Aug to Nov. Grey sand over limestone.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P4 *Spyridium spadiceum* [Rhamnaceae]	NM, WAHERB	Erect slender or weak semi-prostrate shrub, 0.15-3 m high. Flowers white, Aug to Dec or Jan to Feb or Apr. Sand or gravelly loam. Granitic hills.	Potential habitat around Mt Melville, however highly impacted by weeds.	Unlikely. No survey limitations would have prevented detection if present in the Survey Area.
P4 *Thomasia quercifolia* [Malvaceae]	NM, WAHERB, TPFL	Shrub to 1 m high. Pink purple flowers born in Apr, Aug, Oct, Nov or Dec. Karri loam or grey coastal sand.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P4 *Thomasia solanacea* [Malvaceae]	NM, WAHERB	Erect shrub, 0.5-3 m high. Flowers blue-purple-pink, Sep to Dec. Alluvium, sand over limestone, rocky loam. Coastal areas.	No suitable habitat (calcareous sand) present in the Survey Area.	Unlikely. No suitable habitat present.
P4 *Thysanotus isantherus* [Asparagaceae]	NM, WAHERB	Caespitose perennial, herb (with tuberous roots), to 0.15 m high. Flowers purple, Nov to Dec. Granite.		Present (See section 4.2.4)

Table E2. Likelihood of occurrence of conservation significant fauna recorded in the vicinity of the Survey Area (<10 km).

Taxon	Habitat	Likelihood of Occurrence
Mammals		
Bilby, Dalgyte (*Macrotis lagotis*) (T-VU)	Bilbies are now mostly restricted to the drier and least fertile parts of their former range with the exception of populations in the north of the NT and WA. Remaining populations occupy three major vegetation types, namely: open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas (Pavey 2006)	Highly Unlikely. Not within current known range. One uncertain record form 1969.
Chuditch, Western Quoll (*Dasyurus geoffroii*) (T-VU)	Eucalypt forest (especially Jarrah, *Eucalyptus marginata*), dry woodland and mallee shrublands (Van Dyke & Strahan, 2008). In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. The Chuditch occurs at low densities, even in quality habitats of coastal areas. In Jarrah forest they shelter during the day in horizontal, hollow logs or earth burrows (DotEE 2016).	Unlikely. Suitable habitat is present, however the lack of secure, baited reserves Chuditch range widely and occur in very low densities. May use this survey area intermittingly or as movement corridor.
Dibbler (*Parantechinus apicalis*) (T-EN)	Dibblers have been recorded over an extensive area and it is likely that they can occupy a diverse range of habitats (Friend, 2004). However, the species seem to prefer vegetation with a dense canopy greater than 1 m high which has been unburnt for at least 10 years or more (Baczocha & Start 1996). Mainland habitat is characterised by the presence of long-unburnt heathland, typified by sandy substrates and occasionally lateritic soils (Baczocha & Start 1996; Barrett 1998). This generalisation applies to records from Cheyne Beach, Torndirrup National Park and most records from Fitzgerald River National Park (Friend 2004)	Highly unlikely. No suitable habitat exists within the Survey Area
Quokka (*Setonix brachyurus*) (T-VU)	A range of vegetation types including dense forests and thickets, streamside vegetation, heaths and shrublands, *Taxandria linearifolia* dominated swamps in the Jarrah *(Eucalyptus marginata*) forest. On the south coast swamps, riparian areas, incised gullies and dense coastal heath (de Tores et al. 2007). Specifically, in the Two Peoples Bay area habitat critical to survival is known to comprise of coastal heath and thickets (*Eucalyptus staeri, Allocasuarina fraseriana, Hakea elliptica with Melaleuca striatum, Anarthria scabrum*); swamps (*Taxandria juniperina, T. linearifolia, Melaleuca lanceolata* with *Hakea nitida, Beaufortia sparsa and Gahnia trifida*); and riparian systems *(Eucalyptus megacarpa, Banksia littoralis, Lepidosperma spp.*) (DotEE 2016b)	Highly unlikely. No suitable habitat exists within the Survey Area
South-western brush-tailed phascogale, wambenger (*Phascogale tapoatafa wambenger*) (CD)	Woodland and open forests, and less commonly in wetter forests, tree species... The species has an arboreal foraging habit and a preference for mature trees for nesting hollows, although sometimes smaller trees have the potential to provide nesting hollows (Abbott and Whitford (2002). Rees et al. (2006) found that suitable hollows for this species in Victoria ranged in diameter at breast height (DBH) from 25 to 171 cm, with a mean DBH for the trees used by each individual phascogale of >80 cm. Hollow entrance sizes for Brush-tailed phascogales are small, > 5cm diameter (http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10613)	Possible. A confirmed record of South-western brush-tailed phascogale in Mira Mar (an Albany suburb) from March 2017 indicates they possibly occur within the Albany area. Suitable habitat exists within Marri and Jarrah Woodland and Forest within the Survey Area. Trees with potential hollows with entrance sizes suitable for this species were recorded. This species is difficult to detect by signs.
Western Ringtail Possum, ngwayir (*Pseudocheirus occidentalis*) (T-CR)	See main text	Present. See main text
Woylie, Brush-tailed Bettong (*Bettongia penicillata subsp. ogilbyi*) (T-CR)	Current habitat includes tall eucalypt forest and woodland, dense myrtaceous shrubland, Kwongkan (proteaceous) or mallee heath (Yeatman and Groom 2012 and references therein). Thickets and other suitable habitat types such as heath, provide refuges for woylies against predators.	Highly Unlikely. Suitable habitat exists, however the lack of secure, baited reserves in the Survey Area reduces the likelihood of this species being present.
Quenda, Southern Brown Bandicoot (*Isoodon obesulus subsp. fusciventer*) (P4)	See main text.	Present. See main text
Western Brush Wallaby (*Macropus irma*) (P4)	Habitat includes open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest.	Unlikely. Potentially suitable habitat occurs, but no scats were observed during the survey.
Water-rat, Rakali (*Hydromys chrysogaster*) (P4)	See main text	Likely. See discussion in main text

Taxon	Habitat	Likelihood of Occurrence
Birds		
Australasian Bittern (*Botaurus poiciloptilus*) T (EN)	Densely vegetated freshwater wetlands and, rarely, in estuaries or tidal wetlands. In the southwest of Western Australia, the Bittern is found in beds of tall rush mixed with or near short fine sedge or open pools. It also occurs around swamps, lakes, pools, rivers and channels fringed with lignum *Muehlenbeckia*, cane grass *Eragrostis* or other dense vegetation (Marchant & Higgins 1990). It occasionally ventures into areas of open water or onto banks. Brackish water is tolerated in estuaries and tidal wetlands; sea coasts are avoided (Pickering 2013)	Highly Unlikely. No suitable habitat exists within the Study Area.
Baudin's Cockatoo, Long-billed black-cockatoo) (*Calyptorhynchus baudinii*) T (EN)	See main text.	Present. See main text
Blue-billed Duck (*Oxyura australis*) (P4)	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. Feeds by day far from the shore, particularly if dense cover is available in the central parts of the wetland. They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer.	Highly Unlikely. No large permanent wetlands with open water are present.
Carnaby's Cockatoo, Short-billed black-cockatoo (*Calyptorhynchus latirostris*) T (EN)	See main text.	Present. See main text.
Eastern Curlew (*Numenius madagascariensis*) T (CR) & IA	Open mossy or transitional bogs, moss-lichen bogs and wet meadows, and on the swampy shores of small lakes; in the non-breeding season it is essentially coastal, occurring at estuaries, mangrove swamps, saltmarshes and intertidal flats, particularly those with extensive seagrass (Zosteraceae) meadows. BirdLife Australia http://www.birdlife.org.au/bird-profile/eastern-curlew	Highly Unlikely. No suitable habitat exists within the Survey Area.
Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii subsp. naso*) T (VU)	See main text	Present. See main text.
Noisy Scrub-bird, Tjimiluk (*Atrichornis clamosus*) T (EN)	The Noisy Scrub-bird inhabits ecological communities that support a dense understorey or lower stratum of sedges and shrubs, a dense accumulation of leaf litter and an abundant population of litter-dwelling invertebrates. In the area between Oyster Harbour and Cheyne Beach, the core areas of male Noisy Scrub-bird territories are found in dense, long-unburnt vegetation characterised as low forest (5-15 m high), scrub/thicket and (rarely) heath. These vegetation formations occur in the gullies and drainage lines of hills and granite mountains and, in lowland areas, in overgrown swamps, lake margins and beside streams (Danks *et al.* 1996).	Highly Unlikely. No suitable habitat exists within the Survey Area.
Osprey, Eastern Osprey (*Pandion cristatus*) (AI)	Require extensive areas of open fresh, brackish or saline water for foraging. Frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes (DotE 2019)	Highly Unlikely. No suitable habitat exists within the Survey Area.
Recherche Cape Barren Goose (*Cereopsis novaehollandiae*) T (VU)	There is little published information available on the habitat of the Cape Barren Goose (south-western). It occurs on offshore islands and rocks, and at adjacent sites on the mainland. It inhabits grasslands and low fields of succulent herbs (comprised of Carpobrotus sp.), and occasionally occurs in open areas in taller and denser vegetation (although islands that are covered by woodlands or thickets support few birds) (Halse *et al.* 1995; Johnstone & Storr 1998). The bird has also been recorded on and near lakes and freshwater 'soaks', on the mainland (Halse *et al.* 1995).	It is only an occasional visitor to Albany area. It was recorded in 2003 within 10 km of the Survey Area but no signs were observed during the survey. It is considered unlikely given the nature, scale and location of the Survey Area.

Taxon	Habitat	Likelihood of Occurrence
Western Bristlebird (*Dasyornis longirostris*) T (EN)	The Western Bristlebird is restricted to floristically diverse low dense coastal heathland. The distribution of the Western Bristlebird is fragmented, with populations in Fitzgerald National Park separated from those in the Hassell Beach/Waychinicup National Park/Two Peoples Bay Nature Reserve area. Within this distribution, the species occurs in heathland that is 0.5–1.5 m tall, comprising a diverse variety of shrubs such as banksias, paperbarks, hakeas, sheoaks and *Leptospermum* sp. The Western Bristlebird occurs in similar areas to the Western Whipbird (*Psophodes nigrogularis nigrogularis*), Noisy Scrub-bird (*Atrichornis clamosus*) and the western subspecies of the Ground Parrot (*Pezoporus wallicus flaviventris*).	Highly Unlikely. No suitable habitat exists within the Survey Area.
Western Ground Parrot (*Pezoporus flaviventris*) T (CR)	The vegetation types used by Ground Parrots can be broadly characterised as sedgeland, temperate shrub heaths, temperate graminoid heaths or sub-tropical graminoid heaths (Burbidge *et al*. 1997). There is only one population remaining of the western sub-species of the Ground Parrot, in coastal heath east of Albany in southwest Western Australia. There are only two remaining areas of refuge, Arid and Fitzgerald River National Parks, with about 110 individuals still thought to live in the wild.	Highly Unlikely. No suitable habitat exists within the Survey Area.
Western Whipbird (western heath) [*Psophodes nigrogularis subsp. nigrogularis*) T (EN)	The western heath subspecies of the Western Whipbird is known only to occur in one small population in south Western Australia, in the Two-Peoples Bay- Mt Manypeaks region. The population at Two Peoples Bay-Mt Manypeaks region is estimated as less than 100 pairs and occurs in dense coastal heath (Simpson and Day, 2004, Smith, 1991). The preferred habitat is thicket, a two to three-metre-high formation of varied floristic composition. Other vegetation associations are used infrequently, although all nests are usually found in dense heath adjacent to areas of thicket (Smith, 1991). Restricted to a small coastal strip east of Albany from Two Peoples Bay and Mount Gardner in the south west to about Cape Riche Road in the north east, with the South Coast Highway as an approximate inland boundary. In this area it occurs in heath-like thicket associations on coastal dunes and in low, dense mallee woodland or shrubland with understorey of dense, stunted shrubs	Unlikely. The western heath subspecies of the Western Whipbird is restricted to the dense coastal heath in the Two-Peoples Bay- Mt Manypeaks region, east of the Survey Area. Given this species very specific habitat it is unlikely to occur in the Survey Area.
Malleefowl (*Leipoa ocellata*) T (VU)	Malleefowl are large and distinctive ground-dwelling birds. They occur in shrublands and low woodlands that are dominated by mallee vegetation throughout the wheatbelt and Jarrah forests, and coastal areas east of Waychinicup.	Highly unlikely. No suitable habitat present. Out of current known range.
Fork-tailed Swift, Pacific Swift (*Apus pacificus*) (IA)	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. Does not breed in Australia.	Possible, but does not use on-ground habitat.
Glossy ibis (*Plegadis falcinellus*) (IA)	Non-breeding visitor to the south-west of Western Australia. Requires shallow water and mudflats, so is found in well-vegetated wetlands, floodplains (http://www.birdlife.org.au/bird-profile/glossy-ibis)	Highly unlikely. No suitable habitat present.
Masked Owl (southern subsp) (*Tyto novaehollandiae subsp. Novaehollandiae)* (P3)	Inhabits forests, woodlands, timbered waterways and open country on the fringe of these areas. The main requirements are tall Eucalypts with suitable hollows for nesting and roosting and adjacent areas for foraging that support an abundance of principally terrestrial mammals, although arboreal mammals can also be taken. Also use caves for nesting. Masked Owls are territorial, and pairs remain in or near the territory all year round (Garnett 2000).	Possible. Hollows suitable for nesting are present and abundant terrestrial mammals (Quenda) as prey also present.
Peregrine Falcon (*Falco peregrinus)* (OS)	A variety of habitats from woodlands to open grasslands and coastal cliffs. Prey consists of other birds. It requires abundant prey and secure nest sites, and prefers coastal and inland cliffs or open woodlands near water. http://www.birdlife.org.au/bird-profile/peregrine-falcon	Possible. Suitable habitat exists (all forest/woodland vegetation communities) however this species is not common.
Migratory Shorebirds		
Lesser Sand Plover (*Charadrius mongolus*) T (EN) & IA Great Knot (*Calidris tenuirostris)* T (CR) & IA Curlew Sandpiper *(Calidris ferruginea*) T (CR) & IA	Shorebirds are a group of wading birds that can be found feeding on swamps, tidal mudflats, beaches and open country. All those listed are migratory and do not breed in Australia, except for the Hooded Plover which breeds on sandy beaches, and also occurs on inland salt lakes in the South West of WA.	Highly Unlikely. No suitable habitat exists within the Survey Area.

Taxon	Habitat	Likelihood of Occurrence
Ruddy Turnstone (*Arenaria interpres*) IA		
Sharp-tailed Sandpiper (*Calidris acuminata)*		
Sanderling (*Calidris alba)* IA		
Red-necked Stint (*Calidris ruficollis)* IA		
Greater Sand Plover *(Charadrius leschenaultii)* IA		
Bar-tailed Godwit (*Limosa lapponica* IA		
Black-tailed Godwit *(Limosa limosa)* IA		
Whimbrel (*Numenius phaeopus)* IA		
Pacific Golden Plover (*Pluvialis fulva)*		
Grey Plover (*Pluvialis squatarola)* IA		
Grey-tailed Tattler (*Tringa brevipes)* IA		
Wood Sandpiper *(Tringa glareola)* IA		
Ruff Reeve (*Philomachus pugnax)* IA		
Hooded Plover (*Thinornis rubricollis)* IA		
Common Greenshank, greenshank *(Tringa nebularia)* IA		
Marsh Sandpiper, little greenshank *(Tringa stagnatilis*) IA		
Terek Sandpiper (*Xenus cinereus*) IA		
Reptiles		
Short-nosed Snake (*Elapognathus minor*) (P2)	See main text	Possible. See discussion in main text
Fish		
Balston's Pygmy Perch (*Nannatherina balstoni*) T (VU)	Inhabits acidic, tannin-stained freshwater pools, streams and lakes in peat flats within 30 km of the coast Margaret River and Two People's Bay. Typically found in freshwater with a pH range of 3.0–6.5 and seasonally fluctuating temperatures of 11–30 °C. It is typically found amongst inundated riparian vegetation where it is thought to feed and spawn, though adults are also found in open water. Larvae tend to be confined to shallow water < 10 cm deep amongst the flooded riparian vegetation, and as the larvae increase in size they gradually move to deeper waters (Morgan *et al.* 1995).	Highly Unlikely. No suitable habitat exists within the Survey Area.
Mud Minnow, Western Dwarf Galaxias (*Galaxiella munda*) T (EN)	Occurs in swift flowing streams within karri forests and is typically found near submerged vegetation, occasionally in the still water of ponds, swamps and roadside drains, and often inhabiting darkly tannin-stained and acidic water	Highly Unlikely. No suitable habitat exists within the Survey Area.
Pouched Lamprey (*Geotria australis*) (P3)	Adults spawn in the headwaters of freshwater rivers and streams, and when the larvae or ammocoetes hatch, they drift downstream and burrow into soft muddy sediments. They spend the next few years filter-feeding on micro-organisms from the water above. After metamorphosis, young adults migrate downstream to estuaries and coastal waters, where they feed parasitically by rasping flesh from other fishes with their toothy tongues. They eventually cease feeding and migrate back to freshwater to breed (Bray and Gomon 2011)	Highly Unlikely. No suitable habitat exists within the Survey Area.
Black-stripe Minnow, Black-striped Dwarf Galaxias (*Galaxiella nigrostriata*) T (EN)	Found only in coastal wetlands of south-west Western Australia. During summer when ephemeral pools dry out, they burrow into the moist soil below and aestivate until the rains return in autumn (Bray and Gomon 2011)	Highly Unlikely. No suitable habitat exists within the Survey Area.

Taxon	Habitat	Likelihood of Occurrence
Salamanderfish *(Lepidogalaxias salamandroides)* T (EN)	Live in small semi-permanent (ephemeral) pools and shallow streams and drains in generally acidic water around pH 4. Feeds mainly on aquatic insect larvae and small crustaceans Are uniquely adapted to survive the desiccation of their habitat. When pools dry out, they burrow into the damp bottom sand which remains moistened by ground water (Allen et al 2002; Bray 2017)	Highly Unlikely The species was recorded Lake Powel in 1976, but has since been found to be endemic to temperate freshwaters of south-west Western Australia, and known only from heathland peat flats between the Blackwood and Kent Rivers (Bray 2017)
Invertebrates		
Carter's Freshwater Mussel (*Westralunio carteri*) T (VU)	See main text	Possible. See discussion in main text
Banksia brownii plant-louse (*Trioza barrettae*) T (EN)	Current records from the Stirling Range NP and the Vancouver Peninsula (Taylor and Moir 2014). It is closely associated with its only known host plant *Banksia brownii.*	Highly Unlikely. No *Banksia brownii* populations are present.
Western Archaeid Spider (*Zephyrarchaea mainae*) T (VU)	Associated with Gondwanan refugial habitats. Requires long unburnt low coastal peppermint (*Agonis flexuosa*) woodland with a coastal heath understorey and leaf litter accumulating on top of the understorey sedges (*Lepidosperma* and Restionaceae) that remain most throughout the year (Rix and Harvey 2009). Specimens have been collected by beating and sifting sedges and low shrubs in dense coastal or near-coastal groves of Peppermint (*Agonis* sp.), with several outlying populations also known from wet Karri (*Eucalyptus diversicolor)* forest (Rix and Harvey 2012).	Highly unlikely, no suitable habitat exists within the Survey Area
Woolybush bee (*Hylaeus globuliferus*) (P3)	See main text	Possible. See discussion in main text
Helicarionid land snail (*Helicarion castanea*) (EX)	Unknown.	Highly Unlikely. Habitat unknown. Presumed Extinct

13 APPENDIX F - Significant Flora, Weed and Tree Locations

F1. Conservation Significant flora locations.

Taxon	Count	Easting	Northing	Zone	Cons_Code	SurveyDate
Andersonia sp. Jamesii (J. Liddelow 84)	2	574146	6126842	50	P4	22/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	4	574144	6126841	50	P4	22/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	2	574166	6126838	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	4	574152	6126812	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574164	6126832	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574166	6126843	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574158	6126809	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574157	6126809	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574155	6126810	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574168	6126829	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574149	6126806	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574124	6126804	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	574148	6126823	50	P4	28/11/2017
Andersonia sp. Jamesii (J. Liddelow 84)	1	575014	6130503	50	P3	20/02/2018
Andersonia sp. Jamesii (J. Liddelow 84)	1	575065	6130455	50	P4	8/08/2019
Boronia crassipes	10	574428	6127437	50	P3	26/11/2017
Boronia crassipes	5	574410	6127430	50	P3	26/11/2017
Boronia crassipes	20	574401	6127426	50	P3	26/11/2017
Boronia crassipes	6	574388	6127422	50	P3	26/11/2017
Boronia crassipes	5	574374	6127418	50	P3	26/11/2017
Boronia crassipes	5	574452	6127424	50	P3	26/11/2017
Boronia crassipes	100	574316	6127403	50	P3	26/11/2017
Boronia crassipes	15	574275	6127405	50	P3	26/11/2017
Boronia crassipes	100	574253	6127405	50	P3	26/11/2017
Boronia crassipes	750	574500	6127451	50	P3	26/11/2017
Boronia crassipes	1	574266	6127408	50	P3	27/11/2017
Boronia crassipes	1	574274	6127391	50	P3	27/11/2017
Synaphea incurva	1	574217	6126580	50	P1	22/11/2017
Synaphea incurva	4	574298	6127572	50	P1	22/11/2017
Synaphea incurva	3	574217	6126562	50	P1	22/11/2017
Thysanotus isantherus	1	578872	6124100	50	P4	7/11/2017
Thysanotus isantherus	1	578964	6124166	50	P4	7/11/2017

F2. Significant weed locations.

Taxon	Status	Easting	Northing	SurveyDate
Asparagus asparagoides	WONS	573748	6126781	22/11/2017
Asparagus asparagoides	WONS	578591	6124174	23/11/2017
Lantana camara	WONS	578768	6124375	23/11/2017
Rubus fruticosus aggregate	WONS	573750	6126779	22/11/2017
Rubus fruticosus aggregate	WONS	578816	6124060	23/11/2017
Rubus fruticosus aggregate	WONS	578770	6124240	23/11/2017
Rubus fruticosus aggregate	WONS	578774	6124125	23/11/2017
Rubus fruticosus aggregate	WONS	578767	6124106	23/11/2017
Rubus fruticosus aggregate	WONS	576754	6124737	23/11/2017
Rubus fruticosus aggregate	WONS	574435	6127389	24/11/2017
Rubus fruticosus aggregate	WONS	574277	6127385	27/11/2017
Rubus fruticosus aggregate	WONS	574269	6127376	27/11/2017
Rubus fruticosus aggregate	WONS	574210	6127373	27/11/2017
Rubus fruticosus aggregate	WONS	574599	6127487	27/11/2017
Rubus fruticosus aggregate	WONS	575023	6130503	30/11/2017
Rubus fruticosus aggregate	WONS	574989	6130535	30/11/2017
Rubus fruticosus aggregate	WONS	576189	6124831	30/11/2017
Ulex europaeus	WONS	573763	6126758	22/11/2017
Ulex europaeus	WONS	573818	6126574	22/11/2017
Ulex europaeus	WONS	578812	6124053	23/11/2017

Taxon	Status	Easting	Northing	SurveyDate
Ulex europaeus	WONS	578811	6124064	23/11/2017
Zantedeschia aethiopica	Declared Pest	578624	6124155	23/11/2017
Zantedeschia aethiopica	Declared Pest	574405	6127547	24/11/2017

F3. Potential Black Cockatoo breeding tree locations.

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Corymbia calophylla	574249	6125823	500	50	0	
Corymbia calophylla	574246	6125835	500	50	0	
Corymbia calophylla	574245	6125905	500	50	0	
Corymbia calophylla	573667	6126346	500	50	0	
Corymbia calophylla	574205	6126477	500	50	0	
Corymbia calophylla	578343	6124336	500	50	0	
Corymbia calophylla	578652	6124298	500	50	0	
Corymbia calophylla	578619	6124378	500	50	0	
Corymbia calophylla	578629	6124426	500	50	0	
Corymbia calophylla	578845	6123969	500	50	0	
Corymbia calophylla	576775	6124631	500	50	0	
Corymbia calophylla	574302	6127653	500	50	0	
Corymbia calophylla	574368	6129128	500	50	0	
Corymbia calophylla	578790	6124034	505	50	0	
Corymbia calophylla	574365	6125864	510	50	0	
Corymbia calophylla	574243	6125826	510	50	0	
Corymbia calophylla	574252	6125903	510	50	0	
Corymbia calophylla	573738	6126920	510	50	0	
Corymbia calophylla	573726	6126402	510	50	0	
Corymbia calophylla	578663	6124278	510	50	0	
Corymbia calophylla	574227	6125552	510	50	0	
Corymbia calophylla	574364	6125759	510	50	0	
Corymbia calophylla	578763	6124178	515	50	0	
Corymbia calophylla	578780	6124162	515	50	0	
Corymbia calophylla	578631	6124305	520	50	0	
Corymbia calophylla	576785	6124720	520	50	0	
Corymbia calophylla	574422	6125821	520	50	0	
Corymbia calophylla	574360	6125847	520	50	0	
Corymbia calophylla	578774	6124119	520	50	0	
Corymbia calophylla	574233	6125920	520	50	0	
Corymbia calophylla	573630	6126927	520	50	0	
Corymbia calophylla	573816	6126871	520	50	0	
Corymbia calophylla	574205	6126519	520	50	0	
Corymbia calophylla	578877	6124385	520	50	0	
Corymbia calophylla	578622	6124367	520	50	0	
Corymbia calophylla	576762	6124696	520	50	0	
Corymbia calophylla	574350	6129139	520	50	0	
Corymbia calophylla	574399	6125795	520	50	0	
Corymbia calophylla	578843	6124027	525	50	0	
Corymbia calophylla	573801	6126738	530	50	0	
Corymbia calophylla	578662	6124304	530	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Corymbia calophylla	578683	6124398	530	50	0	
Corymbia calophylla	578666	6124387	530	50	0	
Corymbia calophylla	578653	6124394	530	50	0	
Corymbia calophylla	576756	6124647	530	50	0	
Corymbia calophylla	576826	6124694	535	50	0	
Corymbia calophylla	574439	6125820	540	50	0	
Corymbia calophylla	578623	6124424	540	50	0	
Corymbia calophylla	578779	6123986	540	50	0	
Corymbia calophylla	578792	6124040	540	50	0	
Corymbia calophylla	578842	6124018	540	50	0	
Corymbia calophylla	574319	6129083	540	50	0	
Corymbia calophylla	574322	6129121	540	50	0	
Corymbia calophylla	574326	6127624	540	50	0	
Corymbia calophylla	578682	6124225	545	50	0	
Corymbia calophylla	578858	6124195	545	50	0	
Corymbia calophylla	574326	6125885	550	50	0	
Corymbia calophylla	574250	6125913	550	50	0	
Corymbia calophylla	574061	6126412	550	50	0	
Corymbia calophylla	573763	6126590	550	50	0	
Corymbia calophylla	578457	6124573	550	50	0	
Corymbia calophylla	578840	6124232	550	50	0	
Corymbia calophylla	578760	6124400	550	50	0	
Corymbia calophylla	578614	6124379	550	50	0	
Corymbia calophylla	578587	6124408	550	50	0	
Corymbia calophylla	574315	6129064	550	50	0	
Corymbia calophylla	576739	6124686	550	50	0	
Corymbia calophylla	574329	6129069	550	50	0	
Corymbia calophylla	574302	6125875	560	50	0	
Corymbia calophylla	574234	6125961	560	50	0	
Corymbia calophylla	573669	6126273	560	50	0	
Corymbia calophylla	578886	6124254	560	50	0	
Corymbia calophylla	576795	6124622	560	50	0	
Corymbia calophylla	578686	6124214	565	50	0	
Corymbia calophylla	578841	6124242	565	50	0	
Corymbia calophylla	578791	6124041	570	50	0	
Corymbia calophylla	574228	6125881	570	50	0	
Corymbia calophylla	574086	6126449	570	50	0	
Corymbia calophylla	573732	6126402	570	50	0	
Corymbia calophylla	578592	6124428	570	50	0	
Corymbia calophylla	578608	6124437	570	50	0	
Corymbia calophylla	574366	6125763	570	50	0	
Corymbia calophylla	574381	6125889	580	50	0	
Corymbia calophylla	574263	6125916	580	50	0	
Corymbia calophylla	573674	6126831	580	50	0	
Corymbia calophylla	573667	6126302	580	50	0	
Corymbia calophylla	578606	6124411	580	50	0	
Corymbia calophylla	576794	6124626	580	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Corymbia calophylla	574229	6125703	580	50	0	
Corymbia calophylla	574391	6125758	590	50	0	
Corymbia calophylla	574425	6125790	590	50	0	
Corymbia calophylla	573673	6126266	590	50	0	
Corymbia calophylla	573668	6126228	590	50	0	
Corymbia calophylla	578649	6124361	590	50	0	
Corymbia calophylla	576781	6124663	590	50	0	
Corymbia calophylla	576762	6124635	590	50	0	
Corymbia calophylla	574227	6125620	590	50	0	
Corymbia calophylla	578857	6124231	595	50	0	
Corymbia calophylla	578721	6124227	595	50	0	
Corymbia calophylla	578850	6124044	600	50	0	
Corymbia calophylla	578795	6124035	600	50	0	
Corymbia calophylla	574233	6125845	600	50	0	
Corymbia calophylla	574065	6126343	600	50	0	
Corymbia calophylla	573824	6126895	600	50	0	
Corymbia calophylla	578880	6124361	600	50	0	
Corymbia calophylla	578661	6124341	600	50	0	
Corymbia calophylla	578602	6124349	600	50	0	
Corymbia calophylla	578633	6124364	600	50	0	
Corymbia calophylla	578567	6124242	600	50	0	
Corymbia calophylla	578833	6124035	600	50	0	
Corymbia calophylla	574334	6127623	600	50	0	
Corymbia calophylla	574325	6127622	600	50	0	
Corymbia calophylla	574436	6125798	600	50	0	
Corymbia calophylla	578781	6124124	605	50	0	
Corymbia calophylla	574307	6127651	610	50	0	
Corymbia calophylla	578695	6124335	610	50	0	
Corymbia calophylla	574354	6125830	610	50	0	
Corymbia calophylla	578838	6123999	610	50	0	
Corymbia calophylla	574371	6127581	610	50	0	
Corymbia calophylla	574427	6125823	620	50	0	
Corymbia calophylla	578671	6124365	620	50	0	
Corymbia calophylla	578772	6123990	620	50	0	
Corymbia calophylla	576856	6124644	630	50	0	
Corymbia calophylla	574366	6125900	630	50	0	
Corymbia calophylla	574248	6125835	630	50	0	
Corymbia calophylla	578870	6124022	630	50	0	
Corymbia calophylla	574398	6125832	630	50	0	
Corymbia calophylla	574367	6125839	630	50	0	
Corymbia calophylla	574161	6126416	630	50	0	
Corymbia calophylla	573808	6126864	630	50	0	
Corymbia calophylla	578795	6124038	630	50	0	
Corymbia calophylla	576781	6124646	630	50	0	
Corymbia calophylla	576721	6124696	630	50	0	
Corymbia calophylla	574255	6125828	640	50	0	
Corymbia calophylla	578839	6124034	640	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Corymbia calophylla	573727	6126241	640	50	0	
Corymbia calophylla	578664	6124285	640	50	0	
Corymbia calophylla	576763	6124729	640	50	0	
Corymbia calophylla	574346	6127605	640	50	0	
Corymbia calophylla	578835	6124031	650	50	0	
Corymbia calophylla	574320	6125882	650	50	0	
Corymbia calophylla	576860	6124678	650	50	0	
Corymbia calophylla	578433	6124578	650	50	0	
Corymbia calophylla	574316	6129137	650	50	0	
Corymbia calophylla	578764	6124170	655	50	0	
Corymbia calophylla	578819	6124046	655	50	0	
Corymbia calophylla	576832	6124696	655	50	0	
Corymbia calophylla	574278	6125874	660	50	0	
Corymbia calophylla	574320	6125895	660	50	0	
Corymbia calophylla	574277	6125885	660	50	0	
Corymbia calophylla	574365	6125878	660	50	0	
Corymbia calophylla	574338	6127622	660	50	0	
Corymbia calophylla	574225	6125598	660	50	0	
Corymbia calophylla	578800	6124246	670	50	0	
Corymbia calophylla	578645	6124342	670	50	0	
Corymbia calophylla	578613	6124411	670	50	0	
Corymbia calophylla	574319	6127621	670	50	0	
Corymbia calophylla	578611	6124241	680	50	0	
Corymbia calophylla	574229	6125934	680	50	0	
Corymbia calophylla	576784	6124653	680	50	0	
Corymbia calophylla	574226	6125558	690	50	0	
Corymbia calophylla	574233	6125887	690	50	0	
Corymbia calophylla	574086	6126340	690	50	0	
Corymbia calophylla	574023	6126349	690	50	0	
Corymbia calophylla	573700	6126254	690	50	0	
Corymbia calophylla	574230	6125873	690	50	0	
Corymbia calophylla	578659	6124278	690	50	0	
Corymbia calophylla	578652	6124243	690	50	0	
Corymbia calophylla	578605	6124425	690	50	0	
Corymbia calophylla	574287	6125756	690	50	0	
Corymbia calophylla	574407	6125804	690	50	0	
Corymbia calophylla	578822	6124226	695	50	0	
Corymbia calophylla	578698	6124260	700	50	0	
Corymbia calophylla	574232	6125789	700	50	0	
Corymbia calophylla	574234	6126544	700	50	0	
Corymbia calophylla	574027	6126307	700	50	0	
Corymbia calophylla	573665	6126213	700	50	0	
Corymbia calophylla	578671	6124359	700	50	0	
Corymbia calophylla	574333	6128180	700	50	0	
Corymbia calophylla	574318	6129131	700	50	0	
Corymbia calophylla	574228	6125588	700	50	0	
Corymbia calophylla	574376	6125798	700	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Corymbia calophylla	578761	6124143	710	50	0	
Corymbia calophylla	574247	6125869	710	50	0	
Corymbia calophylla	574348	6125884	710	50	0	
Corymbia calophylla	574323	6129069	710	50	0	
Corymbia calophylla	574419	6125799	710	50	0	
Corymbia calophylla	578830	6124224	715	50	0	
Corymbia calophylla	574224	6125420	720	50	0	
Corymbia calophylla	574380	6125885	720	50	0	
Corymbia calophylla	574280	6125905	720	50	0	
Corymbia calophylla	578615	6124395	720	50	0	
Corymbia calophylla	576770	6124724	720	50	0	
Corymbia calophylla	578737	6124255	725	50	0	
Corymbia calophylla	574300	6127650	730	50	0	
Corymbia calophylla	574256	6126513	740	50	0	
Corymbia calophylla	573732	6126390	740	50	0	
Corymbia calophylla	578627	6124395	740	50	0	
Corymbia calophylla	574250	6125855	750	50	0	
Corymbia calophylla	578825	6124225	750	50	0	
Corymbia calophylla	574226	6125926	760	50	0	
Corymbia calophylla	574343	6129082	760	50	0	
Corymbia calophylla	574376	6125933	770	50	0	
Corymbia calophylla	573728	6126278	770	50	0	
Corymbia calophylla	574377	6127575	770	50	0	
Corymbia calophylla	574226	6125699	770	50	0	
Corymbia calophylla	574065	6126334	780	50	0	
Corymbia calophylla	576732	6124686	780	50	0	
Corymbia calophylla	574254	6125820	790	50	0	
Corymbia calophylla	578606	6124239	790	50	0	
Corymbia calophylla	574227	6125430	790	50	0	
Corymbia calophylla	578647	6124382	800	50	0	
Corymbia calophylla	578863	6124020	800	50	0	
Corymbia calophylla	574285	6125886	800	50	0	
Corymbia calophylla	574346	6125888	800	50	0	
Corymbia calophylla	573683	6126252	810	50	0	
Corymbia calophylla	574360	6125916	810	50	0	
Corymbia calophylla	574342	6129114	820	50	0	
Corymbia calophylla	576849	6124651	830	50	0	
Corymbia calophylla	578710	6124310	845	50	0	
Corymbia calophylla	574230	6125901	850	50	0	
Corymbia calophylla	578644	6124424	850	50	0	
Corymbia calophylla	578807	6124146	860	50	0	
Corymbia calophylla	578692	6124232	860	50	0	
Corymbia calophylla	578687	6124234	860	50	0	
Corymbia calophylla	578816	6124217	865	50	0	
Corymbia calophylla	574360	6125807	870	50	0	
Corymbia calophylla	574381	6127577	870	50	0	
Corymbia calophylla	578848	6124048	875	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Corymbia calophylla	578627	6124322	880	50	0	
Corymbia calophylla	574296	6125763	880	50	0	
Corymbia calophylla	576774	6124663	890	50	0	
Corymbia calophylla	578821	6124045	890	50	0	
Corymbia calophylla	578809	6123954	900	50	0	
Corymbia calophylla	574240	6125819	910	50	0	
Corymbia calophylla	574056	6126413	920	50	0	
Corymbia calophylla	578697	6124408	920	50	0	
Corymbia calophylla	574023	6126316	940	50	0	
Corymbia calophylla	578674	6124316	940	50	0	
Corymbia calophylla	578686	6124414	970	50	0	
Corymbia calophylla	574144	6126587	980	50	0	
Corymbia calophylla	578812	6124009	980	50	0	
Corymbia calophylla	578700	6124242	985	50	0	
Corymbia calophylla	573676	6126911	990	50	0	
Corymbia calophylla	574288	6128495	1000	50	0	
Corymbia calophylla	574359	6125796	1000	50	0	
Corymbia calophylla	574269	6125874	1010	50	0	
Corymbia calophylla	574405	6125926	1030	50	0	
Corymbia calophylla	576788	6124626	1040	50	0	
Corymbia calophylla	574232	6125841	1070	50	0	
Corymbia calophylla	578802	6124253	1080	50	0	
Corymbia calophylla	574314	6125877	1080	50	0	
Corymbia calophylla	576783	6124628	1140	50	0	
Corymbia calophylla	574387	6125755	1150	50	0	
Corymbia calophylla	578749	6123993	1230	50	0	
Corymbia calophylla	574292	6127645	1300	50	0	
Corymbia calophylla	578399	6124601	550	50	0	
Corymbia calophylla	576761	6124672	550	50	1	100
Corymbia calophylla	576792	6124651	620	50	1	100
Corymbia calophylla	574323	6129121	730	50	1	100
Corymbia calophylla	576838	6124675	835	50	1	100
Corymbia calophylla	574365	6125885	660	50	2	100,100
Corymbia calophylla	573677	6126294	770	50	2	100,200
Corymbia calophylla	578790	6124037	510	50	1	150
Corymbia calophylla	578876	6124351	510	50	1	150
Corymbia calophylla	574227	6125564	540	50	1	150
Corymbia calophylla	578705	6124400	710	50	1	150
Corymbia calophylla	576774	6124673	950	50	1	150
Corymbia calophylla	578661	6124416	860	50	2	150,150
Corymbia calophylla	574314	6127600	690	50	3	150,150,150
Corymbia calophylla	578882	6124340	730	50	2	150,200
Corymbia calophylla	574341	6127608	520	50	1	200
Corymbia calophylla	578866	6124391	560	50	1	200
Corymbia calophylla	574285	6125875	570	50	1	200
Corymbia calophylla	573772	6126314	590	50	1	200
Corymbia calophylla	574440	6125815	620	50	1	200

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Corymbia calophylla	573672	6126288	630	50	1	200
Corymbia calophylla	578665	6124417	650	50	1	200
Corymbia calophylla	573696	6126255	670	50	1	200
Corymbia calophylla	573777	6126326	690	50	1	200
Corymbia calophylla	574422	6125869	760	50	1	200
Corymbia calophylla	578604	6124399	810	50	1	200
Corymbia calophylla	574363	6125826	940	50	1	200
Corymbia calophylla	574384	6125785	1060	50	1	200
Corymbia calophylla	573715	6126294	850	50	2	200,300
Corymbia calophylla	574407	6125804	690	50	1	300
Corymbia calophylla	578789	6124196	920	50	1	340
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578802	6124152	500	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	574130	6126445	500	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578696	6124401	510	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578824	6124226	520	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578767	6124019	590	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578803	6124042	595	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578785	6124210	600	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578884	6124185	635	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	573980	6126497	640	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578803	6124249	660	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578788	6124167	670	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578798	6124234	670	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578820	6124228	770	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578801	6124254	820	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	573718	6127025	1650	50	0	
Dead Stag of Eucalyptus marginata or Corymbia calophylla	574343	6128064	900	50	1	100
Dead Stag of Eucalyptus marginata or Corymbia calophylla	574318	6128030	730	50	1	100
Dead Stag of Eucalyptus marginata or Corymbia calophylla	573975	6126522	730	50	5	100,100,100,200,300
Dead Stag of Eucalyptus marginata or Corymbia calophylla	574370	6129121	530	50	1	150
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578793	6124279	540	50	1	150
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578785	6124299	560	50	1	150

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Dead Stag of Eucalyptus marginata or Corymbia calophylla	574228	6125608	620	50	1	150
Dead Stag of Eucalyptus marginata or Corymbia calophylla	574434	6125878	570	50	2	150,150
Dead Stag of Eucalyptus marginata or Corymbia calophylla	574385	6128520	820	50	1	200
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578847	6124195	615	50	1	300
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578873	6124367	1370	50	3	300,200,200
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578799	6124239	690	50	1	400
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578824	6124229	810	50	1	400
Dead Stag of Eucalyptus marginata or Corymbia calophylla	578786	6124174	985	50	1	400
Eucalyptus gomphocephala	574317	6129742	500	50	0	
Eucalyptus gomphocephala	574317	6129704	500	50	0	
Eucalyptus gomphocephala	574318	6129710	500	50	0	
Eucalyptus gomphocephala	578607	6124107	510	50	0	
Eucalyptus gomphocephala	578556	6124138	510	50	0	
Eucalyptus gomphocephala	578558	6124199	520	50	0	
Eucalyptus gomphocephala	578596	6124189	530	50	0	
Eucalyptus gomphocephala	578665	6124414	550	50	0	
Eucalyptus gomphocephala	578574	6124238	560	50	0	
Eucalyptus gomphocephala	578593	6124127	560	50	0	
Eucalyptus gomphocephala	578562	6124172	560	50	0	
Eucalyptus gomphocephala	578600	6124284	590	50	0	
Eucalyptus gomphocephala	578515	6124330	600	50	0	
Eucalyptus gomphocephala	578587	6124133	610	50	0	
Eucalyptus gomphocephala	578620	6124101	620	50	0	
Eucalyptus gomphocephala	578619	6124107	620	50	0	
Eucalyptus gomphocephala	574262	6126608	630	50	0	
Eucalyptus gomphocephala	578651	6124094	630	50	0	
Eucalyptus gomphocephala	578509	6124378	630	50	0	
Eucalyptus gomphocephala	578642	6124094	640	50	0	
Eucalyptus gomphocephala	578675	6124095	650	50	0	
Eucalyptus gomphocephala	578555	6124195	650	50	0	
Eucalyptus gomphocephala	578649	6124091	660	50	0	
Eucalyptus gomphocephala	578678	6124086	670	50	0	
Eucalyptus gomphocephala	578561	6124133	670	50	0	
Eucalyptus gomphocephala	578638	6124091	690	50	0	
Eucalyptus gomphocephala	578557	6124233	690	50	0	
Eucalyptus gomphocephala	578654	6124149	730	50	0	
Eucalyptus gomphocephala	578576	6124231	760	50	0	
Eucalyptus gomphocephala	578608	6124153	770	50	0	
Eucalyptus gomphocephala	578649	6124114	780	50	0	
Eucalyptus gomphocephala	578635	6124102	800	50	0	
Eucalyptus gomphocephala	578569	6124220	820	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Eucalyptus gomphocephala	578566	6124226	820	50	0	
Eucalyptus gomphocephala	578587	6124163	830	50	0	
Eucalyptus gomphocephala	578514	6124308	830	50	0	
Eucalyptus gomphocephala	578579	6124228	860	50	0	
Eucalyptus gomphocephala	578512	6124348	870	50	0	
Eucalyptus gomphocephala	578587	6124300	880	50	0	
Eucalyptus gomphocephala	574322	6130081	880	50	0	
Eucalyptus gomphocephala	578595	6124176	890	50	0	
Eucalyptus gomphocephala	578605	6124041	900	50	0	
Eucalyptus gomphocephala	578714	6124153	910	50	0	
Eucalyptus gomphocephala	578604	6124108	920	50	0	
Eucalyptus gomphocephala	578599	6124125	920	50	0	
Eucalyptus gomphocephala	578533	6124219	950	50	0	
Eucalyptus gomphocephala	578508	6124375	990	50	0	
Eucalyptus gomphocephala	578633	6124071	1010	50	0	
Eucalyptus gomphocephala	578573	6124146	1020	50	0	
Eucalyptus gomphocephala	578674	6124132	1050	50	0	
Eucalyptus gomphocephala	578680	6124137	1070	50	0	
Eucalyptus gomphocephala	578596	6124075	1090	50	0	
Eucalyptus gomphocephala	578587	6124170	1140	50	0	
Eucalyptus gomphocephala	578605	6124232	1150	50	0	
Eucalyptus gomphocephala	578553	6124183	1220	50	0	
Eucalyptus gomphocephala	578644	6124156	1230	50	0	
Eucalyptus gomphocephala	578635	6124138	1250	50	0	
Eucalyptus gomphocephala	578651	6124165	1370	50	0	
Eucalyptus gomphocephala	578596	6124083	1559	50	0	
Eucalyptus gomphocephala	578478	6124299	1201	50	0	
Eucalyptus gomphocephala	578477	6124258	1100	50	0	
Eucalyptus gomphocephala	578343	6124290	950	50	0	
Eucalyptus marginata	574131	6126449	500	50	0	
Eucalyptus marginata	574113	6126443	500	50	0	
Eucalyptus marginata	574023	6126480	500	50	0	
Eucalyptus marginata	574040	6126450	500	50	0	
Eucalyptus marginata	573969	6126436	500	50	0	
Eucalyptus marginata	573996	6126531	500	50	0	
Eucalyptus marginata	573911	6126368	500	50	0	
Eucalyptus marginata	573829	6126336	500	50	0	
Eucalyptus marginata	573960	6126507	500	50	0	
Eucalyptus marginata	573819	6126433	500	50	0	
Eucalyptus marginata	573851	6126409	500	50	0	
Eucalyptus marginata	573832	6126377	500	50	0	
Eucalyptus marginata	574332	6128176	500	50	0	
Eucalyptus marginata	574317	6129017	500	50	0	
Eucalyptus marginata	574337	6128626	500	50	0	
Eucalyptus marginata	574236	6126685	510	50	0	
Eucalyptus marginata	574079	6126454	510	50	0	
Eucalyptus marginata	574047	6126461	510	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Eucalyptus marginata	574038	6126430	510	50	0	
Eucalyptus marginata	574018	6126351	510	50	0	
Eucalyptus marginata	574001	6126484	510	50	0	
Eucalyptus marginata	573936	6126432	510	50	0	
Eucalyptus marginata	573914	6126422	510	50	0	
Eucalyptus marginata	573769	6126214	510	50	0	
Eucalyptus marginata	573827	6126363	510	50	0	
Eucalyptus marginata	574341	6128089	520	50	0	
Eucalyptus marginata	574008	6126397	520	50	0	
Eucalyptus marginata	574362	6125838	520	50	0	
Eucalyptus marginata	574070	6126512	520	50	0	
Eucalyptus marginata	573983	6126471	520	50	0	
Eucalyptus marginata	573732	6126914	520	50	0	
Eucalyptus marginata	573749	6126771	520	50	0	
Eucalyptus marginata	573825	6126770	520	50	0	
Eucalyptus marginata	573690	6126157	520	50	0	
Eucalyptus marginata	574321	6128115	530	50	0	
Eucalyptus marginata	574157	6126563	530	50	0	
Eucalyptus marginata	573755	6126290	530	50	0	
Eucalyptus marginata	573859	6126414	530	50	0	
Eucalyptus marginata	573822	6126407	530	50	0	
Eucalyptus marginata	574363	6128581	530	50	0	
Eucalyptus marginata	574367	6128124	540	50	0	
Eucalyptus marginata	574081	6126511	540	50	0	
Eucalyptus marginata	574090	6126618	540	50	0	
Eucalyptus marginata	578734	6124118	540	50	0	
Eucalyptus marginata	574125	6126550	540	50	0	
Eucalyptus marginata	573969	6126287	540	50	0	
Eucalyptus marginata	573734	6126758	540	50	0	
Eucalyptus marginata	573935	6126364	540	50	0	
Eucalyptus marginata	574016	6126619	540	50	0	
Eucalyptus marginata	573891	6126271	540	50	0	
Eucalyptus marginata	573802	6126271	540	50	0	
Eucalyptus marginata	573992	6126647	540	50	0	
Eucalyptus marginata	573915	6126439	540	50	0	
Eucalyptus marginata	573853	6126369	540	50	0	
Eucalyptus marginata	574135	6126437	540	50	0	
Eucalyptus marginata	574118	6126450	540	50	0	
Eucalyptus marginata	574404	6128379	540	50	0	
Eucalyptus marginata	574118	6126449	550	50	0	
Eucalyptus marginata	573974	6126365	550	50	0	
Eucalyptus marginata	573935	6126387	550	50	0	
Eucalyptus marginata	573865	6126341	550	50	0	
Eucalyptus marginata	573767	6126245	550	50	0	
Eucalyptus marginata	573743	6126243	550	50	0	
Eucalyptus marginata	573875	6126398	550	50	0	
Eucalyptus marginata	574144	6126440	550	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Eucalyptus marginata	574157	6126458	550	50	0	
Eucalyptus marginata	574332	6128601	550	50	0	
Eucalyptus marginata	574351	6127582	550	50	0	
Eucalyptus marginata	573626	6126995	550	50	0	
Eucalyptus marginata	574295	6129238	550	50	0	
Eucalyptus marginata	574006	6126394	560	50	0	
Eucalyptus marginata	573987	6126464	560	50	0	
Eucalyptus marginata	574408	6125823	560	50	0	
Eucalyptus marginata	574230	6126013	560	50	0	
Eucalyptus marginata	574115	6126594	560	50	0	
Eucalyptus marginata	574041	6126474	560	50	0	
Eucalyptus marginata	574003	6126486	560	50	0	
Eucalyptus marginata	574008	6126535	560	50	0	
Eucalyptus marginata	573793	6126358	560	50	0	
Eucalyptus marginata	574307	6128519	560	50	0	
Eucalyptus marginata	573678	6126970	570	50	0	
Eucalyptus marginata	574092	6126363	570	50	0	
Eucalyptus marginata	573970	6126329	570	50	0	
Eucalyptus marginata	573970	6126400	570	50	0	
Eucalyptus marginata	573671	6126773	570	50	0	
Eucalyptus marginata	573831	6126219	570	50	0	
Eucalyptus marginata	573842	6126421	570	50	0	
Eucalyptus marginata	574298	6128020	570	50	0	
Eucalyptus marginata	574339	6128484	570	50	0	
Eucalyptus marginata	573676	6126966	570	50	0	
Eucalyptus marginata	574052	6126512	580	50	0	
Eucalyptus marginata	574045	6126515	580	50	0	
Eucalyptus marginata	573900	6126352	580	50	0	
Eucalyptus marginata	573884	6126421	580	50	0	
Eucalyptus marginata	574376	6128552	590	50	0	
Eucalyptus marginata	574340	6128072	590	50	0	
Eucalyptus marginata	574021	6126521	590	50	0	
Eucalyptus marginata	574227	6125602	590	50	0	
Eucalyptus marginata	574123	6126608	590	50	0	
Eucalyptus marginata	573810	6126433	590	50	0	
Eucalyptus marginata	574018	6126492	600	50	0	
Eucalyptus marginata	574428	6125870	600	50	0	
Eucalyptus marginata	573966	6126302	600	50	0	
Eucalyptus marginata	573819	6126761	600	50	0	
Eucalyptus marginata	573934	6126273	600	50	0	
Eucalyptus marginata	573803	6126214	600	50	0	
Eucalyptus marginata	574339	6127598	600	50	0	
Eucalyptus marginata	574333	6128501	600	50	0	
Eucalyptus marginata	574118	6126438	610	50	0	
Eucalyptus marginata	574031	6126322	610	50	0	
Eucalyptus marginata	573682	6126997	610	50	0	
Eucalyptus marginata	574053	6126384	610	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Eucalyptus marginata	574069	6126421	610	50	0	
Eucalyptus marginata	573860	6126251	610	50	0	
Eucalyptus marginata	573804	6126270	610	50	0	
Eucalyptus marginata	578796	6124008	610	50	0	
Eucalyptus marginata	574074	6126436	620	50	0	
Eucalyptus marginata	574171	6126851	620	50	0	
Eucalyptus marginata	573716	6126268	630	50	0	
Eucalyptus marginata	573631	6126925	630	50	0	
Eucalyptus marginata	573918	6126271	630	50	0	
Eucalyptus marginata	573931	6126279	630	50	0	
Eucalyptus marginata	573775	6126234	630	50	0	
Eucalyptus marginata	573842	6126382	630	50	0	
Eucalyptus marginata	574200	6126562	630	50	0	
Eucalyptus marginata	574162	6126420	630	50	0	
Eucalyptus marginata	574316	6129140	630	50	0	
Eucalyptus marginata	573961	6126325	640	50	0	
Eucalyptus marginata	574233	6126509	640	50	0	
Eucalyptus marginata	573973	6126388	640	50	0	
Eucalyptus marginata	573743	6126767	640	50	0	
Eucalyptus marginata	573803	6126873	640	50	0	
Eucalyptus marginata	573914	6126376	640	50	0	
Eucalyptus marginata	573858	6126420	640	50	0	
Eucalyptus marginata	574330	6128583	640	50	0	
Eucalyptus marginata	574380	6128364	640	50	0	
Eucalyptus marginata	574411	6125862	650	50	0	
Eucalyptus marginata	574106	6126580	650	50	0	
Eucalyptus marginata	573983	6126477	650	50	0	
Eucalyptus marginata	573979	6126535	650	50	0	
Eucalyptus marginata	573701	6127000	650	50	0	
Eucalyptus marginata	573684	6126957	670	50	0	
Eucalyptus marginata	573712	6126995	670	50	0	
Eucalyptus marginata	574099	6126547	680	50	0	
Eucalyptus marginata	573960	6126360	680	50	0	
Eucalyptus marginata	573982	6126482	680	50	0	
Eucalyptus marginata	574011	6126527	680	50	0	
Eucalyptus marginata	573648	6126993	680	50	0	
Eucalyptus marginata	573847	6126780	680	50	0	
Eucalyptus marginata	573776	6126299	680	50	0	
Eucalyptus marginata	574341	6128603	680	50	0	
Eucalyptus marginata	574343	6125767	680	50	0	
Eucalyptus marginata	574075	6126514	690	50	0	
Eucalyptus marginata	573962	6126289	690	50	0	
Eucalyptus marginata	573642	6126955	690	50	0	
Eucalyptus marginata	576777	6124640	690	50	0	
Eucalyptus marginata	574327	6128050	710	50	0	
Eucalyptus marginata	574043	6126452	710	50	0	
Eucalyptus marginata	573969	6126377	710	50	0	

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Eucalyptus marginata	573755	6126349	710	50	0	
Eucalyptus marginata	573707	6126937	710	50	0	
Eucalyptus marginata	574069	6126545	720	50	0	
Eucalyptus marginata	573751	6126781	720	50	0	
Eucalyptus marginata	573796	6126859	720	50	0	
Eucalyptus marginata	573865	6126315	720	50	0	
Eucalyptus marginata	574407	6128369	720	50	0	
Eucalyptus marginata	573608	6126973	730	50	0	
Eucalyptus marginata	573659	6126997	730	50	0	
Eucalyptus marginata	574093	6126419	730	50	0	
Eucalyptus marginata	573952	6126341	730	50	0	
Eucalyptus marginata	573699	6126975	730	50	0	
Eucalyptus marginata	573610	6126965	740	50	0	
Eucalyptus marginata	573657	6127035	740	50	0	
Eucalyptus marginata	574337	6128618	740	50	0	
Eucalyptus marginata	573650	6126966	740	50	0	
Eucalyptus marginata	574030	6126586	750	50	0	
Eucalyptus marginata	574020	6126525	760	50	0	
Eucalyptus marginata	574100	6126369	780	50	0	
Eucalyptus marginata	573646	6126990	790	50	0	
Eucalyptus marginata	574008	6126347	800	50	0	
Eucalyptus marginata	573954	6126434	800	50	0	
Eucalyptus marginata	574318	6127593	800	50	0	
Eucalyptus marginata	573971	6126456	800	50	0	
Eucalyptus marginata	574332	6128392	800	50	0	
Eucalyptus marginata	573766	6126796	810	50	0	
Eucalyptus marginata	578764	6124079	810	50	0	
Eucalyptus marginata	574406	6125789	820	50	0	
Eucalyptus marginata	574359	6128117	850	50	0	
Eucalyptus marginata	573707	6126985	880	50	0	
Eucalyptus marginata	574297	6127664	880	50	0	
Eucalyptus marginata	573844	6126769	920	50	0	
Eucalyptus marginata	573827	6126223	920	50	0	
Eucalyptus marginata	573659	6126974	1010	50	0	
Eucalyptus marginata	574352	6128119	1070	50	0	
Eucalyptus marginata	574029	6126497	1070	50	0	
Eucalyptus marginata	573645	6126999	1080	50	0	
Eucalyptus marginata	574282	6126311	1140	50	0	
Eucalyptus marginata	574314	6129139	650	50	0	
Eucalyptus marginata	573904	6126312	540	50	0	
Eucalyptus marginata	574339	6128403	600	50	0	
Eucalyptus marginata	574400	6128462	790	50	0	
Eucalyptus marginata	574340	6128303	710	50	0	
Eucalyptus marginata	573614	6126987	620	50	0	
Eucalyptus marginata	574418	6125899	500	50	1	100
Eucalyptus marginata	573749	6126274	500	50	1	100
Eucalyptus marginata	573915	6126281	550	50	1	100

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Eucalyptus marginata	573866	6126429	550	50	1	100
Eucalyptus marginata	574342	6128483	560	50	1	100
Eucalyptus marginata	574232	6126686	570	50	1	100
Eucalyptus marginata	573954	6126483	570	50	1	100
Eucalyptus marginata	573900	6126425	590	50	1	100
Eucalyptus marginata	573744	6126341	590	50	1	100
Eucalyptus marginata	573673	6126332	600	50	1	100
Eucalyptus marginata	573728	6126252	610	50	1	100
Eucalyptus marginata	573977	6126491	620	50	1	100
Eucalyptus marginata	574382	6125900	670	50	1	100
Eucalyptus marginata	574345	6128471	690	50	1	100
Eucalyptus marginata	573929	6126292	730	50	1	100
Eucalyptus marginata	573772	6126285	740	50	1	100
Eucalyptus marginata	574281	6126287	870	50	1	100
Eucalyptus marginata	574116	6126441	610	50	1	100
Eucalyptus marginata	574318	6129210	580	50	1	100
Eucalyptus marginata	573764	6126210	590	50	2	100,100
Eucalyptus marginata	573756	6126282	540	50	2	100,100
Eucalyptus marginata	574349	6128450	610	50	4	100,100,200,200
Eucalyptus marginata	573945	6126386	900	50	4	100,100,200,200
Eucalyptus marginata	574341	6129177	500	50	2	100,150
Eucalyptus marginata	573790	6126257	690	50	2	100,150
Eucalyptus marginata	574366	6127579	1140	50	2	100,150
Eucalyptus marginata	573917	6126429	510	50	2	100,200
Eucalyptus marginata	573952	6126354	620	50	2	100,200
Eucalyptus marginata	574330	6128419	660	50	2	100,300
Eucalyptus marginata	573914	6126431	500	50	1	150
Eucalyptus marginata	573790	6126302	500	50	1	150
Eucalyptus marginata	574337	6127609	520	50	1	150
Eucalyptus marginata	574166	6126453	520	50	1	150
Eucalyptus marginata	573692	6126238	630	50	1	150
Eucalyptus marginata	574358	6128115	880	50	1	150
Eucalyptus marginata	574445	6125791	1010	50	1	150
Eucalyptus marginata	573852	6126313	500	50	2	150,100
Eucalyptus marginata	573833	6126403	510	50	2	150,100
Eucalyptus marginata	574413	6125855	700	50	2	150,150
Eucalyptus marginata	574396	6125868	500	50	2	150,150
Eucalyptus marginata	573843	6126408	520	50	2	150,150
Eucalyptus marginata	574330	6128419	580	50	2	150,150
Eucalyptus marginata	574288	6126331	930	50	2	150,150
Eucalyptus marginata	574333	6128180	960	50	2	150,150
Eucalyptus marginata	574337	6128594	1030	50	2	150,150
Eucalyptus marginata	573724	6126207	590	50	3	150,150,150
Eucalyptus marginata	574326	6128366	710	50	2	150,200
Eucalyptus marginata	574412	6125867	730	50	2	150,200
Eucalyptus marginata	573827	6126355	530	50	1	200
Eucalyptus marginata	574013	6126584	540	50	1	200

Flora_sp	Easting	Northing	DBH__mm_	Zone	Hollow	Hollow_Sz
Eucalyptus marginata	573873	6126431	560	50	1	200
Eucalyptus marginata	574354	6128526	580	50	1	200
Eucalyptus marginata	573832	6126396	650	50	1	200
Eucalyptus marginata	574439	6125806	660	50	1	200
Eucalyptus marginata	574446	6125814	710	50	1	200
Eucalyptus marginata	574357	6128399	720	50	1	200
Eucalyptus marginata	574354	6128442	820	50	1	200
Eucalyptus marginata	574330	6128060	920	50	1	200
Eucalyptus marginata	573927	6126340	500	50	2	200,200
Eucalyptus marginata	573692	6126288	550	50	2	200,200
Eucalyptus marginata	573972	6126504	630	50	2	200,200
Eucalyptus marginata	573908	6126333	740	50	2	200,200
Eucalyptus marginata	573828	6126307	750	50	2	200,200
Eucalyptus marginata	573812	6126368	660	50	3	200,200,100
Eucalyptus marginata	573785	6126221	550	50	4	200,200,150,100
Eucalyptus marginata	574315	6129174	760	50	1	300
Eucalyptus marginata	574327	6128431	570	50	1	300
Eucalyptus marginata	573871	6126250	900	50	1	300
Eucalyptus marginata	574181	6126648	540	50	1	300
Eucalyptus marginata	574370	6128436	700	50	1	300
Eucalyptus marginata	573857	6126373	610	50	2	300,200
Eucalyptus marginata	573719	6126219	630	50	2	300,200
Eucalyptus marginata	574143	6126539	520	50	2	300,300
Eucalyptus marginata	573921	6126453	600	50	2	300,300
Eucalyptus marginata	573693	6126995	520	50	1	350
Eucalyptus marginata	573981	6126346	570	50	1	400
Eucalyptus staeri	574078	6126464	540	50	0	
Eucalyptus staeri	574342	6127597	560	50	0	
Eucalyptus staeri	574325	6127631	670	50	0	
Eucalyptus staeri	574084	6126480	890	50	0	
Eucalyptus staeri	574361	6127591	1080	50	0	

F4. Fauna observations.

Fauna_Hab	Description	Easting	Northing
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	574406	6125814
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	574388	6125848
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	574400	6125864
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	574420	6125872
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578404	6124615
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	576829	6124696
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578668	6124312
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578635	6124362
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578808	6124032
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	576798	6124627
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	576763	6124646
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578693	6124200
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578685	6124233
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578897	6123935
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578910	6123954

Fauna_Hab	Description	Easting	Northing
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	578929	6124005
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	579031	6123926
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	579071	6123901
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	579023	6123916
Baudin_feed	Baudin's Cockatoo feeding evidence, Marri nuts	579017	6123928
Bodensee	Baudin's Cockatoo see, flock of 1-15 seen flying over	575504	6130098
Baudin_seen	Baudin's Cockatoo see, flock of 1-15 feeding in Marri, approx. 50m SE of this point	575441	6130224
Bird	Whistling kite circling	574244	6125244
BTPhas_hollow	Potential Brush-tailed Phascogale hollow in Sheoak, wear marks.	573929	6126429
Bush_rat	Bush rat burrow system	579105	6123743
BushRat_tunnel	Bush rat tunnel entrance, possible	574030	6126560
Carns_feed	Carnaby's Cockatoo feeding evidence, Marri nuts	574406	6125799
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574383	6125798
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574651	6128299
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574517	6128299
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	575495	6124957
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	578343	6124336
Carns_feed	Carnaby's feeding evidence, Marri nuts	578658	6124287
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574329	6130082
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574333	6130067
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574332	6130050
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	578601	6124587
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	573865	6127024
Carns_feed	Carnaby's Cockatoo feeding evidence	576305	6124809
Carns_feed	Carnaby's Cockatoo feeding evidence	576265	6124814
Carns_feed	Carnaby's Cockatoo feeding evidence	576259	6124815
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576250	6124817
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576117	6124826
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576113	6124831
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576156	6124831
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576192	6124831
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576152	6124831
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576168	6124832
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576155	6124832
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576125	6124833
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576166	6124834
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576102	6124843
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576101	6124843
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576123	6124844
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	576069	6124861
Carns_feed	Carnaby's Cockatoo feeding evidence	574868	6125270
Carns_feed	Carnaby's Cockatoo feeding evidence	574869	6125289
Carns_feed	Carnaby's Cockatoo feeding evidence	574869	6125301
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574470	6125573
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574511	6125623
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574523	6125629
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574495	6125631
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574496	6125631
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574498	6125632
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574500	6125632
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574504	6125633
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574502	6125634
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574523	6125644
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574111	6126340
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574112	6126341
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574120	6126343
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574118	6126343
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574114	6126343

Fauna_Hab	Description	Easting	Northing
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574114	6126343
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574122	6126344
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574123	6126344
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574219	6126765
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574216	6126766
Carns_feed	Carnaby's Cockatoo feeding evidence	574812	6126815
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	573849	6126924
Carns_feed	Carnaby's Cockatoo feeding evidence, pine cones	574340	6128303
Feral_bees	Feral bees in hollow	578647	6124382
Feral_bees	Feral bees in hollow	576838	6124675
Feral_bees	Feral bees in hollow	574363	6125826
Frog_call	Crinea glauertii heard	574426	6125244
Frog_call	Crinea glauertii heard	575420	6130164
Hollow_bees	Hollow with bees	573873	6126431
Quenda_dig	Quenda diggings	574963	6130563
Quenda_dig	Quenda diggings	578939	6123944
Quenda_dig	Quenda diggings	578964	6123956
Quenda_dig	Quenda diggings	574563	6125468
Quenda_dig	Quenda diggings	574518	6125588
Quenda_dig	Quenda diggings	576318	6124801
Quenda_dig	Quenda diggings	574243	6127421
Quenda_dig	Quenda diggings	574299	6128049
Quenda_dig	Quenda diggings	578333	6124332
Quenda_dig	Quenda diggings, many	578680	6124247
Quenda_dig	Quenda diggings	578650	6124215
Quenda_dig	Quenda diggings	578813	6124314
Quenda_dig	Quenda diggings	578754	6124026
Quenda_dig	Quenda diggings	578783	6123956
Quenda_dig	Quenda diggings	578885	6123972
Quenda_dig	Quenda diggings	576730	6124709
Quenda_dig	Quenda diggings	576673	6124696
Quenda_dig	Quenda diggings	574391	6127562
Quenda_dig	Quenda diggings	576184	6124836
Quenda_dig	Quenda diggings	578508	6123816
Quenda_dig	Quenda diggings	575025	6130496
Quenda_dig	Quenda diggings	578867	6123941
Quenda_dig	Quenda diggings	578897	6123949
Quenda_dig	Quenda diggings	578936	6123927
Quenda_dig	Quenda diggings	578990	6123952
Quenda_dig	Quenda diggings	578993	6123927
Quenda_dig	Quenda diggings	579064	6123897
Quenda_dig	Quenda diggings	579040	6123905
Quenda_dig	Quenda diggings	578957	6123926
Quenda_dig	Quenda diggings	578917	6123992
Quenda_dig	Quenda diggings	579011	6123792
Quenda_dig	Quenda diggings	574898	6125120
Quenda_dig	Quenda diggings	574989	6125081
Quenda_dig	Quenda diggings	575061	6125053
Quenda_dig	Quenda diggings	575120	6125047
Quenda_dig	Quenda diggings	575130	6125022
Quenda_dig	Quenda diggings	575357	6124945
Quenda_dig	Quenda diggings	574806	6125162
Quenda_dig	Quenda diggings	574380	6125248
Quenda_dig	Quenda diggings	575421	6130167
Quenda_dig	Quenda diggings	575496	6130099
Quenda_skull	Quenda skull	574957	6130568
RTBC_feed	Red-tailed Black Cockatoo feeding evidence, Jarrah nuts	574906	6125119
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Marri nuts	574374	6125799
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Marri nuts	574438	6125800

Fauna_Hab	Description	Easting	Northing
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Marri nuts	574230	6125923
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Jarrah nuts	574080	6126490
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Jarrah nuts	573891	6126841
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Jarrah nuts	573849	6126780
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Marri nuts	578693	6124199
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Marri nuts	576783	6124710
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Marri nuts	576775	6124662
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Jarrah nuts	576758	6124739
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Jarrah nuts	574307	6127630
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Jarrah and Marri nuts	574339	6127610
RTBlack_feed	Red-tailed Black Cockatoo feeding evidence, Jarrah nuts	574381	6127543
RTP_drey	Western Ringtail Possum drey, possible, in Taxandria about 8m high	574565	6125568
RTP_drey	Western Ringtail Possum drey in Taxandria	574527	6125609
RTP_drey	Western Ringtail Possum drey in Taxandria	574551	6125629
RTP_drey	Western Ringtail Possum drey in Taxandria	574538	6125619
RTP_drey	Western Ringtail Possum drey, half collapsed	574498	6125557
RTP_drey	Western Ringtail Possum dreys (2) in Victorian Tea Tree	578435	6124435
RTP_drey	Western Ringtail Possum drey in Victorian Tea Tree	578451	6124459
RTP_drey	Western Ringtail Possum drey in Taxandria	574237	6125297
RTP_drey	Western Ringtail Possum drey in Hakea ?florida, not occupied but intact, 2m up tree	574175	6126860
RTP_drey	Western Ringtail Possum drey in Sydney Golden Wattle, probably unoccupied	578754	6124166
RTP_drey	Western Ringtail Possum drey, collapsed	578689	6124271
RTP_drey	Western Ringtail Possum drey, 6m up in Acacia longifolia	578925	6123931
RTP_drey	Western Ringtail Possum drey, intact	574809	6125161
RTP_drey	Western Ringtail Possum drey, in Callistachys	574451	6125244
RTP_scats	Western Ringtail Possum scats, one seen in fork of Swamp Mahogany	574845	6125407
RTP_scats	Western Ringtail Possum scats, one seen	574545	6125642
RTP_scats	Western Ringtail Possum scats, one seen, in fork of Swamp Mahogany	574471	6125555
RTP_scats	Western Ringtail Possum scats, one seen	576308	6124803
RTP_scats	Western Ringtail Possum scats, one seen	576301	6124814
RTP_scats	Western Ringtail Possum scats, one seen	576251	6124815
RTP_scats	Western Ringtail Possum scats, one seen, under Victorian Tea Tree	576683	6124635
RTP_scats	Western Ringtail Possum scats, one seen, under Sheoak	574231	6125636
RTP_scats	Western Ringtail Possum scats, one seen, under Sheoak	574229	6125585
RTP_scats	Western Ringtail Possum scats, one seen	574226	6125514
RTP_scats	Western Ringtail Possum scats, one seen, under Sheoak	574335	6128302
RTP_scats	Western Ringtail Possum scats, one seen	574314	6128303
RTP_scats	Western Ringtail Possum scats, one seen	578380	6124566
RTP_scats	Western Ringtail Possum scats, one seen, on very large Eucalyptus botryoides	578274	6124486
RTP_scats	Western Ringtail Possum scats, one seen, under Peppermint	578285	6124499
RTP_scats	Western Ringtail Possum scats, one seen	578308	6124474
RTP_scats	Western Ringtail Possum scats, one seen	574485	6128301
RTP_scats	Western Ringtail Possum scats, one seen	574334	6128151
RTP_scats	Western Ringtail Possum scats, one seen	574329	6128581
RTP_scats	Western Ringtail Possum scats, one seen	574514	6125301
RTP_scats	Western Ringtail Possum scats, one seen	574334	6125299
RTP_scats	Western Ringtail Possum scats, one seen	574907	6125199
RTP_scats	Western Ringtail Possum scats,	575210	6125104
RTP_scats	Western Ringtail Possum scats, one seen	575669	6124924
RTP_scats	Western Ringtail Possum scats, one seen	576542	6124765
RTP_scats	Western Ringtail Possum scats	576777	6124633
RTP_scats	Western Ringtail Possum scats, one seen	574204	6126515
RTP_scats	Western Ringtail Possum scats, one seen	574173	6126438
RTP_scats	Western Ringtail Possum scats, one seen	574141	6126469
RTP_scats	Western Ringtail Possum scats large and small (7mm length)	574162	6126420
RTP_scats	Western Ringtail Possum scats, one seen	574132	6126519
RTP_scats	Western Ringtail Possum scats, one seen	574135	6126508
RTP_scats	Western Ringtail Possum scats, one seen	574103	6126486

Fauna_Hab	Description	Easting	Northing
RTP_scats	Western Ringtail Possum scats, one seen	574113	6126417
RTP_scats	Western Ringtail Possum scats, one seen	574070	6126390
RTP_scats	Western Ringtail Possum scats, one seen	574075	6126426
RTP_scats	Western Ringtail Possum scats, one seen	574094	6126530
RTP_scats	Western Ringtail Possum scats, one seen	574104	6126562
RTP_scats	Western Ringtail Possum scats large and small (7mm length)	574197	6126851
RTP_scats	Western Ringtail Possum scats, one seen	574144	6126856
RTP_scats	Western Ringtail Possum scats, one seen	573993	6126385
RTP_scats	Western Ringtail Possum scats, one seen	573991	6126360
RTP_scats	Western Ringtail Possum scats, one seen	573976	6126335
RTP_scats	Western Ringtail Possum scats, one seen	573974	6126420
RTP_scats	Western Ringtail Possum scats, small (7mm length)	573997	6126475
RTP_scats	Western Ringtail Possum scats, one seen	574022	6126522
RTP_scats	Western Ringtail Possum scats, small (7mm length)	573764	6126843
RTP_scats	Western Ringtail Possum scats large and small (7mm length)	573747	6126853
RTP_scats	Western Ringtail Possum scats, one seen	573743	6126871
RTP_scats	Western Ringtail Possum scats, one seen	573898	6126864
RTP_scats	Western Ringtail Possum scats, one seen	573913	6126870
RTP_scats	Western Ringtail Possum scats large and small (7mm length)	573918	6126856
RTP_scats	Western Ringtail Possum scats, many seen	573923	6126846
RTP_scats	Western Ringtail Possum scats, one seen	574299	6127696
RTP_scats	Western Ringtail Possum scats, one seen	574302	6127920
RTP_scats	Western Ringtail Possum scats, one seen	574304	6127983
RTP_scats	Western Ringtail Possum scats, one seen	573891	6126333
RTP_scats	Western Ringtail Possum scats, one seen	573909	6126291
RTP_scats	Western Ringtail Possum scats, one seen	573987	6126622
RTP_scats	Western Ringtail Possum scats, one seen	573966	6126601
RTP_scats	Western Ringtail Possum scats, one seen	573965	6126516
RTP_scats	Western Ringtail Possum scats, one seen	573797	6126408
RTP_scats	Western Ringtail Possum scats, one seen	573767	6126401
RTP_scats	Western Ringtail Possum scats, one seen	573755	6126381
RTP_scats	Western Ringtail Possum scats, one seen	573732	6126261
RTP_scats	Western Ringtail Possum scats large and small (7mm length)	573792	6126211
RTP_scats	Western Ringtail Possum scats, one seen	573862	6126243
RTP_scats	Western Ringtail Possum scats, one seen	573894	6126287
RTP_scats	Western Ringtail Possum scats, one seen	573904	6126439
RTP_scats	Western Ringtail Possum scats, one seen	573925	6126493
RTP_scats	Western Ringtail Possum scats, one seen	573957	6126577
RTP_scats	Western Ringtail Possum scats, one seen	573995	6126680
RTP_scats	Western Ringtail Possum scats, one seen	574170	6126637
RTP_scats	Western Ringtail Possum scats, small (<10mm length)	573997	6126696
RTP_scats	Western Ringtail Possum scats, one seen	573932	6126752
RTP_scats	Western Ringtail Possum scats, one seen	573916	6126708
RTP_scats	Western Ringtail Possum scats, one seen	573932	6126687
RTP_scats	Western Ringtail Possum scats, one seen	574236	6126638
RTP_scats	Western Ringtail Possum scats, one seen	578086	6124686
RTP_scats	Western Ringtail Possum scats	578754	6124134
RTP_scats	Western Ringtail Possum scats, many, in Victorian Tea Tree grove	578727	6124143
RTP_scats	Western Ringtail Possum scats	578711	6124149
RTP_scats	Western Ringtail Possum scats, one seen	578685	6124233
RTP_scats	Western Ringtail Possum scats, one seen	578809	6124143
RTP_scats	Western Ringtail Possum scats, one seen	578780	6124204
RTP_scats	Western Ringtail Possum scats, one seen	578812	6124157
RTP_scats	Western Ringtail Possum scats, small, old	578797	6124033
RTP_scats	Western Ringtail Possum scats, one seen	578775	6124041
RTP_scats	Western Ringtail Possum scats, one seen	578862	6124195
RTP_scats	Western Ringtail Possum scats, one seen	576831	6124682
RTP_scats	Western Ringtail Possum scats, one seen	576781	6124738
RTP_scats	Western Ringtail Possum scats, one seen	578657	6124283

Fauna_Hab	Description	Easting	Northing
RTP_scats	Western Ringtail Possum scats, one seen	578662	6124227
RTP_scats	Western Ringtail Possum scats, one seen, under Tuart	578655	6124122
RTP_scats	Western Ringtail Possum scats, one seen	578593	6124190
RTP_scats	Western Ringtail Possum scats, one seen	578637	6124306
RTP_scats	Western Ringtail Possum scats, one seen	578773	6124252
RTP_scats	Western Ringtail Possum scats, one seen	578598	6124392
RTP_scats	Western Ringtail Possum scats, one seen	578577	6124435
RTP_scats	Western Ringtail Possum scats, one seen	578760	6123991
RTP_scats	Western Ringtail Possum scats, one seen	578806	6123984
RTP_scats	Western Ringtail Possum scats, one seen	578809	6124013
RTP_scats	Western Ringtail Possum scats, one seen	578815	6124030
RTP_scats	Western Ringtail Possum scats, one seen	578883	6123995
RTP_scats	Western Ringtail Possum scats, one seen	576756	6124708
RTP_scats	Western Ringtail Possum scats	574384	6127573
RTP_scats	Western Ringtail Possum scats, one seen	574373	6127531
RTP_scats	Western Ringtail Possum scats, one seen	574355	6127535
RTP_scats	Western Ringtail Possum scats, one seen	574322	6127559
RTP_scats	Western Ringtail Possum scats, one seen	574311	6127574
RTP_scats	Western Ringtail Possum scats, one seen	574315	6127583
RTP_scats	Western Ringtail Possum scats, one seen	578507	6123816
RTP_scats	Western Ringtail Possum scats	578890	6124001
RTP_scats	Western Ringtail Possum scats	578871	6123966
RTP_scats	Western Ringtail Possum scats	578876	6123950
RTP_scats	Western Ringtail Possum scats	578912	6123954
RTP_scats	Western Ringtail Possum scats	578976	6123965
RTP_scats	Western Ringtail Possum scats	578982	6123954
RTP_scats	Western Ringtail Possum scats	579029	6123930
RTP_scats	Western Ringtail Possum scats	579059	6123916
RTP_scats	Western Ringtail Possum scats	579021	6123914
RTP_scats	Western Ringtail Possum scats	578982	6123795
RTP_scats	Western Ringtail Possum scats	579035	6123780
RTP_scats	Western Ringtail Possum scats	579059	6123766
RTP_scats	Western Ringtail Possum scats	579111	6123741
RTP_scats	Western Ringtail Possum scats	574905	6125124
RTP_scats	Western Ringtail Possum scats	574946	6125106
RTP_scats	Western Ringtail Possum scats	575015	6125066
RTP_scats	Western Ringtail Possum scats	575049	6125059
RTP_scats	Western Ringtail Possum scats	575367	6124943
RTP_scats	Western Ringtail Possum scats	574805	6125162
RTP_scats	Western Ringtail Possum scats	574752	6125188
RTP_scats	Western Ringtail Possum scats	574724	6125198

14 APPENDIX G - TPFL forms (see attached)

15 APPENDIX H - Naturemap and PMST search results (see attached)

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 25/11/2019

Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Line'
Vertices	34° 57' 38" S,117° 48' 58" E 34° 57' 56" S,117° 48' 50" E 34° 59' 05" S,117° 48' 50" E 34° 59' 51" S,117° 48' 50" E 34° 59' 51" S,117° 48' 48" E 35° 00' 42" S,117° 48' 48" E 35° 00' 43" S,117° 49' 04" E 35° 00' 46" S,117° 49' 11" E 35° 00' 46" S,117° 49' 19" E 35° 00' 56" S,117° 49' 43" E 35° 00' 59" S,117° 50' 07" E 35° 00' 60" S,117° 50' 17" E 35° 01' 05" S,117° 50' 27" E 35° 01' 09" S,117° 50' 36" E 35° 01' 09" S,117° 50' 49" E 35° 01' 09" S,117° 51' 03" E 35° 01' 11" S,117° 51' 20" E 35° 01' 16" S,117° 51' 29" E 35° 01' 15" S,117° 51' 38" E
Group By	Kingdom

Kingdom	Species	Records
Animalia	86	4193
Fungi	3	13
Plantae	64	390
TOTAL	**153**	**4596**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Animalia					
1.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
2.	25554	*Apus pacificus (Fork-tailed Swift, Pacific Swift)*		IA	
3.	24208	*Arctocephalus forsteri (New Zealand Fur Seal, long-nosed fur-seal)*		S	
4.	24209	*Arctocephalus tropicalis (Subantarctic fur-seal)*		T	
5.	41326	*Ardenna carneipes (Flesh-footed Shearwater, Fleshy-footed Shearwater)*		T	
6.	41328	*Ardenna tenuirostris (Short-tailed Shearwater)*		IA	
7.	25736	*Arenaria interpres (Ruddy Turnstone)*		IA	
8.	24358	*Atrichornis clamosus (Noisy Scrub-bird, tjimiluk)*		T	
9.	25450	*Balaenoptera musculus (Blue Whale)*		T	
10.	24048	*Balaenoptera musculus subsp. brevicauda (Pygmy Blue Whale)*		T	
11.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
12.	24345	*Botaurus poiciloptilus (Australasian Bittern)*		T	
13.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
14.	24780	*Calidris alba (Sanderling)*		IA	
15.	25738	*Calidris canutus (Red Knot, knot)*		IA	
16.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
17.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
18.	24790	*Calidris tenuirostris (Great Knot)*		T	
19.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
20.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
21.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
22.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
23.	34034	*Carcharias taurus (Grey Nurse Shark)*		T	
24.	34031	*Carcharodon carcharias (Great White Shark)*		T	
25.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
26.	25551	*Cereopsis novaehollandiae (Cape Barren Goose)*		T	
27.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		T	
28.	25576	*Charadrius mongolus (Lesser Sand Plover)*		T	
29.	24440	*Dasyornis longirostris (Western Bristlebird)*		T	
30.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
31.	25346	*Dermochelys coriacea (Leatherback Turtle)*		T	
32.	30836	*Diomedea exulans subsp. exulans (Snowy Albatross)*		T	
33.	25290	*Elapognathus minor (Short-nosed Snake)*		P2	
34.	24043	*Eubalaena australis (Southern Right Whale)*		T	
35.	25624	*Falco peregrinus (Peregrine Falcon)*		S	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
36.	24475	*Falco peregrinus subsp. macropus (Australian Peregrine Falcon)*		S	
37.	34026	*Galaxiella munda (mud minnow, western dwarf galaxias)*		T	
38.	34027	*Galaxiella nigrostriata (Black-stripe Minnow, black-striped dwarf galaxias)*		T	
39.	34030	*Geotria australis (Pouched Lamprey)*		P3	
40.	34115	*Helicarion castanea (a helicarionid land snail)*		X	
41.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
42.	48587	*Hydroprogne caspia (Caspian Tern)*		IA	
43.	33977	*Hylaeus globuliferus (woolybush bee)*		P3	
44.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
45.	24557	*Leipoa ocellata (Malleefowl)*		T	
46.	47983	*Lepidogalaxias salamandroides (Salamanderfish)*		T	
47.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
48.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
49.	24690	*Macronectes giganteus (Southern Giant Petrel)*		IA	
50.	24168	*Macrotis lagotis (Bilby, Dalgyte, Ninu)*		T	
51.	34033	*Nannatherina balstoni (Balston's Pygmy Perch)*		T	
52.	24210	*Neophoca cinerea (Australian Sea-lion)*		T	
53.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
54.	24798	*Numenius madagascariensis (Eastern Curlew)*		T	
55.	25742	*Numenius phaeopus (Whimbrel)*		IA	
56.	24497	*Oceanites oceanicus (Wilson's Storm-petrel)*		IA	
57.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
58.	48591	*Pandion cristatus (Osprey, Eastern Osprey)*		IA	
59.	24097	*Parantechinus apicalis (Dibbler)*		T	
60.	41348	*Pezoporus flaviventris (Western Ground Parrot)*		T	
61.	24663	*Phaethon rubricauda (Red-tailed Tropicbird)*		P4	
62.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		S	
63.	24802	*Philomachus pugnax (Ruff, reeve)*		IA	
64.	24073	*Physeter macrocephalus (Sperm Whale)*		T	
65.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
66.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
67.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
68.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum, ngwayir)*		T	
69.	24388	*Psophodes nigrogularis subsp. nigrogularis (Western Whipbird (western heath))*		T	
70.	24715	*Puffinus huttoni (Hutton's Shearwater)*		T	
71.	42358	*Rhincodon typus (Whale Shark)*		S	
72.	24145	*Setonix brachyurus (Quokka)*		T	
73.	48116	*Stercorarius antarcticus (Brown Skua)*		P4	
74.	34007	*Thalassarche chlororhynchos (Atlantic Yellow-nosed Albatross)*		T	
75.	44607	*Thalassarche melanophris (Black-browed Albatross)*		T	
76.	48597	*Thalasseus bergii (Crested Tern)*		IA	
77.	48135	*Thinornis rubricollis (Hooded Plover, Hooded Dotterel)*		P4	
78.	24803	*Tringa brevipes (Grey-tailed Tattler)*		P4	
79.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
80.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
81.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
82.	44626	*Trioza barrettae (Banksia brownii plant-louse)*		T	
83.	24855	*Tyto novaehollandiae subsp. novaehollandiae (Masked Owl (southwest))*		P3	
84.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
85.	41351	*Xenus cinereus (Terek Sandpiper)*		IA	
86.	42361	*Zephyrarchaea mainae (Main's assasin spider)*		T	
Fungi					
87.	45013	*Amanita drummondii*		P3	
88.	18016	*Degelia flabellata*		P2	
89.	18015	*Usnea pulvinata*		P1	
Plantae					
90.	14725	*Acacia ataxiphylla subsp. ataxiphylla*		P3	
91.	3497	*Acacia prismifolia*		X	
92.	16876	*Adenanthos x cunninghamii*		P4	
93.	23502	*Agrostocrinum scabrum subsp. littorale*		P2	
94.	6301	*Andersonia auriculata*		P3	
95.	6319	*Andersonia setifolia*		P3	
96.	41737	*Andersonia sp. Jamesii (J. Liddelow 84)*		P4	
97.	16997	*Andersonia sp. Mitchell River (B.G. Hammersley 925)*		P3	
98.	42820	*Astartea transversa*		P2	
99.	35317	*Austrostipa mundula*		P3	
100.	1806	*Banksia brownii (Feather-leaved Banksia)*		T	
101.	1818	*Banksia goodii (Good's Banksia)*		T	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
102.	32085	*Banksia seneciifolia*		P4	
103.	32084	*Banksia serra (Serrate-leaved Dryandra)*		P4	
104.	1854	*Banksia verticillata (Albany Banksia)*		T	
105.	4412	*Boronia crassipes*		P3	
106.	14313	*Caladenia evanescens*		P1	
107.	13621	*Caladenia harringtoniae*		T	
108.	1213	*Calectasia cyanea (Blue Tinsel Lily)*		T	
109.	17705	*Chordifex abortivus*		T	
110.	13113	*Chorizema carinatum*		P3	
111.	14003	*Conospermum quadripetalum*		P2	
112.	14004	*Conospermum spectabile*		P2	
113.	1441	*Conostylis misera (Grass Conostylis)*		T	
114.	12935	*Corybas abditus*		P3	
115.	12946	*Corybas limpidus*		P4	
116.	13635	*Drakaea micrantha*		T	
117.	3096	*Drosera fimbriata (Manypeaks Sundew)*		P4	
118.	3117	*Drosera paleacea (Dwarf Sundew)*		P1	
119.	17744	*Gahnia sclerioides*		P4	
120.	6162	*Gonocarpus pusillus*		P4	
121.	6166	*Gonocarpus simplex*		P4	
122.	2790	*Gyrostemon thesioides*		P2	
123.	12908	*Isopogon buxifolius var. buxifolius*		P2	
124.	2242	*Isopogon uncinatus*		T	
125.	14631	*Juncus meianthus*		P3	
126.	5838	*Kunzea pauciflora*		P4	
127.	25863	*Lachnagrostis billardierei subsp. billardierei*		P3	
128.	3042	*Lepidium pseudotasmanicum*		P4	
129.	6355	*Leucopogon alternifolius*		P3	
130.	33379	*Leucopogon altissimus*		P3	
131.	6363	*Leucopogon bracteolaris*		P2	
132.	6384	*Leucopogon cymbiformis*		P2	
133.	6460	*Lysinema lasianthum*		P4	
134.	1662	*Microtis pulchella (Beautiful Mignonette Orchid)*		P4	
135.	33742	*Microtis quadrata*		P4	
136.	6722	*Myosotis australis (Southern Forget-me-not)*		P4	
137.	35396	*Poa billardierei*		P3	
138.	48478	*Prasophyllum paulinae (Pauline's Laughing Leek Orchid)*		P1	
139.	16269	*Schoenus sp. Grassy (E. Gude & J. Harvey 250)*		P2	
140.	4833	*Spyridium spadiceum*		P4	
141.	19704	*Stenanthemum sublineare*		P2	
142.	7686	*Stylidium articulatum (Stout Triggerplant)*		P2	
143.	7724	*Stylidium falcatum (Slender Beaked Triggerplant)*		P2	
144.	16859	*Synaphea incurva*		P3	
145.	2327	*Synaphea preissii*		P3	
146.	1717	*Thelymitra variegata (Queen of Sheba)*		P2	
147.	5090	*Thomasia multiflora*		P1	
148.	17049	*Thomasia purpurea x solanacea*		P1	Y
149.	5096	*Thomasia quercifolia (Oak Leaved Thomasia)*		P4	
150.	5100	*Thomasia solanacea*		P4	
151.	1336	*Thysanotus isantherus*		P4	
152.	12420	*Verticordia endlicheriana var. angustifolia*		P3	
153.	12424	*Verticordia fimbrilepis subsp. australis*		T	

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

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

Australian Government
Department of the Environment and Energy

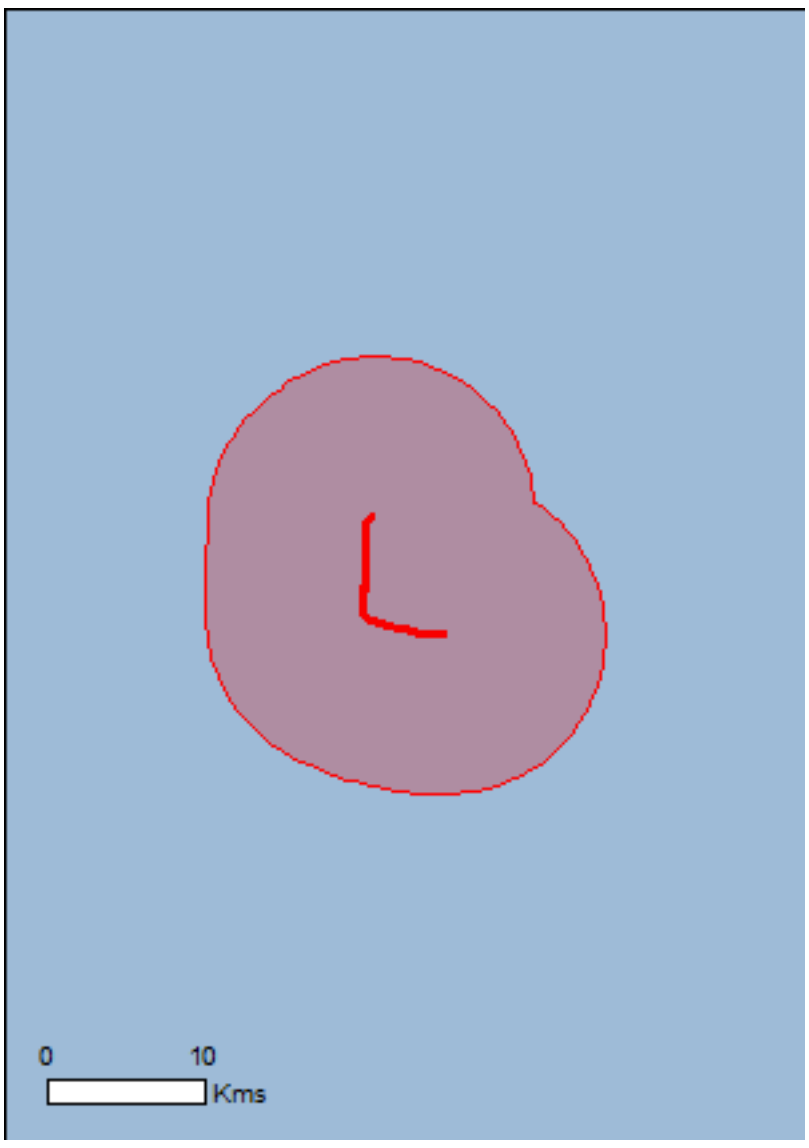
EPBC Act Protected Matters Report

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

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

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

Report created: 24/09/19 12:09:50



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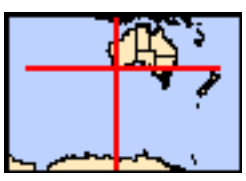

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	62
Listed Migratory Species:	60

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	3
Commonwealth Heritage Places:	None
Listed Marine Species:	90
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	27
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Dasyornis longirostris Western Bristlebird [515]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Psophodes nigrogularis nigrogularis Western Heath Western Whipbird [64449]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche cauta steadi		
White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Insects		
Trioza barrettae		
Banksia brownii plant louse [87805]	Endangered	Species or species habitat known to occur within area
Mammals		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat likely to occur within area
Parantechinus apicalis		
Dibbler [313]	Endangered	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
Other		
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Banksia brownii		
Brown's Banksia, Feather-leaved Banksia [8277]	Endangered	Species or species habitat known to occur within area
Banksia goodii		
Good's Banksia [16727]	Vulnerable	Species or species habitat known to occur within area
Banksia verticillata		
Granite Banksia, Albany Banksia, River Banksia [8333]	Vulnerable	Species or species habitat likely to occur within area
Caladenia granitora		
[65292]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia harringtoniae Harrington's Spider-orchid, Pink Spider-orchid [56786]	Vulnerable	Species or species habitat known to occur within area
Calectasia cyanea Blue Tinsel Lily [7669]	Critically Endangered	Species or species habitat known to occur within area
Chordifex abortivus Manypeaks Rush [64868]	Endangered	Species or species habitat likely to occur within area
Conostylis misera Grass Conostylis [21320]	Endangered	Species or species habitat likely to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Isopogon uncinatus Albany Cone Bush, Hook-leaf Isopogon [20871]	Endangered	Species or species habitat known to occur within area
Kennedia glabrata Northcliffe Kennedia [16452]	Vulnerable	Species or species habitat likely to occur within area
Sphenotoma drummondii Mountain Paper-heath [21160]	Endangered	Species or species habitat may occur within area
Verticordia fimbrilepis subsp. australis Southern Shy Featherflower [24630]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - ALBANY TRAINING DEPOT
Defence - ALBANY TRAINING DEPOT ; AIRTC ALBANY

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area

Name	Threatened	Type of Presence
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Breeding known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area

Name	Threatened	Type of Presence
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
[Phycodurus eques](#) Leafy Seadragon [66267]		Species or species habitat may occur within area
[Phyllopteryx taeniolatus](#) Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
[Pugnaso curtirostris](#) Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
[Solegnathus lettiensis](#) Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
[Stigmatopora argus](#) Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
[Stigmatopora nigra](#) Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
[Urocampus carinirostris](#) Hairy Pipefish [66282]		Species or species habitat may occur within area
[Vanacampus margaritifer](#) Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
[Vanacampus phillipi](#) Port Phillip Pipefish [66284]		Species or species habitat may occur within area
[Vanacampus poecilolaemus](#) Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
[Arctocephalus forsteri](#) Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat likely to occur within area
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Breeding likely to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
[Balaenoptera acutorostrata](#) Minke Whale [33]		Species or species habitat may occur within area
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Down Road	WA
Gledhow	WA
Lake Powell	WA
Marbelup	WA
Mill Brook	WA
Mistaken Island	WA
Phillips Brook	WA
Torndirrup	WA
Unnamed WA23088	WA
Unnamed WA33308	WA

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom		Species or species habitat likely to occur

Name	Status	Type of Presence
[20126] Genista sp. X Genista monspessulana Broom [67538]		within area Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Oyster Harbour	WA

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-34.963858 117.820552,-34.96428 117.819522,-34.967586 117.8142,-34.982847 117.814114,-34.997895 117.814029,-34.998458 117.813428,-35.006894 117.813514,-35.008923 117.81344,-35.009872 117.813698,-35.011243 117.816015,-35.012157 117.817303,-35.01286 117.819362,-35.014441 117.823997,-35.01539 117.827087,-35.016585 117.834726,-35.017007 117.837087,-35.017569 117.839404,-35.018272 117.841464,-35.018975 117.84421,-35.019256 117.8473,-35.019397 117.851592,-35.019538 117.860518

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

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

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

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

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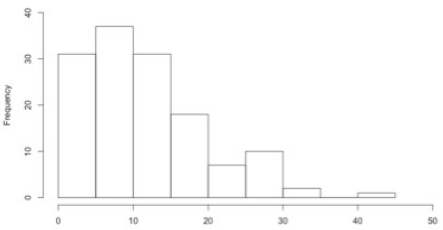
Biota Environmental Sciences

Albany Ring Road Project Western Ringtail Possum Assessment



Main Roads Western Australia

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Albany Ring Road WRP Assessment

Contents

Tables

Figures

1.0 Summary

The Albany Ring Road project is a proposed staged development to support freight growth in the City of Albany, by creating an alternative route for heavy vehicles accessing Albany Port and remove the necessity for these vehicles to travel through built up urban areas of the City. Stage 1 is complete and Stage 2 and Stage 3, the focus of this study, will connect Albany Highway, South Western Highway, Lower Denmark Road and Hanrahan Road allowing access to the port.

This report presents the results of sampling for the Western Ringtail Possum within the Albany Ring Road Project Area (the "Project Area" hereafter) as well as local and regional contextual sampling. Central to the overall assessment of the significance of the Western Ringtail Possum habitat encompassed by the Project Area is the provision of local and regional context. To provide local context, distance sampling was undertaken in the Down Road Nature Reserve located approximately 4 km north-west of the Project Area. The contextual assessment is extended further by comparison with abundance estimates derived for Bakers Junction Nature Reserve, Mt Melville, Mt Clarence and Mt Adelaide. Finally, the assessment extrapolates the density estimates to the extent of the Albany Regional Vegetation Survey to provide an 'Around Albany' sub-population estimate. Assumptions are presented that provide caveats relevant to this extrapolation of density estimates.

Two sampling methods were used within the Project Area: (i) strip sampling was employed in areas where the habitat comprised individual isolated trees or narrow strips of vegetation, and (ii) distance sampling was used over larger remnants (the Old Tip site and CSBP site). At the Down Road Nature Reserve context site, distance sampling was applied to the entire site.

Within the Project Area 16.2 km of strip transects yielded 13 observations of Western Ringtail Possums and, when the expected number of individuals based on distance sampling in the Old Tip site and CSBP site are included, the abundance estimate for the Project Area increased to between 20 and 37 individuals. For the area of habitat sampled (92.2 ha) this represents a density estimate ranging between 0.22 – 0.40 individuals per hectare.

The sampled area of Down Road Nature Reserve (363 ha) was estimated to support 452 ± 85 (95% CI 312 – 656) individuals for a density estimate of 1.246 ± 0.234 individuals per hectare.

At a regional scale, further distance sampling effort has been applied to three other remnant habitat sites, at Bakers Junction Nature Reserve, Mt Melville, Mt Clarence and Mt Adelaide where a combined estimate of 1,480 (95% CI 894 – 2,465) Western Ringtail Possums in an area of 4,400 ha was calculated.

If an average density estimate of 0.8 individuals per hectare (derived from the two largest areas surveyed: Down Road Nature Reserve and Bakers Junction Nature Reserve) is extrapolated to the mapped extent of the vegetation units surveyed within the Albany Regional Vegetation Survey boundary (a combined area of 21,633 ha), an estimate of 17,306 Western Ringtail Possums is obtained. Not all of this habitat would necessarily be utilised by Western Ringtail Possums, due either to land clearing that has occurred since 2010 (when the mapping was completed), recent fires or degradation from a variety of pressures. Nor is it necessarily accurate to apply a uniform density across the region encompassed by the mapping. However, the approach does indicate that the population estimate for the 'Around Albany' sub-population is considerably larger than the 500 reported in the IUCN assessment, perhaps by an order of magnitude.

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2.0 Introduction

2.1 Project Background

The Albany Ring Road project is a proposed staged development to support freight growth in the City of Albany, by creating an alternative route for heavy vehicles accessing Albany Port and remove the necessity for these vehicles to travel through built up urban areas of the City. Stage 1 is complete and Stage 2 and Stage 3, the focus of this document, will connect Albany Highway, South Western Highway, Lower Denmark Road and Hanrahan Road allowing access to the port (Figure 2.1).

A biological assessment of Stages 2 and 3 was undertaken in late 2017 (Rathbone and Gilfillan 2018) and determined that the Western Ringtail Possum *Pseudocheirus occidentalis,* which is listed as Critically Endangered at both State and Commonwealth levels, utilised a large proportion of the study area. Rathbone and Gilfillan (2018) categorised habitat as either Core, Supporting, Linkages or Likely Linkages. They subsequently identified areas of Core habitat in the southern section of their survey area, coincident with reserves and some remnants on private property. Supporting habitat included large areas in the east of their survey area predominantly within land owned by CSBP. Important habitat linkages were identified along the rail reserve, between Elleker Road and the railway line and along Link Road, south of Lancaster Road and on George Street. Much of the remaining habitat was identified as Likely Linkages.

2.2 Current IUCN Conservation Ranking of the Western Ringtail Possum: Rationale and Threats

The most recent assessment of the conservation status of the Western Ringtail Possum took place in 2014 and was published in 2017 (Burbidge and Zichy-Woinarski 2017). This re-assessment determined that the conservation ranking should be Critically Endangered under the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. The key elements of the justification for the ranking were:

- An area of occupancy of <500 km^2 (area of occurrence 40,000 km^2).
- Small severely fragmented populations.
- A continuing decline (threats being a drying climate, urban development, inappropriate fire regime, predation by foxes and cats).
- The upper Warren sub-population, which was identified as the largest prior to 2002, underwent a severe decline (>95%) between 1998 and 2009 (from >10,000 individuals to near extirpation).
- Remaining fragmented populations in coastal habitats also rapidly declining (equating to an overall population decline of >80% in the past 10 years).
- Predicted further decline of >80% within the next 10 years.

The following 2015 abundance estimates are quoted within the IUCN Red List for the five recognised subpopulations of Western Ringtail Possum with Dr B. Jones cited as the source:

- Southern Swan: 2,000
- Cape to Cape: 500
- Other Forest Rivers: 300
- Upper Warren: 100
- Around Albany: 500

These subpopulation estimates yield a 2015 total of about 3,400 adult Western Ringtail Possums (Burbidge and Zichy-Woinarski 2017). At the time of assessment they were considered to occur "*….patchily in coastal areas from near Bunbury to the Leeuwin-Naturaliste National Park and near Albany (B. Jones pers. comm).*" The authors go on to say that "*Most of these fragmented habitat remnants are on private land*" (Burbidge and Zichy-Woinarski 2017).

2.3 Study Purpose

This study details the results of targeted sampling for the Western Ringtail Possum within the Project Area as well as at a context site, the Down Road Nature Reserve (Figure 2.1). These results are also placed in further regional scale context by comparison with density estimates for Bakers Junction Nature Reserve, Mt Melville, Mt Clarence and Mt Adelaide which have been reported on separately (Figure 2.2). Finally, results of this local and regional work are placed in the wider "Around Albany" context.

2.4 Scale of Consideration

Four scales of geographic context are applied in this study (Project Area, Down Road Nature Reserve, Regional Scale and 'Around Albany sub-population') as defined in Table 2.1 and shown in Figure 2.1 and Figure 2.2.

To define the 'Around Albany' Western Ringtail Possum subpopulation identified (but undefined) in the IUCN conservation ranking published in 2017 (Burbidge and Zichy-Woinarski 2017), we have considered it to be equivalent to the extent of the Albany Regional Vegetation Survey (Sandiford and Barrett 2010). This is considered an appropriate definition for the 'Around Albany' sub-population as Sandiford and Barrett (2010) provides a detailed (67 native vegetation units mapped) thematic layer within which potential Western Ringtail Possum habitat can be identified, and for which density estimates can be extrapolated from the aforementioned distance sampling programs.

Table 2.1: Description of project tiers used to provide context for the Albany Ring Road Western Ringtail Possum Assessment.

Tiers	Description
Project Area	Various polygons along the length of the proposed Albany Ring Road route encompassing an area of 92.2 hectares (ha) (Figure 2.1).
Down Road Nature Reserve	The area adjacent to the Project Area within which a local context was ascertained. Specifically, the context is provided by a distance sampling program undertaken in the Down Road Nature Reserve that surveyed 21.8 kilometres (km) of line transects over seven nights. The reserve encompasses approximately 777.3 ha of which approximately 363 ha encompasses vegetation units sampled by the survey. Approximately one third of the reserve was burnt one month prior to the survey and this area has been estimated and excluded from all calculations.
Regional Scale	Extends context to include results of distance sampling programs in Bakers Junction Nature Reserve, Mt Melville, Mt Clarence and Mt Adelaide (Biota 2018a).
'Around Albany' sub-population	The IUCN species account for the Western Ringtail Possum (Burbidge and Zichy-Woinarski 2017) identifies 'Around Albany' as one of five sub-populations for the species. The geographic extent of this sub-population is not described any further by the IUCN account. This study recommends that for the purpose of this assessment, an area coincident with the boundary of the Albany Regional Vegetation Survey (ARVS) (Sandiford and Barrett 2010) be used to circumscribe the range of the 'Around Albany' subpopulation. The ARVS provides a description and extent of vegetation types encompassing 124,415 ha, bounding the Albany town site by 30 km to the east and west and 20 km to the north.

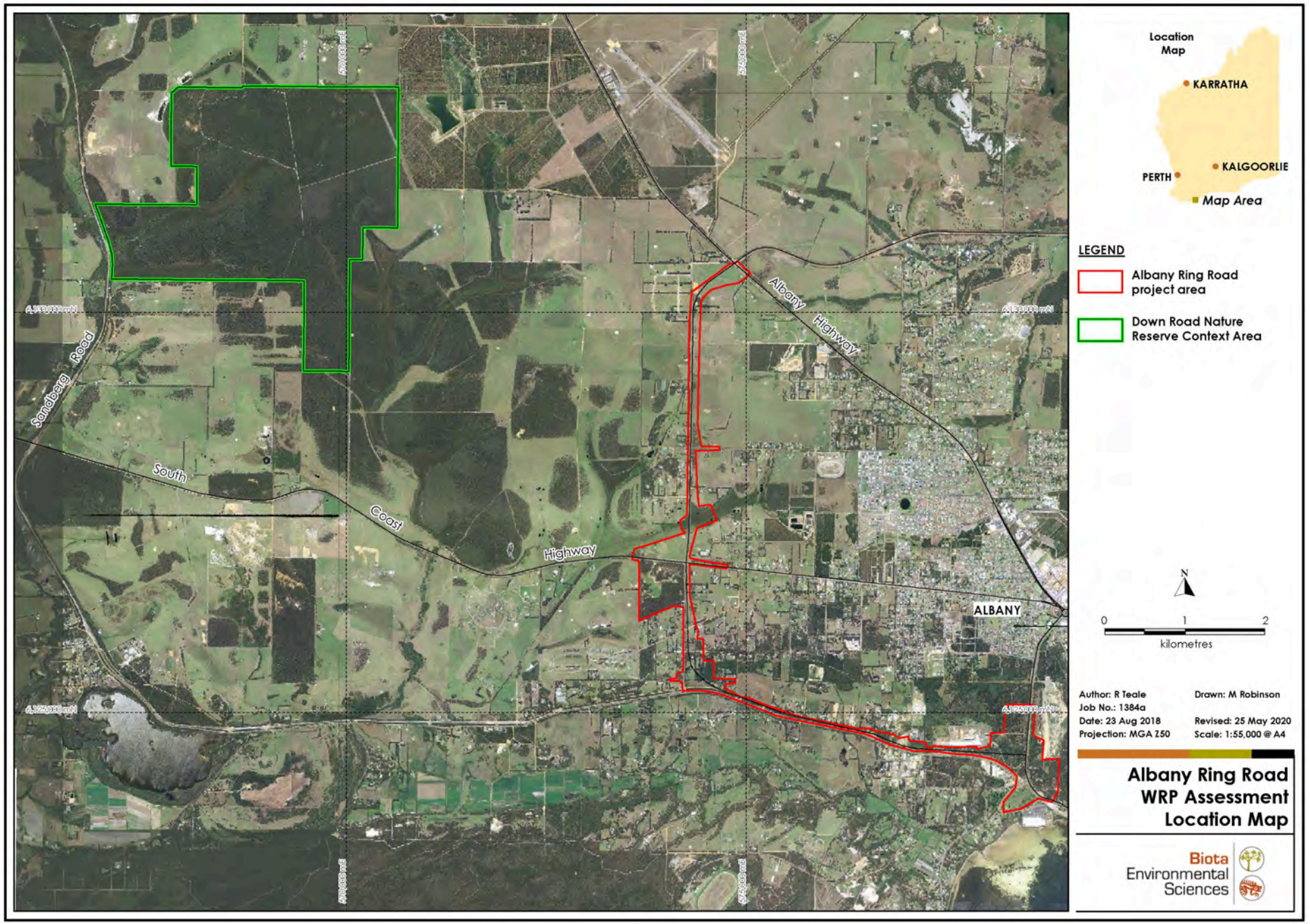


Figure 2.1 The Albany Ring Road Project Area and Down Road Nature Reserve Study Area.

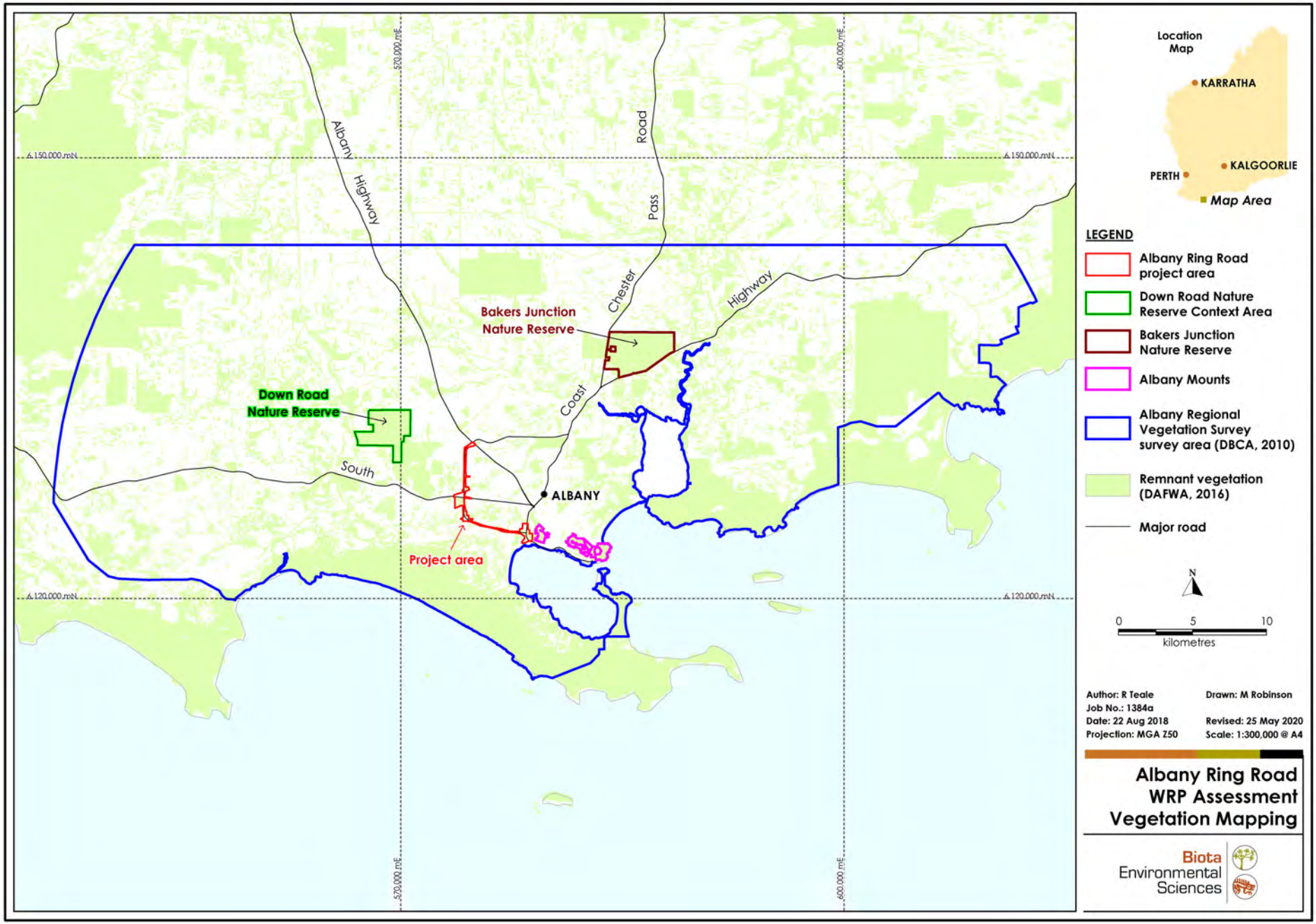


Figure 2.2: Locations of the Project Area, Down Road Nature Reserve and additional contextual sites (Bakers Junction Nature Reserve, Mt Clarence, Mt Adelaide and Mt Melville).

3.0 Methods

3.1 Survey Timing, Personnel and Permits

The survey was undertaken over 11 nights between 5 July and 21 July 2018 by Roy Teale, Stewart Ford, Victoria Ford and Zoe Hamilton all of Biota Environmental Sciences under a Department of Biodiversity, Conservation and Attractions (DBCA) Regulation 17 Licence to take fauna for scientific purposes (08-002410-1).

3.2 Survey Design

3.2.1 Project Area: Strip Transects and Line Transect Distance Sampling

Areas of scattered trees and shrubs and narrow vegetation remnants within the Project Area were surveyed using strip transects (Figure 3.1 - Figure 3.4). Each transect was at most 20 m in width and varied in length between 35 m and 1,376 m. The total length of strip transects in the Project Area was 16.2 km. The 20 m width was selected to yield greater than 90% probability of detection as derived from modelled detection functions fitted to perpendicular distances of Western Ringtail Possum sightings data from other studies (see Section 4.1).

Each 20 m wide strip transect was systematically searched for Western Ringtail Possums by a zoologist using a high-powered head torch. Survey work commenced at approximately 30 min after sunset and ended by 12:30 am. In some areas where the Road Reserve comprised scattered single trees, spotlighting was conducted from a vehicle. In all cases, the location of an observed possum was recorded using a handheld GPS while standing directly below the possum.

When complete detectability is less certain (i.e. probability of detection is less than 1.0, such as when surveying over large areas) other approaches must be adopted that allow the probability of detection and the effective survey area to be estimated. Distance sampling is one such method and is a robust and well documented approach to estimating density. Line transect distance sampling was undertaken at two locations within the Project Area; the George Street Old Tip site and the CSBP Fertiliser site. The Old Tip site encompassed approximately 35 ha and was sampled by ten line transects spaced at 75 m intervals yielding a total effort (combined transect length) of 3.9 km. The CSBP site encompassed approximately 17 ha and was traversed by nine line transects spaced at 75 m intervals with a combined effort of 2.3 km. Distance sampling of these sites followed the methodology in Section 3.3.2.

3.2.2 Down Road Nature Reserve: Line Transect Distance Sampling

To provide local context for the assessment of the habitat within the Project Area, a distance sampling approach (Buckland et al. 2001) was used to estimate the density and abundance of Western Ringtail Possums within the Down Road Nature Reserve (Study Area). Down Road Nature Reserve is a large habitat remnant (777.3 ha) that lies approximately 4 km to the west of the Project Area (see Figure 2.1) and was considered likely to support Western Ringtail Possums.

A total of 50 km of transect was initially proposed for survey (Biota 2018b) however, a fire burnt approximately one third of the Reserve one month prior to the survey and these burnt sections were excluded. The Study Area sampling program was subsequently designed around 17 north-south and 47 east-west oriented parallel line-transects spaced 75 m apart and spanning the entire extent of unburnt sections of the Nature Reserve (Figure 3.5). However, transects generally took longer to complete than initially anticipated, especially those transects within the *Hakea* spp. Shrubland / Woodland Complex vegetation unit (of the ARVS by Sandiford and Barrett (2010)), and the majority of the transects within this vegetation unit were not sampled. Of the initial 50 km of planned transects (Biota 2018b), 21.8 km were actually sampled during this study.

Sandiford and Barrett (2010) define 11 vegetation units within the Down Road Nature Reserve, of which three (considered to represent primary habitat for Western Ringtail Possum) were surveyed as part of the distance sampling program (Table 3.1).

Table 3.1: Vegetation units (after Sandiford and Barrett 2010) surveyed as part of the Western Ringtail Possum distance sampling program in the Down Road Nature Reserve.

Vegetation unit / wetland feature	Area in Reserve (prior to the May 2018 fires)
Jarrah/Marri/Sheoak Laterite Forest (Unit 12)	302.3 ha
Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland (Unit 13)	65.4 ha
Hakea spp. Shrubland / Woodland Complex (Unit 31)	258.1 ha

Two zoologists (Roy Teale and Stewart Ford) undertook the survey within the Down Road Nature Reserve. Each transect was walked by one observer using a high-powered head torch (Led Lenser XEO 19R model) to detect animals. The location of each observation was recorded using a Hemisphere R330 Differential GPS, typically providing accuracy to within 1.5 m. The following data were recorded for each observation:

- species (Western Ringtail Possum or Common Brushtail Possum);
- observer;
- animal location using GPS standing directly underneath;
- time;
- number of individuals;
- cue: Seen (eyeshine), seen (no eyeshine), heard or silhouette; and
- tree type.

Walking pace along transects was generally equivalent to approximately 0.5 km per hour.

3.2.2.1 Data Analysis

There were sufficient observations of Western Ringtail Possums (n=80) yielded by the Down Road Nature Reserve distance sampling program to independently model a detection function (required to derive animal density estimates using distance sampling approaches; Buckland et al. (2001)). However, the number of observations yielded by the distance sampling program within the Old Tip and CSBP sites (n = 7 after truncation) was fewer than the number generally recognised as being suitable for modelling a detection function (n=60 to 80) (Buckland et al. 2001). Hence, observations from these two small remnants (CSBP site and the old George Street Tip site) were pooled with observations from Down Road Nature Reserve and Bakers Junction Nature Reserve to yield a global detection function with derived parameter estimates which were then stratified by Reserve and remnant.

Perpendicular distances to each observation from the transect were calculated using MapInfo Professional Geographical Information System (GIS) v12.5 from the GPS location taken at the point of observation. Perpendicular distance data were analysed using the the 'mrds' (Laake et al. 2013) and 'Distance' (Miller 2013) packages in R statistical software (R Core Team 2013). Probability Detection Functions were modelled based on the histogram of perpendicular distance measurements to individuals and pairs (clusters). Perpendicular distance data were plotted as histograms with customised cut-points and examined to determine whether evasive movement of animals was occurring prior to detection. Stepped lower initial intervals that increase away from the centreline can indicate movement away from the observer, while initially high then decreasing intervals indicate relatively little movement away from the observers (Buckland et al. 2001). Both can lead to bias in density estimation.

Histograms were right truncated as necessary to achieve better model fit, optimally at the distance at which detection probability was 0.15 as recommended by Buckland et al. (2001), but other truncation distances were tested as part of the model selection phase. Akaike's Informative Criterion (AIC) is a quantitative method of model selection and was used to select between potential models (Buckland et al. 2001). In addition to AIC, candidate models were also compared using visual inspection of their fit to histograms of the perpendicular distance, goodness of fit quantile-quantile (Q-Q) plots, Kolmogorov-Smirnov (K-S) and Cramér-von Mises

(CvM) test statistics (Buckland et al. 2004). The half-normal and hazard rate keys were used for modelling the Probability Detection Function, with or without adjustment terms (Buckland et al. 2001).

The selected model was used to estimate the following parameters:

1. the encounter rate (n/L), where n was the number of observed clusters and L was the total length of the transect;
2. the average probability of detection (p);
3. a density estimate (D); and
4. an estimate of the number of animals in the specified area (N).

Variation in the Probability Detection Function caused by observers (factor covariate: observer) and study area (factor covariate: study area) were modelled. The effect of time elapsed since survey commencement (minutes past 18:30) was also examined to see if observer fatigue played a role in affecting detection rates. Only the results from the preferred model are discussed here.

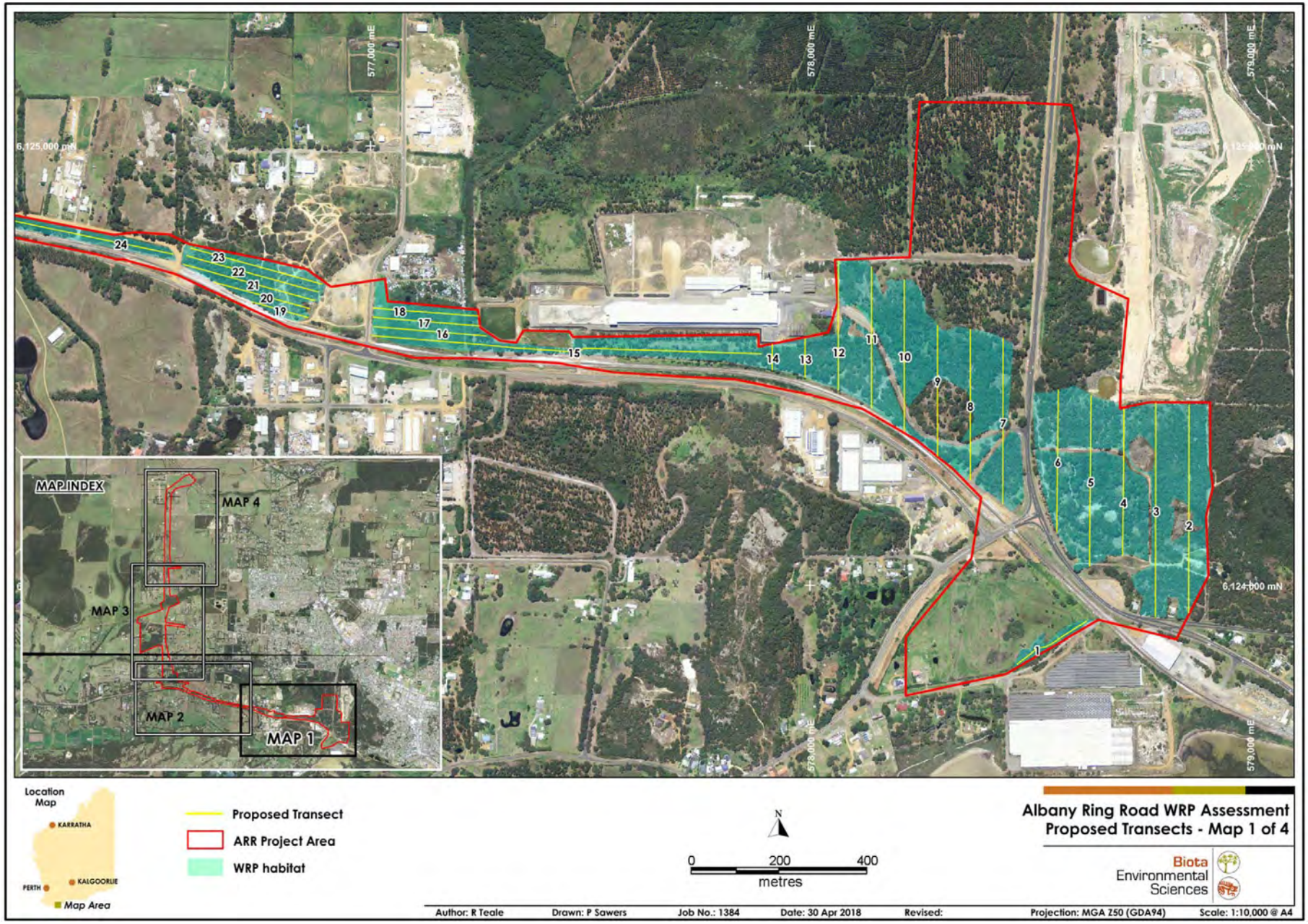


Figure 3.1: Distance sampling transects (Transects 2 – 14) within the CSBP site and strip transects (Transects 15 to 24) within the Albany Ring Road Project Area.

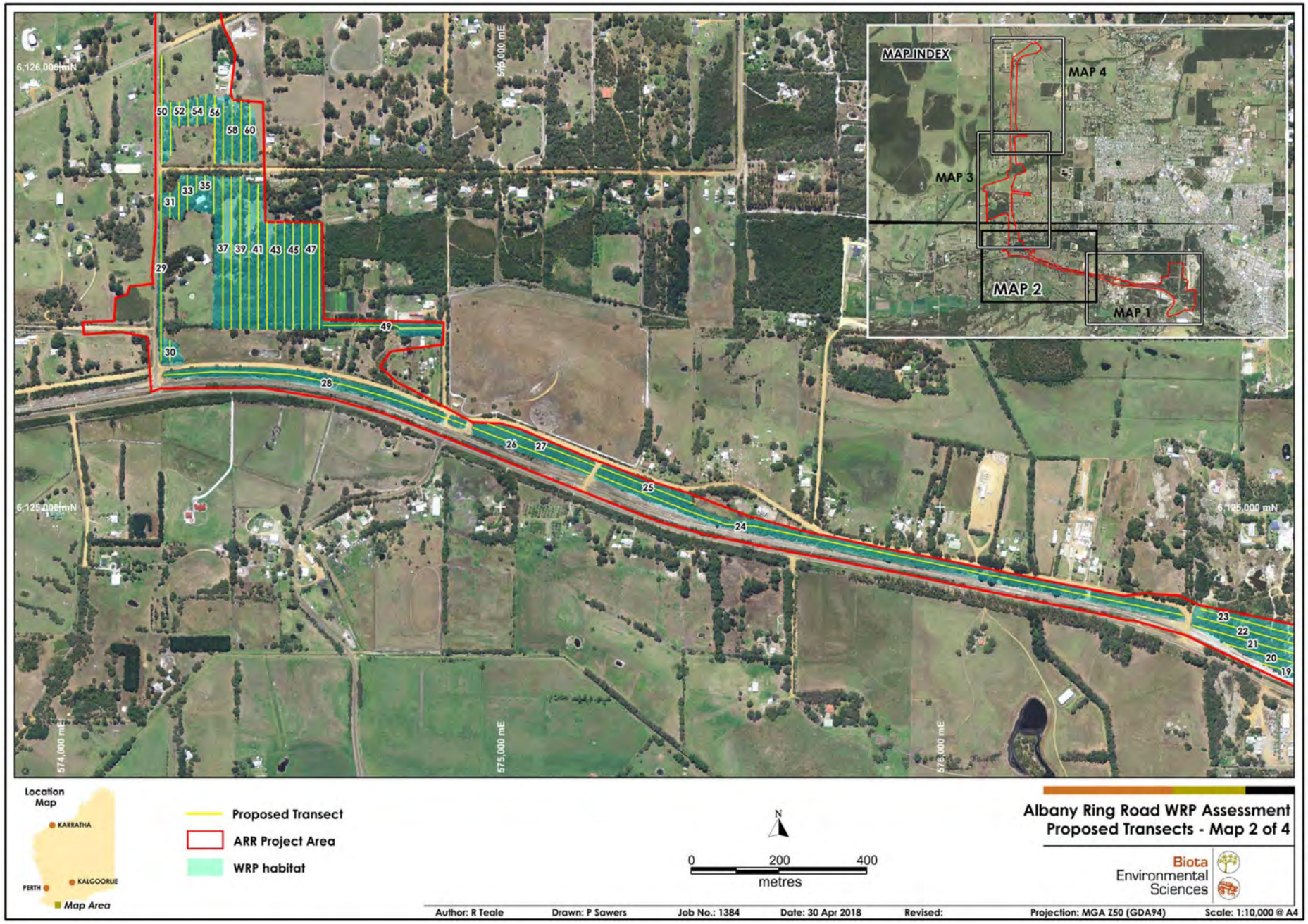


Figure 3.2: Strip transects (Transects 19 to 60) within the Albany Ring Road Project Area (continued).

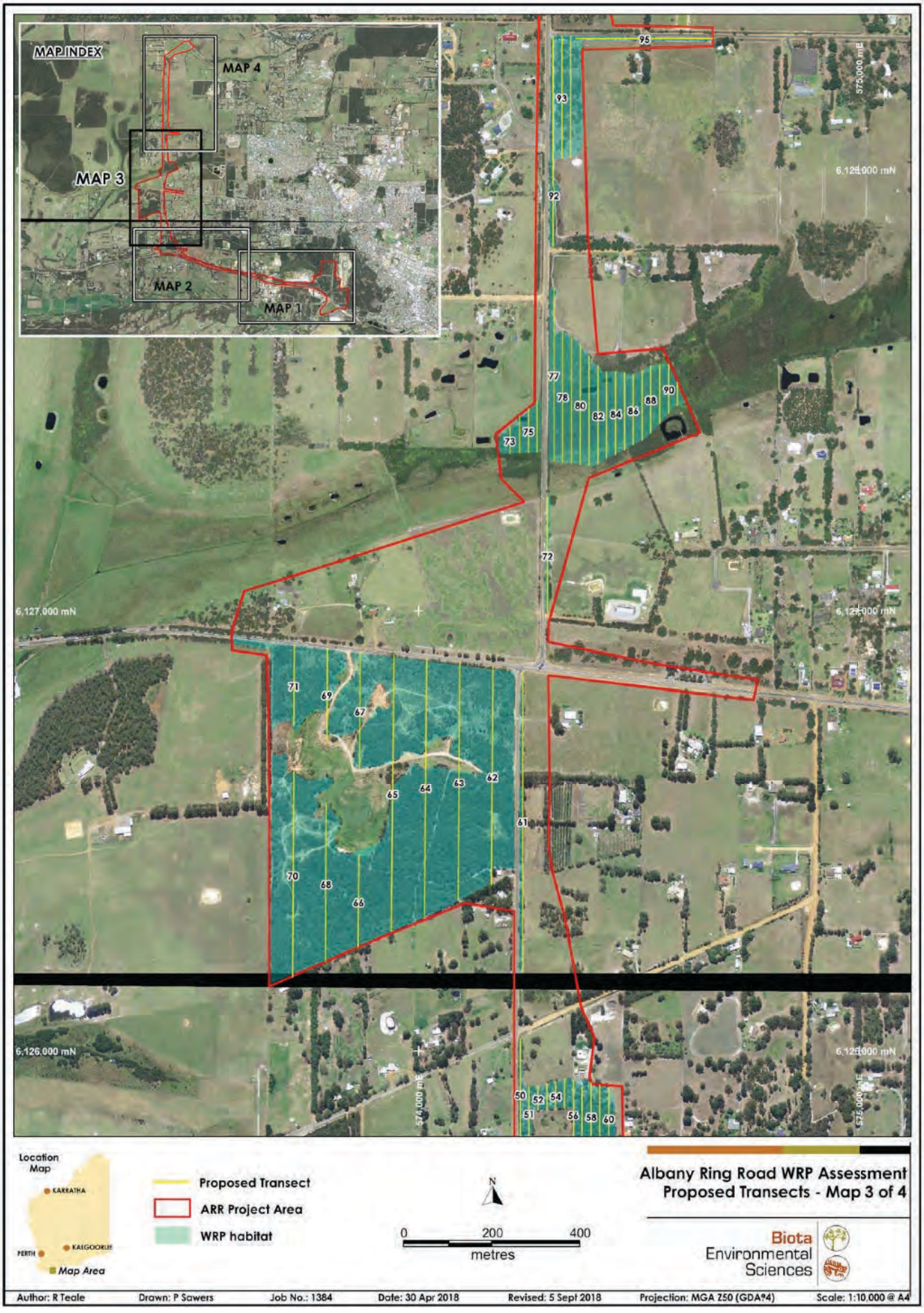


Figure 3.3: Distance sampling transects (Transects 52 – 61) within the Old Tip site and strip transects (Transects 50 to 95) within the Albany Ring Road Project Area (continued).

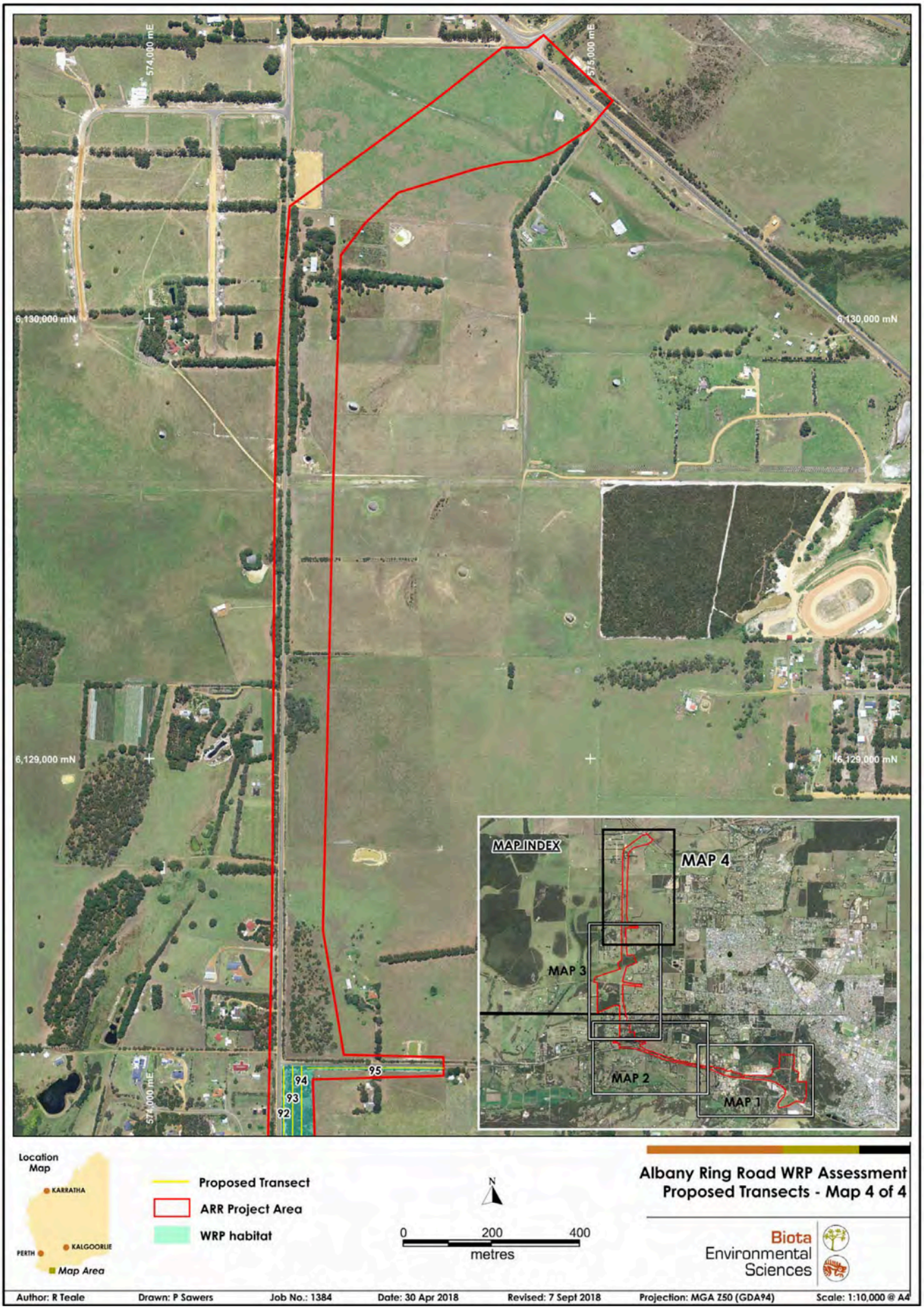


Figure 3.4: Strip transects (Transects 92 to 95) within the Albany Ring Road Project Area (continued).

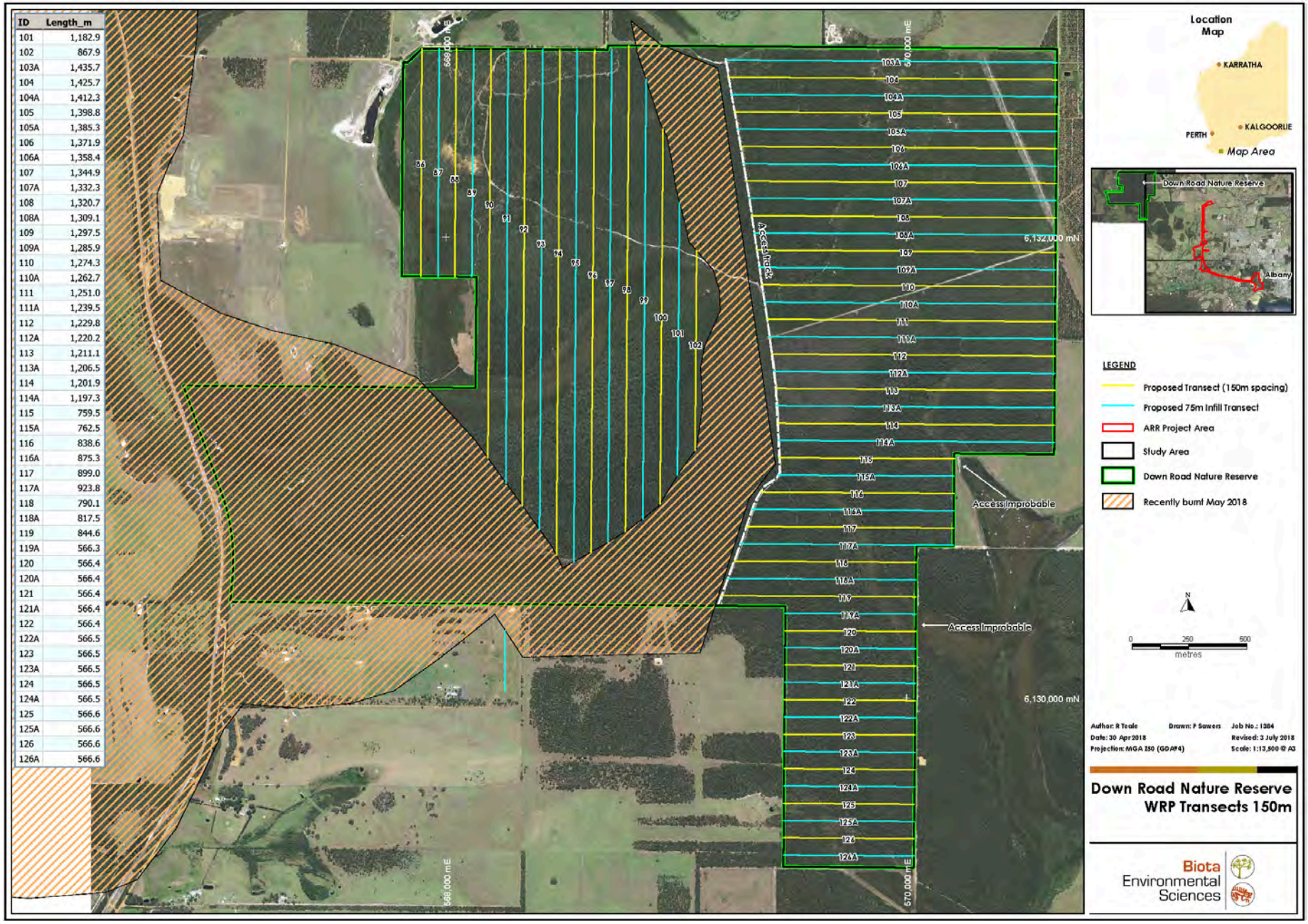


Figure 3.5: Proposed transects layout for the Western Ringtail Possum distance sampling program in the Down Road Nature Reserve study area.

4.0 Results

4.1 Project Area

The area of mapped Western Ringtail Possum habitat within the Project Area comprises approximately 92.2 ha (as per Rathbone and Gilfillan 2018), consisting of 30.89 ha of core Habitat, 31.95 ha of supporting habitat, 9.32 ha of linkage habitat and 20.04 ha of linkage likely habitat. Within this area, a total of 20 sightings of Western Ringtail Possums were recorded from 20 locations and records came from the entire length of the Project Area (Figure 4.5). The tally comprises 13 observations from the strip transects, four observations from the Old tip and three from the CSBP sites (within which distance sampling was conducted). Individuals were recorded from a variety of tree species including Sydney Wattle *Acacia longifolia*, Peppermint *Agonis flexuosa*, eucalypts, *Melaleuca* spp., and a Cypress Pine.

Within those areas sampled by strip transects, we are confident that most, if not all individuals present were recorded during the survey. This assertion is supported by the distance sampling program undertaken in the Down Road Nature Reserve (see Section 4.1.1) that yielded an average probability of detection of p=0.99 from the detection function at a truncation distance of 10 m (i.e. consistent with the 20 m strip transects used). The more open habitat of the road reserve areas likely afforded greater visibility than was possible in the larger vegetation fragments resulting in a higher probability of detection.

Population estimates for the two larger remnants (Old Tip site and the CSBP site) were derived using a distance sampling approach rather than being directly observed as was the case for the strip transects. As noted earlier (Section 3.3.2), the number of observations yielded by the distance sampling surveys within the CSBP and Old Tip sites (n= 7) was too few to adequately model a stand-alone detection function and hence observations were combined across the Down Road and Bakers Junction Nature Reserves. The combined total of 63 transects across the four survey areas yielded 137 observations of Western Ringtail Possums prior to truncation, comprising 50 in Bakers Junction Reserve, 80 in the Down Road Nature Reserve, three in the CSBP site and four in the George Street Tip site.

4.1.1 Model Selection

The histogram of detection distances was indicative of Western Ringtail Possum movement away from the observer (Figure 4.1). An alternative explanation for the initial stepped increase in the number of observations is that insufficient attention was being spent observing along the transect, largely as a result of a requirement to navigate around trees and shrubs, removing the attention of the observer from along the transect. The consequence of the stepped increase is a negative bias in the estimate of Western Ringtail Possums (i.e. an underestimate). Methodological changes were developed to correct the observers' technique from the fifth night onwards and this markedly improved the histogram, supporting our suspicion that the cause of the spike was not animal movement away from the transect (and observer).

The best overall model fit was a hazard rate key with no adjustment terms and no covariate on the detection process (truncation = 20 m, n = 117, K-S p = 0.80, CvM p = 0.96) (Figure 4.2). Key summary statistics are presented in Table 4.1.

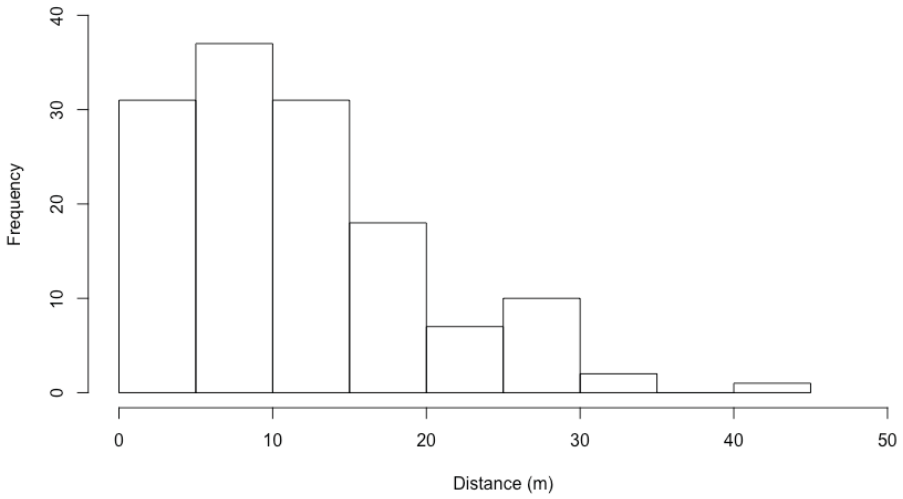


Figure 4.1: Histogram of all Western Ringtail Possum observations from Down Road Nature Reserve, Bakers Junction Nature Reserve, the Old Tip site and the CSBP site (n=137) (n.b. observations include occasions where two individuals were seen together. The tally of individuals was 156).

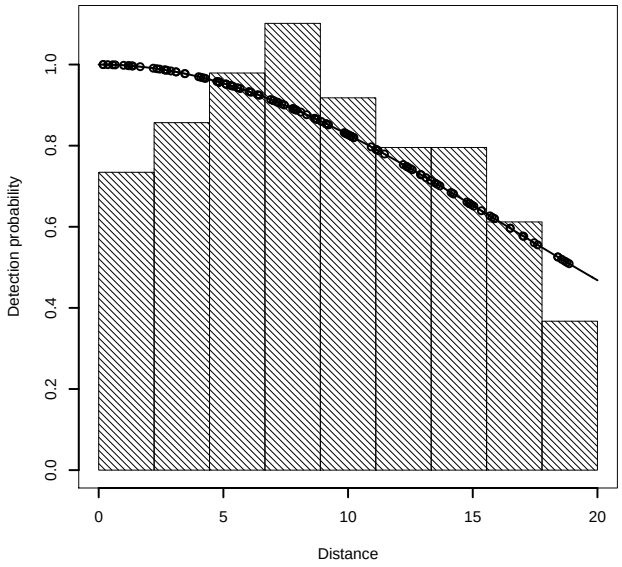


Figure 4.2: Histogram of Western Ringtail Possum observations from Down Road Nature Reserve, Bakers Junction Nature Reserve, the Old Tip site and the CSBP site with hazard-rate Probability Detection Function and truncation at 20 m.

Density estimates derived from the observation data were post-stratified by Reserve / Remnant to provide parameter estimates for the two remnants (namely the Old Tip site and the CSBP site) and then used to obtain abundance estimates. Density estimates of 0.36 ± 0.087 and 0.14 ± 0.101 Western Ringtail Possums per hectare were derived for the CSBP and Old Tip sites respectively (Table 4.2). The density estimates translate to abundance estimates of 6.1 ± 2.5 and 5.0 ± 3.6 individuals for the CSBP and Old Tip sites respectively (Table 4.3).

Table 4.1: Key summary statistics from the Distance Sampling program for Western Ringtail Possum observations (equals clusters) in the CSBP and Old Tip sites (ER = Encounter Rate, n = number of observations, k = number of transects, cv = coefficient of variation).

	Region Area (ha)	Covered Area (ha)	Effort (km)	n	k	ER km^{-1}	se.ER Rate km^{-1}	cv.ER
CSBP site	17	9.3	2.3	3	9	1.29	0.53	0.41
Old Tip site	35	15.6	3.9	2	10	0.51	0.36	0.71

Table 4.2: Density estimates for Western Ringtail Possums (individuals) in the CSBP and Old Tip sites (cv = coefficient of variation, lcl = lower confidence limit, ucl = upper confidence limit).

	Estimate (per ha)	se (per ha)	cv	lcl (per ha)	ucl (per ha)
CSBP site	0.36	0.087	0.41	0.14	0.90
Old Tip site	0.14	0.101	0.71	0.03	0.61

Table 4.3: Abundance estimates for Western Ringtail Possums (individuals) in Bakers Junction Nature Reserve (cv = coefficient of variation, lcl = lower confidence limit, ucl = upper confidence limit).

	Estimate	se	cv	lcl	ucl
CSBP site	6.1	2.5	0.42	2.4	15.3
Old Tip site	5.0	3.6	0.71	1.2	21.3

When the distance sampling abundance estimates (rather than the direct observations) from the Old Tip site and the CSBP site are added to the tally for the Project Area, then the number of expected individuals increases to 25 and ranges between 20 and 37 individuals, yielding a range of densities between 0.22 – 0.40 individuals per ha.

While the Project Area boundary may intersect the home ranges of more individual Western Ringtail Possums than the 20 to 37 estimated above (given that sections abut larger contiguous habitat remnants), we believe it is reasonable to state that the Project Area encompasses habitat that could support the equivalent of 20 to 37 individuals. The local and regional significance of this habitat is in part understood by placing it into a local and regional context by direct comparison with habitat in other nearby remnants, in this case the Down Road Nature Reserve.

4.2 Local Context Area: Down Road Nature Reserve

The histogram of detection distances for the 80 observations (Figure 4.3) shows a clear "shoulder" out to 10 m indicating relatively even detectability to at least this distance from the transect. The best overall model fit for the observation data from the surveyed vegetation units of the Down Road Nature Reserve was a half-normal with no adjustment terms and no covariate on the detection process (truncation = 20 m, n = 75, K-S p = 0.99, CvM p = 0.98) (Figure 4.4). Key summary statistics derived from this model are presented in Table 4.4. An encounter rate of 3.45 ± 0.47 Western Ringtail Possums per kilometre of transect was estimated from a truncation distance of 20 m.

The Jarrah/Marri/Sheoak Laterite Forest and Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland vegetation units of the Down Road Nature Reserve yielded a density estimate of 1.246 ± 0.234 individuals per hectare (Table 4.5), which translates to approximately 452.3 ± 85 (95% CI 311.7 – 656.3) individuals for these vegetation units in the Reserve (Table 4.6).

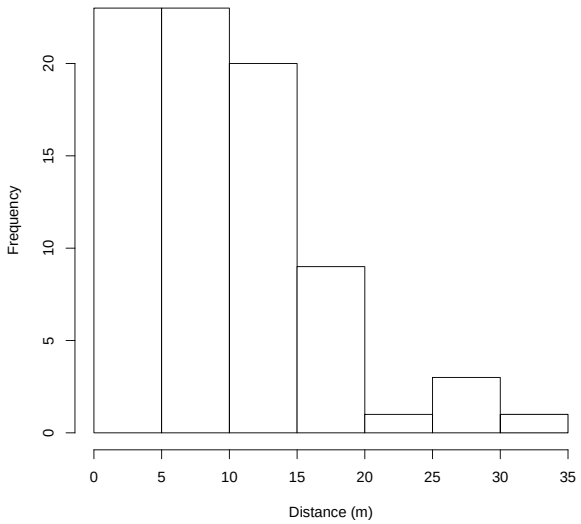


Figure 4.3: Histogram of all Western Ringtail Possum observations from the Down Road Nature Reserve (n=80) (note: observations include occasions where two individuals were seen together. The tally of individuals was 86).

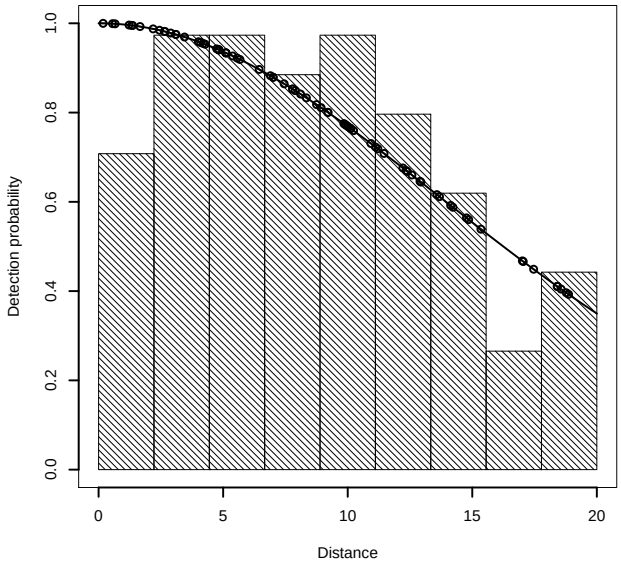


Figure 4.4: Histogram of Western Ringtail Possum observations from the Down Road Nature Reserve with half-normal Probability Detection Function and truncation at 20 m.

Table 4.4: Key summary statistics from the Distance Sampling program for Western Ringtail Possum observations (equals clusters) in Down Road Nature Reserve (ER = Encounter Rate, n = number of observations, k = number of transects, cv = coefficient of variation).

	Region Area (Ha)	Covered Area (Ha)	Effort (km)	n	k	ER km^{-1}	se.ER Rate km^{-1}	cv.ER
Down Road NR	363	87.1	21.8	75	29	3.45	0.47	0.136

Table 4.5: Density estimates for Western Ringtail Possums (individuals) in Down Road Nature Reserve (cv = coefficient of variation, lcl = lower confidence limit, ucl = upper confidence limit).

	Estimate (per ha)	se (per ha)	cv	lcl (per ha)	ucl (per ha)
Down Road NR	1.246	0.234	0.19	0.858	1.808

Table 4.6: Abundance estimates for Western Ringtail Possums (individuals) in Down Road Nature Reserve (cv = coefficient of variation, lcl = lower confidence limit, ucl = upper confidence limit).

	Estimate	se	cv	lcl	ucl
Down Road NR	452.3	85.0	0.18	311.7	656.3

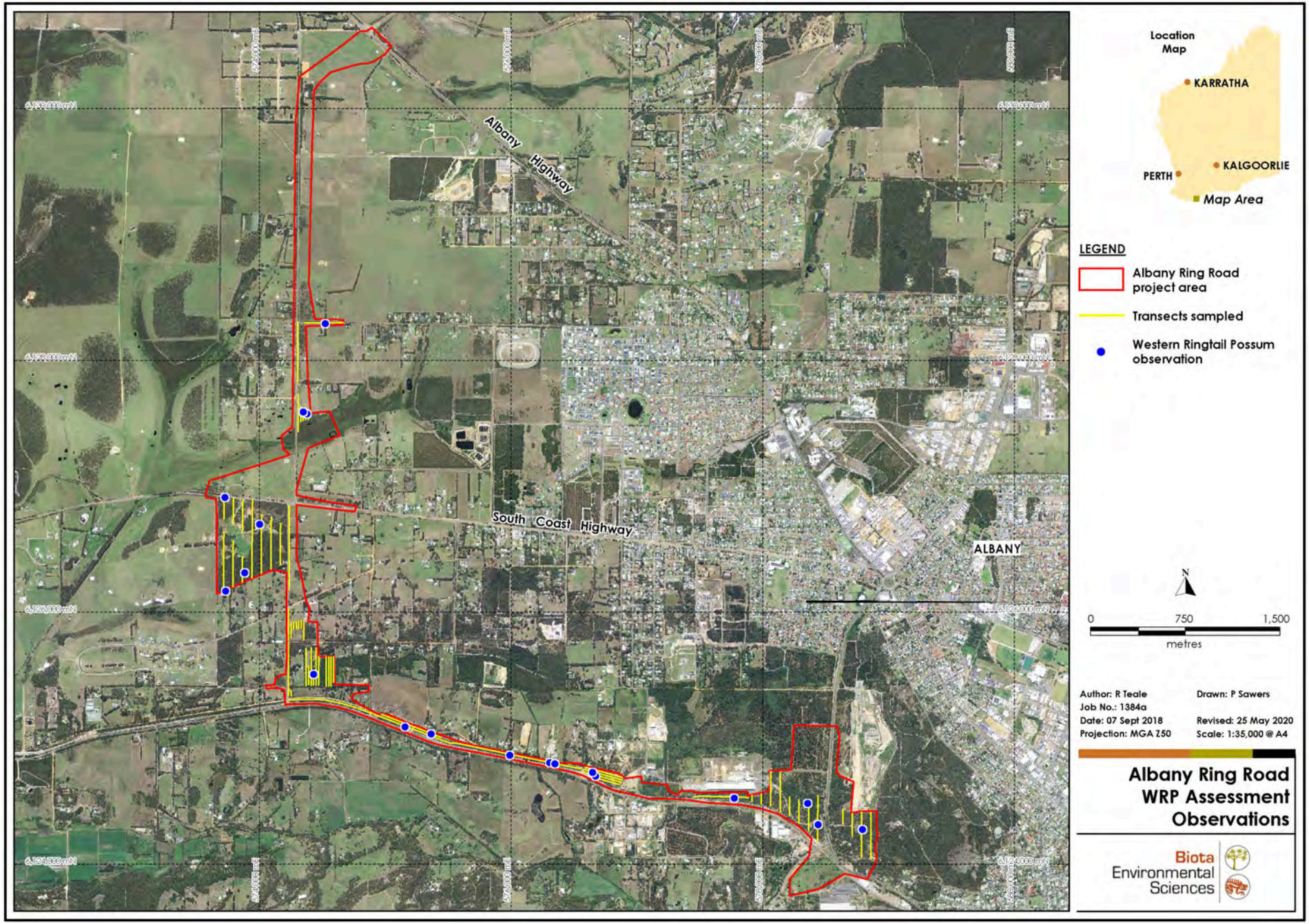
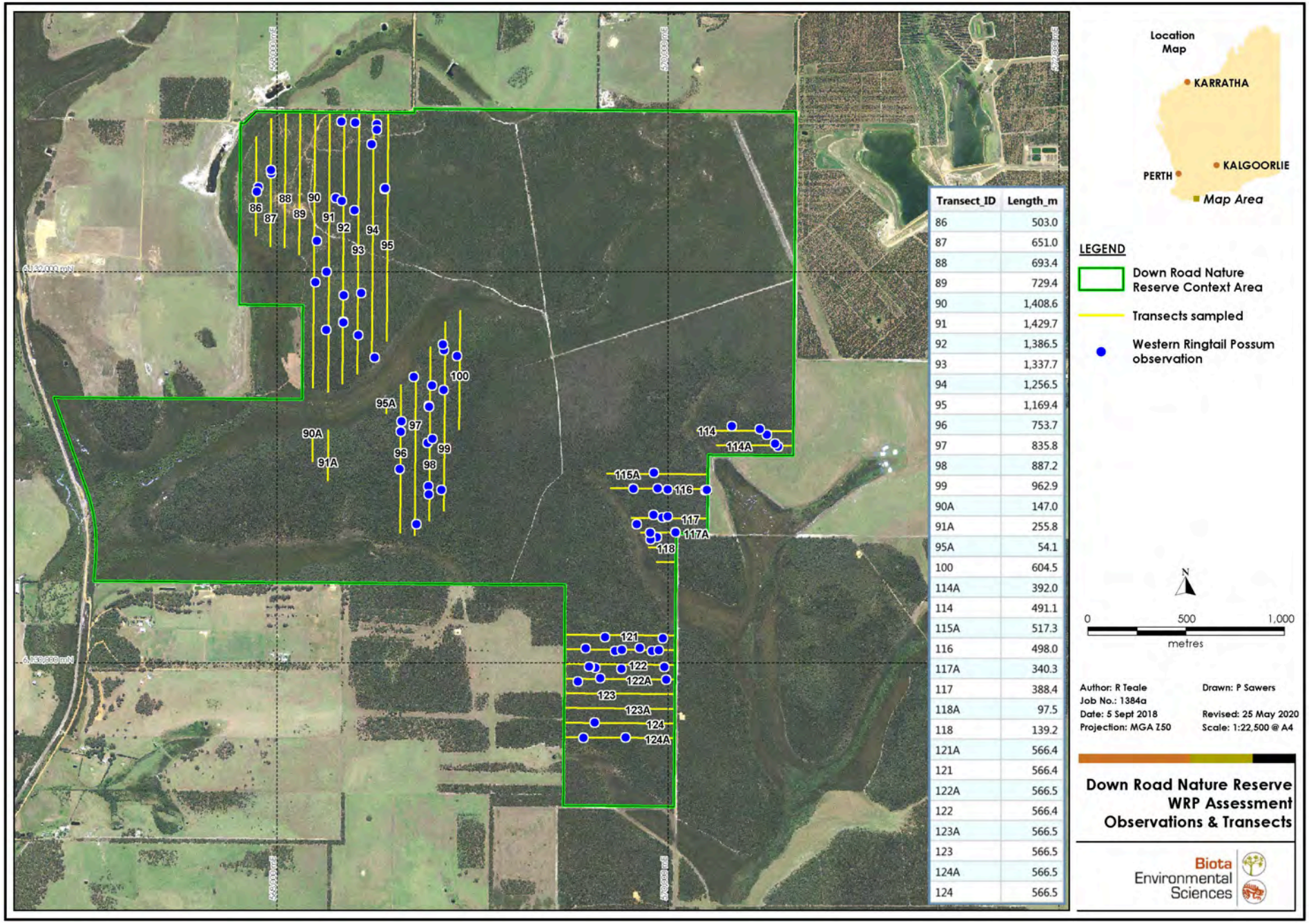


Figure 4.5: Observations of the Western Ringtail Possum within the Project Area from both Distance Sampling and Strip Sampling.



Transect_ID	Length_m
86	503.0
87	651.0
88	693.4
89	729.4
90	1,408.6
91	1,429.7
92	1,386.5
93	1,337.7
94	1,256.5
95	1,169.4
96	753.7
97	835.8
98	887.2
99	962.9
90A	147.0
91A	255.8
95A	54.1
100	604.5
114A	392.0
114	491.1
115A	517.3
116	498.0
117A	340.3
117	388.4
118A	97.5
118	139.2
121A	566.4
121	566.4
122A	566.5
122	566.4
123A	566.5
123	566.5
124A	566.5
124	566.5

Figure 4.6: Locations from which Western Ringtail Possums were recorded within the Down Road Nature Reserve.

5.0 Discussion

The purpose of this study was to assess the importance of the identified Western Ringtail Possum habitat within the Albany Ring Road Project Area (as per Rathbone and Gilfillan 2018) by direct comparison with habitat in a local (the Down Road Nature Reserve) and wider contexts including the extent of the ARVS (Sandiford and Barrett 2010). Density was identified as the preferred metric for making such comparisons and was estimated using either strip transects or a distance sampling approach depending on the extent of habitat. Within the Albany Ring Road Project Area, Western Ringtail Possum habitat ranged from isolated individual habitat trees (both native and exotic), through remnant vegetation strips (between 10 and 80 m wide) surrounded by cleared land, to larger remnants; either isolated from or broadly contiguous with, much larger remnants. Narrow habitat corridors were not amenable to undertaking a distance sampling program and to obtain density estimates in such sections, the strip transect approach was adopted. Strip transects were considered a suitable method for estimating density given that the probability of detection was essentially 1.0 (see Section 3.1) and that in most instances the area of habitat was clearly demarcated. Distance sampling was used to estimate density within two larger remnants of the Project Area (Old Tip site and the CSBP site) as well as the Jarrah/Marri/Sheoak Laterite Forest and Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland vegetation units of the Down Road Nature Reserve.

The strip transects within the Project Area yielded 13 observations of Western Ringtail Possums and, when the expected number of individuals based on the distance sampling exercises in the Old Tip site and CSBP site were included, the estimate for the Project Area increased to between 20 and 37 individuals. The 20 to 37 individuals and an area of habitat of 92.2 ha (encompassed by the Project Area boundary and as mapped by Rathbone and Gilfillan (2018) yielded a density estimate ranging between 0.22 – 0.40 individuals per ha.

At the local scale, the estimate of 20 – 37 individuals supported by the 92.2 ha of mapped habitat within the Project Area compares to an estimate of 452.3 ± 85 individuals from the Jarrah/Marri/Sheoak Laterite Forest and Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland vegetation units (encompassing 363 ha) of the Down Road Nature Reserve for a density estimate of 1.246 ± 0.234 individuals per ha, more than three times that of the Project Area.

At a 'Around Albany' scale, an original estimate of approximately 500 individuals was ascribed to the 'Around Albany' sub-population as presented in the IUCN re-assessment of the conservation status of the Western Ringtail Possum (Burbidge and Zichy-Woinarski 2017). However, since the 2017 publication (initiated in 2014) (Burbidge and Zichy-Woinarski 2017), several programs (including this study) have been implemented in the Albany Region to more robustly estimate the density of Western Ringtail Possums using a distance sampling approach and these have provided additional data to re-evaluate the IUCN estimate.

The Down Road Nature Reserve study reported here was also run in conjunction with a distance sampling program within the Bakers Junction Nature Reserve (Biota 2018a). Neither reserve has previously been surveyed for Western Ringtail Possums and both were previously highlighted as regional gaps in determining the likely distribution of Western Ringtail Possums in the greater Albany region (Gilfillan 2008). The two programs involved walking a combined total of 51.7 km of transects across 13 nights, which yielded 130 individual Western Ringtail Possums (an encounter rate of 2.51 km^{-1}) and yielded population estimates of 306 ± 75 for Bakers Junction Nature Reserve and 452 ± 85 for Down Road Nature Reserve (Table 5.1).

A third program (with Natural Resource Management funding) implemented by the Oyster Harbour Catchment Group (OHGC) and using volunteers to collect the observation data, conducted distance sampling at Mt Clarence, Mt Adelaide and Mount Melville. This program involved repeated monthly sampling of six groups of four transects yielding a total effort of 51.8 km and has been in operation since 2016. The observation data were provided to Main Roads Western Australia for the purpose of providing additional regional context. These data were also analysed as part of the current study, and density for the Mt Clarence and Mt Adelaide sites was estimated to be 3.48 ± 0.91 individuals per ha yielding a population estimate of 767 ± 201,

whilst the density estimate for the Mt Melville site was 1.54 ± 0.38 individuals per ha, yielding a population estimate of 156 ± 39 (Table 5.1).

Table 5.1: Density and population estimates for four sites at which distance sampling has been undertaken in the Albany region.

Reserve / Remnant Bushland (Area of Surveyed habitat)	Number of individuals recorded	Density (ha)	CV	Abundance Estimate (95% CI)
Bakers Junction Nature Reserve (843 ha)	54	0.363 ± 0.088	24%	306 ± 75 (185 – 507)
Down Road Nature Reserve (363 ha)†	80	1.246 ± 0.234	17.9%	452 ± 85 (311 – 656)
Mt Clarence / Mt Adelaide (2,211.7 ha)	Repeat Sampling	3.478 ± 0.908	26.2%	767 ± 201 (441 – 1335)
Mt Melville (1,012.9 ha)	Repeat Sampling	1.54 ± 0.381	24.7%	156 ± 39 (92 – 263)

† Excludes habitat burnt in June 2018 fires. The area is an approximate estimate only as the exact area burnt was not known at the time of reporting.

The distance sampling campaigns at Bakers Junction Nature Reserve, Down Road Nature Reserve, Mt Clarence / Mt Adelaide and Mt Melville yielded in excess of 135 distinct Western Ringtail Possums. These three studies yielded a combined population estimate of 1,681 individuals from a combined area of approximately 4,400 ha. The population estimate for these areas alone is therefore three times the estimate provided for the 'Around Albany' sub-population in the IUCN assessment.

By drawing on the population estimates obtained from recent studies employing a systematic distance sampling approach in the Albany Region (i.e. 1. Biota: Bakers Junction Nature Reserve and Down Road Nature Reserve and 2. OHGC: Mt Clarence, Mt Adelaide and Mount Melville), and placing them in the context of regional vegetation mapping (Sandiford and Barrett 2010) of the same habitat sampled in these studies, it is possible to calculate an approximate population size for these vegetation units in the broader Albany region.

The ARVS (Sandiford and Barrett 2010) provides a description and extent of vegetation types that encompasses 124,415 ha in an area bounded to the east and west of the Albany town site by 30 km and to the north by 20 km (shown in Figure 2.1).

The distance sampling program within the two Bakers Junction Nature Reserve and Down Road Nature Reserve primarily sampled two vegetation Units:

i) Jarrah/Marri Sheoak laterite forest (Unit 12); and

ii) Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland (Unit 13).

Sandiford and Barrett (2010) mapped 13,144 ha of the Jarrah/Marri Sheoak laterite forest (Unit 12) within the ARVS boundary and noted that 1,273 ha was encompassed by IUCN I-IV reserves, a further 3,991 ha occurred on other Crown reserves and 7,879 ha was on non-reserve land. The mapped extent of Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland (Unit 13) occurred on 5,148 ha including 1,334 ha on IUCN-IV reserves, 1,878 ha on other Crown Reserves and 1,936 ha on non-reserved land. The combined area of both vegetation units occurring on reserved land is 8,477 ha, with 9,815 ha on non-reserved land (at the time of mapping). The mean Western Ringtail Possum density across Bakers Junction Nature Reserve and Down Road Nature Reserve was estimated to be approximately 0.80 individuals per hectare. Using this density across the 8,477 ha of reserved land yields over 6,820 individuals and, if the entirety of the 2010 mapped extent is used, the estimate increases to over 14,600 individuals. Clearly not all of this habitat would currently be available either due to land clearing that has occurred since 2010, recent fires or degradation from a variety of pressures. Nor is it necessarily appropriate to apply a uniform density across the region encompassed by the mapping. However, there are a variety of other vegetation types considered likely to support Western Ringtail Possums occurring in the ARVS boundary but not surveyed as part of this study. Conservatively, these include *Hakea* spp. Shrubland/Woodland Complex (2,366 ha), *Banksia coccinea* Shrubland / *Eucalyptus staeri* / Sheoak Open Woodland (1,330 ha) and Peppermint Low Forest (1,232 ha). In addition, Western

Ringtail Possums have been documented to inhabit the urban environment within Albany utilising narrow road reserves and residential gardens (this study and Gilfillan 2008).

Further extrapolation can be obtained with a similar approach, including the additional vegetation units sampled during the studies at Mt Clarence / Mt Adelaide and Mt Melville, and applying the conservative density estimate of 0.8 individuals per hectare (lower than actually recorded during those studies). The vegetation units included in the surveys conducted at Mt Clarence / Mt Adelaide and Mt Melville were as follows:

i) Coastal *Banksia ilicifolia* / Peppermint Low Woodland (Unit 4);

ii) Marri / Jarrah Forest / Peppermint Woodland (Unit 10); and

iii) Marri / Jarrah Coastal Hills Forest (Unit 17).

When an average density estimate of 0.8 individuals per hectare (as derived from the two Nature Reserves) is extrapolated to the mapped extent of all five vegetation units surveyed by distance sampling within the ARVS boundary (a combined area of 21,633 ha; Table 5.2), an estimate of 17,306 Western Ringtail Possums is yielded. Again, not all of this habitat would necessarily be utilised by Western Ringtail Possums and nor is it necessarily accurate to apply a uniform density across the region encompassed by the mapping. However, the approach does indicate that the population estimate for the 'Around Albany' sub-population is considerably larger than the 500 reported in the IUCN assessment, perhaps by an order of magnitude.

Table 5.2: Broader extent of the sampled vegetation units within the ARVS (Sandiford and Barret 2010) and the estimated abundance of Western Ringtail Possum given an average density of 0.5 ha^{-1}.

Vegetation Unit	ARVS Occurrence	Abundance Estimate at 0.8 ha^{-1}
Coastal *Banksia ilicifolia* / Peppermint Low Woodland (Unit 4)	506 ha (411 ha in Reserves)	405 (329 in Reserves)
Marri / Jarrah Forest / Peppermint Woodland (Unit 10)	1,597 ha (516 ha in Reserves)	1,278 (413 in Reserves)
Jarrah/Marri Sheoak laterite forest (Unit 12)	13,144 ha (5,264 ha in Reserves)	10,515 (4,211 in Reserves)
Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland (Unit 13)	5,148 ha (3,212 ha in Reserves)	4,118 (2,570 in Reserves)
Marri / Jarrah Coastal Hills Forest (Unit 17)	1,238 ha (990 ha in Reserves)	990 (792 in Reserves)
All units	21,633 ha (10,393)	17,306 (8,314 in Reserves)

Reserve equates to IUCN I-IV Reserves and Other Crown Reserves after Sandiford and Barrett (2010).

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6.0 References

Biota (2018a). Albany Ring Road Western Ringtail Possum Context – A Desktop Assessment. Unpublished report for Main Roads Western Australia.

Biota (2018b). Mead Road Project: Western Ringtail Possum Assessment. Unpublished report for Main Roads Western Australia.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas (2001). *Introduction to Distance Sampling*. Oxford University Press, Oxford, UK.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas (2004). *Advanced Distance Sampling. Estimating abundance of animal populations*. Oxford University Press, Oxford, UK.

Buckland, S. T., E. A. Wrexstad, T. A. Marques and C.S. Oedekoven (2015). *Distance Sampling: Methods and Application*. Springer International Publishing, AG, Switzerland.

Burbidge, A.A. & Zichy-Woinarski, J. 2017. *Pseudocheirus occidentalis*. The IUCN Red List of Threatened Species 2017: e.T18492A21963100. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T18492A21963100.en.

Clarke, J. R. (2011). Translocation outcomes for the western ringtail possum (*Pseudocheirus occidentalis*) in the presence of the common brushtail possum (*Trichosurus vulpecula*): health, survivorship and habitat use. Doctor of Philosophy, Murdoch University, Western Australia.

Gilfillan, S (2008) Western Ringtail Possum (*Pseudocheirus occidentalis*) Survey and Data Collation in the Great Albany Area. Phase 1 Final Report. Prepared for the Department of Environment and Conservation, Albany Regional Office.

How, R. A., and S. J. Hillcox (2000). Brushtail possum, *Trichosurus vulpecula*, populations in south-western Australia: demography, diet and conservation status. *Wildlife Research* 27:81–89.

Laake, J., D. Borchers, L. Thomas, D. Miller, and J. Bishop (2013). *mrds: Mark-Recapture Distance Sampling (mrds)*. Retrieved from http://CRAN.R-project.org/package=mrds

Miller, D. (2013). *Distance: A simple way to fit detection functions to distance sampling data and calculate abundance/density for biological populations*. Retrieved from http://CRAN.R-project.org/package=Distance.

R Core Team (2013). *R: A Language and Environment for Statistical Computing*. R Development Core Team, R Foundation for Statistical Computing, Vienna, Austria. Retrieved from http://www.R-project.org.

Rathbone, D. and S. Gilfillan (2017). Biological Assessment South Coast Highway King River to Kalgan River, 7.16 to 18.12 SLK. Unpublished report for Main Roads Western Australia.

Sandiford, E. M. and S. Barrett (2010). Albany Regional Vegetation Survey: Extent, Type and Status. A project funded by the Western Australian Planning Commission, South Coast Natural Resource Management Inc., and City of Albany for the Department of Environment and Conservation. An unpublished report for the Department of Environment and Conservation, Western Australia.

Appendix 1

Raw Observation Data

Appendix A1: Distance Sampling Raw Data (Project Area and Down Road Nature Reserve)

Site	Abundance	Date	Time	Easting	Northing	Dominant Veg
ARR Strip sampling	1	20/7/18		574362	6127591	
ARR Strip sampling	1	20/7/18		574379	6127579	Jarrah/Marri
ARR Strip sampling	1	20/7/18		574347	6127595	Jarrah/Marri
ARR Strip sampling	1	16/7/18		574524	6128298	Cypress pine
ARR Strip sampling	1	16/7/18		577776	6124531	Jarrah/Marri
ARR Strip sampling	1	16/7/18		576673	6124705	Melaleuca
ARR Strip sampling	1	16/7/18		576650	6124735	Melaleuca
ARR Strip sampling	1	16/7/18		575989	6124871	Sydney Wattle
ARR Strip sampling	1	16/7/18		575366	6125041	Melaleuca
ARR Strip sampling	1	16/7/18		576309	6124811	Melaleuca
ARR Strip sampling	1	16/7/18		576350	6124802	Melaleuca
ARR Strip sampling	1	12/7/18		575158	6125098	Melaleuca
ARR Strip sampling	1	12/7/18		574432	6125514	
CSBP_ARR Distance sampling	1	16/7/18	21:41	578359	6124488	Melaleuca
CSBP_ARR Distance sampling	1	16/7/18	21:23	578443	6124319	Jarrah/Marri
CSBP_ARR Distance sampling	1	14/7/18	19:01	578795	6124282	
Tip_ARR Distance sampling	1	13/7/18	21:17	573733	6126174	
Tip_ARR Distance sampling	1	13/7/18	23:54	574001	6126704	Jarrah/Marri
Tip_ARR Distance sampling	1	13/7/18	22:35	573726	6126916	Allocasuarina
Tip_ARR Distance sampling	1	13/7/18	21:32	573883	6126322	Allocasuarina

Appendix A2: Down Road Nature Reserve Distance Sampling

Distance	Size	Person	Date	Time	Easting	Northing	Zone	Dominant_Veg
14.223	1	Stewart Ford	10/7/18	7:54	568205	6132162	50	Allocasuarina
14.766	1	Stewart Ford	15/7/18	10:46	568553	6132426	50	Allocasuarina
12.576	1	Stewart Ford	15/7/18	10:51	568555	6132431	50	Allocasuarina
17.046	1	Roy Teale	15/7/18	11:44	568512	6132759	50	Allocasuarina
18.412	1	Roy Teale	15/7/18	11:59	568513	6132730	50	Allocasuarina
8.749	1	Roy Teale	15/7/18	11:52	568485	6132656	50	Allocasuarina
2.667	1	Roy Teale	20/7/18	6:40	570565	6131108	50	Allocasuarina
12.902	1	Roy Teale	20/7/18	6:43	570550	6131124	50	Allocasuarina
20.571	1	Roy Teale	20/7/18	8:53	569928	6130761	50	Jarrah/Marri
7.789	1	Roy Teale	20/7/18	9	569974	6130748	50	Allocasuarina
12.34	1	Roy Teale	20/7/18	9:05	570001	6130752	50	Jarrah/Marri
7.007	1	Roy Teale	20/7/18	7:58	570041	6130672	50	Jarrah/Marri
18.566	1	Roy Teale	18/7/18	9:23	569763	6129973	50	Jarrah/Marri
13.684	1	Roy Teale	18/7/18	9:36	569629	6129979	50	Jarrah/Marri
7.789	1	Roy Teale	18/7/18	9:40	569602	6129985	50	Allocasuarina
7.889	1	Roy Teale	18/7/18	9:41	569597	6129985	50	Allocasuarina
12.939	1	Roy Teale	10/7/18	7:26	567906	6132436	50	Jarrah/Marri
5.564	1	Roy Teale	10/7/18	7:35	567899	6132413	50	Jarrah/Marri
4.831	1	Roy Teale	10/7/18	8:42	567973	6132508	50	Jarrah/Marri
2.189	1	Roy Teale	10/7/18	8:48	567971	6132524	50	Hakea
14.132	1	Roy Teale	15/7/18	6:53	568331	6132773	50	Jarrah/Marri
34.082	1	Roy Teale	15/7/18	7:38	568302	6132381	50	Allocasuarina
9.21	1	Roy Teale	15/7/18	7:49	568333	6132365	50	Jarrah/Marri
4.008	1	Roy Teale	15/7/18	8:32	568343	6131884	50	Jarrah/Marri

Distance	Size	Person	Date	Time	Easting	Northing	Zone	Dominant_Veg
2.642	1	Roy Teale	15/7/18	8:50	568340	6131748	50	Jarrah/Marri
4.099	1	Roy Teale	15/7/18	8:53	568342	6131744	50	Allocasuarina
14.856	1	Roy Teale	15/7/18	9:29	568501	6131564	50	Allocasuarina
5.383	1	Roy Teale	17/7/18	8:31	568778	6131316	50	Jarrah/Marri
3.095	1	Roy Teale	17/7/18	8:32	568780	6131312	50	Jarrah/Marri
13.58	1	Roy Teale	17/7/18	8:52	568796	6131151	50	Jarrah/Marri
9.202	1	Roy Teale	17/7/18	8:56	568773	6131129	50	Jarrah/Marri
4.823	2	Roy Teale	17/7/18	9:22	568775	6130906	50	Jarrah/Marri
1.366	1	Roy Teale	17/7/18	9:29	568779	6130865	50	Allocasuarina
10.93	1	Roy Teale	18/7/18	0:26	568795	6131422	50	Jarrah/Marri
12.395	1	Roy Teale	17/7/18	10:17	568843	6130889	50	Allocasuarina
5.103	1	Roy Teale	17/7/18	11:13	568854	6131398	50	Jarrah/Marri
4.831	1	Roy Teale	17/7/18	11:36	568856	6131603	50	Jarrah/Marri
9.934	1	Roy Teale	17/7/18	11:41	568851	6131632	50	Jarrah/Marri
12.214	1	Stewart Ford	17/7/18	11:00	568923	6131573	50	Jarrah/Marri
17.012	1	Stewart Ford	20/7/18	6:44	570508	6131169	50	Allocasuarina
11.458	1	Stewart Ford	20/7/18	6:51	570471	6131198	50	Melaleuca
25.232	1	Stewart Ford	20/7/18	7:01	570328	6131213	50	Allocasuarina
10.235	1	Stewart Ford	20/7/18	7:51	569929	6130976	50	Jarrah/Marri
3.108	1	Stewart Ford	20/7/18	8:26	569825	6130894	50	Allocasuarina
5.674	1	Stewart Ford	20/7/18	8:43	569949	6130896	50	Jarrah/Marri
0.662	1	Stewart Ford	20/7/18	8:47	569999	6130891	50	Allocasuarina
9.894	1	Stewart Ford	18/7/18	7:35	569580	6130078	50	Jarrah/Marri
1.223	2	Stewart Ford	18/7/18	7:48	569731	6130066	50	Jarrah/Marri
3.448	1	Stewart Ford	18/7/18	8:40	569993	6129919	50	Jarrah/Marri
8.341	1	Stewart Ford	18/7/18	9:13	569655	6129926	50	Allocasuarina
10.005	2	Stewart Ford	18/7/18	9:20	569542	6129909	50	Allocasuarina
8.107	1	Stewart Ford	10/7/18	8:16	568197	6131951	50	Allocasuarina
11.12	1	Stewart Ford	10/7/18	9:29	568254	6131705	50	Jarrah/Marri
18.412	1	Stewart Ford	15/7/18	7:28	568401	6132767	50	Jarrah/Marri
18.774	1	Stewart Ford	15/7/18	8:07	568398	6132319	50	Allocasuarina
18.865	2	Stewart Ford	15/7/18	8:37	568433	6131895	50	Jarrah/Marri
4.28	1	Stewart Ford	15/7/18	9:05	568417	6131679	50	Allocasuarina
4.741	1	Stewart Ford	17/7/18	7:38	568639	6131238	50	Jarrah/Marri
0.181	1	Stewart Ford	17/7/18	7:44	568634	6131187	50	Allocasuarina
4.198	1	Stewart Ford	17/7/18	8:13	568628	6130994	50	Allocasuarina
9.844	1	Stewart Ford	17/7/18	9:01	568714	6130712	50	Allocasuarina
8.93	1	Stewart Ford	17/7/18	10:06	568701	6131466	50	Jarrah/Marri
28.239	1	Roy Teale	20/7/18	8:36	569843	6130713	50	Jarrah/Marri
17.463	1	Roy Teale	20/7/18	8:09	569946	6130648	50	Jarrah/Marri
29.904	2	Roy Teale	20/7/18	8:15	569912	6130636	50	Allocasuarina
5.113	1	Roy Teale	20/7/18	8:19	569910	6130671	50	Allocasuarina
6.897	1	Roy Teale	18/7/18	7:44	569679	6130136	50	Jarrah/Marri
10.125	1	Roy Teale	18/7/18	8:14	569975	6130130	50	Allocasuarina
7.448	1	Roy Teale	18/7/18	8:39	569983	6129983	50	Allocasuarina
7.007	1	Roy Teale	18/7/18	11:31	569626	6129700	50	Allocasuarina
1.664	1	Stewart Ford	20/7/18	8:58	570193	6130887	50	Allocasuarina

Distance	Size	Person	Date	Time	Easting	Northing	Zone	Dominant_Veg
1.333	1	Stewart Ford	20/7/18	8:59	570200	6130887	50	Jarrah/Marri
5.113	1	Stewart Ford	18/7/18	7:55	569766	6130072	50	Allocasuarina
15.348	1	Stewart Ford	18/7/18	8:02	569858	6130081	50	Allocasuarina
0.561	2	Stewart Ford	18/7/18	8:08	569920	6130066	50	Allocasuarina
2.897	1	Stewart Ford	18/7/18	8:13	569955	6130068	50	Allocasuarina
6.446	1	Stewart Ford	18/7/18	11:09	569784	6129623	50	Allocasuarina
2.446	1	Stewart Ford	18/7/18	11:28	569568	6129621	50	Jarrah/Marri
11.21	1	Stewart Ford	10/7/18	9:57	568255	6132003	50	Jarrah/Marri
10.1	1	Roy Teale	15/7/18	-	-	-	50	-
21	1	Zoe Hamilton	13/7/18	9:17	-	-	50	-
25.1	1	Zoe Hamilton	13/7/18	11:54	-	-	50	Jarrah/Marri
2.33	1	Zoe Hamilton	13/7/18	10:35	-	-	50	Allocasuarina
7.34	1	Zoe Hamilton	13/7/18	9:32	-	-	50	Allocasuarina

Memorandum to Main Roads Western Australia:

Defining habitat categories for Western Ringtail Possum in the South Coast population

31st October 2019
Dr Sandra Gilfillan (Southern Ecology)
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Introduction

Current Environment Protection and Biodiversity Conservation (EPBC) Significant Impact Guidelines for the Western Ringtail Possum pertain only to the population occurring on the southern Swan Coastal Plain (DEWHA 2009). No guidelines have yet been developed for the South Coast population, which can be defined as a significant population under these guidelines (DEWHA, 2009). Recently a significant amount of work has been carried out on the South Coast population.

These recent data indicate that the South Coast population is quite different to the Swan Coastal Plain population in some aspects of its ecology. For example, the presence of Peppermint (*Agonis flexuosa*) is not necessary for the presence the species; habitats with high densities are largely confined to Marri/Jarrah/Sheoak communities within 20 km of the coast; diet can be quite broad and a small percentage of individuals use refugia on the ground (Van Helden et al. 2018; Van Helden unpub. data; Van Helden and Close pers com.; Mathieson et al. in review; Gilfillan 2008 and S.Gilfillan pers. obs.). The EPBC Significant Impact Guidelines for the Swan Coastal Plain may therefore have limited application to the South Coast population.

The EPBC Significant Impact Guidelines identified three areas as important for the Western Ringtail Possums within the southern Swan Coastal Plain: *Core habitat, Primary corridors* and *Supporting habitat*. As the definitions in themselves are not Swan Coastal Plain specific they can be used interchangeably to some degree. Using these habitat categories as a guide, plus current available data on Western Ringtail Possum ecology, habitat categories can be defined for the South Coast population and then identified within the Albany Ring Road project area. NB: the defined categories should be considered DRAFT and should be presented to the WRP Recovery Team for discussion and review.

Methods

Habitat category definitions were defined for the South Coast population by:

1. correlating available data on densities and home ranges of WRP with vegetation type (outlined in Table 1) and;
2. gathering expert opinion of what constitutes habitat categories.

Once habitat categories were defined the occurrence of these categories within the Albany Ring Road project area was mapped. In addition, the habitat categories were mapped (desktop assessment only) within a 5km buffer of the project area to give a regional context. This mapping is presented and summarised in a separate memo to Main Roads Western Australia. Details of methods will be provided in a final Biological Survey report for the Albany Ring Road Project (Southern Ecology December 2019).

Results

1. Core Habitats

Definition

- native vegetation with high canopy continuity (>3 canopy connections per tree) between trees >2 m high (Jones *et al.* 1994b; Van Helden *et al.* 2018)
- gardens with high cover of native and/or exotic plants/trees
- large enough to contain multiple home ranges
- long unburnt (if native vegetation)
- high densities (> 1/ha) OR high abundance >50
- breeding by a high % of individuals (if known)
- high recruitment (if known)
- can be connected OR isolated or largely isolated. However, poorly connected areas should be targeted for restoration work to restore connectivity, considering that the Effective Population Size for South Coast populations is not known.

Core Habitats within the South Coast population

Core Habitats occur within 20km of the coast in an area approximately from West Cape Howe NP in the west to Two Peoples Bay NR in the east (Van Helden,B. and Close, P. (*pers com.*). At this point in time the east and west extent of this area is not as clear and requires further survey.

Habitats that should be considered Core Habitats, based on the above definition are:

- Any remnant with an established density of > 1/ha;
- OR
- Any remnant with an established abundance of >50.
- As a precautionary principal, any Jarrah, Marri or Sheoak forest or woodland, or Peppermint Low Forest remnant that is >50 ha in size until densities are established.

    supporting information:

    - Surveyed remnants that are largely comprised of these vegetation types and with these other characteristics have densities ranging from 0.36 – 17/ha (Table 1). Remnants with measured densities at the lower end of this range (Bakers Junction and Down Rd. NR's) are however large and contain estimated abundances of 306 +/-75 and 251 +/-45, respectively.
    - Average home range in Albany bushland (marri / jarrah communities is 0.88 (Van Helden et al. 2018); A population of 50 individuals is generally seen as large enough to avoid inbreeding (Franklin 20018) and with a estimate of 0.88ha home range 50 individuals would conservatively require 50ha to maintain viability, thus Core Habitats are defined as >50ha in size.

- Urban areas (core)

    supporting information: Urban areas with gardens generally having a high % of plant cover and higher densities (Van Helden, pers com.). Average home range in garden areas of Albany are 0.51ha (Van Helden unpub data) with evidence of overlapping HR. Average density within gardens of Albany (averaged across seasons) is 3.4 possums/ha (Van Helden unpub data).

2. Supporting Habitats

Definition

- any area with an established density of <1/ha;

OR

- any area with an established abundance of <50.
- may be breeding occurring or not
- can be native or non-native vegetation, including urban gardens.

Supporting habitats within the South Coast Population

- Jarrah, Marri or Sheoak or Peppermint woodlands or forests that is < 50ha, or has an established density of <50.
- any remnant that has possums present.
- urban areas with gardens generally having a low % of plant cover and lower densities (Van Helden, pers com.)

3. Linkages

Definition

- any structure that allows movement of individuals at a small to medium scale (eg. street-scape/road-side non-native plantings, wind-breaks, plantations, fencelines)
- no resident individuals, movement of animals only
- do not need to be continuous, but can contain small gaps, as Western Ringtail Possums can come to the ground to move short distances.

Linkages within the South Coast Population
As linkages function on a local scale, they have not been identified at the scale of the population as a whole.

4. Primary Corridors

Definition

- provide major connectivity between areas of occupation,
- regional scale,
- containing multiple home ranges,
- breeding occurs,
- provides movements and habitat (residents)

Linkages within the South Coast Population

There are three primary corridors within the South Coast Population:

- King River
- Kalgan River
- Coastal Corridor (from West Cape Howe NP to Cheynes Beach – this may extend either east or west with new records).

Table 1: Densities determined by systematic methods of surveying WRP in various remnants and associated vegetation types.

Remnant/reserve and vegetation association (ARVS # in brackets)	Density	Source and method
Bakers Junction NR Jarrah/Marri Sheoak laterite forest (12) and Jarrah/Sheoak/Eucalyptus staeri Sandy Woodland (13)	**0.483/ha, se = 1.182**	**Biota (in prep)** **Distance Sampling**
Down Rd NR Jarrah/Marri Sheoak laterite forest (12) and Jarrah/Sheoak/Eucalyptus staeri Sandy Woodland (13)	**0.795/ha, se = 1.145**	**Biota (in prep)** **Distance Sampling**
Gull Rock	**0.786/ha, se = 0.373**	**Biota (in prep)** **Distance Sampling**
King River	**0.115/ha, se = 0.213**	**Biota (in prep)** **Distance Sampling**
Marbellup NR	**0.106/ha, se = 0.223**	**Biota (in prep)** **Distance Sampling**
Millbrook NR	**0.142/ha, se = 0.451**	**Biota (in prep)** **Distance Sampling**
Redmond West	**0.000**	**Biota (in prep)** **Distance Sampling**
Simpson Rd	**0.400/ha, se = 0.700**	**Biota (in prep)** **Distance Sampling**
Walmsley East	**0.223/ha, se = 0.356**	**Biota (in prep)** **Distance Sampling**
Walmsley South	**0.175/ha, se = 0.339**	**Biota (in prep)** **Distance Sampling**
Walmsley West	**0.395/ha, se = 0.480**	**Biota (in prep)** **Distance Sampling**
Mt Clarence and Adelaide 3 different vegetation types pooled; Marri/Jarrah Coastal Hills Forest (17), Jarrah Woodland Marri/Jarrah Forest/Peppermint Woodland (10) Coastal *Banksia ilicifolia* Peppermint Low Woodland (4)	**1.60/ha - 2.25/ha (depending on season)**	**Gilfillan and Comer (2018)** **Distance Sampling**
Mt Melville 3 different vegetation types pooled; Marri/Jarrah Coastal Hills Forest, (17) Jarrah/Sheoak/*E. staeri* Sandy Woodland (13), Marri/Jarrah Forest/Peppermint Woodland (10)	**2.90/ha - 3.16/ha (depending on season)**	**Gilfillan and Comer (2018)** **Distance Sampling**

Remnant/reserve and vegetation association (ARVS # in brackets)	Density	Source and method
Mt Clarence and Adelaide Marri/Jarrah Coastal Hills Forest (17), Marri/Jarrah Forest/Peppermint Woodland (10) Jarrah Woodland (11)	**4.13/ha (average density) – up to 5.5/ha in these vegetation types**	**Biota (2019)** **Distance Sampling**
Remnant bushland in urban areas of Albany Marri, jarrah or Sheoak vegetation communities	**4.5/ha (averaged across seasons):**	**Van Helden (unpub data)** **Based on Home Range size**
Urban gardens of Albany Various (exotic and native)	**3.4/ha (averaged across seasons)**	**(Van Helden unpub data)** **Based on Home Range size**
Albany Ring Road Survey Area - CSBP site mix of exotics/Marri/ Jarrah/and Peppermint	**0.36/ha**	**(Biota 2018)** **Distance Sampling**
Albany Ring Road Survey Area - George st. tip site Jarrah/Marri Sheoak laterite forest (12)	**0.14/ha**	**(Biota 2018)** **Distance Sampling**
Albany Ring Road Survey Area - roadside vegetation all vegetation types combined	**< 1/km (14 individuals in 19 km**	**Biota (2018)** **Strip transects**
Albany remnants Peppermint (*Agonis flexuosa*) Woodland	**1.6/ha (av);** **8/ha (max)**	**(Mathiesen et al. in review)** **Systematic,** **exhaustive spotlight searches in multiple 20 m x 20 m quadrats over 20 days**
Albany remnants Sheoak (*Allocasuarina fraseriana*) Woodland	**7.0/ha(av); 12/ha (max)**	**(Mathiesen et al. in review)** **Systematic,** **exhaustive spotlight searches in multiple 20 m x 20 m quadrats over 20 days**
Albany remnants Marri-eucalypt (*Corymbia calophylla*, *Eucalyptus marginanta* and *Eucalyptus staerii*) woodlands	**6.5/ha (av); 17/ha (max)**	**(Mathiesen et al. in review)** **Systematic,** **exhaustive spotlight searches in multiple 20 m x 20 m quadrats over 20 days**

References

Biota (in prep.). A Regional Survey of the Western Ringtail Possum. Unpublished Report for Main Roads Western Australia, Biota Environmental Sciences.

Biota (2019). Albany Mounts Western Ringtail Possum Population Assessment. Unpublished Report. Prepared for City of Albany, Biota Environmental Sciences, Perth, Western Australia.

Biota (2018). Albany Ring Road Project Western Ringtail Possum Assessment. Unpublished report prepared for Main Roads Western Australia, Biota Environmental Sciences, Perth, Western Australia.

Department of Environment, Water, Heritage and the Arts [DEWHA] (2009) Significant impact guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, WA.

Franklin, I. R. (1980). Evolutionary change in small populations. Pages135–140 in: M. E. Soule and B. A. Wilcox (eds.), *Conservation Biology: An Evolutionary Ecological Perspective*. Sunderland, Mass.:Sinauer Associates.

Gilfillan, S. and Comer, S. (2018). Western Ringtail Possums in Albany: Core Habitat, Abundance, and Distribution. Report prepared for the Oyster Harbour Catchment Group. Partners: City of Albany, Department of Biodiversity, Conservation and Attractions, and the Centre of Excellence in Natural Resource Management at UWA. Final Report. November 2018.

Mathiesen, T., Close, P. Van Helden, B., Speldewinde, P. and Comer, C. (in revew 2019) New evidence of unexpectedly high animal density and diet diversity for the critically endangered western ringtail possum. *Austral Ecology, in review.*

Van Helden B. E., Speldewinde P. C., Close P. G. & Comer S. J. (2018) Use of urban bushland remnants by the western ringtail possum (*Pseudocheirus occidentalis*): short term home-range size and habitat use in Albany, Western Australia. *Aust. Mammal.* **40**, 563 173-80.

Wilkins, P., Gilfillan, S., Watson, J. and Sanders, A. (ed). 2006. The Western Australian South Coast Macro Corridor Network – a bioregional strategy for nature conservation, Department of Conservation and Land Management (CALM) and South Coast Regional Initiative Planning Team (SCRIPT), Albany, Western Australia.

Biota Environmental Sciences

Albany Ring Road Black-Cockatoo Habitat Assessment

Prepared for Main Roads WA

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Albany Ring Road Black-cockatoo Habitat Assessment

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1.0 Summary

Main Roads Western Australia (Main Roads) is proposing to construct the Albany Ring Road, a staged development with the purpose of redirecting heavy vehicle traffic bound for the Port away from built up urban areas of the City of Albany. With Stage 1 completed in 2017, Main Roads is now proposing to undertake construction of Stages 2 and 3 of the Albany Ring Road project. The survey area for Stages 2 and 3 is known as the Ultimate Footprint (the area to which this report pertains). It is 12 km in length and consists of 185 ha, of which 144.7 ha are vegetated.

Habitat for black-cockatoos was assessed by foot-traversing as much of the woodland habitat in the study area as practicable. In larger vegetation fragments, a systematic approach was applied, whereby transects of 25 m spacing were overlain on the study area in GIS. A zoologist then walked down the middle of two 25 m transects, effectively using them as the boundary of a strip-search, and recorded the location of all trees within the strip. This was continued until the entire fragment had been searched. In small fragments or where there were singular trees, foot traverses were also undertaken and recorded via a track file. Foraging habitat descriptions were recorded while conducting foot traverses. For any tree supporting hollow/s, details of the hollows were taken, and a differential GPS was used to record an accurate location of the tree. These trees were also subject to a dedicated breeding hollow assessment, which included the use of a remotely piloted aircraft (RPA) to obtain images of the hollows.

A total of 516 'suitable diameter at breast height (DBH) trees' (>50 cm DBH) were recorded in the Ultimate Footprint during the survey. From these trees, a total of 48 hollows with entrance diameters of 10 cm or greater were recorded, 37 of which were considered to warrant further investigation during a dedicated hollow assessment. This follow-up hollow assessment included the use of an RPA with a camera mounted to take photographs of the hollows. This assessment indicated that none of the hollows were suitable for black-cockatoo breeding, primarily due to inadequate chamber size.

Potential foraging habitat within the study area was assessed using the detailed vegetation mapping of the study area (Rathbone and Gilfillan 2018). This comprised 17.4 ha of predominantly Jarrah and/or Marri woodland with varying mid- and under-storeys, in some places included foraging plants. Individual planted *Pinus radiata* were also recorded throughout the study area and represent foraging plants for white-tailed black-cockatoos.

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2.0 Introduction

2.1 Project Background

Main Roads is proposing to construct the Albany Ring Road (ARR), a staged development with the purpose of redirecting heavy vehicle traffic bound for the Port away from built up urban areas of the City of Albany. When complete, the ARR will link four major roads (Albany Highway, South Western Highway, Lower Denmark Road and Hanrahan Road), allowing alternative access to the Port and developing industrial area. With Stage 1 completed in 2017, Main Roads is now proposing to undertake construction of Stages 2 and 3 of the ARR project. The survey area for Stages 2 and 3 is known as the Ultimate Footprint. This is the subject of this report and is referred to as the study area throughout. It is 12 km in length and consists of 185 ha, of which 144.7 ha are vegetated.

Three species of black cockatoo are known to inhabit the Albany area, and all have been recorded within 10 km of the study area: Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) (DSEWPaC 2012). All three species represent threatened fauna and are protected under both the Western Australian *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The area contains old growth remnant Jarrah (*Eucalyptus marginata)* and Marri (*Corymbia calophylla*) trees, which have the potential to represent foraging and nesting habitat for all three species (DSEWPaC 2012). As part of a Biological Survey of the Albany Ring Road in 2017, Southern Ecology assessed threatened black-cockatoo habitat covering an area of 247 ha (Rathbone and Gilfillan 2018), of which 117.2 ha overlapped the Ultimate Footprint study area. During the 2017 survey, 265 habitat trees were identified within the area that intersects with the Ultimate Footprint survey area, and 53 hollows with diameters greater than 10 cm were recorded.

Since some sections of the study area had not been surveyed, and the status and value of some of the habitat trees that were surveyed may have changed since 2017, Main Roads commissioned Biota Environmental Sciences (Biota) to complete an updated assessment of black-cockatoo breeding habitat trees across the entire Ultimate Footprint study area.

Figure 2.1: Location of the study area.

2.2 Scope and Purpose of the Study

The aim of the survey was to re-assess black cockatoo habitat values within the Ultimate Footprint (hereafter 'the study area'). This was undertaken by identifying trees suitable for black-cockatoo nesting, which represent breeding habitat as defined in the EPBC Act referral guidelines (DSEWPaC 2012)

Specifically, this was achieved by undertaking the following scope:

- assessment of black-cockatoo habitat trees (diameter at breast height (DBH) >500 mm) within the Ultimate Footprint study area, including a re-assessment of those trees previously identified by Southern Ecology (Rathbone and Gilfillan 2018);
- identification of habitat trees containing hollows >100 mm and corresponding measurements of diameter, depth and angle, as well as details on suitability/evidence of use by black-cockatoos;
- further investigation using a drone for hollows deemed suitable based on risk assessment criteria; and
- recording evidence of roosting or feeding and any physical observations of black-cockatoo species during the survey.

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3.0 Target Species Overview

All three species of black-cockatoo are endemic to the southwest of Western Australia and have documented breeding areas overlapping the study area (Johnstone and Storr 1998, DSEWPaC 2012). Black-cockatoos require tree hollows with suitable dimensions for nesting and breeding, which typically occur in larger trees over 200 years old (DSEWPaC 2012). As such, breeding habitat trees are defined in the Federal guidelines as any tree with DBH equal to or greater than 500 mm (DSEWPaC 2012). Activities such as logging and deforestation for agriculture have contributed to a decline in abundance and range of black-cockatoos, hence their listing as conservation significant species.

3.1 Carnaby's Cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black-Cockatoo is listed as threatened under both the State BC Act (Schedule 2 - Endangered) and the Commonwealth EPBC Act (Endangered).

This species is distributed from Kalbarri to Esperance. During the breeding season, between July and November, they have been historically concentrated in the Wheatbelt region (Johnstone and Storr 1998, Saunders et al. 2014b). Here, they primarily nest in Salmon Gum (*E. salmonophloia*) and Wandoo (*E. wandoo*) but are also known to nest in Tuart (*E. gomphocephala*), Marri (*Corymbia calophylla*), Red Morrel (*E. longicornis*) and York Gum (*E. loxophleba*) (Johnstone and Storr 1998).

Expansion in breeding range further south and west towards the Jarrah - Marri forests of the Darling Scarp and Tuart forests of the Swan Coastal Plain has occurred in the past 10 to 30 years (Johnstone et al. 2010). Long term studies show that Carnaby's Black-Cockatoos utilise hollows ranging from 10 – 65 cm in diameter (average 26 cm) and approximately 130 cm deep (Saunders et al. 2014a, 2014b). They also frequent coastal areas outside of the breeding season where they forage in large flocks (Saunders et al. 2011), feeding on the seeds of *Banksia*, *Dryandra* and *Eucalyptus* species such as Jarrah, Marri and Karri (*E. diversicolor*).

3.2 Baudin's Cockatoo (*Calyptorhynchus baudinii*)

Baudin's Black-Cockatoo is listed as threatened under both the State BC Act (Schedule 2 - Endangered) and the Commonwealth EPBC Act (Vulnerable).

Baudin's Black-Cockatoo occurs in the humid and subhumid areas of the Southwest, distributed from Gidgegannup in the north to Naturaliste National Park and Augusta; also occurring in the Stirling and Porongurup Ranges and east along the south coast to Waychinicup (Johnstone and Storr 1998). Between March and September, the majority of the population migrates north from the cooler Karri forest to the central and northern Darling Range and eastern Swan Coastal Plain (Johnstone et al. 2010). They feed mainly on the seeds of Marri trees, as well as various species of *Banksia* and *Hakea* (Johnstone and Storr 1998).

Although the breeding requirements of this species are still poorly known, breeding has been recorded in the Southwest, north to Serpentine and east to Kojonup and Albany (Johnstone et al. 2010). They nest mainly in hollows of Karri, Marri and Wandoo trees. Breeding typically occurs between March and October, but egg laying has also been reported less frequently in November and December (Johnstone and Storr 1998, 1998, Johnstone et al. 2010). Specific dimensions of hollows used for breeding have not previously been studied for Baudin's Black-Cockatoo, but are likely to be similar to those hollows used by Carnaby's Black-Cockatoo.

3.3 Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso)*

The Forest Red-tailed Black-Cockatoo is listed as threatened under both the State BC Act (Schedule 3 - Vulnerable) and the Commonwealth EPBC Act (Vulnerable).

This species occurs from Gingin in the north across to near Albany in the south (Johnstone and Storr 1998), typically nesting in Marri, Jarrah and Karri tree hollows with entrance diameters ranging from 10 x 12 cm to 44 x 150 cm (mean 28 x 30 cm), and depths of between 100 cm and 500 cm (average 144 cm) (Johnstone and Storr 1998, Johnstone et al. 2013). This species lays eggs between October and November and incubation is approximately 29 – 31 days, during which time the female stays with the egg and is fed by the male (Johnstone and Storr 1998). They feed mainly on Jarrah and Marri seeds but also Sheoak (*Allocasuarina fraseriana*), Snottygobble (*Persoonia longifolia*) and Swan River Blackbutt (*E. patens*) (Johnstone et al. 2010).

4.0 Survey Methodology

4.1 Desktop Review

The following sources of information were reviewed in relation to the study area:

1. A search of NatureMap, carried out on 9th September 2019 in relation to the three black-cockatoo species using a line search with a 10 km buffer on the following points: (i) 34° 57' 52.5168" S, 117° 49' 14.2968" E; (ii) 34° 59' 47.6592" S, 117° 48' 49.7844" E; (iii) 35° 0' 51.1164" S, 117° 49' 24.2292" E; and (iv) 35° 1' 23.9988" S, 117° 51' 44.3268" E;
2. Results of the Great Cocky Count Report (Peck et al. 2018), particularly in relation to known roosting areas for black-cockatoos;
3. The vegetation and fauna report of Southern Ecology (Rathbone and Gilfillan 2018), which addressed an overlapping study area. Detailed vegetation mapping over the study area was completed by Southern Ecology and provided to Biota as shapefiles;
4. Southdown Magnetite Project Summary of studies and impact assessment for Carnaby's Black-Cockatoo (Rev 12.7) (Everard and Bamford 2016)
5. Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris,* Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso* (DotEE 2017).

4.2 Field Survey

The field survey methodology was performed in accordance with the Commonwealth referral guidelines for threatened black cockatoos (DSEWPaC 2012, DotEE 2017).

4.2.1 Breeding Habitat Assessment

The field assessment aimed to determine whether suitable breeding habitat for black-cockatoos was present within the Ultimate Footprint study area. This included the reassessment of the 663 habitat trees identified by Southern Ecology during earlier assessments (Rathbone and Gilfillan 2018), which were relocated during the survey using a GPS.

The Commonwealth *Revised draft referral guideline for three black cockatoo species* (DotEE 2017) defines breeding habitat as those species of trees known to support breeding within the range of the species, which either have a suitable nest hollow or are of a suitable DBH to develop a nest hollow (being greater than 50 cm DBH for most Eucalypts, or 30 cm in the case of Wandoo and Salmon Gum).

The aim was to assess, as far as practicable, all potential breeding trees within the study area. Two approaches were taken:

1. Larger areas of continuous vegetation were identified from aerial imagery and overlain with 25 m spaced transects in GIS. Using a GPS, a biologist walked up the middle of each 25 m wide transect, assessing all trees within it;
2. In smaller treed areas (e.g. roadside verges and paddocks containing singular trees), a biologist would maintain a GPS track file while using aerial imagery to visit as many trees as possible.

All individual trees of species with the potential to form hollows (primarily Jarrah, Marri and Tuart) and with sufficient diameter to be considered breeding habitat trees (i.e. DBH >50 cm) were recorded using a GPS with accuracy equivalent to that of a differential GPS (i.e. accurate to within 1.5 m).

For trees that were observed to contain hollows potentially suitable for black-cockatoo nesting, the following information was recorded:

- DBH (approximately 1.3 m above the ground);
- tree height;
- tree species;
- height above the ground of each hollow;
- the estimated size of entry of the hollow;

Hollows that met the following risk assessment criteria were considered a potential breeding hollow warranting further investigation using a remotely piloted aircraft (RPA), as described in Section 4.2.1.1:

- whether the hollow was suitably open for access (i.e. not covered by branches);
- whether the orientation of the hollow was suitable for access (i.e. horizontal to upright; downward-facing hollows being unsuitable);
- whether the location of the hollow allows for the formation of a nesting cavity (e.g. if on a spout branch, was the branch large enough to support a nesting cavity);
- signs of cockatoo use (including wear around hollows, nut chews, scarring, scratch marks on trunks and branches, secondary evidence of feeding sites and moulted feathers).

Figure 4.1: Effort applied to the recording of black-cockatoo habitat trees within the study area.

4.2.1.1 Black-cockatoo Breeding Hollow Assessment Field Methodology

Black-cockatoos breed in large hollow-bearing trees, generally within woodlands and forests (Johnstone and Kirkby 2011). Hollow formation results from a number of processes including fungal infection, termite activity and fire, and propensity for hollow formation varies between eucalyptus species (Whitford and Williams 2002). Studies on hollow formation in Jarrah/Marri forests identified a minimum tree age of 130 years before a tree would be suitable for hollow-dependent fauna (Whitford and Williams 2002). Habitat destruction, and the subsequent loss of suitable breeding hollows, has been identified as a process leading to population decline of black-cockatoos (Johnstone and Kirkby 2008). Furthermore, increased competition with both native and introduced species (e.g. Galahs, ducks and European honey bees) continues to reduce the availability of such trees for breeding sites (Johnstone et al. 2013).

Studies of the breeding behaviours of the three threatened black-cockatoo species have identified variation between the tree species and characteristics of hollows chosen for nesting (Table 4.1). For example, hollows formed in Jarrah are typically smaller than those in Marri, and Forest Red-tailed Black-Cockatoos breed predominantly in Marri in the Jarrah-Marri forest of the South-west (Johnstone et al. 2013). Breeding records of Carnaby's Black-Cockatoo on the Swan Coastal Plain indicate that the majority of their nests are in Tuart (Johnstone and Kirkby 2011).

Table 4.1: Breeding habitat for the three Threatened black-cockatoo species.

	Baudin's	Carnaby's	Forest Red-Tailed
Specific breeding habitat for the three black-cockatoo species	Nest in hollows in live or dead trees of Karri, Marri, Wandoo and Tuart.	Nest in hollows in live or dead trees of Salmon Gum, Wandoo, Tuart, Jarrah, Flooded Gum, York Gum, Powderbark, Karri and Marri.	Nest in hollows in live or dead trees of Karri, Marri, Bullich, Swan River Blackbutt, Tuart and Jarrah.
Hollow Characteristics			
Aspect	No preference. Does not affect nesting success (Saunders 1979).	No preference. Does not affect nesting success (Saunders 1979).	–
Depth	Ranges from 0.1 to 2.5+ m (Johnstone and Kirkby 2011).	Majority between 0.5 and over 2.0 m, average just over 1 m (Saunders 1979).	1.0 - 5.0 m (Johnstone and Kirkby 2011).
Height above ground	No preference (Serventy and Whittell 1976).	No evidence that higher hollows are preferenced (Saunders 1979).	No preference (Johnstone and Kirkby 2011).
Living or dead	No preference (Saunders 1979).	No preference (Saunders 1979).	No preference (Saunders 1979).
Entrance Diameter	–	–	>12 cm (Johnstone and Kirkby 2011).

For all hollow-bearing trees >50 cm DBH, which also contained hollows greater than approximately 10 cm dimension that were recorded during the black-cockatoo habitat mapping exercise (see Section 4.2.1), a follow-up survey was conducted using an RPA (DJI Mavic Pro). This aimed to assess the likelihood or evidence of black-cockatoo breeding within each hollow, as well as a better assessment of its suitability for breeding.

The RPA exercise was carried out by two biologists, one of whom is also an experienced RPA pilot. A pre-flight assessment of the tree was completed to ensure proper flight conditions and confirm the order in which hollows would be assessed. Prior to flight, the side of the tree was raked with a branch, which will generally cause any black-cockatoo or other bird species within a hollow to emerge. This provides an indication of hollow use and also reduces the likelihood of RPA-fauna collision.

During the flight stage of the RPA survey, the two participants were each tasked with a specific duty: (i) the pilot was responsible for flying the RPA; and (ii) the spotter monitored the surroundings to ensure the aircraft was not in close proximity to branches, and informed the pilot if any birds fled the hollows.

All accessible hollows with an entrance of 10 cm were examined with the RPA. Photographs were also taken as a visual reference and to aid future identification of the tree. These were also assessed in detail to determine if they represented suitable hollows and/or if they showed any signs of current or previous use by black-cockatoos (e.g. chew marks around hollow entrance, presence of chicks, eggs, feathers, chew/scratch marks).

Breeding suitability of the hollows examined was assessed against the criteria detailed in Table 4.2.

Table 4.2: Categories of hollow suitability for black-cockatoo nesting.

Category	Characteristics
Suitable with Evidence of Use	As for "Suitable" above, but also showing evidence of use that may be from black-cockatoos. The following represent the types of use that were searched for: • Fresh chews around the rim and inside of the hollow. • Freshly cleared vegetation around the entrance. • Eggs that were similar in appearance to those of black-cockatoos.
Suitable	• Entrance greater than 10 cm. • Branch width and depth large enough to support a nesting chamber. • Angle of entrance/egress suitable for black-cockatoo. • Entrance is clear of large branches would block access for black-cockatoo.
Not Suitable	Not a hollow, or hollow not suitable for black-cockatoo nesting.
Ground Assessment Only	The hollow could only be assessed from the ground due to limitations with RPA access (e.g. proximity to road traffic, within a prescribed no-fly zone, foliage covering hollow).

4.2.2 Foraging Habitat Assessment

Foraging habitat is defined as areas including plants of species known to support foraging within the range of each black-cockatoo species. While a broader range of species is utilised for foraging (including introduced species such as pines, **Pinus* spp.), Marri and Jarrah woodlands are particularly important to Baudin's Black-Cockatoo and the Forest Red-tailed Black-Cockatoo, while proteaceous heaths (i.e. shrublands dominated by *Banksia, Hakea* and *Grevillea* species) are also utilised by Carnaby's Black-Cockatoo (DSEWPaC 2012). The quality of the foraging habitat was scored using the elements of the habitat scoring tool described in the referral guideline (DotEE 2017) (Appendix 2).

The detailed vegetation mapping of the study area (Rathbone and Gilfillan 2018) was used in conjunction with the on-site breeding habitat assessment in order to apply the Foraging Habitat Scoring Tool (DotEE 2017) to the vegetation of the study area. Consideration was also given to the wider availability of foraging habitat for black-cockatoos by placing the study area in a 12 km context using mapping from the Albany Regional Vegetation Survey (Sandiford and Barrett 2010).

4.3 Survey Team and Timing

The field work was carried out over two phases, with the initial phase consisting of a habitat tree assessment, and the follow-up second phase involving investigation of hollows (>100 mm opening) potentially suitable for cockatoo nesting using a drone. The first phase was carried out over a period of three days from 5 – 7 August 2019 by two Biota biologists, Brandon King and Simon Colwill, together with Shane Priddle from Southwest Environmental. Shane Priddle and Brandon King carried out the assessment using the RPA in the following week, on 15 August 2019.

The survey timing fell within the recommended (DotEE 2017) South Coast regional window for Baudin's Black-cockatoo (March to September), as the species is likely to occur in foraging habitat and may occur in areas of the south coast region if breeding. Carnaby's Black-cockatoo would primarily occur in the Albany area from January to July to forage, following breeding further inland, however the species may also occur after July if breeding in local areas. Forest Red-tailed Black-Cockatoos are known to breed throughout the year.

The timing of the survey overlapped the beginning of the breeding period for the Carnaby's and Baudin's Black Cockatoo species, taking place near the end of winter, but was not within the usual peak breeding times.

A total of 46.2 mm of rainfall was recorded over the survey period from 5 – 14 August and temperatures were mild, ranging from a minimum of 8°C to a maximum of 21.6°C (data from the Bureau of Meteorology's Albany recording station (No. 9500)).

4.4 Legislation and Policy Conformance

All surveys were completed as far as practicable in accordance with relevant State and Commonwealth policy, and to a standard that would provide adequate information to assess the Proposal against principles and environmental aims relating to the environmental factor 'Terrestrial Fauna' (EPA 2016a).

Table 4.3 provides a summary of the most important and relevant legislation, policy and guidelines relating to this study.

Consistent with the most practically applicable and current policy in relation to the three black-cockatoo species occurring within South-west Western Australia, the current study primarily represents a habitat assessment, and as recommended under DSEWPaC (2012) the following was undertaken:

> *"Assess the extent, type and quality of the vegetation present, including the presence and extent of plants known to be used by the black cockatoos. In potential breeding habitat, measurements of the diameter at breast height of trees in the patch of woodland/forest must be made to determine whether the habitat meets the definition of 'breeding habitat'. Surveys for black cockatoo foraging habitat should be done in any remaining vegetation containing proteaceous heath/woodland, eucalypt woodlands or forest (particularly marri and jarrah forest) and in areas dominated by Pinus spp. Any area within the range of the black cockatoos that contains known food or nesting plant species is considered to be potential habitat for the species."*

While in draft form, the current assessment was conducted to the standard of "Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris* Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii* Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso"* (DotEE 2017), particularly in relation to assessment of foraging habitat.

Table 4.3: State and Commonwealth legislation, policy and guidelines of most relevance to this study.

Legislation, Guideline or Policy	Application to this Study	Regulating Authority
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act).	The Australian Government's central piece of environmental legislation.	The Department of the Environment and Energy
Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DotE 2013).	Details the species falling within the MNES category and what constitutes a significant impact.	The Department of the Environment and Energy
EPBC Act referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (DSEWPaC 2012)	Details distribution, ecology and recommended survey methodology.	The Department of the Environment and Energy

Legislation, Guideline or Policy	Application to this Study	Regulating Authority
Western Australia		
Biodiversity Conservation Act 2016 (BC Act) and Biodiversity Conservation Regulations 2018	Western Australia's central environmental legislation. Came into effect 1 January 2019 and replaces the *Wildlife Conservation Act 1950*.	Department of Biodiversity, Conservation and Attractions
Wildlife Conservation Act 1950 (WC Act)	Now defunct and replaced by the BC Act, however the most recently published Wildlife Conservation (Specially Protected Fauna) Notice 2018 under this act is current at time of writing.	Department of Biodiversity, Conservation and Attractions
Environmental Factor Guideline: Terrestrial Fauna (EPA 2016a).	Overall aim of the study is to provide adequate information to assess the proposal against the objective of the environmental factor Terrestrial Fauna; stated to be "To protect terrestrial fauna so that biological diversity and ecological integrity are maintained".	Environmental Protection Authority

4.5 Nomenclature

Consistent with the EPA (2016b) technical guidelines for terrestrial vertebrate fauna survey, the avifauna nomenclature is in accordance with Christidis and Boles (2008).

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5.0 Results

5.1 Desktop Review: Presence in the Local Area

NatureMap records indicate that all three species have distributions that include the study area; Albany represents the southeastern extent of the distribution of the Forest Red-tailed Black-cockatoo and is well within the distribution of both Carnaby's Black-cockatoo and Baudin's Black-cockatoo.

The two white-tailed black-cockatoo species appear to be most commonly recorded in the Albany area. For example, the Great Cocky Count assessed 22 potential roost sites in the Albany area in 2018 and recorded 557 white-tailed cockatoos (Peck et al. 2018), while no Forest Red-tailed Black-cockatoo individuals were recorded from roost sites. The study area occurs within 12 km of two roost sites assessed during the Great Cocky Count, identified by the suburb names 'Kalgan' (approximately 12 km northeast of the study area), at which 219 white-tailed black-cockatoos were recorded in the 2018 counts; and 'McKail' (within 2 km of the study area), where 49 white-tail black-cockatoos were recorded. An additional known roost site is known from Lake Seppings, 4.8 km from the study area, however, no cockatoos were recorded there during the 2018 count.

A resident population of Carnaby's Black-cockatoo is known to occur within the Stirling Range National Park (Everard and Bamford 2016) and the species has been recorded from the Porongurup National Park.

5.2 Suitable Diameter at Breast Height (DBH) Trees

A total of 516 'suitable DBH trees' (> 50 cm DBH) were recorded in the study area during the survey (Table 5.1). Tuart (historically planted), Marri and Jarrah accounted for the largest proportion of breeding habitat trees at 42%, 31% and 22% respectively. Only Jarrah and Marri trees were found to support hollows, and in some cases a single tree supported up to three hollows.

Table 5.1 Number of breeding habitat trees and hollows.

Tree Species	Breeding Habitat Trees	Number of Hollows
Corymbia calophylla (Marri)	162	20
Eucalyptus diversicolor (Karri)	9	0
Eucalyptus gomphocephala (Tuart)	216	0
Eucalyptus marginata (Jarrah)	112	28
Eucalyptus megacarpa (Bullich)	17	0
Total	516	48

5.3 Hollow Assessment

A total of 48 'hollows' with an entrance diameter greater than or equal to 10 cm were recorded in Jarrah and Marri. Overall, the large majority of hollows (86%) were marginal in entrance size suitability (between 10 and 15 cm), with only six hollows with entrance dimensions greater than 15 cm and the largest being 30 cm across. Hollow bearing trees had an average DBH of 71.1 ± 2.6 cm; on average, hollows were located 5.7 ± 0.47 m above the ground and were 13.2 ± 0.8 cm in diameter.

Based on the conservative criteria employed during the ground-assessment, 37 of the 48 hollows were considered to warrant further investigation using the RPA. Results from the follow-up survey indicated that none of the hollows were suitable for black-cockatoo nesting, primarily because the depth of the chambers was not adequate (Plate 5.1 - Plate 5.10). While not possible to

ascertain from the ground-assessment, images obtained from the RPA revealed that many of the 'hollows' were actually not hollow or lacked sufficient space for a black-cockatoo to turn around inside (see Plate 5.11 and Plate 5.12). One hollow was occupied by a Common Brushtail Possum and another by feral bees.

The Tuart (*Eucalyptus gomphocephala*) occurring within the study area are not native and have been planted quite a few decades ago as indicated by their DBH but none were found to support hollows. However, Tuarts do have the potential to form hollows and are recognised as important breeding trees on the Swan Coastal Plain (Johnstone et al. 2010).

Plate 5.1: Pic 1_0002. Drone tree ARR_01; spout trunk, 14 cm diameter, depth inadequate.

Plate 5.2: Pic 2_0007.

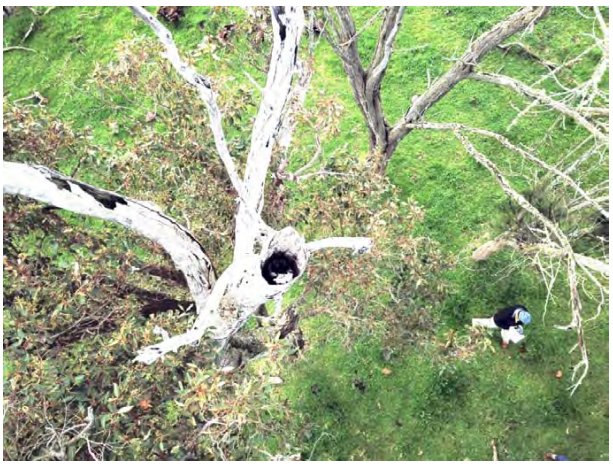

Plate 5.3: Pic 3_0013.

Plate 5.4: Pic 4_0025.

Plate 5.5: Pic 6_0030.

Plate 5.6: Pic 10_0044.

Plate 5.7: Pic 12_059.

Plate 5.8: Pic 19_0069.

Plate 5.9: Pic 20_0083.

Plate 5.10: Pic 22_0094.

Plate 5.11: Tree ARR_21; drone image before contrast manipulation.

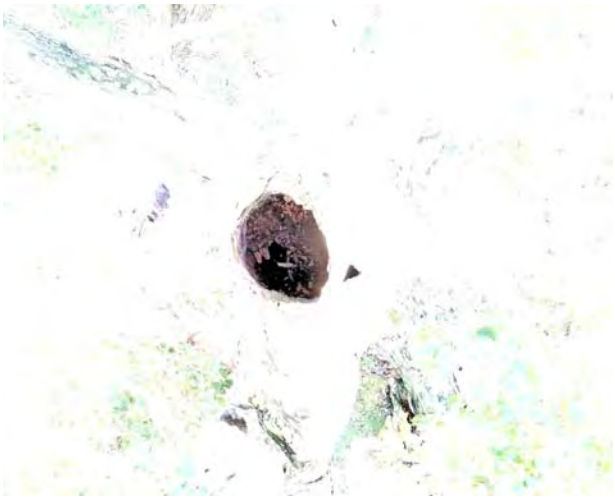

Plate 5.12: Tree ARR_21; drone image after contrast manipulation.

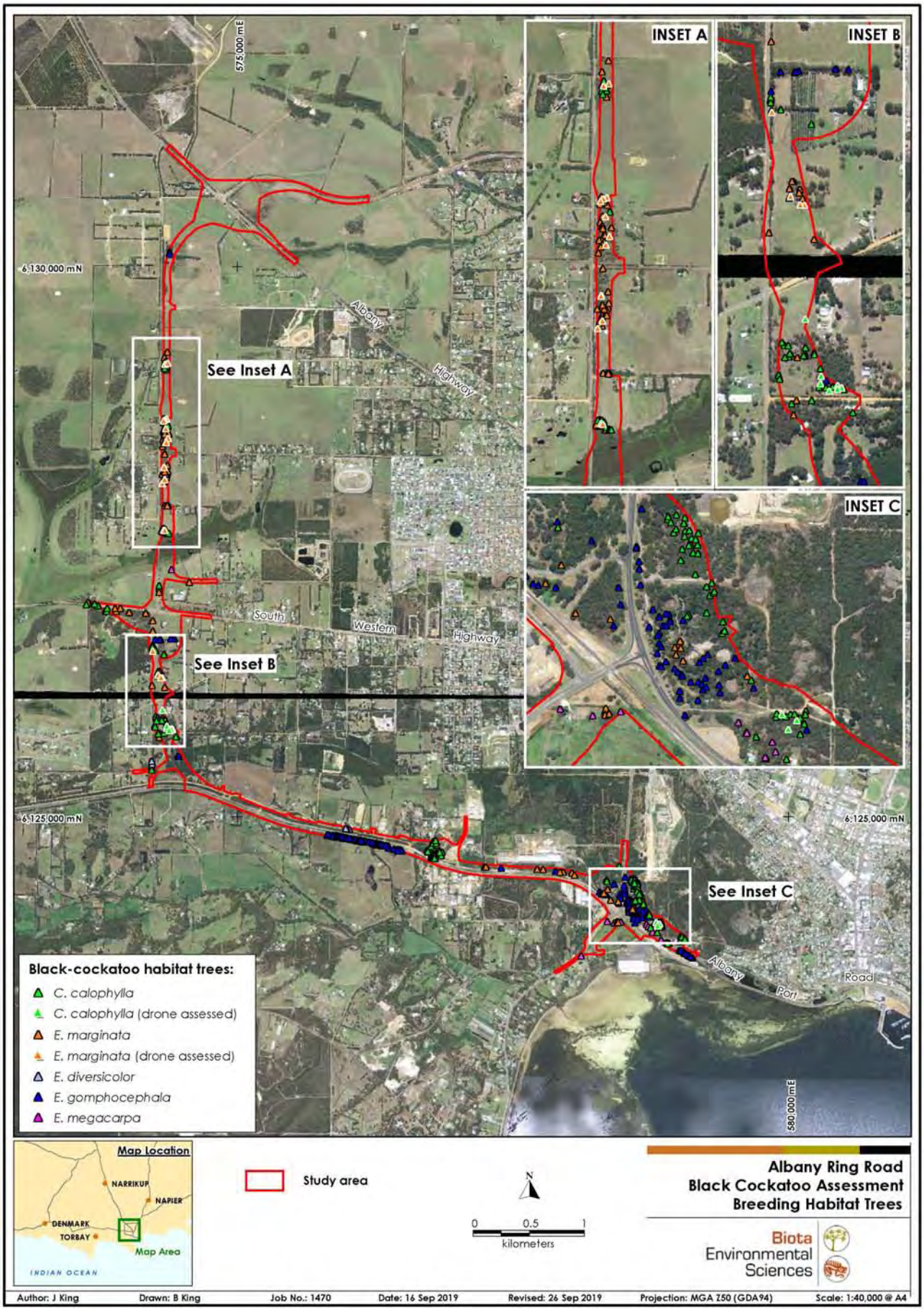

Figure 5.1: Black-cockatoo habitat trees recorded within the study area.

5.4 Foraging Habitat Assessment

The 185.0 ha study area includes 111.8 ha of cleared land, which is devoid of black-cockatoo foraging, breeding or roosting habitat. Using the detailed vegetation mapping of the study area prepared by Rathbone and Gilfillan (2018) as a guide, four vegetation units totalling 17.4 ha of native vegetation are likely to represent black-cockatoo foraging habitat. The foraging habitat quality score for each of these four vegetation units is shown in Table 5.2, while the scoring details are provided in Appendix 3. The distribution of this foraging habitat over the study area is shown in Figure 5.2. Table 5.3 includes descriptions of those vegetation units that are largely devoid of black-cockatoo foraging plants, however, in some areas of revegetation Jarrah and Marri have been planted which represent foraging plants.

Foraging habitat within the study area was largely represented by areas of Marri and Jarrah woodland, and evidence of all three species of black-cockatoo species utilising this habitat type has been previously described from characteristic chew marks on Marri nuts (Rathbone and Gilfillan 2018). The following vegetation units as described by Rathbone and Gilfillan (2018) were considered to represent the primary foraging habitat within the study area.

- Jarrah/Marri/Sheoak Laterite Forest with additional foraging plants including *Banksia grandis*, *Persoonia longifolia* and *Hakea amplexicaulis*;
- Marri/Jarrah Forest/Peppermint Woodland;
- Hakea spp. Shrubland/Woodland Complex with additional foraging plants including *E. marginata* and *Allocasuarina fraseriana;* and,
- Jarrah/Sheoak/*E. staeri* Sandy Woodland with additional foraging plants include *Banksia grandis* and *Hakea ruscifolia.*

In addition to these vegetation units, planted *Pinus radiata*, Jarrah and Marri occurred throughout the study area and also represent potential foraging habitat.

The Foraging Habitat Scoring Tool (DotEE 2017) has been applied to each vegetation type to assist with planning and offsetting (Table 5.2). It is important to note that the study area includes a buffer on the actual project disturbance footprint. Taking the entire study area into account, a starting score of High Quality is appropriate in many cases, as more than individual plants or small stands are included within this boundary, however, this is not necessarily the case for the smaller disturbance footprint, which should be scored separately.

Areas of Jarrah/Marri woodland returned foraging habitat scores indicative of very high quality for all three species of black-cockatoo. Areas largely devoid of Marri received lower scores for Baudin's Black-Cockatoo and Carnaby's Black-Cockatoo (ranging from Low Quality to Quality). The scattered *Pinus radiata* throughout the study area were considered to represent singular/small groups of foraging plants for Baudin's Black-Cockatoo and Carnaby's Black-Cockatoo, and as such qualified for a score indicating quality foraging habitat.

The Foraging Habitat Scoring Tool does include criteria that adjust the quality score downward, such as greater distances from known breeding areas and roosting sites. The study area occurs within the known breeding ranges of all three species as mapped in DotEE (2017), so no negative adjustments were applied on this basis. With regards to roosting sites, the Great Cocky Count includes at least two sites within 12 km of the study area, with white-tailed black-cockatoos recorded at both in 2018. In general, numbers of Forest Red-tailed Black-Cockatoos roosting in the vicinity of Albany are lower: no birds were recorded at roosts within 12 km of the study area in 2018, while in 2017 only 22 birds were recorded across the two roosts.

Table 5.2: Application of the Foraging Habitat Scoring Tool (DotEE 2017).
Low quality – 1-3; quality 4 – 5; high quality 6-7; very high quality 8-10.

Vegetation Unit	Area (ha)	Score		
		Baudin's	Carnaby's	Forest Red-tailed
Jarrah/Marri/Sheoak Laterite Forest	5.9	10	9	10
Marri/Jarrah Forest/Peppermint Woodland	5.7	10	9	10
Hakea spp. Shrubland/Woodland Complex	4.4	2	5	3
Jarrah/Sheoak/*E. staeri* Sandy Woodland	1.4	4	3	10
Planted *Pinus radiata*	-	4	0	-
Planted Jarrah and Marri	-	6	3	1

Table 5.3: Vegetation units (Rathbone and Gilfillan 2018) largely devoid of black-cockatoo foraging plants.

Vegetation Units	Area (ha)
Cleared	111.8
Revegetation or Plantation[1]	33.2
Taxandria juniperina Closed Forest	5.9
>75% Invasive Weeds	5.6
Homalospermum firmum/*Callistemon glaucus* Peat Thicket[2]	4.8
Peppermint Low Forest	1.1
Mosaic *T. marginata*/*Gastrolobium bilobum* Granite Shrubland/Yate Woodland	1.0
Evandra aristata Sedgeland	0.5
Taxandria marginata Granite Shrubland	0.3
Melaleuca preissiana Low Woodland	0.1
Total	164.3

1. includes some individual *Pinus radiata* trees.
2. *Callistemon* may be a foraging plant for Carnaby's Black-Cockatoo.

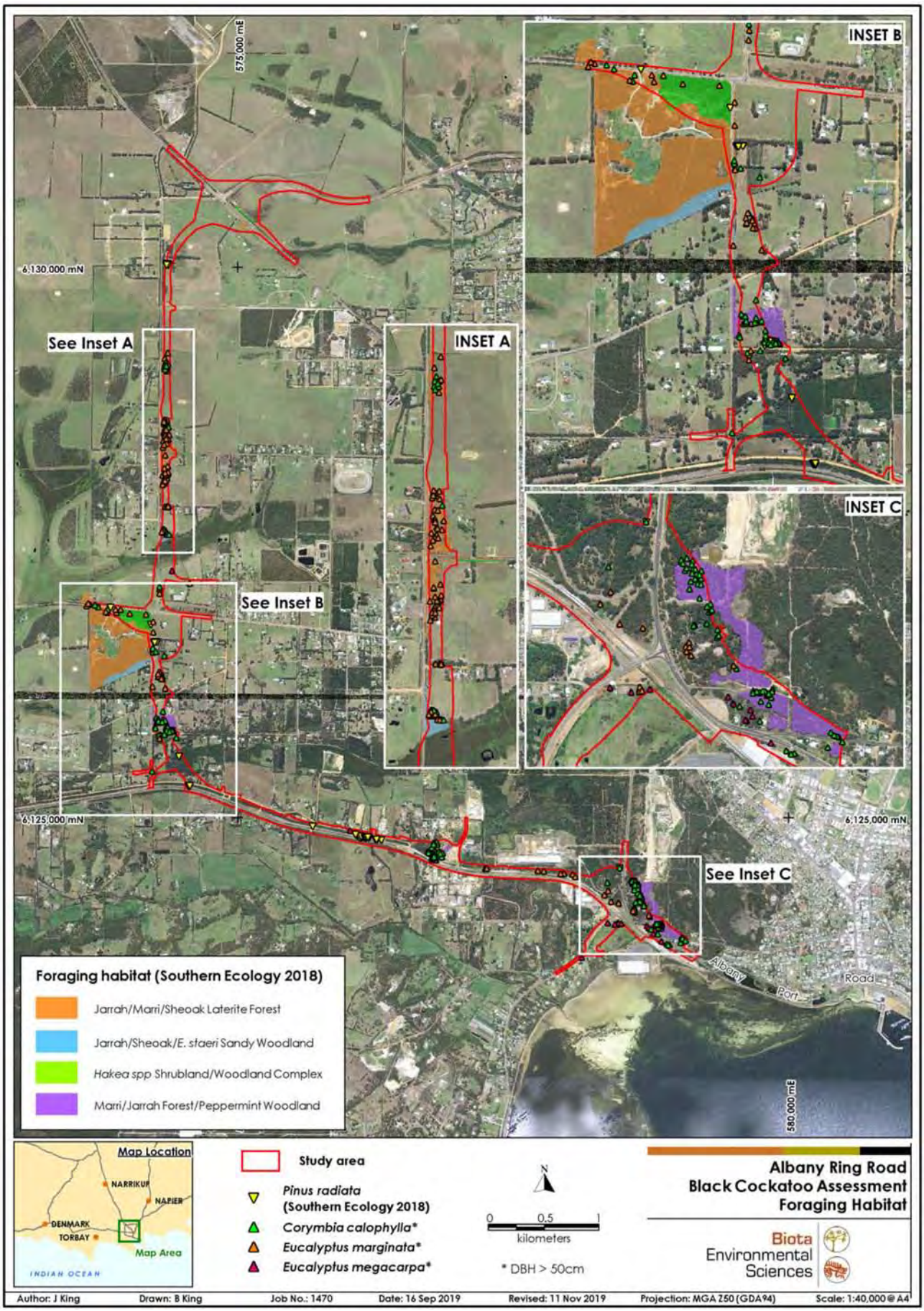

Figure 5.2: Potential black-cockatoo foraging habitat within the study area.

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6.0 Discussion

Within the Ultimate Footprint study area, up to 516 'suitable DBH trees' and 48 hollows were identified and marked. None of the 37 hollows followed up during the RPA assessment were found to be suitable for nesting. For the most part, the dimensions of the hollow entrances were marginal and caverns inside were far too small to support nesting.

The black-cockatoo foraging habitat within the study area has been considered in the context of wider availability using the meso-scale mapping of concordant vegetation units from the Albany Regional Vegetation Survey (Sandiford and Barrett 2010), out to a radius of 12 km around the study area (see Figure 6.1). This radius was chosen as it represents the typical maximum distance that black-cockatoos will fly from roosting locations to forage, under the hypothetical premise that cockatoos were roosting within the study area. The areas of each vegetation unit within the study area and in a 12 km radius are detailed in Table 6.1, while their occurrence is illustrated in Figure 6.1. In the immediate vicinity of the study area, the same foraging vegetation units occur within the Albany Mounts and in the crown reserve south-west of the intersection of South Coast Highway and George Street. Larger swathes of these same vegetation units are found within the Stirling Range National Park, Down Road Nature Reserve and Bakers Junction Nature Reserve.

Table 6.1: Foraging habitat within the study area and ARVS equivalent within 12 km.

Study Area	ARVS Code	Complex Definition	Within Study Area (ha)	Within 12 km (ha)
Afra/Emar/Ccal/Athe	12a	Jarrah/Marri/Sheoak Laterite Forest	5.9	5,077.5
Ccal/Afle	10	Marri/Jarrah Forest/Peppermint Woodland	5.7	475.8
Hspp/Complex	31	Hakea spp. Shrubland/Woodland Complex	4.4	1,101.8
Emar/Afra/Esta	13	Jarrah/Sheoak/*E. staeri* Sandy Woodland	1.4	2,101.7
		Total	17.4	8,756.8

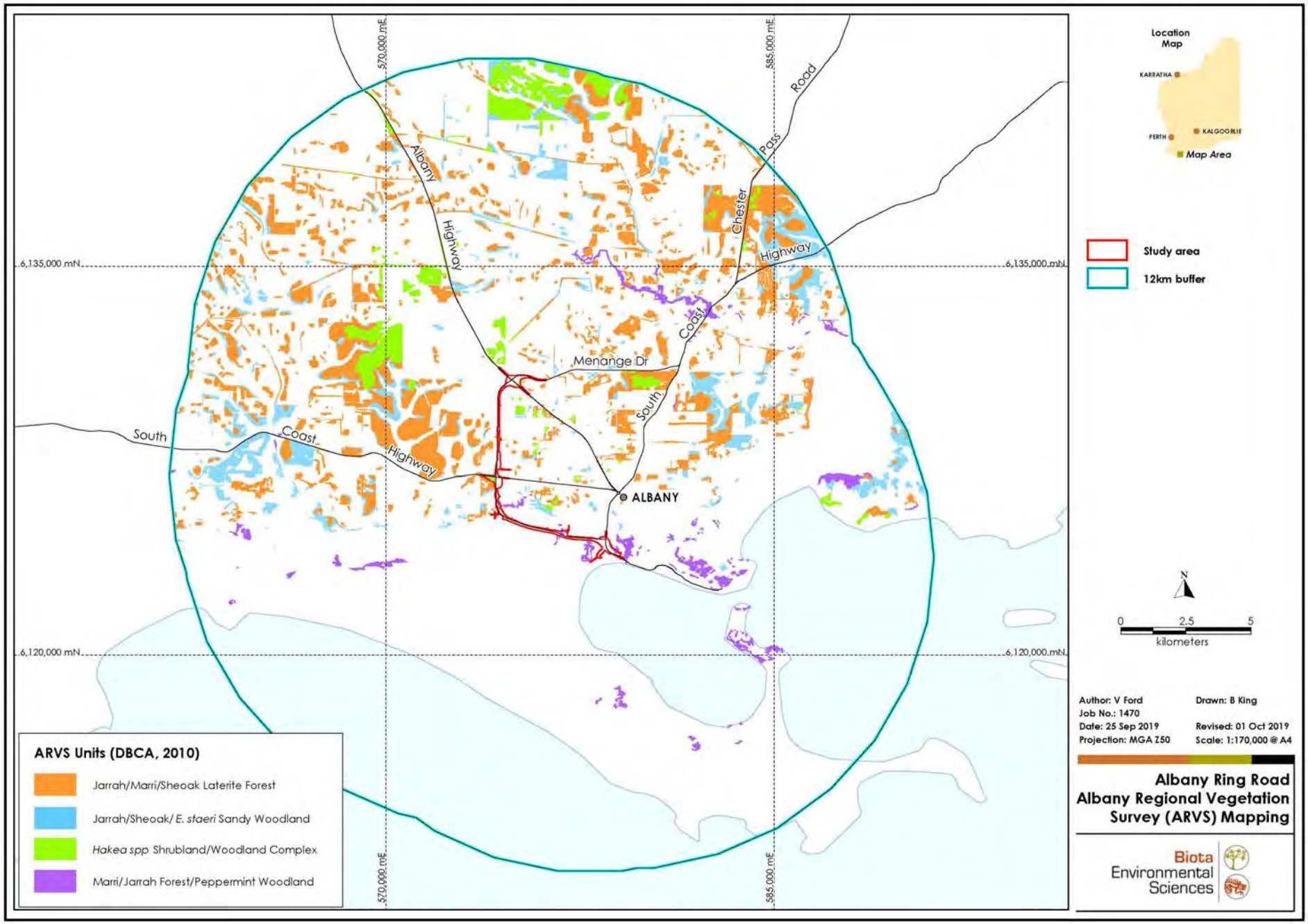


Figure 6.1: Extent of the vegetation units found within the study area in a 12 km radius based on the Albany Regional Vegetation Survey (Sandiford and Barrett 2010).

7.0 References

Christidis, L., and W. E. Boles (2008). *Systematics and Taxonomy of Australian Birds*. CSIRO Publishing, Melbourne.

DotE (2013). Matters of National Environmental Significance - Significant Impact Guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999*. Department of the Environment, Canberra, Australia.

DotEE (2017). Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). Department of the Environment and Energy, Commonwealth of Australia.

DSEWPaC (2012). EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered), *Calyptorhynchus latirostris*; Baudin's cockatoo (vulnerable), *Calyptorhynchus baudinii*; Forest red-tailed black cockatoo (vulnerable), *Calyptorhynchus banksii naso*. Department of Sustainability, Environment, Water, Population and Communities, Commonwealth of Australia.

EPA (2016a). *Environmental Factor Guideline: Terrestrial Fauna*. Environmental Protection Authority, Western Australia.

EPA (2016b). *Technical Guidance: Terrestrial Fauna Surveys*. Environmental Protection Authority, Western Australia.

Everard, C., and M. Bamford (2016). Southdown Magnetite Project Summary of studies and impact assessment Carnaby's Black-Cockatoo (Rev 12.7). Unpublished Report for Southdown Joint Venture, Bamford Consulting Ecologists.

Johnstone, R. E., C. Johnstone, and T. Kirkby (2010). Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin – Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes. Department of Planning, Western Australia.

Johnstone, R. E., and T. Kirkby (2008). Distribution, status, social organisation, movements and conservation of Baudin's Cockatoo (*Calyptorhynchus baudinii*) in South-west Western Australia. *Records of the Western Australian Museum* 25:107–118.

Johnstone, R. E., and T. Kirkby (2011). Black Cockatoos on the Swan Coastal Plain. Department of Planning, Western Australia.

Johnstone, R. E., T. Kirkby, and K. Sarti (2013). The breeding biology of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* Gould in south-western Australia. I. Characteristics of nest trees and nest hollows. *Pacific Conservation Biology* 19:121–142. doi: 10.1071/PC130121.

Johnstone, R. E., and G. M. Storr (1998). *Handbook of Western Australian Birds Volume I - Non-Passerines (Emu to Dollarbird)*. Western Australian Museum, Perth.

Peck, A., G. Barrett, and M. Williams (2018). The 2018 Great Cocky Count: A community-based survey for Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*). BirdLife Australia, Floreat, Western Australia.

Rathbone, D., and S. Gilfillan (2018). Biological Survey: Albany Ring Road. Southern Ecology, Torbay WA.

Sandiford, E. M., and S. Barrett (2010). Albany regional vegetation survey: Extent, type and status. A project funded by Western Australian Planning Commission (EnviroPlanning "Integrating NRM into Land Use Planning" and State NRM Program), South Coast Natural Resource Management Inc. and City of Albany for the Department of Environment and Conservation, Department of Environment and Conservation, Western Australia.

Saunders, D. A. (1979). Distribution and Taxonomy of the White-tailed and Yellow-tailed Black-Cockatoos *Calyptorhynchus* spp. *Emu* 79:215–227.

Saunders, D. A., R. Dawson, A. Doley, J. Lauri, A. Le Souef, P. R. Mawson, K. Warren, and N. White (2014a). Nature conservation on agricultural land: a case study of the endangered Carnaby's Cockatoo *Calyptorhynchus latirostris* breeding at Koobabbie in the northern wheatbelt of Western Australia. *Nature Conservation* 9:19–43.

Saunders, D. A., P. Mawson, and R. Dawson (2011). The impact of two extreme weather events and other causes of death on Carnaby's Black Cockatoo: a promise of things to come for this species? *Pacific Conservation Biology* 17:141–148. doi: https://doi.org/10.1071/PC110141.

Saunders, D. A., P. R. Mawson, and P. R. Dawson (2014b). Use of tree hollows by Carnaby's Cockatoo and the fate of large hollow-bearing trees at Coomallo Creek, Western Australia 1969–2013. *Biological Conservation* 177:185–193. doi: https://doi.org/10.1016/j.biocon.2014.07.002.

Serventy, D. L., and H. M. Whittell (1976). *Birds of Western Australia*. University of Western Australia Press.

Whitford, K., and M. R. Williams (2002). Hollows in jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) trees II. Selecting trees to retain for hollow dependent fauna. *Forest Ecology and Management* 160:215–232.

Appendix 1

Tree Hollow Data

Flora Species	DBH (mm)	Latitude	Longitude	Number of Hollows	Hollow Size/s (mm)	Comment
Corymbia calophylla	500	-35.0176983	117.8421097	2	100,100	Ground assessment: Hollow(s) not suitable for BC nesting
Corymbia calophylla	500	-35.0233359	117.8641153	1	150	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	550	-35.02327559	117.8636603	1	100	Ground assessment: Hollow(s) not suitable for BC nesting
Corymbia calophylla	550	-34.9914124	117.8145234	1	100	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	610	-35.0232296	117.8637886	2	100,100	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	700	-35.0077357	117.8155675	1	100	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	740	-35.0076863	117.8154499	1	300	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	750	-35.0077681	117.8154498	1	100	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	770	-35.0176226	117.8422384	2	100,100	Ground assessment: Hollow(s) not suitable for BC nesting
Corymbia calophylla	850	-35.020017	117.8616057	1	200	Ground assessment: Hollow(s) not suitable for BC nesting
Corymbia calophylla	870	-35.0076482	117.814969	1	150	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	920	-35.0061519	117.8145263	2	150,100	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	950	-35.0074739	117.8149892	1	200	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	1010	-35.0234957	117.8639284	2	100,100	Drone result: Unlikely suitable for BC nesting
Corymbia calophylla	1080	-35.0078189	117.8152168	1	150	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	500	-34.9862827	117.8144703	2	100,100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	500	-34.9778163	117.814501	1	120	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	520	-34.9772517	117.8144266	2	300,100	Ground assessment: Hollow(s) not suitable for BC nesting
Eucalyptus marginata	530	-34.9777293	117.814756	1	100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	560	-34.9823121	117.8147209	1	100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	570	-34.9823641	117.8145375	1	150	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	570	-34.9914377	117.8146041	1	100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	580	-34.9837872	117.8145984	1	100	Ground assessment: Hollow(s) not suitable for BC nesting
Eucalyptus marginata	600	-34.9830831	117.8146528	1	120	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	600	-34.9840263	117.8143454	1	100	Ground assessment: Hollow(s) not suitable for BC nesting
Eucalyptus marginata	630	-34.9862442	117.8144751	1	100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	650	-34.98421394	117.8145071	1	100	Ground assessment: Hollow(s) not suitable for BC nesting
Eucalyptus marginata	680	-34.983879	117.8148551	1	120	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	720	-34.9914673	117.8142802	1	100	Ground assessment: Hollow(s) not suitable for BC nesting
Eucalyptus marginata	730	-34.99167898	117.8148354	1	100	Ground assessment: Hollow(s) not suitable for BC nesting
Eucalyptus marginata	730	-35.0013403	117.8135289	1	100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	730	-34.9875881	117.8143155	2	100,100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	750	-35.0029378	117.8141212	1	100	Ground assessment: Hollow(s) not suitable for BC nesting
Eucalyptus marginata	770	-34.98421476	117.8146859	1	200	Drone result: Unlikely suitable for BC nesting

Flora Species	DBH (mm)	Latitude	Longitude	Number of Hollows	Hollow Size/s (mm)	Comment
Eucalyptus marginata	820	-35.0034959	117.8144761	2	200,100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	870	-35.0032962	117.8140749	1	120	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	910	-34.9872888	117.8145547	1	100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	930	-34.9824702	117.8144144	1	100	Drone result: Unlikely suitable for BC nesting
Eucalyptus marginata	950	-35.0034871	117.8143589	1	100	Drone result: Unlikely suitable for BC nesting

Appendix 2

Foraging Habitat Scoring Tool

Table 3: Foraging habitat scoring tool

Starting Score	Foraging habitat for Carnaby's Cockatoo	Foraging habitat for Baudin's Cockatoo	Foraging habitat for Forest Red-tailed Black cockatoo
10 (Very high quality)	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful **rehabilitation**, and/or has some level of **protection** from clearing, and/or is quality habitat described below with attributes contributing to meet a sore of ≥10.	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of, successful **rehabilitation**, and/or has some level of **protection** from clearing, and/or is quality habitat described below with attributes contributing to meet a sore of ≥10.	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful **rehabilitation**, and/or has some level of **protection** from clearing, and/or is quality habitat described below with attributes contributing to meet a sore of ≥10.
7 (High quality)	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as *Banksia* spp. (including *Dryandra* spp.), *Hakea* spp. and *Grevillea* spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under a RFA.	Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. Does not include orchards or areas under a RFA.	Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under a RFA.
5 (Quality)	Pine plantation or introduced eucalypts.	Pine plantation or introduced eucalypts.	Introduced eucalypts as well as the introduced Cape lilac (*Melia azedarach*).
1 (Low quality)	Individual foraging plants or small stand of foraging plants.	Individual foraging plants or small stand of foraging plants.	Individual foraging plants or small stand of foraging plants.
Additions	**Context adjustor - attributes improving functionality of foraging habitat**	**Context adjustor - attributes improving functionality of foraging habitat**	**Context adjustor - attributes improving functionality of foraging habitat**
+3	Is within the Swan Coastal Plain (important foraging area).	Is within the known foraging area (see map).	Jarrah and/or marri show good recruitment (i.e. evidence of young trees).
+3	Contains trees with suitable nest hollows.	Contains trees with suitable nest hollows.	Contains trees with suitable nest hollows.
+2	Primarily comprises marri.	Primarily contains marri.	Primarily contains marri and/or jarrah.
+2	Contains trees with potential to be used for breeding (dbh ≥ 500 mm or ≥ 300 mm dbh for salmon gum and wandoo).	Contains trees with potential to be used for breeding (dbh ≥ 500 mm or ≥ 300 mm dbh for salmon gum and wandoo).	Contains trees with potential to be used for breeding (dbh ≥ 500 mm or ≥ 300 mm dbh for salmon gum and wandoo).
+1	Is known to be a roosting site.	Is known to be a roosting site.	Is known to be a roosting site.
Subtractions	**Context adjustor - attributes reducing functionality of foraging habitat**	**Context adjustor - attributes reducing functionality of foraging habitat**	**Context adjustor - attributes reducing functionality of foraging habitat quality**
-2	No clear evidence of feeding debris.	No clear evidence of feeding debris.	No clear evidence of feeding debris.
-2	No other foraging habitat within 6 km.	No other foraging habitat within 6 km.	No other foraging habitat within 6 km.
-1	Is > 12 km from a known breeding location.	Is > 12 km from a known breeding location.	Is > 12 km from a known breeding location.
-1	Is > 12 km from a known roosting site.	Is > 12 km from a known roosting site.	Is > 12 km from a known roosting site.
-1	Is > 2 km from a watering point.	Is > 2 km from a watering point.	Is > 2 km from a watering point.
-1	Disease present (e.g. *Phytophthora cinnamomi* or marri canker).	Disease present (e.g. *Phytophthora cinnamomi* or marri canker).	Disease present (e.g. *Phytophthora cinnamomi* or marri canker).

Appendix 3

Foraging Habitat Scoring

Appendix 3.1: Carnaby's Black-Cockatoo

Vegetation Description	Starting Score	+3: Is within the Swan Coastal Plain (important foraging area).	+3: Contains trees with suitable nest hollows.	+2: Primarily comprises Marri	+2: Contains trees with potential to be used for breeding (DBH ≥ 50 cm)	+1: Is known to be a roosting site	-2: No clear evidence of feeding debris	-2 No other foraging habitat within 6 km	-2: Is >12 km from a known breeding location	-1: Is >12 km from a known roosting site	-1: Is >2 km from a watering point	-1: Disease present (e.g. *Phytophthora cinnamomi* or marri canker)	Final Score
Jarrah/Marri/Sheoak Laterite Forest	7				2								9
Marri/Jarrah Forest/Peppermint Woodland	5			2	2								9
Hakea spp. Shrubland/Woodland Complex	7						-2						5
Jarrah/Sheoak/*E. staeri* Sandy Woodland	1				2								3
Planted *Pinus radiata*	1						-2						0
Planted Jarrah and Marri	1				2								3

Appendix 3.2: Baudin's Black-Cockatoo

Vegetation Description	Starting Score	+3: Is within the known foraging area	+3: Contains trees with suitable nest hollows.	+2: Primarily comprises Marri	+2: Contains trees with potential to be used for breeding (DBH ≥ 50 cm)	+1: Is known to be a roosting site	-2: No clear evidence of feeding debris	-2 No other foraging habitat within 6 km	-2: Is >12 km from a known breeding location	-1: Is >12 km from a known roosting site	-1: Is >2 km from a watering point	-1: Disease present (e.g. *Phytophthora cinnamomi* or marri canker)	Final Score
Jarrah/Marri/Sheoak Laterite Forest	7	3			2								12
Marri/Jarrah Forest/Peppermint Woodland	7	3		2	2								14
Hakea spp. Shrubland/Woodland Complex	1	3					-2						2
Jarrah/Sheoak/*E. staeri* Sandy Woodland	1	3			2								4
Planted *Pinus radiata*	1	3											4
Planted Jarrah and Marri	1	3			2								6

Appendix 3.3: Forest Red-tailed Black-Cockatoo

Vegetation Description	Starting Score	+3: Jarrah shows good recruitment.	+3: Contains trees with suitable nest hollows.	+2: Primarily Contains Marri and/or Jarrah	+2: Contains trees with potential to be used for breeding (DBH ≥ 50 cm)	+1: Is known to be a roosting site	-2: No clear evidence of feeding debris	-2 No other foraging habitat within 6 km	-2: Is >12 km from a known breeding location	-1: Is >12 km from a known roosting site	-1: Is >2 km from a watering point	-1: Disease present (e.g. *Phytophthora cinnamomi* or marri canker)	Final Score
Jarrah/Marri/Sheoak Laterite Forest	7	3		2	2								14
Marri/Jarrah Forest/Peppermint Woodland	7	3		2	2								14
Hakea spp. Shrubland/Woodland Complex	1	3											4
Jarrah/Sheoak/*E. staeri* Sandy Woodland	7	3			2		-2						10
Planted *Pinus radiata*	–												–
Planted Jarrah and Marri	1				2		-2						1

Appendix D – Albany Ring Road Stage 2 and 3b WRP Management Plan

Albany Ring Road Stage 2 and 3b

WESTERN RINGTAIL POSSUM MANAGEMENT PLAN

D19#1025140
March 2020

Contents

Amendments

Author / Reviewer	Name and Position	Revision Number	Revision Date
Author	P. West Senior Environmental Officer	Rev A	4/12/2019
Review	ARR Team	Rev 0	4/12/2019

1 BACKGROUND

Main Roads is proposing to construct the Albany Ring Road (ARR) to provide for the long-term transport needs of Albany and is the culmination of decades of planning. The ARR is a dedicated freight route around the City of Albany, in the Great Southern Region of Western Australia (WA). The ARR is intended to be the priority route for freight movement to and from the Port of Albany. The ARR will cater for the travel demands associated with growth in grain, woodchip and other agricultural industries, increased mining production, continued population growth and urban expansion and an expected increase in the number of tourists visiting the region.

The Proposal being referred (Stage 2 and 3b) by Main Roads Western Australia includes the construction of approximately 5 km of new dual carriageway within a footprint area of approximately 137.7 ha**.** The Proposal Area has been significantly altered by human activities, with approximately 58.3 ha (or 42.3 per cent) of the Proposal Area being cleared of native vegetation. Exploiting the paddock cleared landscape has been a key consideration in selection of the alignment and has limited clearing impacts to up to 29.4 ha of native vegetation and 34.4 ha of non-native vegetation (plantation or revegetation).

The Proposal will require the clearing of up to 29.4 ha of native vegetation which provides habitat for the conservation significant (Threatened, Critically Endangered) Western Ringtail Possum (*Pseudocheirus occidentalis*). Evidence of the presence of Western Ringtail Possum (WRP) was recorded during surveys of the Proposal Area and density estimates for the area have identified that the Proposal may intrude on the home ranges of up to 26 individual WRPs.

2 OBJECTIVE AND SCOPE

2.1 Objective

This WRP Management Plan (WRPMP) has been prepared to:

- Reduce potential impacts on individual WRPs.
- Provide for the management of any WRPs encountered during road construction.

The management measures have been developed with the objective of minimising the risk of injury or mortality to any WRP encountered during the clearing operations.

2.2 Scope

The WRPMP highlights the key management actions to be undertaken during clearing operations. The scope of the WRPMP is to define actions to manage interactions with WRP during clearing operations and to allocate areas of responsibility for the implementation of those actions. Timeframes for the completion of actions and monitoring are also provided.

3 IMPLEMENTATION

3.1 Implementation Responsibility

Main Roads Western Australia is responsible for the implementation of this WRPMP. Details of management measures, responsibilities, monitoring and reporting requirements are detailed in Appendix A.

Appendix A will be incorporated into the project specific Construction Environmental Management Plan (CEMP) to be prepared for the clearing operations, and included in contract documents and specifications used by Main Roads in engaging contractors and sub-contractors to work on the Project.

3.2 Monitoring

The Contractor shall monitor compliance with the WRP during the construction period. Monitoring of work activities (including subcontractors) must be conducted as an on-going activity during the normal supervision of works. Records of such surveillance should be kept if any significant issues are observed and should be documented as an information sheet or a diary note as appropriate.

3.3 Project Delivery and Accountability

Main Roads western Australia will manage the Project which will be implemented by appropriately experienced construction Contractors through a formal contractual arrangement.

For the purposes of this WRPMP the following definitions of roles and responsibilities have been used:

Role Defined in HMP	Potential Roles
Project Manager	Main Roads Delivery Manager Roads, Main Roads Contract Manager or Main Roads Superintendent's Representative
Contractor	Private Construction Contractor engaged by Main Roads
Construction Engineer	Main Roads Site Manager, Main Roads Contract Manager and/or Construction Contractor Site Manager
Environmental Officer	Main Roads Project Environmental Manager or Environmental Officer and/or Contractor's Site Environmental Representative

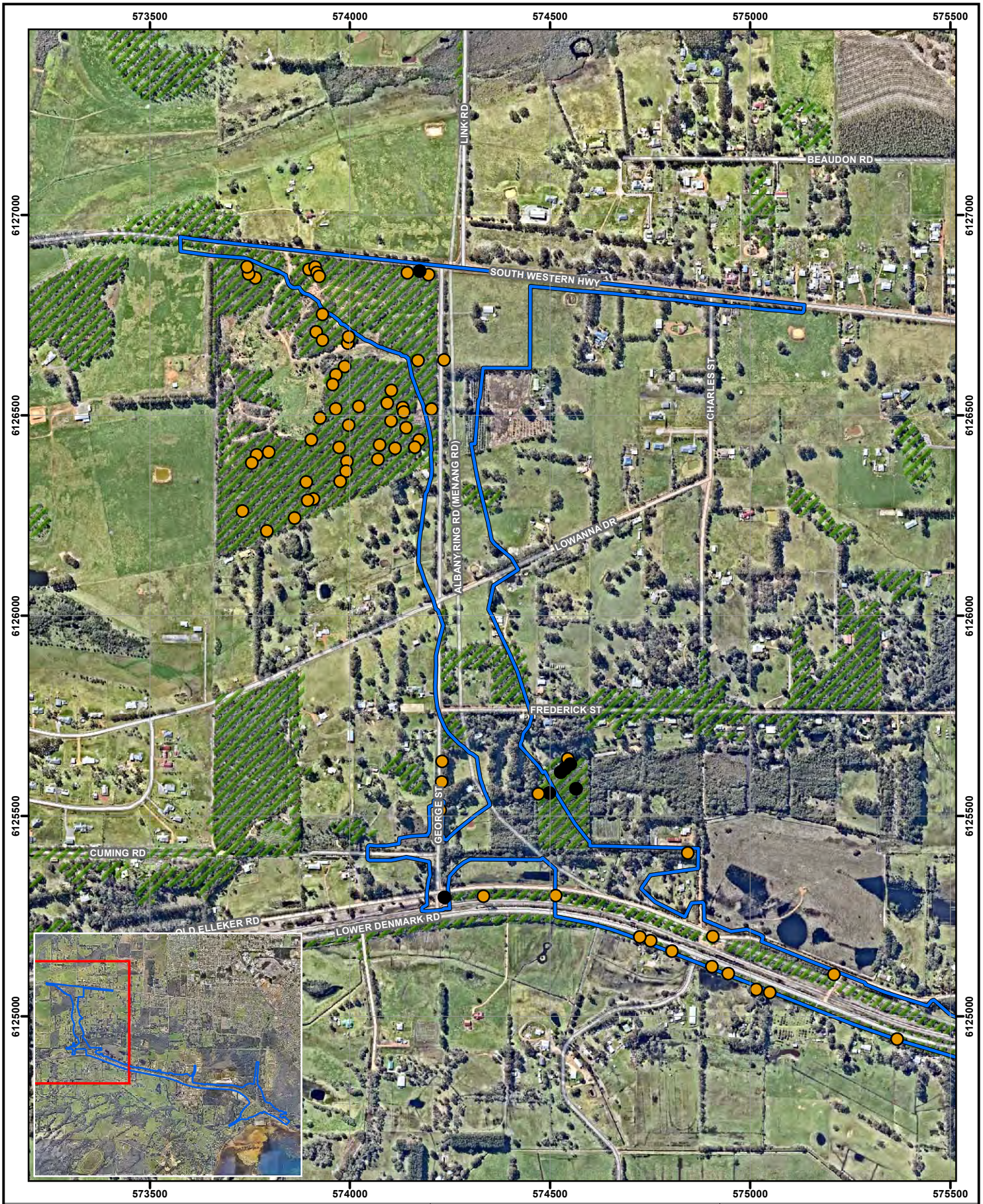
3.4 Communication

WRP management will be communicated at induction, toolbox or contract meetings. Relevant management measures detailed in the WRPMP will be communicated to project and construction personnel, (including sub-contractors) prior to the commencement of project activities and during project implementation.

4 APPENDICES

Appendix	Title
Appendix A	Project Locality Plan and Identified WRP Habitat
Appendix B	Western Ringtail Possum Management Plan

Appendix A: Project Locality Plan and Identified WRP Habitat



Legend:

- Proposal area
- Western Ringtail Possum Hhbitat
  - Supporting
- Conservation significant fauna observations
  - Western Ringtail Possum scats
  - Western Ringtail Possum drey
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

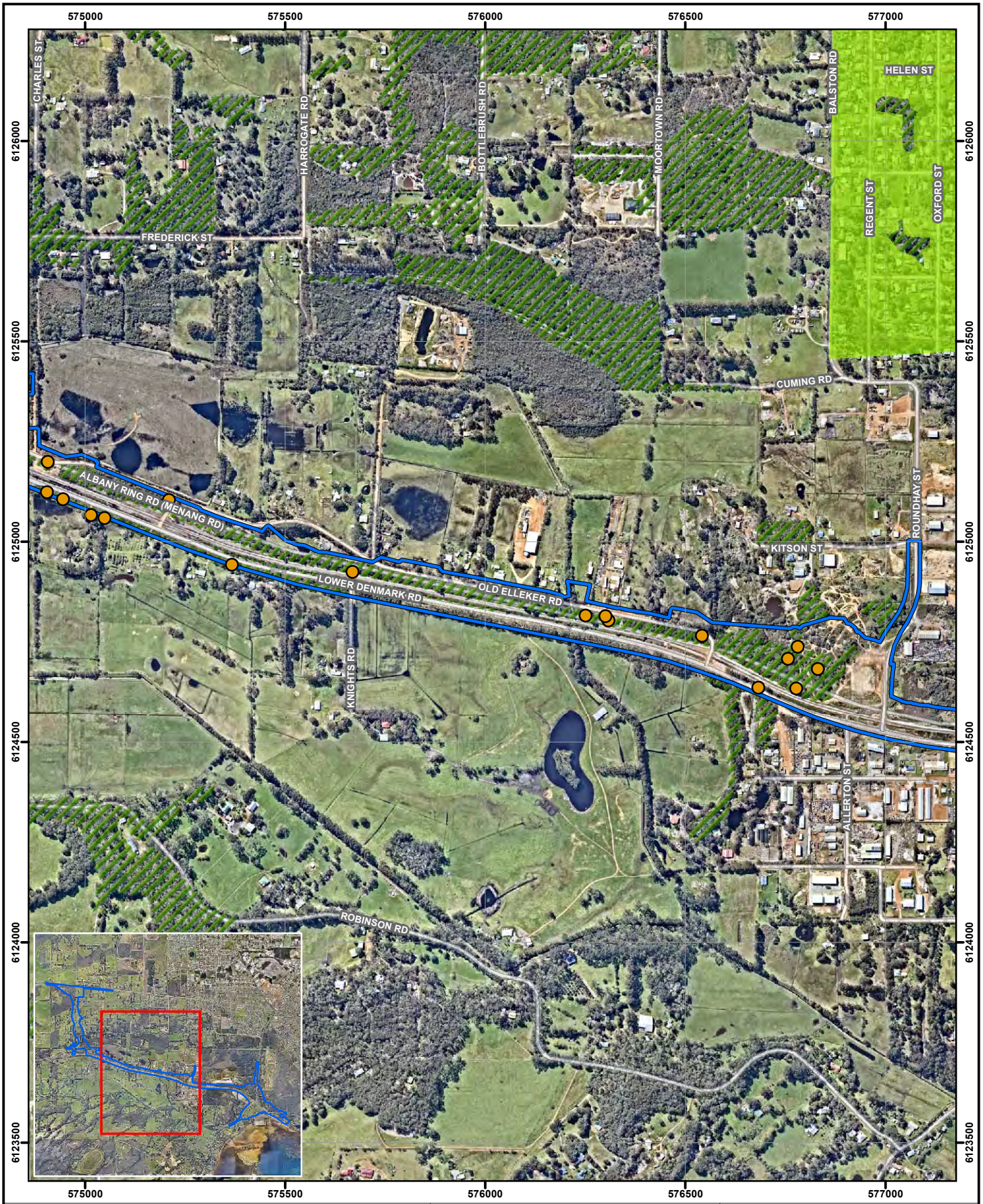
Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B
Appendix A: Project Locality Plan and Identified Western Ringtail Possum Habitat

FIGURE 1 PAGE 1 OF 3

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_11_WRPHab.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Proposal area
- Western Ringtail Possum Hhbitat
  - Core (Urban)
  - Supporting
- Conservation significant fauna observations
  - Western Ringtail Possum scats
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B
Appendix A: Project Locality Plan and Identified Western Ringtail Possum Habitat

FIGURE 1 PAGE 2 OF 3

mainroads WESTERN AUSTRALIA

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Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.

Legend:

- Proposal area

Western Ringtail Possum Hhbitat

- Core
- Core (Urban)
- Supporting

Conservation significant fauna observations

- Western Ringtail Possum scats
- Western Ringtail Possum drey
- Local and regional roads

Scale 1:12,500 at A4

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metres

Coord. Sys. GDA 1994 MGA Zone 50

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MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B
Appendix A: Project Locality Plan and Identified Western Ringtail Possum Habitat

FIGURE 1 PAGE 3 OF 3

Version: A

Date: 04-May-2020

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_11_WRPHab.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.

Appendix B: Western Ringtail Possum Management Plan

ALBANY RING ROAD STAGE 3A – WRPMP				
Project Component	**Management Action**	**Monitoring Program**	**Responsible Person**	**Timeframe**
Pre-construction (Pre-clearing)				
Approval of WRPMP	This WRPMP shall be approved by the CEO of the Department of Water and Environment Regulation prior to the commencement of clearing.	A copy of the approval will be recorded in TRIM.	Project Manager	Pre-construction period
Fauna Licence	Main Roads Western Australia shall obtain the necessary license under Regulation 13c, 14, 15 and 21 of the Biodiversity Conservation Regulations 2018 to licence, take, disturb or relocate any fauna, including WRP on-site.	A copy of the approval will be recorded in TRIM.	Environmental Officer	Pre-construction period
Contract documents and Specifications	WRPMP requirements will be included in contract documents and specifications used by Main Roads in engaging contractors and sub-contractors working on the Project.	Pre-construction documentation	Project Manager	Pre-construction period
Construction (Clearing)				
Communications	Site inductions and pre-start toolbox meetings shall include education regarding WRP management to avoid impacts as far as possible through awareness and behaviour change.	Construction surveillance	Construction Engineer	Construction period
	WRP management will be communicated (as appropriate) at: • inductions, • toolbox meetings, and • contract meetings.	Construction surveillance	Construction Engineer	Construction period
	Relevant management measures detailed in the WRPMP will be communicated to project and construction personnel, (including sub-contractors) prior to the commencement of project activities and during project implementation.	Construction surveillance	Construction Engineer	Construction period
Environmental incidents	Environmental incidents shall be reported through the Case Accident Management Systems (CAMS) or Main Roads Western Australia's Incident Reporting Process.	Construction surveillance	Construction Engineer	Construction period
Clearing	Clearing of vegetation shall be limited to the area defined as the "approved clearing disturbance envelope".	Construction surveillance	Construction Engineer	Construction period
	Identify and mark on the ground the extent of clearing prior to the commencement of clearing operations.	Construction surveillance	Construction Engineer	Construction period
	Significant trees on the edge of the clearing line shall be assessed and where possible shall be retained.	Construction surveillance	Project Manager / Environmental Officer	Construction period
Zoologist	A suitably qualified zoologist or environmental scientist shall be on-site during clearing operations.	Construction surveillance	Project Manager / Construction Engineer	Construction period
Traffic Management	Traffic management will be put in place to reduce speed limits during clearing operations.	Construction surveillance	Project Manager / Construction Engineer	Construction period
	Visual message boards will be used to warn drivers of the potential for WRP to cross the road during clearing operations.	Construction surveillance	Project Manager / Construction Engineer	Construction period

ALBANY RING ROAD STAGE 3A – WRPMP				
Project Component	**Management Action**	**Monitoring Program**	**Responsible Person**	**Timeframe**
WRP Management	A pre-clearing WRP spotlight search shall be conducted prior to clearing operations commencing. NOTE: The spotlight search will identify the trees and locations where WRP are likely to be encountered during the clearing operations.	Construction surveillance	Project Manager / Environmental Officer	Construction period
	Trees that are identified as containing possums may need to be left for a subsequent day when the tree may be vacant.	Construction surveillance	Construction Engineer	Construction period
	Trees that have been identified as supporting WRP or possum dreys will be 'bumped gently" with a machine prior to felling. The operator and zoologist will wait and observe the tree for a short time. If no possum appears to be present then the tree shall be pushed over slowly to minimise risk of injury to the animal.	Construction surveillance	Construction Engineer	Construction period
	WRP encountered during the clearing operation shall be trapped or collected by the fauna spotter and relocated into nearby vegetation outside of the clearing area or encouraged to move into vegetation away from the highway.	Construction surveillance	Construction Engineer	Construction period
	Possums collected by the zoologist shall be immediately re-located into adjacent vegetation.	Construction surveillance	Construction Engineer	Construction period
	Fallen trees that contained possum dreys shall be mulched the day they are fallen, or moved at least 50 m from where they were fallen to prevent animals re-entering.	Construction surveillance	Construction Engineer	Construction period
	Clearing shall be undertaken in stages and along one front to allow fauna to move from the clearing area into adjacent habitats.	Construction surveillance	Construction Engineer	Construction period
	Fauna shall not to be fed or intentionally harmed.	Construction surveillance	Construction Engineer	Construction period
	Apart from the zoologist / environmental scientist no site personnel shall handle any fauna present on-site.	Construction surveillance	Construction Engineer	Construction period
	No pets or firearms shall be permitted on site.	Construction surveillance	Construction Engineer	Construction period
	Any reported injured fauna shall be taken to an approved wildlife carer identified through the Wildcare Helpline on 9474 9055.	Construction surveillance	Construction Engineer	Construction period

Limitations and assumptions

This report has been prepared by GHD for Main Roads Western Australia (Main Roads) and may only be used and relied on by Main Roads for the purpose agreed between GHD and Main Roads.

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

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

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

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	R. Lupton	D.Farrar		M. Brook		25/8/2020

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