Bioregional Range Extensions

No identified taxa recorded from the survey area were identified as being significant range extensions from known records of occurrence, with all the flora taxa having been previously recorded in the Great Sandy Desert region.

Introduced (exotic) taxa

No introduced species were recorded during the survey. One introduced species **Malvastrum americanum* (spiked Malvastrum) has previously been found in close proximity to the survey area. The area was dominated by *Eucalyptus victrix* in a clay depression (360 Environmental 2017). This species is a weed of river and creek margins (*Hussey et al.* 2007) and its habitat was not present in the survey area. Two other introduced species, **Aerva javanica* (Kapok Bush) and **Cenchrus ciliaris* (Buffel Grass) were identified in the database searches as being previously recorded near the survey area.

Vegetation types

Three native vegetation types (VTs) from three landforms were defined and mapped within the western survey area (Figure 9) and are summarised and described in Table 8 and Appendix 5. The southern survey area has been previously surveyed and mapped in the Ecologia survey and 360 Environmental survey. The VTs have been defined and mapped based on the mapping from the Ecologia (2017) and 360 Environmental (2017).

The dendrogram (Appendix 6) shows the clustering of quadrats into three vegetation groups, namely:

- lake margin vegetation dominated by *Frankenia cordata* and or mixed *Tecticornia spp.*
- sandplain vegetation dominated by *Grevillea stenobotrya,* mixed *Acacia* and *Triodia pungens*
- dune vegetation dominated by *Allocasuarina decaisneana,* mixed *Acacia* and *Triodia schinzii.*

Table 8: Vegetation Types in the survey area

Landform	Area within western survey area (ha)	NVIS IV (sub-formation)	NVIS V (Vegetation Type)	Code	Representative sites
Salt lake margin	196.17	*Frankenia* and/or *Tecticornia* low open shrubland on lake margin.	*Scaevola collaris, Frankenia cordata, Lawrencia squamata* low shrubland over mixed *Tecticornia* aff. *calyptrata* [M. Stone LM01.05] and *Tecticornia* aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04] low isolated clumps of samphire shrubs over *Eragrostis falcata, Aristida holathera* low sparse grassland.	ScFc	LM01, LM02, LM03, LM10, LMT0101, LMT0102, LMT0103, LMT0104, LMT0105, LMT0106, LMT0201, LMT0202, LMT0203, LMT0204, LMT0205, LMT0206
Sandplain	335.42	*Acacia* open shrubland over *Triodia* hummock grassland on sandplains.	*Grevillea stenobotrya, Acacia ligulata, Acacia* sp. *Lake Mackay* tall open shrubland over *Melaleuca lasiandra* mid open shrubland over *Newcastelia cladotricha* low open shrubland over *Triodia pungens* hummock grassland.	GsAl	LM07, LM08, LM04

Landform	Area within western survey area (ha)	NVIS IV (sub-formation)	NVIS V (Vegetation Type)	Code	Representative sites
Dunes	669.08	*Allocasuarina* open woodland over *Triodia* hummock grassland on dune swales and foredunes.	*Allocasuarina decaisneana* mid isolated clumps of trees over *Acacia ligulata, Acacia* sp. Lake Mackay, *Grevillea stenobotrya* tall sparse shrubland over *Dicrastylis doranii, Scaevola parvifolia* subsp. *parvifolia* low isolated clumps of shrubs over *Triodia schinzii* open hummock grassland over *Aristida holathera* low open grassland.	AdAl	LM09, LM05, LM06

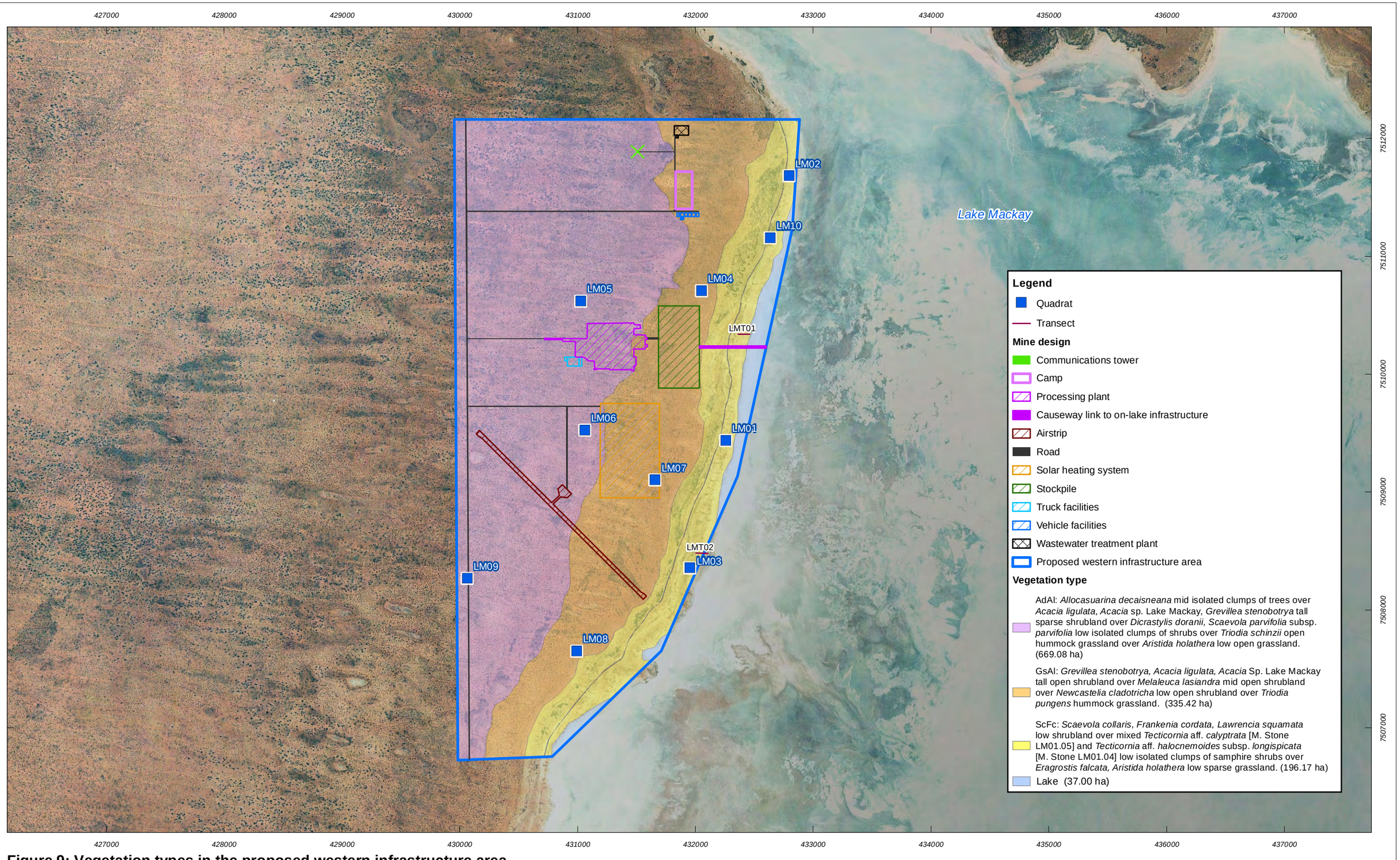

Figure 9: Vegetation types in the proposed western infrastructure area

Scale 1:30,000 at A3

0 500 1,000 1,500 m

Coordinate System: GDA 1994 MGA Zone 52
Note that positional errors may occur in some areas
Date: 20/12/2017
Author: JCrute
Source: Survey area: AGI 11/2017.
Path: Q:\Consult\2017\AGI\AGI17481\01_GIS_documents\ArcMap_documents\AGI17481_G007_RevE.mxd

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Lake Margin Vegetation

Transects were established across the profile of the lake margin to assist in the description of vegetation patterns. Quadrats of 3 m x 3 m were positioned along a 100 m transect and broadly divided into 'upper', 'mid' and 'lower' zones. Generally, two 3 m x 3 m quadrats were placed along the transect in each of the three zones.

Although *Tecticornia* species tend to be the dominant vegetation on salt lake margins, within the western survey area, limited sections (isolated clumps) of the margin were dominated by *Tecticornia* species and the majority of the salt margin vegetation type was dominated by *Scaevola collaris, Frankenia cordata, Maireana luehmannii, Lawrencia glomerata* and *Surreya diandra* with only small isolated patches of *Tecticornia spp.* (Appendix 5 [Figure 9]).

Due to the variation in the width of the vegetated lake margin in the western infrastructure area, these varying zones of vegetation along the lake margin have been mapped as a broader lake margin vegetation unit 'ScFc' (Figure 9).

Vegetation of local significance

Each of the three vegetation types are not considered to be locally significant as they were previously recorded by Ecologia (2017) and 360 Environmental (2017) in the wider area surrounding the survey area and, therefore, are not only restricted to the current western survey area.

Regional representation

There are two pre-European, broad vegetation types mapped for the western survey area (Table 9), with Low to High reservation priorities (CALM 2002). The vegetation in the western survey area was correlated with the Shephard *et al.* (2001) broad vegetation types as much as possible.

Differences exist with the terminology used in the descriptions as they are based on different methods of classifying vegetation types and spatial scale of the analysis i.e. vegetation mapping across the state has been undertaken at a very broad scale in some instances and comparing these to local scale mapping to establish significance can be problematic.

Table 9: Representation of Broad Vegetation Types within the survey area and their state and regional representation along with their reservation priorities.

Shepherd vegetation unit	Pre-European Area (ha)	Current extent (ha)	% Pre-European extent remaining	Current extent in IUCN Class I-IV reserves (%)	Reservation priority
Vegetation types (Shepherd *et al.* 2001) in the state					
125 – Great Sandy Desert	3,485,786.61	3,146,786.61	90.27	5.41	Low
2041 – Great Sandy Desert	435,297.20	434,711.49	99.87	7.10	High
Vegetation types (Shepherd *et al.* 2001) in the Great Sandy Desert Bioregion					
125 – Great Sandy Desert	706,027.95	705,758.53	99.96	6.44	Low
2041 – Great Sandy Desert	371,994.60	371,911.94	99.98	8.31	High
Vegetation types (Shepherd et al. 2001) in the Great Sandy Desert (Mackay) Subregion					
125 – Great Sandy Desert	670,536.18	670,266.76	99.96	6.78	Low
2041 – Great Sandy Desert	342,650.64	342,567.98	99.98	9.03	High

Vegetation condition

Broadly, there has been minimal disturbance to the vegetation in the western and southern survey area. Vegetation at each quadrat was assessed using the Trudgen (1998) vegetation condition scale (Table 10), as being in excellent condition (Appendix 4). The major disturbance in the western survey area was a vehicle track running parallel along the lake margin, with this small section of cleared vegetation being assessed as completely degraded (Table 11). Other notable minor disturbances in both the western and southern survey areas included grazing by camels and rabbits, however, this appeared to have minimal impact on the vegetation. No introduced species were recorded in the western or southern survey area, with only one weed **Malvastrum americanum* being previously recorded in the wider area in the Ecologia (2017) and 360 Environmental (2017) prior surveys.

Some parts of the survey area had been recently burnt (<5 years), but appeared to be regenerating normally. Due to the minimal disturbance, the majority (99.85% [Table 10]) of the western survey area has been mapped as being in excellent condition (Figure 10).

Table 11 gives a numerical breakdown of the area (ha) and percentage occupied by each vegetation condition classification within the western survey area.

Table 10: Vegetation condition scale (Trudgen 1998)

Condition rating	Description
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs

Table 11: Area (ha) covered by each vegetation condition category within the western survey area

Vegetation Condition	Area (ha)	Percentage of the western survey area
Excellent	1200.68	99.85%
Completely Degraded/Track	1.79	0.15%
Total	**1202.47**	**100**

426000 427000 428000 429000 430000 431000 432000 433000 434000 435000 436000 437000

7513000 7512000 7511000 7510000 7509000 7508000 7507000

LM02
LM10
LM04
LM05
LMT01
LM06
LM01
LM07
LMT02
LM03
LM09
LM08

Lake Mackay

426000 427000 428000 429000 430000 431000 432000 433000 434000 435000 436000 437000

Figure 10: Vegetation condition in the proposed western infrastructure area

Scale 1:30,000 at A3

0 500 1,000 1,500 m

Coordinate System: GDA 1994 MGA Zone 52
Note that positional errors may occur in some areas
Date: 20/12/2017
Author: JCrute
Source: Survey area: AGI 11/2017.

Path: Q:\Consult\2017\AGI\AGI17481\01_GIS_documents\ArcMap_documents\AGI17481_G010_RevD.mxd

Legend

- Quadrat
- Transect

Mine design

- Communications tower
- Camp
- Processing plant
- Causeway link to on-lake infrastructure
- Airstrip
- Road
- Solar heating system
- Stockpile
- Truck facilities
- Vehicle facilities
- Wastewater treatment plant
- Proposed western infrastructure area

Vegetation condition

- Excellent (1200.68 ha)
- Completely Degraded (1.79 ha)

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4.1.3 Threatened and Priority Ecological Communities

No TECs were identified within 60 km of the survey area. Additionally, the vegetation types identified in the western survey area do not resemble any known TECs or PECs in the Great Sandy Desert region.

Based on the vegetation types present within the western survey area and the wide representation of these types within the broader area, as well as the well-represented vegetation systems it can be reasonably assumed that no TECs or PECs occur within the western survey area.

5. Discussion

5.1.1 Overview of flora

Native flora

A total of 60 native vascular plant taxa (including species, subspecies, varieties and forms) from 42 plant genera and 26 plant families were recorded from quadrats and opportunistic collections within the western survey area. Of these 60 taxa, 19% were annual or short lived perennial species. Species richness within the 50 m x 50 m quadrats in the western survey area varied from 12 to 23 taxa, with a mean species richness of 15.8.

Whilst 51 taxa were recorded from the quadrat sites, the species extrapolator curves estimated that approximately 60 species would be recorded for the survey area. The extrapolator curves indicate that extra quadrats may have yielded additional taxa (Colwell *et al.* 2004).

The species composition varied from the Ecologia and 360 Environmental surveys. A total of 214 taxa were recorded in the Ecologia survey and 253 in the 360 Environmental survey. In comparison, the current survey yielded 60 taxa. The lower taxa in this current survey can possibly be attributed to a significantly smaller survey area (1240 ha vs 297195 ha).

The most commonly occurring families in the Ecologia survey were Fabaceae (30 taxa), Chenopodiaceae (25 taxa) and Poaceae (23 taxa). In the 360 Environmental survey, Fabaceae (35 taxa), Poaceae (29 taxa) and Malvaceae (21 taxa) were the most commonly occurring families. These are comparable to the current survey, where Poaceae (12 taxa), Chenopodiaceae (8 taxa) and Malvaceae (4 taxa) were the most commonly occurring families.

The timing of the survey was outside of the recommended period for the region, which may have attributed to a lower number of annual species being recorded during the survey.

Flora of conservation significance

No threatened species listed under the EPBC Act and/or gazetted as Threatened under the WA Act or Priority listed flora were recorded during the survey.

Five specimens collected from the western and southern survey area belong to five unknown and potentially new taxon, *Tecticornia* aff. *calyptrata* [M. Stone LM01.05], *Tecticornia* aff. *calyptrata* [M. Stone LM01.06], *Tecticornia* aff. *calyptrata* [M. Stone LM02.03], *Tecticornia* aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04] and *Tecticornia* aff. *calyptrata* [A. Dalton LM OP.03]. These species were recorded in both the western and southern survey area along the lake margin in the lower zone of vegetation type 'ScFc', dominated by *Scaevola collaris* and *Frankenia cordata*. Typical associated species with these specimens included *Lawrencia squamata, Surreya diandra, Eragrostis falcata* and mixed *Tecticornia* species.

Tecticornia aff. *calyptrata* [M. Stone LM01.05], *Tecticornia* aff. *calyptrata* [M. Stone LM01.06], *Tecticornia* aff. *calyptrata* [M. Stone LM02.03] were recorded in the western survey area (Figure 8a) with *Tecticornia* aff. *calyptrata* [A. Dalton LM OP.03] being recorded in the southern survey area (Figure 8b). All of these specimens had morphological affinities with *Tecticornia calyptrata,* however, each specimen was distinct from the typical *T. calyptrata* that is known from Wiluna, with all of the specimens displaying varied similarities to the Northern Territory form of the species (K. Shepherd, WA Herbarium, pers. comm.). These four taxa are therefore of potential conservation significance.

Tecticornia aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04] was recorded in the western survey area (Figure 8a) and was distinct from the typical *Tecticornia halocnemoides* subsp. *longispicata* species, as the vegetative articles and flora bracts were much narrower than the typical form of the known species (K. Shepherd, WA Herbarium, pers. comm.). This taxon is therefore of potential conservation significance.

Potential occurrences of Priority and Threatened flora

The review of the DBCA flora database and EPBC searches did not identify any Threatened/EPBC listed species as potentially occurring in the survey area. However, 12 taxa listed as Priority flora were identified as potentially occurring due to their known habitat and their recorded distances from the survey area (Table 7). Of these 12 taxa, three are considered likely to occur; *Goodenia virgata* (P2), *Goodenia modesta* (P3) and *Stackhousia clementii* (P3). The likelihood of three of the potentially occurring taxa are considered possible; *Tecticornia globulifera* (P1), *Thysanotus* sp. Desert East of Newman (P2) and *Dampiera atriplicina* (P2).

Targeted searches focusing on suitable habitat for potential Priority flora were undertaken in both the western and southern survey areas. Targeted survey effort was focused in areas of potential major disturbance as a result of proposed infrastructure (Figure 5a and 5b). If further targeted searches were undertaken within the survey area in areas outside of the proposed disturbance footprint and adjacent to the survey area, populations of Priority flora would likely be recorded.

Introduced flora

No introduced species were recorded during the survey. One species, **Malvastrum americanum* has previously been recorded south of the southern survey area in vegetation dominated by *Eucalyptus victrix* in clay depressions (360 Environmental 2017). This weed typically occurs along river and creek margins, wasteland and varied arid zone habitats from the Kimberley to the Pilbara and Gascoyne regions (Hussey *et al.* 2007). It is unlikely that this introduced species occurs in the survey area due to a lack of suitable habitat for the species.

5.1.2 Vegetation

Vegetation associations

A total of three floristic-based vegetation types from three landforms were identified in the western survey area. The described vegetation types were separated into floristically similar groups and were correlated with the landform. The most species rich sites were in the dune swales and crests (quadrat LM05 and LM09 in vegetation type 'AdAl'). This vegetation type, dominated by *Allocasuarina decaisneana* and *Triodia schinzii*, was the broadest vegetation community representing 55.64% (669.08 ha) of the total western survey area.

The landforms and the associated vegetation types of the western survey area are considered common and widespread in the surrounding area of Lake Mackay, and in the wider region.

Vegetation of conservation significance

No TECs or PECs or vegetation units likely to be TECs or PECs were located during the survey. Therefore, no vegetation associations of conservation significance were recorded in the western survey area.

Vegetation condition

Overall, there has been minimal disturbance to the survey area and the wider area around Lake Mackay. The majority of the survey area is considered to be in Excellent condition. All quadrats were assessed as being in excellent condition, and no weeds were recorded in the survey area.

There was little to no significant disturbance to the vegetation in the survey area. The most notable disturbance to the western survey area is a well-established vehicle track that runs parallel to the lake margin. Minor disturbances were noted from camels and rabbits, however, these impacts where observed were minimal. Some parts of the survey area had been recently burnt (<5 years), but appeared to be regenerating normally.

Regional representation

To encompass current recognised levels of remnant native vegetation retention, the EPA uses a standard level of native vegetation retention of at least 30% of the pre-clearing extent of the ecological communities. These levels have been most recently recognised in the National Objectives and Targets for Biodiversity Conservation 2001-2005 which recognised that the retention of 30% or more, of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (EPA 2002). Vegetation complexes which have 10-30% remaining may be considered regionally significant while proposals that would affect a vegetation complex with 10% or less remaining are likely to be formally assessed by the EPA (EPA 2000).

The proposed development of the western survey area would not result in any vegetation associations extent falling below the 30% threshold.

6. Conclusion

In summary, the following conclusions on the existing flora and vegetation are made:

- no threatened species pursuant to the EPBC Act and/or gazetted as Declared Rare Flora pursuant to the WC Act were recorded during the survey or are considered likely to occur in the survey area
- no Priority listed flora were recorded during the survey
- three Priority listed flora are considered likely to occur, and three as possibly occurring in the survey area
- five specimens from the *Tecticornia* genera represent potential new taxa; *Tecticornia* aff. *calyptrata* [M. Stone LM01.05], *Tecticornia* aff. *calyptrata* [M. Stone LM01.06], *Tecticornia* aff. *calyptrata* [M. Stone LM02.03], *Tecticornia* aff. *calyptrata* [A. Dalton LM OP.03] and *Tecticornia* aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04] and are therefore potentially conservation significant flora
- no introduced species were recorded during the survey
- none of the three vegetation types recorded are considered to represent any Federal or State listed TECs or PECs
- the proposed western infrastructure area had minimal disturbance and the majority is considered to be in Excellent condition
- the clearing of vegetation for the proposed development would not cause any of the Shepherd *et al.* (2001) vegetation types to fall below the 30% threshold recommended for biodiversity retention
- the landforms and vegetation types are considered common and widespread in the surrounding Lake Mackay area, and more importantly in the region.

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Appendix 1
Conservation significant flora and ecological community definitions

Conservation Codes for Western Australia (DEC 2010)

Under the *Wildlife Conservation Act* (1950), the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 deal with those that are threatened and those that are presumed extinct, respectively.

T: Threatened Flora (Declared Rare Flora – Extant)

Species which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List Criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild
- X: Presumed Extinct Flora (Declared Rare Flora – Extinct).

Species that have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*).

Priority Flora

Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority flora List under Priorities 1, 2 or 3. These three categories are ranked in order of Priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

Priority One: Poorly-known Species

Species that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Two: Poorly-known Species

Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Three: Poorly-known Species

Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

Priority Four: Rare, Near Threatened and other species in need of monitoring

1. Rare: Species that are considered to be have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
2. Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Species that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

Priority 5: Conservation Dependent Species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within 5 years.

Definition of Threatened Ecological Communities (DEC 2010)

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies:

- records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- all occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria:

1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply:
   (a) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years)
   (b) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
2. Current distribution is limited, and one or more of the following apply:
   (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years)
   (b) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
   (c) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
3. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:
   (a) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years)
   (b) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

2. Current distribution is limited, and one or more of the following apply”
    (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years)
    (b) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
    (c) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
3. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
2. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
3. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definition of Priority Ecological Communities (DEC 2010)

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation
- communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: adequately known, rare but not threatened ecological communities

Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. These include:

1. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
2. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 2
Desktop assessment results (DBCA 2017)

NatureMap Species Report

Created By Guest user on 27/03/2017

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	128° 44' 17" E,22° 26' 25" S
Buffer	40km
Group By	Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	3	3
TOTAL	**3**	**3**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Non-conservation taxon					
1.	3419	*Acacia ligulata (Umbrella Bush, Watarka)*			
2.	3430	*Acacia lysiphloia (Turpentine Wattle)*			
3.	3679	*Aenictophyton reconditum*			

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.

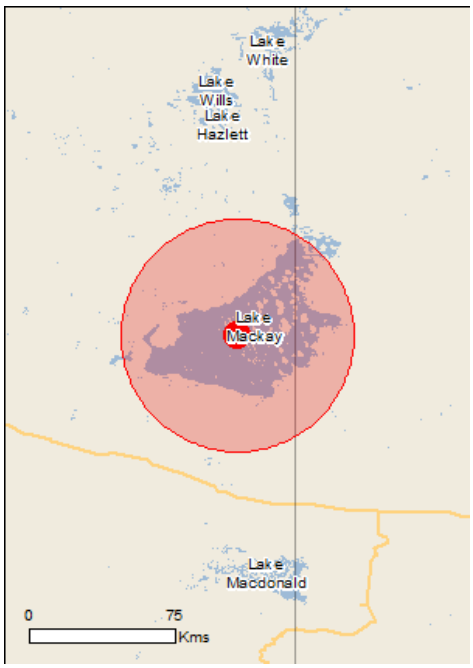
EPBC Act Protected Matters Report

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.

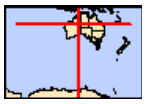
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 27/03/17 18:21:34



Coordinates
Buffer: 60.0Km



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:	None
Listed Threatened Species:	4
Listed Migratory Species:	6

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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	9
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	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:	2
Regional Forest Agreements:	None
Invasive Species:	7
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area
Mammals		
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat known to 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
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

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		
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 likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		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
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Kiwirrkurra	WA
Southern Tanami	NT

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

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
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
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
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

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

-22.43951 128.73826

Acknowledgements

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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+61 2 6274 1111

Taxon	Status	DPaWRegion	DPaWDistrict	Distribution	FloweringPeriod
Dampiera atriplicina	3	GOLD,PILB	KALGOORLIE,KARRATHA	Gregory Range, Jupiter Well, Gibson	May-Jul
Eragrostis lanicaulis	3	GOLD,PILB	KALGOORLIE,KARRATHA	Gibson Desert, Karratha	Mar-May/Aug-Oct
Eremophila jamesiorum	2	GOLD	KALGOORLIE	Gibson Desert N.R.	Sep
Goodenia modesta	3	GOLD,KIMB,PILB	KALGOORLIE,KARRATHA,EA	Stansmore Range, Gibson Desert, De	Dec
Goodenia virgata	2	GOLD	KALGOORLIE	Gibson Desert NR, Drovers Hills, The	Jul
Korthalsella leucothrix	3	GOLD,MWST	KALGOORLIE,GERALDTON	Lake Monger, Wanarra Rock, Kent Bc	-
Maireana sp. Patience (C.P. Campbell 1052)	1	PILB	KARRATHA	Gibson Desert	Feb
Mitrasacme katjarranka	1	GOLD,PILB	KALGOORLIE,KARRATHA	Lake Kerrylyn, Gibson Desert	May and July
Philotheca eremicola	1	GOLD	KALGOORLIE	Blyth Pool, Gibson Desert	Sep
Thysanotus sp. Desert East of Newman (R.P. Hart 964)	2	GOLD,PILB	KALGOORLIE,KARRATHA	Warburton, Gibson Desert, Collier Range, Rudall River	

Taxon	ConsStatus	PopNumbe	Location	District	Vesting	Purpose1	CountDate	MatureCou	LiveTotal	inFlower
Goodenia virgata	2	1	South-west Lake Mackay. 7	KARRATHA	ALT	ABR	21/10/2000 0:00	0	0	Y

Taxon	Cons_(	Plant_Desc	Site	Vegetation	Frequency	Locality	Geocc	Precision	Date
Goodenia virgata	2	Erect herb, yellow flowers.	Runon area above saltlake.	With Triodia pungens.	not uncom	SW Lake Mackey; 7	MAN	2	21/10/2000

Appendix 3
Vascular plant taxa recorded in the survey area

Family	Species
Aizoaceae	*Trianthema pilosum*
	Ptilotus arthrolasius
	Ptilotus obovatus
	Ptilotus sp.
Amaranthaceae	*Surreya diandra*
	Chrysocephalum eremaeum
Asteraceae	*Pluchea ferdinandi-muelleri*
Boraginaceae	*Trichodesma zeylanicum*
Casuarinas	*Allocasuarina decaisneana*
Celastraceae	*Stackhousia* sp. Lake Mackay (P.K Latz 12870)
	Dysphania sp.
	Maireana luehmannii
	Tecticornia aff. *calyptrata* [M. Stone LM01.06]
	Tecticornia aff. *calyptrata* [M. Stone LM01.05]
	Tecticornia aff. *calyptrata* [M. Stone LM02.03]
	Tecticornia aff. *calyptrata* [M. Stone LM01.06]
	Tecticornia aff. *calyptrata* [A. Dalton LM OP.03]
	Tecticornia halocnemoides subsp. *longispicata*
	Tecticornia aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04]
Chenopodiaceae	*Tecticornia* sp.
Cucurbitaceae	*Cucumis argenteus*
Euphorbiaceae	*Euphorbia wheeleri*
	Acacia ligulata
	Acacia melleodora
Fabaceae	*Acacia* sp. Lake Mackay
Frankeniaceae	*Frankenia cordata*
Gentianaceae	*Schenkia clementii*
	Goodenia maideniana
	Scaevola collaris
Goodeniaceae	*Scaevola parvifolia* subsp. *parvifolia*
Gyrostemonaceae	*Gyrostemon tepperi*
	Dicrastylis doranii
Lamiaceae	*Newcastelia cladotricha*
Lauraceae	*Cassytha capillaris*
Malvaceae	*Corchorus sidoides*

	Lawrencia squamata
	Lawrencia viridigrisea
	Malvaceae sp.
	Corymbia sp.
	Melaleuca glomerata
Myrtaceae	*Melaleuca lasiandra*
Nyctaginaceae	*Boerhavia coccinea*
	Stemodia ?sp. Tanami (P.K Latz 8218)
Plantaginaceae	*Stemodia glabella*
	Aristida contorta
	Aristida holathera
	Eragrostis ?laniflora
	Eragrostis eriopoda
	Eragrostis falcata
	Eragrostis laniflora
	Eragrostis sp.
	Eriachne aristidea
	Paraneurachne muelleri
	Triodia pungens
	Triodia schinzii
Poaceae	*Yakirra australiensis* var. *australiensis*
Polygalaceae	*Polygala isingii*
Proteaceae	*Grevillea stenobotrya*
	Synaptantha tillaeacea
Rubiaceae	*Synaptantha tillaeacea* var. *hispidula*
Scrophulariaceae	*Eremophila willsii* subsp. *willsii*
Surianaceae	*Stylobasium spathulatum*

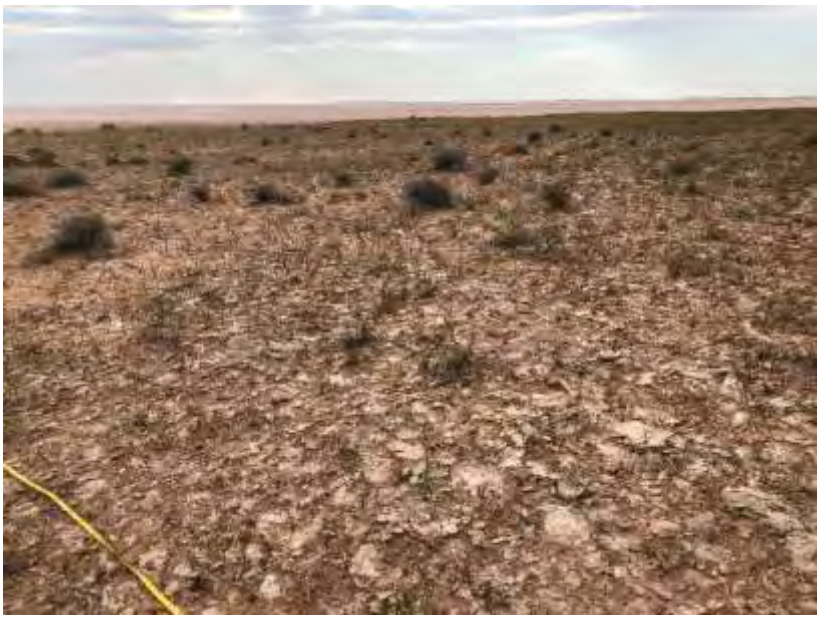
Appendix 4
Quadrat site data

Site LM01

Date	12/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 432260 7509439
Quadrat size	50 x 50 m
Soil type	Clay loam
Soil notes	Orange brown
Bare ground / Litter layer	25% / <1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Frankenia cordata* and *Scaevola collaris* low shrubland over *Tecticornia* spp. low samphire shrubland over *Aristida holathera* and *Eragrostis falcata* low isolated clumps of grasses.

Taxon	**Height cm**	**Cover %**
Frankenia cordata	35	20
Scaevola collaris	20	30
Surreya diandra	20	5
Tecticornia aff. calyptrata [M. Stone LM01.06]	20	4
Tecticornia aff. calyptrata [M. Stone LM01.05]	20	2
Tecticornia aff. halocnemoides subsp. longispicata [M. Stone LM01.04]	20	2
Maireana luehmannii	20	+
Maireana luehmannii	20	+
Aristida holathera	15	+
Eragrostis falcata	15	+
Lawrencia squamata		
Stackhousia sp. Lake Mackay (P.K Latz 12870)		

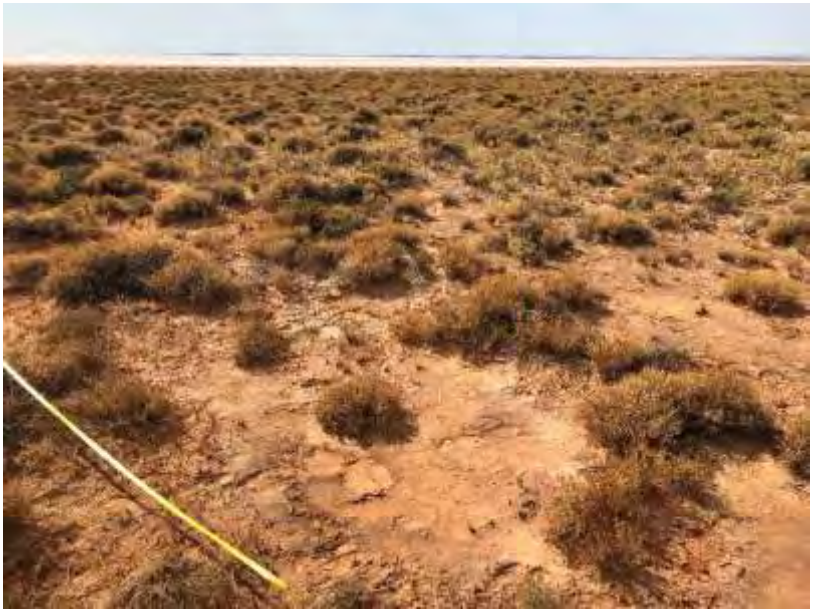
Site LM02



Date	12/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 432260 7509439
Quadrat size	50 x 50 m
Soil type	Clay loam
Soil notes	Brown, white
Bare ground / Litter layer	25% / <1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Lawrencia squamata, Surreya diandra, Scaevola collaris* low sparse shrubland over *Tecticornia* spp. low closed samphire shrubland over *Eragrostis falcata* and *Aristida holathera* low open grassland.

Taxon	**Height cm**	**Cover %**
Lawrencia squamata	50	3
Surreya diandra	30	5
Frankenia cordata	30	+
Tecticornia aff. *calyptrata* [M. Stone LM01.05]	25	3
Tecticornia aff. *calyptrata* [M. Stone LM01.06]	25	1
Scaevola collaris	20	10
Maireana luehmannii	20	1
Maireana luehmannii	20	+
Eragrostis falcata	15	1
Tecticornia halocnemoides subsp. *longispicata*	15	1
Tecticornia aff. *calyptrata* [M. Stone LM02.03]	15	1
Aristida holathera	15	+
Goodenia maideniana	5	+

Site LM03



Date	12/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 431956 7508358
Quadrat size	50 x 50 m
Soil type	Clay loam, calcrete
Soil notes	Orange, brown
Bare ground / Litter layer	20% / <1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Tecticornia* spp. low closed samphire shrubland over *Scaevola collaris, Surreya diandra, Maireana luehmannii* low shrubland over *Eragrostis falcata* and *Aristida holathera* low open grassland

Taxon	**Height cm**	**Cover %**
Tecticornia aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04]	30	15
Tecticornia halocnemoides subsp. *longispicata*	30	1
Tecticornia aff. *calyptrata* [M. Stone LM01.05]	25	1
Tecticornia aff. *calyptrata* [M. Stone LM02.03]	25	1
Eragrostis falcata	20	15
Scaevola collaris	20	15
Aristida holathera	20	+
Surreya diandra	15	20
Maireana luehmannii	15	1
Tecticornia sp.	15	1
Goodenia maideniana	5	+
Dysphania sp.	15	+
Frankenia cordata	30	+
Lawrencia viridigrisea	20	+

Stackhousia sp. Lake Mackay (P.K Latz 12870)	20	+
Triodia pungens	40	+

Site LM04

Date	12/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 431956 7510707
Quadrat size	50 x 50 m
Soil type	Sand
Soil notes	Red
Bare ground / Litter layer	25% / <1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Grevillea stenobotrya, Acacia ligulata* tall open shrubland over *Newcastelia cladotricha* low isolated clumps of shrubs over *Triodia pungens* open hummock grassland

Taxon	**Height cm**	**Cover %**
Grevillea stenobotrya	230	1
Acacia ligulata	180	10
Stylobasium spathulatum	100	+
Melaleuca lasiandra	80	+
Triodia pungens	50	25
Newcastelia cladotricha	40	3
Chrysocephalum eremaeum	20	+
Acacia sp. Lake Mackay	20	+
Aristida holathera	15	+
Malvaceae sp.	15	+
Melaleuca glomerata	100	+
Newcastelia cladotricha	40	+

Synaptantha tillaeacea var. *hispidula*	10	+
Scaevola parvifolia subsp. *parvifolia*	30	+

Site LM05

Date	12/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 431027 7510623
Quadrat size	50 x 50 m
Soil type	Sand
Soil notes	Red
Bare ground / Litter layer	10% / <1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Allocasuarina decaisneana* low isolated clumps of trees over *Grevillea stenobotrya, Acacia* sp. Lake Mackay, *Acacia ligulata* tall sparse shrubland over *Dicrastylis doranii* low isolated clumps of shrubs over *Triodia schinzii* isolated clumps of hummock grasses over *Aristida holathera* low sparse grassland

Taxon	**Height cm**	**Cover %**
Allocasuarina decaisneana	800	2
Grevillea stenobotrya	280	3
Acacia ligulata	230	+
Acacia sp. Lake Mackay	200	5
Acacia melleodora	180	+
Stylobasium spathulatum	120	+
Dicrastylis doranii	80	5
Eremophila willsii subsp. *willsii*	80	+
Trichodesma zeylanicum	70	+
Triodia schinzii	50	15
Triodia pungens	40	+
Aristida holathera	30	5
Scaevola parvifolia subsp. *parvifolia*	30	1
Corchorus sidoides	30	+

Eragrostis eriopoda	30	+
Chrysocephalum eremaeum	20	+
Ptilotus sp.	20	+
Boerhavia coccinea	15	+
Eriachne aristidea	15	+
Synaptantha tillaeacea	15	+
Yakirra australiensis var. *australiensis*	15	+
Trianthema pilosum	10	+
Cucumis argenteus	c	+

Site LM06

Date	12/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 431063 7509526
Quadrat size	50 x 50 m
Soil type	Sand
Soil notes	Red
Bare ground / Litter layer	10% / <1%
Condition	Excellent
Fire age	<5 years
Vegetation description	*Allocasuarina decaisneana* low open woodland over *Acacia ligulata, Acacia* sp. Lake Mackay, *Grevillea stenobotrya* over *Scaevola parvifolia* subsp. *parvifolia, Dicrastylis doranii* low isolated clumps of shrubs over *Triodia schinzii* open hummock grassland over *Aristida holathera* low open grassland

Taxon	**Height cm**	**Cover %**
Allocasuarina decaisneana	200-500	15
Acacia sp. Lake Mackay	200	1
Acacia melleodora	180	+
Grevillea stenobotrya	160	15
Acacia ligulata	150	3
Eremophila willsii subsp. *willsii*	100	+
Dicrastylis doranii	100	2
Stylobasium spathulatum	100	+
Aristida holathera	40	20
Scaevola parvifolia subsp. *parvifolia*	40	1
Triodia schinzii	40	10
Eriachne aristidea	30	+
Corchorus sidoides	25	+

Euphorbia wheeleri	20	+
Eragrostis eriopoda	15	+
Chrysocephalum eremaeum	15	+
Synaptantha tillaeacea	15	+
Trianthema pilosum	15	+

Site LM07

Date	12/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 431659 7509103
Quadrat size	50 x 50 m
Soil type	Sand
Soil notes	Red
Bare ground / Litter layer	10% / <1%
Condition	Excellent
Fire age	<5 years
Vegetation description	*Acacia* sp. Lake Mackay, *Acacia ligulata, Grevillea stenobotrya* tall open shrubland over *Melaleuca lasiandra* mid isolated clumps of shrubs over *Newcastelia cladotricha* low open shrubland over *Triodia pungens* hummock grassland

Taxon	**Height cm**	**Cover %**
Grevillea stenobotrya	300	5
Acacia sp. Lake Mackay	280	10
Acacia ligulata	280	3
Melaleuca glomerata	200	+
Stylobasium spathulatum	200	+
Melaleuca lasiandra	150	1
Pluchea ferdinandi-muelleri	50	1
Triodia pungens	40	50
Newcastelia cladotricha	40	10
Aristida holathera	30	+
Corchorus sidoides	20	+
Chrysocephalum eremaeum	20	+
Yakirra australiensis var. *australiensis*	15	+
Cassytha capillaris	c	+

Site LM08

Date	13/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 430994 7507655
Quadrat size	50 x 50 m
Soil type	Sand
Soil notes	Red
Bare ground / Litter layer	15% / <1%
Condition	Excellent
Fire age	<5 years
Vegetation description	*Grevillea stenobotrya, Stylobasium spathulatum, Melaleuca lasiandra* tall open shrubland over *Triodia pungens* hummock grassland

Taxon	**Height cm**	**Cover %**
Acacia ligulata	180	+
Acacia sp. Lake Mackay	180	+
Stylobasium spathulatum	160	2
Grevillea stenobotrya	150	2
Melaleuca lasiandra	100	10
Corymbia sp.	80	+
Melaleuca glomerata	80	+
Eremophila willsii subsp. *willsii*	60	+
Triodia pungens	50	30
Newcastelia cladotricha	40	+
Scaevola collaris	40	+
Chrysocephalum eremaeum	30	+
Polygala isingii	20	+

Site LM09

Date	13/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 430062 7508270
Quadrat size	50 x 50 m
Soil type	Sand
Soil notes	Red
Bare ground / Litter layer	20% / <1%
Condition	Excellent
Fire age	< 5 years
Vegetation description	*Allocasuarina decaisneana* low isolated clumps of trees over *Acacia ligulata, Acacia* sp. Lake Mackay, *Grevillea stenobotrya* tall isolated clumps of shrubs over *Dicrastylis doranii* low isolated clumps of shrubs over *Triodia schinzii* isolated clumps of hummock grasses over *Aristida holathera* low isolated clumps of grasses

Taxon	**Height cm**	**Cover %**
Allocasuarina decaisneana	300	1
Grevillea stenobotrya	250	1
Acacia ligulata	220	2
Acacia sp. Lake Mackay	200	1
Acacia melleodora	100	+
Dicrastylis doranii	50	3
Trichodesma zeylanicum	40	+
Triodia schinzii	40	2
Aristida holathera	40	1
Aristida contorta	30	+
Scaevola parvifolia subsp. *parvifolia*	30	+
Euphorbia wheeleri	25	+
Corchorus sidoides	20	+
Chrysocephalum eremaeum	20	+
Ptilotus sp.	20	+

Synaptantha tillaeacea	20	+
Eragrostis eriopoda	15	+
Eriachne aristidea	15	+
Polygala isingii	15	+
Trianthema pilosum	15	+
Yakirra australiensis var. *australiensis*	15	+

Site LM10

Date	13/11/2017
Recorder	MS & AD
NW Corner Coordinates	52 K 432636 7511157
Quadrat size	50 x 50 m
Soil type	Clay loam
Soil notes	Brown
Bare ground / Litter layer	20% / <1%
Condition	Excellent
Fire age	<5 years
Vegetation description	*Scaevola collaris, Lawrencia squamata, Stackhousia* sp. Lake Mackay, *Surreya diandra* low shrubland over *Eragrostis falcata, Aristida holathera* low sparse grassland

Taxon	**Height cm**	**Cover %**
Lawrencia squamata	50	3
Stackhousia sp. Lake Mackay (P.K Latz 12870)	40	5
Eragrostis falcata	30	5
Scaevola collaris	30	30
Surreya diandra	30	1
Aristida holathera	20	3
Maireana luehmannii	20	+
Goodenia maideniana	15	+
Frankenia cordata	20	+
Tecticornia aff. *calyptrata* [M. Stone LM01.05]	25	+
Tecticornia aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04]	25	+
Tecticornia halocnemoides subsp. *longispicata*	25	+
Tecticornia aff. *calyptrata* [M. Stone LM02.03]	25	+

Site LMT0101

Date	15/11/2017
Recorder	MS & AD
Location	10 - 13m along transect (lower zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / Litter layer	73% / 18%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Tecticornia* aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04] low sparse shrubland.

Taxon	Height cm	Cover %
Tecticornia aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04]	40	9

Site LMT0102

Date	15/11/2017
Recorder	MS & AD
Location	29 - 32 m along transect (lower zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / Litter layer	77% / 3%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Tecticornia* aff. *calyptrata* [M. Stone LM02.03], *Tecticornia* aff. *calyptrata* [M. Stone LM01.05] low open shrubland

Taxon	**Height cm**	**Cover %**
Tecticornia aff. *calyptrata* [M. Stone LM02.03]	20	19
Tecticornia aff. *calyptrata* [M. Stone LM01.05]	20	1

Site LMT0103

Date	15/11/2017
Recorder	MS & AD
Location	42 - 45 m along transect (mid zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / Litter layer	88% / 1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Scaevola collaris, Surreya diandra* low shrubland over *Eragrostis* sp. low open grassland

Taxon	**Height cm**	**Cover %**
Scaevola collaris	20	8
Surreya diandra	20	3
Eragrostis sp.	15	0.25

Site LMT0104

Date	15/11/2017
Recorder	MS & AD
Location	53 - 56 m along transect (mid zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / Litter layer	90% / <1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Scaevola collaris*, *Surreya diandra*, *Stackhousia* sp. Lake Mackay (P.K Latz 12870) low shrubland

Taxon	**Height cm**	**Cover %**
Scaevola collaris	25	5
Surreya diandra	20	7
Eragrostis sp.	15	0.1
Goodenia maideniana	10	0.1

Site LMT0105

Date	15/11/2017
Recorder	MS & AD
Location	70 - 73 m along transect (upper zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / litter layer	85% / 1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Scaevola collaris* and *Stackhousia* sp. Lake Mackay (P.K Latz 12870) low shrubland over *Eragrostis* sp. low grassland

Taxon	**Height cm**	**Cover %**
Stackhousia sp. Lake Mackay (P.K Latz 12870)	40	10
Scaevola collaris	25	3
Eragrostis sp.	15	0.1

Site LMT0106

Date	15/11/2017
Recorder	MS & AD
Location	87 - 90 m along transect (upper zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / litter layer	92% / 1%
Condition	Excellent
Fire age	>5
Vegetation description	*Scaevola collaris, Stackhousia* sp. Lake Mackay (P.K Latz 12870) and *Lawrencia squamata* low shrubland over *Eragrostis* sp. low isolated clumps of grasses

Taxon	**Height cm**	**Cover %**
Lawrencia squamata	50	2
Stackhousia sp. Lake Mackay (P.K Latz 12870)	30	3
Eragrostis sp.	20	1
Scaevola collaris	20	1
Goodenia maideniana	10	0.1

Site LMT0201

Date	15/11/2017
Recorder	MS & AD
Location	5 - 8 m along transect (lower zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / Litter layer	75% / 1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Tecticornia* aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04] low open shrubland

Taxon	**Height cm**	**Cover %**
Tecticornia aff. *halocnemoides* subsp. *longispicata* [M. Stone LM01.04]	20	13

Site LMT0202

Date	15/11/2017
Recorder	MS & AD
Location	25 - 28 m along transect (lower zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown, grey
Bareground / Litter layer	86% / 1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Tecticornia* aff. *calyptrata* [M. Stone LM02.03] low open shrubland

Taxon	**Height cm**	**Cover %**
Tecticornia aff. *calyptrata* [M. Stone LM02.03]	25	34

Site LMT0203

Date	15/11/2017
Recorder	MS & AD
Location	45 - 48 m along transect (mid zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / Litter layer	84% / 1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Scaevola collaris, Surreya diandra* low shrubland over *Eragrostis* sp. low open grassland

Taxon	**Height cm**	**Cover %**
Scaevola collaris	30	9
Surreya diandra	25	6
Eragrostis sp.	15	0.1

Site LMT0204

Date	15/11/2017
Recorder	MS & AD
Location	55 - 58 m along transect (mid zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / Litter layer	86% / 1%
Condition	Excellent
Fire age	>5
Vegetation description	*Scaevola collaris, Surreya diandra* low shrubland over *Eragrostis* sp. low open grassland

Taxon	**Height cm**	**Cover %**
Scaevola collaris	30	9
Surreya diandra	25	6
Eragrostis sp.	15	0.1

Site LMT0205

Date	15/11/2017
Recorder	MS & AD
Location	70 - 83 m along transect (upper zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / litter layer	89% / 1%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Scaevola collaris, Surreya diandra* low shrubland over *Eragrostis* sp. low open grassland

Taxon	**Height cm**	**Cover %**
Scaevola collaris	30	6
Eragrostis sp.	30	3
Surreya diandra	30	3

Site LMT0206

Date	15/11/2017
Recorder	MS & AD
Location	90 - 93 m along transect (upper zone)
Quadrat size	3 x 3 m
Soil type	Clay loam, calcrete
Soil notes	Brown
Bare ground / Litter layer	93% / 2%
Condition	Excellent
Fire age	>5 years
Vegetation description	*Scaevola collaris, Surreya diandra, Maireana luehmannii* low shrubland over *Eragrostis* sp. low open grassland

Taxon	**Height cm**	**Cover %**
Surreya diandra	30	1
Scaevola collaris	20	3
Eragrostis sp.	15	1.5
Maireana luehmannii	15	1

Opportunistic observations

Dicrastylis doranii
Eragrostis ?laniflora
Eragrostis laniflora
Gyrostemon tepperi
Newcastelia cladotricha
Paraneurachne muelleri
Ptilotus arthrolasius
Schenkia clementii
Stemodia ?sp. Tanami (P.K Latz 8218)
Stemodia glabella
Tecticornia aff. *calyptrata* (A. Dalton LM OP.03)

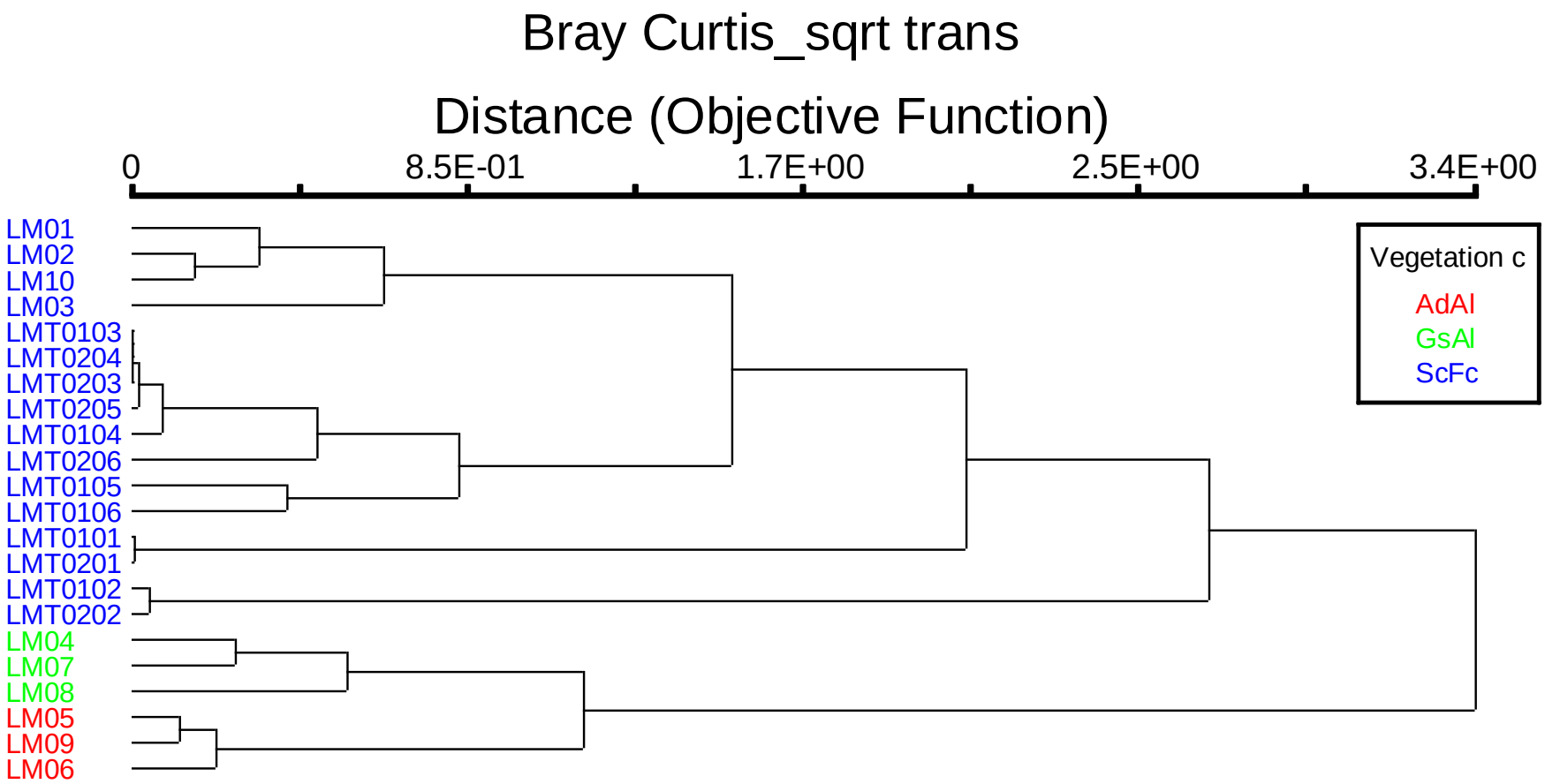
Appendix 5
Vegetation descriptions and associated species

Vegetation type	Representative sites	Vegetation description (NVIS level III and NIVS level V)	Other typical species	Landform
ScFc	LM01, LM02, LM03, LM10, LMT0101, LMT0102, LMT0103, LMT0104, LMT0105, LMT0106, LMT0201, LMT0202, LMT0203, LMT0204, LMT0205, LMT0206	*Scaevola* and *Tecticornia* shrubland *Scaevola collaris, Frankenia cordata, Lawrencia squamata* low shrubland over mixed *Tecticornia* spp. low isolated clumps of samphire shrubs over *Eragrostis falcata, Aristida holathera* low sparse grassland.	*Maireana luehmannii* *Surreya diandra* *Stackhousia* sp. Lake Mackay (P.K Latz 12870) *Goodenia maideniana* *Triodia pungens* *Tecticornia aff. calyptrata* [M. Stone LM01.05] *Tecticornia aff. halocnemoides* subsp. *longispicata* [M. Stone LM01.04] *Tecticornia halocnemoides* subsp. *longispicata* *Tecticornia* aff. *calyptrata* [M. Stone LM01.06]	Salt Lake margin

Vegetation type	Representative sites	Vegetation description (NVIS level III and NIVS level V)	Other typical species	Landform
AlGs	LM07, LM08, LM04	*Acacia* shrubland *Grevillea stenobotrya, Acacia ligulata, Acacia Sp. Lake Mackay* tall open shrubland over *Melaleuca lasiandra* mid open shrubland over *Newcastelia cladotricha* low open shrubland over *Triodia pungens* hummock grassland.	*Aristida holathera* *Chrysocephalum eremaeum* *Cassytha capillaris* *Corchorus sidoides* *Melaleuca lasiandra* *Scaevola parvifolia* subsp. *parvifolia* *Stylobasium spathulatum* *Synaptantha tillaeacea* var. *hispidula* *Pluchea ferdinandi-muelleri* *Yakirra australiensis* var. *australiensis*	Sandplain

Vegetation type	Representative sites	Vegetation description (NVIS level III and NIVS level V)	Other typical species	Landform
AdAl	LM05, LM06, LM09	*Allocasuarina* open woodland *Allocasuarina decaisneana* mid isolated clumps of trees over *Acacia ligulata, Acacia* sp. Lake Mackay, *Grevillea stenobotrya* tall sparse shrubland over *Dicrastylis doranii, Scaevola parvifolia* subsp. *parvifolia* low isolated clumps of shrubs over *Triodia schinzii* open hummock grassland over *Aristida holathera* low open grassland.	*Acacia melleodora* *Boerhavia coccinea* *Chrysocephalum eremaeum* *Corchorus sidoides* *Cucumis argenteus* *Eragrostis eriopoda* *Eremophila willsii* subsp. *Willsii* *Eriachne aristidea* *Euphorbia wheeleri* *Stylobasium spathulatum* *Synaptantha tillaeacea* *Trianthema pilosum* *Trichodesma zeylanicum* *Yakirra australiensis* var. *australiensis*	Dune swales and crests

Appendix 6
Vegetation community dendrogram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Distance (Objective Function)
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1.7E+00
2.5E+00
3.4E+00
LM01
LM02
LM10
LM03
LMT0103
LMT0204
LMT0203
LMT0205
LMT0104
LMT0206
LMT0105
LMT0106
LMT0101
LMT0201
LMT0102
LMT0202
LM04
LM07
LM08
LM05
LM09
LM06
Vegetation c
AdAl
GsAl
ScFc