Chapter 7
Biodiversity

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ABBREVIATIONS

AS	Australian Standards
CEMP	Construction Environmental Management Plan
DENR	Department of Environment and Natural Resources
DLRM	Department of Lands and Resource Management
DOE	Department of the Environment
DOEE	Department of Environment and Energy
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EL	Exploration Lease
EPA	Environmental Protection Authority
EPBC	*Environmental Protection and Biodiversity Conservation Act*
IBRA	Interim Biogeographic Regionalisation of Australia
NT	Northern Territory
OEMP	Operational Environmental Management Plan
PFS	Pre-Feasibility Study
RCP	Rehabilitation Closure Plan
ToR	Terms of Reference
TPWC	*Territory Parks and Wildlife Conservation Act*

7 BIODIVERSITY

7.1 Introduction

This chapter provides a review of biodiversity values that may be potentially affected by the Proposal. This chapter draws on a comprehensive terrestrial ecological assessment, which is included as Appendix O. This chapter describes the terrestrial flora and fauna, their habitats and the presence and likelihood of occurrence of conservation-significant and migratory species, populations and ecological communities within the proposed development footprint and vicinity of the Proposal. The potential impacts on terrestrial ecology are assessed and mitigation and management measures are identified to reduce potential impacts. A draft Biodiversity Management Plan is provided in Appendix O.

The assessment has been prepared in consultation with pastoralists and Traditional Owners. It has also been prepared with reference to the *Guidelines for Assessment of Impacts on Terrestrial Biodiversity* (NT EPA 2013a), *Guidelines on Environmental Offsets and Associated Approval Conditions* (NT EPA 2013b) and in accordance with the Terms of Reference (refer to Appendix A).

7.2 Methodology

The methodology for the terrestrial ecological assessment included a review of databases and relevant literature, field surveys and vegetation and habitat mapping. Impact calculations and an assessment of the significance of impacts were undertaken to determine the effect of the Proposal on terrestrial flora and fauna.

7.2.1 Database and literature review

A desktop assessment was undertaken to gain an understanding of the ecological context of the area (specifically, to gain an understanding of the flora and fauna species known to occur in the region, particularly those of conservation significance). Relevant biodiversity databases pertaining to the locality (defined as a 20 kilometre radius from the boundary of the mining lease area [EL29018], a 20 kilometre radius centred on the proposed Apirnta Facility and 20 kilometres either side of the proposed Chandler Haul Road and Maryvale Access Road) were reviewed. The database searches included:

- NT DENR Species Atlas (including the NT Flora Atlas and NT Fauna Atlas) – for threatened species listed under the TPWC Act that have been recorded in the locality and for Sites of Conservation Significance and Sites of Botanical Significance.
- DoEE Protected Matters Search Tool – for matters of national environmental significance listed under the EPBC Act that have been recorded in the locality.

Additional databases that were reviewed to inform the terrestrial ecological assessment are listed in Appendix O.

The results of previous ecological assessments and scientific publications were also reviewed to determine the likely presence of terrestrial flora and fauna species and their habitats within the area and to determine potential impacts from the Proposal. These included relevant statutory plans such as action plans, recovery plans and threat abatement plants. A list of the literature that was reviewed is provided in Appendix O.

7.2.2 Likelihood of occurrence

Following the collation of database records, species and community profiles, and the results of previous ecological assessments within the locality, a 'likelihood of occurrence' assessment was prepared with reference to the habitats contained within the proposed development footprint and vicinity. This was further refined following field surveys and the identification and assessment of the habitats present.

7.2.3 Field surveys

Extensive field surveys have been undertaken within the proposed development footprint and vicinity over the past four years (between October 2012 and April 2016) (refer to Table 7-1 and Figure 7-1). Sixty-nine sites were surveyed in total. The survey sites were selected to provide a representative sample of the different habitats within the proposed development footprint and vicinity. They were also selected based on the habitat requirements of conservation-significant species predicted to occur within the proposed development footprint or vicinity. The surveys were undertaken over several seasons and in varying weather conditions.

The flora surveys were designed with reference to *Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping* (Brocklehurst *et al.* 2007) and *A resource assessment towards a conservation strategy for the Finke Bioregion* (Neave *et al*. 2004). The general fauna surveys were designed with reference to *Standard Terrestrial Vertebrate Survey Methods used by the DLRM* (NT EPA 2013c) and *A Resource Assessment towards a Conservation Strategy for the Finke Bioregion* (Neave *et al*. 2004).

Surveys for conservation-significant fauna species were undertaken with reference to *Survey Guidelines for Australia's Threatened Mammals* (Department of the Environment, Water, Heritage and the Arts 2010a), *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment, Water, Heritage and the Arts 2010b) and *Survey Guidelines for Australia's Threatened Reptiles* (Department of Sustainability, Environment, Water, Population and Communities 2011).

The field surveys are summarised below with further detail provided in Appendix O.

Table 7-1 Survey effort (terrestrial flora and fauna surveys)

Location	Survey date	Focus	Survey type	Survey effort	Approximate field person hours
Chandler Facility and Chandler Haul Road	Oct 2012	Spring biodiversity survey	Trapping, bird survey, landscape and vegetation	Seven sites	360
Chandler Facility and Chandler Haul Road	Sept 2013	Spring biodiversity survey and soil survey	Trapping, mole trenches, bat surveys (SM2BAT+), bird survey, secondary sign, landscape, vegetation and soil	Eight sites	264
Chandler Facility and Chandler Haul Road, Apirnta Facility	June 2015	Winter biodiversity survey	Trapping, SM2BAT+, bird survey, secondary sign, landscape and vegetation	15 sites	276
Chandler Facility and Chandler Haul Road, Apirnta Facility	Oct 2015	Spring biodiversity survey	Trapping, SM2BAT+, bird survey, secondary sign, landscape and vegetation	10 sites	382
Henbury Access Road and Apirnta Facility	Nov 2015	Spring biodiversity survey	Trapping, bird survey, secondary sign, landscape and vegetation	14 sites	280
Henbury Access Road and Apirnta Facility	May 2016	Autumn biodiversity survey	Trapping, bird survey, secondary sign, landscape and vegetation	16 sites	280

Terrestrial flora surveys

Terrestrial flora surveys consisted of vegetation mapping and validation (via transect surveys). At each site, a 100 metre transect was surveyed within each distinctly different vegetation type present. Data recorded along each transect generally included vascular plant species present, vegetation structure and density, the presence of woody debris and weeds, the impact of disturbance and current vegetation condition. The presence of termite mounds and the soils and geology within each quadrat/transect were recorded. The location and extent of weed infestations within the proposed development footprint were also recorded.

Surveys were undertaken for those conservation-significant species likely to occur within the proposed development footprint or vicinity based on previous records (as found in the database and

literature review) and based on suitable habitat. One conservation-significant flora species was targeted during the flora surveys described above. This was Latz's wattle (*Acacia latzii*).

Terrestrial fauna surveys

Terrestrial fauna surveys consisted of a detailed habitat searches and targeted fauna surveys. The habitat searches included ground-truthing habitat in the field, paying particular attention to identify potentially suitable habitat for conservation-significant species within the proposed development footprint and vicinity.

The targeted fauna surveys consisted of trapping, secondary sign surveys, area search bird surveys, spotlighting, motion-sensing camera surveys, microchiropteran bat surveys, mole trench surveys and incidental observations. The fauna surveys focused on sites with suitable habitat for conservation-significant species and those that would be expected to be subject to direct disturbance during construction and operation of the Proposal. The fauna surveys involved:

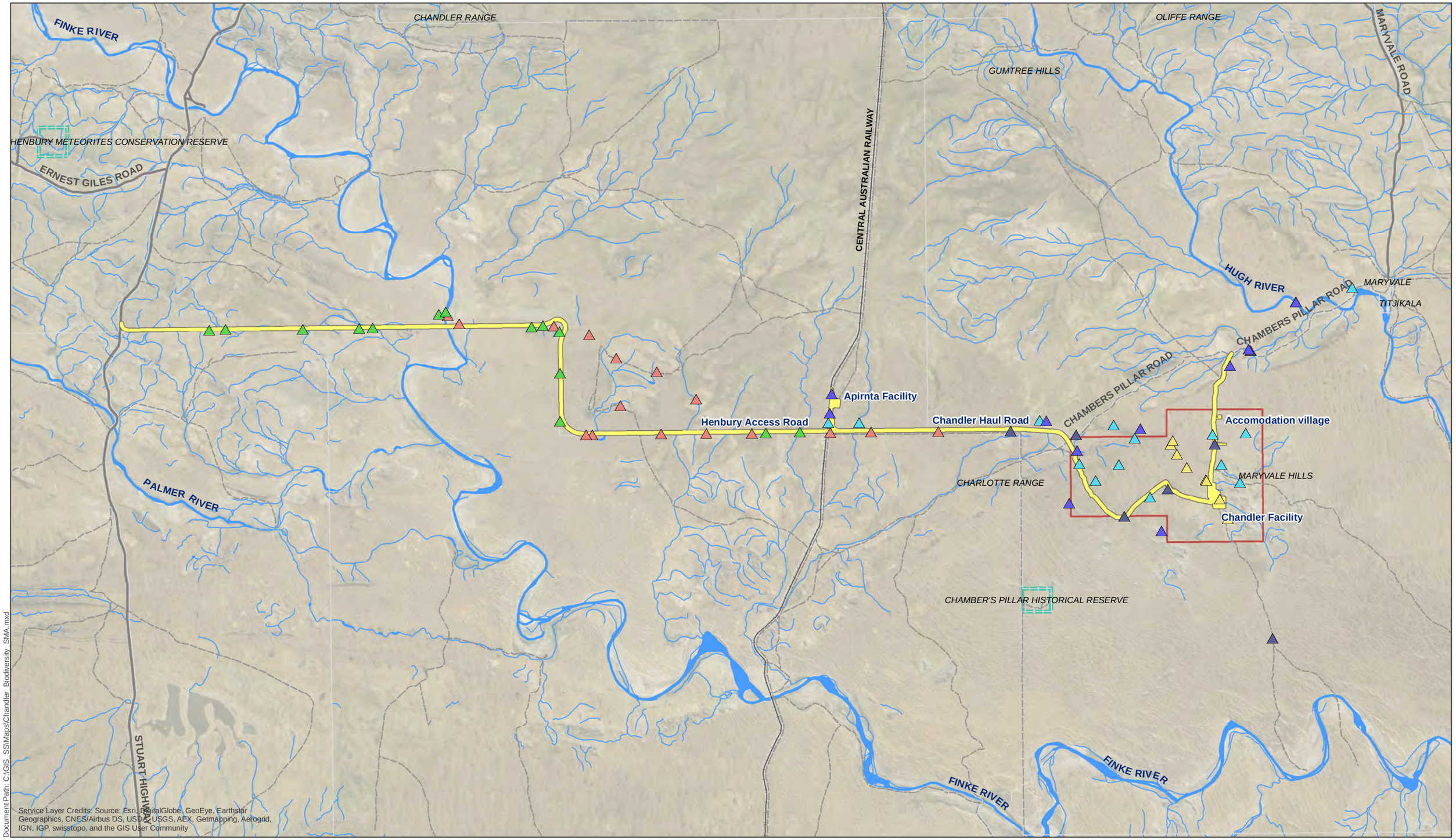
- **Trapping**. Trapping for small mammals and reptiles was undertaken at sites within each land system present within the proposed development footprint. A transect consisting of 25 Elliot traps (spaced 10 – 20 metres apart), two pitfall traps (placed adjacent to the Elliot trap transect with a 10 metre drift fence centred on top) and four funnel traps (one funnel trap placed at either end of each 10 metre drift fence) was established at each site. Cage trapping was not conducted, as there were no species likely to be present in the appropriate size range for cage trapping. Medium to large sized mammals (cats, foxes, dingoes and rabbit) presence and abundance was determined though secondry sign surveys (refer below).
- **Secondary sign surveys**. Searches for secondary signs of fauna species (e.g. tracks and scats) were undertaken within a 200 metre by 250 metre quadrat at each trapping site. Secondary sign surveys were also undertaken at additional sites within land systems not expected to be subject to direct disturbance during construction and operation of the Proposal.
- **Area searches**. Area search bird surveys were undertaken in the morning and afternoons. The surveys consisted of identifying birds by sight and call within 100 metre by 250 metre quadrats. Two targeted bird surveys were undertaken in habitat identified as potentially suitable for thick-billed grasswren (*Amytornis modestus indulkana*). For these surveys, call playback of thick-billed grasswren were broadcast. Area searches were also used to survey for desert sandskipper (*Croitana aestival*).
- **Spotlighting.** Spotlighting transects were undertaken opportunistically along established tracks at night to record nocturnal mammals and birds. The location of fauna species observed during spotlighting was recorded and where introduced/pest species were encountered, the number of animals was recorded.
- **Motion-sensing camera surveys.** Motion-sensing cameras were deployed at three sites to record cryptic species. Cameras were set to take pictures when triggered by movement.
- **Microchiropteran bat surveys**. Surveys for microchiropteran bats involved echolocation call recordings using a call detection unit (Song Meter 2). The call detection units were placed

near a dam and in an open area identified as a fly-way within the proposed development footprint. Calls were then analysed by a bat specialist.

- **Mole trench surveys**. Mole trenches were excavated at sites with suitable substrate (sandy or sandy clay). Trench survey techniques were used to detect signs for marsupial moles underground as traditional trapping techniques are ineffective for these subterranean species. The trenching methodology followed *Manual for Marsupial Mole Survey and Monitoring by Trenches, Version 1.0* (Benshemesh 2005). Trenches were approximatley 120 centimetres long, 40 centimetres wide and 80 centimetres deep. Trenches were excavated on the northern or western side of a dune to maximise drying by sunlight. The longest side of the trench faced north to maximise sunlight on the southern side. A step was dug into the northern wall to increase the sunlight reaching into the trench. The southern side of the trench was rubbed to make it smooth. Trenches were left for three days for the surface to dry. After this time, the surface of the southern wall was inspected for any symmetrical sand filled oval shaped structures larger the 25 millimetres.
- **Incidental observations.** Incidental observations of fauna species were recorded at all times during the field surveys.

Surveys were undertaken for those conservation-significant species likely to occur within the proposed development footprint or vicinity based on previous records (as found in the database searches and literature review) and based on suitable habitat. Conservation-significant fauna species targeted during the fauna surveys described above included:

- Great desert skink (*Liopholis kintorei*).
- Slater's skink (*Liopholis slateri slateri*).
- Desert sandskipper (*Croitana aestival*).
- Australian painted snipe (*Rostratula australis*).
- Night parrot (*Pezoporus occidentalis*).
- Princess parrot (*Polytelis alexandrae*).
- Thick-billed grasswren (*Amytornis modestus indulkana*).
- Black-footed rock-wallaby (*Petrogale lateralis,* MacDonnell Ranges race).
- Central rock-rat (*Zyzomys pendunculatus*).
- Greater bilby (*Macrotis lagotis*).
- Crest-tailed mulgara (*Dasycercus cristicauda*).
- Brush-tailed mulgara (*Dasycercus blythi)*.
- Southern marsupial mole (*Notoryctes typhlops*).



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N

4 2 0 4 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Survey sites

- May 2016
- November 2015
- October 2015
- June 2015
- Septempber 2013
- October 2012

Figure 7-1
Terrestrial flora and fauna survey site locations

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Data source: DPI & F, Land systems polygons, 1989; Geoscience Australia, 250K Topo base data, 2006; USGS, SRTM elevation, 2000; AUSURV SURVEYORS, detailed elevation data, 2016.
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7.2.4 Impact calculations

Direct impacts on flora and fauna (the removal of vegetation and habitat loss) were quantified to determine the potential impacts during construction and operation of the Proposal. The amount of each vegetation type and fauna habitat type directly affected was recorded in a geographic information system.

7.2.5 Assessment of significance of impacts

The potential for significant impacts on matters of national environmental significance and on state-listed threatened species (defined as those listed as vulnerable, endangered or critically endangered under the TPWC Act) were assessed using the criteria set out in the *Significant Impact Guidelines 1.1-Matters of National Environmental Significance* (DoE 2013).[1] The potential for significant impacts were assessed for those species recorded during the field surveys and for those species considered to have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity. Assessments of significance were prepared for eight threatened fauna species listed under the EPBC Act and/or TPWC Act and for eight migratory species listed under the EPBC Act.

7.3 Existing environment

This section describes the physical environment of the proposed development footprint and vicinity and the existing terrestrial flora, fauna and fauna habitat within the proposed development footprint and vicinity. Conservation-significant species known or predicted to occur within the proposed development footprint and vicinity, along with their conservation status, are described.

7.3.1 Physical environment

This section describes the climate, bioregion, land systems and soils within the proposed development footprint and vicinity.

Climate

The climate of the proposed development footprint and vicinity is characterised by distinct hot summers and cold winters, with a wide diurnal range in temperature. Rainfall in the area is highly variable, with a mean annual rainfall of 282.8 millimetres, varying from 76.8 millimetres to 782.5 millimetres. Rainfall is generally higher in the summer months. Summer months have mean maximum temperatures over 30 degrees Celsius. Winter months have mean minimum temperatures under 10 degrees Celsius.

[1] Threatened species listed under the TPWC Act were assessed using the criteria set out in the *Significant Impact Guidelines 1.1-Matters of National Environmental Significance* (DoE 2013). This was due to a lack of similar guidelines for assessing impacts on threatened species in the NT.

Bioregion

The Interim Biogeographic Regionalisation of Australia (IBRA) provides a division of Australia into geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information (Department of Sustainability, Environment, Water, Population and Communities 2012a). The proposed development footprint and vicinity lies within the NT section of the Finke IBRA Bioregion (refer to Figure 3-3 in Appendix R).

The Finke IBRA Bioregion is a geo-morphologically complex and varied area of low sandstone ranges, weathered tablelands and rounded metamorphic hills, laterite-capped mesas, saline depressions and sandplains. Dominant vegetation includes hummock grasslands, *Acacia* shrublands and saltbush/bluebush open shrublands.

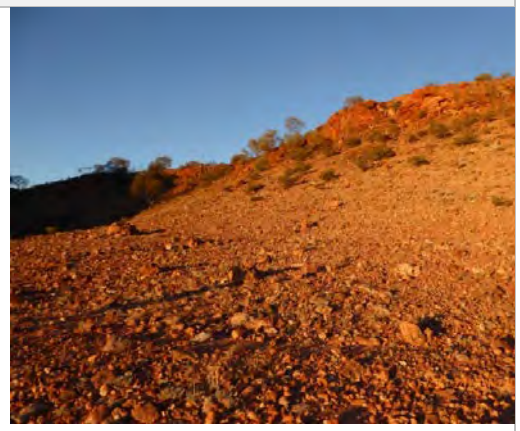
Land systems

A total of nine broad land systems has been mapped within the proposed development footprint and vicinity (as per Perry *et al.* 1960). The dominant land systems within the area of the Chandler Facility are Singleton and Rumbalara. The dominant land system within the area of the Apirnta Facility is Singleton and the dominant land systems on the Maryvale Haul Road and Henbury Access Road are Chandler, Simpson, Angas and Singleton. Land systems within the proposed development footprint and vicinity are described in Table 7-2 and are also shown in Table 7-2.

Table 7-2: Land systems within the proposed development footprint and vicinity

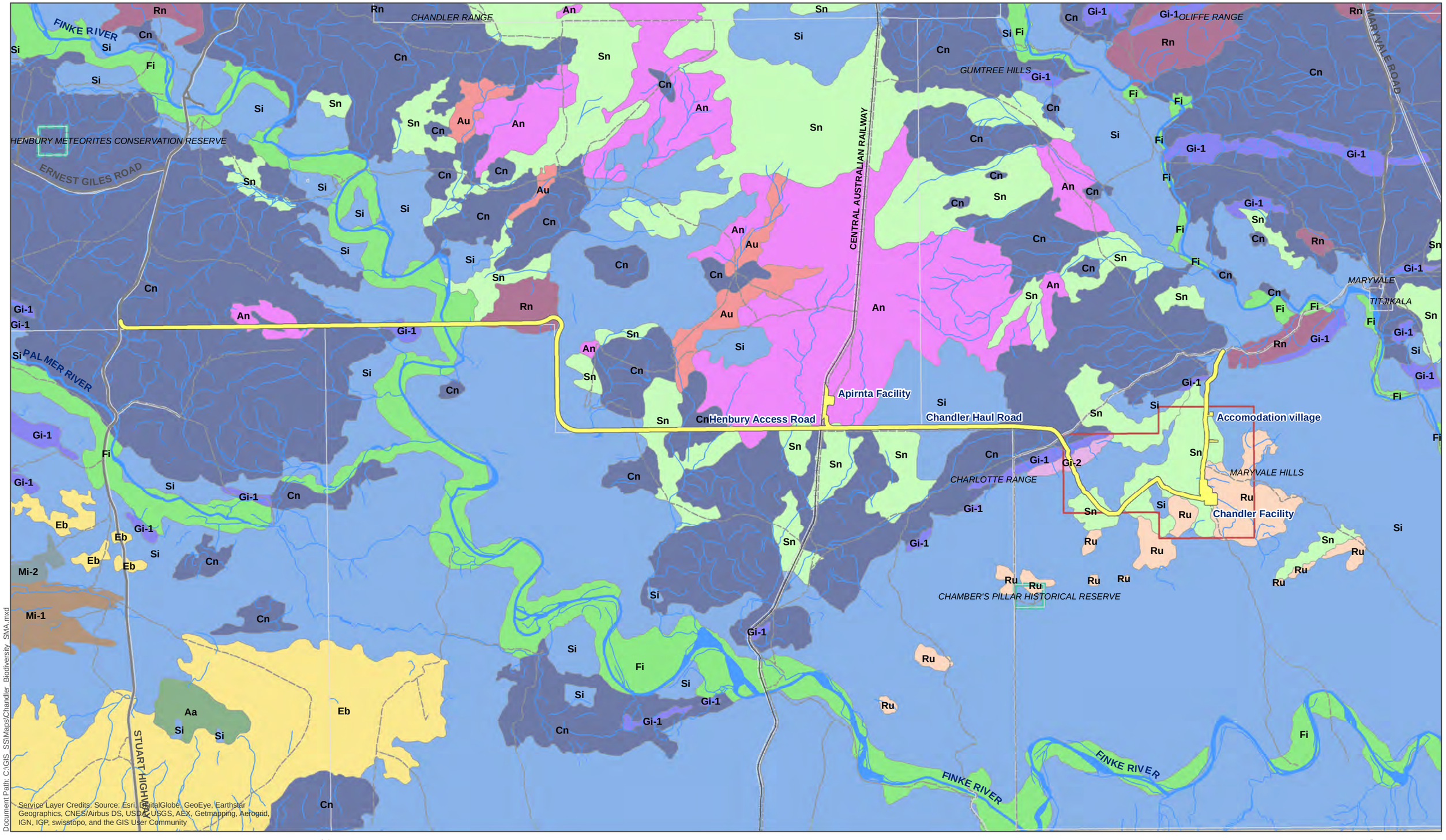
Code	Land system	Landform	Soil description	Vegetation	Photograph
An	Angas	Undulating sandy plains with sandstone and limestone ridges.	Reddish brown sandy loams and calcareous earths.	Open to scattered mulga and witchetty bush over emubush, cassia and bluebush. Understory consists of coppurburrs, sida and forbs.	
Au	Amulda	Sandy foothill fans with broad drainage depressions and creeks.	Red clayey sands and sandy clay loams.	Over storey of Mulga, blue mallee and ironwood over witchetty bush and emu bush. Understory of spinifex, woollybutt grass and kerosene grass.	

Code	Land system	Landform	Soil description	Vegetation	Photograph
Cn	Chandlers	Mesas, low ranges and stony plains with clayey stony slopes and silcrete or shale outcrop.	Stony clayey soils, and shallow calcareous soils.	Generally treeless, scattered bluebush emubush and cassia over copperburrs and sida.	
Fi	Finke	Sandy alluvial plains adjacent to major rivers including active floodplains and dunes.	Sand bed. Levees with loamy sands and fine sands. Dunes with reddish sands.	Tall open woodland of river red gum over colony wattle and sticky hopbush with an understory of buffel grass, couch and sand hill cane grass.	

Code	Land system	Landform	Soil description	Vegetation	Photograph
Gi-1	Gillen	Quartzite and sandstone ranges.	Rock and shallow stony soils.	Absent or scattered mulga and witchetty bush over low shrubs, spinifex and forbs.	
Gi-2	Gillen	Colluvial and alluvial fans and plains.	Red brown sandy clay loams and deep red loamy sands.	Ironwood, mulga, corkwood and witchetty over kerosene grass, mulga grass and other perennial grasses.	

Code	Land system	Landform	Soil description	Vegetation	Photograph
Rn	Renners	Undulating limestone slopes and rises.	Calcareous earths and shallow gravelly soils.	Sparsely vegetated. Mulga and witchetty bush with a shrub layer of dead finish, emu bush and bluebush over copperburrs, sidas and forbs.	
Ru	Rumbulara	Plateaux, mesas and stony slopes.	Rocky and stony surfaces, stony sandy clay loams, shallow calcareous earths.	Scattered mulga on the plateaux. Low shrubs – cassia, emu bush, bluebush over perennial grasses and forbs.	

Code	Land system	Landform	Soil description	Vegetation	Photograph
Si	Simpson	Sand dunes and swales.	Red sands on dunes, red clayey sands, sandy loams and calcareous earths in swales.	Desert oak over cassia and emu bush. Understory consists of spinifex and seasonal forbs.	
Sn	Singleton	Level to slightly undulating plain. Occasional low rises and very broad swales including broad drainage depressions.	Red clayey sands and red earths.	Sparse trees (mulga, mallee, desert oak, beefwood) and shrub layer over spinifex. Small areas with mulga over woolybutt and kerosene grass.	



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N

4 2 0 4 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Land systems unit

Aa, An, Au, Cn, Eb, Ed, Fi, Gi-1, Gi-2, Mi-1, Mi-2, Rn, Ru, Si, Sn

Figure 7-2
Distribution of land systems
within the proposed development footprint and vicinity

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Soils

Soils within the proposed development footprint and vicinity have been mapped in the *Atlas of Australian Soils* (Northcote *et al.* 1968). However, because the currently accepted classification system is the Australian Soil Classification (Isbell and National Committee on Soil and Terrain 2016), a conversion from the Atlas of Australian Soils to Australian Soil Classification was developed by Ashton and McKenzie (2001). Soils within the area of the Chandler Facility include Rudosol and Sodosols. Soils within the area of the Apirnta Facility include Tenosol and Sodosol. Soils within the area of the Chandler Haul Road and Henbury Access Road include Tenosol, Calcerosol and Sodosols.

Soils within the proposed development footprint and vicinity are described further in Chapter 8 and in Appendix E.

Hydrology

The surface hydrology within the proposed development footprint and vicinity consists of ephemeral watercourses, claypans and swamps, all of which provide an important water source for flora and fauna during wet periods. There are two major watercourses in the area, the Hugh River and the Finke River. Both are ephemeral and can result in large-scale flows and associated flooding during high rainfalls. The head of these rivers are located in the West MacDonnell Ranges, approximately 250 kilometres north of the proposed development footprint and, as such, heavy rains in head water catchments can result in significant down stream flows affecting the proposed development footprint and vicinity.

Duck Swamp and associated coolabah swamps and claypans are considered environmentally and culturally important ephemeral wetlands. Duck Swamp is located approximately one kilometre north-east of the proposed Henbury Access Road. The associated coolabah swamps extend downstream across the proposed Henbury Access Road.

According to the Bureau Meteorology's (BoM) Atlas of Groundwater Dependent Ecosystems, there are no groundwater dependent ecosystems within the proposed development footprint or vicinity. In addition, there is a 'low potential for groundwater interaction in the area of interest'. The nearest groundwater dependent ecosystem is located approximately 250 kilometres to the west.

There are no Nationally Important Wetlands within the proposed development footprint or vicinity. The nearest Nationally Important Wetland is the Karinga Creek Paleodrainage System located approximately 130 kilometres to the south-west. There are no Ramsar Wetlands or Wetlands of National Significance located within the proposed development footprint or vicinity. The nearest Ramsar Wetland is Lake Pinaroo which is located approximately 860 kilometres to the south-east.

7.3.2 Terrestrial flora

This section describes the terrestrial flora within the proposed development footprint and vicinity, including the presence of conservation-significant species. A description of the fire history of the

area is provided. The location of Sites of Conservation Significance or Sites of Botanical Significance are also assessed in relation to the proposed development footprint.

Flora species

A total of 192 plant species (of which 185 were native and seven were introduced) from 37 families were recorded within the proposed development footprint and vicinity during the field surveys. The most diverse families recorded were Poaceae (34 native species including 2 introduced), Fabaceae (29 native species) and Chenopodiaceae (22 native species). A list of plant species recorded within the proposed development footprint and vicinity is provided in Appendix R. One conservation-significant species was recorded during the field surveys within the proposed development footprint and is discussed in further detail below.

Introduced species

A total of seven introduced species were recorded within the proposed development footprint and vicinity (refer to Table 7-3). With the exception of buffel grass, all weed species recorded occurred in very low densities. Of the seven species recorded, one species is listed as a weed of national significance by the Australian Weeds Strategy (2005). Three species are declared weeds under the *Weeds Management Act*.

Athel pine (*Tamarix aphylla*), the weed of national significance, was recorded in the Finke River during the surveys undertaken in November 2015.

Weeds within the proposed development footprint and vicinity would be managed in accordance with the mitigation measures listed in Section 7.9.

Table 7-3 Introduced flora species in the proposed development footprint and vicinity

Scientific Name	Common Name	Weed of National Significance	Declared weed in NT	Control requirements (*Weeds Management Act*)
Cenchrus ciliaris	Buffel grass	-	-	-
Citrullus coloynthis	Paddy melon	-	-	-
Cynodon dactylon	Couch grass	-	-	-
Datura leichhardtii	Native thorn apple	-	Class C under Datura spp.	Not to be introduced into the NT.
Solanum nigrum	Blackberry nightshade	-	-	-
Tamarix aphylla	Athel pine	×	Class B and Class C	Growth and spread to be controlled. Not to be introduced into the NT.
Tribulus terrestrus	Caltrop	-	Class B	Growth and spread to be controlled.

Vegetation communities

Field surveys confirmed the presence of six native plant community types within the proposed development footprint and vicinity, as mapped in the *Vegetation Survey of the Northern Territory*

(Wilson *et al*. 1990). The vegetation communities are described in Table 7-4 and their distribution is shown in Figure 7-3.

The proposed Chandler Facility is located on *Triodia* low hummock grassland and *Maireana* low open chenopod shrubland. The proposed Apirnta Facility is located on *Triodia* low hummock grassland. The proposed Chandler Haul Road and Henbury Access Road are located on predominantly *Triodia* low hummock grassland and *Maireana* low open chenopod shrubland with smaller areas of *Acacia* tall open shrubland and *Acacia* tall sparse shrubland.

Vegetation within the proposed development footprint and vicinity is generally in moderate to good condition. There is a high level of disturbance as a result of cattle (grazing, trampling and weed invasion) that is confined to watering points, ephemeral watercourses and tracks. Land has also been previously cleared for tracks and a small amount of land has been cleared previously for mining exploration by Central Petroleum.

Fire history

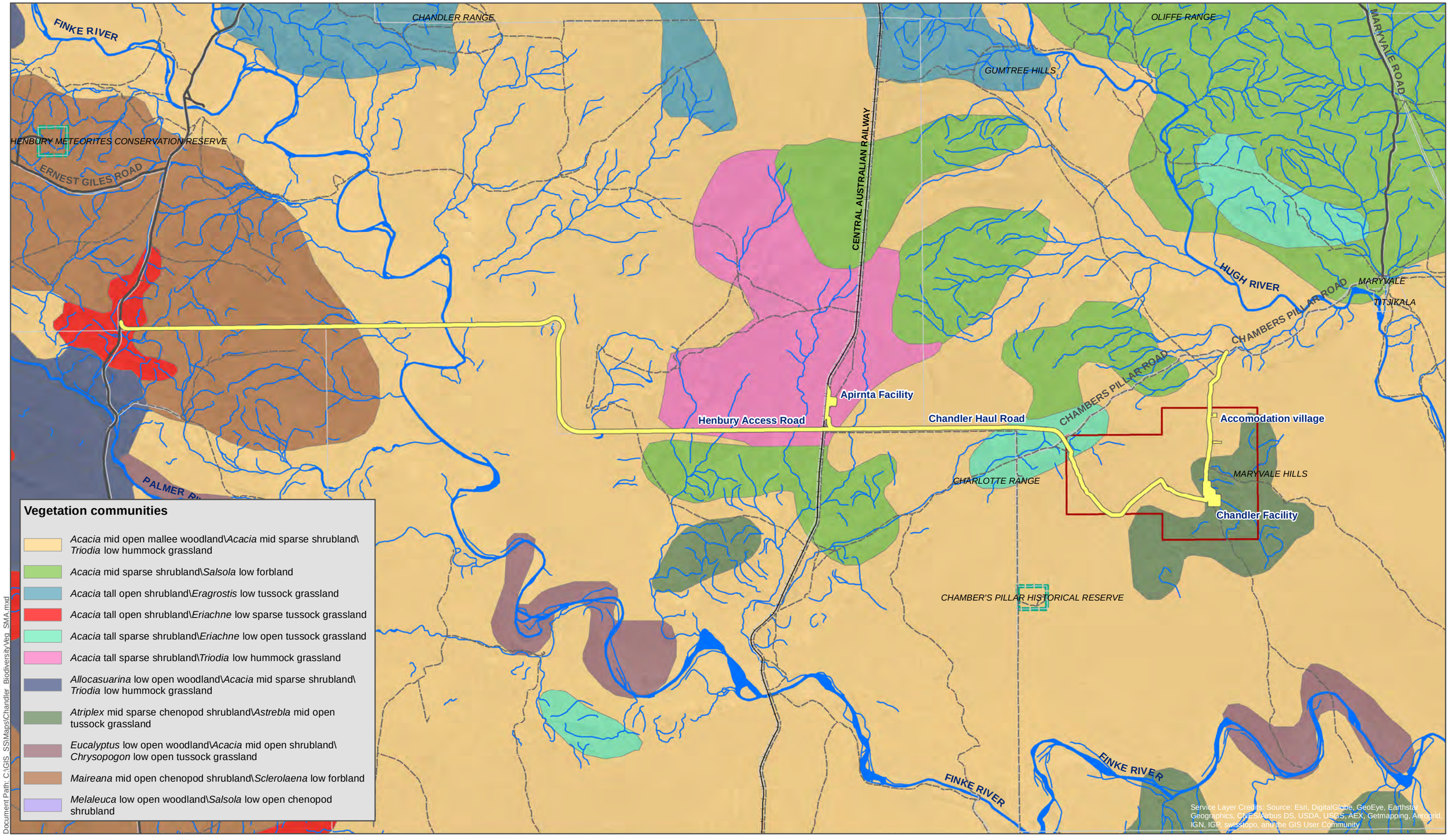
Mapping obtained from North Australia and Rangelands Information shows areas of fire scarring within the proposed development footprint and vicinity in 2011. The fire history of the proposed development footprint and vicinity is shown in Figure 7-4.

Table 7-4 Description of vegetation communities within the proposed development footprint and vicinity

Broad vegetation classification (vegetation community)	Structural formation	Fine vegetation classification	Description	Photographs
Hummock grassland (82)	*Triodia* low hummock grassland	*Acacia* tall sparse shrubland\ *Triodia* low hummock grassland	*Acacia aneura, Acacia kempeana, cassia,* over *Triodia pungens, Eragrostis eriopoda, Aristida holathera*, hummock grass, tussock grass	
Hummock grassland (83)	*Triodia* low hummock grassland	*Acacia* mid open mallee woodland\ *Acacia* mid sparse shrubland\ *Triodia* low hummock grassland	*Allolcasurina decasneana, Eucalyptus gamophylla, Acacia aneura, Acacia kempeana, Acacia ligulata, Senna artemisioides* subsp. *filifolia* over *Triodia basedowii, Triodia pungens, Eragrostis eriopoda* hummock grass tussock grass. Includes stands of *Allocasurina decasneana*	

Broad vegetation classification (vegetation community)	Structural formation	Fine vegetation classification	Description	Photographs
Open shrubland (66)	*Acacia* tall open shrubland	*Acacia* tall open shrubland\ *Eriachne* low sparse tussock grassland	*Acacia aneura, Acacia kempeana+/ Corymbia opaca* over *Enneapogon avenaceus,* tussock grass, forbs, fern	
Open shrubland (108)	*Maireana* low open chenopod shrubland	*Maireana* mid open chenopod shrubland\ *Sclerolaena* low forbland	*Maireana astrotricha, Atriplex vesicaria, Acacia* spp. over chenopod shrubs, *Sclerolaena cornishiana, Enneapogon cylindricus,* forb, tussock grass	

Broad vegetation classification (vegetation community)	Structural formation	Fine vegetation classification	Description	Photographs
Sparse shrubland (73)	*Acacia* sparse shrubland	*Acacia* mid sparse shrubland*Salsola* low forbland	*Acacia tetragonophylla, Acacia kempeana* +/- *Atalaya hemiglauca* over senna, tussock grass	
Sparse shrubland (110)	*Atriplex* low sparse chenopod shrubland	*Atriplex* mid sparse chenopod shrubland\ *Astrebla* mid open tussock grassland	*Saltbush* +/- *Acacia aneura* +/- *cassia*, chenopod shrubs over *sida, Portulaca oleracea*, forbs, tussock grass	



Document Path: C:\GIS_SSIMaps\Chandler_BiodiversityVeg_SMA.mxd

N

5 2.5 0 5 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Figure 7-3
Distribution of vegetation communities
within the proposed development footprint and vicinity

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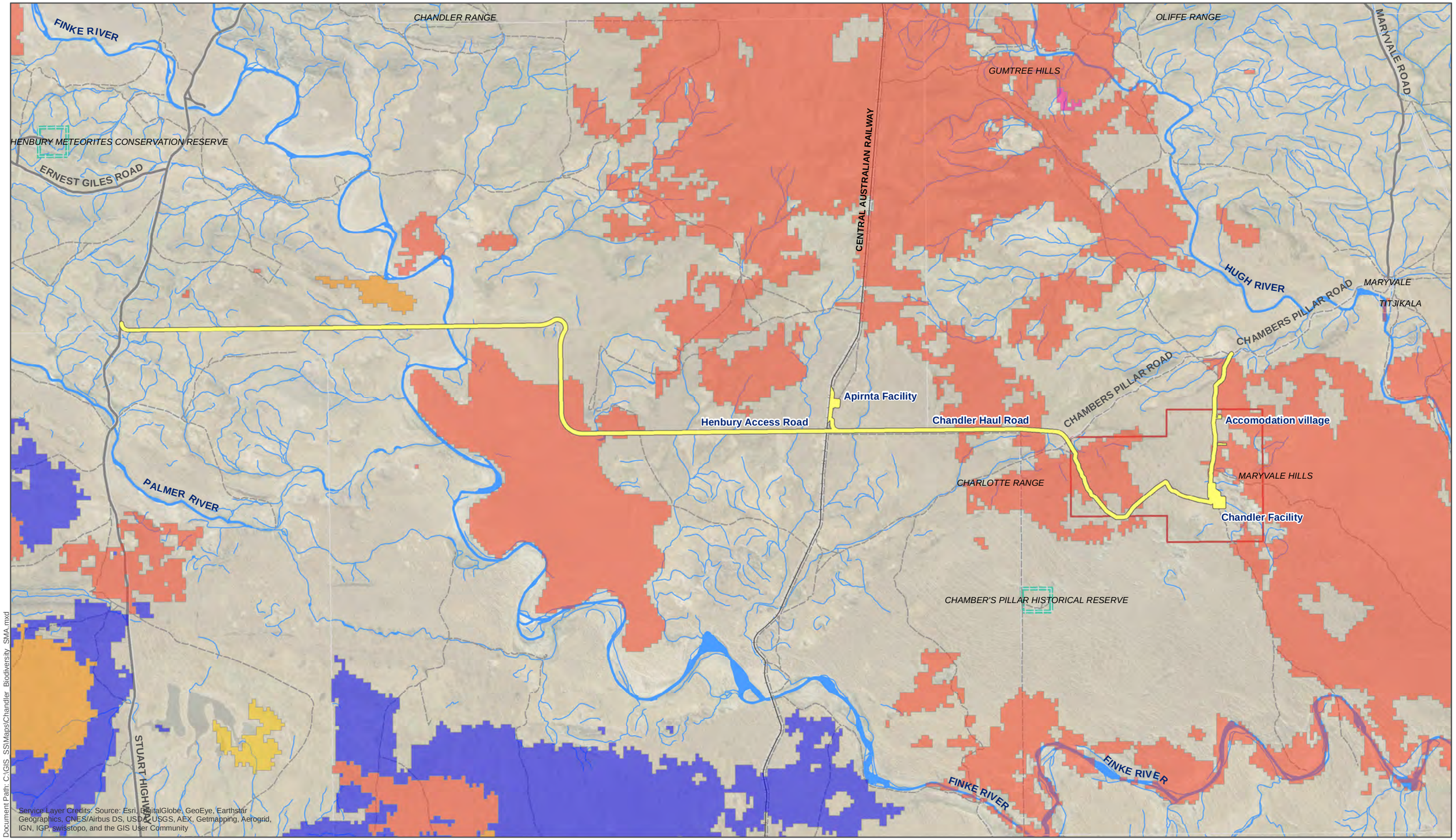

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N

4 2 0 4 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Years since last burnt

- 3
- 4
- 5
- 7
- 14

Figure 7-4
Fire history within the proposed development footprint and vicinity

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Conservation-significant flora species

Ten conservation-significant flora species listed under the TPWC Act and/or EPBC Act have been recorded or are predicted to occur within the proposed development footprint or within the locality. These species, along with their conservation status and likelihood of occurrence in the proposed development footprint or vicinity, are listed in Table 7-5. Of these, eight are considered to have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity. The remaining species are considered to have a low likelihood of occurrence and are not considered further in this assessment.

Three conservation-significant flora species were recorded during the field surveys within the vicinity of the proposed development footprint. These included:

- Cottony bluebush (*Maireana carnosa*), listed as near threatened under the TPWC Act. This species was recorded on sandplains approximately 500 metres south of the proposed Apirnta Facility. It was also recorded in the vicinity of the proposed Henbury Access Road.
- *Crotalaria eremaea*, listed as data deficient under the TPWC Act. This species was recorded in sand dunes within the vicinity of the proposed development footprint, near the proposed Chandler Haul Road.
- *Calandrinia remota*, listed as data deficient under the TPWC Act. This species has not been previously recorded within the locality (that is, did not appear in any of the database searches – nether the NT DENR Flora Atlas or the DoEE Protected Matters Search Tool). This species was recorded approximately four kilometres north-east of the proposed Chandler Facility.

No threatened flora species listed under the TPWC Act or EPBC Act have been recorded or are likely to occur within the proposed development footprint or vicinity.

Table 7-5 Conservation-significant flora species either recorded or predicted to occur within the proposed development footprint or locality

Scientific name	Common name	Conservation status[1]		Likelihood of occurrence
		TPWC Act	EPBC Act	
Acacia latzii	Latz's wattle	Vu	Vu	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Acacia oswaldii	-	DD	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Brachyscome ciliaris	Variable daisy	DD	-	**High**. Suitable habitat present within the proposed development footprint and vicinity. Numerous records of the species within the locality.
Calandrinia remota	-	DD	-	**High.** Species recorded within the proposed development footprint and vicinity during field surveys.
Crotalaria eremaea	Bluebush pea	DD	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Ixiochlamys nana	Small fuzzweed	DD	-	**Moderate.** Suitable habitat present within the proposed development footprint and vicinity.
Maireana carnosa	Cottony bluebush	Nt	-	**High**. Species recorded within the vicinity of the proposed development footprint during field surveys.
Potamogeton crispus	Curly pondweed	Nt	-	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Sclerolaena longicuspis	-	Nt	-	**Moderate**. Suitable habitat present within the vicinity of the proposed development footprint.
Synapthantha tillaeacea	-	DD	-	**Moderate**. Suitable habitat present within the proposed development footprint and vicinity.

Notes: 1. Conservation status: Vu = Vulnerable, DD = Data deficient, Nt = Near threatened.

Conservation-significant flora populations and ecological communities

No threatened flora populations or endangered ecological communities listed under the TPWC Act and/or EPBC Act have been recorded or are predicted to occur within the proposed development footprint or within the locality.

Sites of conservation significance

There are no Sites of Conservation Significance or Sites of Botanical Significance as defined under the TPWC Act located within the proposed development footprint or vicinity. The nearest Sites of Conservation Significance are the:

- Greater MacDonnell Ranges, located approximately 30 kilometres to the north of the proposed Henbury Access Road.
- Rodinga Range and Adjacent Ranges, located approximately 35 kilometres to the east of the proposed Chandler Facility.
- Karinga Creek Palaeodrainage System, located approximately 39 kilometres to the south of the proposed Henbury Access Road.

The nearest Sites of Botanical Significance are the:

- Bacon Ranges, located approximately 15 kilometres from the western end of the proposed Henbury Access Road.
- Camel Creek, located approximately 24 kilometres north-north-east of the proposed Chandler Facility.
- Fox Salt Lakes, located approximately 25 kilometres south of the western end of the proposed Henbury Access Road.

7.3.3 Terrestrial fauna

This section describes the terrestrial fauna and fauna habitat within the proposed development footprint and vicinity, including the presence of conservation-significant species.

Fauna species

A total of 143 fauna species (25 native reptile species, 89 native bird species 19 mammal species [12 native and seven introduced] and 10 native bat species) were recorded within the proposed development footprint and vicinity during the field surveys. A list of animal species recorded within the proposed development footprint and vicinity is provided in Appendix R. Five conservation-significant species were recorded during the field surveys within the proposed development footprint and are discussed in further detail below.

Introduced species

Seven introduced fauna species were recorded within the proposed development footprint and vicinity during the field surveys. These included domestic cattle (*Bos taurus*), camel (*Camelus dromedaries*), donkey (*Equus asinus*), cat (*Felis catus*), house mouse (*Mus musculus*), rabbit (*Oryctolaugs cuniculus*) and red fox (*Vulpes vulpes*).

Fauna habitat

Eleven fauna habitat types were recorded within the proposed development footprint and vicinity. These habitats are described below and their distribution is shown in Figure 7-5.

FINKE RIVER

ERNEST GILES ROAD

CENTRAL AUSTRALIAN RAILWAY

Apirnta Facility

Henbury Access Road

PALMER RIVE R

STUART HIGHWAY

FINKE RIVER

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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N

2.5 1.25 0 2.5 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Habitat type

- Alluvial plain
- Coolabah/ lignum swamp
- Creekline/ drainage depression
- Dunefield
- Mesa terrain
- Plain
- Prominant hills and low ranges
- Riverine/ dunes
- Sandplain

Figure 7-5
Distribution of fauna habitat within the proposed development footprint and vicinity (Sheet 1)

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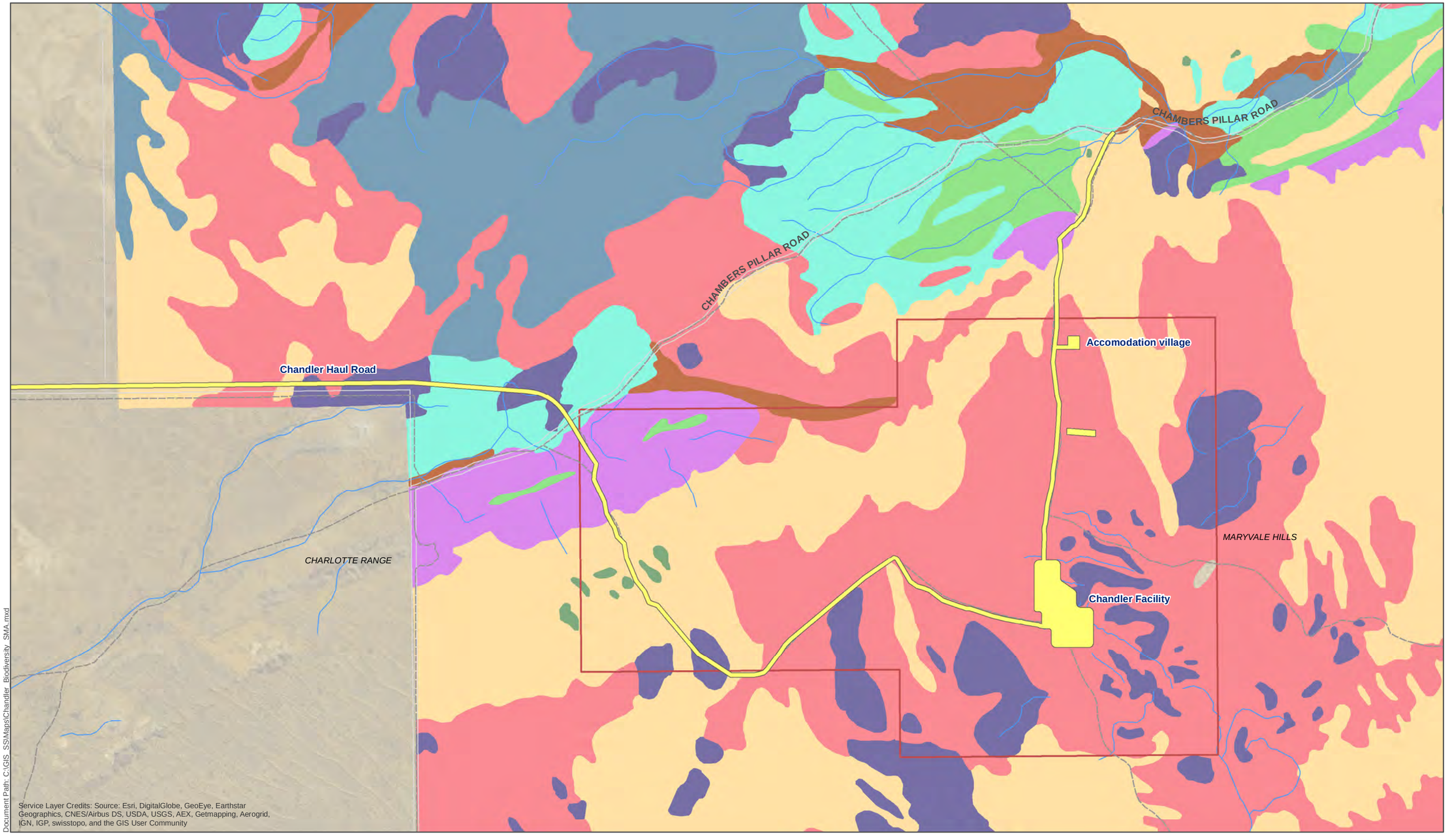

Document Path: C:\GIS_SSMaps\Chandler_Biodiversity_SMA.mxd

N

1 0.5 0 1 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Habitat type

- Tertiary conglomerate
- Prominant hills and low ranges
- Plains
- Sandplain
- Tall rocky outcrops and valleys
- Mesa terrain
- Limestone outcrops and plains
- Dune fields
- River
- amoeba
- Claypan
- sandy creek

Figure 7-5
Distribution of fauna habitat within the proposed development footprint and vicinity (Sheet 2)

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Dunefield

Plate 7-1 Dunefield habitat

Dunefields support mulga (*Acacia aneura*) open to low open-woodland with a mixed *Acacia* midstorey and a grassy understorey. The overstorey at some sites included desert oak (*Allocasuarina decaisneana*), ironwood (*Acacia estrophiolata*) and whitewood (*Atalaya hemiglauca*). The midstorey consisted of *Acacia* spp. and narrow-leaved hop bush (*Dodonea viscosa* subsp. *angustissima*). The grassy understorey included woollybutt grass (*Eragrostis eriopoda*), soft spinifex (*Trioda pungens*), sandhill canegrass (*Zygochloa paradoxa*) and erect kerosene grass (*Aristida holathera*). Termite mounds were not observed at survey sites, and there was little cover of fallen logs. An example of dunefield habitat is provided in Plate 7-1.

Allocasuarina decaisneana provides important habitat for birds, reptiles and bats. Sandy inland mouse (*Pseudomys hermannsburgensis*), central netted dragon (*Ctenophorus nuchalis*), canegrass dragon (*Diporiphora winneckei*), perentie (*Varanus giganteus)*, sand goanna (*Varanus gouldii*), and short-tailed pygmy monitor (*Varanus brevicauda*) were recorded in dunefield habitat during the field surveys. Bat species recorded in this habitat included Gould's wattled bat (*Chalinolobus gouldii*) and chocolate wattled bat (*Chalinolobus morio*), lesser long-eared bat (*Nyctophilus geoffroyi*) and western broad-nosed bat (*Scotorepens balstoni*). All bat species recorded are tree hollow dwelling. Roosting in this habitat is likely (Churchill 2008). Nineteen species of birds were recorded in this habitat type, including zebra finch (*Taeniopygia guttata*), Torresian crow *(Corvus orru*), black-faced woodswallow *(Artamus cinereus*) and crested pigeon (*Ocyphaps lophotes*).

Secondary signs of macropod, rodent, dasyurid, bird and reptile were common during all seasons in this habitat type. Secondary signs of introduced species was also commonly recorded and species identified were donkey, cattle, house mouse, camel and red fox.

Although not detected, the dunefield habitat has the potential to support threatened species including brush-tailed mulgara (*Dasycercus blythi*), crest-tailed mulgara *(Dasycercus cristicauda),* greater bilby *(Macrotis lagotis)* and southern marsupial mole (*Notoryctes typhlops).* Other non-threatened species potentially occurring within the dunefield habitat are spinifex hopping mouse (*Notomys alexis*), hairy-footed dunnart (*Sminthopsis hirtipes*), lesser hairy-footed dunnart (*Sminthopsis youngsoni*) and frog species such as *Neobatrachus* spp.

Sandplain

Sandplains support mulga (*Acacia aneura*) tall to tall-open shrubland or low open woodland with a midstorey of emu bush (*Eremophila* spp.) and cassia (*Senna aremisioides* subspp.) and a grassy

understorey. Witchetty bush (*Acacia kempeana*), desert bloodwood (*Corymbia terminalis*) and *Acacia decaisneana* were present at some but not all sandplain sites. Grasses in the understorey included woolybutt grass (*Eragrostis eriopoda*), soft spinifex (*Triodia pungens*), *Aristida* spp. and bandicoot grass (*Monachather paradoxus*). Flora species diversity was low on the sandplains relative to the dunefields. Vegetation cover was also relatively low (approximately 35%), with the remaining cover being mainly represented by bare ground. Introduced buffel grass (*Cenchrus ciliaris*) was common along the railway. An example of sandplain habitat is provided in Plate 7-2.

Mammals recorded in the sandplain habitat were sandy inland mouse (*Pseudomys hermannsburgensis*) and house mouse (*Mus musculus*). Reptiles were common during summer and included wedge-snouted ctenotus (*Ctenotus schomburgkii*), leopard ctenotus *(Ctenotus pantherinus*), common desert ctenotus (*Ctenotus leonardhii*), central military dragon (*Ctenophorus isolepis*), knob-tailed gecko (*Nephrurus levis*) and short-tailed pygmy monitor (*Varanus brevicauda*). Twenty species of bird were recorded in the sandplain habitat, with common species including zebra finch (*Taeniopygia guttata*), southern whiteface (*Aphelocephala leucopsis*), willie wagtail (*Rhipidura leucophrys*) and grey-crowned babbler (*Pomatostamus temporalis*).

There were no threatened species or secondary signs of threatened species recorded within the sandplain habitat. Despite this, sandplain habitat has the potential to support brush-tailed mulgara (*Dasycercus blythi*), crest-tailed mulgara (*Dasycercus cristicauda*) and southern marsupial mole (*Notoryctes typhlops).* Other non-threatened species potentially occurring within the sandplain habitat include desert mouse (*Pseudomys desertor*), sandplain gecko (*Lucasium stenodactylum*) and kultarr (*Antechinomys laniger*).

Plate 7-2 Sandplain habitat (left) and sandplain with watercourses (right)

Mesa terrain

Mesa terrain includes low mesa terrain and high mesa terrain. Vegetation in the low mesa terrain (the plains between mesas) consist of mixed *Acacia* tall open-shrubland with a mixed species shrubby midstorey and a grassy understorey. Overstorey species include mulga (*Acacia aneura)*, ironwood (*Acacia estrophiolata*) and dead finish (*Acacia tetragonophylla*). The midstorey contains *Senna artemisioides subsp. filifolia*, rock fuschia (*Eremophila freelingii*) and narrow-leaved hop bush

(*Dodonea viscosa* subsp. *angustissima*). Common fringe-rush (*Fimbristylis dichotomoa*) was the predominant understorey species. An example of low mesa terrain habitat is provided in Plate 7-3.

Vegetation on the high mesa terrain (the slope and top of the mesas) consisted of mulga (*Acacia aneura*) open-scrub over a rock fuschia (*Eremophila freelingii*) and dead finish (*Acacia tetragonophylla*) midstorey and a forb and low shrub understorey. Species in the understorey included wild tomato (*Solanum quadriloculatum*), golden bluebush (*Maireana georgeii*), goathead burr (*Sclerolaena bicornis*) and silver mulla mulla (*Ptilotus obovatus*). An example of high mesa terrain habitat is provided in Plate 7-3.

Four bird species were recorded in the mesa terrain habitat of which the chestnut-rumped thornbill (*Acanthiza uropygialis*) was the most common. Secondary signs of reptiles (dragons) and macropods were recorded in the low mesa terrain habitat.

Secondary signs of macropods and echidna (*Tachyglossus aculeatus*) were common in the high mesa terrain habitat. In addition, small caves (common in the high mesa terrain habitat) may provide shelter for a range of bird and mammal species, including bats. Fat-tailed false antechinus (*Pseudantechinus macdonnellensis*) and an unknown rodent were recorded within one of these caves during the field surveys (via motion sensing camera). The calls of Finlayson's cave bat (*Vespadelus finlaysoni*) were also recorded in the high mesa terrain habitat.

Secondary signs of introduced species were recorded in the low mesa terrain habitat and species identified were camels, donkeys and rabbits. Secondary signs of cattle and camel were recorded in the high mesa terrain habitat.

Plate 7-3 Low mesa terrain habitat (left) and high mesa terrain habitat (right)

Riverine dunes/river

Plate 7-4 Riverine dune/river habitat

Riverine dunes/river includes the river channel and banks associated with the Hugh River. The river channel consists of soft sand and is unvegetated. The river banks and dunes consists of deep yellow sands dominated by a river red gum (*Eucalyptus camaldulensis*) and desert honey myrtle (*Melaleuca glomerata*) open-woodland over a mixed *Acacia* midstorey and shrub and grass understorey. Midstorey species included prickly wattle (*Acacia victoriae*), umbrella wattle (*Acacia ligulata*), sandplain wattle (*Acacia murrayana*), narrow-leaved hop bush (*Dodonea viscosa* subsp. *angustissima*) and needle bush (*Vachellia farnesiana*). The understorey included *Euphorbia wheeleri*, *Euphorbia australis*, tall saltbush (*Rhagodia eremaea*) and currant bush (*Scaevola spinescens*). *Zygochloa paradoxa,* buffel grass *(Cenchrus ciliaris*) and *Cenchrus dactylon* were also common along the banks of the Hugh River. An example of riverine dunes/river habitat is provided in Plate 7-4.

Sandy inland mouse (*Pseudomys hermannsburgensis*) was the only mammal species recorded in this habitat. Secondary signs of echidna (*Tachyglossus aculeatus*) were recorded on the river bank. Reptiles recorded included two-toed lerista *(Lerista bipes*), yellow-face whip-snake (*Demansia psammophis*), tree dtella (*Gehyra ariegate*) and sand goanna (*Varanus gouldii*). Eight bird species were recorded in this habitat, including white-plumed honeyeater (*Lichenostomus penicillatus*) and zebra finch (*Taeniopygia guttata*). River channels are often used as flyways and foraging sites by bats and a number of species likely occur here. There were no records or secondary signs of threatened species in the riverine dune/river habitat.

Introduced species recorded in the riverine dune/river habitat were cat, red fox, cattle and donkey.

Prominent hills and low ranges

Plate 7-5 Prominent hill and low range habitat

Prominent hills and low ranges (with slopes between 5-8%) support desert bloodwood (*Corymbia terminalis*) and mulga (*Acacia aneura*) low open-woodland over a mixed species shrub midstorey and grass understorey. Dead finish (*Acacia tetragonophylla*) was present in the overstorey at some sites. Midstorey species included *Senna artemisioides* subsp*. filifolia*, *Eremophila* spp., *Ptilotus* spp. and saltbushes. Bunched kerosene grass (*Aristida contorta*), woolybutt grass (*Eragrostis eriopoda*) and *Enneapogon* spp. were common in the understorey. An example of prominent hills and low ranges habitat is provided in Plate 7-5.

Both direct observations and secondary signs of red kangaroo (*Macropus rufus*), *Varanus* sp., common wallaroo (*Macropus robustus*) and dingo (*Canis lupus dingo*) were recorded in this habitat. Introduced species recorded included donkey and cattle.

There were no threatened species recorded in the prominent hills and low ranges habitat and it was assessed as not being suitable for any of the threatened species identified in the desktop study.

Alluvial plains

Alluvial plains are located at the base of low mesas. Vegetation consists of *Atalaya hemiglauca* low open-woodlands over a mixed shrub midstorey and grass understorey. Midstorey species include narrow-leaved hop bush (*Dodonea viscosa* subsp. *angustissima*), sandplain wattle (*Acacia murrayana*) and mulga (*Acacia aneura*). Understorey species include soft spinifex (*Triodia pungens*), *Enneapogon avenaceus* and introduced buffel grass (*Cenchrus ciliaris*). An example of alluvial plains habitat is provided in Plate 7-6.

Secondary signs of red kangaroo (*Macropus rufus*), *Varanus* sp., perentie (*Varanus giganteus*) and skinks were common within the alluvial plains habitat. Nine species of bird, including brown falcon (*Falco berigora*), were recorded in this habitat. Introduced species recorded in the alluvial plains habitat were cattle, red fox, donkey and camel.

Plate 7-6 Alluvial plain habitat

The deep sands and hummock grasses associated with the alluvial plain habitat may provide suitable habitat for threatened fauna including great desert skink (*Liopholis kintorei*) and Slater's skink (*Liopholis slateri slateri*). These species were not recorded during the field surveys, however.

Claypans

Claypans are devoid of vegetation. Vegetation surrounding the claypans consist of mulga (*Acacia aneura*), witchetty bush (*Acacia kempeana*) and dead finish (*Acacia tetragonophylla*) tall open-shrubland over a mixed shrub midstorey and erect kerosene grass (*Aristida holathera*) understorey. Midstorey species include emu bush (*Eremophila duttoni*), *Sclerolaena* sp. And wild tomato (*Solanum quadriloculatum*). An example of claypan habitat is provided in Plate 7-7.

Claypans hold water after rain and are, therefore, an important habitat type for fauna. Secondary signs of red kangaroo (*Macropus rufus*), emu (*Dromaius novaehollandiae*), dingo (*Canis lupus dingo*) and *Varanus* sp. Were recorded in the claypan habitat. The emu is listed as near threatened under the TPWC Act. Three bird species were observed in the vegetation surrounding the claypan habitat – black-faced woodswallow (*Artamus cinereus*), singing honeyeater (*Lichenostomus virescens*) and zebra finch (*Taeniopygia guttata*). Introduced species recorded in this habitat include cattle, camels and donkeys.

Plate 7-7 Claypan habitat

Claypans may provide ephemeral habitat for migratory birds following rainfall and, as discussed above, provide water for a range of other species.

Plains

Plains support mulga (*Acacia aneura*) open to tall open-shrubland over a midstorey of dead finish (*Acacia tetragonophylla*) and witchetty bush (*Acacia kempeana*) and an understorey of shrubs, grasses and forbs. *Acacia decaisneana* and *Atalaya hemiglauca* are present in the overstorey in some areas. An overstorey is occasionally not present. Midstorey species may also include *Eremophila sturtii, Senna artemisioides subsp. filifolia,* spiney saltbush (*Rhagodia spinescens*) and lignum (*Muehlenbeckia cunninghammii*). Understorey species include wild tomato (*Solanum quadriloculatum*), *Sclerolaena* spp., *Ptilotus sessfolius,* buffel grass *(Cenchrus ciliaris*), *Enneapogon cylindricus, Eragrostis setifolia,* woolybutt grass (*Eragrostis eriopoda*) and *Aristida* spp. An example of plains habitat is provided in Plate 7-8.

Sandy inland mouse (*Pseudomys hermannsburgensis*), bearded dragon (*Pogona vitticeps*), and Leonard's ctenotus (*Ctenotus leonardii*) were trapped at survey sites within the plains habitat. Recent mulgara (*Dasycercus* sp.) tracks were also recorded within this habitat approximately 0.5 kilometres north of the proposed Chandler Haul Road (about midway along the proposed route). It is likely that the tracks were from brush-tailed mulgara (*Dasycercus blythi*). Sand goanna (*Varanus gouldii*) was observed in this habitat. Secondary signs of reptiles (dragons), rodents, red kangaroo (*Macropus rufus),* common wallaroo (*Macropus robustus*) and dingo (*Canis lupus dingo*) were also recorded in the plains habitat. Eleven species of bird, including emu (*Dromaius novaehollandiae*), crested bellbird (*Oreioca guttarlis*), willie wagtail (*Rhipidura leucophrys*), zebra finch (*Taeniopygia guttata*), mulga parrot (*Psephotus varius*) and black-faced woodswallow (*Artamus cinereus*), were recorded in the plains habitat. Introduced species recorded in the plains habitat were house mouse, rabbit, cat, cattle and camel.

Plate 7-8 Plains habitat

Tall rocky outcrops and valleys

This habitat consisted of two distinct habitats; tall rocky outcrops and valleys. Vegetation consists of coolibah (*Eucalyptus intertexta*) low open-woodland over a mixed shrub midstorey and an understorey dominated by *Tecticornia* spp. Midstorey species include desert cassia (*Senna artemisioides. filifolia*), *Acacia tetragonophylla,* needlewood (*Hakea leucoptera*) and hareliquin fuchsia (*Eremophila duttonii*). Additional understorey species include bottlewashers (*Enneapogon avenaceus*), fairy grass (*Sporobolus actinocladus*) and introduced buffel grass (*Cenchrus ciliaris*).

Five bird species, including zebra finch (*Taeniopygia guttata*) and weebill (*Smicrornis brevirostris*), were recorded.

Creekline/drainage depression

Plate 7-9 Creekline/drainage depression habitat dominated by mulga (*Acacia aneura)*

Creekline/drainage depressions support woodland to open-woodland over a mixed species shrub midstorey and a grass/forb understorey. The overstorey is dominated by mulga (*Acacia aneura*), coolabah (*Eucalyptus intertexta*) or *Eucalyptus camaldulensis* with *Acacia hemiglauca* also present. Midstorey species include witchetty bush (*Acacia kempeana*), dead finish (*Acacia tetragonophylla*), *Senna artfilifolia,* crimson turkey bush (*Eremophila latrobei*), emu bush (*Eremophila duttoni*) and *Eremophila sturtii*. Understorey species include *Acacia holathera,* desert Chinese lantern (*Abutilon otocarpum*), buffel grass (*Cenchrus ciliaris*), *Fimbristylis dichotoma,* woolybutt grass (*Eragrostis eriopoda*), *Maireana astrotricha* and *Solanum quadriloculatum.* An example of creekline/drainage depression habitat is provided in Plate 7-9.

Reptiles were the dominant group recorded within the creekline/drainage depression habitat, with species including central netted dragon (*Ctenophorus nuchalis*), lined firetail skink (*Morethia ruficauda*) and tree dtella (*Gehyra variegata*). House mouse (*Mus musculus*) was also trapped in this habitat. Secondary signs of reptiles (dragons) and skinks was abundant. Sixteen bird species, including white-browed babbler (*Pomatostomus superciliosus*) and mulga parrot (*Psephotus varius*), were recorded in the creekline/drainage depression habitat.

Coolabah and lignum swamp

Coolabah and lignum swamp habitat is found in Duck Swamp (and associated claypans). This habitat incorporates an area of approximately 50 hectares and experiences irregular ephemeral inundation. The vegetation community is a low-open woodland of coolabah (*Eucalyptus coolabah arida*) over a midstory of mixed species including lignum (*Muehlenbeckia cunninghamii*), *Euphorbia biconvexa* and spiney saltbush (*Rhagodia spinescens*). Understory species include short grasses and forbs including salty heath (*Frankenia cordata*), spear-fruit copper burr (*Scleroleana patenticuspis*), tall copper burr *(Scleroleana convexula*), lifesaver burr (*Sida platycalyx*), bindieye (*Tribulus eichlerianus*), narrow-leaf neverfail (*Eregrostis setifolia*) *and* woolybutt grass (*Eragrostis eriopoda*). Buffel grass (*Cenchrus ciliaris*) was recorded around the fringes of the swamp above the flood line. Vegetation within this habitat type is dependent on ephemeral and infrequent inundation. An example of coolabah and lignum swamp habitat is provided in Plate 7-10.

Four bird species were recorded in this habitat including mulga parrot (*Psephotus varius*), white-plumed honeyeater (*Lichenostomus penicillatus*), crested bellbird (*Oreoica gutturalis*) and willie wagtail (*Rhipidura leucophrys*). Reptile species recorded included central netted dragon (*Ctenophorus nuchalis*), fat-tailed gecko (*Diplodactylus conspicillatus*) and tree dtella (*Gehyra variegata)*. Mammal species recorded included red kangaroo (*Macropus rufus*) and dingo (*Canis lupus dingo*). Bat species recorded are tree hollow dwelling and roosting in this habitat is likely.

While there were no threatened species recorded in this habitat, coolabah and lignum swamps are potentially suitable habitat for conservation-significant species including the red-tailed cockatoo (*Calyptorhynchus samueli*), scarlett chested parrot (*Neophema splendida*) and princess parrot (*Polytelis alexandrae*).

Secondary signs of introduced species including donkey and cattle were recorded in this habitat.

Plate 7-10 Coolabah lignum swamp habitat

Conservation-significant species

Thirty-two conservation-significant fauna species listed under the TPWC Act and/or EPBC Act have been recorded or are predicted to occur within the proposed development footprint or within the locality. This includes one invertebrate, four reptiles, 17 birds and 10 mammals. These species, along with their conservation status and likelihood of occurrence in the proposed development footprint or vicinity, are listed in Table 7-6. Of these, 22 are considered to have a low to moderate, moderate, or high likelihood of occurrence within the proposed development footprint or vicinity. The remaining species are considered to have a low likelihood of occurrence and are not considered further in this assessment.

Six conservation-significant fauna species were recorded during the field surveys within the proposed development footprint or vicinity. These included:

- Australian bustard (*Ardeotis australis*), listed as near threatened under the TPWC Act. This species was recorded in spinifex hummock grassland in the vicinity of the proposed Chandler Facility.

- Bush-stone curlew (*Burhinus grallarius*) listed as near threatened under the TPWC Act. This species was recorded in spinifex hummock grassland and low sparse shrubland in the vicinity of the proposed Chandler Facility.
- Red-tailed cockatoo (*Calyptorhynchus samueli*) listed as near threatened under the TPWC Act. This species was recorded on the proposed Henbury Access Road.
- Emu (*Dromaius novaehollandiae*), listed as near threatened under the TPWC Act. This species was recorded in spinifex hummock grassland in the vicinity of the proposed Henbury Access Road and Apirnta Facility.
- Scarlett chested parrot (*Neophema splendida*) listed as near threatened under the TPWC Act. This species was recorded in spinifex hummock grassland in the vicinity of the proposed Chandler Facility.
- Redthroat (*Pyrrholaemus brunneus*), listed as near threatened under the TPWC Act. This species was recorded in low sparse-shrubland in the vicinity of the proposed Chandler Facility.

In addition, secondary signs of three conservation-significant species were also recorded within the vicinity of the proposed development footprint. These included:

- Brush-tailed mulgara (*Dasycercus blythi*) listed as vulnerable under the TPWC Act. This species has not been previously recorded within the locality (that is, did not appear in any of the database searches – neither the NT DENR Fauna Atlas nor the DoEE Protected Matters Search Tool). Mulgara (*Dasycercus* sp.) tracks were observed approximately 0.5 kilometres north of the proposed Chandler Haul Road (about midway along the proposeed route) during the field surveys. The tracks may belong to either this species, or the crest-tailed mulgara (*Dasycercus cristicauda*).
- Crest-tailed mulgara (*Dasycercus cristicauda*) listed as vulnerable under the TPWC Act and the EPBC Act. As stated above, *Dasycercus* sp. tracks were observed approximately 0.5 kilometres north of the proposed Chandler Haul Road during the field surveys. The tracks may belong to either this species or the brush-tailed mulgara (*Dasycercus blythi*).
- Southern marsupial mole (*Notoryctes typhlops*) listed as vulnerable under the TPWC Act. Secondary signs of this species were recorded on the banks of the Finke River (approximately 850 metres north of the proposed Henbury Access Road) (refer to Plate 7- 11).

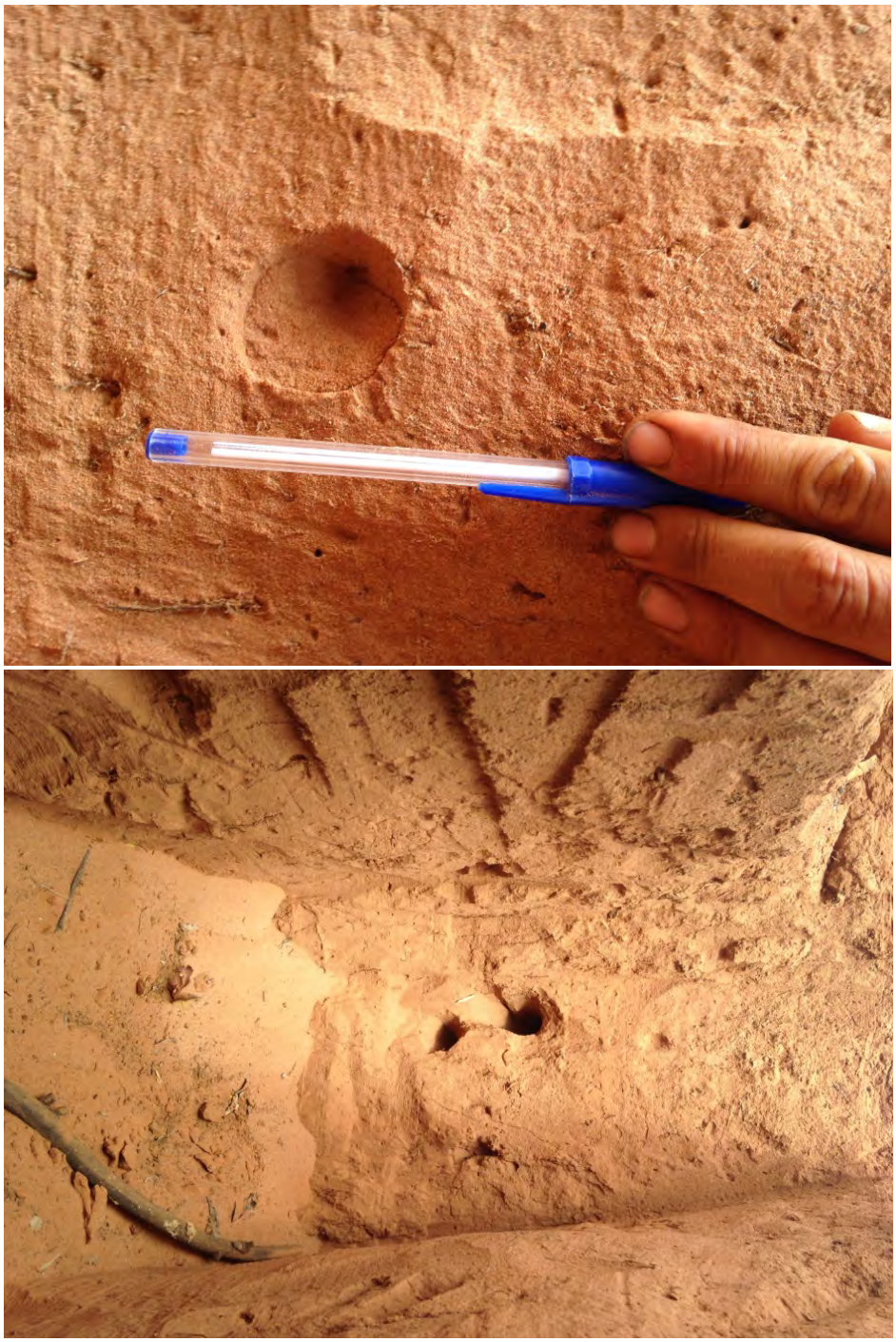

Plate 7-11 Southern marsupial mole backfilled tunnels in a mole trench on the bank of the Finke River

Table 7-6 Conservation-significant fauna species either recorded or predicted to occur within the proposed development footprint or locality

Scientific name	Common name	Conservation status[1]		Likelihood of occurrence
		TPWC Act	EPBC Act	
Invertebrates				
Croitana aestiva	Desert sand-skipper	En	En	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Reptiles				
Delma demosa	Desert delma	DD	-	**High.** Suitable habitat present within the proposed development footprint and vicinity.
Liopholis kintorei	Great desert skink	Vu	Vu	**Low to moderate**. Suitable habitat present within the proposed development footprint and vicinity.
Liopholis slateri	Slater's skink	Vu	En	**Low to moderate.** Suitable habitat present within the proposed development footprint and vicinity.
Pseudechis australis	King brown snake	Nt	-	**High.** Suitable habitat present within the proposed development footprint and vicinity.
Birds				
Acanthiza iredalei	Slender thornbill	ER	Vu	**Low**. Considered regionally extinct.
Amytornis modestus indulkana	Thick-billed grasswren	Cr	Vu	**Low to moderate**. Suitable habitat present within the proposed development footprint and vicinity.
Amytornis striatus	Striated grasswren	Nt	-	**Moderate.** Suitable habitat present within the proposed development footprint and vicinity.
Ardeotis australis	Australian bustard	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Burhinus grallarius	Bush stone-curlew	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Calyptorhynchus samueli	Red-tailed black cockatoo	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Canopophila whitei	Grey honeyeater	DD	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Cinclosoma castanotum	Chestnut quail-thrush	Nt	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Dromaius novaehollandiae	Emu	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Elanus scriptus	Letter-winged kite	Nt	-	**High**. Suitable habitat present within the proposed development footprint and vicinity after heavy rainfall.

Scientific name	Common name	Conservation status[1]		Likelihood of occurrence
		TPWC Act	EPBC Act	
Leipoa ocellata	Malleefowl	Cr	Vu	**Low**. Considered regionally extinct.
Lophoictinia isura	Square-tailed kite	Nt	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Neophema splendida	Scarlet-chested parrot	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys. Suitable habitat present within the proposed development footprint and vicinity after heavy rainfall.
Pezoporus occidentalis	Night parrot	Cr	En	**Low**. Considered regionally extinct.
Polytelis alexandrae	Princess parrot	Vu	Vu	**Moderate.** Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall (particularly around the Finke River).
Pyrrholaemus brunneus	Redthroat	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Rostratula australis	Australian painted snipe	Vu	En	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Mammals				
Antechinomys laniger	Kultarr	Nt	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Dasycercus cristicauda	Crest-tailed mulgara	Vu	Vu	**High**. Suitable habitat present within the proposed development footprint and vicinity. Tracks of *Dasycerus* spp. recorded during field surveys.
Dasycercus blythi	Brush-tailed mulgara	Vu	-	**High**. Suitable habitat present within the proposed development footprint and vicinity. Tracks of *Dasycerus* spp. recorded during field surveys.
Isoodon auratus	Golden bandicoot	Vu	En	**Low**. Suitable habitat not present within the proposed development footprint or vicinity. Has not been recorded in central Australia since 1952.
Macrotis lagotis	Greater bilby	Vu	Vu	**Low**. Suitable habitat is present within the proposed development footprint and vicinity, but species not been recorded in central Australia since 1969.
Notomys cervinus	Fawn hopping-mouse	ER	-	**Low**. Suitable habitat not present within the proposed development footprint or vicinity. Species considered extinct in the NT.
Notoryctes typhlops	Southern marsupial mole	Vu	-	**High.** Secondary signs of the species were recorded at two sites on the Finke River during the field surveys.

Scientific name	Common name	Conservation status[1]		Likelihood of occurrence
		TPWC Act	EPBC Act	
***Petrogale lateralis,* MacDonnell Ranges race**	Black-footed rock-wallaby	Nt	Vu	**Low**. Suitable habitat not present within the proposed development footprint or vicinity. No historical records of the species in the locality.
Rattus tunneyi	Pale field-rat	Vu	-	**Low**. Species has not been recorded in central Australia since 1975. Not thought to currently persist in central Australia.
Zyzomys pedunculatus	Central rock-rat	En	En	**Low**. Suitable habitat not present within the proposed development footprint or vicinity. Has not been recorded in central Australia since before 1971.

Notes: 1. Conservation status: En = Endangered, Vu = Vulnerable, ER = Extinct regionally, Cr = Critically Endangered DD = Data deficient, Nt = Near threatened.

Migratory species

Eleven migratory species listed under the EPBC Act have been recorded or are predicted to occur within the proposed development footprint or within the locality. These species, along with their conservation status and likelihood of occurrence in the proposed development footprint or vicinity, are listed in Table 7-7. Of these, eight are considered to have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity. The remaining species are considered to have a low likelihood of occurrence and are not considered further in this assessment.

Three migratory species were recorded during the field surveys within the proposed development footprint or vicinity. These were:

- Sharp-tailed sandpiper (*Calidris acuminata*). This species was recorded in the vicinity of the proposed Chandler Facility.
- Rainbow bee-eater (*Merops ornatus*). This species was recorded in a range of habitats within the proposed development footprint and vicinity.
- Marsh sandpiper (*Tringa stagnatilis*). This species has not been previously recorded within the proposed development footprint or vicinity (that is, did not appear in any of the database searches – nether the NT DENR Fauna Atlas or the DoEE Protected Matters Search Tool). This species was recorded incidentally in a small ephemeral waterhole in the Finke River.

Table 7-7 Migratory species either recorded or predicted to occur within the proposed development footprint or locality

Scientific name	Common name	Conservation Status		International agreements	Likelihood of occurrence
		TPWC Act	EPBC Act		
Apus pacificus	Fork-tailed swift	-	Mi, Ma	J, C, R	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Ardea alba	Great egret	-	Mi, Ma	-	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Calidris acuminata	Sharp-tailed sandpiper	-	Mi, Ma	B, J, C, R	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Charadrius veredus	Oriental plover	-	Mi, Ma	B, J, C, R	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Glareola maldivarum	Oriental pratincole	-	Mi, Ma	J, C, R	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Merops ornatus	Rainbow bee-eater	-	Mi, Ma	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Motacilla cinerea	Grey wagtail	-	Mi, Ma	J, C, R	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Motacilla flava	Yellow wagtail	-	Mi, Ma	J, C, R	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Pandion haliaetus	Osprey	-	Mi, Ma	B	**Low.** Suitable habitat not present in the proposed development footprint or vicinity.
Tringa nebularia	Common greenshank	-	Mi, Ma	B, J, C, R	**High.** Suitable habitat is present in the proposed development footprint and vicinity. Likely to occur particularly during the non-breeding season.
Tringa stagnatilis	Marsh sandpiper	-	Mi, Ma	B, J, C, R	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.

Notes: 1. Conservation status: Mi = Migratory, Ma = Marine. International agreements: J = Japan-Australia Migratory Bird Agreement (JAMBA), C = China-Australia Migratory Bird Agreement (CAMBA), R = Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), B = Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

7.3.4 Other matters of national environmental significance

There are no other matters of national environmental significance within the proposed development footprint or vicinity. The closest matter of national environmental significance is Witjira-Dalhousie Springs National Heritage Place, located approximately 230 kilometres south-east of the proposed Chandler Facility.

7.3.5 NT Reserves

Chambers Pillar Historical Reserve is located approximately 6.8 kilometres from the proposed Chandler Facility. It is not a matter of national environmental significance.

7.4 Assessment of risk during construction

This section presents the potential impacts (both direct and indirect) on terrestrial flora and fauna during construction of the Proposal. Mitigation measures to avoid or reduce these impacts are discussed in Section 7.9.

7.4.1 Direct impacts

Direct impacts on flora and fauna during construction include the removal of vegetation and the loss of fauna habitat. These impacts are discussed below.

Removal of vegetation

Approximately 397.5 hectares of vegetation would be removed during construction of the Proposal. This would include approximately 85.5 hectares for the proposed Chandler Facility, 39 hectares for the Apirnta Facility, 180 hectares for the Henbury Access Road and 93 hectares for the Chandler Haul Road. The estimated amount of land system that would be cleared for construction is presented in Table 7-8. The estimated amount of vegetation removed by vegetation type is presented in Table 7- 9.

Both the land systems and vegetation types that would be impacted by vegetation removal during construction are well represented in the surrounding undeveloped land in the Finke Bioregion and/or in the neighbouring MacDonnell Ranges Bioregion, as shown graphically in Figure 7-2 and Figure 7-3.

The removal of native vegetation is highly unlikely to threaten the persistence of any populations of native plants or vegetation communities, including those conservation-significant flora species recorded or considered likely to occur within the proposed development footprint or vicinity (refer to Section 7.3.2). As discussed in Section 7.3.2, no threatened flora species listed under the TPWC Act and/or EPBC Act were recorded or are predicted to occur within the proposed development footprint or vicinity. Therefore, no threatened flora species would be impacted during vegetation removal for the construction of the Proposal.

One flora species listed as near threatened and two listed as data deficient under the TPWC Act were recorded within the vicinity of the proposed development footprint during the field surveys. An

additional five near threatened or data deficient species listed under the TPWC Act have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity (refer to Section 7.3.2). Some of these species may be impacted during construction of the Proposal. However, none of these species are considered to have conservation significance within the proposed development footprint or vicinity, or within the wider locality. All species are locally common with a widespread distribution and there is no critical habitat for any of these species within the proposed development footprint or vicinity.

Table 7-8 Estimated amount of land system cleared for construction of the Proposal.

Land systems	Chandler Facility (ha)	Apirnta Facility (ha)	Henbury Access Road (ha)	Chandler Haul Road (ha)	Total (ha)
Angas	0	39	22.5	2.28	**63.78**
Amulda	0	0	0	0	**0**
Chandler	0	0	63.9	19.94	**83.84**
Finke	0	0	7.92	0	**7.92**
Gillen (1)	0	0	6.3	1.88	**8.18**
Gillen (2)	0	0	0	2.90	**2.90**
Renners	0	0	15.61	1.61	**17.22**
Rumbulara	34.2	0	0	1.71	**35.91**
Simpson	0	0	47.34	33.86	**81.2**
Singleton	51.3	0	14.84	30.41	**96.55**
Total	**85.5**	**39.0**	**180.0**	**93**	**397.5**

Table 7-9 Estimated vegetation removal by vegetation type for construction of the Proposal

Vegetation type	Chandler Facility (ha)	Apirnta Facility (ha)	Henbury Access Road (ha)	Chandler Haul Road (ha)	Total (ha)
***Maireana* low open chenopod Shrubland (type 110)**	43.5	39	0	3.42	**85.92**
***Triodia* low hummock grassland (type 83)**	42	0	95.68	69.10	**206.78**
***Triodia* low hummock grassland (type 82)**	0	0	32.06	3.08	**35.14**
***Maireana* low open chenopod shrubland (type 108)**	0	0	47.72	0	**47.72**
Mulga tall sparse shrubland with low sparse shrubland understorey (Type 70)	0	0	0	17.40	**17.40**
***Acacia* tall open shrubland (type 66)**	0	0	4.54	0	**4.54**
Total	**85.5**	**39.0**	**180.0**	**93**	**397.5**

Loss of fauna habitat

The proposed development footprint and vicinity provides habitat for a range of fauna including reptiles, birds and mammals (refer to Section 7.3.3). The removal of vegetation within the proposed development footprint would result in a loss of fauna foraging, breeding, roosting, sheltering and/or dispersal habitat. The loss of fauna habitat (and the potential conservation-significant fauna species that rely on that habitat) is summarised in Table 7-10. Habitat loss would be minimal when compared to the amount of available, undisturbed habitat in the vicinity of the proposed development footprint, and in the locality.

As discussed in Section 7.3.3, eight threatened fauna species listed under the TPWC Act and/or EPBC Act and eight migratory species listed under the EPBC Act were recorded or are predicted to occur within the proposed development footprint or vicinity. Potential impacts on these species are discussed in Section 7.7.1 and 7.7.2.

An additional 14 species listed as near threatened or data deficient under the TPWC Act were recorded or are predicted to occur with the proposed development footprint or vicinity (refer to Section 7.3.3). None of these species are considered to have conservation significance within the proposed development footprint or vicinity, or within the wider locality. All species are locally common with a widespread distribution and there is no critical habitat for any of these species within the proposed development footprint or vicinity.

Table 7-10 Estimated loss of habitat from construction of the Proposal

Habitat type	Dependant on groundwater	Dependant on surface water	Potentially supports threatened or migratory species	Chandler Facility (ha)	Apirnta Facility (ha)	Chandler Haul Road (ha)	Henbury Access Road (ha)	Total (ha)
Dune fields	No	No	*Dasycercus blythi, D. cristicauda, N. typhlops, Polytelis alexandrae* and *Merops ornatus*	0.36	0	27.98	39.78	**68.12**
Sand plains	No	No	*Dasycercus blythi, D. cristicauda (D. cristicauda is predominantly found on sand dunes),* and *Notoryctes typhlops, polytelis alexandrae* and *Merops ornatus*	59.74	0	23.25	8.32	**91.31**
Mesa terrain	No	No	*Amytonris modestys indulkana* and *Merops ornatus*	0.76	0	15.06	15.81	**31.63**
Riverina dunes/river	No	Yes – ephemeral river flows	*Notoryctes typhlops, Polytelis alexandrae* and *Merops ornatus*	0	0	0	2.09	**2.09**
Prominent hills and low ranges	No	No	*Polytelis alexandrae* and *Merops ornatus*	24.64	0	6.4	14.77	**45.81**
Alluvial plains	No	No	*Liopholis kintorei, Liopholis slaeri slateri, Polytelis alexandrae* and *Merops ornatus*	0	0	0	75.11	**75.11**
Clay plans	No	Yes	*Merops ornatus* and may support migratory birds after high rainfall - *Rostularia australis, Apus pacificus, Ardea modesta, Caladris acuminata, Charadrius veredus, Glareola maldivarum, Tringa nebularia* and *Tringa stagnatilis*	0	0	0	0	**0**
Plains	No	No	*D. blythi* and *Merops ornatus*	0	39	10.71	20.30	**70.01**
Tall rocky out crops and valleys	No	No	*Merops ornatus*	0	0	9.6	0	**9.6**
Creek lines and drainage depressions	No	Yes - ephemeral	*P. alexandrae* and *Merops ornatus*	0	0	0	0	**0**
Coolabah and lignum swamps	No	Yes – infrequent flooding	*P. alexandrae* and *Merops ornatus*	0	0	0	3.82	**3.82**
Total				**85.5**	**39**	**93**	**180**	**397.5**

7.4.2 Indirect impacts

Potential indirect impacts on flora and fauna during construction may include: habitat fragmentation; fauna displacement, injury or mortality; fauna strike; edge effects; altered hydrology; groundwater abstraction; contamination; erosion and sedimentation; dust; increased light, noise and vibration; the introduction and spread of weeds and invasive species; increased predator species; increased introduced fauna use; and an increased incidence of bushfire. These impacts are discussed below.

Habitat fragmentation

Habitat fragmentation is the process of habitat loss whereby large continuous habitat is broken down into smaller, more isolated sections (Fahrig 2003). There may be some small-scale, localised fragmentation of habitat created during construction of the Proposal. However, most habitat types that would be directly impacted during construction are well represented and interconnected in the vicinity of the proposed development footprint and all are well represented the wider locality (within the Finke Bioregion and/or in the neighbouring MacDonnell Ranges Bioregion).

Fauna displacement, injury or mortality

The removal of vegetation has the potential to result in fauna displacement, injury or mortality. This would be particularly the case for less mobile species such as invertebrates and small reptiles and mammals. More mobile species such as birds and larger mammals would be able to avoid vegetation removal and other construction activities, seeking refuge in nearby alternative habitat outside of the proposed development footprint.

Fauna strike

Increased vehicle movements within the proposed development footprint and vicinity during construction may result in an increased incidence of fauna strike (resulting in injury or mortality). Initially, access to the site would be via the Stuart Highway and Maryvale Road. Both of these roads are already heavily trafficked and well established, hence the increased risk of fauna strike along these roads would be minimal.

Construction of the proposed Henbury Access Road and Chandler Haul Road would be undertaken early in the construction phase to improve site access. Construction of these new roads may result in an increased incidence of fauna strike, particularly during the hours of dusk and dawn, which coincides with high activity for crepuscular species (those species active primarily during twilight hours) accompanied with low visibility (Rowden *et al*. 2008). Vehicle movements would be restricted during these times, as far as practicable.

Edge effects

'Edge effects' are the result of a disturbance or development that results in two contrasting habitats to meet without any gradient or gradual change between. Edge effects can occur due to clearing,

decreasing ecosystems resilience to external pressures such as weeds, erosion, and invasive pests, reducing the ability of the remnant vegetation to buffer against these factors (May and Norton 1996). Generally, it is more prevalent where the remnant vegetation has a larger perimeter to area ratio, (for example, a long narrow rectangular block). The level of risk is dependent on clearing type (bare soil or top vegetation only), location and cumulative impacts from surrounding developments.

The biggest risk to biodiversity due to edge effects is the establishment of weed species and the increased ease of access for introduced fauna (May and Norton 1996, Parendes and Jones 2000).

Due to the remote location, lack of developments in the surrounding area and the majority of land systems and vegetation types being well represented locally, there is unlikely to be a long term impact on biodiversity in the vicinity of the proposed development footprint as a result of edge effects.

Altered hydrology

The existing landform and hydrology within the proposed development footprint and vicinity would be altered during construction of the Proposal. These alterations have the potential to adversely affect the hydrological regime downstream, including associated aquatic and riparian communities. These impacts would, however, be localised and short term. As the surface hydrology is ephemeral and because important wetlands or dry season water refuges would not be impacted during construction, the changes and modifications impacting downstream flora and fauna would be low. A water management plan has been developed, which outlines provisions for establishing surface water detention basins located on the perimeter of hardstand areas to (a) retain surface water runoff and (b) separate dirty water from clean water. This would be done to minimise impacts on downstream water quality (refer to Chapter 9).

Groundwater abstraction

There would be no drawdown impacts on vegetation as the target horizon for water supply is between 140 metres below ground level and 170 metres below ground level.

Contamination

Potential contamination may occur from the accidental release of fuel, oil or other hazardous materials during the handling, use and storage of such materials within the proposed development footprint and vicinity during construction of the Proposal.

Accidental spills or leaks of fuel, oil or hazardous materials could result in contamination of soil or watercourses. Contamination of soil or watercourses can impact vegetation and also downstream receptors through direct or indirect pathways (Donaldson and Bennet 2004). Direct impacts may occur through inhalation, dermal contact or ingestion; and indirect impacts may occur through root uptake or water contamination.

There would only be minimal amounts of fuel, oil or hazardous materials stored on-site for general construction use and these materials would be stored in designated bunded areas. These materials

would be stored and handled on-site in accordance with AS 1940-2004 *Storage and Handling of Flammable and Combustible Liquids.*

Erosion and sedimentation

Erosion and thus sedimentation may occur from activities such as vegetation removal, excavations and earthworks during construction of the Proposal. This could result in reduced habitat quality in the vicinity of the proposed development footprint, and downstream of the proposed development footprint. Erosion and sedimentation controls would be established prior to construction to manage the potential impacts associated with vegetation removal, excavations and earthworks during construction of the Proposal.

Dust

Dust from vegetation removal, excavation and earthworks has been shown to reduce plant and animal health. Dust can affect photosynthesis, respiration and transpiration in plants, and allow the penetration of gaseous pollutants. This can lead to decreased productivity and in the long term can alter community structure. Dust has also been shown to impact the health of fauna, such as through respiratory disease, and the reduction in health of animals can be exacerbated by changes to plant health and community structure.

Impacts on the surrounding flora and fauna due to a temporary increase in dust would be minimal, however. The heterogeneous nature of dust and the difference in plant response means that dust issues for local flora and fauna is site specific (Turner 2013). Flora and fauna in the arid environment are adapted to periods of 'boom and bust', where it is possible to experience several years of drought and high amounts of dust. This natural occurrence of dust in the arid environment has increased species resilience to impacts related to dust deposition on leaves, bark, flowers, etc.

Light, noise and vibration

An increase in light within the proposed development footprint and vicinity from vehicles and machinery could affect nocturnal fauna, potentially disrupting movement and behaviour. An increase in light would likely increase the number of insects within the vicinity of the proposed development footprint, attracting native and introduced fauna to the proposed development footprint and vicinity (insects provide a valuable food source for many native and introduced fauna species). An increase in light may attract more predator fauna species, increasing the pressure on native prey.

Construction activities would also result in an increase in noise levels within the proposed development footprint and vicinity, which may affect fauna species. Some fauna species would likely tolerate an increase in noise, while others may not, causing them to leave the affected area or making the area less desirable for foraging, nesting and breeding.

Vibration from construction activities such as from blasting and heavy vehicle movements may deter native fauna from using the area near the vibration sources. This may potentially interrupt dispersal within the vicinity of the proposed development footprint if an individual is unwilling to travel

through an area where vibration is detectable, or may cause some species to abandon an area in search of areas where vibration is not detectable.

Introduction and spread of weeds and invasive species

There is a potential to introduce or spread weeds and other invasive species within the proposed development footprint or vicinity via vehicle movements, imported material and through vegetation removal (disturbance) during construction of the Proposal. Weeds and invasive flora species can readily establish in disturbed areas after rain, quickly out competing native vegetation and colonising. Weeds and invasive flora species are currently confined to small localised areas within the proposed development footprint and vicinity and there is a risk that the current populations could be expanded during construction of the Proposal.

Increased predator species

There is a potential to increase predator species access, and hence predation success, within the proposed development footprint and vicinity via the creation of new roads and through vegetation removal (disturbance) during construction of the Proposal. This may result in increased stress on native prey species within the proposed development footprint or vicinity.

The creation of artificial water sources, heat and shade, and food sources (from staff and rubbish bins) may also cause predators to habituate the proposed development footprint and vicinity, increasing stress on native prey species.

Increased introduced fauna use

Introduced species may use the proposed development footprint and vicinity more frequently due to the creation of artificial water sources, new roads and vegetation removal (disturbance). This may result in increased fauna strike, increased pressure on native flora and fauna (through competition and predation) and the potential spread of weeds.

Bushfire

There may be an increase in the incidence of fire from the accidental ignition of combustible fuels. Fire can benefit some disturbance-tolerant species, but can be detrimental to other species if it occurs at the wrong time of year or in habitats that do not respond well to fire. Fire could result in the injury or mortality of flora and fauna within the proposed development footprint and vicinity, or within the wider locality.

7.5 Assessment of risk during operation

This section presents the potential impacts (both direct and indirect) on flora and fauna during operation of the Proposal. Mitigation measures to avoid or reduce these impacts are discussed in Section 7.9.

7.5.1 Direct impacts

There would be no direct impacts on flora or fauna during operation of the Proposal. Impacts to biodiversity would be limited to indirect impacts which are discussed below.

7.5.1 Indirect impacts

Potential indirect impacts on flora and fauna during operation may include: fauna strike; altered hydrology; groundwater abstraction; contamination; increased light, noise and vibration; the introduction and spread of weeds and invasive species; an increased incidence of bushfire; and potential impacts associated with salt runoff and windblown salt from stockpiles. These impacts are discussed below.

Fauna strike

Vehicles traveling along the proposed Henbury Access Road and Chandler Haul Road may result in an increased incidence of fauna strike (resulting in injury or mortality), particularly during the hours of dusk and dawn during operation of the Proposal.

Altered hydrology

Alterations to the surface hydrology within the proposed development footprint would occur during operational phase of the Proposal.

Drainage would be established on the proposed Chandler Haul Road and Maryvale Access Road. Drainage would also be established at the Chandler Facility and Apirnta Facility and would be designed to divert clean water around the proposed infrastructure located at the Chandler Facility and Apirnta Facility. Where possible, newly constructed drainage would either align with existing drainage lines or look to re-connect to them downstream.

New drainage has the potential to concentrate natural surface flow into the receiving environment, causing erosion (Costantini *et al*. 1999). Water pooling due to blocked drains or poorly designed drainage channels can attract fauna and potentially breed mosquitos. These risks would be mitigated through appropriate road construction design and monitoring.

If in the unlikely event surface waters pool for long periods of time and cause predator species to habituate to an area, this can, in turn, place stress on fauna species (DeStafano *et al*. 2000). The installation of river crossings can also cause follow-on erosion or sedimentation issues on the banks of the watercourse and on surrounding watercourses. To manage potential downstream erosion or sedimentation risks, the proponent has prepared a draft Sedimentation and Erosion Management Plan (refer to Chapter 9 and Appendix L).

Groundwater abstraction

As discussed above, there would be no drawdown impacts on vegetation as the target horizon for water supply is between 140 metres below ground level and 170 metres below ground level.

Contamination

Potential contamination may occur from the accidental release of fuel, oil or other hazardous materials during the handling, use and storage of such materials at the proposed Apirnta Facility and Chandler Facility. In addition, potential contamination may occur from the accidental release of waste materials that are being transported to the proposed Apirnta Facility along the Henbury Access Road and to the proposed Chandler Facility along Chandler Haul Road during operation of the Proposal.

Accidental spills or leaks of fuel, oil or hazardous materials or the accidental release of waste materials could result in contamination of soil or watercourses. Contamination of soil or watercourses can impact vegetation and also downstream receptors through direct or indirect pathways (Donaldson and Bennet 2004). Direct impacts may occur through inhalation, dermal contact or ingestion; and indirect impacts may occur through root uptake or water contamination.

There would only be minimal amounts of fuel, oil or hazardous materials stored on-site for general operations and these materials would be stored in designated bunded areas. These materials would be stored and handled on-site in accordance with AS 1940-2004 *Storage and Handling of Flammable and Combustible Liquids.* In addition, all hazardous and intractable wastes brought to site for storage (either temporarily at the Apirnta Facility or for permanent storage and isolation at the Chandler Facility) would be packaged and transported in accordance with a strict Waste Acceptance Criteria (refer to Appendix C). The risk of contamination from the accidental release of waste materials that are being transported to the proposed Apirnta Facility and Chandler Facility would, therefore, be very low.

Light, noise and vibration

The risks associated with light and noise and vibration during operation of would be similar to those during construction of the Proposal (ref to Section 7.4.2). Operational light and noise would be more consistent with less variation in source, location and timing. Blasting during operation would have minimal impact due to the infrequent short period of duration.

Introduction and spread of weeds and invasive species

There is the potential to introduce or spread weeds and other invasive species within the vicinity of the proposed Chandler Facility, Apirnta Facility, Chandler Haul Road and Henbury Access Road via vehicle movements during operation of the Proposal. This risk would be much reduced, however, compared to construction.

Bushfire

There may be an increase in the incidence of fire from the accidental ignition of combustible fuels. In addition, there may be a need to conduct controlled burns in the vicinity of the proposed Chandler Facility and Apirnta Facility to reduce fuel loads. Fire can benefit some disturbance-tolerant species, but can be detrimental to other species if it occurs at the wrong time of year or in habitats that do not respond well to fire. Fire could result in the injury or mortality of flora and fauna within the proposed development footprint and vicinity, or within the wider locality.

Salt

There is a low risk that salt would be released to the environment (via rain or wind) from the salt stockpiles located at the proposed Chandler Facility. The salt stockpiles would be established on an impervious clay base to block saline leachate from draining into the soil and groundwater. During low intensity rainfall events, water would interact with the salt on the surface of the stockpiles naturally forming an impervious crust that would impede run-off and also prevent the occurrence of windblown salt. Dish drains would also be constructed around the perimeter of the salt stock piles to control runoff during high intensity rainfall events.

There is the risk that salt may be released to the environment during transportation from the proposed Chandler Facility to the proposed rail siding at the Apirnta Facility via accident. As the area is semi-arid with only ephemeral watercourses, the off-site migration of accidentally spilled salt would be minimal.

7.6 Assessment of risk during closure and rehabilitation

This section presents the potential impacts (both direct and indirect) on flora and fauna during closure and rehabilitation of the Proposal. Mitigation measures to avoid or reduce these impacts are discussed in Section 7.9.

7.6.1 Direct impacts

There would be no direct impacts on flora or fauna during closure and rehabilitation of the Proposal. Impacts to biodiversity would be limited to indirect impacts which are discussed below.

7.6.2 Indirect impacts

Potential indirect impacts on flora and fauna during closure and rehabilitation may include: fauna strike; altered hydrology; contamination; erosion and sedimentation; dust; increased light, noise and vibration; the introduction and spread of weeds and invasive species; and an increased incidence of bushfire. These impacts would generally be the same as those during construction of the Proposal (refer to Section 7.4.2).

Indirect impacts on flora and fauna during closure and rehabilitation may also include soil compaction and topsoil loss. Soil left compacted and not deep ripped has a reduced ability to rehabilitate due to difficulties for flora to re-establish. Compacted soil has a lower infiltration rate

and this makes it more difficult for seedlings to emerge. Compacted soil also increases surface runoff and decreases staggered sediment loss, resulting in large sediment loads running downstream.

Nutrient-rich topsoil containing the seed bank required for rehabilitation can be lost post rehabilitation through rain and wind. The loss of topsoil can reduce the rehabilitated surfaces ability to re-vegetate.

7.7 Assessments of significance – impacts on threatened and migratory species

This section discusses impacts on matters of national environmental significance and on state-listed threatened species from the construction, operation, and closure and rehabilitation of the Proposal.

7.7.1 Impacts on matters of national environmental significance

Assessments of significance for matters of national environmental significance have been prepared for six threatened fauna species and eight migratory bird species in accordance with the *Significant Impact Guidelines 1.1-Matters of National Environmental Significance* (DoE 2013). The assessments of significance are included in Appendix R.

Threatened species

Two fauna species listed as endangered under the EPBC Act have a low to moderate likelihood of occurrence within the proposed development footprint or vicinity. These are:

- Slater's skink (*Liopholis slateri slateri*).
- Australian painted snipe (*Rostratula australis*).

In addition, four fauna species listed as vulnerable under the EPBC Act have a low to moderate or high likelihood of occurrence within the proposed development footprint or vicinity. These are:

- Great desert skink (*Liopholis kintorei*).
- Thick-billed grasswren (*Amytornis modestus indulkana*).
- Princess parrot (*Polytelis alexandrae*).
- Crest-tailed mulgara (*Dasycercus cristicauda*).

All of these species are also listed as threatened species under the TPWC Act (refer to Table 7-6). Assessments of significance were prepared for these species, the results of which are summarised below.

Slater's skink (*Liopholis slateri slateri*)

Slater's skink (*Liopholis slateri slateri*) is listed as endangered under the EPBC Act (and also under the TPWC Act). Scattered populations of Slater's skink occur on depositional alluvial plains under shrubs in shrublands and open-shrublands close to drainage lines, and minor drainages among stony hills in

catchments of the Finke, Hugh and formerly Todd Rivers emanating from the central Ranges (McDonald 2012). Slater's skink was not recorded during the field surveys. There is a low to moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of suitable habitat. Marginally suitable habitat occurs on the proposed Henbury Access Road at the crossing of the Finke River.

The closest record of the species to the proposed devleopment footprint is approximately 67 kilometres north-east of the western end of the proposed Henbury Access Road.

If the species is present within the proposed development footprint, it is possible that an isolated population of the species would be significantly impacted through habitat loss and by the potential encroachment of buffel grass into suitable habitat following the removal of vegetation. Surveys would be undertaken of the proposed access road alignment prior to construction to determine the presence/absence of this species. If the species is found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to the species. If significant impacts could not be avoided, the need for offsets would be assessed in consultation with the DoEE.

Australian painted snipe (*Rostratula australis*)

The Australian painted snipe (*Rostratula australis*) is listed as endangered under the EPBC Act (and as vulnerable under the TPWC Act). It inhabits shallow inland wetlands. The Australian painted snipe was not recorded during the field surveys. There is a low to moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat, but only during times of high rainfall. If it were to occur, this migratory species would occur in low numbers.

The closest record of the species to the proposed development footprint is approximately 85 kilometres north-west of the western end of the proposed Henbury Access Road.

Considering that this species is only likely to occur within the proposed development footprint and vicinity in low numbers (not constituting a population) and ephemeral wetlands would not be impacted, there would be no long-term decrease in the size of a population of Australian painted snipe resulting from the construction, operation, or decommissioning and rehabilitaiton of the Proposal. There would be no reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the survivial of the Australian painted snipe. There are no important breeding sites within the proposed development footprint or vicinity for the species. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to interfere with the recovery of the Australian painted snipe.

For the reasons listed above, there would be no significant impact on the Australian painted snipe during construction, operation, or closure and rehabilitation of the Proposal.

Great desert skink (*Liopholis kintorei*)

The great desert skink (*Liophlis kintorei*) is listed as vulnerable under the EPBC Act (and also under the TPWC Act). It is predominantly found in low dunes on sandplains and adjacent swales containing *Triodia* grassland vegetation and scattered shrubs, but can occupy a range of vegetation types such as lateritic palaeodrainage lines within *Melaleuca* shrubs. The great desert skink was not recorded during the field surveys. There is a low to moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat, as much of the proposed development footprint and vicinity consists of sandplain habitat with *Triodia* grassland vegetation.

The closest record of the great desert skink to the proposed development footprint is approximately 100 kilometres south-west of the western end of the proposed Henbury Access Road.

Potentially suitable habitat for the great desert skink is widespread regionally as well as within the proposed development footprint and vicinity and no populations are known within the region. Consequently, the localised construction, operation, and rehabilitation and decommissioning activities are highly unlikely to cause a long term decrease in the size of an important population of the species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the surivial of the great desert skink. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species, impact the availabiliy or quality of habitat for the species, or interfere with the recovery status of the great desert skink.

For the reasons listed above, there would be no significant impact on the great desert skink during construction, operation, or closure and rehabilitation of the Proposal.

Thick-billed grasswren (*Amytornis modestus indulkana*)

The thick-billed grasswren (*Amytornis modestus indulkana*) is listed as vulnerable under the EPBC Act (and as critically endangered under the TPWC Act). It inhabits low sparse shrublands of predominanly saltbush and cottonbush vegetation on bare and rocky ground. The thick-billed grasswren was not recorded during the field surveys. There is a low to moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat. However, the nearest known population of this northern South Australia species being approximately 167 kilometres to the south-east suggests this northern habitat is marginal and likelihood of the species moving into the area would only occur under extremely good conditions. The potentially suitable habitat occurs on the proposed Henbury Access Road.

If the species is present within the proposed development footprint, it is possible that the species would be significantly impacted because a population within the proposed development footprint or vicinity would be at the northern limit of it's range. This population would, therefore, meet the criteria of an important population. Given this, there is the potential for a long-term decrease in the

size of an important population of this species. There is also a possibilitiy of a slight reduction in the occupancy of an important population. If the species is present within the proposed development footprint, there is the potential to fragment an existing population into two or more populations or to disrupt the breeding cycle of an important population. There is also a possibility that invasive species harmul to the thick-billed grasswren become established in it's habitat.

Surveys would be undertaken prior to construction to confirm the presence/absense of this species. If the species is found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to the species. If significant impacts could not be avoided, the need for offsets would be assessed in consultation with the DoEE.

Princess parrot (*Polytelis alexandrae*)

The princess parrot (*Polytelis alexandrae*) is listed as vulnerable under the EPBC Act (and also under the TPWC Act). It inhabits sandplain environments with vegetation characterised by large *Eucalyptus gongylocarpa* or other large northern desert species of Eucalypts, *Eremophila , Grevillea* and *Hakea* shrubs with scattered trees, and less often in riverine forest, woodland and shubland habitats. The princess parrot was not recorded during the field surveys. There is a moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat, but only when extended seasonal resources are suitable. Marginally suitable habitat types within the proposed development foorprint and vicinity include sandplain, hill/low ranges areas and creekline/drainage depressions with hollow bearing trees and *Eremophila*/*Grevillea*/*Hakea* shrubs, and to a lesser extent the alluvial areas around the Finke River. These habitats may provide potential breeding habitat for the princess parrot during irruptions.

The closest record of princess parrot to the proposed development footprint is approximately 57 kilometres to the south-west where they were once common near Umbeara Creek.

As a population of princess parrot within the proposed devleopment footprint or vicinity would not meet the criteria for being an important population, activities associated with construction, operation, and decommissioning and rehabiliation would not impact an important population of this species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the surivial of the princess parrot. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to interfere with the recovery of the princess parrot. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species, impact the availabiliy or quality of habitat for the species, or interfere with the recovery of the princess parrot.

There is a potential for encroachment of buffel grass into disturbed areas where it is not currently established, which may negatively impact food plants and breeding trees for the princess parrot. Though as this species is highly mobile and there is suitable habitat outside the proposed development footprint, it is unlikely that this would significantly impact princess parrot.

For the reasons listed above, there would be no significant impact on the princess parrot during construction, operation, or closure and rehabilitation of the Proposal.

Crest-tailed mulgara (*Dasycercus cristicauda*)

The crest-tailed mulgara (*Dasycercus cristicauda*) is listed as vulnerable under the EPBC Act (and also under the TPWC Act). This species occurs in sand dune habitats, and is found predominantly on the slopes and crests of dunes with *Zygochloa paradoxa* and *Triodia* spp. vegetation.

There is a high likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat and because mulgara tracks (belonging either to the crest-tailed mulgara or brush-tailed mulgara) were recorded within the vicinity of the proposed development footprint during the field surveys. *Triodia* sp. sand dunes are present and widespread within the proposed development footprint and vicinity.

As potentially suitable habitat for the crest-tailed mulgara is widespread within the proposed development footprint and vicinity (and in the region) and the construction, operation, and rehabilitation and decommissioning activities would be localised, it is highly unlikely that there would be a long term decrease in the size of an important population of the species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the surivial of the crest-tailed mulgara. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species, impact the availabiliy or quality of habitat for the species, or interfere with the recovery of the crest-tailed mulgara.

For the reasons listed above, there would be no significant impact on the crest-tailed mulgara during construction, operation, or closure and rehabilitation of the Proposal.

Migratory species

Three migratory species were recorded during the field surveys within the proposed development footprint or vicinity. These were:

- Sharp-tailed sandpiper (*Calidris acuminata*).
- Rainbow bee-eater (*Merops ornatus*).
- Marsh sandpiper (*Tringa stagnatilis*).

A further five migratory species have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity during good seasons. These are:

- Fork-tailed swift (*Apus pacificus*).
- Great egret (*Ardea alba).*
- Oriental plover (*Charadrius veredus).*

- Oriental pratincole (*Glareola maldivarum).*
- Common greenshank (*Tringa nebularia*) (refer to Table 7-7).

A combined assessment of significance was prepared for these species and is presented in Appendix R. The proposed development footprint and vicinity is not considered important habitat for any of these migratory species, according to the significant impact criteria for migratory species. The proposed development footprint and vicinity would not support an ecologically significant proportion of the population of these species, is not of critical importance to these species at particular life-cycle stages, is not at the limit of these species ranges, and is not within an area where these species are declining.

Conclusion

At present, no biodiversity offsets are deemed necessary as there would be no significant impact to matters of national environmental significance during construction, operation, or closure and rehabilitation of the Proposal.

Surveys would be undertaken prior to construction to confirm the presence/absence of two matters of national environmental significance (threatened species) considered to have a low to moderate likelihood of occurrence within the proposed development footprint or vicinity. These are and Slater's skink (*Liopholis slateri slateri*) and the thick-billed grasswren (*Amytornis modestus indulkana*). Potential habitat for these species is located within the vicinity of the proposed Henbury Access Road. If these species are found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to these species. If significant impacts could not be avoided, the need to calculate and deliver biodiversity offsets would be assessed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC 2012b) and in consultation with the DoEE.

7.7.2 Impacts on state-listed threatened species

Assessments of significance for state-listed threatened species have been prepared for two fauna species in accordance with the *Significant Impact Guidelines 1.1-Matters of National Environmental Significance* (DoE 2013). The assessments of significance are included in Appendix R.

Threatened species

Secondary signs of two threatened fauna species listed as vulnerable under the TPWC Act were recorded within the proposed development footprint or vicinity. These were:

- Brush-tailed mulgara (*Dasycercus blythi*).
- Southern marsupial mole (*Notoryctes typhlops*) (refer to Table 7-6).

Assessments of significance were prepared for these species, the results of which are summarised below.

Brush-tailed mulgara (*Dasycercus blythi*)

The brush-tailed mulgara (*Dasycerus blythi*) is listed as vulnerable under the TPWC Act. This species inhabits sandplain, gibber plain and cracking clay habitats supporting tussock or hummock grasslands, or sparse chenopod shrubland (Dickman *et al*. 2001; Pavey *et al*. 2011; L. Young, unpublished data).

As discussed above, there is a high likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat and because mulgara tracks (belonging either to the brush-tailed mulgara or crest-tailed mulgara) were recorded within the vicinity of the proposed development footprint during the field surveys.

As potentially suitable habitat for the brush-tailed mulgara is widespread within the proposed development footprint and vicinity (and in the locality) and the construction, operation, and rehabilitation and decommissioning activities would be localised, it is highly unlikely that there would be a long term decrease in the size of an important population of the species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the survival of the brush-tailed mulgara. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species, impact the availabiliy or quality of habitat for the species, or interfere with the recovery of the brush-tailed mulgara.

For the reasons listed above, there would be no significant impact on the brush-tailed mulgara during construction, operation, or closure and rehabilitation of the Proposal.

Southern marsupial mole (*Notoryctes typhlops*)

The southern marsupial mole (*Notoryctes typhlops*) is listed as vulnerable under the TPWC Act. This species occupies dune flanks, sandy plains and river flats (Pavey 2015).

There is a high likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat and because secondary signs of this species were recorded in the riparian floodplain alongside the Finke River (approximately 850 metres north of the proposed Henbury Access Road) during the field surveys.

As potentially suitable habitat for the southern marsupial mole is widespread within the proposed development footprint and vicinity (and in the locality) and the construction, operation, and rehabilitation and decommissioning activities would be localised, it is highly unlikely that there would be a long term decrease in the size of an important population of the species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the surivial of the southern marsupial mole. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species,

impact the availabiliy or quality of habitat for the species, or interfere with the recovery of the southern marsupial mole.

For the reasons listed above, there would be no significant impact on the southern marsupial mole during construction, operation, or closure and rehabilitation of the Proposal.

Conclusion

The outcome of the assessments is that there would be no significant impact on state-listed threatened species recorded or predicted to occur within the proposed development footprint or vicinity during construction, operation or closure and rehabilitation of the Proposal.

7.8 Key threatening processes

Key threatening processes threaten, or have the potential to threaten, the survival or evolutionary development of a species, population or ecological community. They are listed under the EPBC Act. Three key threatening processes are of relevance to the Proposal. These are:

- Competition and land degradation by rabbits.
- Predation by the European red fox.
- Predation by feral cats.

Key threatening processes have been considered in the assessment of risks and assessments of significance for the threatened and migratory species recorded or predicted to occur within the proposed development footprint or vicinity. Mitigation measures to limit the potential impacts of the above key threatening processes are discussed in Section 7.9.

7.9 Mitigation and monitoring

Mitigation and management measures proposed to minimise the impacts on flora and fauna (including conservation-significant species) during construction, operation, and closure and rehabilitation of the Proposal are listed in Table 7-11. These measures would be incorporated into the CEMP, OEMP and/or RCP for the Proposal. A draft Biodiversity Management Plan and draft Bushfire Management Plan have also been prepared for the Proposal (refer to Appendix O and Appendix W).

The mitigation and management measures listed in Chapter 9 (Surface water), Chapter 11 (Human Health and Safety), Chapter 15 (Air quality) and Chapter 16 (Noise and vibration) would be implemented to minimise potential impacts associated with erosion and sedimentation, contamination, altered hydrology, dust, and noise and vibration on flora and fauna.

Surveys would be undertaken prior to construction to confirm the presense/absense of two matters of national environmental significance (threatened species) considered to have a low to moderate likelihood of occurrence within the propsoed development fooprint or vicinity. These are and Slater's skink (*Liopholis slateri slateri*) and the thick-billed grasswren (*Amytornis modestus indulkana*). Potential habitat for these species is located within the vicinity of the proposed Henbury

Access Road. If these species are found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to these species. If significant impacts could not be avoided, the need to calculate and deliver biodiversity offsets would be assessed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC 2012b) and in consultation with the DoEE.

Table 7-11 Biodiversity mitigation and management measures

ID	Outcome	Mitigation/management measure	Timing
B.1	Preservation of biodiversity	Finalise draft Biodiversity Management Plan prior to construction and incorporate into the CEMP, OEMP and/or RCP for the Proposal. The plan collates measures to mitigate and manage potential impacts on biodiversity.	Pre-construction
B.2	Reduced incidence of bushfire	Finalise draft Bushfire Management Plan prior to construction and incorporate into the CEMP, OEMP and RCP. The plan collates measures to mitigate and manage potential impacts on biodiversity.	Pre-construction
B.3	Preservation of biodiversity	Provide workers with an environmental induction prior to starting construction activities. This would include information on the ecological values of the site and protection measures to be implemented to protect biodiversity during construction.	Pre-construction and construction
B.4	Protection of threatened species	Undertake pre-clearance surveys for threatened species by a qualified ecologist.	Pre-construction and construction
B.5	Minimisation of vegetation removal and habitat loss	Defer vegetation removal until necessary.	Pre-construction and construction
B.6	Minimisation of vegetation removal and habitat loss	Locate site offices and stockpiles in already cleared and disturbed areas, where possible.	Pre-construction and construction
B.7	Minimisation of vegetation removal and habitat loss	Provide maps to construction staff clearly showing vegetation clearing boundaries.	Pre-construction and construction
B.8	Minimisation of vegetation removal and habitat loss	Leave mature trees, where possible, especially desert oaks, bloodwoods and bush tucker species.	Construction
B.9	Minimisation of vegetation removal and habitat loss	Leave fallen logs greater than 15 cm diameter or relocate to surrounding environment.	Construction
B.10	Minimise vegetation removal and habitat loss	Relocate bird nests found in trees or shrubs to be cleared to surrounding environment.	Construction
B.11	Reduced incidence of fauna injury/mortality	Ensure fauna is removed from areas intended to be cleared by a qualified ecologist.	Pre-construction and construction
B.12	Reduced incidence of fauna injury/mortality	Avoid driving during high risk times; dawn, dusk and at night, where possible.	Construction, operation, closure and rehabilitation
B.13	Reduced incidence of fauna injury/mortality	Prohibit off-road driving.	Construction, operation, closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
B.14	Reduced incidence of fauna injury/mortality	Develop and maintain a fauna strike register.	Construction, operation, closure and rehabilitation
B.15	Reduced incidence of fauna injury/mortality	Limit access of third parties on-site.	Construction, operation, closure and rehabilitation
B.16	Reduced incidence of fauna injury/mortality	Ensure traffic adheres to speed limits and local road rules.	Construction, operation, closure and rehabilitation
B.17	Reduced incidence of fauna injury/mortality	Ensure speed limit and potential fauna crossing signs clearly are displayed on Chandler Haul Road, Henbury Access Road and other access tracks, as necessary.	Construction, operation, closure and rehabilitation
B.18	Reduced habitat fragmentation and edge effects	Implement weed and invasive species mitigation measures listed above.	Construction, operation, closure and rehabilitation
B.19	Reduced habitat fragmentation and edge effects	Implement introduced fauna mitigation measures listed above.	Construction, operation, closure and rehabilitation
B.20	Reduced habitat fragmentation and edge effects	Undertake routine inspections for weeds and invasive species.	Construction, operation, closure and rehabilitation
B.21	Elimination of waste left uncontained on-site	Develop and implement a Waste Management Plan.	Pre-construction
B.22	Elimination of waste left uncontained on-site	Ensure domestic waste stored in fauna proof bins.	Construction, operation, closure and rehabilitation
B.23	Elimination of waste left uncontained on-site	Ensure waste stored is stored in appropriately labelled containers.	Construction, operation, closure and rehabilitation
B.24	Elimination of waste left uncontained on-site	Bund liquid waste, where required.	Construction, operation, closure and rehabilitation
B.25	Elimination of waste left uncontained on-site	Implement waste hierarchy of avoid/minimise, reuse, recycle, recovery, and then disposal.	Construction, operation, closure and rehabilitation
B.26	Elimination of waste left uncontained on-site	Ensure waste is disposed off-site by licensed contractor(s).	Construction, operation, closure and rehabilitation
B.27	Elimination of waste left uncontained on-site	Ensure hazardous waste and hydrocarbons are stored separately in bunding, with appropriate signage.	Construction, operation, closure and rehabilitation
B.28	Minimised dust	Stage vegetation removal (clearing) to reduce total exposed cleared surface at any one time.	Construction
B.29	Minimised dust	Avoid clearing during dry windy conditions.	Construction
B.30	Minimised dust	Clear with blade up, where possible.	Construction
B.31	Minimised dust	Leave vegetation 10 centimetres in height on firebreaks and non-crucial tracks.	Construction

ID	Outcome	Mitigation/management measure	Timing
B.32	Minimised dust	Use water trucks during construction and closure and rehabilitation to control dust.	Construction, closure and rehabilitation
B.33	Elimination of unnecessary lighting in surrounding environment	Use lower intensity lights, e.g. yellow or red lighting, where possible. This would reduce impacts on nocturnal species and limit insect attraction.	Construction
B.34	Elimination of unnecessary lighting in surrounding environment	Only have minimal lights on needed for safe operation of facilities.	Operation
B.35	Elimination of unnecessary lighting in surrounding environment	Direct lights towards the ground (where possible) or use shields to direct lights to only where light is required. Have lights positioned as low as possible.	Construction, operation, closure and rehabilitation
B.36	Elimination of unnecessary lighting in surrounding environment	Turn lights off when not in use.	Construction, operation, closure and rehabilitation
B.37	Elimination of unnecessary lighting in surrounding environment	Restrict work to daylight hours, where possible.	Construction, operation, closure and rehabilitation
B.38	Reduce noise and vibration	Turn off machinery when not in use.	Construction, operation, closure and rehabilitation
B.39	Reduce noise and vibration	Maintain and regularly service all generators, engines and vehicles on-site.	Construction, operation, closure and rehabilitation
B.40	Reduce noise and vibration	Ensure vehicles carry full loads were possible to limit the number of vehicles on the Chandler Haul Road and Henbury Access Road.	Construction, operation, closure and rehabilitation
B.41	Prevention of the introduction and spread of weeds and invasive species	Vehicle/machinery wash-down prior to leaving Alice Springs or entering an area uncontaminated by weeds.	Construction, operation, closure and rehabilitation
B.42	Prevention of the introduction and spread of weeds and invasive species	Avoid contact with weed or invasive species seed, plant matter or soil potentially contaminated with weed seeds.	Construction, operation, closure and rehabilitation
B.43	Prevention of the introduction and spread of weeds and invasive species	Avoid clearing or removal of any weed or invasive species during seeding, or put plastic bag over seed heads before removing plant.	Construction, operation, closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
B.44	Prevention of the introduction and spread of weeds and invasive species	Remove seed and mud from vehicle tyres and front grill daily.	Construction, operation, closure and rehabilitation
B.45	Prevention of the introduction and spread of weeds and invasive species	Undertake annual weed mapping in the vicinity of the proposed development footprint.	Construction, operation, closure and rehabilitation
B.46	Prevention of the introduction and spread of weeds and invasive species	Remove weeds following specialist advice from qualified ecologist or Weeds Branch, NT Government.	Construction, operation, closure and rehabilitation
B.47	Prevention of the introduction and spread of weeds and invasive species	Remove weed or invasive species before seeding times, where possible.	Construction, operation, closure and rehabilitation
B.48	Prevention of the introduction and spread of weeds and invasive species	Avoid driving in wet and muddy conditions, where possible.	Construction, operation, closure and rehabilitation
B.49	Prevention of an increase in the number or frequency of introduced fauna	Prevent access to artificial water and heat sources through construction of fences.	Construction, operation, closure and rehabilitation
B.50	Prevention of an increase in the number or frequency of introduced fauna	Dispose of all waste in predator-proof bins.	Construction, operation, closure and rehabilitation
B.51	Prevention of an increase in the number or frequency of introduced fauna	Develop and implement a no tolerance policy to the introduction of pest species by contractors, suppliers and personnel.	Construction, operation, closure and rehabilitation
B.52	Prevention of an increase in the number or frequency of introduced fauna	Place brush or vegetation stockpiles across linear developments no longer required (access tracks etc.) to inhibit movement of predators and introduced herbivores.	Construction, operation, closure and rehabilitation
B.53	Prevention of an increase in the number or frequency of introduced fauna	Undertake annual flora and fauna survey to record numbers of introduced fauna species.	Construction, operation, closure and rehabilitation
B.54	Prevention of an increase in the number or frequency of introduced fauna	Develop, implement and maintain fauna sighting register.	Construction, operation, closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
B.55	Prevention of an increase in the number or frequency of introduced fauna	Develop and implement an introduced fauna control program.	Construction, operation, closure and rehabilitation
B.56	Prevention of an increase in the number or frequency of introduced fauna	Carry out feral animal control as required in consultation with stakeholders.	Construction, operation, closure and rehabilitation
B.57	Prevention of an increase in the number or frequency of introduced fauna	Install fauna proof fence around all infrastructure.	Construction
B.58	Prevention of an increase in the number or frequency of introduced fauna	Reduce artificial standing water.	Construction, operation, closure and rehabilitation
B.59	Prevention of an increase in the number or frequency of introduced fauna	Close off and rehabilitate any cleared areas no longer required for safe operation.	Construction, operation, closure and rehabilitation
B.60	Prevention of an increase in the number or frequency of introduced fauna	Ensure waste receptacles are fauna proof.	Construction, operation, closure and rehabilitation
B.61	Prevention of an increase in the number or frequency of introduced fauna	Do not feed fauna.	Construction, operation, closure and rehabilitation
B.62	Prevention of an increase in the number or frequency of introduced fauna	Remove any dead fauna or insects and either dispose off-site or bury greater than 50 centimetres deep to avoid predators uncovering.	Construction, operation, closure and rehabilitation
B.63	Prevention of an increase in the number or frequency of introduced fauna	Trap and relocate predator species if they are noticed to have increased in numbers and habituate around facilities. Trapping and relocating of fauna would be undertaken by a qualified ecologist.	Construction, operation, closure and rehabilitation
B.64	Prevention of fires resulting from the Proposal	Keep up to date with bushfire website and state services.	Construction, operation, closure and rehabilitation
B.65	Prevention of fires resulting from the Proposal	Construct and maintain firebreaks around infrastructure and significant habitats.	Construction, operation, closure and rehabilitation
B.66	Prevention of fires resulting from the Proposal	No open flames outside of designated areas unless hot works permit is approved.	Construction, operation, closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
B.67	Prevention of fires resulting from the Proposal	Ensure flammable material is clearly labelled.	Construction, operation, closure and rehabilitation
B.68	Prevention of fires resulting from the Proposal	Ensure adequate firefighting equipment is stored on-site and staff trained in use.	Construction, operation, closure and rehabilitation
B.69	Prevention of fires resulting from the Proposal	Provide designated smoking area.	Construction, operation, closure and rehabilitation
B.70	Prevention of fires resulting from the Proposal	Organise and implement strategic back burning with traditional owners and Central Land Council.	Construction, operation, closure and rehabilitation
B.71	Prevention of fires resulting from the Proposal	Implement and carry out annual fuel load surveys before high risk fire season.	Construction, operation, closure and rehabilitation
B.72	Prevention of impacts to surrounding flora or watercourses from salt	Survey/monitor flora in dominant down wind direction from salt stockpiles for impacts.	Construction, operation, closure and rehabilitation
B.73	Prevention of impacts to surrounding flora or watercourses from salt	Cover all salt during transport.	Construction, operation, closure and rehabilitation
B.74	Prevention of impacts to surrounding flora or watercourses from salt	Monitor dust and airborne particles.	Construction, operation, closure and rehabilitation
B.75	Prevention of impacts to surrounding flora or watercourses from salt	Store salt in open stockpile for minimum time required.	Construction, operation, closure and rehabilitation
B.76	Prevention of unauthorised third party access	Inspect site for signs of unauthorised entry.	Construction, operation, closure and rehabilitation
B.77	Prevention of unauthorised third party access	Record all access to site in a site register.	Construction, operation, closure and rehabilitation
B.78	Prevention of unauthorised third party access	Ensure visitors complete induction or are accompanied by Tellus employee whilst on-site.	Construction, operation, closure and rehabilitation
B.79	Prevention of unauthorised third party access	Dog leg smaller access tracks when joining larger roads to limit third party access by reducing access tracks visibility from the main road.	Construction
B.80	Prevention of unauthorised third party access	Mark access tracks and roads as private property.	Construction
B.81	Prevention of unauthorised third party access	Erect clear signage indicating prohibition of unauthorised entry.	Construction

ID	Outcome	Mitigation/management measure	Timing
B.82	Prevention of soil compaction and topsoil loss	Locate roads, access tracks and required operational areas on solid surfaces, where possible.	Construction
B.83	Prevention of soil compaction and topsoil loss	Limit compacted areas to minimum required.	Construction
B.84	Successful rehabilitation of disturbed areas	Develop and implement a closure and Rehabilitation Management Plan.	Pre-closure and rehabilitation
B.85	Successful rehabilitation of disturbed areas	Install erosion and sediment control temporary structures to assist with rehabilitation.	Closure and rehabilitation
B.86	Successful rehabilitation of disturbed areas	Respread spoil first, then top soil and last cleared vegetation over surfaces.	Closure and rehabilitation
B.87	Successful rehabilitation of disturbed areas	Leave any infrastructure, plant or cleared area as so detailed in a land use agreement with the land manager.	Closure and rehabilitation
B.88	Successful rehabilitation of disturbed areas	Remove all infrastructure, plant, machinery and operational and construction wastes.	Closure and rehabilitation
B.89	Successful rehabilitation of disturbed areas	Re-contour all cleared surfaces to match surrounding topography, as close as possible.	Closure and rehabilitation
B.90	Successful rehabilitation of disturbed areas	Rip any compacted areas.	Closure and rehabilitation
B.91	Successful rehabilitation of disturbed areas	Ensure final surface is rough to increase infiltration.	Closure and rehabilitation
B.92	Successful rehabilitation of disturbed areas	Block all access points to roads and tracks, unless agreed with land manager.	Closure and rehabilitation
B.93	Successful rehabilitation of disturbed areas	Fill in sumps or turkey nest, unless agreed otherwise with land manager.	Closure and rehabilitation
B.94	Successful rehabilitation of disturbed areas	Close off and seal all groundwater wells.	Closure and rehabilitation
B.95	Successful rehabilitation of disturbed areas	Re-spread top soil.	Closure and rehabilitation

7.10 Summary of risk assessment

A summary of the risk assessment undertaken for terrestrial biodiversity during construction, operation, and closure and rehabilitation of the Proposal is provided in Table 7-12.

Table 7-12 Summary of risk assessment (biodiversity)

Hazard	Pre-mitigated risk			Post-mitigated risks			Risk outcome
	Likelihood	Consequence	Risk ranking	Likelihood	Consequence	Risk ranking	
Loss of habitat and/or mortality of threatened fauna species	Possible	Major	High	Unlikely	Major	Medium	Risk reduced
Removal of vegetation	Almost certain	Moderate	High	Almost certain	Minor	High	Risk reduced
Loss of fauna habitat from removal of vegetation	Almost certain	Moderate	High	Almost certain	Minor	High	Risk reduced
Habitat fragmentation from removal of vegetation	Almost certain	Moderate	High	Possible	Moderate	Medium	Risk reduced
Fauna displacement injury or mortality from removal of vegetation	Possible	Moderate	Medium	Unlikely	Minor	Low	Risk reduced
Fauna strike (vehicle)	Possible	Catastrophic	High	Unlikely	Catastrophic	High	Risk reduced
Removal of vegetation resulting in edge effects	Almost certain	Minor	High	Possible	Minor	Medium	Risk reduced
Altered hydrology leading to flora mortality and loss of habitat	Possible	Minor	Medium	Unlikely	Minor	Low	Risk reduced
Groundwater abstraction (at 50 m below ground level) impacting vegetation	Remote	Minor	Low	Eliminated	Insignificant	Eliminated	Risk reduced
Contamination of soil and water	Possible	Minor	Medium	Eliminated	Minor	Eliminated	Risk reduced
Erosion and sedimentation of soils	Likely	Major	High	Unlikely	Major	Medium	Risk reduced
Dust deposition from vehicle traffic and earthworks	Almost certain	Minor	High	Possible	Minor	Medium	Risk reduced
Construction light, noise and vibration	Almost certain	Minor	High	Likely	Minor	Medium	Risk reduced
Operational light, noise and vibration	Almost certain	Minor	High	Likely	Minor	Medium	Risk reduced
Introduction and spread of weeds and invasive species	Likely	Minor	Medium	Unlikely	Minor	Low	Risk reduced
Increased predator species	Likely	Minor	Medium	Unlikely	Minor	Low	Risk reduced
Increased introduced fauna	Likely	Minor	Medium	Unlikely	Minor	Low	Risk reduced
Bushfire	Possible	Catastrophic	High	Possible	Minor	Medium	Risk reduced
Salt erosion and spoil erosion	Likely	Catastrophic	Extreme	Remote	Major	Medium	Risk reduced
Soil compaction and topsoil loss	Possible	Minor	Medium	Unlikely	Minor	Low	Risk reduced

7.11 Conclusion

Construction of the Proposal would result in the removal of approximately 397.5 hectares of vegetation. The removal of this vegetation would result in the loss of fauna foraging, breeding, roosting, sheltering and/or dispersal habitat. Construction of the Proposal may also result in indirect impacts including habitat fragmentation; fauna displacement, injury or mortality; fauna strike; edge effects; altered hydrology; contamination; erosion and sedimentation; dust; increased light, noise and vibration; the introduction and spread of weeds and invasive species; increased predator species; increased introduced fauna use; and an increased incidence of fire.

Operation of the Proposal may result in indirect impacts including fauna strike; altered hydrology; contamination; increased light, noise and vibration; the introduction and spread of weeds and invasive species; an increased incidence of fire; and potential impacts associated with salt runoff and windblown salt from stockpiles.

Potential impacts on flora and fauna during closure and rehabilitation of the Proposal would generally be the same as those during construction of the Proposal.

There would be no significant impact on species listed as near threatened or data deficient under the TPWC Act. None of the species are considered to have conservation significance within the proposed development footprint or vicinity, or within the wider locality. All species are locally common with a widespread distribution and there is no critical habitat for any of the species listed as near threatened or data deficient recorded or predicted to occur within the proposed development footprint or vicinity.

There would be no significant impacts on species listed as threatened under the TPWC Act and/or EPBC Act. At present, no biodiversity offsets are deemed necessary as there would be no significant impact to matters of national environmental significance during construction, operation, or closure and rehabilitation of the Proposal.

Surveys would be undertaken prior to construction to confirm the presense/absense of two matters of national environmental significance (threatened species) considered to have a low to moderate likelihood of occurrence within the propsoed development fooprint or vicinity. These are and Slater's skink (*Liopholis slateri slateri*) and the thick-billed grasswren (*Amytornis modestus indulkana*). Potential habitat for these species is located within the vicinity of the proposed Henbury Access Road. If these species are found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to these species. If significant impacts could not be avoided, the need to calculate and deliver biodiversity offsets would be assessed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC 2012b) and in consultation with the DoEE.

Mitigation and management measures would be implemented to reduce potential impacts on biodiversity during construction, operation, and closure and rehabilitation of the Proposal. These measures would be incorporated into the CEMP and OEMP for the Proposal. A draft Biodiversity Management Plan and draft Bushfire Management Plan have been prepared and would be finalised prior to the construction of the Proposal.