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Flora and Vegetation

Project Location Client

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Glossary

BC Act – Biodiversity Conservation Act 2016 (Western Australia)

EPBC Act – Environment Protection and Biodiversity Conservation Act 1999 (Aust.)

Matters of National Environmental Significance (MNES) – Protect matters listed under the EPBC Act

Interim Biogeographic Regionalisation of Australia (IBRA) – Explanation

‘Significant Impact’ – As defined in the Significant Impact Guidelines... CONT.

1.0 INTRODUCTION

Ngaanyatjarra Council's Land and Culture Unit has staff skilled in the identification and ecology of local flora and fauna, and was engaged by Ngaanyatjaraku Shire to deliver a threatened flora and vegetation assessment of the area proposed for roadworks to bypass the Jameson township.

The area is within the Shire of Ngaanyatjaraku and in the Indigenous Protected Area managed by Ngaanyatjarra Council Aboriginal Corporation.

2.0 METHODS

The methods employed during this assessment aimed to adhere to formal guidelines, including those laid out in the following documents:

- Technical Guidelines – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016)
- Instructions for the preparation of data packages for the Index of Biodiversity Surveys for Assessments (IBSA; EPA 2018)

2.1 DESKTOP ASSESSMENT

2.1.1 Personnel and Consultation

Custodians of Traditional Ecological Knowledge provided their ecological expertise to guide the desktop assessment phase. Consultations and the field survey engaged Angela Lyons and Winston Mitchell, whose qualifications are outlined in the table below.

| |
|--|
| Angela Lyons |
| Yanangu Woman from Blackstone |
| 10 years' experience as an Indigenous Ranger with Ngaanyatjarra Council Aboriginal Corporation |
| Weed identification and management (CLC) |
| Flora survey experience for purposes of land management and chaperoning botanists |
| Winston Mitchell |
| Senior Yanangu Man from Blackstone area |
| 10 years' experience as an Indigenous Ranger with Ngaanyatjarra Council Aboriginal Corporation |
| Cert II Conservation and Land Management |
| Jennifer Timbs |
| Bachelor of Science (Environment); Permit SL012492 |
| 7 years' experience in ecological assessment |

2.1.2 Database Searches

The desktop and pre-field investigation drew upon the following resources:

- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Protected Matters search tool

- Wildlife Conservation Act 1950 (WC Act) search tool
- Atlas of Living Australia search tool
- Records of flora and habitat features held by NG Council

2.2 FIELD ASSESSMENT

2.2.1 Vegetation Survey & Threatened Flora Search

The site was visited on 4th December 2018, after a period of heavy rainfall, including rainfall early on the morning of the survey. Large areas of the ground were too wet to traverse by vehicle without incurring disturbance to the survey area; therefore, the survey was carried out wholly on foot. Quadrat sizes of 40m x 40m were used based on precedence set during other surveys in the surrounding area, by which species area curves have indicated 40m x 40m to be sufficient to capture species richness (Western Botanical 2018). Foliage Projective Cover was assessed along a central transect of 25 metres.

Five 40m x 40m quadrats were established within the proposed area, and an additional 4 releve sites. Quadrats were positioned to fall within a single vegetation unit.

Vegetation surveys were carried out in accordance with the Technical Guidelines for Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016), with the exception that quadrat sizes were reduced to 40m x 40m for reasons provided above.

The following attributes were recorded:

- Site ID;
- location, with GPS coordinates and datum;
- method used to mark quadrat (e.g. GPS, measuring tape, flagging tape, stakes);
- dimensions of quadrat;
- photograph from NW corner;
- landform and soil description;
- slope, aspect, coarse woody debris (recorded as metres of CWD >15cm diameter);
- assessment of vegetation condition as per technical guidelines (EPA 2016);
- description of disturbances, including fire history;
- dominant growth form (e.g. herb, tussock grass, small shrub, tall shrub, tree);
- height for the upper, mid and ground strata;
- foliage projective cover at intervals of 2 m along 50 m transect; and
- a comprehensive species list, including weeds.

A 50m line transect through the centre of the quadrat was walked using the point-intercept method at 2m intervals, to record groundcover attributes as follows:

- ground cover (litter, rock, gravel, bare, native vegetation [species], non-native vegetation [species]; and
- canopy cover (native vegetation [species], non-native vegetation [species], open).

In addition, threatened flora searches were carried out in habitats and microhabitats within the proposed impact area, including a 100m buffer, that were considered to have potential to harbour threatened species (see [Table ii](#) for further detail).

2.3 DATA ANALYSIS

2.3.1 Spatial Analysis

Mapping and analysis of spatial data was carried out using ArcGIS Suite Version 10.5.

2.3.2 Flora Identification

Samples were collected under permit **SL012492** for determination and/or confirmation of species following the field survey. All specimens were checked against descriptions of declared threatened flora of the same respective genus. The identification of flora drew upon knowledge of the local plants and referred primarily to the following texts and keys:

- Western Australian Herbarium (1998–2018), ‘FloraBase—the Western Australian Flora’. Department of Biodiversity, Conservation and Attractions. <https://florabase.dpaw.wa.gov.au/>
- The Australian Systematic Botany Society (1981), ‘Flora of Central Australia’, John Jessop, Editor in Chief, Reed, Sydney
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- Kellermann, J. (ed.), *Flora of South Australia* (ed. 5). 18 pp., State Herbarium of South Australia: Adelaide. www.flora.sa.gov.au/ed5

3.0 RESULTS

3.1 DESKTOP ASSESSMENT

3.1.1 Vegetation and Habitat Features

Vegetation of the subject area and surrounds was broadly mapped between 1972 and 1980 at a scale of 1:250000. The area is shown as supporting Low Mulga Woodland.

The Federal Threatened Ecological Communities (TEC) database indicates that no listed TECs or Priority Ecological Communities (PECs) have been recorded in or near the survey area.

There are no Nationally Important Wetlands within the vicinity of the subject area.

3.1.2 Listed Introduced Species

Native flora species of conservation concern for which historical records exist for the Ngaanyatjarra IPA are described in **Table ii**. This table has been composed based on historical records made available to Western Australian State databases. It is therefore not exhaustive; additional listed species, which have not yet been detected in targeted threatened species searches, may have potential to occur within the subject area and will be sought in accordance with the WA Technical Guide for Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). Weed species with the potential to occur within the subject area are described in Error! Reference source not found..

Table i Introduced species of management concern with potential to occur in subject area.

| FAMILY | Species | Common | Status | Habitat & Phenology |
|--------|---------|--------|--------|---------------------|
|--------|---------|--------|--------|---------------------|

| | | Name | | |
|--------------|--------------------------|--------------|------|---|
| FLORA | | | | |
| POACEAE | <i>Cenchrus ciliaris</i> | Buffel Grass | WoNS | Widespread in Ngaanyatjarra lands. |
| FABACEAE | <i>Prosopis</i> spp. | Mesquite | WoNS | Predominantly confined to communities. Not widespread on lands. |

3.1.3 Listed Flora

Native flora species of conservation concern for which historical records exist for the Ngaanyatjarra IPA are described in **Table ii**. This table has been composed based on historical records made available to Western Australian State databases. In addition, threatened species lists accrued during surveys in the region and made available to Ngaanyatjarra Council were interrogated.

Table ii Native flora species of conservation concern with potential to occur in subject area based on historical records.

| FAMILY | Species | Description | Conservation Status Code BC Act | Habitat, Phenology & likelihood of occurrence |
|---------------|--|--|--|---|
| AMARANTHACEAE | <i>Amaranthus centralis</i> | Annual herb to 0.6 m wit reddish stems. | 3 | Associated with watercourses and ephemeral and permanent waterbodies or soaks, but has also been recorded within a clay playa in the Hardpan Mulga Woodland vegetation complex (Western Botanical). Potential to Occur. |
| ASTERACEAE | <i>Calotis latiuscula</i> | “Leafy-burr Daisy”. Upright herb to 0.5m high with yellow daisy-like flowers. | 3 | Flowers June to October. Occurs on sand or sandy-loam, on rocky hillsides, floodplains, rocky creeks or riverbeds (WA Herbarium 2018). |
| FABACEAE | <i>Aenictophyton anomalum</i> | Pinnate-leaved small, prostrate shrub. Flowers orange, terminally clustered. | 1 | Western Botanical (2018) determined this species to have a strong association with Grevillea-Acacia shrubland on deep sandy soils. As this soil type and vegetation association was not expected to occur in the study area, this species was considered unlikely to occur. |
| FABACEAE | <i>Indigofera warburtonensis</i> | Shrub to 1m high, upright or spreading with pinnate eaves, the leaflets having triangular stipules. | 1 | Abundant population recorded South of Jameson township, in association with Acacia shrublands, This species was considered to have HIGH POTENTIAL TO OCCUR. |
| FABACEAE | <i>Isotropis winneckeii</i> | Pink to purple pea-flowered herb. May be upright or with stem growing along the ground (procumbent). Grows to 20cm. Leaves narrow, unifoliate, folded ‘upwards’ along axis of midvein. | 1 | Observed flowering in January, July and October (may flower year-round). Occurs on sandstone ridges and rocky rises. Leguminous, non-fleshy fruit, dehiscent (dry). Fruit elongated and 1 celled, sepals persistent. |
| FABACEAE | <i>Tephrosia sp.</i> Central (P.K. Latz 17037) | Pinnate, pubescent leaves; leaflets between 0.4 and 1 cm. Elongate | 3 | Recorded from Hardpan Mulga Woodland. Observed south of Jameson |

| | | | | |
|-------------|--|---|---|---|
| | | Pods. | | Road, approximately 50km south-west of the subject area (Western Botanical 2018). HIGH POTENTIAL TO OCCUR. |
| FABACEAE | <i>Acacia eremophila</i> var. Numerousnerved variant (A.S. George 11924) | Terete phyllodes Flowers August to September, seed set December – January. | 3 | Recorded near Katjukatjurin, approximately 175 km south of the subject area, representing a range extension of 300km North of its prior known range. Locally, it has been recorded primarily in association with calccrete-rich substrates, (Western Botanical 2018), which are not expected within the subject area. |
| MYRTACEAE | <i>Calytrix warburtonensis</i> | Shrub growing to between 30cm and 60cm high, star-shaped flowers with 5 white to pink petals, numerous stamens longer than the petals. | 2 | Flowers September to October on stony hills and sandy, rocky soils. |
| MYRTACEAE | <i>Verticordia mirabilis</i> | Spreading shrub with showy red flowers on thick petioles (stalks), growing to between 30 and 100cm high. Leaves narrow, stems to circular cross-section with irregular teeth at tips. | 1 | Showy red flowers in spring. |
| ELATINACEAE | <i>Elatine macrocalyx</i> | Annual herb growing close to the ground (prostrate) forming dense mats. Leaves opposite, smooth, tapering at base. Flowers sessile, 3-merous. Sepals longer or equal in length to petals (Albrecht 2002). | 3 | Flowering and fruiting between May and October. Moist margins of claypans or shallow sands over clay. Tolerates highly alkaline soils. |
| POACEAE | <i>Aristida jerichoensis</i> var. <i>subspinulifera</i> | Easily mistaken for common <i>Aristida inaequiglumis</i> -distinguished by lengths of awns | 3 | Occurs in mulga groves and Wanderrie grass associations. Previously recorded south of Jameson Road. HIGH |

| | | | | |
|------------------|----------------------------------|--|---|--|
| | | and minor differences in shape of seed. 0.8 – 2.0 metres high tussock grass, flowering and fruiting all year round. | | POTENTIAL TO OCCUR. |
| SCROPHULARIACEAE | <i>Eremophila pallida</i> | Small shrub to 40cm high, with branches of pale yellow/white covered in sometimes resinous hairs. Flowers usually in leaf axis on a pubescent stalk 2-4mm long. Petals reddish-purple & white with dark purple markings inside the tube. Papery outer casing of dry, woody fruit covered with short hairs (Chinnock 2007) | 2 | Flowers May-August. Recorded North-West of Warburton on lateritic soils, often with gibber surface. |
| SCROPHULARIACEAE | <i>Eremophila viscimarginata</i> | Small, erect shrub to around 50cm high. Hairy stems, small, sharply pointed leaves with a prickly effect, arranged alternately and overlapping. Leaves resinous and covered in glandular hairs at base. Flowers pubescent, reddish purple to greenish pink to mauve. | 1 | Flowers September. Occurs on skeletal soils (e.g. ironstone, shallow soils with no discernible strata). It is only known from a few locations; therefore, further sampling in the region may produce more records. |
| GOODENIACEAE | <i>Goodenia gibbosa</i> | Small, prostrate to decumbent herb, sometimes stoloniferous (spreading through roots either at or below soil surface), to 40cm. Leaves sparsely hairy, flat, 1.5-6cm long, 0.7 to 1.7cm wide. Leaves can be toothed or entire. Flower stalks 3-6.5cm long and smooth. Calyx 0.2-0.3cm long, smooth. Petals yellow, 1.3-2cm long. | 3 | Flowers in July in sandy soils. |
| GOODENIACEAE | <i>Goodenia asteriscus</i> | Perennial rosette with | 3 | Recorded East of Blackstone. Records |

| | | | | |
|--------------|------------------------------|--|---|--|
| | | stoloniferous habit. Spent pedicels persist on plant. | | on site would represent a range extension. Has so far been associated with calcrete hummock grassland. Potential to occur. |
| GOODENIACEAE | <i>Goodenia grandiflora</i> | Upright, sticky shrub. 0.4-1.6m high. Stems ribbed, leaves hairy, flat, 1.5-5cm long, 0.8-2.5cm wide. Flower stalks 0.6-1.5cm long, hairy. Petals yellow, 2.1-3.5cm long. Hairy on the outside with sparse hairs. Smooth on the inside. | 1 | Flowers May to December on sandy/gravelly soils on rocky hillsides and breakaways. |
| GOODENIACEAE | <i>Goodenia lyrata</i> | Prostrate herb, with lyrate leaves (shaped like a dandelion leaf). Stems ribbed. Leaves 0.5-1cm long, 0.3-1cm wide, covered in sparse hairs. | 3 | Flowers August. Occurs on red, sandy loam or near clayplan |
| GOODENIACEAE | <i>Goodenia modesta</i> | Small herb to 0.5m high. Leaves 0.7-7cm long, 0.2-1cm wide, sparsely hairy. Entire (not lobed). Flower stalks 0.7-1cm long and hair. Petals yellow 0.8-1.7cm long, sparsely hairy on outside and inside. Yellow wings with purple central lobes. | 3 | Flowers year-round on red loam-sand. |
| PROTEACEAE | <i>Grevillea aspera</i> | Shrubs to 2.5m high. Branches hairy, leaves alternate 3-8cm long, Inflorescence at the ends of branches or in the forks, red, pink or brown. Fruit smooth, dry, 13-1.7cm long | 1 | Flowers May-November, loam, clay-loam, quartzite or laterite soils, rocky hillsides or open heathland. |
| CELASTRACEAE | <i>Stackhousia clementii</i> | An inconspicuous herb with slender stems and reduced leaves. | 3 | Grows over calcrete (Western Botanical 2018). |

| | | | | |
|----------------|---|---|---|--|
| | | Appears 'sedge-like; in form. | | |
| SANTALACEAE | <i>Korthalsella leucothrix</i> | A mistletoe; Flowers white, around 20 flowers per node. Rounded leaf tip. | 1 | A parasitic aerial shrub attached to the branch of <i>Acacia acuminata</i> or <i>Acacia craspedocarpa</i> . Flowers in August. |
| CHENOPODIACEAE | <i>Maireana sp. Patience (C.P. Campbell 1052)</i> | Very low shrub, with fleshy, finely pubescent (furry), narrow leaves. Papery 'wing' encircling the fruit. | 1 | Perennial. Recorded on red sand, lateritic soils, adjacent gullies. Potential to occur. |
| LAMIACEAE | <i>Dicrastylis subterminalis</i> | Small shrub. Opposite, entire, leaves 5-10 mm long, 1 mm wide, hairy stems. Hairy calyx 1.5 mm long. Corolla 6-8 mm long, hairy, with anthers 0.7 mm long. | 1 | Grows in red sand along drainage lines. Potential to occur. |
| LAMIACEAE | <i>Physopsis chrysotricha</i> | Small shrub. Yellow-white sessile, minute, 5-lobed 'mint' flowers. 4-6mm long petals. 4 stamens, 1 style. Stem cross section circular. Leaves opposite on alternate axes (WA Herbarium 2018). | 2 | Flowers in September. Occurs on or around gypsum soils (Anglo-Gold Ashanti 2017). |
| ASTERACEAE | <i>Vittadinia pustulata</i> | Small, spreading, bushy shrub to 1m high. Large red flowers in small clusters towards the ends of branches. Thick petioles (flower stalks). Fleshy leaves, oblong d or triangular in cross-section (WA Herbarium 2018). | 3 | Showy red flowers September/October. Found in lateritic soil South of Warburton on rocky outcrop. Fruit non-fleshy nut, 1-celled, indehiscent (not splitting), (WA Herbarium 2018). |
| CYPERACEAE | <i>Fuirena nudiflora</i> | Sedge growing to 0.1 to 0.2m. Terminal inflorescence brown, perianth (petals and sepals) absent, 1 stamen. Stems obtusely triangular to round and approximately 1mm diameter. | 3 | Annual, flowering and fruiting between April and July although may vary. Observed in sandy depressions, drainage lines or seepages subject to inundation. Wetland indicator species. Likely to respond to seasonal |

| | | | | |
|---------|---------------------------|---|---|---|
| | | Upper leaves 40-70mm long, 7-15mm wide (NT Herbarium 2013). | | conditions, i.e. rainfall events, inundation. May be confused with <i>Fuirena ciliaris</i> in the field – suspected samples should be submitted to the herbarium (NT Herbarium 2013). |
| POACEAE | <i>Neurachne lanigera</i> | “Mulga Grass”. Tufted perennial grass to 15-30cm high. | 1 | Flowers July to October. Occurs on red sand, laterite, on diverse landforms from rocky outcrops to plains. |

3.2 FIELD SURVEYS

3.2.1 Vegetation



Plate 1. Site 1 (40 x 40 m quadrat). Stony Ironstone Grassland/ Mulga Shrubland

This community approximates a Stony Ironstone Shrubland that has been denuded of trees and shrubs through frequent fire events. Site 1, at the northern end of the proposed bypass, was characterised by a distinct paucity of vegetative cover, with grass cover of less than 5% and trees absent from the plot. The substrate was fine ironstone gravel over lateritic soil. Species richness was low, comprising *Eragrostis eriopoda*, *Dissocarpus paradoxa* and *Bonamia erecta* at low densities. Relieve points in the surrounding vegetation recorded similarly low species richness, with the addition of *Cenchrus ciliaris* to 0.2m at ~ 1% cover, *Acacia aneura* to 1-3 m at ~ up to 15% cover, and *Maireana triptera* to 0.15m at 1% cover.



Plate 2. Site 2 (Quadrat 40 x 40 m)

Site 2 was characterised as Hardpan Mulga Woodland – Drainage, comprising *Acacia aneura*, *Senna artemesoides*, *Dissocarpus paradoxa*, *Eragrostis eriopoda*, *Eremophea spinosa*, *Rhagodia eremea*, *Maireana triptera*, *Sclerolaena cornishiana*, *Aristida holathera* and *Convolvulus clementii*, as well as *Cenchrus ciliaris* at low densities (2%).



Plate 3. Seasonally inundated depression in Claypan Grassland.

The vegetation community depicted in Plate 3 was too limited in size and extent to accommodate a 40 x 40 m quadrata; however, a releve point was taken and the vegetation described as a small, internally draining depression dominated by *Eragrostis eriopoda* and *Fimbristylis dichotoma* (no fertile material), with *Atriplex verscaria* and an indeterminate Bryophyte, grading into the adjacent Claypan Grassland.



Plate 4. Claypan Grassland

The proposed road corridor intersects with two parts of a continuous patch of this vegetation community (See Appendix A). Buffel grass (*Cenchrus ciliaris*) is present at low density (2.5%). Groundcover is predominately comprised of graminoid species with frequent chenopods *Dissocarpus paradoxa* and *Sclerolaena cornishiana*.



Plate 5. Mulga over *Maireana triptera* Shrubland

Site 3 was characterised as Mulga over *Maireana triptera* shrubland, spanning the foot of a stony Ironstone slope. Inactive termite mounds were present. Species included *Maireana triptera*, *Acacia aneura*, *Eragrostis eriopoda*, *Dissocarpus paradoxa*, *Sclerolaena cornishiana*, *Rhagodia eremea*, *Eremophila longifolia* with *Cymbopogon ambiguus* at low densities.

A history of prior disturbance was evident, with numerous tyre tracks traversing the lower slope. Some dieback of *Acacia aneura* was also observed, with no apparent recruitment.

This vegetation community is not widespread in the local context (Western Botanical 2018). The area subject to proposed impacts by the road corridor reduction amounts to 2.25ha of this community; however, the point at which the footprint intercepts with this community represents an intergrade with the adjacent Claypan grassland community at the base of the slope. Furthermore, the footprint overlays an extrusion of the hillside, which has exposed the community not only to a natural intergrade with the adjacent communities, but also to edge effects and impacts from off-road traffic ascending the ridge to the upper slope. The proposed road corridor is therefore considered unlikely to represent an unacceptable impact on the local extent of this community.



Plate 6. Stony Ironstone Mulga Shrubland

This vegetation is characterised by patchy *Eremophila duttonii*, *Bonamia erecta*, and *Senna artemesoides* low shrubland on clay with Ironstone gravel/ gibber surface. *Hakea lorea* was recorded in the broader polygon but was uncommon and not captured in the quadrat.



Plate 7. Mulga Grove



Plate 8. Mulga Grove, continuous

The southern portion of the proposed footprint comprises Mulga groves, dominated by *Acacia aneura*, with groundcovers codominated by chenopods, *Eragrostis* spp. and *Triodia* sp. (indet.), with scattered *Eremophila glabra*. Tree cover varies with groves interspersed with open areas dominated by tussock grasses.

4.0 DISCUSSION

Existing tracks of varying degrees of definition traverse the proposed road corridor, predominantly at two to three locations towards the Northern portion of the proposed footprint. This is consistent with a history of prior disturbance associated with the adjacent highway and township of Jameson. On balance, however, the extant vegetation is in good condition, with low frequency of Buffel grass, *Cenchrus ciliaris*; albeit exhibiting some indications of very frequent fire exposure (e.g. low tree and shrub recruitment in some areas). The proposed road realignment will impact on just over 34 ha of native vegetation; however, given that no threatened species were recorded during targeted searches, and the impacts on restricted vegetation communities are limited to historically degraded vegetation at the edge of a patch, it is expected that the impact of the clearing will not have a significant impact on the vegetation communities in the local or regional context.

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APPENDIX A

VEGETATION MAPPING



APPENDIX B

SURVEY DATA

| File Information and Site Location | | | |
|---|--|---------------------------------------|--|
| Date | 4/12/2018 | Project Title (e.g. Ninu2018) | JamesonBypass |
| Ranger Team | Blackstone | Observer | Angela Lyons, Jennifer Timbs |
| Nearest Community | Mantamaru | Scribe | JT, AL, Ningbell Lyons |
| SiteName | JamesonBypass73 | Waypoint - GPS | 73 |
| Photo 0m | JamesonBypass73_0 | Site Type | 40 x 40 m |
| Photo 50m | JamesonBypass73_50 | Transect bearing | 185 |
| MGA Zone | 52 | Site number | 1 |
| Camera ID | Yellow Nikon | Other Notes | Ngaanyatjarraku Shire 1-NE. Corners marked with pegged flagging tapee on pegs; removed following survey. |
| About the site - plants, soil, fire | | | |
| Landscape Position | | Veg brief description | Sparsely vegetated ironstone gibber surface. Grassland comprising see sp list |
| Slope | flat | Veg Condition/ Comments | Subject to frequent fires and edge effects from road |
| Aspect (which direction does the slope face?) | | Buffel Grass | Absent |
| Soil Surface Colour | red | Other weeds? | Nil |
| Soil Surface | Black Ironstone Gibber/ gravel over red clay | How long since the last fire? (Years) | 1 |
| Coarse Woody Debris (m) - Pini waru? | 0 | Scorch height on tree trunks | NA |
| Foliage Projective Cover | | | |
| Meters | Cover | Ngaanya warta above? | Ngaanya below? |
| 2 | Bare | Nil | Nil |
| 4 | Bare | Nil | Nil |
| 6 | Bare | Nil | Nil |
| 8 | Bare | Nil | Nil |
| 10 | Bare | Nil | Nil |
| 12 | Bare | Nil | Nil |
| 14 | Bare | Nil | Nil |
| 16 | Bare | Nil | Nil |
| 18 | Tjarnpi | Nil | Eragrostis eriopoda |
| 20 | Bare | Nil | Nil |
| 22 | Bare | Nil | Nil |
| 24 | Bare | Nil | Nil |
| 26 | Bare | Nil | Nil |
| 28 | Bare | Nil | Nil |
| 30 | Bare | Nil | Nil |
| 32 | Bare | Nil | Nil |

| | | | |
|-------------------------------------|-----------------------------|----------------|------------------------|
| 34 | Bare | Nil | Nil |
| 36 | Bare | Nil | Nil |
| 38 | Bare | Nil | Nil |
| 40 | Bare | Nil | Nil |
| 42 | Bare | Nil | Nil |
| 44 | Bare | Nil | Nil |
| 46 | Tjarnpi | Nil | Eragrostis eriopoda |
| 48 | Bare | Nil | Nil |
| 50 | Bare | Nil | Nil |
| Species Richness | | | |
| Ngaanyatjarra | Species | % Cover | Mean Height (m) |
| <i>Tjilka tjilka</i> | <i>Dissocarpus paradoxa</i> | 1 | 0.15 |
| <i>Tjarnpi</i> | <i>Eragrostis eriopoda</i> | 5 | 0.15 |
| <i>Tjilka tjilka</i> | <i>Bonamia erecta</i> | 1 | 0.2 |
| Tree structure (>2m high) | | | |
| NIL | NA | NA | NA |

Table iii Field Data for Site 2

| File Information and Site Location | | | |
|--|------------------------|--|--|
| Date | 4/12/2018 | Project Title (e.g. Ninu2018) | JamesonBypass |
| Ranger Team | Blackstone | Observer | Angela Lyons, Jennifer Timbs |
| Nearest Community | Mantamaru | Scribe | JT, AL, Ningbell Lyons |
| Site Name | JamesonBypass77 | Waypoint - GPS | 77 |
| Photo 0m | JamesonBypass77_0 | Site Type | 40 x 40 m |
| Photo 50m | JamesonBypass77_50 | Transect bearing | 195 |
| MGA Zone | 52 | Site number | 2 |
| Camera ID | Yellow Nikon | Other Notes | Ngaanyatjarraku Shire. Corners marked with pegged flagging tape on pegs; removed following survey. |
| About the site - plants, soil, fire | | | |
| Landscape Position | | Vegetation community | Hardpan Mulga Woodland – Drainage |
| Slope | flat | Veg Condition/ Comments | |
| Aspect (which direction does the slope face?) | | Buffel Grass | Rare |
| Soil Surface Colour | red | Other weeds? | Nil |
| Soil Surface | CLS | How long since the last fire? (Years) | 1 |

| | | | |
|--------------------------------------|--------------------------------|------------------------------|--------------------------------|
| Coarse Woody Debris (m) - Pini waru? | 0 | Scorch height on tree trunks | NA |
| Foliage Projective Cover | | | |
| Meters | Cover | Ngaanya warta above? | Ngaanya below? |
| 2 | Bare | Nil | Nil |
| 4 | Litter | Nil | Nil |
| 6 | Vegetation | Nil | <i>Rhagodia eremea</i> |
| 8 | Vegetation | Nil | <i>Sclerolaena cornishiana</i> |
| 10 | Litter | Nil | Nil |
| 12 | Bare | Nil | Nil |
| 14 | Litter | Nil | Nil |
| 16 | Litter | Nil | Nil |
| 18 | Litter | Nil | Nil |
| 20 | Tjarnpi | Nil | <i>Eragrostis eriopoda</i> |
| 22 | Vegetation | Nil | <i>Dissocarpus paradoxa</i> |
| 24 | Bare | Nil | Nil |
| 26 | Rock | Nil | Nil |
| 28 | Vegetation | Nil | <i>Rhagodia eremea</i> |
| 30 | Bare | Nil | Nil |
| 32 | Litter | Nil | Nil |
| 34 | Bare | Nil | Nil |
| 36 | Vegetation | Nil | <i>Eremophea spinosa</i> |
| 38 | Tjarnpi | Nil | <i>Eragrostis eriopoda</i> |
| 40 | Non-native graminoid | Nil | <i>Cenchrus ciliaris</i> |
| 42 | Bare | Nil | Nil |
| 44 | Vegetation | Nil | <i>Senna artemesoides</i> |
| 46 | Tjarnpi | <i>Acacia aneura</i> | <i>Eragrostis eriopoda</i> |
| 48 | Bare | <i>Acacia aneura</i> | Nil |
| 50 | Bare | <i>Acacia aneura</i> | Nil |
| Species Richness | | | |
| Ngaanyatjarra | Species | % Cover | Mean Height (m) |
| <i>Tjilka tjilka</i> | <i>Dissocarpus paradoxa</i> | 1 | 0.15 |
| <i>Tjarnpi</i> | <i>Eragrostis eriopoda</i> | 5 | 0.15 |
| | <i>Eremophea spinosa</i> | 1 | 0.4 |
| <i>Buffel</i> | <i>Cenchrus ciliaris</i> | 2.5 | 0.2 |
| <i>Yarapita</i> | <i>Senna artemesoides</i> | 5 | 0.6 |
| <i>Nyiyurr-nyiyurpa</i> | <i>Rhagodia eremea</i> | 5 | 0.45 |
| | <i>Maireana triptera</i> | 2.5 | 0.3 |
| <i>Tjilka tjilka</i> | <i>Sclerolaena cornishiana</i> | 2.5 | 0.3 |

| | | | |
|-------------------------------------|------------------------------|-------------------|-----------------|
| | <i>Aristida holathera</i> | 1 | 0.4 |
| Yaranpa | <i>Acacia aneura</i> | 17 | 4.9 |
| | <i>Convolvulus clementii</i> | 2 | Outside plot |
| | <i>Atriplex versicaria</i> | 3 | Outside plot |
| Tree structure (>2m high) | | | |
| Ngaanyatjarra | Species | Height (m) | DBH (cm) |
| Yaranpa | <i>Acacia aneura</i> | 5.4 | 16.2 |
| Yaranpa | <i>Acacia aneura</i> | 4.3 | 14 |

Table iv Field Data for Site 3

| File Information and Site Location | | | |
|--|----------------------------------|--|--|
| Date | 4/12/2018 | Project Title (e.g. Ninu2018) | JamesonBypass |
| Ranger Team | Blackstone | Observer | Angela Lyons, Jennifer Timbs |
| Nearest Community | Mantamaru | Scribe | JT, AL, Ningbell Lyons |
| Site Name | JamesonBypass83 | Waypoint - GPS | 83 |
| Photo 0m | JamesonBypass83_0 | Site Type | 40 x 40 m |
| Photo 50m | JamesonBypass83_50 | Transect bearing | 225 |
| MGA Zone | 52 | Site number | 3 |
| Camera ID | Yellow Nikon | Other Notes | Ngaanyatjarraku Shire. Corners marked with pegged flagging tape on pegs; removed following survey. |
| About the site - plants, soil, fire | | | |
| Landscape Position | Midslope | Vegetation community | MMts - Mulga over Maireana triptera shrublands |
| Slope | 25 | Veg Condition/ Comments | Inactive termite mounds present |
| Aspect (which direction does the slope face?) | NW | Buffel Grass | Rare |
| Soil Surface Colour | red with black ironstone pebbles | Other weeds? | Nil |
| Soil Surface | CLS | How long since the last fire? (Years) | 1 |
| Coarse Woody Debris (m) - Pini waru? | 0 | Scorch height on tree trunks | NA |
| Foliage Projective Cover | | | |
| Meters | Cover | Ngaanya warta above? | Ngaanya below? |
| 2 | Bare | Nil | Nil |

| 4 | Bare | Nil | Nil |
|-------------------------------------|--------------------------------|-------------------|------------------------|
| 6 | Bare | Nil | Nil |
| 8 | Bare | Nil | Nil |
| 10 | Bare | Nil | Nil |
| 12 | Bare | Nil | Nil |
| 14 | Vegetation | Nil | Maireana triptera |
| 16 | Bare | Nil | Nil |
| 18 | Bare | Nil | Nil |
| 20 | Bare | Nil | Nil |
| 22 | Bare | Nil | Nil |
| 24 | Bare | Nil | Nil |
| 26 | Bare | Nil | Nil |
| 28 | Vegetation | Nil | Maireana triptera |
| 30 | Non-native graminoid | Nil | Cenchrus ciliaris |
| 32 | Bare | Nil | Nil |
| 34 | Bare | Nil | Nil |
| 36 | Vegetation | Nil | Maireana triptera |
| 38 | Bare | Nil | Nil |
| 40 | Vegetation | Nil | Rhagodia eremea |
| 42 | Vegetation | Nil | Dissocarpus paradoxa |
| 44 | Bare | Nil | Nil |
| 46 | Bare | Nil | Nil |
| 48 | Bare | Nil | Nil |
| 50 | Bare | Nil | Nil |
| Species Richness | | | |
| Ngaanyatjarra | Species | % Cover | Mean Height (m) |
| Yilintji | <i>Cymbopogon ambiguus</i> | 1 | 0.45 |
| Tjarnpi | <i>Eragrostis eriopoda</i> | 15 | 0.2 |
| Tjilka tjilka | <i>Dissocarpus paradoxa</i> | 2.5 | 0.35 |
| Buffel | <i>Cenchrus ciliaris</i> | 2.5 | 0.3 |
| Nyiyurr-nyiyurpa | <i>Rhagodia eremea</i> | 1 | 0.2 |
| | <i>Eremophila longifolia</i> | 1 | 0.6 |
| | <i>Maireana triptera</i> | 2.5 | 0.3 |
| Tjilka tjilka | <i>Sclerolaena cornishiana</i> | 1 | 0.2 |
| Yaranpa | <i>Acacia aneura</i> | 15 | 3 |
| Tree structure (>2m high) | | | |
| Ngaanyatjarra | Species | Height (m) | DBH (cm) |
| Yaranpa | <i>Acacia aneura</i> | 3.8 | 17.1 |
| Yaranpa | <i>Acacia aneura</i> | 4.5 | 14 |
| Yaranpa | <i>Acacia aneura</i> | 2.8 | 9 |
| Yaranpa | <i>Acacia aneura</i> | 2.5 | 8 |

Table v Field Data for Site 5

| File Information and Site Location | | | |
|--|--------------------|--|---|
| Date | 4/12/2018 | Project Title (e.g. Ninu2018) | JamesonBypass |
| Ranger Team | Blackstone | Observer | Angela Lyons, Jennifer Timbs, Ningbell Lyons |
| Nearest Community | Mantamaru | Scribe | JT, AL, Ningbell Lyons |
| SiteName | JamesonBypass85 | Waypoint - GPS | 85 |
| Photo 0m | JamesonBypass85_0 | Site Type | 40 x 40 m |
| Photo 50m | JamesonBypass85_50 | Transect bearing | 245 |
| MGA Zone | 52 | Site number | 4 |
| Camera ID | Yellow Nikon | Other Notes | Ngaanyatjarraku Shire. Corners marked with pegged flagging tapee on pegs; removed following survey. |
| About the site - plants, soil, fire | | | |
| Landscape Position | | Vegetation community | Claypan grassland |
| Slope | flat | Veg Condition/ Comments | Wirtjintji (Hakea lorea) present in broader polygon, not within quadrat. |
| Aspect (which direction does the slope face?) | | Buffel Grass | Abundant |
| Soil Surface Colour | red | Other weeds? | Nil |
| Soil Surface | CLS | How long since the last fire? (Years) | 1 |
| Coarse Woody Debris (m) - Pini waru? | 0 | Scorch height on tree trunks | NA |
| Foliage Projective Cover | | | |
| Meters | Cover | Ngaanya warta above? | Ngaanya below? |
| 2 | Bare | Nil | Nil |
| 4 | Bare | Nil | Nil |
| 6 | Bare | Nil | Nil |
| 8 | Bare | Nil | Nil |
| 10 | Tjarnpi | Nil | Eragrostis eriopoda |
| 12 | Bare | Nil | Nil |
| 14 | Bare | Nil | Nil |
| 16 | Tjarnpi | Nil | Eragrostis eriopoda |
| 18 | Tjarnpi | Nil | Eragrostis eriopoda |

| | | | |
|-------------------------------------|-----------------------------|----------------|------------------------|
| 20 | Bare | Nil | Nil |
| 22 | Bare | Nil | Nil |
| 24 | Bare | Nil | Nil |
| 26 | Non-native graminoid | Nil | Cenchrus ciliaris |
| 28 | Non-native graminoid | Nil | Cenchrus ciliaris |
| 30 | Non-native graminoid | Nil | Cenchrus ciliaris |
| 32 | Bare | Nil | Nil |
| 34 | Bare | Nil | Nil |
| 36 | Bare | Nil | Nil |
| 38 | Bare | Nil | Nil |
| 40 | Bare | Nil | Nil |
| 42 | Bare | Nil | Nil |
| 44 | Bare | Nil | Nil |
| 46 | Tjarnpi | Nil | Eragrostis eriopoda |
| 48 | Bare | Nil | Nil |
| 50 | Bare | Nil | Nil |
| Species Richness | | | |
| Ngaanyatjarra | Species | % Cover | Mean Height (m) |
| <i>Tjilka tjilka</i> | <i>Dissocarpus paradoxa</i> | 2.5 | 0.2 |
| <i>Tjarnpi</i> | <i>Eragrostis eriopoda</i> | 40 | 0.15 |
| <i>Buffel</i> | <i>Cenchrus ciliaris</i> | 5 | 0.25 |
| <i>Yilintji</i> | <i>Cymbopogon ambiguus</i> | 2.5 | 0.45 |
| <i>Wirtjintji</i> | <i>Hakea lorea</i> | Outside plot | Outside plot |
| Tree structure (>2m high) | | | |
| NIL | NA | | |

Table vi Field Data for Site 6

| File Information and Site Location | | | |
|---|--------------------|--------------------------------------|---|
| Date | 4/12/2018 | Project Title (e.g. Ninu2018) | JamesonBypass |
| Ranger Team | Blackstone | Observer | Angela Lyons, Jennifer Timbs |
| Nearest Community | Mantamaru | Scribe | JT, AL, Ningbell Lyons |
| SiteName | JamesonBypass90 | Waypoint - GPS | 90 |
| Photo 0m | JamesonBypass90_0 | Site Type | RELEVE |
| Photo 50m | JamesonBypass90_50 | Transect bearing | 145 |
| MGA Zone | 52 | Site number | 6 |
| Camera ID | Yellow Nikon | Other Notes | Ngaanyatjarraku Shire. Corners marked with pegged flagging tapee on pegs; |

| | | | |
|--|-------------------------------|--|---------------------------|
| | | | removed following survey. |
| About the site - plants, soil, fire | | | |
| Landscape Position | | Vegetation community | |
| Slope | flat | Veg Condition/ Comments | |
| Aspect (which direction does the slope face?) | | Buffel Grass | Frequent |
| Soil Surface Colour | red | Other weeds? | Nil |
| Soil Surface | CLS | How long since the last fire? (Years) | 1 |
| Coarse Woody Debris (m) - Pini waru? | 0 | Scorch height on tree trunks | NA |
| Species Richness | | | |
| Ngaanyatjarra | Species | % Cover | Mean Height (m) |
| <i>Buffel</i> | <i>Cenchrus ciliaris</i> | 10 | 0.2 |
| <i>Tjarnpi</i> | <i>Eragrostis eriopoda</i> | 15 | 0.2 |
| <i>Yitawari</i> | <i>Acacia pruinocarpa</i> | 15 | 4.4 |
| <i>Wakalpuka</i> | <i>Acacia tetragonophylla</i> | 2 | 1.2 |
| <i>Tjilka tjilka</i> | <i>Dissocarpus paradoxus</i> | 1 | 0.2 |
| <i>Yilintji</i> | <i>Cymbopogon ambiguus</i> | 1 | 0.45 |
| <i>Tjulpin tjulpinpa</i> | <i>Trychodesma zeylanicum</i> | 0.5 | 0.2 |
| | <i>Solanum lasiophyllum</i> | 1 | 0.4 |
| <i>Tjarnpi</i> | <i>Eragrostis laniflora</i> | 5 | 0.2 |
| | <i>Dicrastylus doranii</i> | 1 | 0.15 |
| | BRYOPHYTE (Indet.) | 1 | 0.001 |
| <i>Purirru</i> | <i>Eremophila glabra</i> | 2.5 | 0.4 |
| | <i>Acacia aneura</i> | 30 | 4.3 |
| Foliage Projective Cover | | | |
| Meters | Cover | Ngaanya warta above? | Ngaanya below? |
| 2 | Bare | Acacia pruinocarpa | Nil |
| 4 | Bare | Acacia pruinocarpa | Nil |
| 6 | Bare | Acacia aneura | Nil |
| 8 | Bare | Acacia aneura | Nil |
| 10 | Bare | Nil | Nil |

| | | | |
|-------------------------------------|----------------------|--------------------|-----------------------|
| 12 | Tjarnpi | Acacia aneura | Eragrostis eriopoda |
| 14 | Litter | Nil | Nil |
| 16 | Vegetation | Acacia pruinocarpa | Dissocarpus paradoxus |
| 18 | Tjarnpi | Nil | Eragrostis eriopoda |
| 20 | Litter | Nil | Nil |
| 22 | Litter | Nil | Nil |
| 24 | Litter | Nil | Nil |
| 26 | Bare | Nil | Nil |
| 28 | Litter | Acacia aneura | Nil |
| 30 | Non-native graminoid | Nil | Cenchrus ciliaris |
| 32 | Bare | Acacia aneura | Nil |
| 34 | Bare | Nil | Nil |
| 36 | Bare | Acacia aneura | Nil |
| 38 | Bare | Nil | Nil |
| 40 | Litter | Nil | Nil |
| 42 | Litter | Nil | Nil |
| 44 | Tjarnpi | Nil | Eragrostis eriopoda |
| 46 | Tjarnpi | Acacia aneura | Eragrostis eriopoda |
| 48 | Bare | Acacia aneura | Nil |
| 50 | Bare | Acacia aneura | Nil |
| Tree structure (>2m high) | | | |
| Ngaanyatjarra | Species | Height (m) | DBH (cm) |
| Yaranpa | Acacia aneura | 2.8 | 13.9 |
| Yaranpa | Acacia aneura | 5.2 | 7.8 |
| Yaranpa | Acacia aneura | 5.1 | 8 |
| Yaranpa | Acacia aneura | 3.3 | 4 |
| Yaranpa | Acacia aneura | 5.2 | 6.7 |
| Yaranpa | Acacia aneura | 5.3 | 3 |
| Yaranpa | Acacia aneura | 4.5 | 5.3 |
| Yaranpa | Acacia aneura | 3.1 | 4.2 |
| Yaranpa | Acacia aneura | 4.4 | 11 |
| Yaranpa | Acacia aneura | 4.8 | 9.6 |
| Yaranpa | Acacia aneura | 3.6 | 4.8 |
| Yitawara | Acacia pruinocarpa | 2.8 | 6.2 |
| Yitawara | Acacia pruinocarpa | 5.8 | 17.5 |
| Yitawara | Acacia pruinocarpa | 3.6 | 17 |
| Yitawara | Acacia pruinocarpa | 4.1 | 27.1 |
| Yitawara | Acacia pruinocarpa | 5 | 17 |
| Yitawara | Acacia pruinocarpa | 5.9 | 17.5 |
| Yitawara | Acacia pruinocarpa | 3.5 | 14 |

