A report on a field survey for habitat suitable for bilby (*Macrotis lagotis*) and mulgara (*Dasycercus* spp.) in the proposed Jartaku Conservation Area on the Yandeyarra Aboriginal Reserve and Kangan Pastoral Lease, in the Pilbara Region of Western Australia.

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by

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Summary
Forty-eight survey sites across the proposed Jartaku Conservation Area, within the Yandeyarra Aboriginal Reserve and Kangan Pastoral Lease, were assessed for suitable bilby and mulgara habitat and to determine if these species exist in the area. As predicted from geology, regolith type and land systems, suitable habitat was confirmed in the southern portion and the northeast corner of the survey area. Suitable sites where generally characterized by deep sands with shrubs or adjacent shrub areas or vegetated drainage lines as resource areas. No evidence of bilbies was found within the survey area, although extensive bilby diggings were found along the Roy Hill rail corridor road, approximately 400 m from the northeastern border of the survey area. Evidence of old mulgara burrows was found at several sites in the southern portion and the northeast corner of the survey area. Cattle damage was extensive throughout the survey area and particularly severe along drainage lines and sandy areas which form important suitable habitat areas for bilbies and mulgara. The survey was limited by vehicular access and survey points are biased towards access tracks. Helicopter access would be required to access a greater part of the survey area.

Introduction
The survey area forms part of the Yandeyarra Aboriginal Reserve and Kangan Pastoral Lease and is located on the Great Northern Highway approximately 130 km south from Port Hedland, and 75 km north from the Fortescue Marsh (see Figures 1 and 2 in Dziminski *et al*. 2012) and is 48 037 ha in size (Dziminski *et al*. 2012). It lies within the distributional range of the bilby (*Macrotis lagotis*), and both species of mulgaras (Van Dyke and Strahan 2008). The taxonomy and status of both mulgara species (*Dasycercus blythi* and *D. cristicauda*) is as yet unresolved in the Pilbara region (Woolley 2005, 2008; Masters 2008). Therefore, in this report, both species will be referred to as mulgara. The desktop habitat assessment (Dziminski *et al*. 2012) predicted that 28 – 51 % (13 516 – 24 565 ha) of the survey area is potentially suitable bilby and mulgara habitat, and both these species have been recorded within 40 km of the survey area.

The aims of the field survey were to:
1. Survey the Jartaku Conservation Area for the presence of bilbies and mulgara; and,
2. Confirm if suitable bilby and mulgara habitat is present in the survey area.

Limitations
The major limitation of this survey was access. It can be seen from Figure 1 that survey points were limited to areas where tracks were accessible by vehicle. Some tracks where we attempted to gain access were overgrown and eroded preventing access. Therefore the whole survey area was not evenly surveyed and survey points are biased towards where accessible vehicular tracks and roads exist.

In addition, this survey was programmed for only a four day period, and up to four hours each day was spent travelling to and from the survey area.

Methods
The survey was conducted between 28 to 31 August 2012 by vehicle on all available access tracks and roads within the survey site. Some locations away from tracks and roads were accessed on foot. Survey points were selected approximately 2 km apart or where substrate or vegetation visibly changed (Figure 1). This technique encompassed all accessible land systems, regolith and geological units as evenly as possible.

At each survey point a 100 m^2 area was searched on foot for 10 minutes by four observers. At each survey point a digital image was taken, and details of the substrate, vegetation and any relevant observations were recorded. Each point was assessed as either:

1. Suitable: Habitat that is potentially suitable to support bilbies and mulgara.
2. Marginal: Habitat in which bilbies or mulgara are not expected to be found, but could possibly occur.
3. Unsuitable: Habitat that is unlikely to support any bilbies or mulgara.

This habitat assessment was assigned without considering the effects of cattle damage. A second assessment was assigned to sites at which cattle damage currently affected the suitability. Any observed bilby or mulgara diggings or burrows were recorded as digital images with geo-reference data.

Results and Discussion

Habitat Assessment

The field survey resulted in the assessment of 48 locations across the survey area. The majority of sites assessed as suitable were located in the southern portion of the survey area and a small area in the northeast (Figure 1).

This pattern supported and confirmed the predictions of the desktop survey (Dziminski *et al*. 2012) which identified from geology (Figure 2), regolith (Figure 3) and land systems (Figure 4) that the most likely suitable bilby and mulgara habitat would occur in the southern portion and in the northeast corner of the survey area. The small area in the northeast is likely to extend northwest into the survey area adjacent to the drainage line (Figure 2) but access was not possible to confirm this.

Characteristics of substrate, vegetation and observations for each site are shown in Table1. Suitable sites were generally characterized by deep sands with shrubs or adjacent shrub areas or vegetated drainage lines as food resource areas. Although many sites in the southern portion of the survey area were identified as suitable, shrubs were usually sparse, which could mean that the major resource providing areas could be the vegetated areas adjacent to drainage lines as has been found in areas in central Australia where bilbies are known to occur (Lavery and Kirkpatrick 1997; Southgate *et al*. 2005, 2007).

Bilby and Mulgara Observations

No burrows, diggings or scats of bilbies were found within the survey area. Extensive bilby diggings at the base of *Acacia* shrubs (Photo Panel 1) were found on the Roy Hill rail corridor at Site 095 (Figure 1). This site was approximately 400 m to the east and outside the survey area. The diggings were adjacent to the rail corridor road and assessed as being not more than 12 months old. The substrate in this area was deep granitic sand in a low area between granite ridges, with spinifex and very low *Acacia* shrubs. It is possible that this suitable habitat extends to the northwest into the survey area adjacent to the drainage line as indicated by geology (Figure 2).

Mulgara burrows (Photo Panel 2) were found at sites 008 and 093 within the survey area (Figure 1). These burrows were old and not recently occupied. A possible mulgara burrow was found at site 073 but was too old to be confirmed as a mulgara burrow. Outside the survey area, old, disused mulgara burrows were found at site 096, in the same area that bilby diggings were found. Varanid burrows were located at site 110 and can be identified by distinctive low, crescent-shaped entrances (Photo Panel 2).

Livestock and Feral Animals

Every site visited showed evidence of heavy cattle damage, and cattle were observed at many sites. Effects of cattle damage included heavy erosion, extensive trampling of vegetation and destruction of shrubs and trees. In particular areas surrounding drainage lines were heavily used and severely damaged by cattle. In many cases such areas that are potentially suitable for bilbies are at the current time downgraded and assessed as marginal or unsuitable as indicated in Table 1 due to extreme cattle damage.

Currently, it would be difficult for bilbies or mulgaras to maintain burrows in these areas due to trampling by cattle and collapsing. These vegetated areas potentially provide foraging habitat for bilbies and would need at least two years regeneration time after exclusion of cattle and other livestock. Evidence of horses was widespread and horses were seen at several sites (e.g. Site 089; Table 1). Examples of cattle and other livestock are shown in Photo Panel 3. Feral cat tracks were confirmed at sites 77, 79 and 110 (Figure 1). No fox or dog tracks were seen.

Recently Burnt Areas
Several sites were identified as recently burnt. Recently burnt areas that have not regenerated are likely low in resources and unsuitable for bilbies and mulgara. The difference in recently burnt and unburnt areas can be seen on opposite sides of the Great Northern Highway at sites 070, 071 and 089 in Table 1.

Heritage values
Traditional owners indicated rock carvings could possibly exist at site 074 (Figure 1; Table 1).

Future Work
It would be important to determine if the habitat that bilby diggings were found in the north east extends to the northwest into the survey area, and if bilbies or evidence of occupation exists in this area. Unfortunately access was not possible, and any future work requires at least two vehicles of at least Land Cruiser or equivalent capability, with at least three spare tyres each. This survey was limited to vehicular access routes and helicopter access would be required to broaden the survey. Alternatively, upgrading the tracks would assist in this.

More detailed vegetation and floristics surveys of likely bilby and mulgara habitat would be required to confirm if suitable food resource species and complexes occurred, and to determine the extent of cattle damage on food resource areas.

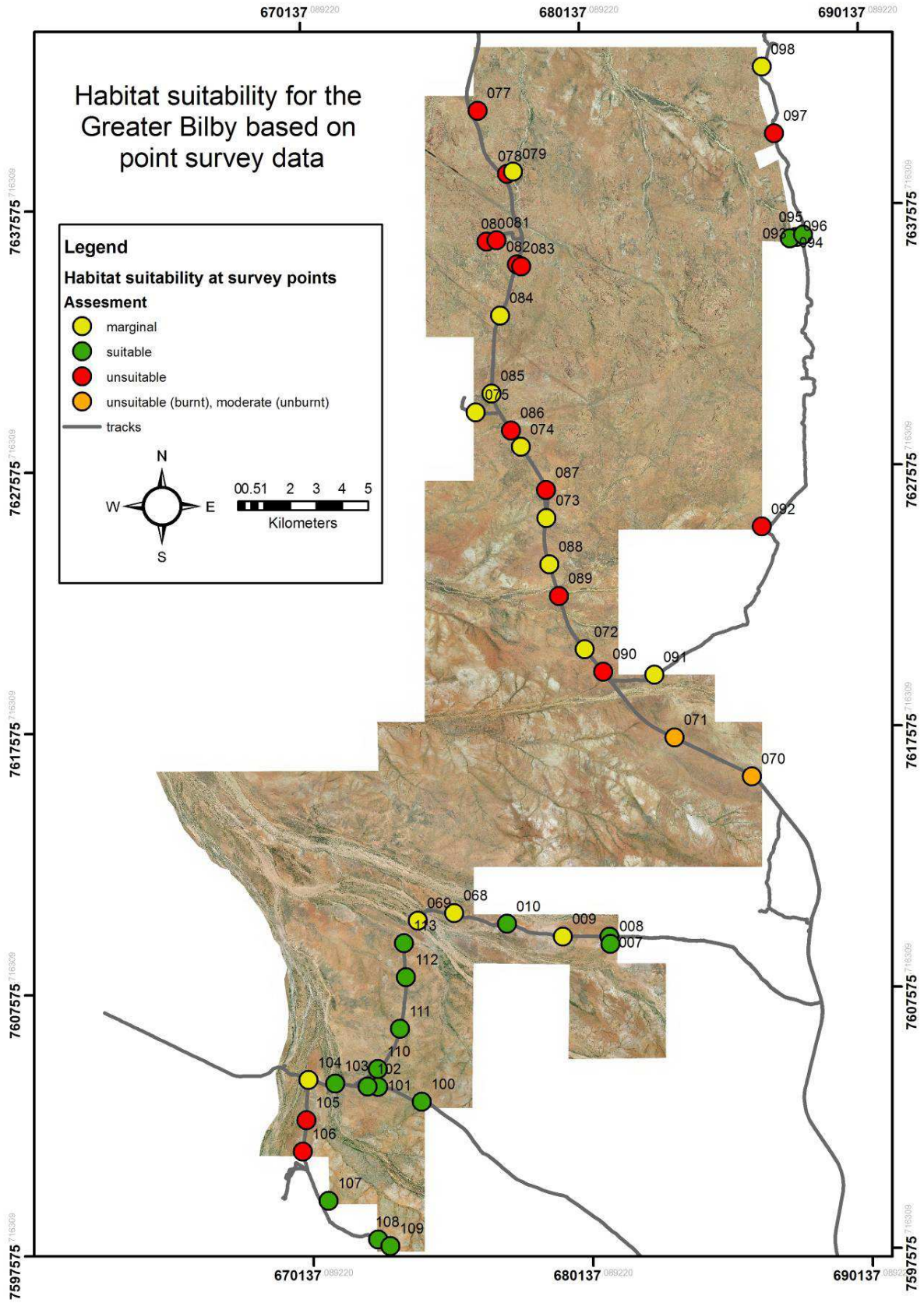


Figure 1. Survey sites in the survey area.

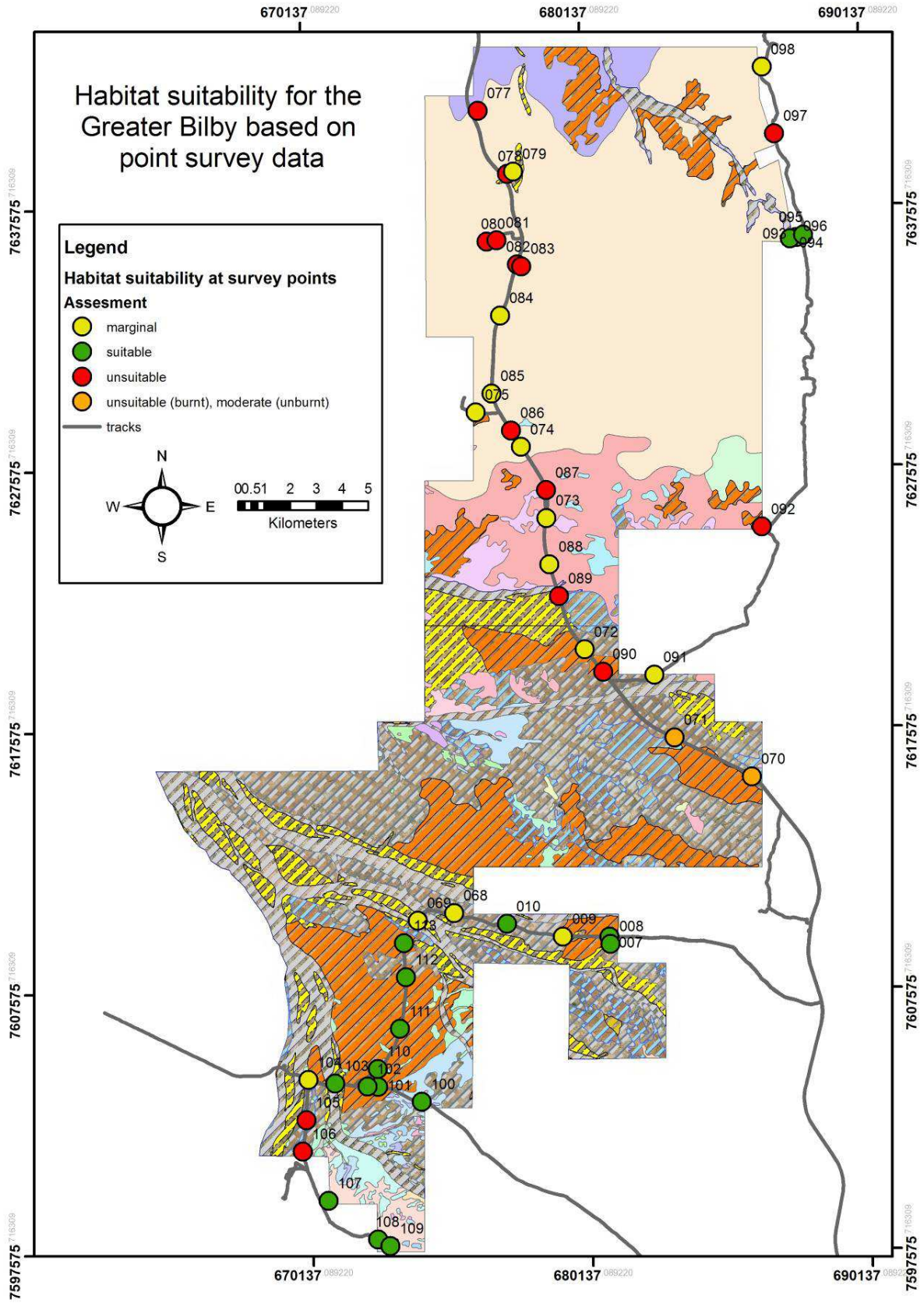


Figure 2. Geology and survey sites in the survey area.

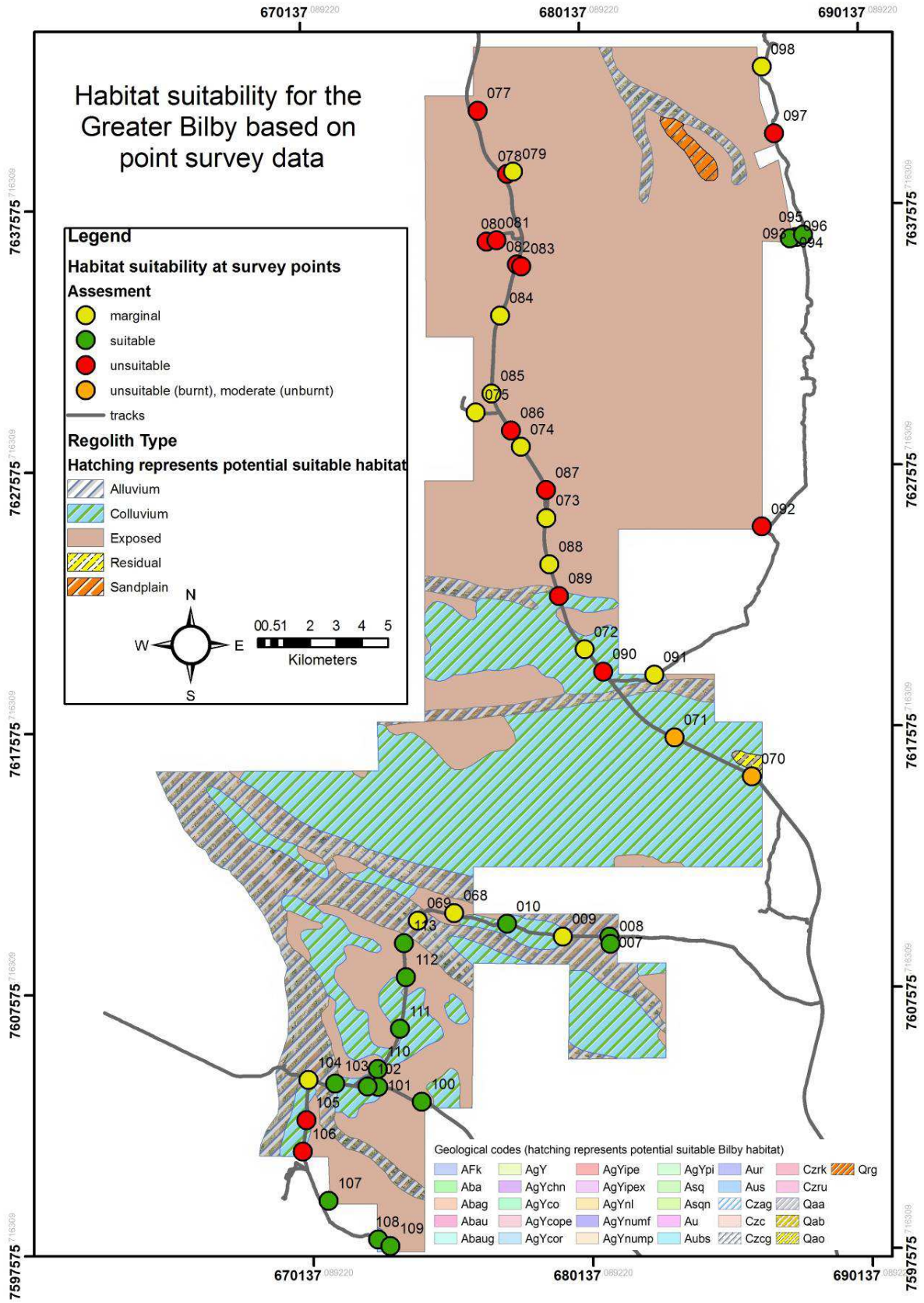


Figure 3. Regolith type and survey sites in the survey area.

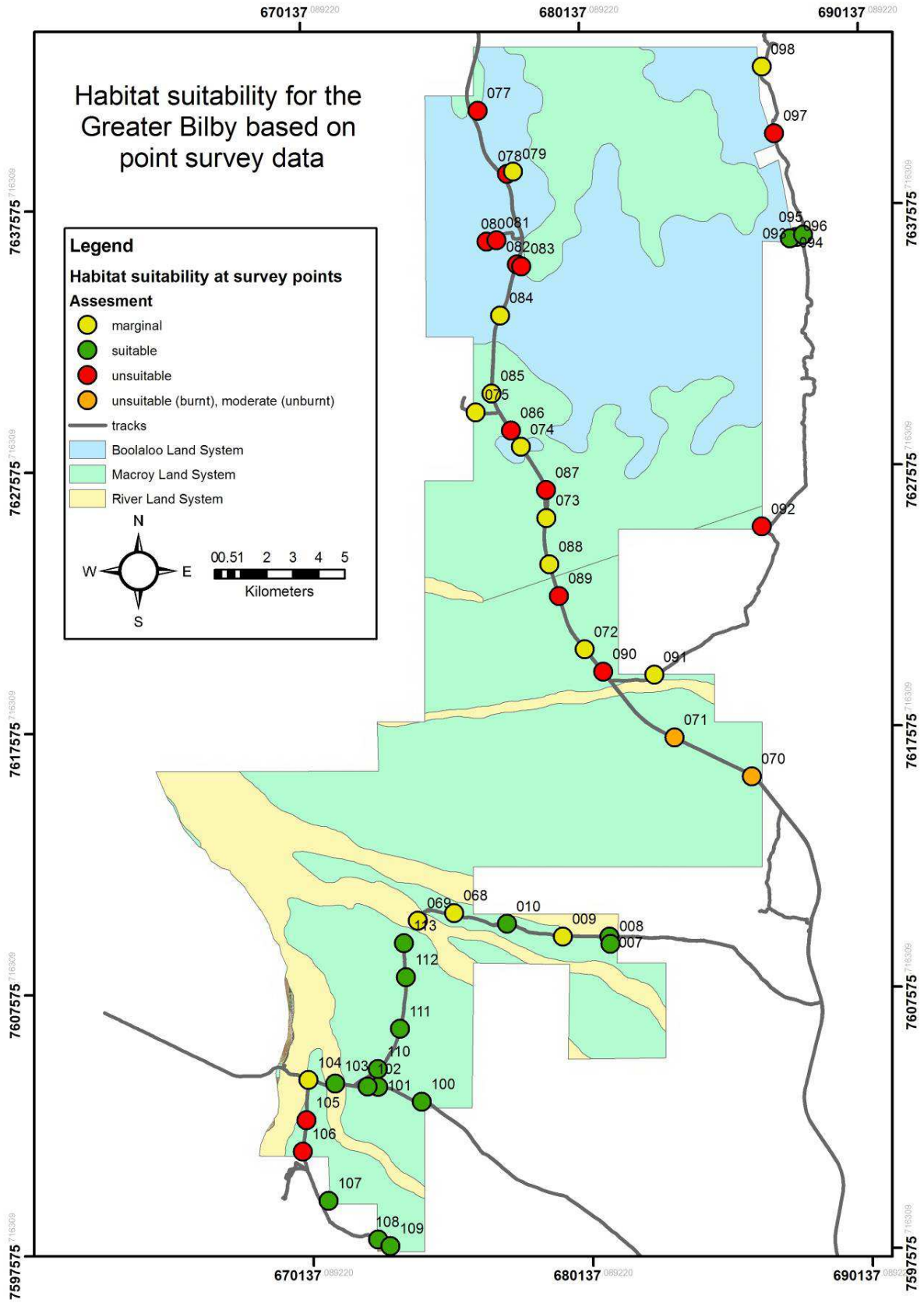
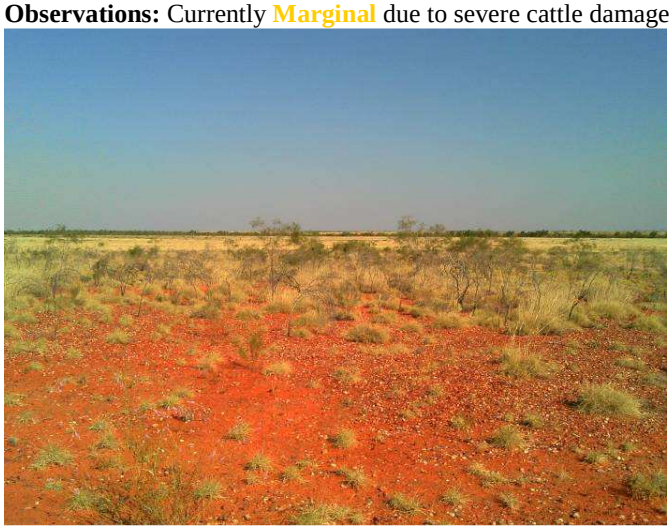


Figure 4. Land systems and survey sites in the survey area.

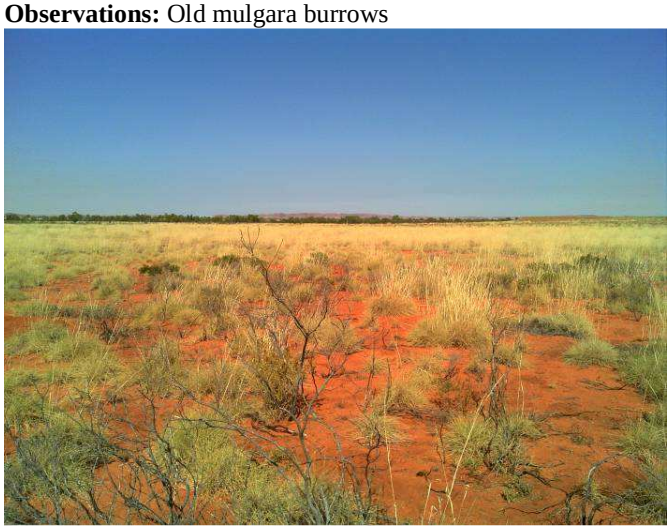
Table 1. Substrate and vegetation descriptions and observations at each survey site.

Site: 007 **Suitability:** **Suitable**
Substrate: Drainage channel, very sandy
Vegetation: Miniritchie, eucalypts, grasses and shrubs
Observations: Currently **Marginal** due to severe cattle damage

Site: 008 **Suitability:** **Suitable**
Substrate: Sand plain
Vegetation: Spinifex, no shrub overstorey
Observations: Old mulgara burrows



Site: 009 **Suitability:** **Marginal**
Substrate: Gravel and sand on low rise
Vegetation: Sparse spinifex and dead shrubs



Site: 010 **Suitability:** **Suitable**
Substrate: Sand plain
Vegetation: Spinifex with low shrubs

Site: 068 **Suitability:** **Marginal**
Substrate: Sandy loam and gravel
Vegetation: Spinifex and acacia shrubs

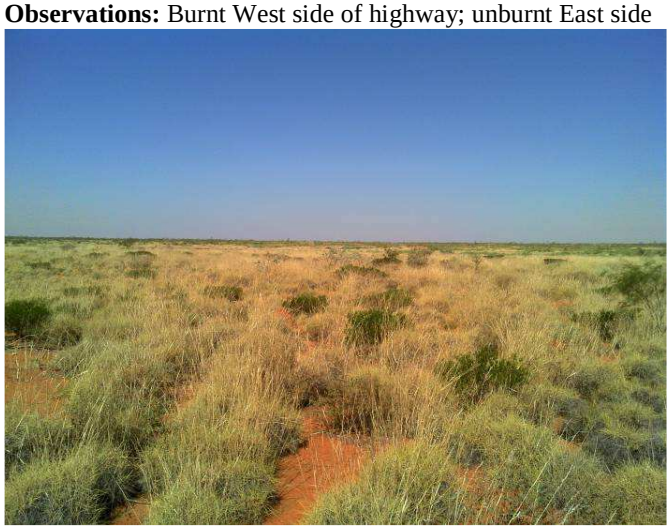
Site: 069 **Suitability:** **Marginal**
Substrate: Sandy banks of drainage line
Vegetation: Buffel grass, very little spinifex, melaleucas, miniritchie and other acacias, redgums
Observations: Currently **Unsuitable** due to severe cattle damage

Site: 070 **Suitability:** Marginal (unburnt site)
Substrate: Gravel
Vegetation: Spinifex with low shrubs
Observations: East side of highway

Site: 070 **Suitability:** Unsuitable (burnt site)
Substrate: Gravel
Vegetation: Recently burnt spinifex
Observations: West side of highway

Site: 071 **Suitability:** Marginal (unburnt site)
Substrate: Sandy, clay loam **Unsuitable** (burnt site)
Vegetation: Spinifex with sparse low acacia shrubs
Observations: Burnt West side of highway; unburnt East side

Site: 072 **Suitability:** Marginal
Substrate: Sandy and loamy fine gravel
Vegetation: Sparse spinifex with low shrubs



Site: 073 **Suitability:** Suitable
Substrate: Rocky granite at surface, sandy in low areas
Vegetation: Spinifex with shrubs
Observations: Very old possible mulgara burrows

Site: 074 **Suitability:** Marginal
Substrate: Granite outcrops, granitic sand between outcrops
Vegetation: Spinifex with very sparse shrubs
Observations: Traditional owner indicated possibility of rock carvings here

Site: 075 **Suitability:** Marginal
Substrate: Rocky gravel and coarse granitic sand
Vegetation: Spinifex with shrubs

Site: 077 **Suitability:** Unsuitable
Substrate: Granite outcrops, boulders, exposed granite at surface, granitic sand between rocks with granite just under surface
Vegetation: Spinifex and sparse acacia shrubs
Observations: Cat tracks

Site: 078 **Suitability:** Unsuitable
Substrate: Granite outcrops, exposed granite at surface, shallow granitic sand and gravel between rocks with granite just under surface
Vegetation: Spinifex with some acacia shrubs around granite

Site: 079 **Suitability:** Marginal
Substrate: Sandy drainage line with sandy and loamy banks
Vegetation: Spinifex, melaleuca, Themeda
Observations: Currently **Unsuitable** due to severe cattle damage

Site: 080 **Suitability:** Unsuitable
Substrate: Rocky with granite outcrops
Vegetation: Spinifex with some small trees

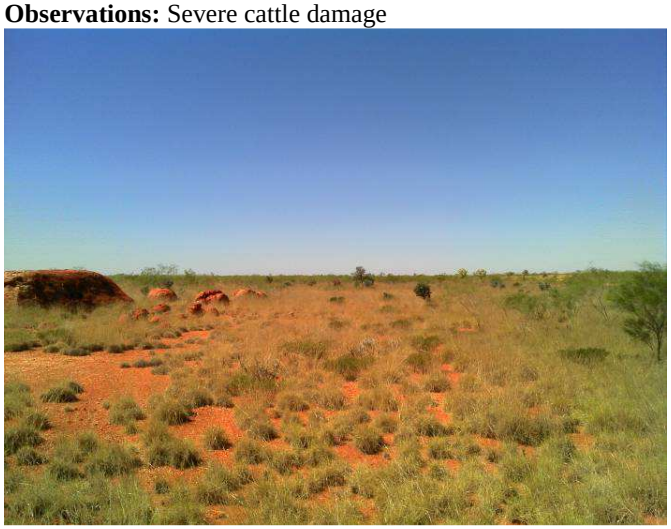
Site: 081 **Suitability:** Unsuitable
Substrate: Shallow granitic sand with rock under surface and exposed rock
Vegetation: Mature large spinifex and scattered acacia shrubs

Site: 083 **Suitability:** Unsuitable
Substrate: Coarse quartz gravel and exposed granite with some drainage lines
Vegetation: Spinifex and low acacia shrubs

Site: 084 **Suitability:** Marginal
Substrate: Shallow granitic sand and exposed rock
Vegetation: Spinifex and low shrubs

Site: 085 **Suitability:** Marginal
Substrate: Drainage line with sandy and loamy banks, some granite
Vegetation: Tall miniritchie, Themeda, large spinifex, some redgums
Observations: Severe cattle damage

Site: 086 **Suitability:** Unsuitable
Substrate: Shallow granitic sand with exposed granite and granite outcrops
Vegetation: Sparse small spinifex and sparse low shrubs



Site: 087 **Suitability:** Unsuitable
Substrate: Shallow granitic sand with exposed granite and granite outcrops
Vegetation: Sparse small spinifex and sparse low shrubs

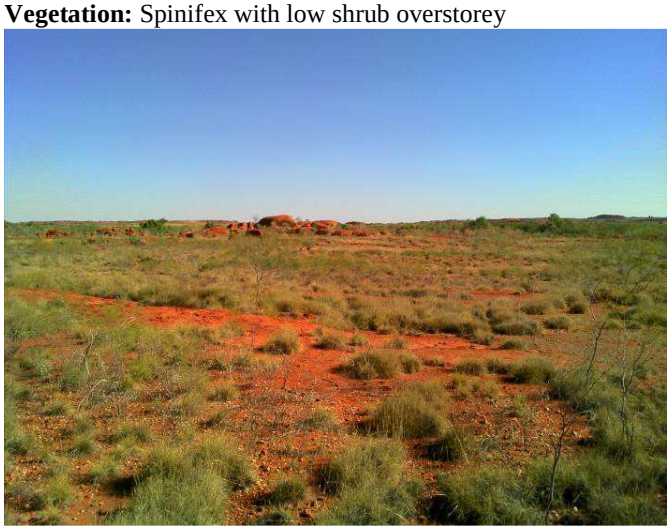
Site: 088 **Suitability:** Marginal
Substrate: Hard compacted gravelly loam
Vegetation: Spinifex with acacia shrub overstory

Site: 089 **Suitability:** **Unsuitable**
Substrate: Coarse rocky gravel
Vegetation: Very small sparse spinifex with low acacia shrubs burnt recently
Observations: Horses

Site: 090 **Suitability:** **Unsuitable**
Substrate: Coarse rocky gravel
Vegetation: Spinifex with tall shrub overstorey

Site: 091 **Suitability:** **Marginal**
Substrate: Sandy loam but covered by water when wet
Vegetation: Spinifex with low shrub overstorey

Site: 092 **Suitability:** **Unsuitable**
Substrate: Gravel and rocks with exposed rock
Vegetation: Spinifex with sparse tall shrubs



Site: 093, 096 **Suitability:** **Suitable**
Substrate: Sand between granite outcrops
Vegetation: Spinifex with low shrub overstorey
Observations: Old mulgara burrows

Site: 094 **Suitability:** **Suitable**
Substrate: Drainage line with sandy and loamy banks
Vegetation: Spinifex, Themeda and other tussock grasses, large acacias, miniritchie
Observations: Currently **Marginal** due to severe cattle damage

Site: 095 **(Outside Survey Area) Suitability: Suitable**
Substrate: Low area between granite ridges, deep granitic sand
Vegetation: Spinifex and very low acacia shrubs
Observations: Bilby diggings at base of many acacias, some old mulgara burrows

Site: 097 **Suitability: Unsuitable**
Substrate: Rocky, sandy gravel with granite outcrops
Vegetation: Spinifex with overstorey of shrubs

Site: 098 **Suitability: Marginal**
Substrate: Sandy loam between granite outcrops
Vegetation: Spinifex with low shrubs

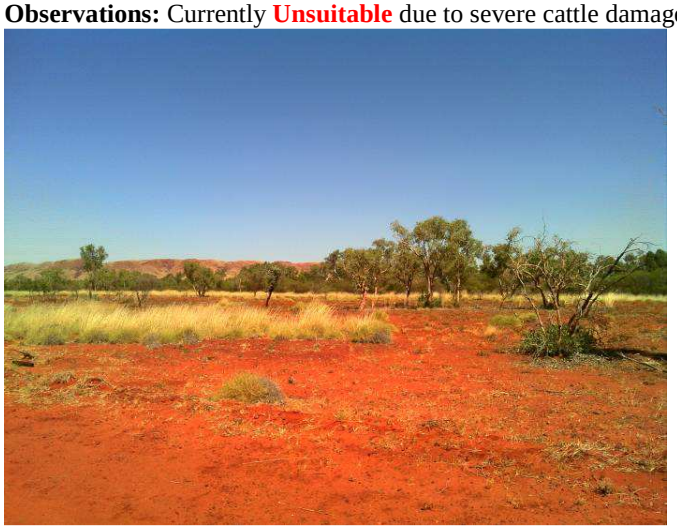
Site: 100 **Suitability: Suitable**
Substrate: Sandy with some gravel patches
Vegetation: Spinifex with sparse tall acacia shrubs

Site: 101 **Suitability: Suitable**
Substrate: Sandy - sand plain
Vegetation: Spinifex with sparse acacia and miniritchie
Observations: Currently **Marginal** due to severe cattle damage

Site: 102 **Suitability: Suitable**
Substrate: Very sandy - sand plain
Vegetation: Spinifex with sparse acacia and miniritchie
Observations: Currently **Marginal** due to severe cattle damage; some recent burnt patches from mustering

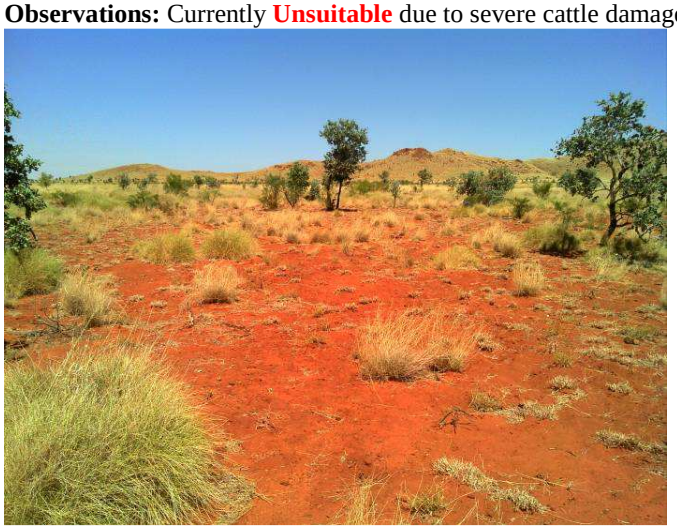
Site: 103 **Suitability:** **Suitable**
Substrate: Sandy drainage banks
Vegetation: Sparse large spinifex, tall miniritchie, tall eucalypt trees
Observations: Currently **Unsuitable** due to severe cattle damage

Site: 105 **Suitability:** **Unsuitable**
Substrate: Stones
Vegetation: Low small spinifex no shrubs



Site: 104 **Suitability:** **Marginal**
Substrate: Sandy loam, drainage line
Vegetation: Spinifex with no shrubs
Observations: Currently **Unsuitable** due to severe cattle damage

Site: 106 **Suitability:** **Unsuitable**
Substrate: Stoney large gravel
Vegetation: Spinifex with some sparse low shrubs



Site: 107 **Suitability:** **Suitable**
Substrate: Deep sand
Vegetation: Spinifex with acacia and miniritchie overstorey
Observations: Currently **Marginal** due to severe cattle damage

Site: 108 **Suitability:** **Suitable**
Substrate: Sandy and some gravelly sand
Vegetation: Spinifex with miniritchie and other tall shrub overstorey

Site: 109 **Suitability:** **Suitable**
Substrate: Gravelly sand
Vegetation: Spinifex with acacia and miniritchie overstorey

Site: 110 **Suitability:** **Suitable**
Substrate: Sand
Vegetation: Spinifex with low shrubs
Observations: Cat tracks and varanid burrows

Site: 111 **Suitability:** **Suitable**
Substrate: Sand and loamy sand
Vegetation: Spinifex with low shrubs

Site: 112 **Suitability:** **Suitable**
Substrate: Sand
Vegetation: Spinifex with miniritchie and other low shrubs

Site: 113 **Suitability:** **Suitable**
Substrate: Sand
Vegetation: Spinifex with acacia shrub overstorey


Photo Panel 1. Bilby diggings at the base of *Acacia* shrubs at site 095.

Site 008

Site 093

Site 096

Site 073

Varanid burrows at Site110

Photo Panel 2: Mulgara and varanid burrows in the survey area.

Site 007

Site 069

Site 079

Site 094

Site 103

Site 107

Photo Panel 3. Examples of cattle damage in the survey area.

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Appendix 1. Electronic version of ArcGIS clickable map of the survey sites with photos (provided separately)

Appendix 2. Electronic spatial data (provided separately).