

Cliffs Asia Pacific Iron Ore

Investigations into the distribution and abundance of the Tree-stem Trapdoor Spider in the Koolyanobbing Area, December 2008

Prepared for: Cliffs Asia Pacific Iron Ore Pty Ltd.
Level 11, The Quadrant,
1 William Street,
Perth, 6000

Prepared by: M. Bamford, S. Smith and P. Smith,
M.J. & A.R. Bamford,
CONSULTING ECOLOGISTS.
23 Plover Way,
Kingsley, WA, 6026.



27th March 2009

EXECUTIVE SUMMARY

Cliffs Asia Pacific Iron Ore (Cliffs) is preparing to expand operations at the Koolyanobbing mine and as part of environmental impact assessment for this expansion, Bamford Consulting Ecologists was commissioned to conduct investigations into the distribution of the Tree-stem Trapdoor Spider *Aganippe castellum* in the area. This is a species of high conservation significance (Schedule 1 of the WA *Wildlife Conservation Act*) that has recently been found to occur on gravelly-loam and rocky soils of hills in the Mt Jackson, Windarling and Koolyanobbing ranges.

A number of studies into the Tree-stem Trapdoor Spider have been undertaken. This report presents the results of field work carried out in December 2008 to which there were two components: intensive surveys in an area north-east of Pits B and C aimed at assessing the possible impacts of the proposed expansion of the existing waste rock landform and ore stockpile, and more broad-scale surveys south of Pits B and C, and south along the Koolyanobbing range, intended to better define the distribution of the species in these areas. An important aim of both studies was to provide a population density estimate and a population distribution so that an estimate of the population size for the ridge from Pit A to the southern end of the ridge could be derived.

The survey method involved marking out 10m by 10m quadrats, spaced at 50m intervals along transects that ran from the surrounding plain across the Koolyanobbing Range. Each quadrat was searched intensively for spider burrows (active and inactive) by a team of two people. A total of 400 quadrats was searched and 144 active (and 44 inactive) burrows found.

As was determined in previous studies, spiders were found from the lower slopes to the top of the ridge, in various vegetation associations but always on soils that were gravelly loam, and sometimes quite rocky. Spiders were absent from the surrounding loam plains where the soil was a heavy loam or clay supporting eucalypt woodland over saltbush. The burrows were also usually found, as per previous studies, attached to the stems of live bushes, particularly those with small, fine leaves.

Of the 400 quadrats, 195 either contained active burrows or were within suitable habitat for the species. As the quadrats were widespread across the suitable habitat, the number of active burrows and the number of quadrats within suitable habitat was used to calculate a density of 73.8 spiders/ha. However, the maximum number of active burrows in a 10m by 10m quadrat (12) suggested densities of up to 1200 spiders/ha can occur. The total area of suitable habitat along the Koolyanobbing Range, south from A Pit, was determined based on the distribution of active and inactive burrows along the transects surveyed in December 2008, and the distribution of other burrow records from earlier surveys. This gave a habitat area of 602.8ha, and therefore a population estimate of 44,487 Tree-stem Trapdoor Spiders.

CONTENTS

1. INTRODUCTION	4
2. METHODS	5
2.1 Investigations in the Pit B and C expansion area	5
2.1 Control transects	5
3. RESULTS	6
3.1 Investigations in the Pit B and C expansion area	6
3.2 Control transects	9
4. DISCUSSION.	12
5. REFERENCES	15
Appendix 1. Details of quadrats surveyed in the Pit B and C expansion area.	
Appendix 2. Quadrat details for the control transects.	

1. INTRODUCTION

The Tree-stem Trapdoor Spider *Aganippe castellum* is listed under Schedule 1 of the WA *Wildlife Conservation Act 1950* and until recently was thought to be restricted to a few small areas of bushland in the Merredin district. However, during the course of fauna investigations carried out by Bamford Consulting Ecologists for Portman Iron Ore, it has been found to be locally common around hills at Windarling (M. Bamford pes. obs.), Mt Jackson (Bancroft and Bamford 2007) and Koolyanobbing (Bamford and Turpin 2007). Intensive surveys at the J1 area of Mt Jackson found that the species occurs mainly on the mid to lower slopes of the hills, where the soils are a gravelly-loam, and its burrows are usually attached to the stems of small, fine-leaved shrubs such as *Philotheca* spp. and *Eremophila* spp.. Burrow densities can be very high (up to 12 in a 10m by 10m quadrat), but the distribution is patchy and the belt of suitable soil on the slopes of hills is typically only a few hundred metres wide.

As part of plans to expand mining on the Koolyanobbing range, Bamford Consulting Ecologists was commissioned to undertake investigations into the abundance and distribution of the Tree-stem Trapdoor Spider along the Koolyanobbing range. An initial survey in August 2007 confirmed that the species was present along the range and could be found wherever suitable soils and vegetation were located (Bamford and Turpin 2007). Early in 2008, further studies were undertaken to determine the abundance of the spiders in the proposed A Pit expansion area, while a transect covering the length of the Koolyanobbing Range along both the north and south sides was surveyed to determine the presence of the species as a continuous population throughout the area of suitable habitat (Bamford 2008). This also provided a preliminary whole-of-range population estimate of over 5000 spiders. Detailed investigations were also carried out in the region of the proposed Koolyanobbing runway upgrade (Bancroft and Bamford 2009). These found that the spider was present on very slight slopes (even in loam soils with a small gravelly component) and that the distribution could be closely related to the presence of slope.

Expansion plans at Koolyanobbing include development of Pits B and C, and the creation of overburden stockpiles just north of these pits. It was therefore determined that the distribution of the Tree-stem Trapdoor Spider in these impact areas needed to be known, and that more information on the extent of the species' distribution on the ridge, and its population size, was needed. Further studies were therefore undertaken in December 2008 with the following aims:

- Detailed surveys around the proposed location of an overburden stockpile north of Pits B and C, with the aim of determining the extent and abundance of the spider population in this area.
- Survey other areas on the ridge to the south-west of Pits B and C, and to the south-east along the southern extent of the Koolyanobbing range, to determine extent and abundance of the spider population in these areas. Although earlier surveys (eg. Bamford and Turpin 2007, Bamford 2008 and Bancroft and Bamford 2009) had found that the spiders occurred the length of the ridge, more detailed surveys were called for to better define in particular the distribution of the species in these areas.

2. METHODS

2.1 Investigations in the Pit B and C expansion area

These investigations were carried out from 10-17 December 2008 by Peter and Sarah Smith, Mike Bamford and Mike Walters working in two teams, each of two people. The survey was carried out by installing transects approximately 200m apart from the top of the hill running out to the North-East onto the adjacent clayey-loam plains, and therefore through proposed locations of the waste dump and ore stockpile. Along each transect, 10m by 10m quadrats were placed at 50m intervals and searched thoroughly for spider burrows. Quadrat locations varied slightly to avoid areas of disturbed soil surface, very barren locations or sheets of rock where spiders would not be found. Nine transects were surveyed, with a total of 211 quadrats (21,100m² or 2.11ha) searched for spider burrows. Details of transects are given in Table 1 and details of quadrats (including locations, vegetation type, soil type and landscape position) appear in Appendix 1. Locations of transects and quadrats are presented on Figure 1.

When found, a brief description of each burrow was made, including internal diameter of the burrow and whether or not it was active (based on presence of a well-maintained door and the burrow being free of debris). Soil, slope, host plant species and vegetation type of each quadrat were also recorded. Note that the mid-slope section of a number of transects passed through an area disturbed by exploration and mining, and no quadrats were placed in these areas.

Some opportunistic searching in between transects also took place.

Table 1. Start and end coordinates of spider survey transects in the Pit B and C expansion area (UTM Zone 50, datum WGS84).

Transect code	N quadrats	Start coordinates		End coordinates	
		Easting	Northing	Easting	Northing
A1	14	743844	6586563	743360	6586037
A2	27	744098	6586479	743205	6585613
A3	23	744250	6586360	743308	6585411
A4	30	743763	6585614	743244	6585271
A5	29	744647	6586321	743749	6585466
A6	22	744930	6586350	743800	6585190
A7	24	745110	6586291	743880	6585025
A8	24	744643	6585560	743904	6584943
A9	18	745330	6586030	744080	6584884
9	211				

2.1 Control transects

These transects were surveyed in the same period as the Pit B and C expansion transects with the same team (but assistance from Cliffs Environmental Officer Tim Duff on one day). There were eight control transects: two installed as a continuation of A3 and A5 transects from the Pit B and C expansion area (see Figure 1) but on the south side of the Koolyanobbing Range, with the remaining six control transects

passing across the range to the south-east (see Figure 1). Along each transect, 10m by 10m quadrats were placed at 50m intervals and searched thoroughly for spider burrows. The eight control transects contained 189 quadrats (18,900m² or 1.89ha) searched for spider burrows. Details of transects are given in Table 2 and details of quadrats in Appendix 2.

Table 2. Start and end coordinates of spider survey transects in the control survey (UTM Zone 50, datum WGS84).

Transect code	N quadrats	Start coordinates		End coordinates	
		Easting	Northing	Easting	Northing
C1A	15	743140	6585220	742550	6584540
C1B	18	743370	6584965	742701	6584292
C2A	32	745500	6585430	744255	6584150
C2B	33	745740	6585025	744645	6583929
C3A	25	746584	6584049	745570	6583130
C3B	21	747104	6583715	746446	6582968
C4A	21	748063	6583503	747247	6582770
C4B	24	748600	6583360	747700	6582467
8	189				

3. RESULTS

3.1 Investigations in the Pit B and C expansion area

In the 211 quadrats surveyed in the vicinity of the proposed Pit B and C expansion, 114 spider burrows (88 active, 26 inactive) were found. Details on these burrows are given in Table 3. The distribution of quadrats and spider burrows across the landscape was (see also Figure 1):

- ridge and upper slope: 23 quadrats; 7 spider burrows (0.3 burrows/100m²).
- mid-slope: 27 quadrats; 14 spider burrows (0.52 burrows/100²).
- lower-slope: 64 quadrats; 90 spider burrows (1.41 burrows/100²).
- plain: 97 quadrats; 3 spider burrows (0.03 burrows/100m²).

The results show a strong bias for burrows to be found on the lower slopes of the ridge, with one quadrat in this area (Quadrat 3.3) having 12 active burrows. The lower slopes were characterised by gravelly soils supporting mixed *Acacia* sp. shrubland. Many of the upper slope quadrats had large areas of outcropping rock. Few burrows were found in these areas. The loamy plain with *Eucalyptus* spp. woodland and saltbush shrubland supported very few burrows, with these in the quadrats closes to the lower slopes.

Table 3. Details on burrows of the Tree-stem Trapdoor Spider in quadrats in the B and C Pit expansion area (see Figure 1).

Transect	Quadrat	Burrow code	Activity	Internal diameter (mm)	“Host” shrub species
1	12	1.12.01	Active	12	<i>Eremophila</i>
1	12	1.12.02	Active	13	dead shrub
1	14	1.14.01	Inactive	15	<i>Myrtaceae</i>
1	14	1.14.02	Inactive	8	<i>Myrtaceae</i>
2	10	2.10.01	inactive	6	<i>Olearia</i>
2	11	2.11.01	inactive	10	<i>Dodonea</i>
2	11	2.11.02	inactive	8	dead fallen stick
2	13	2.13.01	active	9	<i>Dodonea</i>
2	13	2.13.02	active	12	<i>Dodonea</i>
2	13	2.13.03	active	15	<i>Dodonea</i>
2	13	2.13.04	active	18	<i>Acacia tetragonophylla</i>
2	14	2.14.01	active	7	<i>Philotheca</i>
2	14	2.14.02	inactive	5	<i>Eremophila</i>
2	15	2.15.01	active	5	<i>Acacia</i>
2	16	2.16.01	active	20	<i>Philotheca</i>
2	16	2.16.02	active	8	<i>Eremophila</i>
2	17	2.17.01	inactive	10	<i>Eremophila</i>
2	17	2.17.02	active	10	<i>Dodonea</i>
2	17	2.17.03	inactive	8	<i>Philotheca</i>
2	17	2.17.04	active	8	dead stick
2	18	2.18.01	active	8	<i>Dodonea</i>
2	18	2.18.02	active	5	<i>Eremophila</i>
2	19	2.19.01	active	10	<i>Senna</i>
2	23	2.23.01	Active	15	Fallen branch
2	23	2.23.02	Active	10	dead shrub
2	23	2.23.03	Inactive	7	<i>Eremophila</i>
2	24	2.24.01	active	8	<i>Olearia</i>
2	25	2.25.01	inactive	6	<i>Eremophila</i>
2	26	2.26.01	inactive	12	<i>Eremophila</i>
3	3	3.3.01	Inactive	10	free standing (no “host”)
3	3	3.3.02	Inactive	5	<i>Eremophila</i>
3	3	3.3.03	Active	12	dead shrub
3	3	3.3.04	Active	9	<i>Dodonea</i>
3	3	3.3.05	Active	9	<i>Dodonea</i>
3	3	3.3.06	Active	6	<i>Eremophila</i>
3	3	3.3.07	Active	7	<i>Eremophila</i>
3	3	3.3.08	Active	12	<i>Eremophila</i>
3	3	3.3.09	Active	10	<i>Eremophila</i>

Table 3 (cont.)

Transect	Quadrat	Burrow code	Activity	Internal diameter (mm)	“Host” shrub species
3	3	3.3.10	Active	5	<i>Eremophila</i>
3	3	3.3.11	Active	6	<i>Eremophila</i>
3	3	3.3.12	Active	20	<i>Scaevola spinescens</i>
3	4	3.4.01	Active	19	<i>Philotheca</i>
3	4	3.4.02	Active	17	<i>Eremophila</i>
3	4	3.4.03	Active	5	<i>Philotheca</i>
3	4	3.4.04	Active	16	<i>Philotheca</i>
3	4	3.4.05	Inactive	13	sandalwood
3	5	3.5.01	Active	5	<i>Eremophila</i>
3	5	3.5.02	Inactive	14	<i>Philotheca</i>
3	5	3.5.03	Active	19	<i>Philotheca</i>
3	5	3.5.04	Active	8	<i>Eremophila</i>
3	6	3.6.01	Active	7	<i>Philotheca</i>
3	6	3.6.02	Active	7	<i>Eremophila</i>
3	7	3.7.01	Inactive	12	<i>Eremophila</i>
3	7	3.7.02	Active	10	<i>Dodonea</i>
3	7	3.7.03	Inactive	10	<i>Eremophila</i>
3	7	3.7.04	Inactive	11	<i>Dodonea</i>
3	7	3.7.05	Active	4	<i>Grevillea</i>
3	7	3.7.06	Active	6	<i>Eremophila</i>
3	8	3.8.01	Active	4	<i>Dodonea</i>
3	8	3.8.02	Inactive	3	<i>Dodonea</i>
3	9	3.9.01	Active	8	<i>Acacia</i>
3	17	3.17.01	Active	10	<i>Eremophila</i>
3	19	3.19.01	active	9	<i>Olearia</i> , dead
4	2	4.02.01	active	21	<i>Philotheca</i>
4	4	4.04.01	active	16	<i>Eremophila</i>
4	5	4.05.01	active	22	<i>Philotheca</i>
4	6	4.06.01	active	20	<i>Olearia</i>
4	8	4.08.01	active	16	<i>Eremophila</i>
4	8	4.08.02	active	12	<i>Olearia</i>
4	9	4.09.01	active	5	<i>Eremophila</i>
4	24	4.24.01	active	16	dead stick
4	29	4.29.01	active	5	<i>Olearia</i>
5	12	5.12.01	active	8	<i>Olearia</i>
5	12	5.12.02	active	8	<i>Olearia</i>
5	13	5.13.01	active	5	<i>Dodonea</i>
5	14	5.14.01	active	12	<i>Olearia</i>
5	16	5.16.01	active	10	<i>Acacia tetragonaphylla</i>
5	17	5.17.01	active	6	<i>Eremophila</i>
5	18	5.18.01	inactive	6	<i>Philotheca</i>
5	21	5.21.01	Active	6	<i>Philotheca</i>
5	24	5.24.01	active	20	<i>Prostanthera</i>
5	24	5.24.02	inactive	4	<i>Philotheca</i>
5	26	5.26.01	active	18	<i>Philotheca</i>

Table 3 (cont.)

Transect	Quadrat	Burrow code	Activity	Internal diameter (mm)	"Host" shrub species
5	26	5.26.02	active	16	<i>Philotheca</i>
6	14	6.14.01	Inactive	15	<i>Dodonea</i>
6	14	6.14.02	Active	8	<i>Dodonea</i>
6	15	6.15.01	Active	10	<i>Dodonea</i>
6	15	6.15.02	Active	6	<i>Dodonea</i>
6	15	6.15.03	Active	6	<i>Dodonea</i>
6	16	6.16.01	Active	9	<i>Eremophila</i>
6	16	6.16.02	Active	5	<i>Eremophila</i>
6	16	6.16.03	Active	6	<i>Eremophila</i>
6	16	6.16.04	Active	14	<i>Eremophila</i>
6	16	6.16.05	Active	11	<i>Philotheca</i>
6	16	6.16.06	Active	20	<i>Eremophila</i>
6	16	6.16.07	Active	15	<i>Acacia</i>
6	17	6.17.01	Active	7	<i>Dodonea</i>
6	17	6.17.02	Active	13	<i>Philotheca</i>
6	17	6.17.03	Active	12	<i>Eremophila</i>
6	17	6.17.04	Inactive	13	<i>Eremophila</i>
7	16	7.16.01	active	18	Myrtaceous shrub
7	19	7.19.01	active	7	<i>Philotheca</i>
7	22	7.22.01	Active	9	prickly shrub
7	23	7.23.01	Inactive	18	<i>Philotheca</i>
7	23	7.23.02	Active	7	shrub
7	24	7.24.01	Active	18	<i>Acacia</i> "Mt Jackson"
7	24	7.24.02	Inactive	6	<i>Eremophila</i>
8	2	8.02.01	active	12	<i>Olearia</i>
8	24	8.24.01	active	5	<i>Dodonea</i>
8	24	8.24.02	active	10	<i>Dodonea</i>
9	49	9.49.01	active	8	<i>Dodonea</i>
9	49	9.49.02	active	18	<i>Eremophila</i>
9	50	9.50.01	inactive	6	<i>Dodonea</i>
9	50	9.50.02	active	6	<i>Eremophila</i>

3.2 Control transects

In the 189 quadrats surveyed in the control transects, 74 spider burrows (56 active, 18 inactive) were found. Details on these burrows are given in Table 4. The distribution of quadrats and spider burrows across the landscape was (see also Figure 1):

- upper slope: 29 quadrats; 26 spider burrows (0.90 burrows/100m²).
- mid-slope: 39 quadrats; 15 spider burrows (0.38 burrows/100m²).
- lower-slope: 64 quadrats; 31 spider burrows (0.48 burrows/100m²).
- plain: 57 quadrats; 2 spider burrows (0.04 burrows/100m²).

Burrows occurred at similar densities to those observed in the B and C Pit expansion area, but the highest density was on the upper slopes rather than the lower slopes. On the southern extent of the ridge in particular, the ridge is low with less outcropping

rock than in the Pit B & C expansion area, which made the habitat more suitable for the spiders.

In both areas, the majority of burrows were on the stems of live bushes, but a few were on dead sticks and one inactive burrow was free-standing. No burrows were found against rocks despite the abundance of rocks in the area.

Table 4. Details on burrows of the Tree-stem Trapdoor Spider in control quadrats (see Figure 1).

TRANSECT	QUADRAT	BURROW	STATUS	INTERNAL DIAMETER (mm)	"Host" PLANT SPECIES
C1A	2	1A.2.01	Active	8	<i>Eremophila</i>
C1A	2	1A.2.02	Active	10	<i>Eremophila</i>
C1A	7	1A.7.01	Inactive	18	<i>Scaevola spinescens</i>
C1A	8	1A.8.01	Active	10	<i>Eremophila</i>
C1A	8	1A.8.02	Active	11	<i>Eremophila</i>
C1A	10	1A.10.01	Inactive	6	<i>Acacia "Mt Jackson"</i>
C1A	10	1A.10.02	Active	6	<i>Eremophila</i>
C1A	10	1A.10.03	Active	11	daisy
C1B	7	1B.7.01	Active	7	<i>Acacia</i>
C1B	7	1B.7.02	Active	11	<i>Dodonea</i>
C1B	7	1B.7.03	Active	13	<i>Dodonea</i>
C1B	7	1B.7.04	Inactive	9	<i>Grevillea</i>
C1B	8	1B.8.01	Active	10	<i>Scaevola spinescens</i>
C1B	13	1B.37.01	active	8	<i>Philotheca</i>
C2A	3	2A.3.01	Active	7	dead stick
C2A	6	2A.6.01	Active	12	<i>Eremophila</i>
C2A	8	2A.8.03	Inactive	10	<i>Eremophila</i>
C2A	8	2A.8.01	Active	9	<i>Eremophila</i>
C2A	8	2A.8.02	Active	14	<i>Acacia Mt Jackson</i>
C2A	25	2A.25.01	Inactive	9	<i>myrtaceae</i>
C2A	25	2A.25.02	Active	6	<i>myrtaceae</i>
C2A	27	2A.27.01	Active	8	daisy
C2A	29	2A.29.01	Active	12	<i>Eremophila</i>
C2A	34	2A.34.01	Inactive	10	<i>Eremophila</i>
C2A	34	2A.34.02	Active	13	<i>Dodonea</i>
C2A	34	2A.34.03	Active	13	<i>Philotheca</i>
C2A	35	2A.35.01	Active	12	<i>Eremophila</i>
C2A	36	2A.36.01	Active	7	<i>Philotheca</i>
C2B	5	2B.05.01	active	8	<i>Acacia</i>
C2B	7	2B.07.01	active	12	<i>Ptilotus</i>
C2B	9	2B.09.01	inactive	5	<i>Olearia</i>
C2B	10	2B.10.01	active	6	<i>Olearia</i>
C2B	14	2B.14.01	active	10	<i>Allocasuarina</i>

Table 4 (cont.)

TRANSECT	QUADRAT	BURROW	STATUS	INTERNAL DIAMETER (mm)	PLANT SPECIES
C2B	15	2B.15.01	inactive	8	<i>Eremophila</i>
C2B	17	2B.17.01	active	20	<i>Acacia</i> Mt Jackson
C2B	18	2B.18.01	active	8	dead stick
C2B	22	2B.22.01	active	5	<i>Philotheca</i>
C2B	25	2B.25.01	active	16	<i>Eremophila</i>
C2B	28	2B.28.01	active	12	<i>Eremophila</i>
C3A	13	3A.13.01	Inactive	10	<i>Philotheca</i>
C3A	15	3A.15.01	Inactive	8	stick
C3B	10	3B.10.01	active	10	<i>Olearia</i>
C3B	10	3B.19.02	active	8	<i>Dodonea</i>
C3B	11	3B.11.01	inactive	12	<i>Philotheca</i>
C3B	11	3B.11.02	active	5	epacrid
C3B	12	3B.12.01	active	16	<i>Eremophila</i>
C3B	13	3B.13.01	active	8	dead stick
C3B	13	3B.13.02	active	12	epacrid
C3B	14	3B.14.01	active	7	<i>Olearia</i>
C3B	14	3B.14.02	active	7	<i>Olearia</i>
C3B	14	3B.14.03	inactive	10	<i>Eremophila</i>
C3B	15	3B.15.01	active	6	<i>Ptilotus obovatus</i>
C4A	35	4A.35.01	active	22	dead horizontal stick
C4A	39	4A.39.01	active	15	<i>Philotheca</i>
C4A	41	4A.41.01	active	14	<i>Philotheca</i>
C4A	41	4A.41.02	inactive	12	<i>Eremophila</i>
C4B	1	4B.1.01	Active	7	<i>Ptilotus</i>
C4B	1	4B.1.02	Active	11	daisy
C4B	2	4B.2.01	Inactive	10	daisy
C4B	2	4B.2.02	Active	6	<i>Eremophila</i>
C4B	3	4B.3.01	Inactive	10	<i>Eremophila</i>
C4B	3	4B.3.02	Active	5	daisy
C4B	3	4B.3.03	Active	6	daisy
C4B	4	4B.4.01	Inactive	7	<i>Eremophila</i>
C4B	4	4B.4.02	Active	12	<i>Eremophila</i>
C4B	5	4B.5.01	Active	23	<i>Eremophila</i>
C4B	5	4B.5.02	Active	10	<i>Eremophila</i>
C4B	5	4B.5.03	Active	10	<i>Eremophila</i>
C4B	6	4B.6.01	Active	13	<i>Eremophila</i>
C4B	7	4B.7.01	Inactive	20	<i>Eremophila</i>
C4B	7	4B.7.02	Active	14	daisy
C4B	7	4B.7.03	Active	16	unknown
C4B	15	4B.15.01	Inactive	5	<i>Acacia</i>
C4B	15	4B.15.02	Active	20	daisy

4. DISCUSSION.

The 211 quadrats surveyed in the B and C Pit expansion area equate to 2.11ha searched. With 88 active burrows, the average spider density is therefore 41.7 spiders/ha. However, this calculation includes the many quadrats on the loam plain that did not contain burrows and were outside the preferred habitat of the species. If only quadrats that contained burrows, or were between quadrats with burrows, are considered, then the 88 active burrows were distributed across 105 quadrats, giving an average spider density of 83/ha in suitable habitat. The density was clearly much higher than this in some areas, however. Along the third transect in particular, there were three quadrats with five or more active burrows, equating to a density of at least 500 spiders/ha.

Along the more widely-spaced control transects, the 189 quadrats (1.89ha) contained 56 active burrows, but only 90 quadrats either contained active burrows or were between quadrats with active burrows. These 90 quadrats included some without burrows and that were up to 250m from a quadrat with burrows, but they were upslope of quadrats with burrows and were therefore considered to be in suitable habitat. This gives an average spider density of 62/ha in suitable habitat. Again there were some areas with a higher density, but the area in the Pit B and C expansion area had the highest recorded spider densities.

The quadrat surveys give a measure of spider density and indicate that this is very patchy (see Figure 1). While there are some general locations with especially high density, these are not uniform and therefore it is not possible to produce isolines of spider abundance. The simplest approach to calculating a population estimate is therefore to calculate a mean density based on the number of active burrows found and the number of quadrats in suitable habitat. This is reasonable because of the wide spread of quadrats (ie they were not clumped in areas of either high or low density). This mean value is 73.8 spiders/ha (195 quadrats and 144 burrows).

The total area potentially occupied by the spiders was determined by plotting all spider burrow records (active and inactive) from across the Koolyanobbing range, including records from the A Pit area (Bamford 2008) and the airstrip extension area (Bancroft and Bamford 2009). The quadrat data and point records for spider burrows provided over 250 locations and allow for the habitat extent to be mapped to a high degree of accuracy based on the distribution of records and on characteristics such as slope and soil (see Figure 2). The total area of habitat occupied by the Tree-stem Trapdoor Spider along the Koolyanobbing Range south from the A pit area is *ca.* 602.8ha. This provides a population estimate of 44,487 spiders. The population is almost certainly larger than this, as the habitat extent was mapped conservatively, while the density estimate is based on the assumption that all active burrows were found in every quadrat.

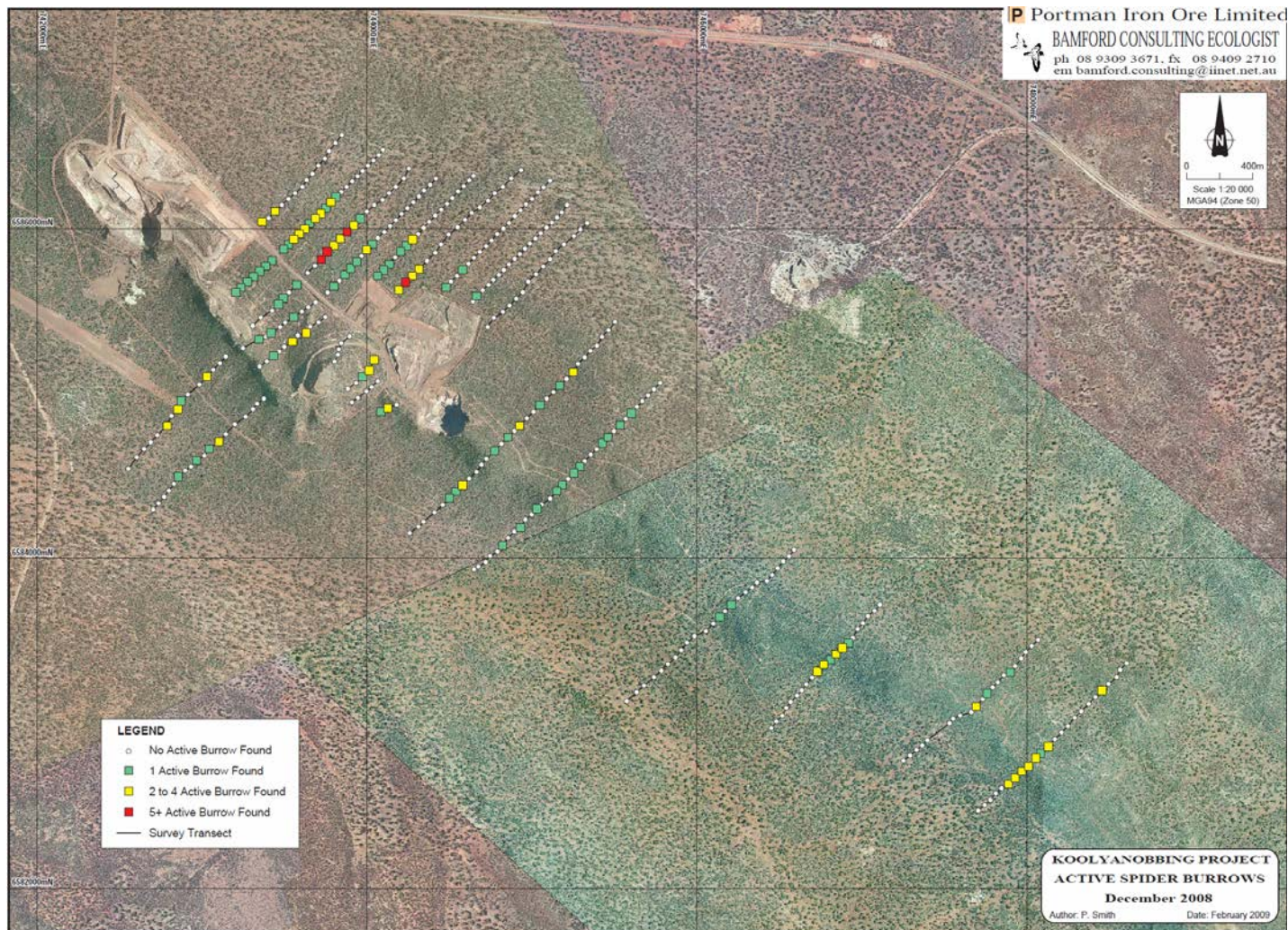


Figure 1. Tree-stem Trapdoor Spider survey transects and quadrats on the Koolyanobbing Range, December 2008.

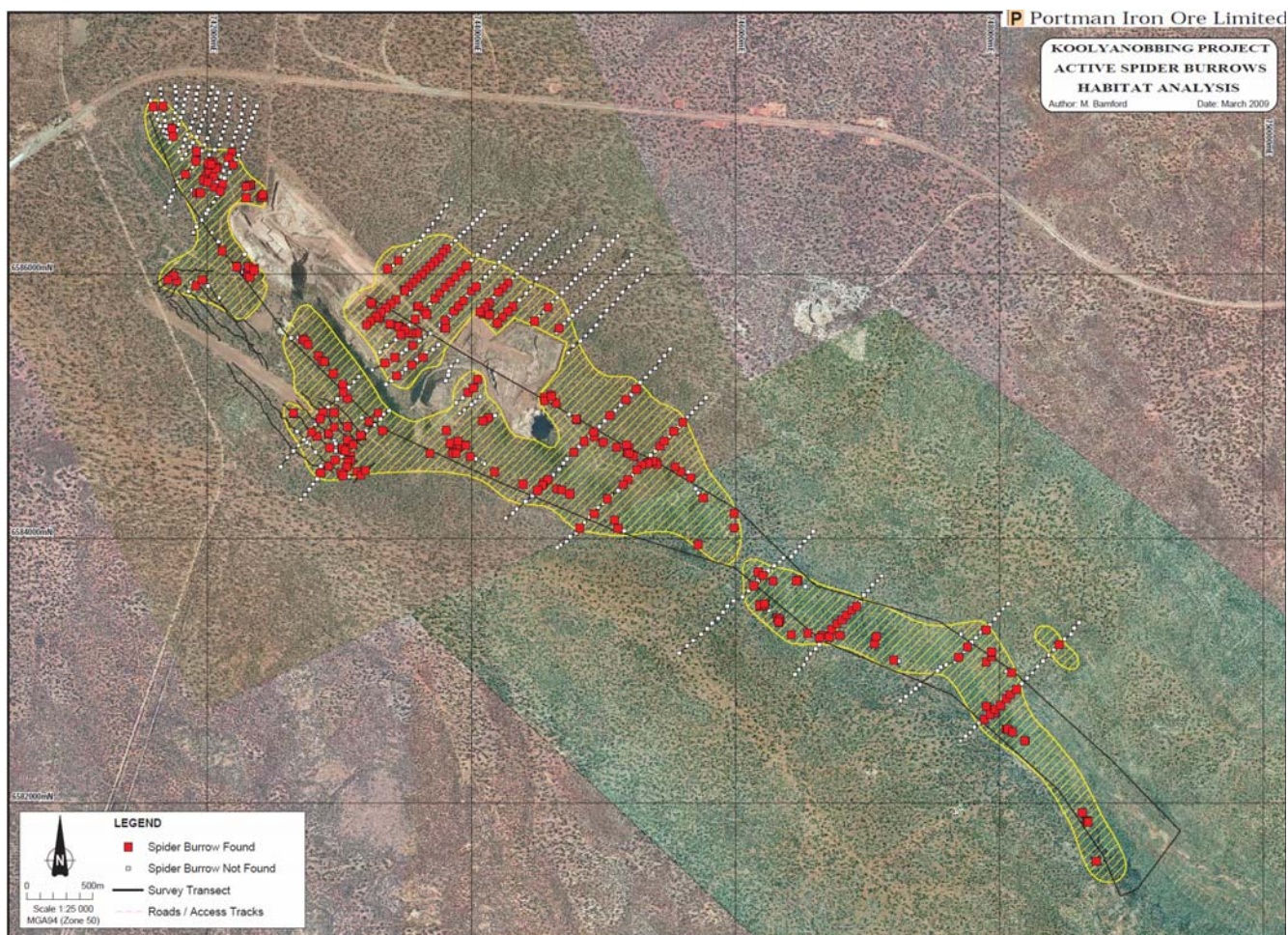


Figure 2. *Tree-stem Trapdoor Spider extent of habitat (yellow hatching) on the Koolyanobbing range, based on the distribution of all burrow records and the December 2008 transects.*

5. REFERENCES

- Bamford, M.J. and Turpin, J. (2007). Portman Iron Ore. Fauna assessment of the Koolyanobbing area. Unpubl. report to Portman Iron Ore by Bamford Consulting Ecologists, Kingsley.
- Bancroft, W.J. and Bamford, M.J. (2009). Second survey for the Tree-stem Trapdoor Spider *Aganippe castellum* at Portman's Proposed Koolyanobbing Runway Realignment. Unpubl. Report to Portman Iron Ore by Bamford Consulting Ecologists, Kingsley.
- Bamford, M.J (2008). Portman Iron Ore. Investigations into the distribution and abundance of the Tree-stem Trapdoor spider in the Koolyanobbing area. Unpubl. Report to Portman Iron Ore by Bamford Consulting Ecologists, Kingsley.

Appendix 1. Details of quadrats surveyed in the Pit B and C expansion area.

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
A1.1	743844	6586563	mallee over tall shrubs	cobbles and loam	slight slope
A1.2	743805	6586515	Mixed shrubland with scattered eucalypts	loam with few cobbles	very little slope
A1.3	743766	6586466	Eremophila and bluebush shrubland	loam	flat
A1.4	743740	6586420	Eucalypt open woodland over acacia shrubland	loam	flat
A1.5	743701	6586378	Acacia shrubland	loam	flat
A1.6	743665	6586328	Acacia shrubland	cobbles and loam	slight slope
A1.7	743630	6586290	Acacia shrubland	cobbles and loam	slight slope
A1.8	743605	6586250	Acacia and Eremophila shrubland	cobbles and loam	slight slope
A1.9	743560	6586210	Mallee over scattered mixed shrubs	cobbles and loam	slight slope
A1.10	743520	6586177	Mixed Shrubland	loam with few cobbles	slight slope
A1.11	743480	6586140	Mallee over mixed shrubs	cobbles and loam	slight slope
A1.12	743440	6586100	Eucalypt open woodland over acacia shrubland	cobbles and loam	slight slope
A1.13	743400	6586060	Acacia shrubland	loam with few cobbles	flat
A1.14	743360	6586037	Dense mixed shrubland	loam with few cobbles	flat
A2.1	744098	6586479	Eucalyptus woodland with Atriplex understorey	gravelly loam	low rise
A2.2	744072	6586448	Eucalyptus woodland with Atriplex understorey and mixed shrubs	gravelly loam	low rise
A2.3	744040	6586413	Eucalyptus woodland with Atriplex understorey and mixed shrubs	loam	plain
A2.4	744007	6586383	Eucalyptus woodland with Atriplex understorey and mixed shrubs	loam	plain
A2.5	743974	6586350	Eucalyptus woodland with Atriplex understorey	loam	plain
A2.6	743943	6586319	Eucalyptus woodland with Atriplex understorey and mixed shrubs	loam	plain
A2.7	743912	6586287	Eucalyptus woodland with Atriplex understorey and mixed shrubs	loam	plain
A2.8	743878	6586255	Eucalyptus woodland over mixed shrubs	loam, some ironstone gravel	plain
A2.9	743844	6586223	Eucalyptus woodland over mixed shrubs	gravelly loam	slight rise
A2.10	743812	6586192	Eucalyptus woodland over mixed shrubs	gravelly loam	slight rise
A2.11	743782	6586162	Eucalyptus woodland over mixed shrubs	gravelly loam	gentle rise
A2.12	743752	6586124	Eucalyptus woodland over mixed shrubs	gravelly loam	gentle rise
A2.13	743721	6586093	Eucalyptus woodland over mixed shrubs	gravelly loam	gentle rise
A2.14	743687	6586061	Eucalyptus woodland over mixed shrubs	gravelly loam	gentle rise
A2.15	743652	6586031	Eucalyptus woodland over of mixed shrubs	gravelly loam	gentle rise
A2.16	743622	6585998	Acacia shrubland, dense	gravelly loam	gentle rise
A2.17	743589	6585968	Acacia shrubland, dense	gravelly loam	gentle rise
A2.18	743557	6585936	Eucalyptus woodland with understorey of mixed shrubs	gravelly loam	gentle rise
A2.19	743524	6585904	Eucalyptus woodland with understorey of mixed shrubs	gravelly loam	gentle rise
A2.20	743495	6585876	Acacia shrubland, dense	gravelly loam	gentle rise
A2.21	743426	6585807	Shrubland of Acacia and Grevillea regrowth on disturbed ground	loam with cobbles (40%)	lower-slope
A2.22	743387	6585774	Acacia regrowth on disturbed ground, isolated Eucalyptus	loam, some gravel and cobbles	lower-slope
A2.23	743350	6585741	Acacia dense shrubland	loam with cobbles (80%)	mid-slope
A2.24	743313	6585709	Thick Acacia shrubland	gravel, cobbles with loam	mid slope
A2.25	743277	6585676	Acacia shrubland with mixed shrubs	gravel, cobbles with loam	mid slope
A2.26	743237	6585644	Acacia shrubland with mixed shrubs	gravel, cobbles with loam	mid slope
A2.27	743205	6585613	Dryandra, mixed shrubs	Outcropping rock, cobbles, gravel, some loam	upper slope
A3.1	743641	6585733	Acacia shrubland	loam with few cobbles	slight slope

Appendix 1 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
A3.2	743685	6585775	Eremophila and Acacia shrubland	cobbles and loam	slight slope
A3.3	743725	6585815	Mallee over Dodonea shrubland	cobbles and loam	slight slope
A3.4	743760	6585860	Eremophila and Acacia shrubland	cobbles and loam	slight slope
A3.5	743800	6585900	Eremophila and Acacia tall shrubland	cobbles and loam	slight slope
A3.6	743840	6585940	Eremophila and Acacia tall shrubland	cobbles and loam	slight slope
A3.7	743880	6585980	Mallee over Mixed shrubland	cobbles and loam	slight slope
A3.8	743920	6586020	Eremophila and Acacia tall shrubland	cobbles and loam	slight slope
A3.9	743960	6586060	Eremophila and Acacia tall shrubland	cobbles and loam	slight slope
A3.10	744000	6586105	Eucalypt open woodland over sparse shrubland of Acacia and Scaevola spinescens	loam with few cobbles	flat
A3.11	744045	6586145	Open shrubland of Acacia and Scaevola spinescens	loam with a veneer of gravel	flat
A3.12	744095	6586175	Eucalypt open woodland over mixed open shrubland	loam	flat
A3.13	744135	6586215	Eucalypt open woodland over Saltbush	loam	flat
A3.14	744175	6586255	Eucalypt open woodland over Saltbush	loam	flat
A3.15	744225	6586305	Open Saltbush	loam with a veneer of quartz	flat
A3.16	744255	6586365	Eremophila and Saltbush shrubland	loam with quartz and calcrete nodules	flat
A3.17	743575	6585658	Acacia and Eremophila open shrubland	Rocks and cobbles (80%) and loam	upper slope
A3.18	743529	6585614	Thick Acacia shrubland	gravel, cobbles with loam	upper slope
A3.19	743493	6585579	Mixed Acacia shrubland	gravel, cobbles with loam	mid slope
A3.20	743464	6585542	Acacia tall shrubland over Scaevola spinescens	cobbles (60%) and loam	lower slope
A3.21	743426	6585503	Mixed Acacia shrubland	gravel, cobbles with loam	mid slope
A3.22	743357	6585462	Mixed Acacia shrubland	gravel, cobbles with loam	mid slope
A3.23	743308	6585411	Mixed Acacia shrubland	gravel, cobbles with loam	mid slope
A4.1	743763	6585614	Acacia shrubland, dense	gravelly loam	gentle rise
A4.2	743800	6585650	Acacia shrubland, dense	gravelly loam	gentle rise
A4.3	743833	6585685	Acacia shrubland, dense	gravelly loam	gentle rise
A4.4	743867	6585722	Acacia shrubland, dense	gravelly loam	gentle rise
A4.5	743903	6585760	Acacia shrubland, dense	gravelly loam	gentle rise
A4.6	743939	6585799	Acacia shrubland, dense	gravelly loam	gentle rise
A4.7	743968	6585835	Acacia shrubland, dense	gravelly loam	gentle rise
A4.8	743999	6585873	Eucalyptus woodland with understorey of mixed shrubs	gravelly loam	slight rise
A4.9	744033	6585907	Eucalyptus woodland with understorey of mixed shrubs	gravelly loam	slight rise
A4.10	744066	6585944	Eucalyptus woodland with understorey of mixed shrubs	loam	plain
A4.11	744106	6585980	Eucalyptus woodland with understorey of mixed shrubs	loam, bit of gravel	plain
A4.12	744141	6586016	Eucalyptus woodland with understorey of mixed shrubs	loam, bit of gravel	plain
A4.13	744176	6586052	Eucalyptus woodland with understorey of mixed shrubs	loam, bit of gravel	plain
A4.14	744210	6586089	Eucalyptus woodland with Atriplex understorey and mixed shrubs	loam	plain
A4.15	744246	6586125	Eucalyptus woodland with Atriplex understorey and mixed shrubs	loam	plain
A4.16	744282	6586160	Eucalyptus woodland with Atriplex understorey	gravelly loam	low rise
A4.17	744316	6586196	Eucalyptus woodland with Atriplex understorey very sparse	gravelly loam	low rise
A4.18	744347	6586232	Eucalyptus woodland with Atriplex understorey very sparse	gravelly loam	low rise

Appendix 1 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
A4.19	744384	6586266	Eucalyptus woodland with mixed understorey very sparse	gravelly loam	lower slope
A4.20	744419	6586305	Eucalyptus woodland with Atriplex understorey very sparse	gravelly loam	lower slope
A4.21	743689	6585553	Acacia tetragonophylla and Scaevola spinescens shrubland	Cobbles (90%) and loam	lower slope
A4.22	743645	6585525	Mixed Acacia shrubland	gravel, cobbles with loam	mid slope
A4.23	743607	6585497	Acacia tall shrubland over Eremophila	Rocks and cobbles (90%) and loam	mid-slope
A4.24	743556	6585463	Mixed Acacia shrubland	gravel, cobbles with loam	mid slope
A4.25	743505	6585430	Mixed Acacia shrubland	gravel, cobbles with loam	mid slope
A4.26	743474	6585405	Acacia tetragonophylla and Scaevola spinescens shrubland	Cobbles (60%) and loam	mid-slope
A4.27	743420	6585369	Mixed Acacia shrubland, isolated Eucalyptus	rocks, gravel, cobbles with loam	mid slope
A4.28	743387	6585345	Acacia tetragonophylla and Scaevola spinescens shrubland	Rocks and cobbles (80%) and loam	mid-slope
A4.29	743346	6585329	Mixed Acacia shrubland	outcropping rocks, cobbles, gravel , bit of loam	upper slope
A4.30	743249	6585276	Mixed Acacia and Dryandra shrubland	outcropping rocks, cobbles, bit of gravel and loam	crest
A5.1	744647	6586321	Eucalyptus woodland with mixed understorey very sparse	gravelly loam	low rise
A5.2	744620	6586294	Eucalyptus woodland with mixed understorey	gravelly loam with cobbles	low rise
A5.3	744587	6586260	Eucalyptus woodland with mixed understorey	gravelly loam	lower slope
A5.4	744553	6586225	Eucalyptus woodland with mixed understorey	gravelly loam	lower slope
A5.5	744518	6586187	Eucalyptus woodland with Atriplex understorey	loam, bit of gravel	lower slope
A5.6	744486	6586151	Eucalyptus woodland with Atriplex understorey	loam	plain
A5.7	744451	6586117	Eucalyptus woodland with Atriplex understorey	loam, bit of gravel	plain
A5.8	744415	6586080	Eucalyptus woodland with Atriplex understorey	loam, bit of gravel	plain
A5.9	744379	6586042	Eucalyptus woodland with mixed understorey	loam, bit of gravel	plain
A5.10	744344	6586006	Eucalyptus woodland with mixed understorey	loamy gravel	slight rise
A5.11	744311	6585968	Eucalyptus woodland with dense mixed understorey	loam, bit of gravel	slight rise
A5.12	744277	6585934	Eucalyptus woodland with mixed understorey	loamy gravel	slight rise
A5.13	744241	6585897	Eucalyptus woodland with mixed understorey	gravelly loam	slight rise
A5.14	744205	6585862	Eucalyptus woodland with mixed understorey	gravelly loam	slight rise
A5.15	744172	6585825	slight rise	gravelly loam	slight rise
A5.16	744136	6585786	Acacia shrubland, dense	gravelly loam, cobbles	slight rise
A5.17	744103	6585749	Acacia shrubland, dense	gravelly loam, cobbles	slight rise
A5.18	744064	6585715	Acacia shrubland, dense	gravelly loam, cobbles	slight rise
A5.19	743351	6585166	Acacia and Dryandra tall shrubs over Eremophila and Acacia low shrubs	80% exposed rock	ridge and upper slope
A5.20	743394	6585196	Mixed Acacia shrubland	outcropping rocks, cobbles, bit of gravel and loam	upper slope
A5.21	743434	6585230	Acacia shrubland	Rock (30%), cobbles (40%) and loam	upper slope
A5.22	743469	6585256	Mixed Acacia shrubland	rocks, cobbles, gravel and loam	upper slope
A5.23	743500	6585284	Tall shrubland of Acacia, Scaevola and Eremophila		mid-slope

Appendix 1 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
A5.24	743550	6585315	Mixed Acacia shrubland	outcropping rocks, cobbles, gravel and loam	mid slope
A5.25	743582	6585353	Acacia tall shrubland	Rocks and cobbles (90%) and loam	mid-slope
A5.26	743632	6585369	Mixed Acacia shrubland	rocks, cobbles, gravel and loam	crest of small hill
A5.27	743657	6585408	Acacia "Mt Jackson" and Dodonea tall shrubland	Rocks and cobbles (80%) and loam	mid-slope
A5.28	743707	6585432	Mixed Acacia shrubland	rocks, cobbles, gravel and loam	mid slope
A5.29	743749	6585466	Mixed Acacia shrubland	disturbed area, cobbles, gravel and loam	mid slope
A6.1	744930	6586350	Mallee over Acacia shrubland	lateritic slope on a small rise	sloping
A6.2	744870	6586300	Mallee over Acacia and saltbush shrubland	loam with gravel veneer	slight slope
A6.3	744820	6586250	Eucalypt woodland over Saltbush and Acacia open shrubland	loam	flat
A6.4	744770	6586210	Eucalypt open woodland over open shrubland of Eremophila and Saltbush	loam with patches of gravel veneer	slight slope
A6.5	744730	6586165	Open shrubland of Eremophila and Saltbush	loam with patches of gravel veneer	slight slope
A6.6	744680	6586125	Eucalypt open woodland over open shrubland of Eremophila and Saltbush	loam	slight slope
A6.7	744630	6586090	Eucalypt open woodland over open shrubland of Eremophila and Saltbush	loam with gravel veneer	slight slope
A6.8	744590	6586050	Eucalypt open woodland over open shrubland of Eremophila and Saltbush	loam	flat
A6.9	744545	6586005	Open shrubland of Eremophila and Saltbush	loam	flat
A6.10	744490	6585960	Open shrubland of Eremophila and Saltbush	loam	flat
A6.11	744445	6585900	Eucalypt woodland over Eremophila and Acacia shrubland	loam with cobbles (10%)	flat
A6.12	744410	6585850	Eucalypt woodland over Acacia shrubland	loam with cobbles (5%)	flat
A6.13	744360	6585800	Acacia and Dodonea tall shrubland	loam with cobbles (70%)	slight slope
A6.14	744310	6585750	Eremophila and Acacia tall open shrubland	loam with cobbles (60%)	slight slope
A6.15	744270	6585710	Eremophila Acacia and Doldonea open shrubland	loam with cobbles (70%)	slight slope
A6.16	744230	6585670	Eremophila and Acacia open tall shrubland	loam with cobbles (70%)	slight slope
A6.17	744190	6585625	Eremophila Dodonea and Acacia open tall shrubland	loam with cobbles (60%)	slight slope
A6.18	743890	6585343	Open shrubland degraded by rolling boulders!	loose boulders, cobbles and loam	mid-slope
A6.19	743840	6585300	Open shrubland degraded by rolling boulders!	loose boulders, cobbles and loam	mid-slope
A6.20	743825	6585265	Acacia "Mt Jackson" tall, open shrubland over Eremophila shrubland	Rock (30%), cobbles (40%) and loam	upper slope
A6.21	743820	6585230	Acacia and Ptilotus open shrubland	Very steep. Rock (80%), cobbles (20%)	upper slope

Appendix 1 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
A6.22	743800	6585190	Acacia and Ptilotus open shrubland	Very steep. Rock (80%), cobbles (20%)	upper slope
A7.1	745110	6586291	Eucalyptus woodland with sparse mixed understorey	gravel, ironstone, quartz, calcrete, bit of loam	mid slope
A7.2	745071	6586252	Eucalyptus woodland with sparse Atriplex understorey	gravelly loam, cobbles	plain
A7.3	745037	6586221	Eucalyptus woodland with sparse Atriplex understorey	gravelly loam, cobbles	plain
A7.4	745002	6586182	Eucalyptus woodland with sparse Atriplex understorey	loam	plain
A7.5	744964	6586148	Atriplex and Eremophila scoparia	loam, bit of quartz	plain
A7.6	744931	6586113	Atriplex and Eremophila scoparia	loam	plain
A7.7	744897	6586076	Atriplex and mixed shrubs	loam, bit of quartz	plain
A7.8	744862	6586035	Atriplex and mixed shrubs	loam	plain
A7.9	744827	6586001	Eucalyptus woodland with mixed understorey	loam	plain
A7.10	744790	6585968	Eucalyptus woodland with Atriplex understorey	loam	plain
A7.11	744756	6585929	Eucalyptus woodland with sparse Atriplex understorey	loam	plain
A7.12	744723	6585894	Eucalyptus woodland with sparse mixed understorey	loam	plain
A7.13	744686	6585861	Small clump of Acacia thicket with Atriplex	loam	plain
A7.14	744649	6585823	Eucalyptus woodland with sparse mixed understorey	gravelly loam	plain
A7.15	744616	6585788	Eucalyptus woodland with sparse mixed understorey	gravelly loam	plain
A7.16	744581	6585750	Eucalyptus woodland with sparse mixed understorey	gravelly loam	plain
A7.17	744546	6585714	Eucalyptus woodland with dense mixed understorey	loam, bit of gravel	plain
A7.18	744510	6585679	Eucalyptus woodland with sparse mixed understorey	gravelly loam	plain
A7.19	744480	6585644	Eucalyptus woodland with sparse mixed understorey	gravelly loam	very slight rise
A7.20	743885	6585030	Eremophila, acacia and sedges shrubland	Rock (40%), cobbles (50%) and loam	upper slope
A7.21	743935	6585065	Eremophila and acacia dense shrubland	Rock (20%), cobbles (50%) and loam	upper slope
A7.22	743975	6585105	Eremophila and acacia dense shrubland	Rock (20%), cobbles (60%) and loam	upper slope
A7.23	744015	6585140	Acacia, Eremophila and Philotheca dense shrubland	Loam with cobbles (60%)	mid-slope
A7.24	744045	6585205	Acacia "Mt Jackson" tall, open shrubland over Eremophila and Grevillea shrubland	Loam with cobbles (60%)	mid-slope
A8.1	744643	6585560	Eucalyptus woodland with mixed understorey	gravelly loam	very slight rise
A8.2	744666	6585593	Eucalyptus woodland with mixed understorey	gravelly loam	very slight rise
A8.3	744702	6585626	Eucalyptus woodland with mixed understorey	gravel, loam, cobbles	slight rise
A8.4	744737	6585660	Eucalyptus woodland with mixed understorey	gravel, loam, cobbles	slight rise
A8.5	744766	6585689	Eucalyptus woodland with mixed understorey	gravelly loam	slight rise
A8.6	744800	6585720	Eucalyptus woodland with mixed understorey	gravelly loam	slight rise
A8.7	744830	6585750	Eucalyptus woodland with mixed understorey	gravelly loam	slight rise
A8.8	744861	6585784	Eucalyptus woodland with Atriplex understorey	loam, bit of gravel	plain
A8.9	744896	6585817	Atriplex and Eremophila scoparia	loam, bit of gravel	plain
A8.10	744927	6585846	Atriplex and Eremophila scoparia	loam, bit of gravel	plain
A8.11	744959	6585880	Eucalyptus woodland with Atriplex understorey	loam	plain
A8.12	744988	6585910	Eucalyptus woodland with Atriplex understorey	loam, bit of quartz gravel	plain
A8.13	745021	6585940	Eucalyptus woodland with Atriplex understorey	loam, quartz gravel	plain

Appendix 1 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
A8.14	745054	6585973	Eucalyptus woodland with Atriplex understorey	loam, bit of quartz gravel	plain
A8.15	745089	6586008	Atriplex and Eremophila scoparia	loam, bit of quartz gravel	plain
A8.16	745122	6586038	Eucalyptus woodland with sparse Atriplex and Eremophila understorey	loam, bit of quartz gravel	plain
A8.17	745153	6586068	Eucalyptus woodland with sparse Atriplex and Eremophila understorey	loam, bit of quartz gravel	plain
A8.18	745181	6586098	Sparse Atriplex	loam with quartz gravel and cobbles	plain
A8.19	745213	6586145	Sparse Atriplex	loam with quartz gravel and cobbles	plain
A8.20	744066	6585076	Tammar and mixed shrubs	rocks, cobbles, gravel, bit of loam	upper slope
A8.21	744029	6585039	Tammar and mixed shrubs	Outcropping rocks, cobbles, gravel, bit of loam	upper slope
A8.22	743998	6585015	Eucalyptus, tammar and mixed shrubs	Outcropping rocks, cobbles, gravel, bit of loam	Steep upper slope
A8.23	743946	6584974	Eucalyptus and mixed shrubs	Outcropping rocks, cobbles, gravel, bit of loam	Steep upper slope
A8.24	743909	6584948	Disturbed Eucalyptus and mixed shrubs	Outcropping rocks, cobbles, gravel, bit of loam	upper slope
A9.1	744732	6585405	Eremophila and Acacia shrubland	loam with cobbles (30%)	slight slope
A9.2	744770	6585460	Acacia open shrubland	loam with few cobbles	slight slope
A9.3	744825	6585495	Eremophila open shrubland	loam with cobbles (10%)	edge of gravelly rise
A9.4	744865	6585535	Acacia tall shrubland with lots of litter	loam with cobbles (80%)	mid-slope rise on small ironstone hill
A9.5	744905	6585575	Acacia tall shrubland with some Eremophila and Grevillea	Rocks, cobbles and loam; edge of breakaway	lower slope
A9.6	744945	6585615	Acacia and Eremophila shrubland	loam with cobbles (60%)	slight slope
A9.7	744978	6585679	Acacia and Eremophila open shrubland	loam with cobbles (70%)	slight slope
A9.8	745025	6585725	Open eucalypt woodland over Eremophila shrubland	loam with cobbles (20%)	flat
A9.9	745070	6585770	Eremophila and Saltbush shrubland	loam	flat
A9.10	745110	6585815	Open eucalypt woodland over Eremophila shrubland	loam	flat
A9.11	745145	6585865	Open eucalypt woodland over Eremophila and saltbush shrubland	loam	flat
A9.12	745195	6585905	Open eucalypt woodland over saltbush shrubland	loam	flat
A9.13	745255	6585955	Open eucalypt woodland over saltbush shrubland	loam	flat
A9.14	745295	6585995	Gimlet woodland over sparse Atriplex shrubland	loam	flat
A9.15	745335	6586035	Open eucalypt woodland over open Atriplex shrubland	loam	flat
A9.48	744180	6584932	Acacia and mixed shrubs	Outcropping rocks, cobbles, gravel, bit of loam	crest
A9.49	744127	6584912	Eucalyptus and mixed shrubs	Outcropping rocks, cobbles, gravel, bit of loam	upper slope
A9.50	744085	6584889	Eucalyptus and mixed shrubs	gravelly loam	mid slope

Appendix 2. Quadrat details for the control transects.

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
Control 1A.1	742985	6585055	Acacia tall shrubland over Eremophila	loam with cobbles (60%)	lower slope
Control 1A.2	743030	6585105	Acacia and eucalypt low, open woodland over Dodonea shrubland	loam with cobbles (80%)	lower slope
Control 1A.3	743070	6585145	Acacia and eucalypt low, open woodland over Eremophila shrubland	loam with cobbles (80%)	mid-slope
Control 1A.4	743110	6585185	Mixed shrubland	exposed rock (10%), cobbles (60%) and loam	mid-slope
Control 1A.5	743145	6585225	Acacia Mt Jackson tall shrubland over Eremophila and Philotheca shrubland	exposed rock (40%), cobbles (40%) and loam	upper slope
Control 1A.6	742915	6584995	Acacia "Mt Jackson" tall shrubland over Eremophila open shrubland	loam with cobbles (50%)	lower slope
Control 1A.7	742875	6584955	Eremophila, Dodonea and Scaevola spinescens shrubland	loam with cobbles (50%)	lower slope
Control 1A.8	742855	6584905	Acacia "Mt Jackson" tall, open shrubland over Eremophila shrubland	loam with cobbles (20%)	lower slope
Control 1A.9	742815	6584865	Acacia tall shrubland over Scaevola spinescens shrubland. Disturbed and some regeneration	loam with cobbles (40%)	lower slope
Control 1A.10	742790	6584805	Eucalypt open woodland over acacia open shrubland	loam with cobbles (20%)	lower slope
Control 1A.11	742730	6584749	Acacia open shrubland	loam with cobbles (10%)	slight slope
Control 1A.12	742690	6584705	Eucalypt open woodland over acacia and eremophila open shrubland	Loam	flat
Control 1A.13	742650	6584665	Eucalypt open woodland over saltbush and daisy open shrubland	Loam	flat
Control 1A.14	742605	6584615	Eucalypt open woodland over Acacia tall, open shrubland	Loam	flat
Control 1A.15	742555	6584545	Eucalypt open woodland over Acacia tall shrubland	Loam	flat
Control 1B.1	743375	6584970	Dodonea and Scaevola spinescens shrubland	exposed rock (40%), cobbles (40%) and loam	upper slope
Control 1B.2	743335	6584940	Acacia Mt Jackson tall shrubland over Eremophila and Philotheca shrubland	exposed rock (20%), cobbles (60%) and loam	upper slope
Control 1B.3	743310	6584905	Acacia Mt Jackson tall shrubland over Eremophila and Philotheca shrubland	loam with cobbles (60%)	mid-slope
Control 1B.4	743265	6584860	Acacia Mt Jackson tall shrubland over Eremophila and Dodonea open shrubland	loam with cobbles (60%)	mid-slope
Control 1B.5	743200	6584815	Eucalypt open woodland over Eremophila and Acacia open shrubland	loam with cobbles (30%)	lower-slope
Control 1B.6	743145	6584755	Acacia and Scaevola spinescens shrubland	loam with cobbles (70%)	lower-slope
Control 1B.7	743105	6584710	Eremophila and Dodonea shrubland	loam with cobbles (40%)	lower-slope
Control 1B.8	743045	6584665	Open shrubland of Eremophila	loam with cobbles (60%)	slight slope
Control 1B.9	743015	6584625	Eucalypt woodland over open shrubland of daisies, Acacia and Ptilotus	loam with cobbles (30%)	slight slope
Control 1B.10	742968	6584595	Eucalyptus with Acacia and mixed shrub understorey	gravelly loam	slight slope
Control 1B.11	742934	6584558	Eucalyptus with Acacia and mixed shrub understorey	gravelly loam	slight slope
Control 1B.12	742899	6584534	Eucalyptus with Acacia and mixed shrub understorey	gravelly loam	slight slope
Control 1B.13	742856	6584497	Eucalyptus with Acacia and mixed shrub understorey	gravel, bit of loam	slight slope
Control 1B.14	742831	6584452	Eucalyptus with Acacia and mixed shrub understorey	gravel, bit of loam	slight slope
Control 1B.15	742800	6584412	Eucalyptus with Acacia and mixed shrub understorey	gravel, bit of loam	slight slope

Appendix 2 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
Control 1B.16	742772	6584374	Eucalyptus with Acacia and mixed shrub understorey	gravel, bit of loam	plain
Control 1B.17	742738	6584334	Eucalyptus with Acacia and mixed shrub understorey	gravel, bit of loam	plain
Control 1B.18	742706	6584297	Eucalyptus with sparse mixed shrub understorey	gravel, bit of loam	plain
Control 2A.1	744970	6584850	Tammar thicket	loam with large cobbles (90%)	mid-slope
Control 2A.2	745010	6584890	Open shrubland of Tammar and Acacia	loam with cobbles (60%)	mid-slope
Control 2A.3	745050	6584930	Acacia and mixed shrubland	loam with cobbles (60%)	mid-slope
Control 2A.4	745090	6584970	Acacia tall shrubland over Scaevola spinescens	loam with cobbles (80%)	mid-slope
Control 2A.5	745130	6585010	Acacia open shrubland	loam with cobbles (60%)	low slope
Control 2A.6	745170	6585050	Dense shrubland of Eremophila and Acacia	loam with few cobbles	slight slope
Control 2A.7	745210	6585090	Eucalypt open woodland over shrubland of Acacia and Dodonea	loam with gravel veneer	slight slope
Control 2A.8	745250	6585130	Acacia and S. spinescens shrubland	loam with cobbles (50%)	lower slope
Control 2A.9	745280	6585180	Acacia Mt Jackson tall shrubland over low shrubs	loam with cobbles (80%)	slight slope
Control 2A.10	745320	6585220	Tall shrubland of acacia and sandalwood	loam with cobbles (60%)	slight slope
Control 2A.11	745355	6585260	Acacia and Dodonea shrubland	rocks and cobbles (70%) with loam	mid-slope
Control 2A.12	745395	6585290	Eucalypt open woodland over acacia and eremophila open shrubland	loam with cobbles (40%)	lower slope
Control 2A.13	745425	6585345	Mallee over open shrubland of daisies	loam	slight slope
Control 2A.14	745465	6585385	Eucalypt woodland over Saltbush	loam	flat
Control 2A.15	745505	6585435	Eucalypt open woodland over saltbush	loam	flat
Control 2A.16	744925	6584805	Mallee over shrubland of Eremophila and Scaevola spinescens	loam with cobbles (70%)	mid-slope
Control 2A.17	744895	6584775	Acacia "Mt Jackson" tall shrubland over Eremophila and Scaevola spinescens shrubland	loam with cobbles (60%)	mid-slope
Control 2A.18	744855	6584735	Acacia, Eremophila and Grevillea shrubland	loam with cobbles (60%)	upper slope
Control 2A.19	744815	6584695	Acacia "Mt Jackson" tall, open shrubland over Eremophila and daisy shrubland	Rock (30%), cobbles (60%) and loam	upper slope
Control 2A.20	744775	6584655	Acacia "Mt Jackson" tall, open shrubland over Eremophila and Grevillea shrubland	Rock (80%), cobbles (10%) and loam	upper slope to ridge
Control 2A.21	744725	6584605	Acacia "Mt Jackson" tall, open shrubland over Eremophila open shrubland	Rock (60%), cobbles (20%) and loam	upper slope
Control 2A.22	744695	6584570	Acacia "Mt Jackson", Sandalwood and Grevillea tall, open shrubland over low, open shrubland	Rock (50%), cobbles (40%) and loam	upper slope
Control 2A.23	744665	6584525	Eucalypt open woodland over Dodonea, Eremophila and Scaevola spinescens shrubland	Rock (30%), cobbles (40%) and loam	mid-slope
Control 2A.24	744620	6584485	Tammar tall, open shrubland over Eremophila shrubland	Rock (10%), cobbles (60%) and loam	mid-slope
Control 2A.25	744580	6584445	Acacia "Mt Jackson" and A. tetragonophylla tall, open shrubland over Eremophila open shrubland	loam with cobbles (70%)	lower slope
Control 2A.26	744540	6584405	Acacia tall, open shrubland over Eremophila and Acacia shrubland	loam with cobbles (60%)	lower slope
Control 2A.27	744500	6584365	Acacia and Tammar tall, open shrubland over Philotheca and Scaevola spinescens open shrubland	loam with cobbles (60%)	lower slope

Appendix 2 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
Control 2A.28	744460	6584325	Acacia tall, open shrubland over Eremophila and Acacia shrubland	loam with cobbles (10%)	lower slope
Control 2A.29	744410	6584280	Acacia, Eremophila and saltbush open shrubland	loam with cobbles (60%)	lower slope
Control 2A.30	744343	6584224	Eucalyptus with mixed shrub understorey	gravelly loam	slight slope
Control 2A.31	744312	6584193	Eucalyptus with sparse Atriplex and mixed shrub understorey	loam, bit of gravel	slight slope
Control 2A.32	744260	6584155	Very open eucalypt woodland over Eremophila and saltbush open shrubland	loam with cobbles (30%)	slight slope
Control 2B.1	745740	6585026	Eucalyptus woodland with sparse Atriplex and Eremophila understorey	loam, bit of quartz gravel	slope of low rise
Control 2B.2	745705	6584990	Eucalyptus woodland with mixed shrub understorey	bif rock, cobbles, gravel , loam	low hill
Control 2B.3	745670	6584955	Sparse Atriplex and Eremophila	loam with quartz gravel and outcrop	slope of low hill adjacent to creekline
Control 2B.4	745637	6584921	Mixed shrubs with isolated Eucalyptus	loam with quartz and ironstone gravel and cobbles and cobbles	slope of low hill adjacent to creekline
Control 2B.5	745603	6584881	Dense mixed shrubs with isolated Eucalyptus	loam with ironstone gravel and cobbles and cobbles	low slope
Control 2B.6	745569	6584847	Dense mixed shrubs with isolated Eucalyptus	loam with ironstone gravel and cobbles and cobbles	low slope
Control 2B.7	745534	6584810	Dense mixed shrubs with isolated Eucalyptus	gravelly loam	low slope
Control 2B.8	745498	6584773	Dense mixed shrubs with isolated Eucalyptus	gravelly loam	low slope
Control 2B.9	745461	6584736	Eucalyptus woodland with dense mixed shrub understorey	gravelly loam	mid slope
Control 2B.10	745428	6584699	Eucalyptus woodland with dense mixed shrub understorey	gravelly loam	mid slope
Control 2B.11	745393	6584663	Eucalyptus woodland with dense mixed shrub understorey	loamy gravel	mid slope
Control 2B.12	745357	6584631	Eucalyptus woodland with very dense mixed shrub understorey	loamy gravel and cobbles	mid slope
Control 2B.13	745320	6584590	Eucalyptus woodland with very dense mixed shrub understorey	loamy gravel and cobbles	mid slope
Control 2B.14	745291	6584558	Eucalyptus woodland with very dense mixed shrub understorey	loamy gravel and cobbles	mid slope
Control 2B.15	745254	6584518	Very dense Acacia and mixed shrub understorey	mostly gravel and cobbles	upper slope
Control 2B.16	745220	6584484	Very dense Acacia and mixed shrub understorey	mostly gravel and cobbles, some outcropping	upper slope
Control 2B.17	745184	6584447	Very dense Acacia and mixed shrub understorey	outcropping rock, some boulders, cobbles, gravel and loam	upper slope
Control 2B.18	745150	6584411	Dense Acacia and mixed shrub understorey	outcropping rock, some boulders, cobbles, gravel and loam	crest
Control 2B.19	745777	6585065	Eucalyptus with isolated Atriplex and mixed shrubs	loam with bits of quartz gravel	plain
Control 2B.20	745111	6584363	Eucalyptus with dense mixed shrub understorey	Outcropping rock, cobbles, bit of gravel and loam	upper slope, steep
Control 2B.21	745059	6584327	Mixed shrubs	Outcropping rock, cobbles, bit of gravel and loam	upper slope, steep
Control 2B.22	745030	6584301	Dryandra and mixed shrubs	Outcropping rock, cobbles, bit of gravel and loam	upper slope

Appendix 2 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
Control 2B.23	744999	6584267	Eucalyptus with mixed shrub understorey	Rock, cobbles, bit of gravel and loam	mid slope
Control 2B.24	744961	6584236	Eucalyptus with mixed shrub understorey	gravelly loam	mid slope
Control 2B.25	744931	6584189	Eucalyptus with mixed shrub understorey	gravelly loam	mid slope
Control 2B.26	744893	6584164	Eucalyptus with mixed shrub understorey	cobbles, gravelly loam	lower slope
Control 2B.27	744856	6584124	Eucalyptus with Atriplex and mixed shrub understorey	cobbles, gravelly loam	lower slope
Control 2B.28	744822	6584079	Eucalyptus with Atriplex and mixed shrub understorey	gravelly loam	lower slope
Control 2B.29	744792	6584043	Eucalyptus with mixed shrub understorey	gravelly loam	lower slope
Control 2B.30	744747	6584017	Eucalyptus with Atriplex and mixed shrub understorey	gravelly loam	slight slope
Control 2B.31	744721	6583978	Eucalyptus with mixed shrub understorey	gravelly loam	slight slope
Control 2B.32	744676	6583952	Eucalyptus with Acacia and mixed shrub understorey	gravelly loam	slight slope
Control 2B.33	744650	6583934	Eucalyptus with Acacia and mixed shrub understorey	gravelly loam	plain
Control 3A.1	745575	6583135	Eucalypt open woodland over saltbush	Loam	plain
Control 3A.2	745635	6583190	Eucalypt open woodland over shrubland of Eremophila and saltbush	Loam	plain
Control 3A.3	745680	6583230	Eucalypt open woodland over open shrubland of Eremophila and saltbush	Loam	plain
Control 3A.4	745740	6583280	Quandong, Eremophila and saltbush shrubland	loam	plain
Control 3A.5	745785	6583320	Eucalypt open woodland over shrubland of Acacia, Eremophila and saltbush	loam with cobbles (20%)	slight slope
Control 3A.6	745825	6583360	Eremophila and Saltbush shrubland	Loam with cobbles (40%)	plain
Control 3A.7	745870	6583400	Eremophila and Saltbush shrubland	Loam with cobbles (10%)	plain
Control 3A.8	745905	6583445	Saltbush shrubland	Loam with cobbles (10%)	plain
Control 3A.9	745940	6583490	Eremophila and Saltbush shrubland	Loam with cobbles (80%)	slight slope
Control 3A.10	745985	6583530	Eremophila and Saltbush shrubland	Loam with cobbles (20%)	slight slope
Control 3A.11	746055	6583560	Acacia, eremophila and saltbush shrubland	Loam with cobbles (60%)	slight slope
Control 3A.12	746100	6583605	Acacia and Scaevola spinescens open shrubland	Loam with cobbles (80%)	lower slope
Control 3A.13	746140	6583645	Acacia and Eremophila tall shrubland over sparse shrubs	Loam with cobbles (60%)	lower slope
Control 3A.14	746170	6583680	Acacia "Mt Jackson" tall shrubland over Eremophila and Scaevola spinescens	Loam with cobbles (60%)	mid-slope
Control 3A.15	746210	6583720	Acacia and Grevillea tall shrubland	Rock (20%), cobbles (60%) and loam	mid-slope
Control 3A.16	746250	6583760	Acacia "Mt Jackson" tall shrubland over Eremophila open shrubland	Loam with cobbles (80%)	mid-slope
Control 3A.17	746295	6583795	Acacia "Mt Jackson" tall shrubland over Eremophila open shrubland	Loam with cobbles (70%)	mid-slope
Control 3A.18	746335	6583825	Eremophila and Dodonea open shrubland	Loam with cobbles (70%)	lower slope
Control 3A.19	746365	6583855	Acacia, Eremophila and Scaevola spinescens open shrubland	Loam with cobbles (10%)	slight slope
Control 3A.45	746425	6583864	Eucalyptus woodland with sparse mixed shrubs	gravelly loam	mid slope
Control 3A.46	746456	6583901	Eucalyptus woodland with sparse mixed shrubs	gravelly loam	mid slope

Appendix 2 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
Control 3A.47	746490	6583941	Eucalyptus woodland with sparse mixed shrubs	gravelly loam	slight slope
Control 3A.48	746524	6583983	Eucalyptus woodland with sparse mixed shrubs	gravelly loam	slight slope
Control 3A.49	746559	6584014	Eucalyptus woodland with sparse Atriplex and mixed shrubs	loam	plain
Control 3A.50	746589	6584054	Eucalyptus woodland with sparse Atriplex and mixed shrubs	loam	plain
Control 3B.1	746451	6582973	Eucalyptus woodland with sparse Atriplex and mixed shrubs	gravelly loam	plain
Control 3B.2	746482	6583011	Eucalyptus woodland with Atriplex and Eremophila	gravelly loam	plain
Control 3B.3	746518	6583047	Eucalyptus woodland with Acacia, Ptilotus, Atriplex and Eremophila	gravelly loam	plain
Control 3B.4	746542	6583094	Eucalyptus woodland with mixed shrubs with Atriplex and Eremophila	gravelly loam	plain
Control 3B.5	746569	6583131	Eucalyptus woodland with Sparse Atriplex	gravelly loam	plain
Control 3B.6	746607	6583169	Eucalyptus woodland with sparse Atriplex and mixed shrubs	gravelly loam	plain
Control 3B.7	746636	6583201	Eucalyptus woodland with Atriplex and mixed shrubs	gravelly loam	slight rise
Control 3B.8	746663	6583238	Eucalyptus woodland with Atriplex and mixed shrubs	gravelly loam	slight rise
Control 3B.9	746699	6583278	Eucalyptus woodland with mixed shrubs	gravelly loam	slight rise
Control 3B.10	746730	6583315	Eucalyptus woodland with mixed shrubs	gravelly loam with cobbles	mid slope
Control 3B.11	746770	6583357	Dense tammar with mixed shrubs	rocks, gravel , loam	upper slope
Control 3B.12	746810	6583386	Dense tammar with mixed shrubs	rocks, gravel , loam	crest
Control 3B.13	746843	6583420	Dense tammar with mixed shrubs	rocks, gravel , loam	crest
Control 3B.14	746882	6583459	Dense tammar with mixed shrubs	cobbles, gravel , loam	upper slope
Control 3B.15	746919	6583488	Eucalyptus woodland with mixed shrubs	cobbles, gravel , loam	mid slope
Control 3B.16	746946	6583518	Eucalyptus woodland with mixed shrubs	cobbles, gravel , loam	mid slope
Control 3B.17	746974	6583574	Eucalyptus woodland with mixed shrubs	loam with cobbles and gravel	lower slope
Control 3B.18	747007	6583608	Eucalyptus woodland with sparsemixed shrubs	loam with gravel	lower slope
Control 3B.19	747037	6583651	Eucalyptus woodland with sparsemixed shrubs	loam with gravel	lower slope
Control 3B.20	747077	6583683	Eucalyptus woodland with sparsemixed shrubs	loam with gravel	plain
Control 3B.21	747109	6583720	Eucalyptus woodland with sparsemixed shrubs	loam with gravel	plain
Control 4A.30	748068	6583508	Eucalyptus with sparse Atriplex and mixed shrub understorey	gravelly loam	plain
Control 4A.31	748029	6583470	Acacia with mixed shrubs understorey	gravelly loam	plain
Control 4A.32	747993	6583433	Eucalyptus with sparse Atriplex and mixed shrub understorey	loam, bit of gravel	plain
Control 4A.33	747966	6583395	Eucalyptus with sparse Atriplex understorey	gravelly loam	lower slope
Control 4A.34	747930	6583347	Eucalyptus with mixed shrub understorey	gravelly loam	lower slope
Control 4A.35	747899	6583310	Eucalyptus with mixed shrub understorey	gravelly loam	lower slope
Control 4A.36	747861	6583292	Eucalyptus with mixed shrub understorey	gravel, bit of loam	lower slope

Appendix 2 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
Control 4A.37	747824	6583251	Acacia and mixed shrubs	cobbles, gravel, bit of loam	mid slope
Control 4A.38	747792	6583219	Acacia and mixed shrubs	cobbles, gravel, bit of loam	mid slope
Control 4A.39	747759	6583182	Thick Acacia and mixed shrubs	Outcropping rocks, cobbles, bit of loam	upper slope
Control 4A.40	747733	6583147	Thick Acacia, Dryandra and mixed shrubs	Outcropping rocks, cobbles, bit of loam	upper slope
Control 4A.41	747692	6583103	Thick Acacia and mixed shrubs	Outcropping rocks, cobbles, bit of loam	upper slope
Control 4A.42	747664	6583069	Thick Eucalyptus, Acacia and mixed shrubs	Outcropping rocks, cobbles, bit of loam	crest
Control 4A.43	747596	6583049	Eucalyptus, Acacia and mixed shrubs	Outcropping rocks, cobbles, gravel, bit of loam	upper slope
Control 4A.44	747554	6583029	Eucalyptus woodland with Acacia and mixed shrubs	Cobbles, gravel , bit of loam	mid slope
Control 4A.45	747531	6583002	Eucalyptus woodland with Atriplex and mixed shrubs	Cobbles, gravel , bit of loam	mid slope
Control 4A.46	747397	6582898	Eucalyptus woodland with sparse Atriplex and mixed shrubs	Loam	low slope
Control 4A.47	747366	6582866	Eucalyptus woodland with sparse Atriplex and mixed shrubs	Quartz and ironstone gravel with loam	slight rise
Control 4A.48	747331	6582840	Eucalyptus woodland with sparse Atriplex and mixed shrubs	Quartz and ironstone gravel with loam	plain
Control 4A.49	747293	6582806	Eucalyptus woodland with sparse Atriplex and mixed shrubs	Quartz and ironstone gravel with loam	plain
Control 4A.50	747252	6582775	Eucalyptus woodland with sparse Atriplex and mixed shrubs	Quartz gravel with loam	plain
Control 4B.46	747705	6582472	Eucalyptus woodland with sparse Atriplex and mixed shrubs	gravelly loam	plain
Control 4B.47	747744	6582506	Eucalyptus woodland with sparse Atriplex and mixed shrubs	Quartz gravel with loam	plain
Control 4B.48	747779	6582536	Eucalyptus woodland with sparse mixed shrubs	Quartz cobbles and gravel with loam	plain
Control 4B.49	747812	6582577	Eucalyptus woodland with sparse mixed shrubs	outcropping rocks, cobbles, gravel , bit of loam	slight slope
Control 4B.50	747847	6582607	Eucalyptus woodland with sparse mixed shrubs	gravelly loam	slight slope
Control 4B.1	747889	6582634	Acacia "Mt Jackson" open, tall shrubland over open Eremophila	Loam with cobbles (20%)	lower slope
Control 4B.2	747930	6582670	Eremophila, daisy and Scaevola spinescens open shrubland	Loam with cobbles (30%)	lower slope
Control 4B.3	747970	6582710	eucalypt woodland over Eremophila open shrubland	Loam with cobbles (40%)	mid-slope
Control 4B.4	748010	6582740	Tammar, eucalypt and Dryandra arborea tall, open shrubland	Loam with cobbles (40%)	upper slope
Control 4B.5	748055	6582790	Tammar, eucalypt, Acacia, Eremophila and Dryandra arborea shrubland	Rock (10%), cobbles (50%) and loam	ridge top
Control 4B.6	748085	6582820	Acacia "Mt Jackson" tall, open shrubland over open shrubland of Eremophila	rock and cobbles (80%) with loam	upper slope
Control 4B.7	748130	6582860	Shrubland of Eremophila, Grevillea and Sandalwood	Rock (40%), cobbles (40%) with loam. Rock is agglomerated laterite	upper slope
Control 4B.8	748170	6582905	Acacia and Eremophila shrubland	Loam with cobbles (40%)	lower slope
Control 4B.9	748210	6582945	Eucalypt woodland over acacia open shrubland	Loam with cobbles (50%)	lower slope
Control 4B.10	748250	6582985	Eucalypt woodland over very open shrubland	Loam with cobbles (40%)	lower slope
Control 4B.11	748290	6583035	Eremophila and saltbush open shrubland	Loam with cobbles (20%)	plain
Control 4B.12	748330	6583075	Saltbush shrubland	Loam	plain

Appendix 2 (cont.)

QUAD NO	EASTING	NORTHING	VEGETATION TYPE	SOIL SURFACE	POSITION IN LANDSCAPE
Control 4B.13	748375	6583120	Acacia and Eremophila tall, open shrubland	Loam with cobbles (60%)	lower slope
Control 4B.14	748415	6583160	Dodonea tall, open shrubland	Loam with cobbles (80%)	mid-slope
Control 4B.15	748455	6583200	Acacia "Mt Jackson" tall, open shrubland over Eremophila open shrubland	Loam with cobbles (50%)	mid-slope
Control 4B.16	748495	6583240	Eucalypt and Acacia "Mt Jackson" tall, open shrubland over Eremophila shrubland	Rock (20%), cobbles (30%) and loam	mid-slope
Control 4B.17	748545	6583280	Acacia "Mt Jackson" and A. tetragonophylla tall shrubland	Rock (30%), cobbles (60%) and loam	upper slope
Control 4B.18	748565	6583325	Acacia and Dodonea shrubland	loam with cobbles (60%)	lower slope
Control 4B.19	748605	6583365	Eucalyptus campaspe woodland over saltbush	Loam	plain