DRAFT TECHNICAL REPORT

CHICHESTER DEVIATION BASELINE MULGA (*ACACIA ANEURA*) VEGETATION CONDITION ASSESSMENT

FEBRUARY 2010

FOR
FLUOR SKM IRON ORE JOINT VENTURE

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EXECUTIVE SUMMARY

A baseline Mulga (*Acacia aneura*) vegetation survey was conducted at the proposed Chichester rail deviation site located approximately 220km south of Port Hedland and 150km north-west of Newman within the Pilbara region of Western Australia. The intent of the survey was to capture data on the structure, composition and condition of sheetflow dependent mulga communities, as well as associated physical parameters (erosion), as a means of determining changes over time related to impacts of the rail deviation works.

A Monitoring Program was submitted to and approved by the DEC in January 2010, and this formed the basis of the field program. Some methods were slightly modified on-site to accommodate changes in the field.

A total of 11 belt transects covering approximately 6.5ha of the area was traversed and the number of Mulga plants counted and sorted according to age group (mature, juvenile, seedling, resprout). In addition, a visual assessment of Mulga health was undertaken and a species list compiled for each transect surveyed.

It is intended that the data collected will provide a basis for ongoing monitoring over a 10 year period (duration may be under review by DEC after 2013) and contribute to understanding the Mulga dynamics with respect to changes brought about by construction of the railway.

The most dominant community noted was *Acacia aneura* var *tenuis* low open woodland over *Triodia sp.* open grassland. However, there was more extensive areas of non-mulga communities than indicated on broadscale vegetation maps previously mapped by Ecologia (2008), and these have been captured within most transects.

Overall, the condition of vegetation at the time of survey is very good to excellent, however multiple disturbance factors such as fire and grazing have affected condition of some Mulga vegetation communities. Most areas show a change in vegetation structure due to fire (e.g. dominance of resprouts and juvenile Mulga) with three of the transects surveyed showing no evidence of recent fire.

PART 1: INTRODUCTION

1.0 BACKGROUND TO THE PROJECT

1.1 PROJECT OVERVIEW

The Chichester Rail Deviation is a part of BHP Billiton Iron Ore (BHPBIO) Rapid Growth Project 5 (RGP5). The railway spur is 23km long, however the area of sheetflow Mulga is approximately 9 kms.

Sheetflow Mulga communities were identified as a dominant vegetation feature in the proposed project area by Ecologia in 2008. Subsequently, a Surface Water Management Plan (BHPB, 2009) for the area identified the need for assessment of sheetflow Mulga communities, due to potential impacts on surface hydrology associated with the construction of the rail and road corridor.

In mid-2009 Fluor SKM Iron Ore Joint Venture (FAST) appointed Syrinx Environmental PL (Syrinx) to prepare a Mulga Monitoring Program (Appendix 1) and undertake a Baseline Survey of the area (this report). The purpose of this study is to provide information on the health condition of the Mulga communities prior to the commencement of railway construction. The data collected provides a baseline to compare the results of future monitoring events against, and will be used to assess the impact (if any) the construction of the railway has on these Mulga communities within the Chichester Deviation area.

1.2 PROJECT OBJECTIVES

The objectives of this Baseline study were to:

- Conduct and record baseline Mulga vegetation condition prior to commencement of railway construction;
- Install erosion markers and record baseline erosion levels;
- Document the presence of plant species along the transect by establishing baseline floristic plots; and
- Refine proposed methodology in preparation for future surveys.

This report presents the survey methodology, and findings which will serve as a baseline for future monitoring of Mulga in the proposed Chichester Deviation area.

1.3 STUDY SITE

1.3.1 Location

The study site is located approximately 220km south of Port Hedland and 150km north-west of Newman within the Pilbara region of Western Australia (Figure 1). The proposed railway deviation is located on Lease L45/147, and is adjacent to Lease E45/1073 and E45/1074. This survey focused on those areas identified as sheet-flow dependant Mulga by Ecologia in 2008, limiting the survey work to between Chichester Deviation Chainage Sections D234 and D242.

1.3.2 Land Systems and Soils

The majority of the study site is located on the Jamindie land system and has been classified as gently undulating hardpan wash plains with mantles of ironstone grit and pebbles, minor stony plains, low rises and occasionally low ridges with relief up to 30 meters (van Vresswyk, 2004). A small percentage of the area lies within the Newman land system. These landform units are vulnerable to erosive forces, especially in the intergrove areas where sediment can be removed (washed) and deposited in the groves creating varied surface roughness between groves and intergroves.

The soils of the area are hard setting loamy soils with red clayey subsoils, highly calcareous loamy earths and an area of coherent and porous clays on the southern boundary in the Fortescue drainage area (Bettenay et al, 1967, Ecologia, 2008).

1.3.3 Bioregions and Mulga Distribution

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into 85 bioregions based on climate, geomorphology, landform, lithology and biological attributes (DEWHA, 2005).

The study area comprises of two subregions: the Chichester Subregion and the Fortescue Plains. The Chichester subregion is described by Kendrick and McKenzie (2001) as an area comprising of undulating Archean granite and basalt plains supporting a shrub steppe of *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges. The Fortescue plains subregion is the northern limit of *Acacia aneura* and is characterised by alluvial plains and river frontages with extensive salt marshes, mulga bunch grasses, and short grass communities on alluvial plains in the east (Kendrick et al, 2001).

The study area is therefore at the northern limit of mulga distribution.

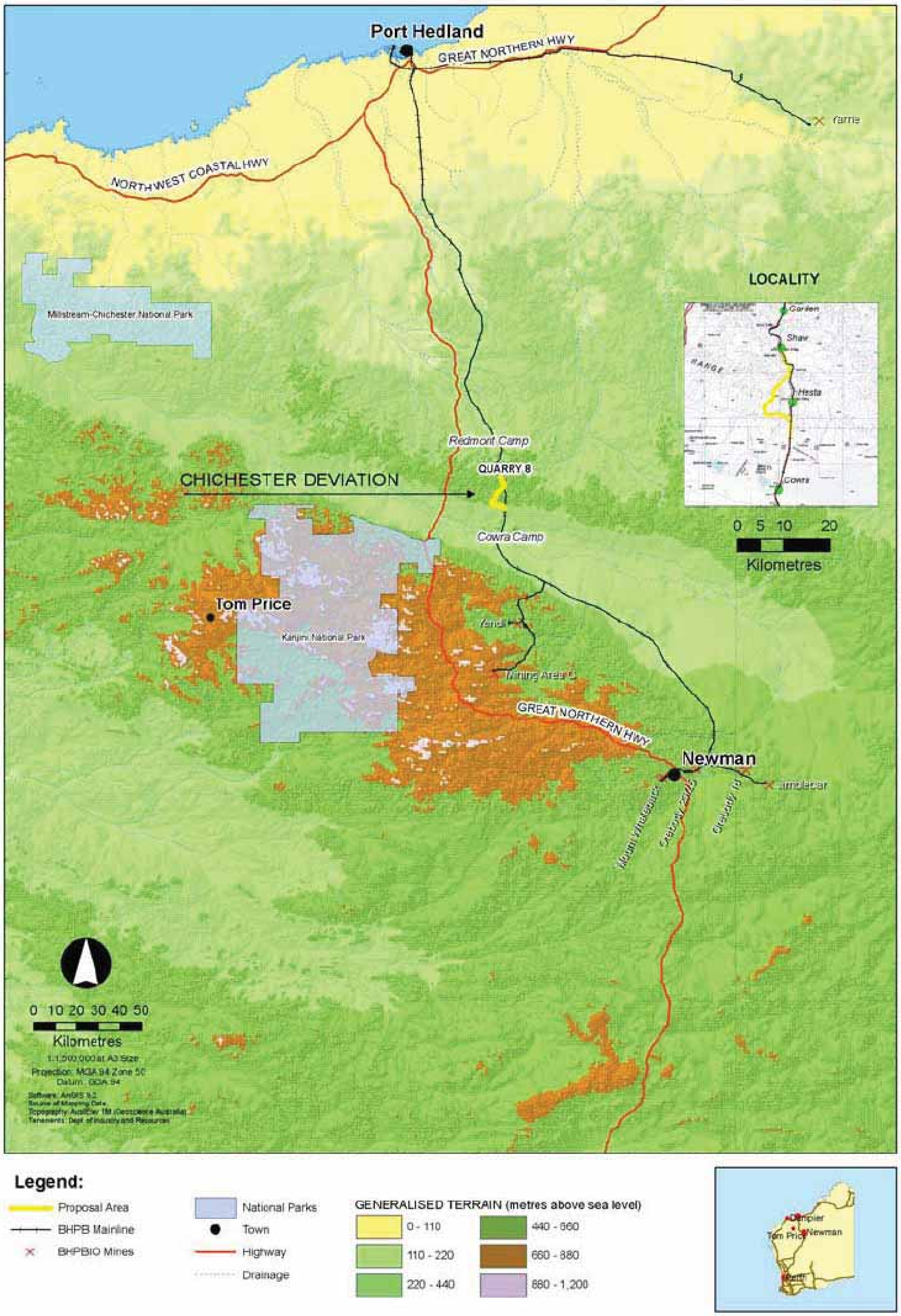

Figure 1 Location of the study site (BHPBIO, 2009)

1.3.4 Vegetation

Ecologia (2008) mapped the vegetation communities along the railway corridor and identified areas of sheet flow dependent vegetation within the project area. The vegetation types and landform descriptions within the sheet flow areas are as described by Ecologia (2008) and are detailed below:

Vegetation Type 3: *Acacia aneura* low woodland on clay flats

Landform description: Open areas of hard clay pans with common ferrous pebbles

- *Acacia aneura var. aneura* low woodland, over varying *Dodonaea petiolaris* and *Sida sp.* unisexual (N.H. Speck) Shrubland over *Aristida contorta* open tussock and *Triodia pungens* very open hummock grassland.

Vegetation Type 9b: *Acacia aneura* low open forest

Landform description: Drainage channel on rocky hill slopes, stones and boulders of ironstone.

- Scattered *Eucalyptus leucophloia* subsp.*leucophloia* tall to medium trees, over *Acacia aneura* var. *intermedia* low open forest, over *Dodonaea petiolaris* open heath, over *Eriachne mucronata* tussock grassland.

1.3.5 Climate

Climate data given here is based on records (1951 – 2010) from the Wittenoom Bureau of Meteorology Weather Station (005026), situated 70km west from the study site (i.e. nearest station). For future analysis of follow-up surveys, it is suggested that both the Wittenoom (base of ranges) and the Nullagine data sets (inland) are used to better capture the site local climate variations.

The region has an arid climate with two distinct seasons, a hot summer from October to April and a mild winter from May – September. This region experiences a wide range of temperatures with an average temperature of 32.8ºC. Maximum summer temperatures may reach 39.6ºC whilst in winter minimum temperatures may reach 11.5°C (Bureau of Meteorology, 2010).

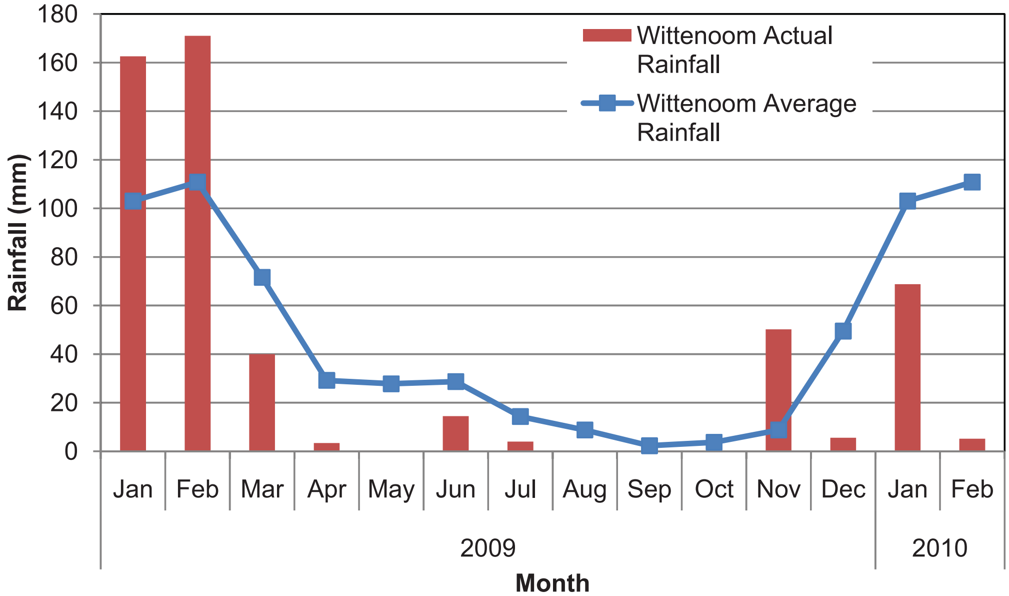

Figure 2. Average and Actual Monthly Rainfall at Wittenoom Station (Bureau of Meteorology, 2010).

The average annual rainfall at Wittenoom is 457.9mm (1951 - 2010) (Figure 2). The majority of the rain falls between the months of December to March. This region is influenced in the summer by tropical storms and cyclones bringing heavy rainfall. The mild winter rainfall is usually the result of cold fronts moving north-easterly across the state.

1.4 PREVIOUS ENVIRONMENTAL STUDIES

Various surveys have been conducted in the study area with those most relevant to the current survey listed below:

- Chichester Deviation Vegetation and Flora Report. Version 3 (Ecologia 2008);
- Chichester Deviation and Mainline Rail Duplication Surface Water Management Plan (Aquaterra, 2008);
- Chichester Deviation Surface Water Management Plan Revision A (BHPBIO, 2009); and
- Newman - Port Hedland Railway Chichester Deviation Environmental Referral Document (BHPBIO, 2009).

A synthesis of the above literature will not be presented in this report, since they are covered in the Mulga Monitoring Methodology (Syrinx Environmental PL, 2010, see Appendix 1). This report also details background information on Mulga taxonomy, sheet flow and environmental conditions.

PART 2: METHODOLOGY

2.0 METHODS

2.1 MONITORING APPROACH

Syrinx undertook a desktop study of previous vegetation surveys conducted in the study area. The preliminary location of survey transects was selected on the basis of the Ecologia report (2008), given this was the most recent survey underatken specifically for the deviation assessment. In addition, sites were based on maps produced by BHPBIO for the Chichester Deviation Environmental Referral Document (BHPBIO, 2009).

The location of individual transects was then confirmed/adjusted in the field after visual observation of the area for the presence of Mulga, whilst taking into consideration the location of proposed railway culverts and the slope of the ground. Maps provided by BHPBIO titled ‘Shaw Siding to Cowra Siding Deviation’ (BHPBIO 2010) provided information as to the surface flow direction aiding in the positioning and alignment of the transects.

The methodology used for this survey was based on the Chichester Deviation Mulga (*Acacia aneura*) Monitoring Methodology (Syrinx Environmental PL, 2010) a document (see Appendix 1) which was reviewed and approved by the DEC in early January 2010. Some components of the methodology were modified and further refined during the fieldwork; these changes are clearly described in the following sections.

2.2 FIELD SURVEY

2.2.1 Transect set up

A total of eleven (11) 600m transects were set up perpendicular to the railway line and parallel to the surface water flow. One hundred meters of each transect was set-up upslope of the proposed railway, and 500m down slope unless the existing roads and the change in vegetation structure (i.e. no Mulga) resulted in shortened transects. The upslope section of each transect is recorded as a reference transect, and the 500m section down slope as a main transect (Figure 3). The line of the transect was recorded using a Trimble SPS551 Receiver and Trimble Nomad 800GL Handheld equipment with OmniSTAR VBS Correction (sub-metre accuracy), at 20m intervals (with the exception of transect 10 where GPS points were taken at 100m intervals). It is intended that erosion pickets be installed at 20m intervals along each transect line during the proposed April 2010 floristic survey.

2.2.2 Photographic Record

Reference Transect

Photo points were set up at 40m and 100m marks along each transect, and the photographs taken facing away from the proposed railway centreline using the rule of thirds. An additional photo was taken at the end of each transect looking back towards the proposed railway line.

Main Transect

Photo points were set up at the 40m mark away from the railway centreline and every 100m thereafter. Photos were taken facing away from proposed railway deviation using the rule of thirds. An additional photo was taken at the end of each transect looking back towards the proposed railway line.

Floristic Plots

Floristic photo records were taken at the corner closest to the proposed railway deviation (i.e. if a floristic plot was established at 70 - 80m along the transect line then the photo was taken at the 70m mark). Photos were taken facing away from proposed railway deviation using the rule of thirds.

2.2.3 Mulga Population Health

The health of each tree within each transect was assessed using the definitions described in the table below:

Table 1 Mulga health ranking definitions

Ranking	Health Ranking	Health rating
1	Alive	A canopy cover of phyllodes present
2	Dead	No phyllodes on canopy and branches brittle (i.e. snap when broken) indicating no xylem flow.

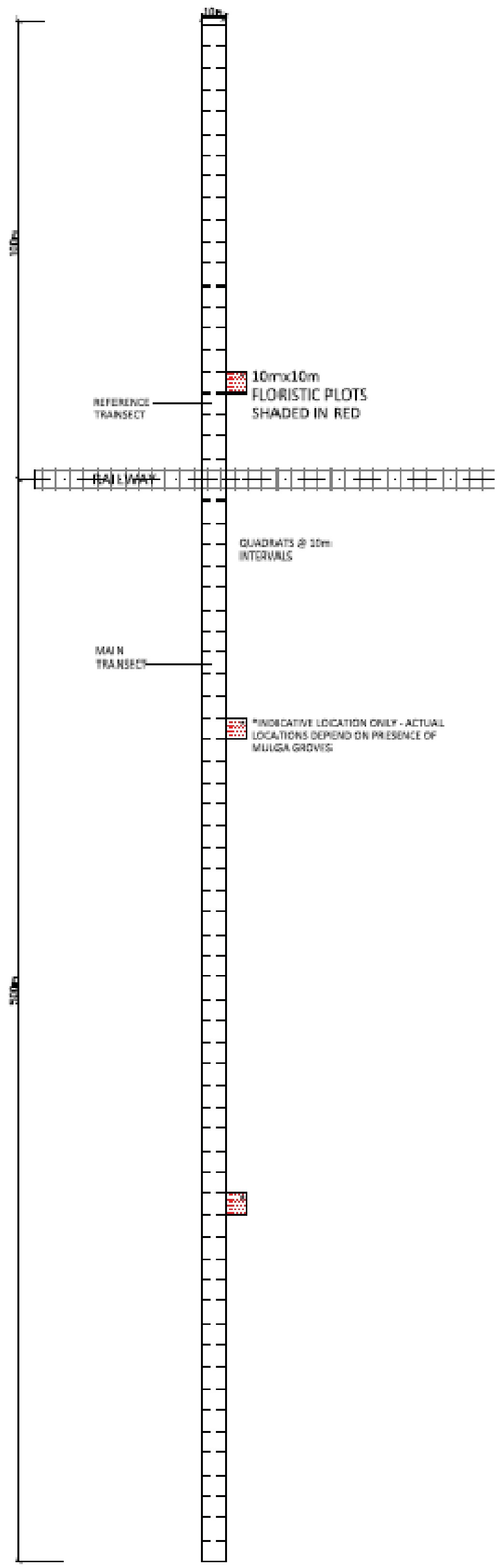

Figure 3 Transect and floristic plot layout

2.2.4 Mulga Population Structure

To determine Mulga population structure, the total number of Mulga plants was counted for each age class in each of the eleven 10m x 600m transects (a 500m main transect and a 100m reference transect). All Mulga counts were recorded to the left side of each transect (see Figure 3). For ease of recording and increased accuracy in counting, each transect was segmented into 10m plots.

The Mulga was grouped in age classes as per Table 2 below. Note, this table is the same as per the approved Mulga Monitoring Methodology (Syrinx Environmental PL, 2010 Appendix 1), with the exception of definitions for a resprout and seedling. This was because it was not possible to surface excavate and hence verify these groups, due to lack of Project Environmental and Aboriginal Heritage Review (PEAHR) approval.

Table 2 Age class assessment method

Age Classes	Definition
Mature	Any Mulga plant above 2m tall, and with ascending branches present, no phyllodes in 'clusters'
Juvenile	Any Mulga plant between 0.5 - 2m tall; may have phyllodes in 'clusters' at ends of branches; usually demonstrating a horizontal branching habit; and with possibly with some ascending branches present.
Resprout	Any shoot arising from a dead main stem/trunk. If several shoots arise from the same dead trunk they are counted as one. If a new Mulga shoot is located more than 0.5m from the main dead trunk it is counted as a separate plant. Refer to Figure 4 for resprout photographs.
Seedling	Any plant that still has a cotyledon attached or less than 0.1m tall.

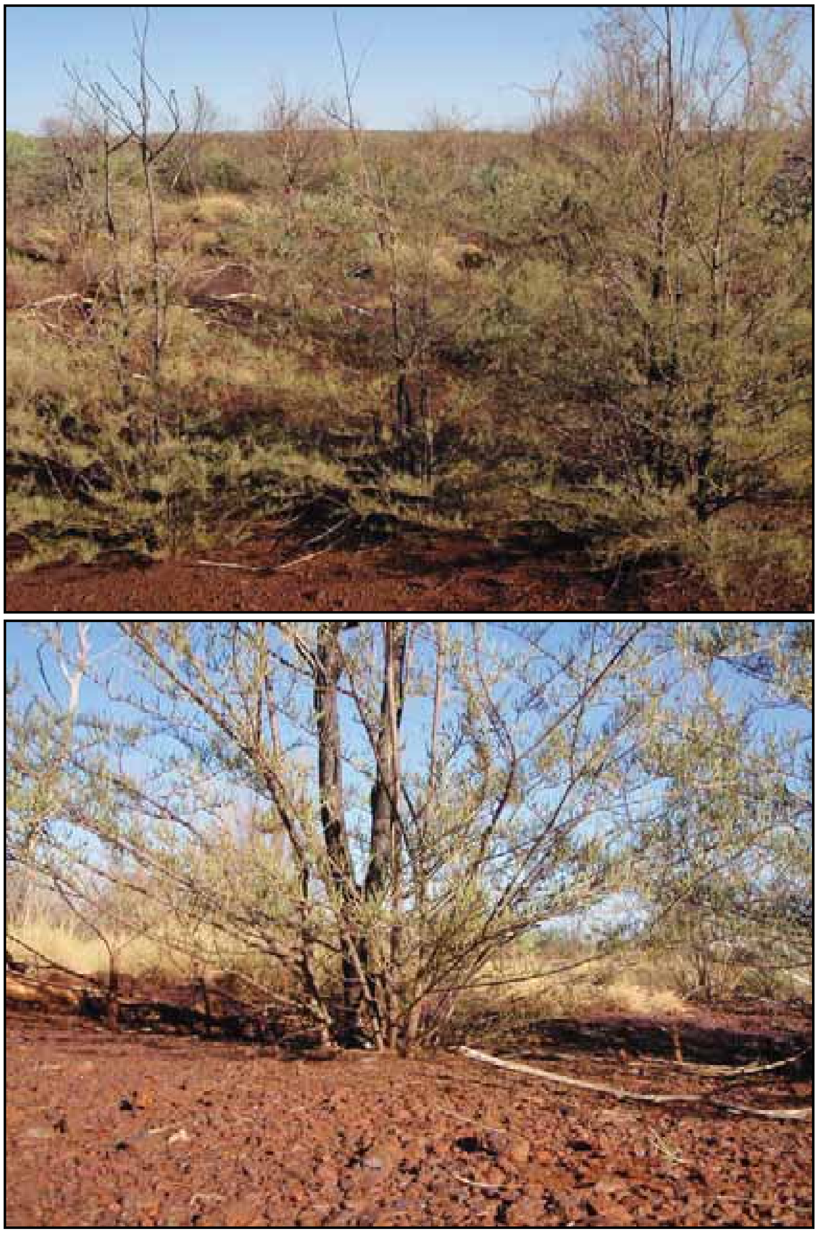

Figure 4 Example of resprouting Mulga

2.2.5 Mulga Density

Data recorded for population structure and health was used to determine the total number of Mulga plants (i.e. Mulga density) in each transect. The total number of alive Mulga per transect is used to calculate an average density per 100m^2.

2.2.6 Floristic Plots

One reference floristic plot and two main transect floristic plots were set up along the length of the transect (Figure 3), and situated where possible within the Mulga groves. The 10m x 10m floristic plots were recorded to the eastern side of each transect. Being mindful of the proposed railway construction, no plots were set up before the 40m mark of both reference and main transects. A modified version of the Keighery (1994) method was used to capture the vegetation structure and species diversity within each plot.

2.2.7 Fire

Notes on vegetation damage by fire were taken for each transect, however the time since the last fire was not previously reported on. Fire records were not accessed for this report, however it is recommended that Landgate data is sourced for future monitoring events to enable separation of fire impacts from rail impacts.

2.3 PLANT IDENTIFICATION

All Mulga samples were taken to the WA Herbarium and were examined by Bruce Maslin (Acacia specialist at the DEC), in order to identify different varieties of Mulga.

2.4 DATA ANALYSIS

The fieldwork data (transect Mulga counts and floristic data) was entered in an Excel spreadsheet and analysed to determine Mulga health, population structure and density. Each data point was double-checked to ensure accuracy.

2.5 SURVEY LIMITATIONS AND CONSTRAINTS

Listed below are the constraints associated with the Chichester Deviation Mulga Monitoring Baseline Survey.

Survey Timing

The well below average rainfall received within the month prior to the field survey (Figure 5) meant that most of the plant species were not growing (annuals), nor were in fruit or in flower, making the identification process difficult. Few annual species were recorded during the survey and were often identified from dead plants that remained in the ground. The floristic results do not give a good indication of annuals that are likely to occur in the area following an extended rainfall event. Since March 2009 the area has received below average rainfall with the exception of November which was well above average (Figure 2). Therefore, a follow-up survey will be required to accurately represent the floristic composition.

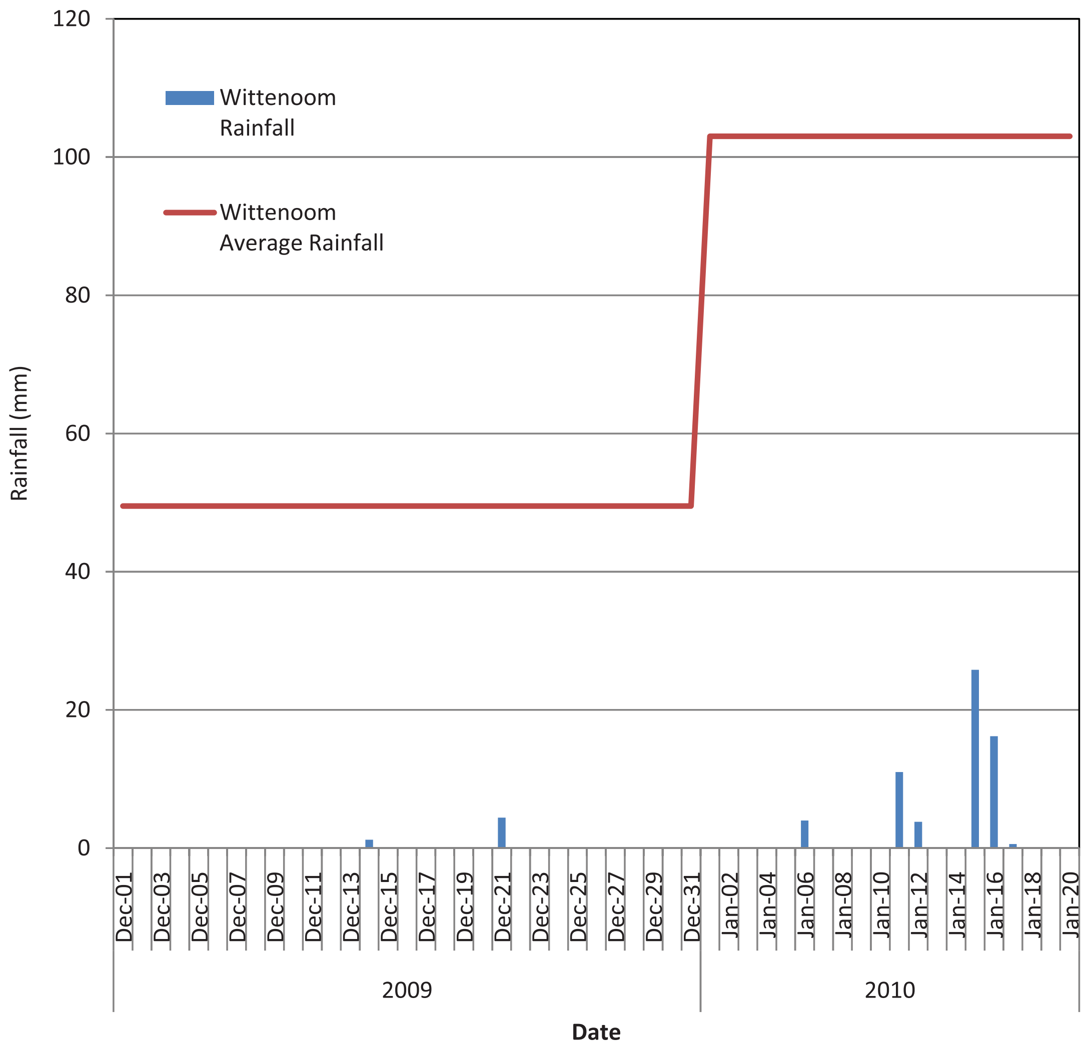

Figure 5 Daily rainfall received one month prior to and during the baseline study

Mulga Identification

Mulga are very complex in terms of taxonomy and determining the exact variety was hampered by the absence of pods and presence of hybrid forms (e.g. *Acacia aneura var. intermedia x ayersiana*), neotony, and resprouts.

It is recommended that the identification of the Mulga varieties be confirmed in September either in the field with the help of an expert such as Bruce Maslin or by collecting pods and confirming identification at the WA Herbarium.

Fire affected plants

The majority of the project area had been burnt and the evidence of fire is present in all transects. It is important to note that it is very difficult to identify very old burnt Mulga if identifying features are missing such as bark or generic shrub/tree form, and there is evidence of other similar looking shrubs/trees in the same area (e.g. *Acacia ayersiana*). Great care was taken in identifying dead juvenile Mulga, however it is possible that other species (dead and burnt) were also recorded. This should not interfere with future monitoring, however it is important to record as a limitation to this baseline study.

Existing Railway Line

Consideration will need to be given when analysing and comparing future monitoring data for transects 10 and 11 as they are proximal to the existing railway and evidence of erosion is prominent along the whole length of the transects, especially transect 11. Careful examination of the existing erosion patterns will provide a better picture in terms of future data analysis. Without baseline vegetation data for the area before construction of the existing railway line, these potentially earlier impacts cannot be readily determined (however it will be possible to see if they worsen with the deviation).

Grazing and trampling by cattle

Evidence of grazing by cattle was present in most areas that were surveyed which has resulted in degradation of some vegetation, mainly the perennial grasses, which made them unidentifiable.

PART 3: RESULTS

3.0 OVERVIEW

The results presented in this section are summarised for each transect (reference and main transects) in terms of Mulga population health, structure (age), and density. A general description of each transect (including the vegetation community name and condition derived from the floristic plot data) is given and the photographs at the 40m mark for both reference and main transects provided, as well as those of the floristic plots (see Appendix 2).

A full species list is pending accurate identification of samples, which is not possible until adequate specimens are collected after sufficient rains (possibly April).

3.1 TRANSECT LOCATIONS

A differential scale GPS was used to record each transect line at 20m intervals. All GPS points were then transferred and processed by GIS software to produce a transect location image below. The GPS points used to produce this figure are presented in Appendix 4.

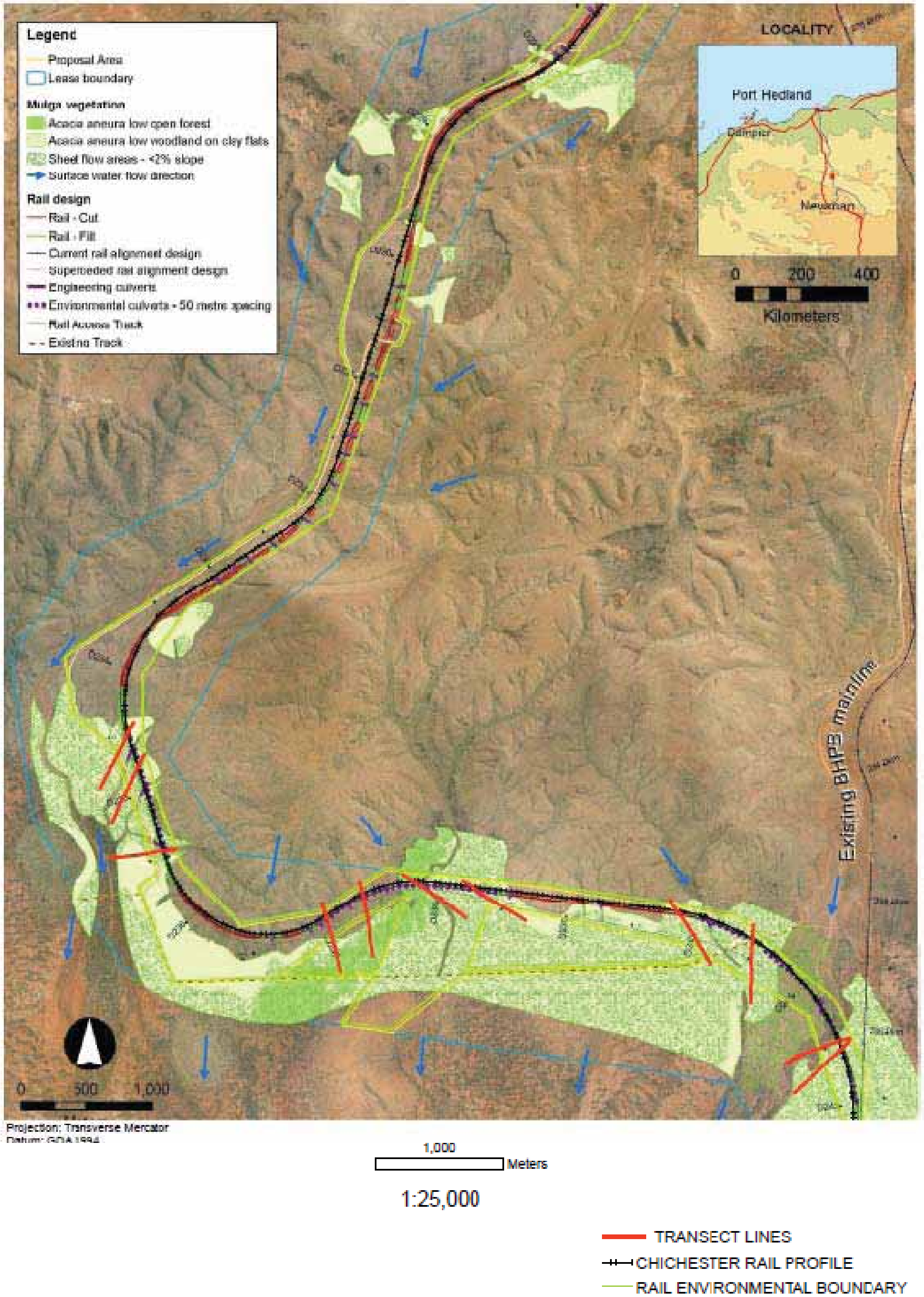

Figure 6 Transect Locations and Alignment (underlying aerial sourced from BHPBIO, 2009).

3.2 GENERAL VEGETATION DESCRIPTION

Due to micro scale variation in landscape (e.g. presence of small creek lines and drainage points), which were not anticipated after the review of previous botanical surveys, most transects intercept vegetation communities other than Mulga. The most dominant vegetation communities are Mulga-dominated, with *Acacia aneura* var *tenuis* low open woodland over *Triodia sp.* open grassland most common. This lies within the broader Ecologia mapping unit of Vegetation Type 3 (Ecologia 2008).

Acacia aneura var *tenuis* was the most dominant Mulga with samples of *Acacia aneura* var*. intermedia* and a hybrid *Acacia aneura* var. *intermedia x ayersiana* also found in four out of eleven transects.

The overall condition of vegetation was very good to excellent, however multiple disturbance factors such as fire and grazing have affected the condition of some Mulga vegetation communities where perennial grass cover is low (grasses appear heavily grazed), and the soil shows evidence of animal impacts (e.g. depressions, compaction and cow pats). Most areas show a change in vegetation structure due to fire (e.g. dominance of resprouts and juvenile Mulga).

3.3 FIRE

Evidence of fire (within the last 5-7 years) was recorded in all transects surveyed, however, transects 9 – 11 did not appear to be affected by recent fires. The number of resprouts present in transects affected by more recent fires would suggest that the fire was either short in duration or of low intensity.

3.4 SUMMARY MULGA DATA

3.4.1 Mulga Health

The number of dead and alive Mulga recorded in reference and main transects varied between transects (Figure 7). Most of the dead Mulga recorded were mature trees that have been damaged by fire. The highest number of dead juvenile plants was recorded in transect 10. All juveniles recorded as dead were also damaged by fire. No stressed or diseased Mulga were noted in any transects. It is important to note that the identification of dead Mulga juveniles was difficult especially in areas where similar plant forms were found (e.g. *Acacia ayersiana*).

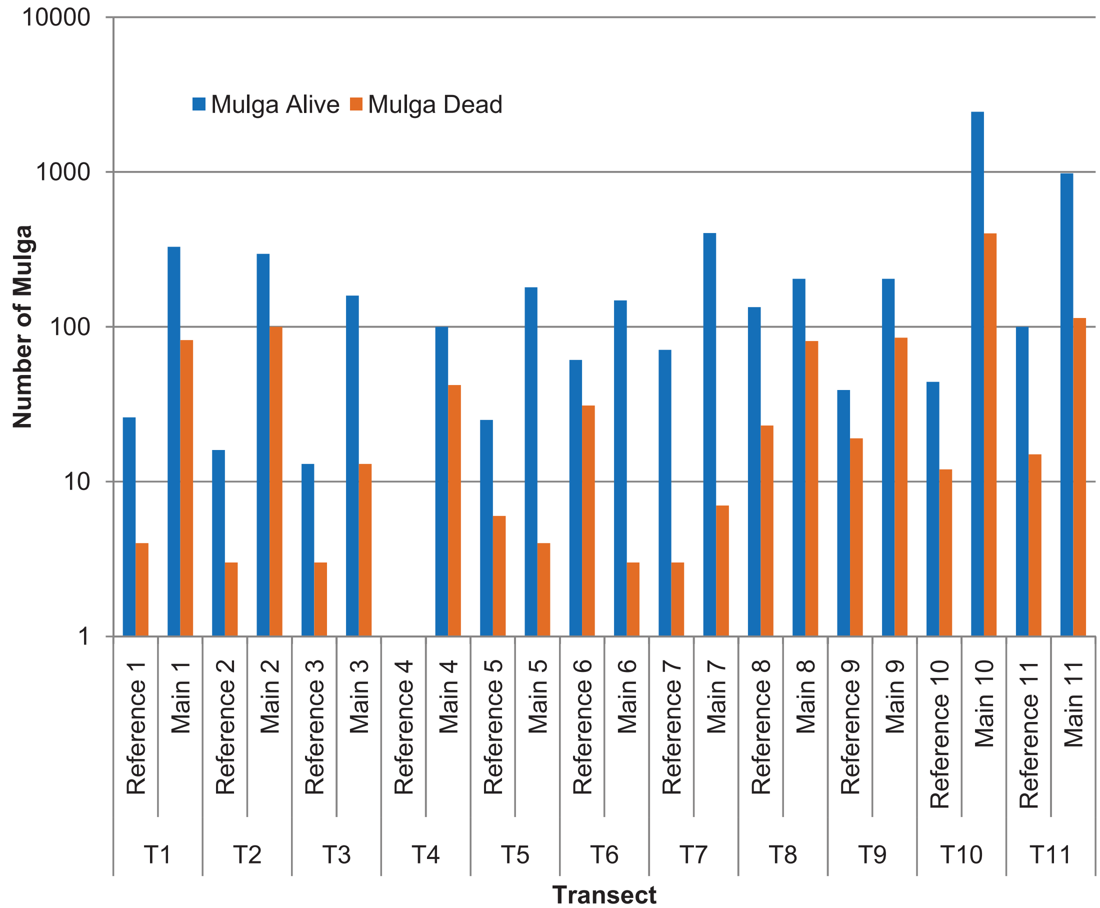

Figure 7 Total number of alive and dead Mulga (including juveniles and mature) per transect

3.4.2 Mulga Age Structure

All transects with the exception of reference transect 4 had Mulga present. The mature and juvenile age classes were present in all transects with seedlings recorded only in the reference transect 11 (i.e. transect apparently not recently fire-affected). Most of the resprouts were less than 2m tall and were present in all transects affected by recent fire (within the last ~5-7 years). The number of mature trees and juveniles appears to also correspond to evidence of fire, with transects 10 and 11 not burnt by recent fires having the highest number of mature trees. Data presented in Table 3 outlines the population structure for all transects surveyed.

Table 3 Summary of Mulga Transect Data

Transect Number	Transect Type	Mature Alive	Mature Dead	Juveniles Alive	Juveniles Dead	Seedlings Alive	Seedlings Dead	Resprouts
T1	Reference 1	4	15	12	0	0	0	6
	Main 1	81	55	161	1	0	0	6
T2	Reference 2	2	25	8	1	0	0	4
	Main 2	99	66	87	1	0	0	11
T3	Reference 3	3	40	6	0	0	0	1
	Main 3	12	74	113	1	0	0	22
T4	Reference 4	0	0	0	0	0	0	0
	Main 4	41	49	11	1	0	0	7
T5	Reference 5	6	1	13	0	0	0	0
	Main 5	4	40	172	0	0	0	0
T6	Reference 6	17	46	27	14	0	0	0
	Main 6	3	72	142	0	0	0	0
T7	Reference 7	2	21	67	1	0	0	0
	Main 7	5	87	391	2	0	0	2
T8	Reference 8	23	16	83	0	0	0	5
	Main 8	77	62	42	4	0	0	8
T9	Reference 9	19	9	1	0	0	0	0
	Main 9	85	39	34	0	0	0	0
T10	Reference 10	12	5	20	0	0	0	0
	Main 10	366	55	1715	35	0	0	0
T11	Reference 11	13	3	73	2	1	0	0
	Main 11	112	51	757	2	0	0	0

3.4.3 Mulga Density

The Mulga density figures for each transect segregated in age classes are presented in Figure 8. The highest Mulga density is recorded in transects which were not affected by recent fires (transects 10 and 11). The mature Mulga density varies between 0.1 - 7.8 trees, juveniles between 0.8 - 36.5 and resprouts between 0.1 – 0.6 per 100m2. seedlings were noted in transect 11, the Mulga community least affected by fire.

A summary table indicating individual values used to produce Figure 8 are included in Appendix 5.

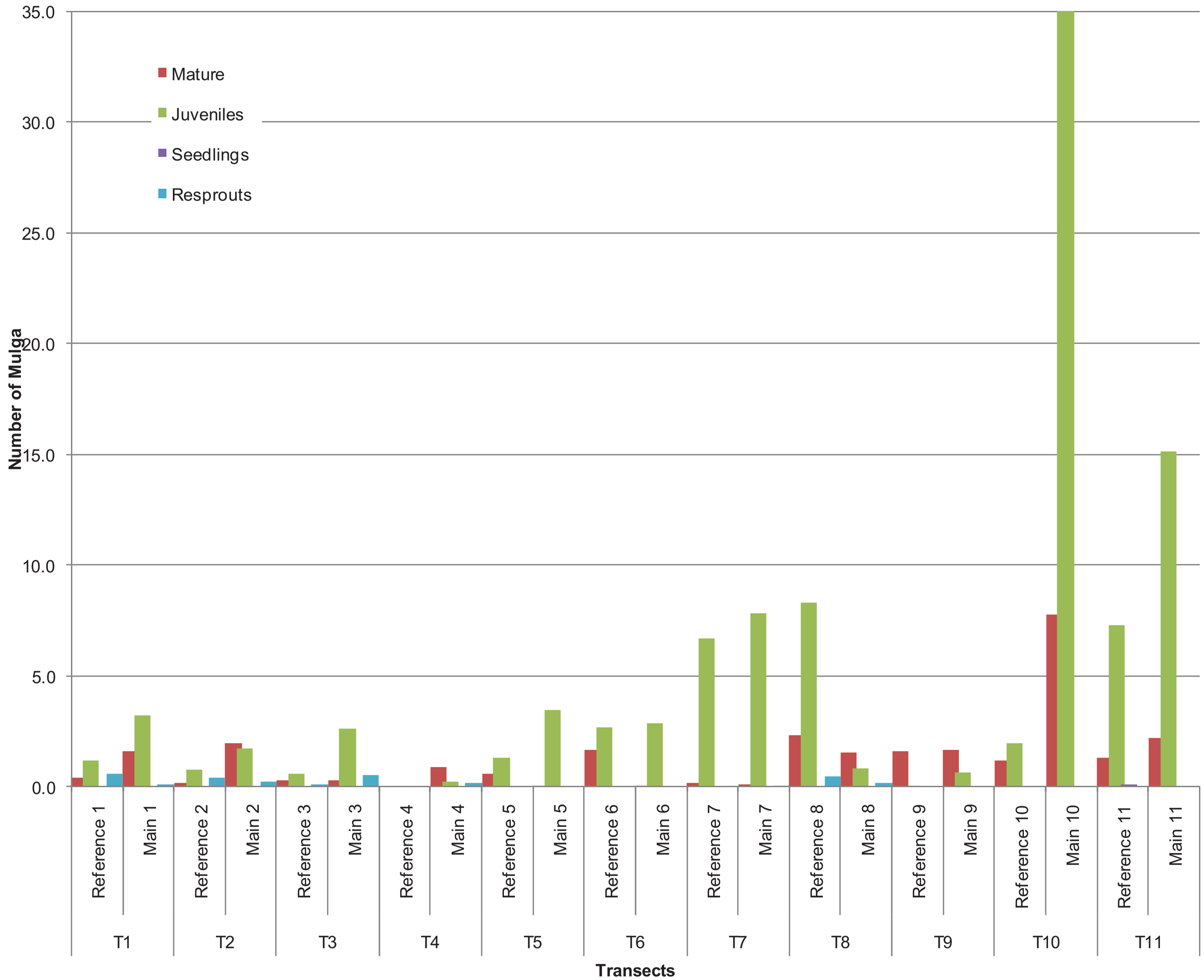

Figure 8 Mulga density per 100m^2

3.5 EROSION

Erosion monitoring was not completed in the first visit to the site as no erosion markers could be installed due to statutory approvals. However, erosion was noted within transects.

In general, no 'significant' erosion (i.e. see Figure 9 for example) was noted in most transects. transects 10 and 11 were the most affected by erosion, showing a number of large pot holes and rills for most of the transect length, and some root exposure.

Figure 9 Examples of Erosion in Transect 11.

Note: Arrows show erosion points in the landscape and exposed Mulga roots.

4.0 FLORISTIC PLOTS

The results for floristic plots (one per reference and two per main transect) are presented in Appendix 2. The species list for each plot is presented in Appendix 3.

NOTE. The information presented is a preliminary only and is pending confirmatory identification. Further notes on the floristic composition will be added once data from the second survey is available and the confirmation of Mulga varieties provided.

5.0 WEEDS

No declared weeds were recorded during the survey. With the exception of buffel grass, which was recorded on one occasion (transect 6) no other weeds were recorded. Due to the timing of the survey and the heavy grazing by cattle it is not known if the areas surveyed have other species of weeds. Weeds will be collected and identified during the April 2010 visit to the site.

6.0 NEXT STEPS

The following additional tasks are required to complete this baseline report:

1. Revisit site once PEAHA approvals are obtained to install baseline erosion stakes and undertake erosion measurements. This is expected in April 2010, and will need to be done prior to construction of the proposed railway.
2. Follow up survey for floristics after sufficient rainfall - expected in April 2010.
3. Follow up survey to confirm Mulga varieties - expected in September 2010.

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APPENDICES

Appendix 1 Syrinx Environmental PL. (2010) *Chichester Deviation Mulga (Acacia aneura) Monitoring Methodology.*

TECHNICAL REPORT

CHICHESTER DEVIATION MULGA (*ACACIA ANEURA*) MONITORING METHODOLOGY

FOR FLUOR SKM IRON ORE JOINT VENTURE

DECEMBER 2009

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1.0 INTRODUCTION

BHP Billiton Iron Ore (BHPBIO) is seeking approval under Part IV of the Environmental Protection Act 1986 for the proposed construction of a new section of rail through the Chichester Ranges (Chichester Deviation) as part of Rapid Growth Project 5 (RGP5). The environmental impact assessment of the Chichester Deviation highlighted the requirement for a Mulga Monitoring Program as the project traverses sheet flow dependent Mulga communities.

Fluor SKM Iron Ore Joint Venture (FAST) has requested Syrinx Environmental PL (Syrinx) to undertake the preparation and execution of a Mulga Monitoring Program.

The objectives of the overall Mulga Monitoring project are to:

- Prepare a Mulga Monitoring Program in consultation with the Department of Environment and Conservation (DEC) to evaluate the impact on sheet flow dependent Mulga vegetation downstream of the Chichester Deviation railway; and
- Conduct a baseline Mulga vegetation condition assessment prior to commencement of construction.

This report presents the proposed methodology for the Mulga Monitoring Program as well as a background to the development of the methodology.

1.1 THE STUDY SITE

1.1.1 Location

The study site is approximately 220km south of Port Hedland and 150km north-west of Newman within the Pilbara region of Western Australia, as shown in Figure 1.

1.1.2 Topography and Soils

The study site is located on the Jamindie landsystem and has been classified as level to gently undulating hardpan wash plains with mantles of ironstone grit and pebbles, minor stony plains, low rises and occasionally low ridges with relief up to 30 meters (van Vresswyk, 2004). These landform units are vulnerable to erosive forces, especially in the intergrove areas where sediment is removed and deposited in the groves creating varied surface roughness between groves and intergroves.

1.1.3 Vegetation

Ecologia (2008) mapped the vegetation communities along the railway corridor and identified areas of sheet flow dependent vegetation within the project area. The vegetation types and landform descriptions within the sheet flow area are described by Ecologia (2008) as:

Vegetation Type 3: *Acacia aneura* low Woodland on clay flats

Landform description: Open areas of hard clay pans with common ferrous pebbles

- *Acacia aneura* var. *aneura* low woodland, over varying *Dodonaea petiolaris* and *Sida* sp. unisexual (N.H. Speck) Shrubland over *Aristida contorta* open tussock and *Triodia pungens* very open hummock grassland

Vegetation Type 9b: *Acacia aneura* low open forest

Landform description: Drainage channel on rocky hill slopes, stones and boulders of ironstone

- Scattered *Eucalyptus leucophloia* subsp. *leucophloia* tall to medium trees, over *Acacia aneura* var. *intermedia* low open forest, over *Dodonaea petiolaris* open heath, over *Eriachne mucronata* tussock grassland.

Criss-cross patterns of sheet flow result in intersecting grove patterns (Mabbut and Fanning 1987). Preliminary aerial photography analysis indicates intersecting grove patterns may be present at the project site.

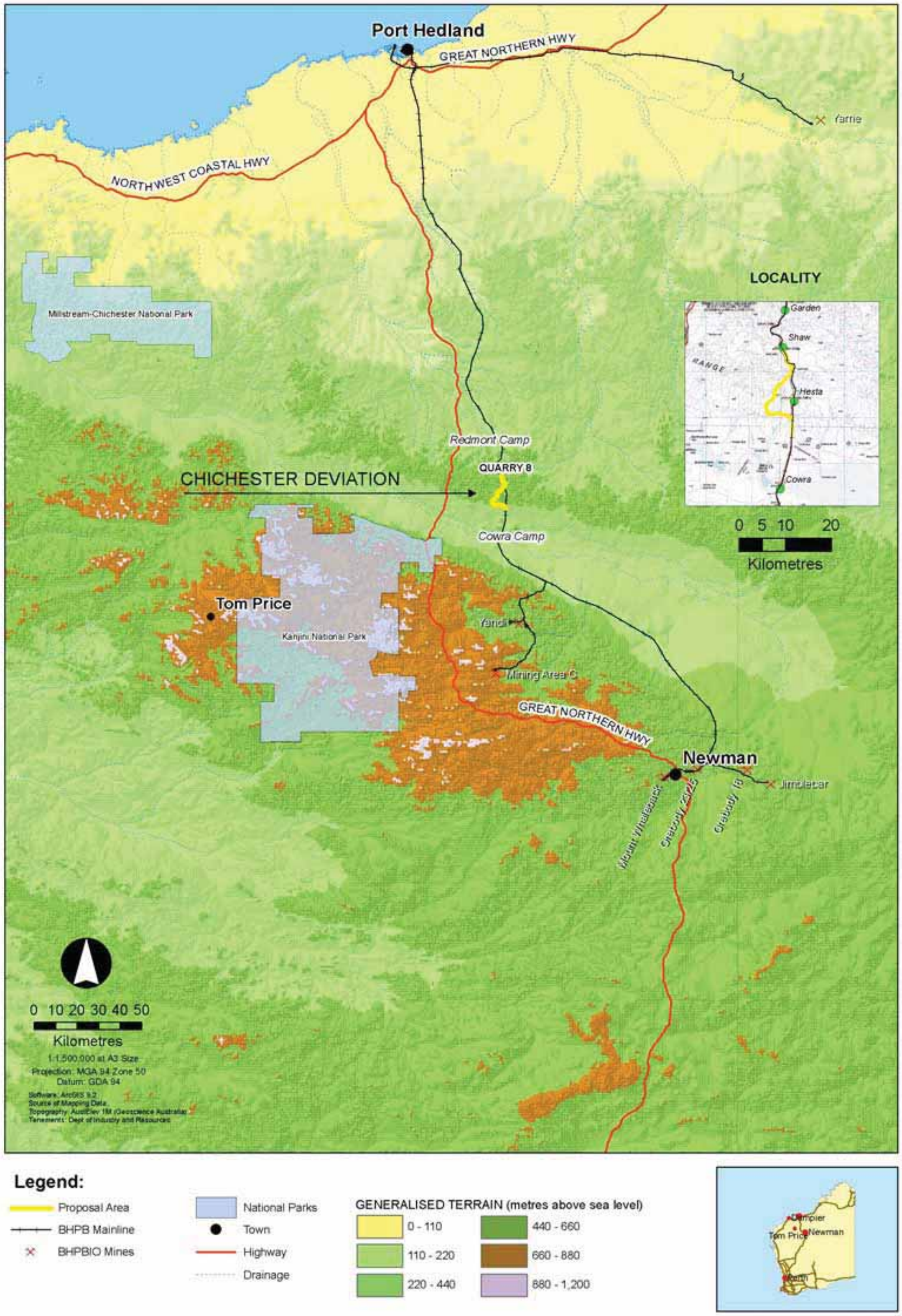

Figure 1 Location of the study site (BHPBIO, 2009)

2.0 BACKGROUND REVIEW

2.1 MULGA (ACACIA ANEURA) IN AUSTRALIA

Acacia aneura Woodlands cover over 20% of the Australian continent (Johnson & Burrows 1981) within arid and semiarid (200–500mm mean annual rainfall) areas of Australia. *Acacia aneura* is able to survive under low and variable rainfall and high evaporation due to a number of adaptations, including spatial patterning such as forming Mulga bands (Johnson and Burrows 1981).

In Western Australia, Mulga can form vegetation bands with areas of distinct groves and intergroves of varying width between groves depending on landform and soils (Wilcox and Fox 1994). This form of vegetation structure is typical of other semi-arid regions such as central Australia (Slatyer 1961) and western New South Wales (Anderson and Hodgkinson 1997) and south east Queensland (Erskine *et al*. 1996). The vegetation has been termed 'banded Mulga' (Anderson and Hodgkinson 1997), 'vegetation banding' (Mabbutt and Fanning 1987) or banded mosaics (Dunkerley and Brown 1999). All describe the same form of vegetation consisting of groves of Mulga with corresponding intergroves.

The grove vegetation forms its own microenvironment that favours the growth of seedlings and establishment and survival of the vegetation (Mabbutt and Fanning 1987). In Western Australia the downslope distance between bands ranges from 70m to 500m, although more commonly this distance is between 100 and 250m. The intergroves are commonly between two and four times as wide as the band (Mabbutt and Fanning 1987).

Intergroves are usually bare except for annual grasses, such as those present on the surface water run-on areas into groves (Mabbutt and Fanning 1987). Intergrove areas, and stony surface strew in the Pilbara, are typically noted for their less favourable plant-water relationships due to factors such as low infiltration capacities (Dunkerley, 2002) and soil moisture deficiency (Mabbutt and Fanning 1987).

The pattern of surface water run-off and run-on is the most important property that sustains the banded Mulga (Dunkerley and Brown 1999). Other parameters associated with Mulga banding include subdued microtopography (Mabbut and Fanning 1987). These parameters are expanded on in the sections below.

2.1.1 *Acacia aneura* taxonomy

Acacia aneura forms a highly variable species complex with individual variants differing in growth form, phyllode shape size and colour and pod morphology (Miller *et al*. 2002). Historically the variability was only commented on during previous decades (Pedley 1973, Johnson and Burrows 1981, Burrows and Fox 1983) with taxonomic descriptions provided relatively recently in Flora of Australia (2001), and further guidance to the variations provided by Miller *et al.* (2002). Currently there are 10 *Acacia aneura* variants recognised.

Most differences in *Acacia aneura* varieties lie in the phyllode and pod morphology. In addition, the tree habit can also show differences (Miller *et. al.* 2002). Using phyllode shape as the only method of identification can provide misleading results as the same tree can have different shaped phyllodes at different levels of the tree crown or at different ages.

Genetic analysis has indicated that out of 24 morphotypes over 95% are genetically identical. This suggests that Mulga may reproduce by facultative apomixes (asexual reproduction through seed) (Miller *et al.* 2002). The Mulga complex is also considered to be polyploidic at least in part and only diploid specimens were grown outside of Australia, however it is not specified how much this influences the variation in Mulga. Some Mulga varieties can also show retention of juvenile features in adult plants (neotony) (e.g. phyllodes in Holey Mulga) (Miller *et al.* 2002).

Currently no literature exists on the different ecological requirements of the 10 *Acacia aneura* variants, or any potential differences in their response to disturbances to sheet-flow hydrology.

2.2 MULGA AND SHEET FLOW

Sheet flow refers to a surface water flow over ground surface as a thin layer not concentrated in a channel (BHPBIO, 2009). Sheet flow has been reported to occur in slopes ranging from 0.2 -2% (Mabbutt and Fanning 1987; and Ludwig and Tongway 1997) which usually support Mulga vegetation communities.

The major factors affecting sheet flow (run-off, run-on) are the grade of slope and the length of slope. The slight variation of topography and the slope allows for the formation of water sheet flow and is responsible for maintenance of typical Mulga patterned vegetation through retention of resources (water, soil and nutrients) in the landscape. Interruption to the sheet flow can cause detrimental effects to Mulga due to water and nutrient run-off (Ludwig and Tongway 1997). Indicators of water stress in the Mulga are both biotic and abiotic. Biotic water stress indicators are related to the flora and fauna health, whereas abiotic indicators would be changes in soil and micro-climatic attributes.

In general, the surface water drainage in the survey area flows in a south westerly to southerly direction mostly perpendicular to the railway line with a low sloping gradient away from the railway line.

The main issues with maintaining sheet flow in the project area are:

- Blockage of culverts by sediment and organic matter upstream of the railway and the consequent ponding;
- Possible erosion of the land downstream of the railway (through increased water velocity in the culvert) which can impact on vegetation by altering surface water flow patterns, introducing sediments and organic matter or by diverting water to other areas (e.g. via the access road).

2.3 ECOLOGICAL REQUIREMENTS AND CONDITION ASSESSMENTS

A significant number of studies have been conducted across Australia to determine a wide range of ecological requirements of *Acacia aneura* (e.g. Miller *et al*. 2002, Fox 1985, Williams 2002). These studies are published in a wide range of literature types from refereed journal articles to compliance reporting to comply with environmental assessment requirements. Much of the research to date has focussed on its fodder values (Pressland 1975), floristic composition (van Leeuwen *et al.* 1995, Wilcox and Fox 1994, Burrows and Beale 1969) or as part of rangeland condition assessment (Watson *et al.* 2001, Tongway and Smith 1989).

The first regional assessment of vegetation condition methodology in Western Australia was the Western Australian Rangeland Monitoring System (WARMS) implemented in 1993, with results published in 2007 (Watson *et al*. 2007). Both quantitative and qualitative data was collected. Unfortunately, the monitoring methodologies used resulted in difficulties in interpretation of data (Watson *et. al.* 2007), reiterating the importance of a suitable methodology which will allow for collection and interpretation of meaningful data.

Within the Pilbara, Syrinx recently conducted a study of widespread change in vegetation condition at Roy Hill station for BHPBIO (Syrinx Environmental PL 2005 a and b). The study included fieldwork, pathology studies and analysis of remote sensing data to identify the potential reason for the widespread decline of Mulga in the upper Fortescue Valley. Another recent Mulga monitoring project in the Pilbara includes Rio Tinto's monitoring of the impact of a railway on sheet flow dependent Mulga as part of the Marandoo mining operations (Batini 2008).

By exploring the relationship between vegetation health and prevailing environmental conditions, spatial and temporal data has been used to assist in identifying the most probable cause of a decline in vegetation health. As plants often show similar responses to different sources of stress, especially when the triggering cause is water stress (Chapin 1991), the selection of parameters to be measured is critical to determining the source of the stress if a change in Mulga health is observed.

2.4 *ACACIA ANEURA* WITHIN THE STUDY AREA

In the Pilbara Mulga is a dominant component of the vegetation, where the mosaic arrangement of Mulga woodlands and hummock grasslands is determined in part by the region's fire history (van Leeuwen *et al.* 1995). Understorey perennial grasses of Mulga woodlands vary, ranging from *Aristida obscura* and *Triodia melvillei* in the Hamersley Ranges (van Leeuwen *et al.* 1995), to *Eragrostis eriopoda* along drainage lines (Wilcock and Fox 1994). This variation is typical in Mulga woodlands where the understorey is commonly floristically independent of the overstorey and more an artefact of landscape position, soil types and water/nutrient availability.

The project area is in the southern Chichester Ranges and represents the most north western distribution of *Acacia aneura* (Kendrick 2001) after which it is replaced by *Acacia xiphophylla* which dominates the Chichester Ranges (Wilcox and Fox 1994). Three *Acacia aneura* variants have been recorded in the study area, although two of the variants have been identified as possible variants only, indicating the difficulty in delineating between the variants.

3.0 DEVELOPMENT OF FIELD INVESTIGATION METHODOLOGIES

The investigations are aimed towards identifying any changes to mulga health and/or the associated understorey species as a result of construction of the railway deviation and associated road and support infrastructure. The approach is to use an initial baseline study to characterise vegetation health before construction works commence, and use this as the reference data for monitoring any changes with time.

A preliminary methodology for conducting this study was developed by BHPBIO (BHPBIO, 2009) in conjunction with the DEC in July 2009. This has formed the basis of developing the detailed methods described here. The detailed methods here in turn have been derived from previous approaches used by referencing the above literature, or where not available, drawing on standard ecological monitoring tools and adapting these as appropriate to meet the objectives of the study. A database was built from the literature review collating feasible methodologies and information on the stress indicators for a range of parameters.

3.1 POTENTIAL MONITORING PARAMETERS

A range of parameters proposed for assessment as part of the baseline and future monitoring events are discussed below. Each parameter is first reviewed within the knowledge context for the specific subject, and a stress indicator derived. Methods for assessing each stress indicator, except fire, are then detailed in the following sections.

3.1.1 Mulga Population Structure

3.1.1.1 Context

The population structure of Mulga woodlands is dependent on several factors including frequency of fire (van Leeuwen 1995), rainfall, landforms, soil types (Wilcox and Fox 1994) and microtopography (Burrows and Beale 1969).

Mulga is believed to live for about 250 years (Crisp 1978), implying that successful establishment of new plants need not be a frequent event. Once trees are established, they do not grow in height and retain the same branching pattern and crown shape (Fox 1980). The demographic structure of Mulga reflects their fire history (Nicholas *et al*. 2009).

Seedlings are usually scarce in areas under grazing pressure (Fox 1980). Plant species succession of the herbaceous understorey therefore can provide a better surrogate for looking at consequences for vegetation of altered hydrological processes (Montana *et al.* 2001) however assessment of this can be problematic in the Pilbara due to the episodic nature of rainfall. Dead branches are not a good indicator of plant health as they would require a baseline to compare against what is considered a 'normal' amount of branch death that occurs naturally with senescence in *Acacia aneura.*

3.1.1.2 Stress Indicator

Increase in number of dead Mulga, especially juvenile Mulga which are more sensitive to changes in surface water flow.

3.1.2 Groundcover - Grasses

3.1.2.1 Context

On the Mulga band upslope, fringe soil moisture dynamics influence both germination and establishment of herbaceous plants and impact on the vegetation dynamics of the community. Perennial grasses are a common component of the understorey of Mulga woodlands. The loss of grasses and biological crusts can promote erosion and subsequent degradation and loss of Mulga (Tongway and Ludwig 2007).

Removal of perennial grasses shortens the period of water supply to *Acacia aneura* plants in Mulga groves and they prematurely die during low rainfall periods (Anderson and Hodgkinson 1997). When grass cover is reduced, seedling recruitment can become lower on the upslopes of the grove, with a high mortality on the downslope as there is a lower capture of sheet flow in the interception zone before the grove (Anderson and Hodgkinson 1997).

Impacts of land degradation are evidenced by a decrease in plant productivity, particularly of forbs and grasses, and less so for trees and shrubs. The earliest indicator of degradation is the death of perennial grass species (Valentini *et al.* 2001).

3.1.2.2 Stress Indicator

A reduction in cover of perennial grasses would provide a surrogate for water stress.

3.1.3 Microtopography

3.1.3.1 Context

Microtopography has been a parameter recorded in various Mulga studies (Dunkerley and Brown 1999). Microtopography is the series of unconnected micro-depressions or bowl-shaped structures several millimetres deep and about 5- 50cm across the landscape (Tongway and Hindley, 1995). The roughness of the soil is of great significance for the behaviour of run-off and erosion-deposition processes (Seighery and Dunkerly 2001).

Microtopography can influence vegetation cover, water infiltration rate, water storage capacity and deposition of organic matter and as a result the health of the vegetation. Altered surface hydrology can result in changes to the microtopography of a site, with increased run-off and less litter accumulation and impact on the soil structure. This would influence water infiltration rates and subsequently water supply to Mulga.

Such features within the Mulga groves enhances stability, longevity and the soil condition through the accumulation and retention potential of sediments and water that may otherwise be lost to erosive forces such as wind and sheet flow. With the decreased surface roughness in the intergroves the run-off rate is increased and sediment deposition is captured within the groves. The banded landscape occurs in such a way that interception, run-on and run-off are easily identifiable. The run-off zone is relatively smooth and is the area least influenced by microtopography, here the loose sediment is easily transportable by sheet flow, which is captured further down in the interception and run-on zone (i.e. zone of forbs and Mulga groves respectively) (Dunkerley and Brown 1999). The interception zone is generally vegetated with grasses and will be identifiable in the field, as in this zone sediment and small stones from the smooth run-off zone accumulate.

3.1.3.2 Stress indicator

Any significant changes in the rate of erosion and deposition would provide an early indication as to the capability of the study site to capture water and retain sediment and prevent water stress during the drier months.

3.1.4 Fire

3.1.4.1 Context

Fire is usually frequent in arid areas and influences Mulga populations. Mulga does not typically resprout after fire, however *Acacia aneura* var. *tenuis* (Nicholas *et al.* 2009), has been observed resprouting from fire. In the Pilbara Mulga woodlands which have a higher frequency of fire are characterised by a below average number of extant plants, especially on midslope pediments of the Hamersley range (van Leeuwen *et al.* 2005), south of the project area.

The interval of fires does not impact below 1cm in the soil profile of Mulga woodlands, however soil respiration declines linearly with increasing number of fires and increasing total fuel load. Phosphorus and potassium, derived from the ash from the artificial fuel, builds up in the soil proportionately with increased fire number and total fuel load (Tongway and Hodgkinson 1992).

Change in sheet flow is not expected to directly impact on fire frequency or intensity and therefore there is no stress indicator described. However, given the frequency of fires in the Pilbara it is likely fire can impact either the study site between monitoring events and must be taken into account when analysing data.

4.0 MONITORING PROGRAM

4.1 MONITORING APPROACH

The methods described below are conservative measurements and a pragmatic approach will be taken. The data collection methods will be refined in the field as required. The intent is to collect all data described below unless logistically not possible (e.g. too many seedlings) or if the data is not useful for the outcomes of the project. If this is the case, then data collection methods will be amended in the field. For example, seedlings may be only counted every third quadrat if they are too numerous to count along the whole transect.

4.2 TRANSECTS AND PLOTS LAYOUT

4.2.1 Rationale

The transect length and location have been designed to assess disturbance spatially, both in the distance away from the railway and also along the railway. The size and number of plots have been designed to capture at least 1% of the Mulga sheet flow area. Of the 112ha of sheet flow it is proposed to monitor is 6.96ha.

4.2.2 Transects

The baseline monitoring will use random stratified 10m x 580m transects (a 500m 'main' transect and a 80m 'reference' transect).

The monitoring program will consist of transects perpendicular to the railway (or flowline if it is not perpendicular to the railway) to assess disturbance in distance away from the railway. 500m of the transect (the 'main transect') will be downslope of the railway and 80m will be upslope of the railway line and act as a reference site. The distance of the main transect will be reviewed after the first monitoring event.

During the baseline event the monitoring will commence at the midline of the railway line, acknowledging that after construction the beginning of each transect will be removed. The lengths of the transects have allowed for this so that post –construction there will be an approximate minimum of 450m for the main transect and 50m for the reference transect,

Transects will be placed in areas of proposed fill where sheetflow has been interrupted between chainages D234 and D242. There will be a total of 12 transects which represent a total of 6.96ha. The erosion markers installed every 20m will delineate the location and extent of the transect centre line. A GPS location will be taken at the start and end of each transect.

4.2.3 Floristic Plots

Up to five floristic plots will be located along each transect. These will be placed within Mulga groves, therefore the actual number of plots will depend on the presence of Mulga groves along the transect (Figure 2).

The floristic plot size will be 10m^2. The transect boundary will form one side of the floristic plot. Field recording sheets indicating parameters to be recorded within the floristic plots are outlined in Appendix 1.

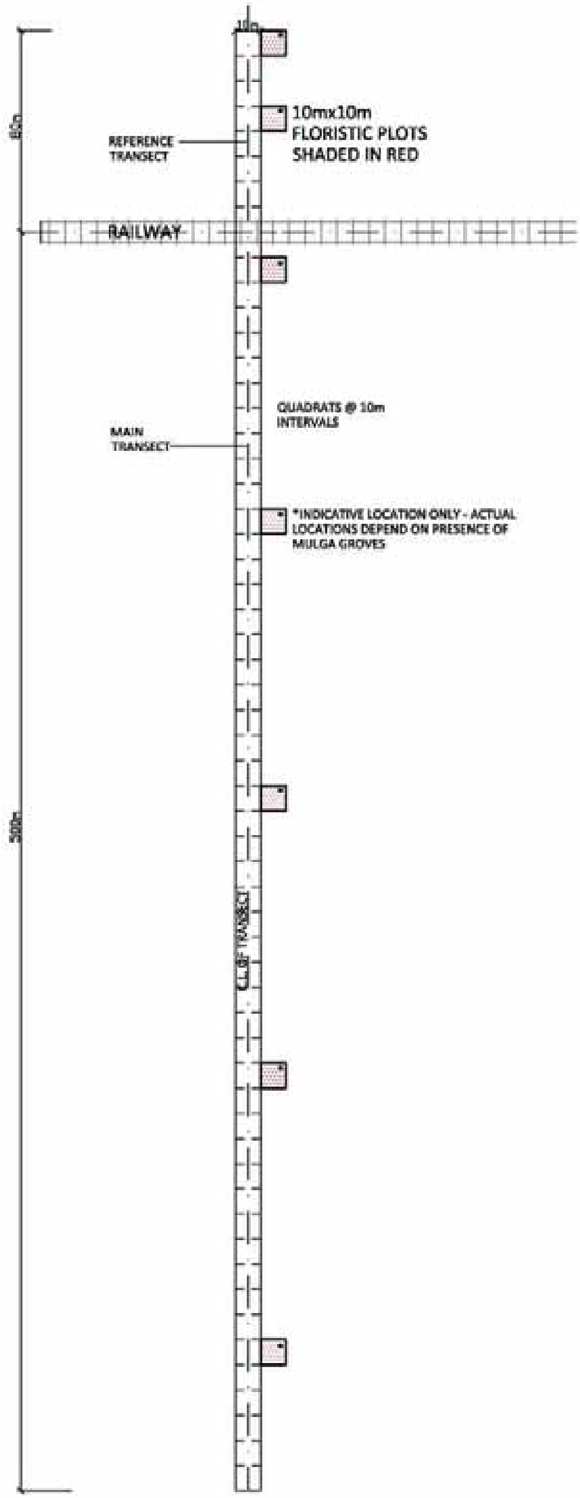

Figure 2 Transect and floristic plot layout

4.3 ASSESSMENT METHODS

The assessment methods described below can be used as surrogates to identify changes in vegetation condition due to changed sheet flow. An example of a typical data recording sheet for the parameters is shown in Appendix 1.

4.3.1 Mulga Health

The health of each tree within the perpendicular and parallel transects will be assessed using the definitions described in Table 1. Photo references for each ranking will be provided in the final reporting. The assessments will also include visual assessment of shoot tips and buds of each tree

Table 1 Mulga Health measurement rankings

Ranking	Health Ranking	Health rating
1	Alive	A canopy cover of phyllodes present
2	Dead	No phyllodes on canopy and branches brittle (i.e. snap when broken) indicating no xylem flow.

4.3.2 Population Structure

The age classes of Mulga present will be assessed according to the definitions provided in Table 2.

Table 2 Age class assessment methods

Age Classes	Definition
Mature	Anything above 2m tall, and with ascending branches present, no phyllodes in 'clusters'.
Juvenile	Anything between 0.5 – 2m tall; may have phyllodes in 'clusters' at ends of branches; usually demonstrating a horizontal branching habit; and with possibly with some ascending branches present.
Seedling or resprout	Any plant that still has a cotyledon attached or less than 0.5m tall.

In addition, percentage cover of perennial grasses in each of 10m x 10m quadrats along the 500m main transect and 50m reference transect will also be recorded.

4.3.3 Mulga Density

The data collected for determining Mulga Health and Population Structure will also be used to determine a count of all Mulga in each quadrat, divided into age classes (see above). Only mature trees with the main trunk completely or partly within the quadrats will be counted (i.e. no trees with overhang recorded). Seedlings and juveniles will also be counted. Data will be added together to provide a total number of Mulga for the whole transect.

4.3.4 Erosion Assessment

The changes in ground surface level caused by erosion and deposition will be measured with fixed and graduated survey posts placed vertically in the ground: along the centreline of the main transect at 20m, intervals along the reference and main transect. The survey posts will be made of galvanised steel (fence droppers). The erosion and or deposition can then be measured from the top of the post to ground level.

4.3.5 Photographic Monitoring

Photo monitoring points will be set up at the start, middle and end of each transect, beginning with the end closest to the railway line. Photographic records are to be taken from the transect mid-point at a consistent height (actual height and distance from the erosion survey posts will be investigated during the baseline survey). Two photos will be taken looking down slope along the transect. The location of each photographic site will be recorded using a differential GPS.

4.3.6 Fire

Any evidence of fire will be recorded for each transect, as well as the time since last fire if easily identified.

4.3.7 Weeds

Six weeds species have previously been recorded in the study area. Presence of exotic species will be noted in each transect and any unknown species will be collected and identified. Particular attention will be given to Buffel grass (*Cenchrus ciliaris*) as it was previously recorded in the area (Ecologia 2008).

4.4 MONITORING FREQUENCY

The monitoring program will capture the first baseline in the first quarter of 2009 prior to railway construction. If the baseline survey data from the floristic plots is not considered sufficient due to the timing of the survey, a follow up trip to collect additional floristic data will be conducted in April – May 2010.

The baseline trip will be followed by a survey in April - May 2011 and then every second year after that until 2015. This will be followed with the final monitoring event in 2019. A review of the necessity to continue monitoring to be undertaken with the Department of Environment and Conservation (DEC) in 2013.

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APPENDICES

Appendix 1 Data Sheets

Chichester Deviation Mulga Health Monitoring - Transect Quadrat General Data

PAGE OF

Date:	**Evidence of Fire:**
Transect Number:	**Most Recent Rainfall Date:** **Volume (mm):**
Photo Number:	**BOM Weather Station Number:**
Data Recorders:	
GPS Location **Easting:**	
Northing:	

Distance along transect (m)	Number of Mature		Number of Juveniles		Number of Seedlings		Perennial Grass Cover (%)	Weed Cover (%)	General observations
	Alive	Dead	Alive	Dead	Alive	Dead			
0-10									
10-20									
20-30									
30-40									
40-50									
50-60									
60-70									
70-80									
80-90									
90-100									
100-110									
110-120									
120-130									
130-140									
140-150									
150-160									
160-170									
170-180									
180-190									
190-200									

Chichester Deviation Mulga Health Monitoring - Erosion Monitoring **PAGE OF .**

Date:
Transect Number:
Data Recorders:

Slope Aspect:
Evidence of Fire:
Surface Soil Colour/ Texture:

Distance along transect (m)	GPS		Photo	Erosion/ deposition measurement (mm)	General ground surface description: (e.g rills, vegetation cover within $2m^2$)
	Easting	Northing			
20					
40					
60					

BUSHLAND PLANT SURVEY RECORDING SHEET 1 (Keighery 1994, with modifications)

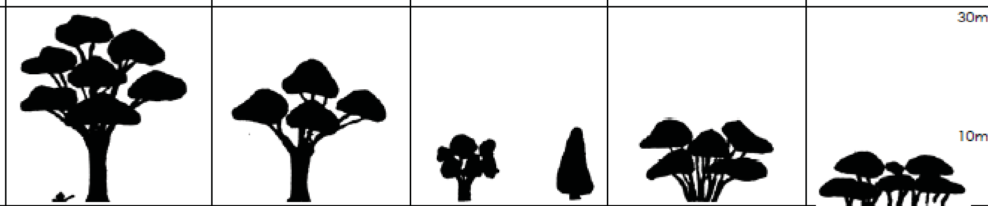
Date:	**GPS Location** **Easting:**
Transect Number:	**Northing:**
Photo Number:	**Evidence of Fire:**
Data Recorders:	**Surface Soil Colour/ Texture:**
Start Time:	**Slope: flat gentle steep** **Aspect: N NE E SE S SW W NW na**
End Time:	**Litter: %cover depth(cm)**
	Bare Ground: %cover

Location of the Floristic Plot

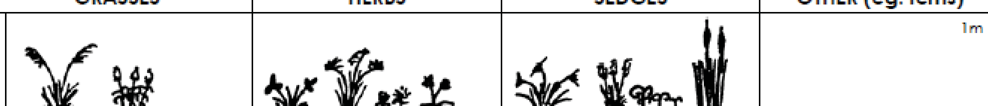
↑N

BUSHLAND PLANT SURVEY RECORDING SHEET 2 (Keighery 1994, with minor modifications)

Cover Class	2 – 10%	10 – 30%	30 – 70%	over 70%

	TREES			MALLEES	
	over 30m	10 – 30m	under 10m	over 8m	under 8m
GROWTH FORM					
COVER CLASS (%)	#	#	#	#	#
HEIGHT & CROWN COVER (NVIS)					
DOMINANT SPECIES					

	SHRUBS		SHRUBS
	over 2m	2m – 1m	under 1m
GROWTH FORM			
COVER CLASS (%)	#	#	#
HEIGHT & CROWN COVER (NVIS)			
DOMINANT SPECIES			

	GRASSES	HERBS	SEDGES	OTHER (eg. ferns)
GROWTH FORM				
COVER CLASS (%)	#	#	#	#
HEIGHT & CROWN COVER (NVIS)				
DOMINANT SPECIES				

4. VEGETATION CONDITION		
1 'PRISTINE'		COMMENTS (give reasoning for choice)
2 EXCELLENT		
3 VERY GOOD		
4 GOOD		
5 DEGRADED		

BUSHLAND PLANT SURVEY RECORDING SHEET 3 (Keighery 1994, with minor modifications)

SPECIES PRESCENCE **Label** each plant with **plant's number, site code, date and plant's name or working name if required**

From '*Bushland Plant Survey*' written by B. Keighery (1994) and published by the Wildflower Society of WA (Inc.), PO Box 64 Nedlands WA 6008.

Database SITE No	
Date	

Record on sheet
- **Column 1** **plant name**
- **Column 2** **plant number**
- **Column 3** **identification checked -** √ when checked

TREES	No	ID	SHRUBS (cont.)	No	ID	HERBS (cont.)	No	ID
MALLEES								
			GRASSES					
SHRUBS								
						SEDGES		
			HERBS					

Description of Structural Plant Community No. __

Appendix 2 Transect and Floristic Data

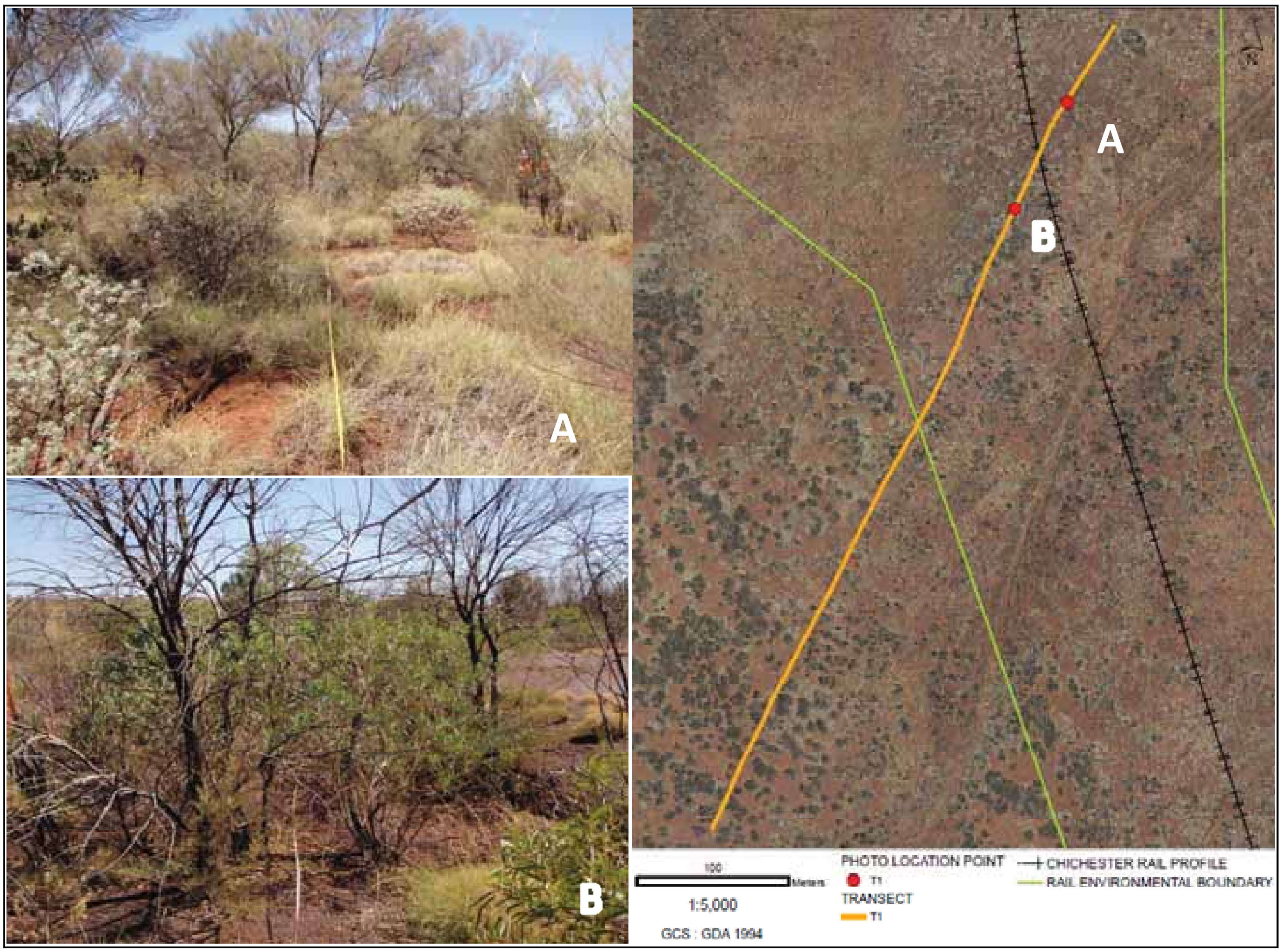
Note: Phtotos within each transect are taken from the 40m in the reference transect (A), and the 40m mark in the main transect (B).

TRANSECT 1

Observations: Gentle undulating landscape with evidence of minor channels created by surface water runoff. These channels occurred at 70-80m and 90-100m along the reference transect. This transect runs parallel approximately 70m to the west of a minor creekline. The main transect gently slopes away from the reference transect. The first 150m of the main transect has evidence of minor rills running perpendicular to the transect line.

Soil: Red hard pan with medium sized stones.

Ecologia (2008) Vegetation Classification Equivalent*: Acacia aneura* low woodland on the clay flats.



Floristic Plot Data

Reference Transect Floristic Plot 1

Vegetation Community	*Atalaya hemiglauca* low open woodland over *Acacia aneura var. tenuis* tall shrubland over *Triodia sp.* very open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	40m-50m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* and *Acacia pruinocarpa* tall shrubland over *Eremophila sp*. and ?Lamiaceae sp. open shrubland over *Triodia sp.* closed grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	50m- 60m

Main Transect Floristic Plot 2

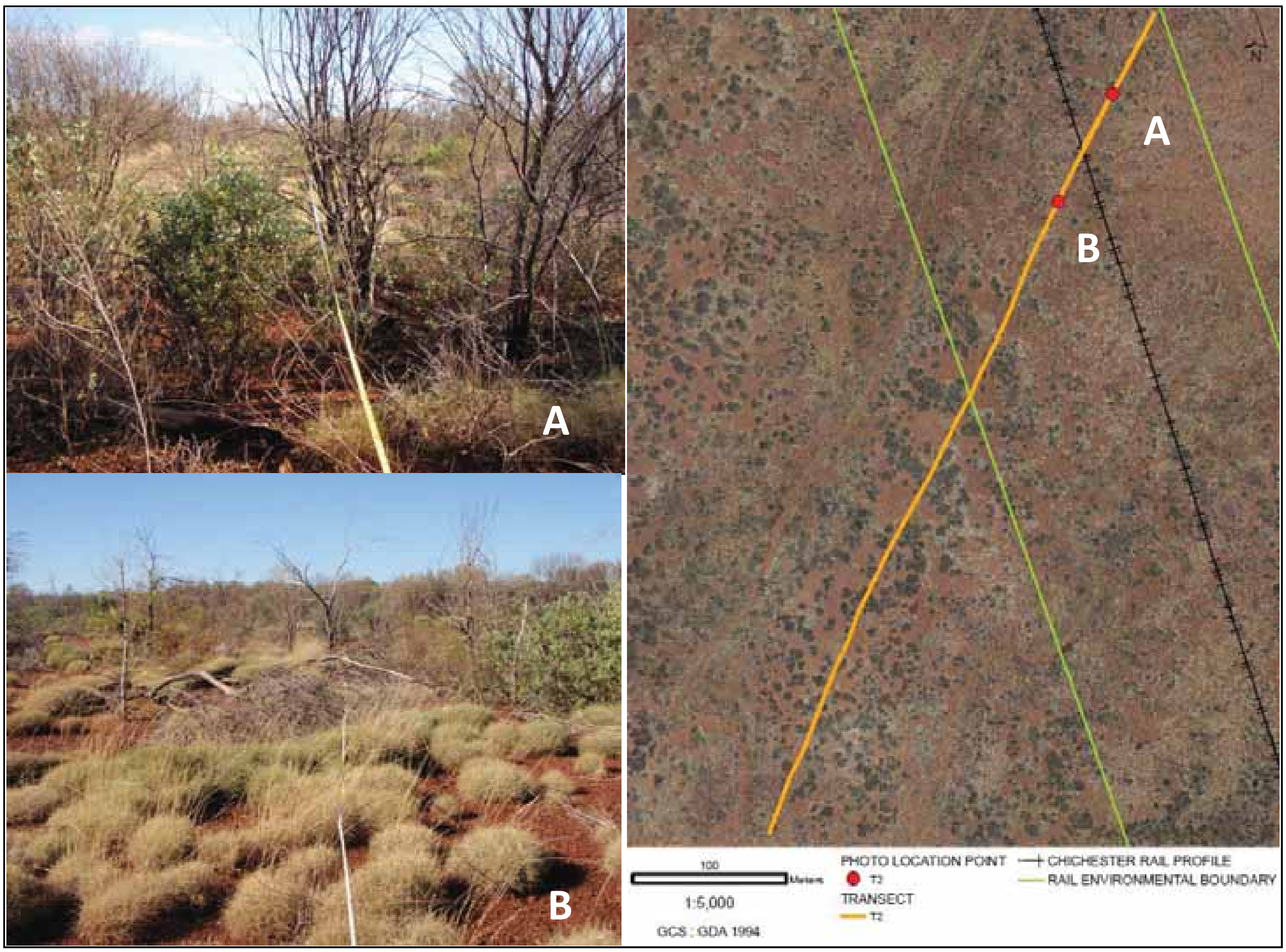
Vegetation Community	*Acacia aneura var. tenuis* and *Acacia pruinocarpa* tall open scrub over *Eremophila sp*. and ?Lamiaceae sp. open heath over *Triodia sp.* open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	360m – 370m

TRANSECT 2

Observation: This transect gently slopes towards a minor creekline which is running parallel approximately 50mto the west of transect. Slight surface undulation occurs at 420m of the main transect otherwise landform is fairly uniform throughout the length of the transect. This transect passes through some dense groves of Mulga of excellent condition. Majority of transect is unaffected by fire, although evidence of fire at 470m of the main transect was noted.

Soil: Red hard pan with medium sized stones.

Ecologia (2008) Vegetation Classification Equivalent: *Acacia aneura* low woodland on the clay flats.



Floristic Plot Data

Reference Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis and Acacia pruinocarpa* tall open scrub over *Acacia inaequilatera* shrubland over *Triodia sp.* open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	40m – 50m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* and *Acacia pruinocarpa* tall open scrub over *Acacia maitlandii* open shrubland over *Triodia sp.* very open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	50m - 60m

Main Transect Floristic Plot 2

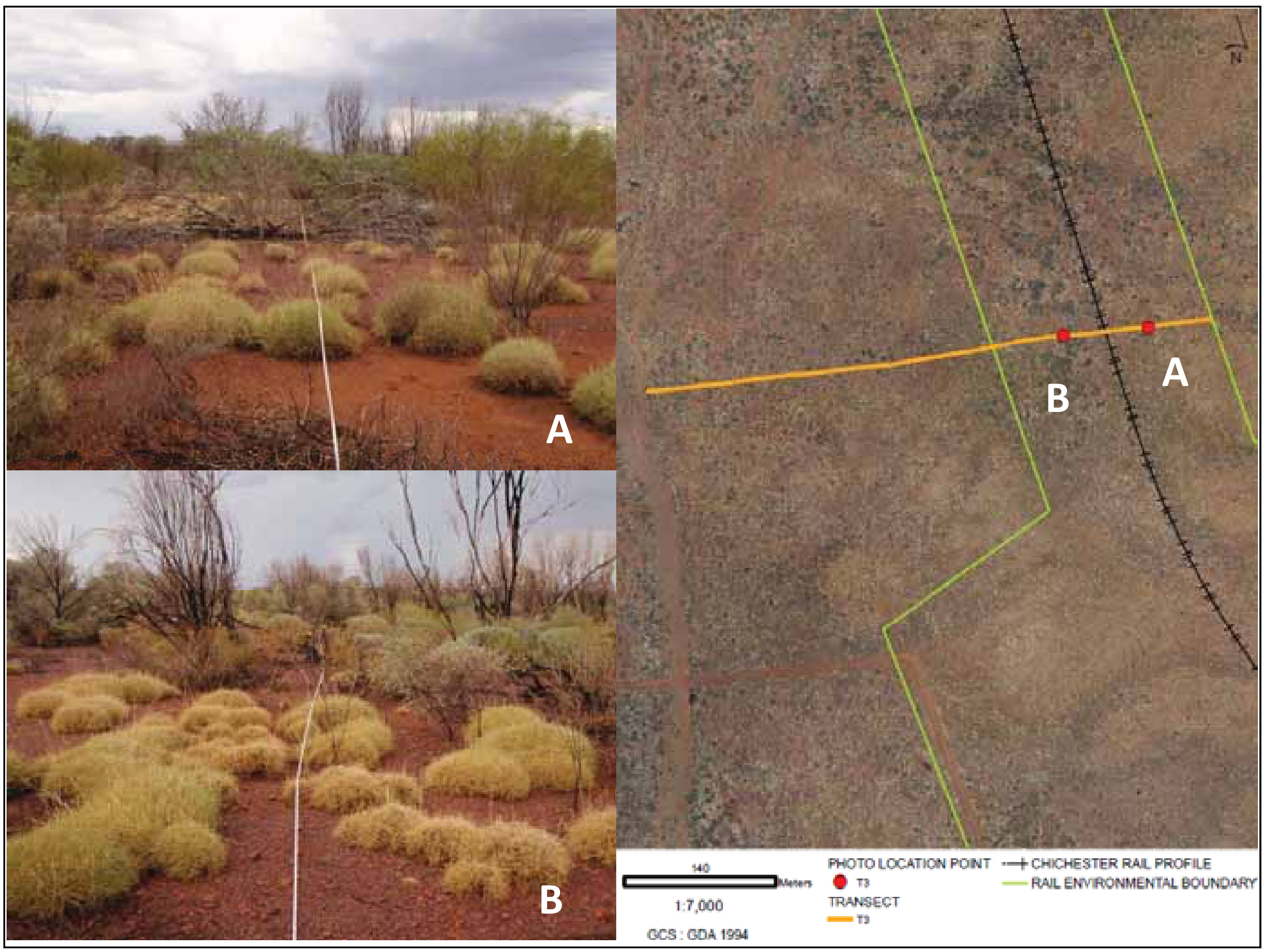
Vegetation Community	*Acacia aneura var. tenuis* tall open scrub over *Ptilotus sp. T2* low open shrubland over *Triodia sp. resinous* open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	230m – 240m

TRANSECT 3

Observation: This transect intercepts the drillers access road at 30m-40m of the reference transect. A slight elevation in the landscape occurs at 220m on the main transect consequently sloping gently into a minor creekline where transect terminates at 430m. Evidence of fire was noted along the entire length of the transect.

Soil: Red hard pan with medium sized stones. A change in the soil type from red hard pan with medium sized stones to a more clayey substrate was noted at 370m.

Ecologia (2008) Vegetation Classification Equivalent: *Acacia aneura* low woodland on the clay flats.



Reference Transect Floristic Plot 1

Vegetation Community	Acacia aneura var. tenuis tall shrubland over *Acacia inaequilatera* open shrubland.
Condition	
Weeds	None present
Distance along Transect	60m – 70m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* and *Acacia pruinocarpa* tall open shrubland over *Triodia sp.* very open grassland.
Condition	
Weeds	None present
Distance along Transect	50m – 60m

No Picture Available

Main Transect Floristic Plot 2

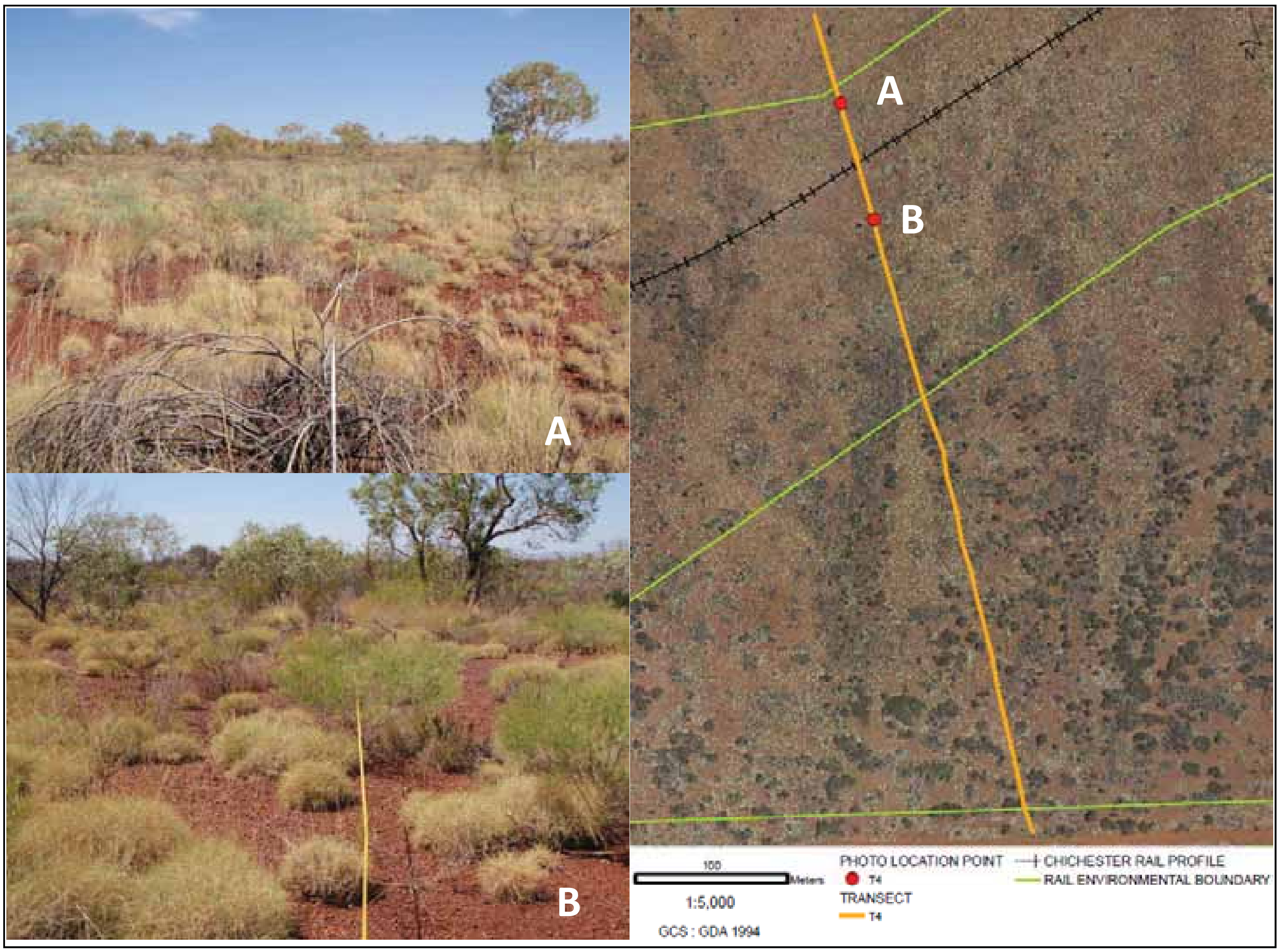
Vegetation Community	*Acacia aneura var. tenuis* all open shrubland over mixed low open shrubland.
Condition	
Weeds	None present
Distance along Transect	70m – 80m

TRANSECT 4

Observations: Gentle slope with southerly aspect towards main access track. Open areas of bare ground, and evidence of fire present. No Mulga were recorded in the reference transect. In the main transect the Mulga was first noted at 170m. Transect terminated at 460m at the main access road.

Soil: Red hardpan clay with medium sized stones.

Ecologia (2008) Vegetation Classification Equivalent: 3. *Acacia aneura* low woodland on the clay flats; 4a)Acacia aneura low open forest; 4b) *Acacia ayersiana* and *Acacia aneura* low open forest on the drainage areas at the base of the footslope; 8b) *Acacia aneura* low woodland on the steeper rocky hill slopes.



Reference Transect Floristic Plot 1

Vegetation Community	*Eucalyptus gamophylla* very open shrub over mixed low open shrubland over *Triodia sp.* open grassland
Condition	Excellent
Weeds	None recorded
Distance along Transect	70m- 80m

Main Transect Floristic Plot 1

Vegetation Community	*Eucalyptus gamophylla* open shrub malee over *Gompholobium karijini* open shrubland over *Triodia sp. T4* open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	40m- 50m

Main Transect Floristic Plot 2

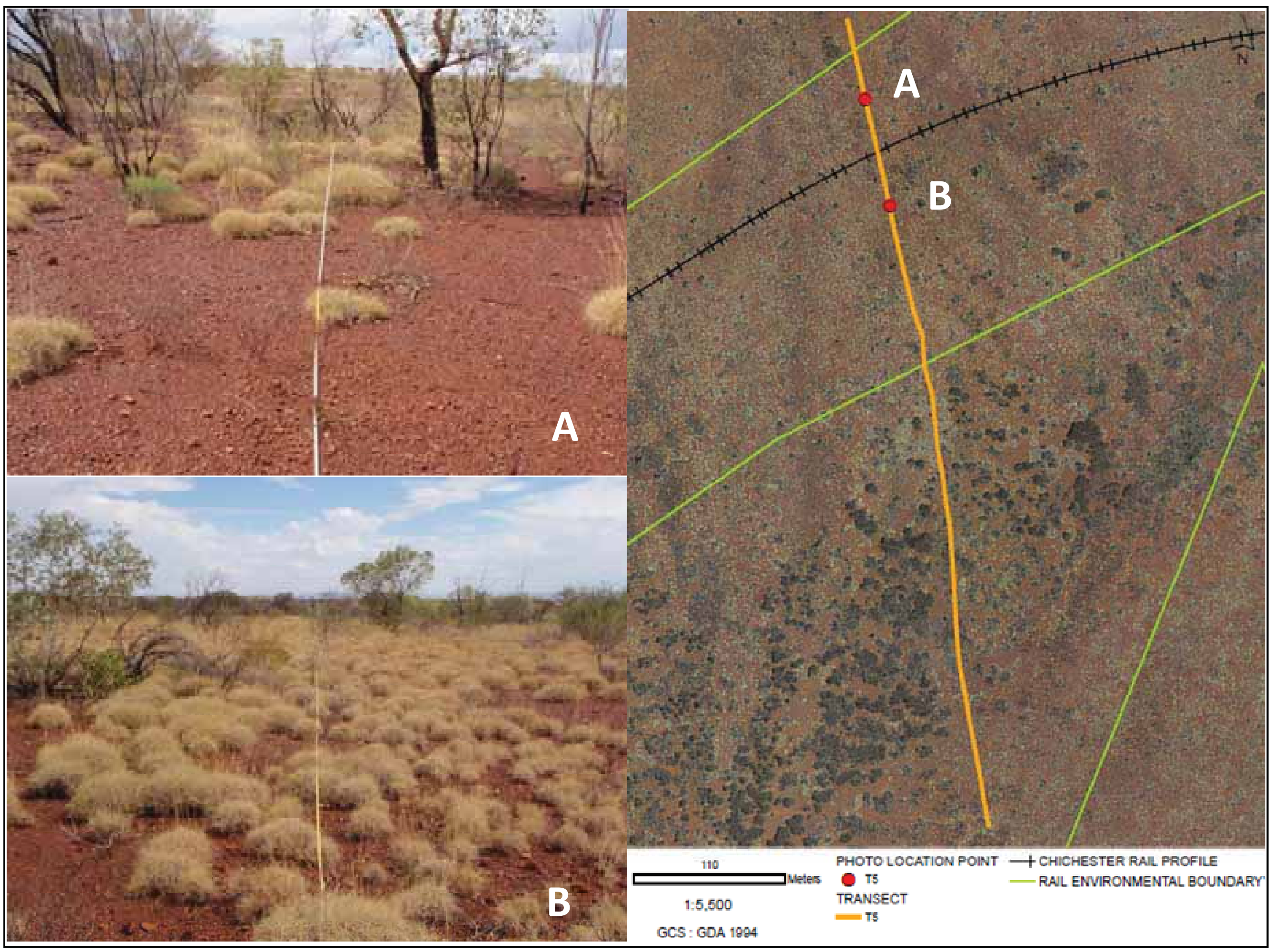
Vegetation Community	*Acacia arida* tall open shrubland over mixed very open shrubland over open grassland
Condition	excellent
Weeds	None present
Distance along Transect	310m – 320m

TRANSECT 5

Observations: Gentle southerly slope. Large areas of bare patches were noted along the transect. No Mulga were recorded within the first 60m of reference transect and at 220m on the main transect. Evidence of fire and grazing present.

Soil: Red hardpan clay with medium sized stones.

Ecologia (2008) Equivalent: Ecologia (2008) : Vegetation Classification Equivalent: 3. *Acacia aneura* low woodland on the clay flats; 4a)Acacia aneura low open forest; 4b) *Acacia ayersiana* and *Acacia aneura* low open forest on the drainage areas at the base of the footslope; 8b) *Acacia aneura* low woodland on the steeper rocky hill slopes.



Reference Transect Floristic Plot 1

Vegetation Community	*Corymbia aspera* open woodland over Acacia aneura var. tenuis tall open scrub over *Triodia sp*. grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	60m – 70m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* very tall open shrubland over mixed low open shrubland over mixed open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	290m – 300m

Main Transect Floristic Plot 2

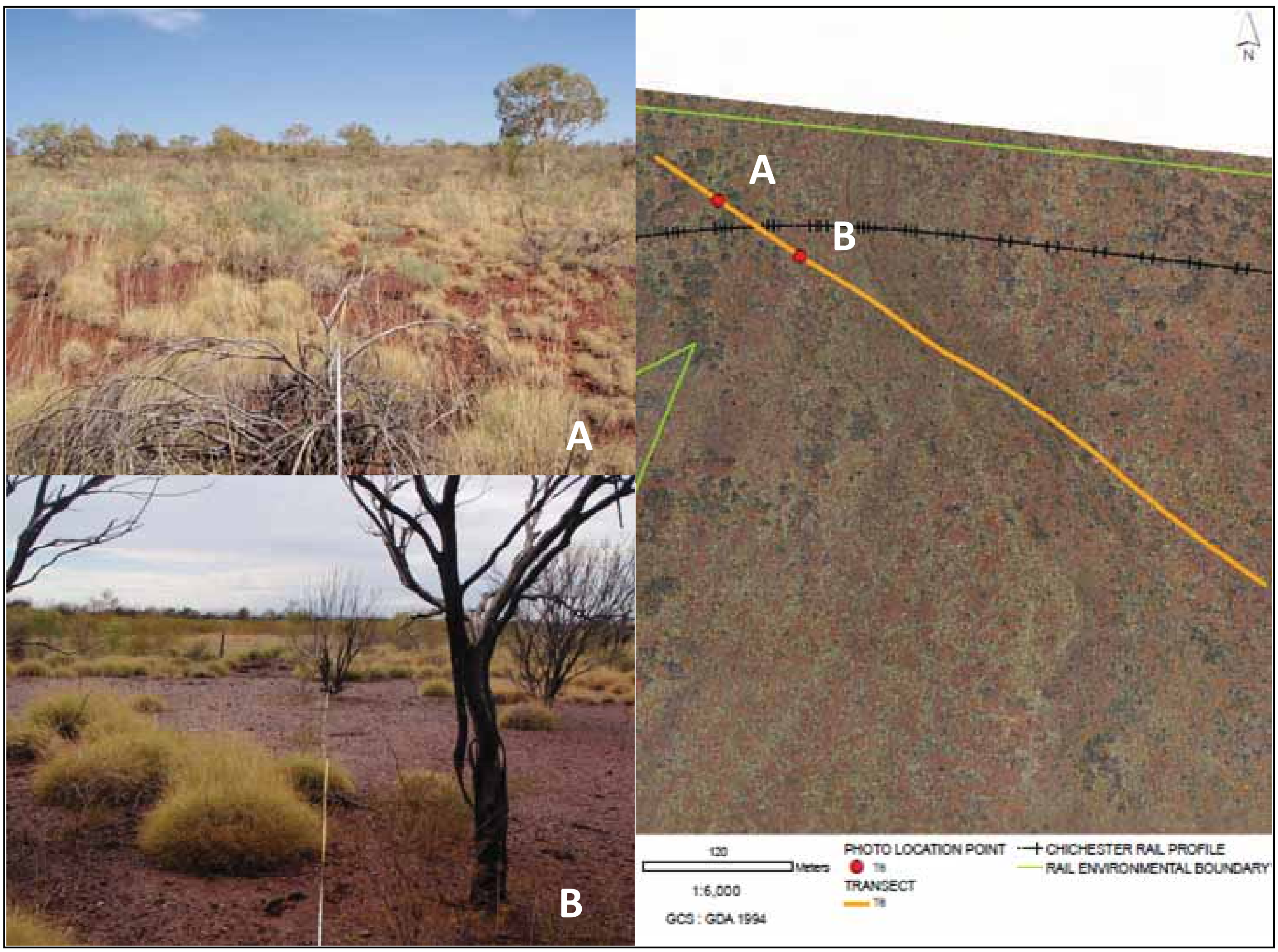
Vegetation Community	*Acacia aneura var. tenuis* tall shrubland over mixed low open shrubland over mixed very open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	470m – 480m

TRANSECT 6

Observations: Gentle south easterly slope. Minor creek crossing at 130m of the main transect. No Mulga were recorded from 130m- 200m. Evidence of fire present, but sighting of large *Triodia sp*. suggest that the fires were not recent.

Soil: Red hard pan with medium sized stones.

Ecologia (2008) Vegetation Classification Equivalent: 3. *Acacia aneura* low woodland on the clay flats; 4a) *Acacia aneura* low open forest.



Reference Transect Floristic Plot 1

Vegetation Community	*Acacia aneura ? var. intermedia low* woodland over *Triodia sp*. very open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	90m – 100m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura ? var. intermedia* low open woodland.
Condition	Excellent
Weeds	None present
Distance along Transect	50m – 60m

Main Transect Floristic Plot 2

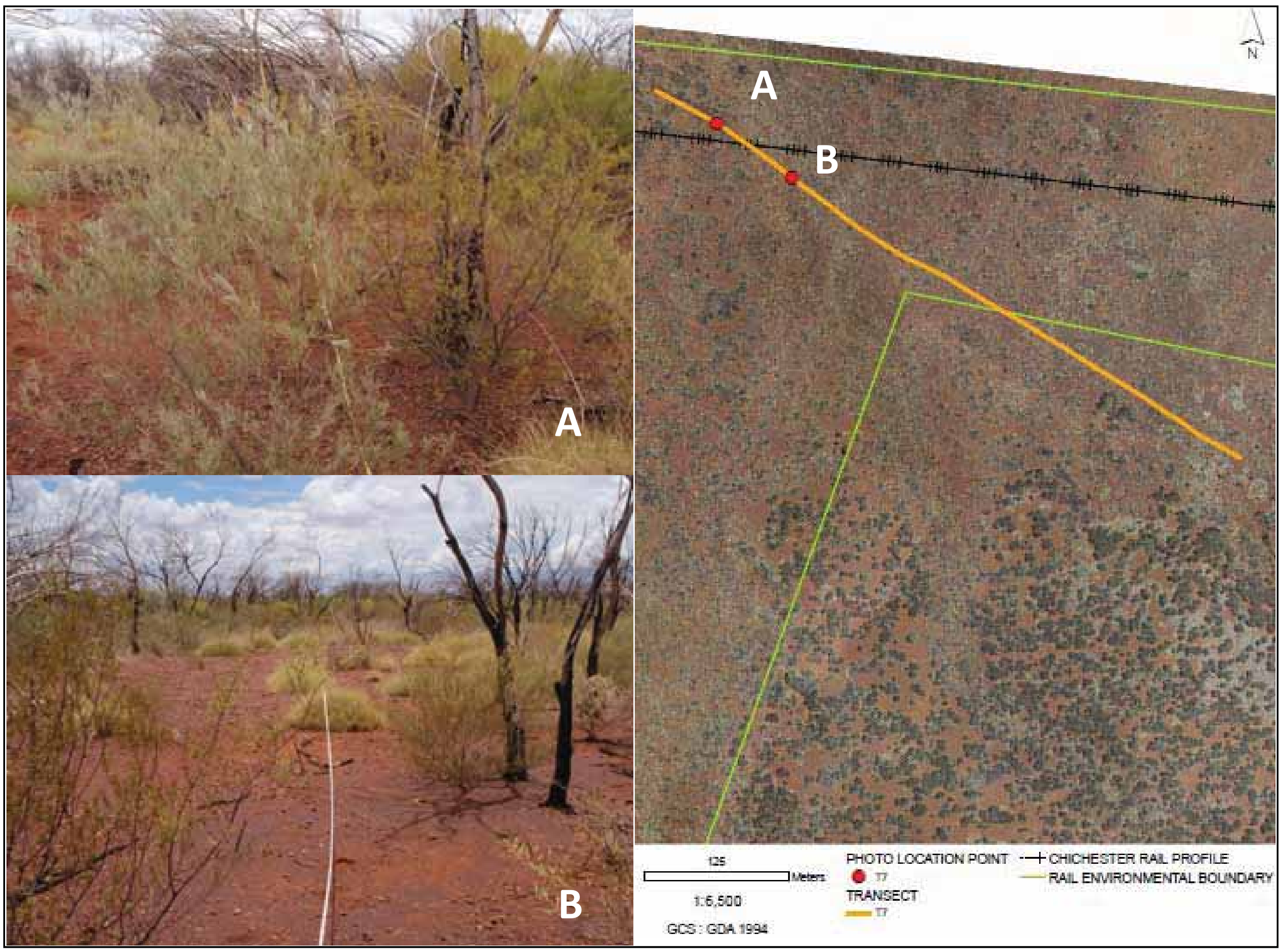
Vegetation Community	*Acacia aneura ? var. intermedia* low open woodland over *Triodia sp.* grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	320m – 330m

TRANSECT 7

Observation: Gentle south easterly slope. Evidence of fire.

Soil: Red hard pan with medium sized stones.

Ecologia (2008) Vegetation Classification Equivalent: 3. *Acacia aneura* low woodland on the clay flats; 4a) *Acacia aneura* low open forest.



Reference Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* very open shrub over mixed low open shrubland
Condition	Excellent
Weeds	None present
Distance along Transect	80m – 90m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* low woodland over *Tephrosia sp.* open shrubland over mixed low open shrubland.
Condition	Excellent
Weeds	None present
Distance along Transect	70m – 80m

Main Transect Floristic Plot 2

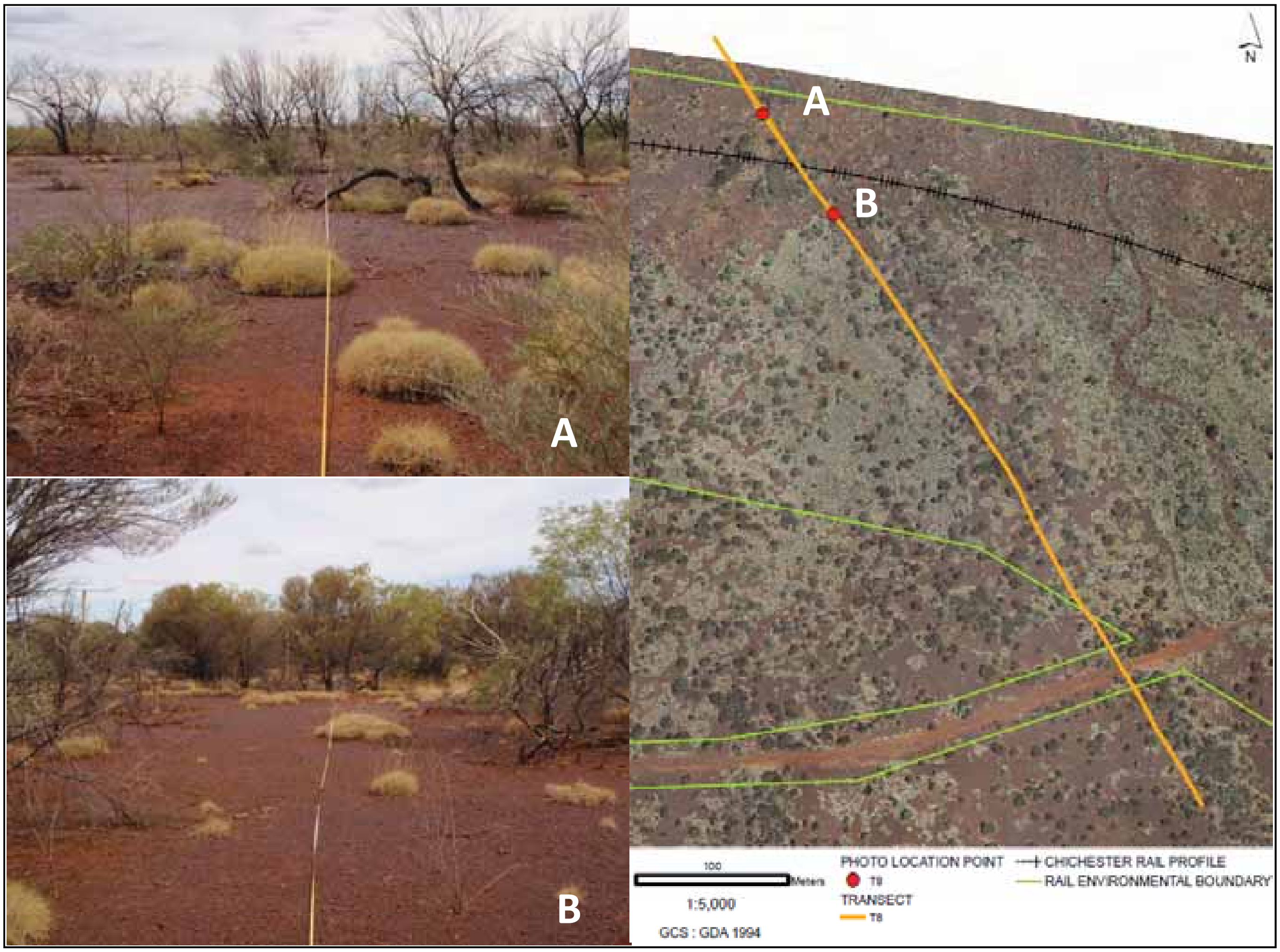
Vegetation Community	? Lamiaceae sp. low open shrubland over mixed grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	380m – 390m

TRANSECT 8

Observations: Transect intercepts the main access road at 370m – 380m. Transect dominated by *Acacia sp*. and *Triodia sp.* No evidence of recent fire. Open areas of bare patches were noted along the transect.

Soil: Red hardpan soils with medium to small sized stones.

Ecologia (2008) Vegetation Classification Equivalent*:* *Acacia aneura* low woodland on the clay flats.



Reference Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* low woodland
Condition	Excellent
Weeds	None present
Distance along Transect	70m – 80m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* low open woodland over mixed low open shrubland over *Triodia sp.* very open grassland
Condition	Very good
Weeds	None present
Distance along Transect	70m – 80m

Main Transect Floristic Plot 2

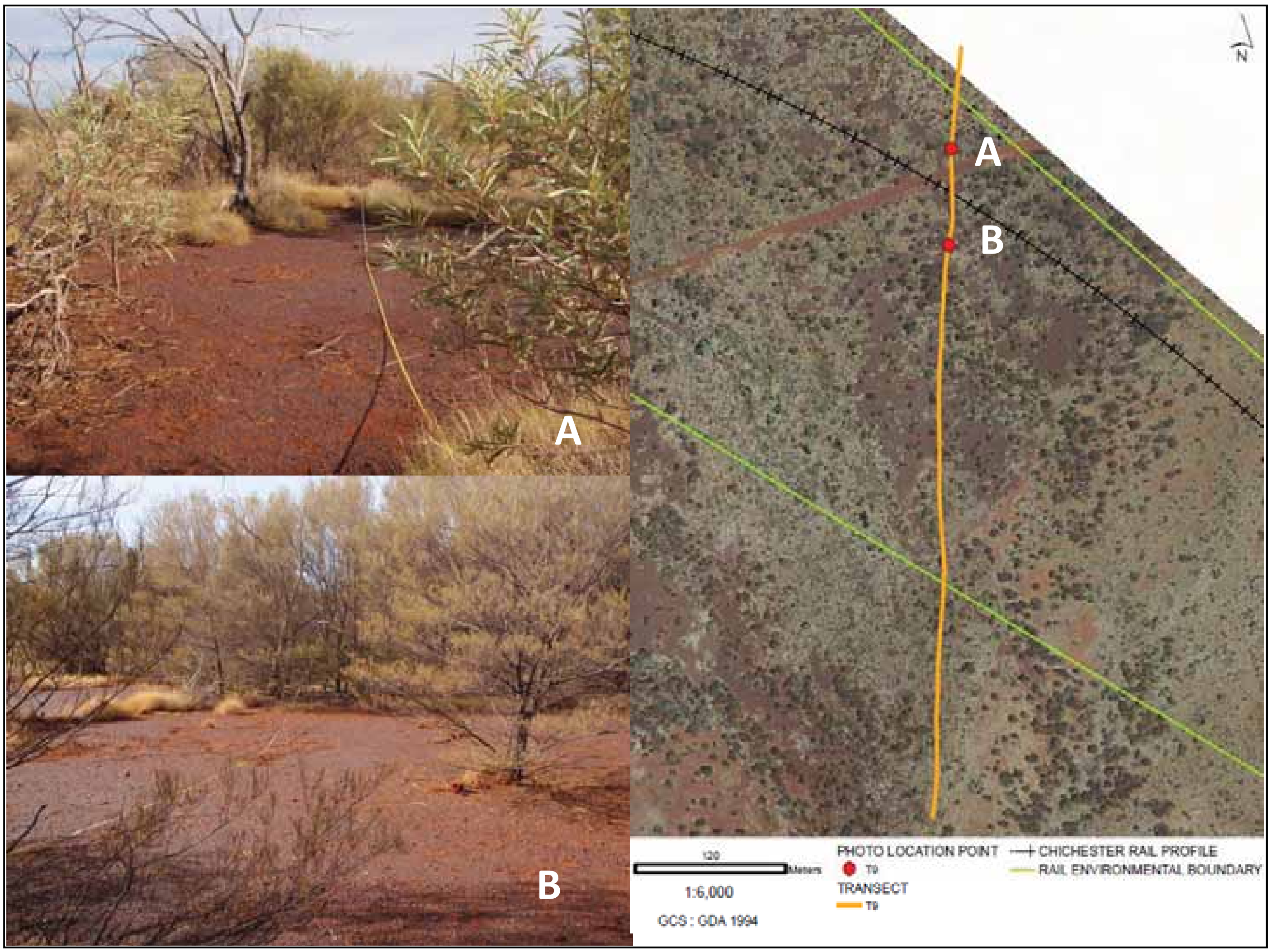
Vegetation Community	*Acacia aneura var. tenuis* low woodland over *Triodia sp.* very open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	280m - 290m

TRANSECT 9

Observations: Transect running parallel to the west of major creekline. No evidence of fire. Evidence of grazing. Slight rise in the landscape noted around the 300m mark with a gentle southerly slope towards the major creekline.

Soil: Red hardpan clay with medium- small sized stones.

Ecologia (2008) Vegetation Classification Equivalent*:* 3. *Acacia aneura* low woodland on the clay flats.



Reference Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* low woodland
Condition	Excellent
Weeds	None present
Distance along Transect	70m – 80m

No Picture Available

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* low woodland over mixed Open shrubland over *Triodia sp.* open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	70m – 80m

No Picture Available

Main Transect Floristic Plot 2

Vegetation Community	*Acacia aneura var. tenuis* low woodland over mixed low open shrubland over very open grassland
Condition	Good
Weeds	None present
Distance along Transect	320m – 330m

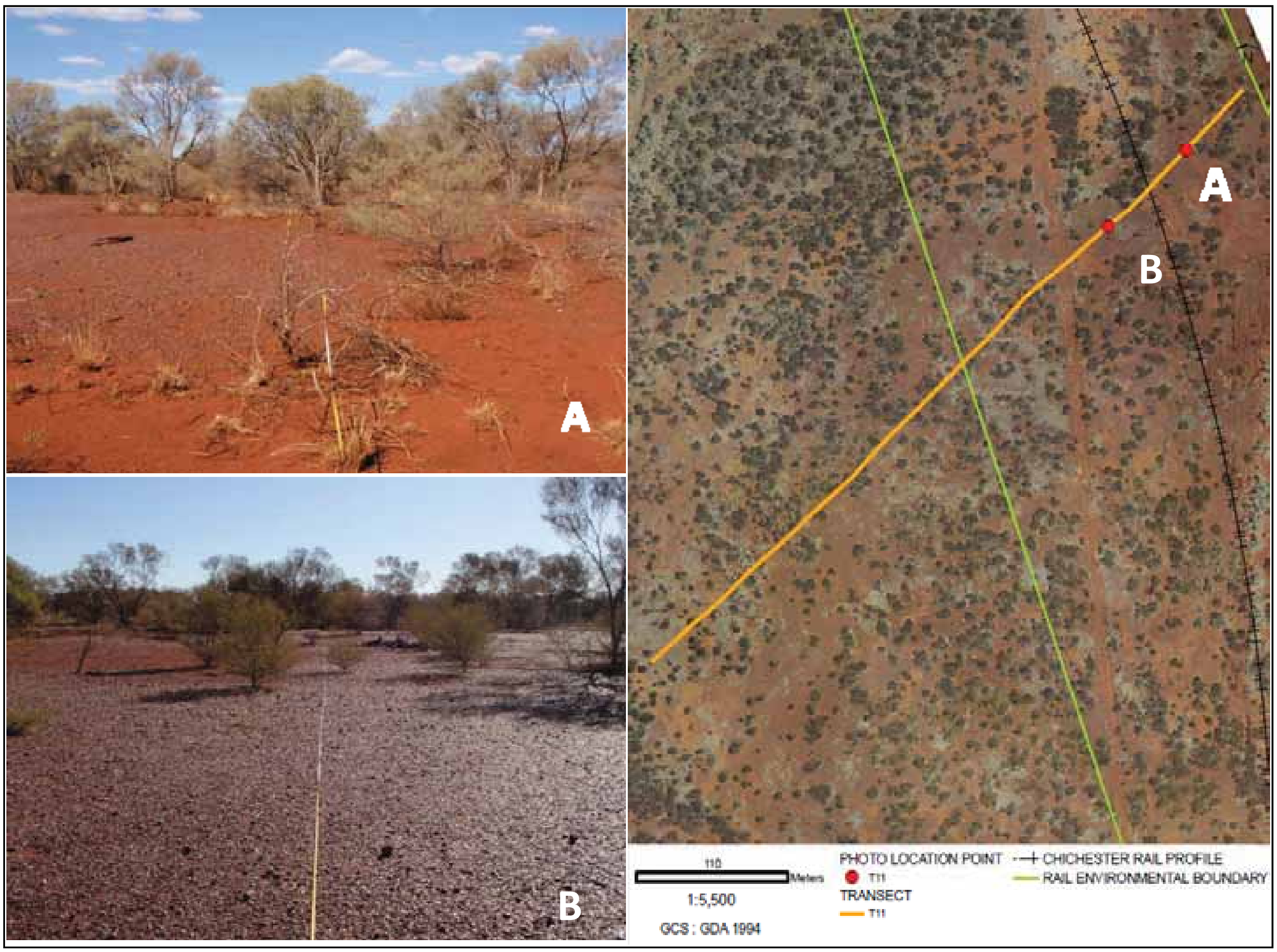
No Picture Available

TRANSECT 10

Observations: Transect running parallel to the east of major creekline. Evidence of severe erosion present, with surface water flow creating potholes, rills and exposed tree roots. Evidence of heavy grazing and animals tracks. No evidence of recent fire. Transect terminated at 470m at the major creekline.

Soil: Red hardpan clay with medium sized stones, with intermittent clayey patches.

Ecologia (2008) Vegetation Classification Equivalent*:* 3. *Acacia aneura* low woodland on the clay flats.



Reference Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* low woodland over mixed open shrubland over mixed very open grassland.
Condition	Excellent
Weeds	None present
Distance along Transect	40m – 50m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* low open forest
Condition	Very good
Weeds	None present
Distance along Transect	40m – 50m

Main Transect Floristic Plot 2

Vegetation Community	*Acacia aneura var. tenuis* low open woodland
Condition	Very good
Weeds	None present
Distance along Transect	140m – 150m

Main Transect Floristic Plot 3

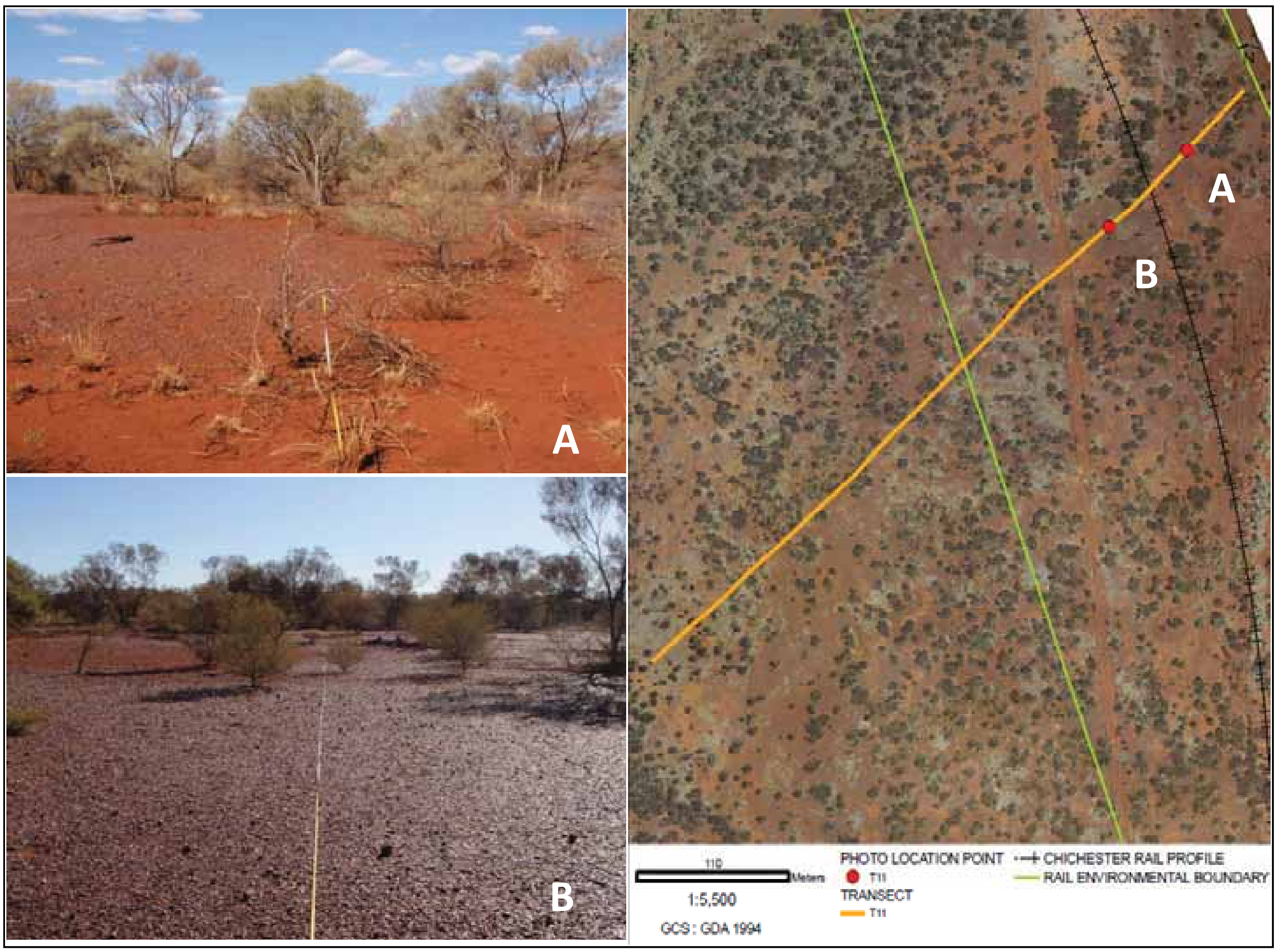
Vegetation Community	*Acacia aneura var. tenuis* low open forest
Condition	Very good
Weeds	None present
Distance along Transect	130m – 140m

TRANSECT 11

Observations: Evidence of severe erosion present, with large rills, exposed roots and pot holes in both the main and reference transect. Heavy grazing and animal tracks noted. No evidence of recent fire.

Soil: Red hardpan clay with medium sized stones, with intermittent clayey patches.

Ecologia (2008) Vegetation Classification Equivalent: 3. *Acacia aneura* low woodland on the clay flats.



Reference Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* tall open shrubland over *Triodia sp.* very open grassland
Condition	Good
Weeds	None present
Distance along Transect	90m – 100m

Main Transect Floristic Plot 1

Vegetation Community	*Acacia aneura var. tenuis* tall shrubland over *Eremophila sp*. shrubland
Condition	Good
Weeds	None present
Distance along Transect	110m - 120m

Main Transect Floristic Plot 2

Vegetation Community	*Acacia aneura var. tenuis* tall shrubland over mixed open shrubland
Condition	Good
Weeds	None present
Distance along Transect	360m – 370m

Appendix 3 Baseline Mulga Species List- Pending April 2010 floristic survey

Appendix 4 Transect GPS Point Locations

GPS_ID	DATE_	TRANSECT	COMMENTS	POINT_X	POINT_Y	DATA_COLLE	COMPANY
209	17/01/2010	T1	Rail centreline_T1	118.97051400000	-22.21245000090	Rada Tomanovic	Syrinx Environmental PL
210	17/01/2010	T1	Reference_20m	118.97058900000	-22.21228700050	Rada Tomanovic	Syrinx Environmental PL
211	17/01/2010	T1	Reference_40m	118.97068900000	-22.21213700080	Rada Tomanovic	Syrinx Environmental PL
212	17/01/2010	T1	Reference_60m	118.97078300000	-22.21198300090	Rada Tomanovic	Syrinx Environmental PL
213	17/01/2010	T1	Reference_80m	118.97088700000	-22.21182800100	Rada Tomanovic	Syrinx Environmental PL
214	17/01/2010	T1	Reference_100m	118.97098500000	-22.21167700030	Rada Tomanovic	Syrinx Environmental PL
215	17/01/2010	T1	Main_20m	118.97043900000	-22.21261700050	Rada Tomanovic	Syrinx Environmental PL
216	17/01/2010	T1	Main_40m	118.97035700000	-22.21277900080	Rada Tomanovic	Syrinx Environmental PL
217	17/01/2010	T1	Main_60m	118.97027100000	-22.21296500030	Rada Tomanovic	Syrinx Environmental PL
218	17/01/2010	T1	Main_80m	118.97019800000	-22.21310200040	Rada Tomanovic	Syrinx Environmental PL
219	17/01/2010	T1	Main_100m	118.97013100000	-22.21327300100	Rada Tomanovic	Syrinx Environmental PL
220	17/01/2010	T1	Main_120m	118.97006600000	-22.21343800060	Rada Tomanovic	Syrinx Environmental PL
221	17/01/2010	T1	Main_140m	118.96999900000	-22.21360500110	Rada Tomanovic	Syrinx Environmental PL
222	17/01/2010	T1	Main_160m	118.96991600000	-22.21377700090	Rada Tomanovic	Syrinx Environmental PL
223	17/01/2010	T1	Main_180m	118.96983600000	-22.21393200090	Rada Tomanovic	Syrinx Environmental PL
224	17/01/2010	T1	Main_200m	118.96974800000	-22.21409200100	Rada Tomanovic	Syrinx Environmental PL
225	17/01/2010	T1	Main_220m	118.96965200000	-22.21425000110	Rada Tomanovic	Syrinx Environmental PL
226	17/01/2010	T1	Main_240m	118.96955900000	-22.21440500110	Rada Tomanovic	Syrinx Environmental PL
227	17/01/2010	T1	Main_260m	118.96947300000	-22.21457300070	Rada Tomanovic	Syrinx Environmental PL
228	17/01/2010	T1	Main_280m	118.96938800000	-22.21472900070	Rada Tomanovic	Syrinx Environmental PL
229	17/01/2010	T1	Main_300m	118.96930700000	-22.21488900090	Rada Tomanovic	Syrinx Environmental PL
230	17/01/2010	T1	Main_320m	118.96922300000	-22.21505400040	Rada Tomanovic	Syrinx Environmental PL
231	17/01/2010	T1	Main_340m	118.96913500000	-22.21521200050	Rada Tomanovic	Syrinx Environmental PL
232	17/01/2010	T1	Main_360m	118.96905200000	-22.21537100070	Rada Tomanovic	Syrinx Environmental PL
233	17/01/2010	T1	Main_380m	118.96896000000	-22.21553400100	Rada Tomanovic	Syrinx Environmental PL
234	17/01/2010	T1	Main_400m	118.96885400000	-22.21572300070	Rada Tomanovic	Syrinx Environmental PL
235	17/01/2010	T1	Main_420m	118.96879300000	-22.21585500050	Rada Tomanovic	Syrinx Environmental PL
236	17/01/2010	T1	Main_440m	118.96870600000	-22.21602100100	Rada Tomanovic	Syrinx Environmental PL
237	17/01/2010	T1	Main_460m	118.96862100000	-22.21619500090	Rada Tomanovic	Syrinx Environmental PL
238	17/01/2010	T1	Main_480m	118.96855500000	-22.21634500060	Rada Tomanovic	Syrinx Environmental PL
239	17/01/2010	T1	Main_500m	118.96847800000	-22.21650600090	Rada Tomanovic	Syrinx Environmental PL
240	18/01/2010	T2	Rail centreline_T2	118.97131000000	-22.21479300100	Rada Tomanovic	Syrinx Environmental PL
241	18/01/2010	T2	Reference_20m	118.97140300000	-22.21462900060	Rada Tomanovic	Syrinx Environmental PL
242	18/01/2010	T2	Reference_40m	118.97148900000	-22.21447300060	Rada Tomanovic	Syrinx Environmental PL
243	18/01/2010	T2	Reference_60m	118.97157700000	-22.21431600060	Rada Tomanovic	Syrinx Environmental PL
244	18/01/2010	T2	Reference_80m	118.97166600000	-22.21415400030	Rada Tomanovic	Syrinx Environmental PL
245	18/01/2010	T2	Reference_100m	118.97175000000	-22.21398800070	Rada Tomanovic	Syrinx Environmental PL
246	18/01/2010	T2	Main_20m	118.97123600000	-22.21495100110	Rada Tomanovic	Syrinx Environmental PL
247	18/01/2010	T2	Main_40m	118.97115600000	-22.21511900070	Rada Tomanovic	Syrinx Environmental PL
248	18/01/2010	T2	Main_60m	118.97107600000	-22.21528500030	Rada Tomanovic	Syrinx Environmental PL
249	18/01/2010	T2	Main_80m	118.97099500000	-22.21544800060	Rada Tomanovic	Syrinx Environmental PL
250	18/01/2010	T2	Main_100m	118.97092700000	-22.21561400110	Rada Tomanovic	Syrinx Environmental PL
251	18/01/2010	T2	Main_120m	118.97085800000	-22.21578400080	Rada Tomanovic	Syrinx Environmental PL
252	18/01/2010	T2	Main_140m	118.97078100000	-22.21594900030	Rada Tomanovic	Syrinx Environmental PL
253	18/01/2010	T2	Main_160m	118.97069900000	-22.21611200070	Rada Tomanovic	Syrinx Environmental PL
254	18/01/2010	T2	Main_180m	118.97062500000	-22.21627700110	Rada Tomanovic	Syrinx Environmental PL
255	18/01/2010	T2	Main_200m	118.97053500000	-22.21643400110	Rada Tomanovic	Syrinx Environmental PL
256	18/01/2010	T2	Main_220m	118.97045400000	-22.21659700060	Rada Tomanovic	Syrinx Environmental PL
257	18/01/2010	T2	Main_240m	118.97036900000	-22.21676500020	Rada Tomanovic	Syrinx Environmental PL
258	18/01/2010	T2	Main_260m	118.97027700000	-22.21692300030	Rada Tomanovic	Syrinx Environmental PL
259	18/01/2010	T2	Main_280m	118.97019200000	-22.21708300050	Rada Tomanovic	Syrinx Environmental PL
260	18/01/2010	T2	Main_300m	118.97010200000	-22.21724100060	Rada Tomanovic	Syrinx Environmental PL
261	18/01/2010	T2	Main_320m	118.97002200000	-22.21740400090	Rada Tomanovic	Syrinx Environmental PL
262	18/01/2010	T2	Main_340m	118.96993800000	-22.21756600030	Rada Tomanovic	Syrinx Environmental PL
263	18/01/2010	T2	Main_360m	118.96987500000	-22.21774400040	Rada Tomanovic	Syrinx Environmental PL
264	18/01/2010	T2	Main_380m	118.96980000000	-22.21790000040	Rada Tomanovic	Syrinx Environmental PL
265	18/01/2010	T2	Main_400m	118.96973100000	-22.21806600080	Rada Tomanovic	Syrinx Environmental PL
266	18/01/2010	T2	Main_420m	118.96966500000	-22.21823800070	Rada Tomanovic	Syrinx Environmental PL
267	18/01/2010	T2	Main_440m	118.96960000000	-22.21840500030	Rada Tomanovic	Syrinx Environmental PL
268	18/01/2010	T2	Main_460m	118.96951600000	-22.21856400040	Rada Tomanovic	Syrinx Environmental PL
269	18/01/2010	T2	Main_480m	118.96945500000	-22.21874000050	Rada Tomanovic	Syrinx Environmental PL
270	18/01/2010	T2	Main_500m	118.96938800000	-22.21890600090	Rada Tomanovic	Syrinx Environmental PL
193	16/01/2010	T3	Rail centreline_T3	118.97338800000	-22.22066000090	Rada Tomanovic	Syrinx Environmental PL
194	16/01/2010	T3	Reference_20m	118.97357500000	-22.22063800070	Rada Tomanovic	Syrinx Environmental PL
195	16/01/2010	T3	Reference_40m	118.97376600000	-22.22063000040	Rada Tomanovic	Syrinx Environmental PL
196	16/01/2010	T3	Reference_60m	118.97395700000	-22.22059400050	Rada Tomanovic	Syrinx Environmental PL

GPS_ID	DATE_	TRANSECT	COMMENTS	POINT_X	POINT_Y	DATA_COLLE	COMPANY
197	16/01/2010	T3	Reference_80m	118.97414300000	-22.22057400050	Rada Tomanovic	Syrinx Environmental PL
198	16/01/2010	T3	Reference_100m	118.97434200000	-22.22054500100	Rada Tomanovic	Syrinx Environmental PL
199	16/01/2010	T3	Main_20m	118.97319300000	-22.22068700030	Rada Tomanovic	Syrinx Environmental PL
200	16/01/2010	T3	Main_40m	118.97299800000	-22.22070400110	Rada Tomanovic	Syrinx Environmental PL
201	16/01/2010	T3	Main_60m	118.97280800000	-22.22072500030	Rada Tomanovic	Syrinx Environmental PL
202	16/01/2010	T3	Main_80m	118.97262100000	-22.22075500070	Rada Tomanovic	Syrinx Environmental PL
203	16/01/2010	T3	Main_100m	118.97242900000	-22.22079400070	Rada Tomanovic	Syrinx Environmental PL
204	16/01/2010	T3	Main_120m	118.97224300000	-22.22083300070	Rada Tomanovic	Syrinx Environmental PL
205	16/01/2010	T3	Main_140m	118.97205000000	-22.22086100020	Rada Tomanovic	Syrinx Environmental PL
206	17/01/2010	T3	Main_160m	118.97186100000	-22.22089700100	Rada Tomanovic	Syrinx Environmental PL
207	17/01/2010	T3	Main_180m	118.97166700000	-22.22092800060	Rada Tomanovic	Syrinx Environmental PL
208	17/01/2010	T3	Main_200m	118.97147800000	-22.22095900030	Rada Tomanovic	Syrinx Environmental PL
302	19/01/2010	T3	Main_220m	118.97128600000	-22.22098200040	Rada Tomanovic	Syrinx Environmental PL
303	19/01/2010	T3	Main_240m	118.97109500000	-22.22100500060	Rada Tomanovic	Syrinx Environmental PL
304	19/01/2010	T3	Main_260m	118.97090300000	-22.22102700070	Rada Tomanovic	Syrinx Environmental PL
305	19/01/2010	T3	Main_280m	118.97071075600	-22.22105239040	Rada Tomanovic	Syrinx Environmental PL
306	19/01/2010	T3	Main_300m	118.97052500000	-22.22106600070	Rada Tomanovic	Syrinx Environmental PL
307	19/01/2010	T3	Main_320m	118.97033100000	-22.22108800080	Rada Tomanovic	Syrinx Environmental PL
308	19/01/2010	T3	Main_340m	118.97013900000	-22.22111200100	Rada Tomanovic	Syrinx Environmental PL
309	19/01/2010	T3	Main_360m	118.96994700000	-22.22113900050	Rada Tomanovic	Syrinx Environmental PL
310	19/01/2010	T3	Main_380m	118.96975200000	-22.22116100060	Rada Tomanovic	Syrinx Environmental PL
311	19/01/2010	T3	Main_400m	118.96956600000	-22.22118100060	Rada Tomanovic	Syrinx Environmental PL
312	19/01/2010	T3	Main_420m	118.96937600000	-22.22119900050	Rada Tomanovic	Syrinx Environmental PL
313	19/01/2010	T3	Main_430m	118.96927900000	-22.22120700090	Rada Tomanovic	Syrinx Environmental PL
164	16/01/2010	T4	Rail centreline_T4	118.98557300000	-22.22502000050	Rada Tomanovic	Syrinx Environmental PL
165	16/01/2010	T4	Reference_20m	118.98550900000	-22.22484300040	Rada Tomanovic	Syrinx Environmental PL
166	16/01/2010	T4	Reference_40m	118.98545400000	-22.22467000050	Rada Tomanovic	Syrinx Environmental PL
167	16/01/2010	T4	Reference_60m	118.98539300000	-22.22450100080	Rada Tomanovic	Syrinx Environmental PL
168	16/01/2010	T4	Reference_80m	118.98533600000	-22.22432700090	Rada Tomanovic	Syrinx Environmental PL
169	16/01/2010	T4	Reference_100m	118.98528000000	-22.22415800030	Rada Tomanovic	Syrinx Environmental PL
170	16/01/2010	T4	Main_20m	118.98562000000	-22.22518900110	Rada Tomanovic	Syrinx Environmental PL
171	16/01/2010	T4	Main_40m	118.98567200000	-22.22535600070	Rada Tomanovic	Syrinx Environmental PL
172	16/01/2010	T4	Main_60m	118.98572300000	-22.22553700090	Rada Tomanovic	Syrinx Environmental PL
173	16/01/2010	T4	Main_80m	118.98578100000	-22.22571400100	Rada Tomanovic	Syrinx Environmental PL
174	16/01/2010	T4	Main_100m	118.98583600000	-22.22588400070	Rada Tomanovic	Syrinx Environmental PL
175	16/01/2010	T4	Main_120m	118.98589000000	-22.22606400100	Rada Tomanovic	Syrinx Environmental PL
176	16/01/2010	T4	Main_140m	118.98594900000	-22.22623600080	Rada Tomanovic	Syrinx Environmental PL
177	16/01/2010	T4	Main_160m	118.98600300000	-22.22640300040	Rada Tomanovic	Syrinx Environmental PL
178	16/01/2010	T4	Mai _180m	118.98607400000	-22.22658700080	Rada Tomanovic	Syrinx Environmental PL
179	16/01/2010	T4	Main_200m	118.98613900000	-22.22673600050	Rada Tomanovic	Syrinx Environmental PL
180	16/01/2010	T4	Main_220m	118.98616500000	-22.22689900080	Rada Tomanovic	Syrinx Environmental PL
181	16/01/2010	T4	Main_240m	118.98622300000	-22.22706700040	Rada Tomanovic	Syrinx Environmental PL
182	16/01/2010	T4	Main_260m	118.98626800000	-22.22727700020	Rada Tomanovic	Syrinx Environmental PL
183	16/01/2010	T4	Main_280m	118.98631900000	-22.22742200060	Rada Tomanovic	Syrinx Environmental PL
184	16/01/2010	T4	Main_300m	118.98636500000	-22.22759800060	Rada Tomanovic	Syrinx Environmental PL
185	16/01/2010	T4	Main_320m	118.98641700000	-22.22777100050	Rada Tomanovic	Syrinx Environmental PL
186	16/01/2010	T4	Main_340m	118.98646400000	-22.22794300040	Rada Tomanovic	Syrinx Environmental PL
187	16/01/2010	T4	Main_360m	118.98650200000	-22.22812200050	Rada Tomanovic	Syrinx Environmental PL
188	16/01/2010	T4	Main_380m	118.98654800000	-22.22830200070	Rada Tomanovic	Syrinx Environmental PL
189	16/01/2010	T4	Main_400m	118.98659400000	-22.22847400060	Rada Tomanovic	Syrinx Environmental PL
190	16/01/2010	T4	Main_420m	118.98664000000	-22.22865300070	Rada Tomanovic	Syrinx Environmental PL
191	16/01/2010	T4	Main_440m	118.98668300000	-22.22883300090	Rada Tomanovic	Syrinx Environmental PL
192	16/01/2010	T4	Main_460m	118.98674300000	-22.22899300020	Rada Tomanovic	Syrinx Environmental PL
133	15/01/2010	T5	Rail centreline_T5	118.98824500000	-22.22348000050	Rada Tomanovic	Syrinx Environmental PL
134	15/01/2010	T5	Reference_20m	118.98820100000	-22.22331000080	Rada Tomanovic	Syrinx Environmental PL
135	15/01/2010	T5	Reference_40m	118.98814800000	-22.22313100060	Rada Tomanovic	Syrinx Environmental PL
136	15/01/2010	T5	Reference_60m	118.98810900000	-22.22296000080	Rada Tomanovic	Syrinx Environmental PL
137	15/01/2010	T5	Reference_80m	118.98806200000	-22.22279000110	Rada Tomanovic	Syrinx Environmental PL
138	15/01/2010	T5	Reference_100m	118.98801900000	-22.22261900040	Rada Tomanovic	Syrinx Environmental PL
139	15/01/2010	T5	Main_20m	118.98829000000	-22.22365400040	Rada Tomanovic	Syrinx Environmental PL
140	15/01/2010	T5	Main_40m	118.98833300000	-22.22382900040	Rada Tomanovic	Syrinx Environmental PL
141	15/01/2010	T5	Main_60m	118.98837400000	-22.22400800060	Rada Tomanovic	Syrinx Environmental PL
142	15/01/2010	T5	Main_80m	118.98842000000	-22.22418300050	Rada Tomanovic	Syrinx Environmental PL
143	15/01/2010	T5	Main_100m	118.98847000000	-22.22435400030	Rada Tomanovic	Syrinx Environmental PL
144	15/01/2010	T5	Main_120m	118.98851400000	-22.22452800030	Rada Tomanovic	Syrinx Environmental PL
145	15/01/2010	T5	Main_140m	118.98857800000	-22.22468300110	Rada Tomanovic	Syrinx Environmental PL

GPS_ID	DATE_	TRANSECT	COMMENTS	POINT_X	POINT_Y	DATA_COLLE	COMPANY
146	15/01/2010	T5	Main_160m	118.98859700000	-22.22488700060	Rada Tomanovic	Syrinx Environmental PL
147	15/01/2010	T5	Main_180m	118.98865100000	-22.22506200060	Rada Tomanovic	Syrinx Environmental PL
148	15/01/2010	T5	Main_200m	118.98867700000	-22.22523700060	Rada Tomanovic	Syrinx Environmental PL
149	15/01/2010	T5	Main_220m	118.98869400000	-22.22541500070	Rada Tomanovic	Syrinx Environmental PL
150	15/01/2010	T5	Main_240m	118.98873200000	-22.22558800060	Rada Tomanovic	Syrinx Environmental PL
151	15/01/2010	T5	Main_260m	118.98876100000	-22.22576700070	Rada Tomanovic	Syrinx Environmental PL
152	15/01/2010	T5	Main_280m	118.98879200000	-22.22594400080	Rada Tomanovic	Syrinx Environmental PL
153	15/01/2010	T5	Main_300m	118.98881100000	-22.22612200090	Rada Tomanovic	Syrinx Environmental PL
154	15/01/2010	T5	Main_320m	118.98882400000	-22.22631000060	Rada Tomanovic	Syrinx Environmental PL
155	15/01/2010	T5	Main_340m	118.98883800000	-22.22649000080	Rada Tomanovic	Syrinx Environmental PL
156	15/01/2010	T5	Main_360m	118.98885200000	-22.22667200020	Rada Tomanovic	Syrinx Environmental PL
157	15/01/2010	T5	Main_380m	118.98887600000	-22.22685100040	Rada Tomanovic	Syrinx Environmental PL
158	15/01/2010	T5	Main_400m	118.98891200000	-22.22702700040	Rada Tomanovic	Syrinx Environmental PL
159	16/01/2010	T5	Main_420m	118.98894500000	-22.22719700100	Rada Tomanovic	Syrinx Environmental PL
160	16/01/2010	T5	Main_440m	118.98898700000	-22.22737200100	Rada Tomanovic	Syrinx Environmental PL
161	16/01/2010	T5	Main_460m	118.98902400000	-22.22754600090	Rada Tomanovic	Syrinx Environmental PL
162	16/01/2010	T5	Main_480m	118.98905800000	-22.22772800030	Rada Tomanovic	Syrinx Environmental PL
163	16/01/2010	T5	Main_500m	118.98909900000	-22.22790600050	Rada Tomanovic	Syrinx Environmental PL
102	15/01/2010	T6	Rail centreline_T6	118.99207800000	-22.22256700070	Rada Tomanovic	Syrinx Environmental PL
103	15/01/2010	T6	Reference_20m	118.99191400000	-22.22246300040	Rada Tomanovic	Syrinx Environmental PL
104	15/01/2010	T6	Reference_40m	118.99175500000	-22.22236500030	Rada Tomanovic	Syrinx Environmental PL
105	15/01/2010	T6	Reference_60m	118.99159500000	-22.22226400110	Rada Tomanovic	Syrinx Environmental PL
106	15/01/2010	T6	Reference_80m	118.99143600000	-22.22216300090	Rada Tomanovic	Syrinx Environmental PL
107	15/01/2010	T6	Reference_100m	118.99127300000	-22.22206500090	Rada Tomanovic	Syrinx Environmental PL
108	15/01/2010	T6	Main_20m	118.99224000000	-22.22266200060	Rada Tomanovic	Syrinx Environmental PL
109	15/01/2010	T6	Main_40m	118.99240000000	-22.22275900050	Rada Tomanovic	Syrinx Environmental PL
110	15/01/2010	T6	Main_60m	118.99256500000	-22.22285600050	Rada Tomanovic	Syrinx Environmental PL
111	15/01/2010	T6	Main_80m	118.99272900000	-22.22294900030	Rada Tomanovic	Syrinx Environmental PL
112	15/01/2010	T6	Main_100m	118.99289300000	-22.22303800080	Rada Tomanovic	Syrinx Environmental PL
113	15/01/2010	T6	Main_120m	118.99305200000	-22.22314100110	Rada Tomanovic	Syrinx Environmental PL
114	15/01/2010	T6	Main_140m	118.99320800000	-22.22324300040	Rada Tomanovic	Syrinx Environmental PL
115	15/01/2010	T6	Main_160m	118.99336500000	-22.22334800070	Rada Tomanovic	Syrinx Environmental PL
116	15/01/2010	T6	Main_180m	118.99352400000	-22.22344400060	Rada Tomanovic	Syrinx Environmental PL
117	15/01/2010	T6	Main_200m	118.99369600000	-22.22353100110	Rada Tomanovic	Syrinx Environmental PL
118	15/01/2010	T6	Main_220m	118.99387400000	-22.22362300080	Rada Tomanovic	Syrinx Environmental PL
119	15/01/2010	T6	Main_240m	118.99403300000	-22.22371500050	Rada Tomanovic	Syrinx Environmental PL
120	15/01/2010	T6	Main_260m	118.99419600000	-22.22381900080	Rada Tomanovic	Syrinx Environmental PL
121	15/01/2010	T6	Main_280m	118.99435200000	-22.22391300070	Rada Tomanovic	Syrinx Environmental PL
122	15/01/2010	T6	Main_300m	118.99451900000	-22.22402900060	Rada Tomanovic	Syrinx Environmental PL
123	15/01/2010	T6	Main_320m	118.99466300000	-22.22413000080	Rada Tomanovic	Syrinx Environmental PL
124	15/01/2010	T6	Main_340m	118.99481200000	-22.22424200060	Rada Tomanovic	Syrinx Environmental PL
125	15/01/2010	T6	Main_360m	118.99495400000	-22.22436100070	Rada Tomanovic	Syrinx Environmental PL
126	15/01/2010	T6	Main_380m	118.99511000000	-22.22447500050	Rada Tomanovic	Syrinx Environmental PL
127	15/01/2010	T6	Main_400m	118.99526000000	-22.22458400110	Rada Tomanovic	Syrinx Environmental PL
128	15/01/2010	T6	Main_420m	118.99541600000	-22.22469100060	Rada Tomanovic	Syrinx Environmental PL
129	15/01/2010	T6	Main_440m	118.99557000000	-22.22479600090	Rada Tomanovic	Syrinx Environmental PL
130	15/01/2010	T6	Main_460m	118.99572900000	-22.22490000030	Rada Tomanovic	Syrinx Environmental PL
131	15/01/2010	T6	Main_480m	118.99588500000	-22.22500400060	Rada Tomanovic	Syrinx Environmental PL
132	15/01/2010	T6	Main_500m	118.99604400000	-22.22510600080	Rada Tomanovic	Syrinx Environmental PL
71	14/01/2010	T7	Rail centreline_T7	118.99647000000	-22.22290400090	Rada Tomanovic	Syrinx Environmental PL
72	14/01/2010	T7	Reference_20m	118.99630500000	-22.22280700090	Rada Tomanovic	Syrinx Environmental PL
73	14/01/2010	T7	Reference_40m	118.99614600000	-22.22271200110	Rada Tomanovic	Syrinx Environmental PL
74	14/01/2010	T7	Reference_60m	118.99597900000	-22.22261900040	Rada Tomanovic	Syrinx Environmental PL
75	14/01/2010	T7	Reference_80m	118.99580600000	-22.22254000030	Rada Tomanovic	Syrinx Environmental PL
76	14/01/2010	T7	Reference_100m	118.99563000000	-22.22245800100	Rada Tomanovic	Syrinx Environmental PL
77	14/01/2010	T7	Main_20m	118.99663400000	-22.22301300050	Rada Tomanovic	Syrinx Environmental PL
78	14/01/2010	T7	Main_40m	118.99678000000	-22.22311800090	Rada Tomanovic	Syrinx Environmental PL
79	14/01/2010	T7	Main_60m	118.99693900000	-22.22322400040	Rada Tomanovic	Syrinx Environmental PL
80	14/01/2010	T7	Main_80m	118.99709600000	-22.22333100080	Rada Tomanovic	Syrinx Environmental PL
81	14/01/2010	T7	Main_100m	118.99724900000	-22.22343800040	Rada Tomanovic	Syrinx Environmental PL
82	14/01/2010	T7	Main_120m	118.99741200000	-22.22353800050	Rada Tomanovic	Syrinx Environmental PL
83	14/01/2010	T7	Main_140m	118.99757100000	-22.22363400040	Rada Tomanovic	Syrinx Environmental PL

GPS_ID	DATE_	TRANSECT	COMMENTS	POINT_X	POINT_Y	DATA_COLLE	COMPANY
84	14/01/2010	T7	Main_160m	118.99774300000	-22.22373100040	Rada Tomanovic	Syrinx Environmental PL
85	14/01/2010	T7	Main_180m	118.99791000000	-22.22379600070	Rada Tomanovic	Syrinx Environmental PL
86	14/01/2010	T7	Main_200m	118.99809000000	-22.22387400070	Rada Tomanovic	Syrinx Environmental PL
87	14/01/2010	T7	Main_220m	118.99825100000	-22.22397000060	Rada Tomanovic	Syrinx Environmental PL
88	14/01/2010	T7	Main_240m	118.99841500000	-22.22405700100	Rada Tomanovic	Syrinx Environmental PL
89	14/01/2010	T7	Main_260m	118.99858700000	-22.22414300050	Rada Tomanovic	Syrinx Environmental PL
90	14/01/2010	T7	Main_280m	118.99875600000	-22.22423100100	Rada Tomanovic	Syrinx Environmental PL
91	14/01/2010	T7	Main_300m	118.99891700000	-22.22432500080	Rada Tomanovic	Syrinx Environmental PL
92	14/01/2010	T7	Main_320m	118.99908900000	-22.22441400040	Rada Tomanovic	Syrinx Environmental PL
93	14/01/2010	T7	Main_340m	118.99925300000	-22.22450700110	Rada Tomanovic	Syrinx Environmental PL
94	14/01/2010	T7	Main_360m	118.99942000000	-22.22459800080	Rada Tomanovic	Syrinx Environmental PL
95	14/01/2010	T7	Main_380m	118.99958700000	-22.22469100060	Rada Tomanovic	Syrinx Environmental PL
96	14/01/2010	T7	Main_400m	118.99975000000	-22.22478100020	Rada Tomanovic	Syrinx Environmental PL
97	14/01/2010	T7	Main_420m	118.99991000000	-22.22488100040	Rada Tomanovic	Syrinx Environmental PL
98	14/01/2010	T7	Main_440m	119.00007400000	-22.22497400100	Rada Tomanovic	Syrinx Environmental PL
99	14/01/2010	T7	Main_460m	119.00022200000	-22.22507400030	Rada Tomanovic	Syrinx Environmental PL
100	14/01/2010	T7	Main_480m	119.00040300000	-22.22516100070	Rada Tomanovic	Syrinx Environmental PL
101	14/01/2010	T7	Main_500m	119.00057100000	-22.22524900110	Rada Tomanovic	Syrinx Environmental PL
40	13/01/2010	T8	Rail centreline_T8	119.01178300000	-22.22437200030	Rada Tomanovic	Syrinx Environmental PL
41	13/01/2010	T8	Reference_20m	119.01167500000	-22.22422200050	Rada Tomanovic	Syrinx Environmental PL
42	13/01/2010	T8	Reference_40m	119.01156400000	-22.22407500100	Rada Tomanovic	Syrinx Environmental PL
43	13/01/2010	T8	Reference_60m	119.01145800000	-22.22392600040	Rada Tomanovic	Syrinx Environmental PL
44	13/01/2010	T8	Reference_80m	119.01135400000	-22.22377100040	Rada Tomanovic	Syrinx Environmental PL
45	13/01/2010	T8	Reference_100m	119.01124900000	-22.22362300080	Rada Tomanovic	Syrinx Environmental PL
46	13/01/2010	T8	Main_20m	119.01189500000	-22.22451500060	Rada Tomanovic	Syrinx Environmental PL
47	13/01/2010	T8	Main_40m	119.01202200000	-22.22465700080	Rada Tomanovic	Syrinx Environmental PL
48	13/01/2010	T8	Main_60m	119.01214100000	-22.22480100030	Rada Tomanovic	Syrinx Environmental PL
49	13/01/2010	T8	Main_80m	119.01225100000	-22.22494600070	Rada Tomanovic	Syrinx Environmental PL
50	13/01/2010	T8	Main_100m	119.01236200000	-22.22509500030	Rada Tomanovic	Syrinx Environmental PL
51	13/01/2010	T8	Main_120m	119.01247400000	-22.22524700100	Rada Tomanovic	Syrinx Environmental PL
52	13/01/2010	T8	Main_140m	119.01258500000	-22.22539600070	Rada Tomanovic	Syrinx Environmental PL
53	13/01/2010	T8	Main_160m	119.01268800000	-22.22554600040	Rada Tomanovic	Syrinx Environmental PL
54	13/01/2010	T8	Main_180m	119.01279600000	-22.22570500060	Rada Tomanovic	Syrinx Environmental PL
55	14/01/2010	T8	Main_200m	119.01291700000	-22.22584000050	Rada Tomanovic	Syrinx Environmental PL
56	14/01/2010	T8	Main_220m	119.01302600000	-22.22599300040	Rada Tomanovic	Syrinx Environmental PL
57	14/01/2010	T8	Main_240m	119.01313100000	-22.22613700070	Rada Tomanovic	Syrinx Environmental PL
58	14/01/2010	T8	Main_260m	119.01323300000	-22.22629500080	Rada Tomanovic	Syrinx Environmental PL
59	14/01/2010	T8	Main_280m	119.01331300000	-22.22646100040	Rada Tomanovic	Syrinx Environmental PL
60	14/01/2010	T8	Main_300m	119.01341300000	-22.22661800040	Rada Tomanovic	Syrinx Environmental PL
61	14/01/2010	T8	Main_320m	119.01350300000	-22.22677700060	Rada Tomanovic	Syrinx Environmental PL
62	14/01/2010	T8	Main_340m	119.01360200000	-22.22692600020	Rada Tomanovic	Syrinx Environmental PL
63	14/01/2010	T8	Main_360m	119.01372300000	-22.22707300070	Rada Tomanovic	Syrinx Environmental PL
64	14/01/2010	T8	Main_380m	119.01382400000	-22.22722500050	Rada Tomanovic	Syrinx Environmental PL
65	14/01/2010	T8	Main_400m	119.01392500000	-22.22737700030	Rada Tomanovic	Syrinx Environmental PL
66	14/01/2010	T8	Main_420m	119.01402800000	-22.22752900110	Rada Tomanovic	Syrinx Environmental PL
67	14/01/2010	T8	Main_440m	119.01412300000	-22.22769400060	Rada Tomanovic	Syrinx Environmental PL
68	14/01/2010	T8	Main_460m	119.01422700000	-22.22784200110	Rada Tomanovic	Syrinx Environmental PL
69	14/01/2010	T8	Main_480m	119.01432700000	-22.22799400090	Rada Tomanovic	Syrinx Environmental PL
70	14/01/2010	T8	Main_500m	119.01442400000	-22.22815300110	Rada Tomanovic	Syrinx Environmental PL
8	13/01/2010	T9	Rail centreline_T9	119.01751600000	-22.22628600040	Rada Tomanovic	Syrinx Environmental PL
9	13/01/2010	T9	Reference_20m	119.01749700000	-22.22610800030	Rada Tomanovic	Syrinx Environmental PL
10	13/01/2010	T9	Reference_40m	119.01748300000	-22.22594300080	Rada Tomanovic	Syrinx Environmental PL
11	13/01/2010	T9	Reference_60m	119.01750600000	-22.22574800080	Rada Tomanovic	Syrinx Environmental PL
12	13/01/2010	T9	Reference_80m	119.01752500000	-22.22556600050	Rada Tomanovic	Syrinx Environmental PL
13	13/01/2010	T9	Reference_100m	119.01753100000	-22.22538900040	Rada Tomanovic	Syrinx Environmental PL
14	13/01/2010	T9	Reference_ 120m	119.01755200000	-22.22520500090	Rada Tomanovic	Syrinx Environmental PL
15	13/01/2010	T9	Main_20m	119.01750500000	-22.22646400050	Rada Tomanovic	Syrinx Environmental PL
16	13/01/2010	T9	Main_40m	119.01747400000	-22.22664200060	Rada Tomanovic	Syrinx Environmental PL
17	13/01/2010	T9	Main_60m	119.01745100000	-22.22682000070	Rada Tomanovic	Syrinx Environmental PL
18	13/01/2010	T9	Main_80m	119.01744600000	-22.22699700080	Rada Tomanovic	Syrinx Environmental PL
19	13/01/2010	T9	Main_100m	119.01743000000	-22.22717700100	Rada Tomanovic	Syrinx Environmental PL
20	13/01/2010	T9	Main_120m	119.01742800000	-22.22735600030	Rada Tomanovic	Syrinx Environmental PL
21	13/01/2010	T9	Main_140m	119.01741900000	-22.22753600050	Rada Tomanovic	Syrinx Environmental PL
22	13/01/2010	T9	Main_160m	119.01741500000	-22.22771600070	Rada Tomanovic	Syrinx Environmental PL
23	13/01/2010	T9	Main_180m	119.01741700000	-22.22789500090	Rada Tomanovic	Syrinx Environmental PL
24	13/01/2010	T9	Main_200m	119.01742600000	-22.22807600110	Rada Tomanovic	Syrinx Environmental PL
25	13/01/2010	T9	Main_220m	119.01742700000	-22.22825800050	Rada Tomanovic	Syrinx Environmental PL
26	13/01/2010	T9	Main_240m	119.01743100000	-22.22843400050	Rada Tomanovic	Syrinx Environmental PL
27	13/01/2010	T9	Main_260m	119.01744300000	-22.22861400070	Rada Tomanovic	Syrinx Environmental PL

GPS_ID	DATE_	TRANSECT	COMMENTS	POINT_X	POINT_Y	DATA_COLLE	COMPANY
28	13/01/2010	T9	Main_280m	119.01746000000	-22.22879500100	Rada Tomanovic	Syrinx Environmental PL
29	13/01/2010	T9	Main_300m	119.01747700000	-22.22897400020	Rada Tomanovic	Syrinx Environmental PL
30	13/01/2010	T9	Main_320m	119.01746800000	-22.22916700110	Rada Tomanovic	Syrinx Environmental PL
31	13/01/2010	T9	Main_340m	119.01745600000	-22.22934300020	Rada Tomanovic	Syrinx Environmental PL
32	13/01/2010	T9	Main_360m	119.01744600000	-22.22952500050	Rada Tomanovic	Syrinx Environmental PL
33	13/01/2010	T9	Main_380m	119.01743400000	-22.22970200050	Rada Tomanovic	Syrinx Environmental PL
34	13/01/2010	T9	Main_400m	119.01743700000	-22.22988400080	Rada Tomanovic	Syrinx Environmental PL
35	13/01/2010	T9	Main_420m	119.01742700000	-22.23005700070	Rada Tomanovic	Syrinx Environmental PL
36	13/01/2010	T9	Main_440m	119.01743600000	-22.23024300030	Rada Tomanovic	Syrinx Environmental PL
37	13/01/2010	T9	Main_460m	119.01743800000	-22.23041900030	Rada Tomanovic	Syrinx Environmental PL
38	13/01/2010	T9	Main_480m	119.01743200000	-22.23060600090	Rada Tomanovic	Syrinx Environmental PL
39	13/01/2010	T9	Main_500m	119.01741200000	-22.23079200050	Rada Tomanovic	Syrinx Environmental PL
1	12/01/2010	T10	Rail centreline_T11	119.02402100000	-22.23327300060	Rada Tomanovic	Syrinx Environmental PL
2	12/01/2010	T10	Reference_100m	119.02494900000	-22.23303100030	Rada Tomanovic	Syrinx Environmental PL
3	12/01/2010	T10	Main_100m	119.02313300000	-22.23362500070	Rada Tomanovic	Syrinx Environmental PL
4	12/01/2010	T10	Main_200m	119.02223300000	-22.23395900080	Rada Tomanovic	Syrinx Environmental PL
5	12/01/2010	T10	Main_300m	119.02134000000	-22.23428700060	Rada Tomanovic	Syrinx Environmental PL
6	12/01/2010	T10	Main_400m	119.02047600000	-22.23469400050	Rada Tomanovic	Syrinx Environmental PL
7	12/01/2010	T10	Main_470m	119.01989800000	-22.23501200080	Rada Tomanovic	Syrinx Environmental PL
271	18/01/2010	T11	Rail centreline_T12	119.02426200000	-22.23387500050	Rada Tomanovic	Syrinx Environmental PL
272	18/01/2010	T11	Reference_20m	119.02438600000	-22.23373400030	Rada Tomanovic	Syrinx Environmental PL
273	18/01/2010	T11	Reference_40m	119.02451100000	-22.23359800030	Rada Tomanovic	Syrinx Environmental PL
274	18/01/2010	T11	Reference_60m	119.02463400000	-22.23347500100	Rada Tomanovic	Syrinx Environmental PL
275	18/01/2010	T11	Reference_80m	119.02476500000	-22.23333100060	Rada Tomanovic	Syrinx Environmental PL
276	18/01/2010	T11	Reference_100m	119.02490700000	-22.23320100090	Rada Tomanovic	Syrinx Environmental PL
277	18/01/2010	T11	Main_20m	119.02411800000	-22.23399700080	Rada Tomanovic	Syrinx Environmental PL
278	18/01/2010	T11	Main_40m	119.02397300000	-22.23411000060	Rada Tomanovic	Syrinx Environmental PL
279	18/01/2010	T11	Main_60m	119.02382800000	-22.23423000070	Rada Tomanovic	Syrinx Environmental PL
280	18/01/2010	T11	Main_80m	119.02368600000	-22.23435000090	Rada Tomanovic	Syrinx Environmental PL
281	18/01/2010	T11	Main_100m	119.02353700000	-22.23446600080	Rada Tomanovic	Syrinx Environmental PL
282	19/01/2010	T11	Main_120m	119.02338100000	-22.23459300040	Rada Tomanovic	Syrinx Environmental PL
283	19/01/2010	T11	Main_140m	119.02326400000	-22.23472500110	Rada Tomanovic	Syrinx Environmental PL
284	19/01/2010	T11	Main_160m	119.02312900000	-22.23486100100	Rada Tomanovic	Syrinx Environmental PL
285	19/01/2010	T11	Main_180m	119.02299400000	-22.23499200080	Rada Tomanovic	Syrinx Environmental PL
286	19/01/2010	T11	Main_200m	119.02286200000	-22.23512400060	Rada Tomanovic	Syrinx Environmental PL
287	19/01/2010	T11	Main_220m	119.02272100000	-22.23525000100	Rada Tomanovic	Syrinx Environmental PL
288	19/01/2010	T11	Main_240m	119.02259200000	-22.23537800060	Rada Tomanovic	Syrinx Environmental PL
289	19/01/2010	T11	Main_260m	119.02246600000	-22.23549800070	Rada Tomanovic	Syrinx Environmental PL
290	19/01/2010	T11	Main_280m	119.02232800000	-22.23563400070	Rada Tomanovic	Syrinx Environmental PL
291	19/01/2010	T11	Main_300m	119.02219600000	-22.23577600100	Rada Tomanovic	Syrinx Environmental PL
292	19/01/2010	T11	Main_320m	119.02206600000	-22.23589200090	Rada Tomanovic	Syrinx Environmental PL
293	19/01/2010	T11	Main_340m	119.02192500000	-22.23601700040	Rada Tomanovic	Syrinx Environmental PL
294	19/01/2010	T11	Main_360m	119.02178100000	-22.23614600090	Rada Tomanovic	Syrinx Environmental PL
295	19/01/2010	T11	Main_380m	119.02164200000	-22.23627100040	Rada Tomanovic	Syrinx Environmental PL
296	19/01/2010	T11	Main_400m	119.02149600000	-22.23639300060	Rada Tomanovic	Syrinx Environmental PL
297	19/01/2010	T11	Main_420m	119.02135200000	-22.23653100070	Rada Tomanovic	Syrinx Environmental PL
298	19/01/2010	T11	Main_440m	119.02121500000	-22.23665500100	Rada Tomanovic	Syrinx Environmental PL
299	19/01/2010	T11	Main_460m	119.02107300000	-22.23677400110	Rada Tomanovic	Syrinx Environmental PL
300	19/01/2010	T11	Main_480m	119.02093300000	-22.23689600050	Rada Tomanovic	Syrinx Environmental PL
301	19/01/2010	T11	Main_500m	119.02079200000	-22.23701900070	Rada Tomanovic	Syrinx Environmental PL

Appendix 5 Summary Baseline Mulga Density Data

Transect Number	Transect Type	Total Transect Area (m^2)	Mature Alive per $100m^2$	Juveniles Alive per $100m^2$	Seedlings Alive per $100m^2$	Resprouts per $100m^2$	Total Number of Mulga per $100m^2$
T1	Reference 1	1000	0.4	1.2	0.0	0.6	2.2
	Main 1	5000	1.6	3.2	0.0	0.1	5.0
T2	Reference 2	1000	0.2	0.8	0.0	0.4	1.4
	Main 2	5000	2.0	1.7	0.0	0.2	3.9
T3	Reference 3	1000	0.3	0.6	0.0	0.1	1.0
	Main 3	4300	0.3	2.6	0.0	0.5	3.4
T4	Reference 4	1000	0.0	0.0	0.0	0.0	0.0
	Main 4	4600	0.9	0.2	0.0	0.2	1.3
T5	Reference 5	1000	0.6	1.3	0.0	0.0	1.9
	Main 5	5000	0.1	3.4	0.0	0.0	3.5
T6	Reference 6	1000	1.7	2.7	0.0	0.0	4.4
	Main 6	5000	0.1	2.8	0.0	0.0	2.9
T7	Reference 7	1000	0.2	6.7	0.0	0.0	6.9
	Main 7	5000	0.1	7.8	0.0	0.0	8.0
T8	Reference 8	1000	2.3	8.3	0.0	0.5	11.1
	Main 8	5000	1.5	0.8	0.0	0.2	2.5
T9	Reference 9	1200	1.6	0.1	0.0	0.0	1.7
	Main 9	5000	1.7	0.7	0.0	0.0	2.4
T10	Reference 10	1000	1.2	2.0	0.0	0.0	3.2
	Main 10	4700	7.8	36.5	0.0	0.0	44.3
T11	Reference 11	1000	1.3	7.3	0.1	0.0	8.7
	Main 11	5000	2.2	15.1	0.0	0.0	17.4