



# Flora and Vegetation Assessment of the Bald Hill Project Expansion Areas

March 2017



## 1.0 INTRODUCTION

Alliance Mineral Assets Ltd and Tawana Resources Ltd intend to expand the existing Bald Hill mining operation to extract lithium from a significant deposit recently identified within the project area.

Expansion of the operation will include clearing of vegetation for an additional access road, expanded ROM, significantly increased pit, a new tailings storage facility and waste dumps.

To assist with development of the approvals required for the Bald Hill expansion, Ecotec (WA) Pty Ltd undertook a flora and vegetation assessment of the project area to:

- determine whether any threatened or otherwise conservation-significant flora exists within the project area
- describe and assess the condition of the vegetation within the areas to be impacted by expansion of the operation.

The project area is located within an active pastoral lease and the surrounding vegetation has been subjected to intensive grazing for many years. Historic mining and prospecting disturbance is also found throughout the surrounding area.

The flora and vegetation assessment was conducted on 29 and 30 March 2017 by Jeremy Shepherdson, an environmental consultant with more than 18 years experience in environmental management in the Goldfields, Mid-west, Pilbara and Kimberley regions of Western Australia.

## 2.0 DATABASE SEARCH RESULTS

A search of the Department of Parks and Wildlife (DPaW) NatureMap database was undertaken using the coordinates of the existing mine operation. No results were obtained when a 5km radius was applied, indicating the absence of recent biological surveys undertaken in the area. With an expanded search radius of 20km the search returned 83 flora species, including four Priority listed species (Table 1).

**Table 2.1: Database search results for conservation-significant flora in the Bald Hill project area**

Status	Species name	Preferred habitat
P3	<i>Allocasuarina eriochlamys</i> subsp. <i>grossa</i>	Stony loam, laterite clay. Granite outcrops.
P4	<i>Eucalyptus kruseana</i>	Sandy loam. Granite outcrops and hills.
P4	<i>Eucalyptus x brachyphylla</i>	Sandy loam. Granite outcrops.
P4	<i>Lepidosperma lyonsii</i>	Gentle hill slopes, upper slopes of large hills.

A search of the Department of Environment and Energy EPBC Protected Matters database for the area with a 20km buffer returned no threatened flora species.

### 3.0 ASSESSMENT RESULTS

The flora and vegetation assessment was conducted over two days as a targeted search for any threatened or otherwise conservation significant species as well as to provide a general description of the vegetation types present in the area. The dominant and most common species were recorded at each of the assessment sites, identified in Figure 3.1. The sites were selected based on planned project disturbance and changes in vegetation identified from satellite imagery. The assessment of each site was conducted as a releve of the surrounding area. The site data is included as Attachment 1.

No threatened or conservation significant flora was identified. The flora species recorded are generally common and widespread in the surrounding region. Several introduced species were identified, and are also common and widespread in the region.

In broad terms, four vegetation types were identified during the assessment. Figure 3.2 shows the extent of these vegetation types in the vicinity of the Bald Hill Project. The following sections describe each vegetation type.

#### 3.1 Maireana Low Shrubland

The most common vegetation type in the Bald Hill Project area is Maireana Low Shrubland, comprising *Maireana brevifolia* and *M. sedifolia* over a variety of herbaceous species. Scattered larger *Acacia* shrubs and *Eucalyptus* trees are found throughout this vegetation type. The introduced species *Salvia verbenaca* was abundant at the time the assessment was undertaken.

This vegetation type is believed to be the result of timber harvesting from the area, followed by decades of grazing by cattle. Palatable vegetation is heavily grazed and the diversity of flora species is low. This vegetation type is considered to be in Degraded condition according to Keighery (1994).



Photograph 3.1: Maireana Low Shrubland vegetation.

### 3.2 Eucalyptus Open Woodland

Surrounding the Bald Hill site at a distance of 1.5 – 2 km is Eucalyptus Open Woodland vegetation. *Eucalyptus salmonophloia* (Salmon Gum) and *E. salubris* (Gimlet) are the most common tree species in this vegetation type, with *Atriplex vesicaria* the most common understorey species, although this is variable depending on grazing activity. Within this vegetation type are denser stands of Eucalypts, such as *E. salubris* and *E. lesoufii* (Goldfields Blackbutt). While this is also subject to grazing, the vegetation is generally in Good condition according to Keighery (1994). A much lower prevalence of introduced flora is apparent.



Photograph 3.2: Typical Eucalypt Open Woodland.

### 3.3 *Callitris preissii* Open Low Woodland

*Callitris preissii* Open Low Woodland is located to the south of the mine site on the higher ground of the salt lake fringes. Soils are sandy loam. Although there is a high degree of cattle activity in this vegetation type, vegetation condition is generally Good according to Keighery (1994). Other common species in the vegetation type include *Acacia ligulata* and *Dodonaea viscosa* subsp. *angustissima*.



Photograph 3.3: *Callitris preissii* Open Low Woodland

### 3.4 *Tecticornia* Low Shrubland

*Tecticornia* Low Shrubland is found extensively in the lower-lying areas to the south of the mine site and comprises a number of *Tecticornia* and *Frankenia* species. Soils are typically saline and may be inundated following large rainfall events. Due to the inpalatability of the vegetation, the condition is considered Good according to Keighery (1994).



Photograph 3.4: *Tecticornia* Low Shrubland.

## 4.0 DISCUSSION

Vegetation in the areas proposed for further disturbance associated with the Bald Hill Project is generally in a degraded condition as a result of decades of grazing activity. Species present in the Maireana Low Shrubland and Eucalypt Open Woodland vegetation types are common and widespread in the surrounding region.

No threatened flora species were located and not considered likely to be present due to lack of suitable habitat and extensive cattle grazing.

The two vegetation types to the south of the operation - *Callitris preissii* Open Low Woodland and *Tecticornia* Low Shrubland – require further investigation by a botanist with salt lake experience.

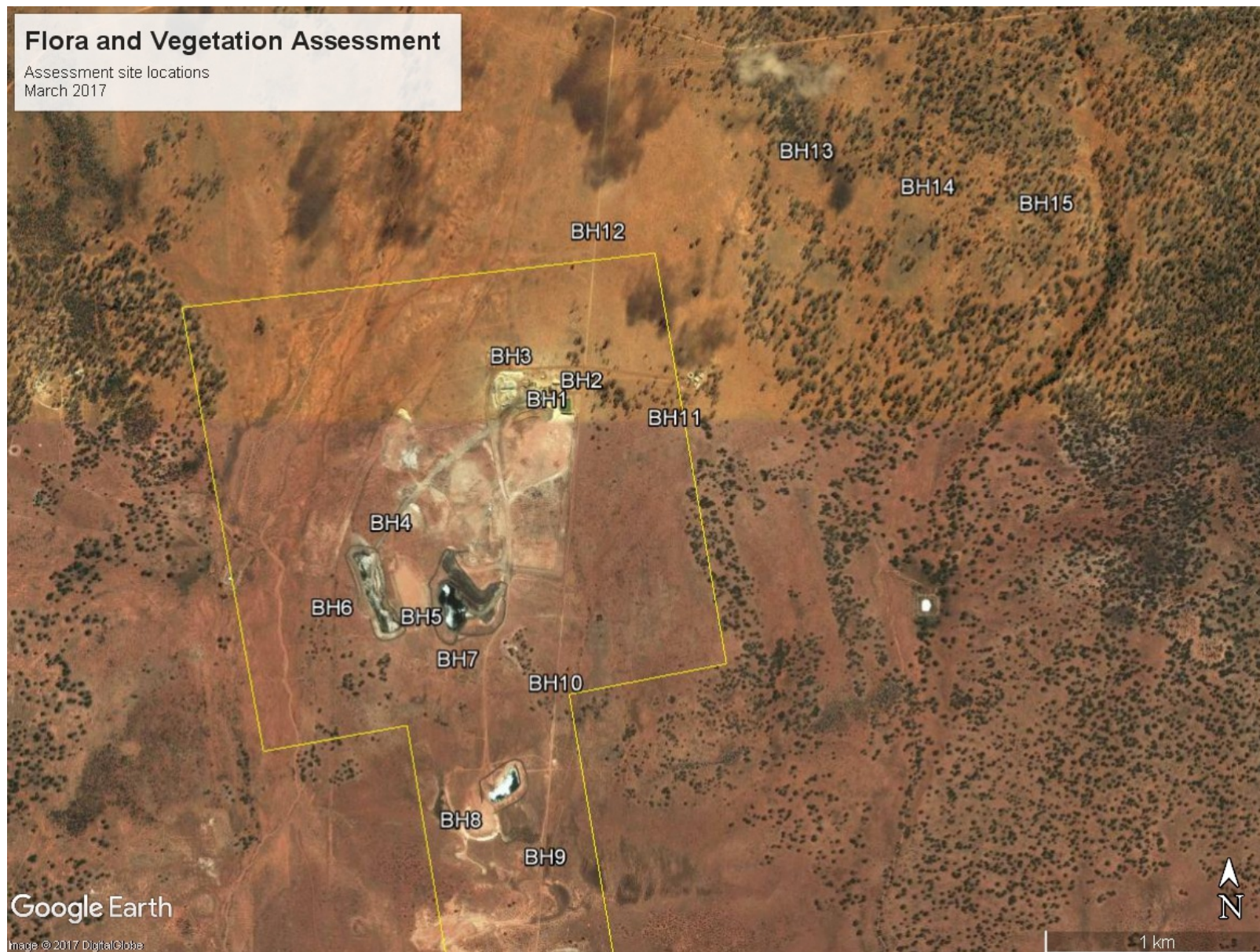


Figure 3.1: Flora and vegetation assessment sites.

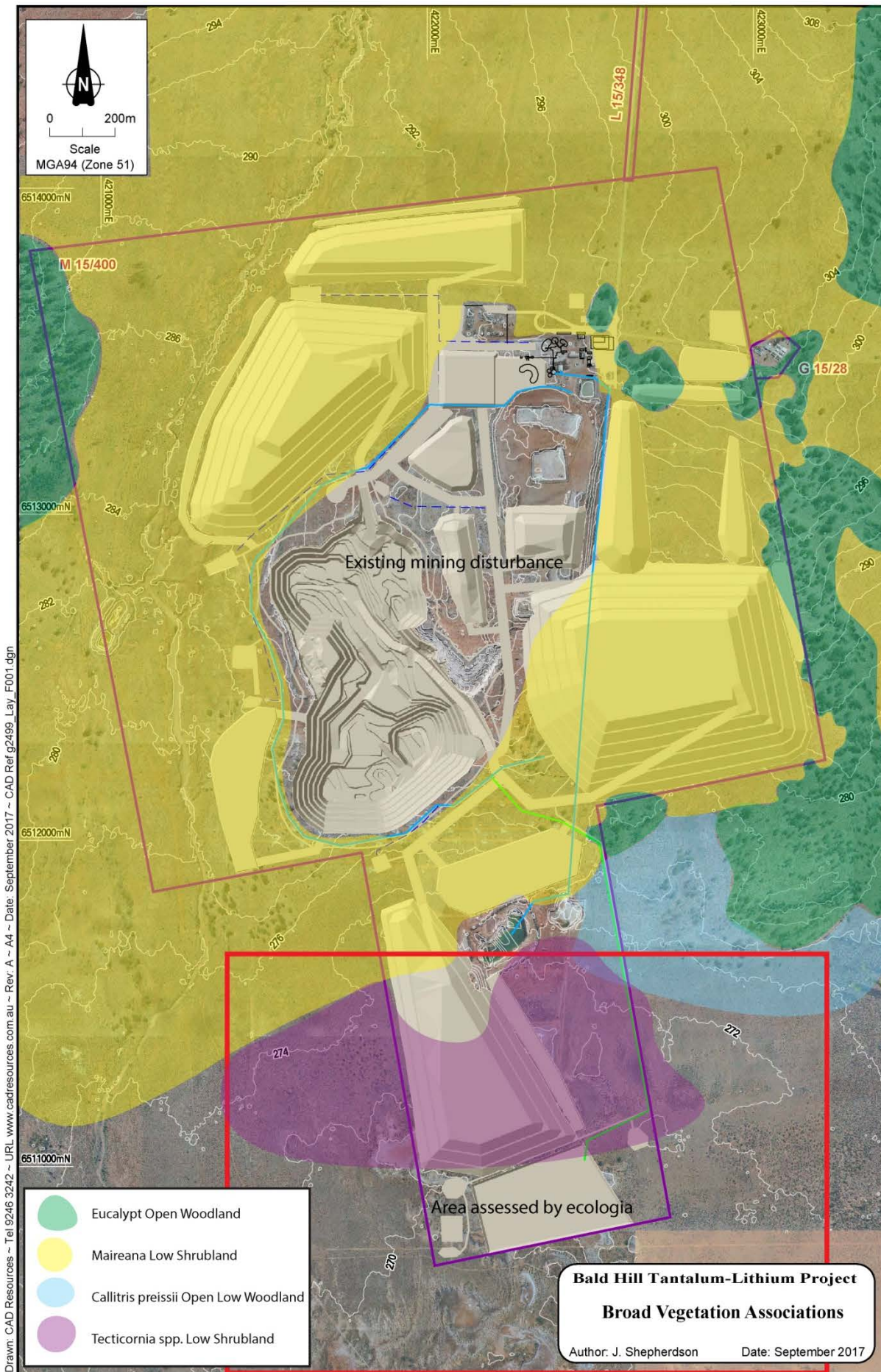




Figure 3.2: Broad vegetation types in the vicinity of the Bald Hill Project.





## **Attachment 1**


### **Vegetation Assessment Site Data**


<b>Site</b>	<b>BH1</b>	<b>Location</b>	<b>Proposed offices and carpark, east side of existing carpark and office.</b>
			
<b>Vegetation description</b>	Very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species.		
<b>Vegetation condition (Keighery, 1994)</b>	Degraded		
<b>Flora species present</b>			
<b>Species</b>	<b>Common name</b>		
<i>Atriplex nummularia</i>	Old man saltbush		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Solanum orbiculatum</i>	Round-leaved solanum		
<i>Sclerolaena spp</i>			
* <i>Salvia verbenaca</i>	Wild sage		
<b>Comments</b>			
Extremely degraded, predominately due to grazing. Evidence of cattle activity. Annual weed <i>Salvia verbenaca</i> abundant due to recent rainfall.			


Site	BH2	Location	Proposed ring road and stockpiles, north side of plant.
			
Vegetation description	Very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species.		
Vegetation condition (Keighery, 1994)	Degraded		
<b>Flora species present</b>			
<b>Species</b>	<b>Common name</b>		
<i>Atriplex nummularia</i>	Old man saltbush		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Solanum orbiculatum</i>	Round-leaved solanum		
<i>Sclerolaena</i> spp			
* <i>Salvia verbenaca</i>	Wild sage		
<b>Comments</b>			
Extremely degraded, predominately due to grazing. Evidence of cattle activity. Annual weed <i>Salvia verbenaca</i> abundant due to recent rainfall.			

Site	BH3	Location	ROM extension, west side of plant.
			
Vegetation description	Very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species. Scattered <i>Acacia tetragonophylla</i> .		
Vegetation condition (Keighery, 1994)	Degraded		
Flora species present			
Species	Common name		
<i>Acacia tetragonophylla</i>	Curara		
<i>Atriplex nummularia</i>	Old man saltbush		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Solanum orbiculatum</i>	Round-leaved solanum		
<i>Sclerolaena</i> spp			
* <i>Salvia verbenaca</i>	Wild sage		
Comments			
Extremely degraded, predominately due to grazing. Cattle present. Annual weed <i>Salvia verbenaca</i> abundant due to recent rainfall.			


Site	BH4	Location	Proposed new pit, north end of existing Hillview pit and waste dump.
			
Vegetation description	<p>Remnants of very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species.</p> <p>Some areas may be rehabilitated disturbance.</p> <p>Extensive recent exploration activity</p>		
Vegetation condition (Keighery, 1994)	Degraded		
<b>Flora species present</b>			
<b>Species</b>	<b>Common name</b>		
<i>Atriplex nummularia</i> <i>Maireana brevifolia</i> <i>Maireana sedifolia</i> <i>Solanum lasiophyllum</i> <i>Sclerolaena</i> spp	Old man saltbush Short-leaf bluebush Pearl bluebush Flannel bush		
<b>Comments</b>			
Extremely degraded due to grazing, recent exploration and proximity to mining activity. Evidence of cattle.			


<b>Site</b>	<b>BH5</b>	<b>Location</b>	<b>Proposed new pit, currently Hillview waste dump.</b>
			
<b>Vegetation description</b>	Rehabilitated waste dump		
<b>Vegetation condition (Keighery, 1994)</b>	Degraded		
<b>Flora species present</b>			
<b>Species</b>	<b>Common name</b>		
<i>Tecticornia</i> sp. <i>Maireana brevifolia</i> <i>Solanum lasiophyllum</i> <i>Sclerolaena</i> spp.	Samphire Short-leaf bluebush Flannel bush		
<b>Comments</b>			
Sparse regrowth on a rehabilitated waste dump. Recent exploration activity.			


Site	BH6	Location	Proposed new pit, south-west end of Hillview pit.
			
Vegetation description	Very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species. Scattered <i>Acacia tetragonophylla</i> .		
Vegetation condition (Keighery, 1994)	Degraded		
Flora species present			
Species	Common name		
<i>Acacia tetragonophylla</i>	Curara		
<i>Atriplex nummularia</i>	Old man saltbush		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Solanum orbiculatum</i>	Round-leaved solanum		
<i>Sclerolaena</i> spp			
* <i>Salvia verbenaca</i>	Wild sage		
Comments			
Degraded, predominately due to grazing. Evidence of cattle activity. Recent exploration activity.			


<b>Site</b>	<b>BH7</b>	<b>Location</b>	<b>South end of Central Pit.</b>
			
<b>Vegetation description</b>	Very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species. Scattered <i>Eucalyptus</i> spp.		
<b>Vegetation condition (Keighery, 1994)</b>	Degraded		
<b>Flora species present</b>			
<b>Species</b>	<b>Common name</b>		
<i>Acacia tetragonophylla</i>	Curara		
<i>Atriplex nummularia</i>	Old man saltbush		
<i>Eucalyptus flocktoniae</i>	Flockton's mallee		
<i>Eucalyptus griffithsii</i>	Griffiths' gum		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Sclerolaena</i> spp			
* <i>Salvia verbenaca</i>	Wild sage		
<b>Comments</b>			
<p>Sparse regrowth on predominately disturbed area.</p> <p>Recent exploration and historic mining/processing activity.</p>			




Site	BH8	Location	West side of Boreline Pit and waste dump.
			
Vegetation description	Closed to open heath of <i>Tecticornia</i> spp. over <i>Disphyma crassifolium</i> and <i>Gunniopsis quadrifida</i> .		
Vegetation condition (Keighery, 1994)	Good		
Flora species present			
Species	Common name		
<i>Disphyma crassifolium</i> <i>Gunniopsis quadrifida</i> <i>Tecticornia</i> spp.	Round-leaved pigface Sturt's pigface Samphire		
Comments			
Low-lying area subject to inundation. Saline soil. Evidence of cattle.			


<b>Site</b>	<b>BH9</b>	<b>Location</b>	<b>South side of Boreline Pit.</b>
			
<b>Vegetation description</b>	Closed to open heath of <i>Tecticornia</i> spp. over <i>Disphyma crassifolium</i> and <i>Gunniopsis quadrifida</i> .		
<b>Vegetation condition (Keighery, 1994)</b>	Good		
<b>Predominant flora species present</b>			
<b>Species</b>	<b>Common name</b>		
<i>Disphyma crassifolium</i>	Round-leaved pigface		
<i>Gunniopsis quadrifida</i>	Sturt's pigface		
<i>Pittosporum phylliraeoides</i>	Native apricot		
<i>Tecticornia</i> sp.	Samphire		
<b>Comments</b>			
<p>Low-lying area subject to inundation. Saline soil.</p> <p>Evidence of cattle.</p> <p>Historic mining activity on higher ground (in background of photo).</p>			


<b>Site</b>	<b>BH10</b>	<b>Location</b>	<b>East side of Main Waste Dump and TSF1.</b>
			
<b>Vegetation description</b>	Very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species.		
<b>Vegetation condition (Keighery, 1994)</b>	Degraded		
<b>Flora species present</b>			
<b>Species</b>	<b>Common name</b>		
<i>Atriplex nummularia</i>	Old man saltbush		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Solanum orbiculatum</i>	Round-leaved solanum		
<i>Sclerolaena</i> spp			
* <i>Salvia verbenaca</i>	Wild sage		
<b>Comments</b>			
Extremely degraded, predominately due to grazing. Evidence of cattle activity. Annual weed <i>Salvia verbenaca</i> abundant due to recent rainfall.			

<b>Site</b>	<b>BH11</b>	<b>Location</b>	<b>South side of camp access road.</b>
			
<b>Vegetation description</b>	Very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species. Scattered <i>Eucalyptus</i> spp.		
<b>Vegetation condition (Keighery, 1994)</b>	Degraded		
<b>Flora species present</b>			
<b>Species</b>	<b>Common name</b>		
<i>Atriplex nummularia</i>	Old man saltbush		
<i>Eucalyptus griffithsii</i>	Griffiths' gum		
<i>Eucalyptus salmonophloia</i>	Salmon gum		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Solanum orbiculatum</i>	Round-leaved solanum		
<i>Sclerolaena</i> spp			
* <i>Salvia verbenaca</i>	Wild sage		
<b>Comments</b>			
Degraded, predominately due to grazing. Evidence of cattle activity.			

Site	BH12	Location	East side of site access road.
			
Vegetation description	Very open shrubland of <i>Maireana brevifolia</i> and <i>M. sedifolia</i> over various herbaceous species.		
Vegetation condition (Keighery, 1994)	Degraded		
Flora species present			
Species	Common name		
<i>Atriplex nummularia</i> <i>*Carthamus lanatus</i> <i>*Citrullus lanatus</i> <i>Maireana brevifolia</i> <i>Maireana sedifolia</i> <i>Solanum lasiophyllum</i> <i>Solanum orbiculatum</i> <i>Sclerolaena</i> spp <i>*Salvia verbenaca</i>	Old man saltbush Saffron thistle (dead) Pie melon Short-leaf bluebush Pearl bluebush Flannel bush Round-leaved solanum  Wild sage		
Comments			
Old track supports abundance of <i>Salvia</i> due to increased moisture content.			

Site	BH13	Location	East side of site access road.
			
Vegetation description	Open Eucalypt woodland over <i>Atriplex vesicaria</i> and other herbaceous species.		
Vegetation condition (Keighery, 1994)	Good		
Flora species present			
Species	Common name		
<i>Atriplex vesicaria</i>	Bladder saltbush		
<i>Eucalyptus salmonophloia</i>	Salmon gum		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Solanum orbiculatum</i>	Round-leaved solanum		
<i>Sclerolaena</i> spp			
Comments			
<p>No weeds noted.</p> <p>Evidence of grazing.</p>			

Site	BH14	Location	East side of site access road.
			
Vegetation description	Open Eucalypt woodland over <i>Atriplex vesicaria</i> and other herbaceous species. Scattered dense stands of <i>E. salubris</i> .		
Vegetation condition (Keighery, 1994)	Good		
Flora species present			
Species	Common name		
<i>Atriplex vesicaria</i>	Bladder saltbush		
<i>Eucalyptus celastroides</i>	Mirret		
<i>Eucalyptus flocktoniae</i>	Merrit		
<i>Eucalyptus salmonophloia</i>	Salmon gum		
<i>Eucalyptus salubris</i>	Gimlet		
<i>Maireana brevifolia</i>	Short-leaf bluebush		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Solanum lasiophyllum</i>	Flannel bush		
<i>Solanum orbiculatum</i>	Round-leaved solanum		
<i>Sclerolaena</i> spp			
Comments			
<p>No weeds noted.  Evidence of grazing.  Ephemeral creek line with evidence of erosion, possibly due to old vehicle or cattle track.</p>			

Site	BH15	Location	East side of site access road.
			
Vegetation description	Open Eucalypt woodland over <i>Atriplex vesicaria</i> and other herbaceous species. Scattered dense stands of <i>E. salubris</i> .		
Vegetation condition (Keighery, 1994)	Good		
Flora species present			
Species	Common name		
<i>Atriplex vesicaria</i>	Bladder saltbush		
<i>Eremophila scoparia</i>	Broom bush		
<i>Eucalyptus flocktoniae</i>	Merrit		
<i>Eucalyptus lesouefii</i>	Goldfields blackbutt		
<i>Eucalyptus salubris</i>	Gimlet		
<i>Maireana sedifolia</i>	Pearl bluebush		
<i>Melaleuca sp.</i>			
<i>Rhagodia drummondii</i>	Rhagodia		
Comments			
<p>No weeds noted.</p> <p>Evidence of grazing and timber harvesting.</p>			



## **Attachment 2**

### **Vegetation Description and Condition References**

<b>Scheme for Description of Vegetation Structure</b> as adapted from Muir (1977) and via Aplin (1979) and Keighery (1994)				
<b>Growth Form/ Height Class</b>	<b>Canopy Cover</b>			
	<b>100% to 70</b>	<b>% 70% to 30</b>	<b>% 30% to 10</b>	<b>% 10% to 2 %</b>
Trees over 30 m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10-30 m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees under 10 m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Mallee over 8 m (Tree Mallee)	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee under 8 m (Shrub Mallee)	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs over 2 m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1-2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs under 1 m	Closed Low Heath	Open Low Heath	Low Shrubland	Very Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

<b>Condition Scale</b>	<b>Description</b>
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback , logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees or shrubs.