Broken Hill Solar Plant Biodiversity Offset Site

Annual Ecological Monitoring Report Year 5 – 2021

Final

March 07, 2022

AGL

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Contents

Executive Summary

As per the requirements of the Conditions of Approval (COA) the Broken Hill biodiversity offset site is required to be monitored and the results reported annually to the NSW Department of Planning, Industry and Environment (DPIE). Condition C5(b) specifically states that the biodiversity outcome to be achieved must 'improve or maintain' the biodiversity values of the offset site.

This report outlines the results of the Year 5 ecological monitoring survey, which is the fifth survey for the offset site.

It is important to note that the conditions in Year 4 (2020) were considerably improved from the Year 3 and Year 2 periods when drought was prevalent and floristic diversity, cover and condition was very low when compared to the vegetation community benchmarks (DECC 2008). It is likely that vegetation is still recovering from the impacts of 2018 and 2019 drought conditions.

The key results are summarised as follows:

- The monitoring has shown an improvement in overall condition of native vegetation on the offset site. The cover of native vegetation has increased in comparison with last year (Year 4) and is much higher than 2018 and 2019 levels. The increases in average rainfall in 2020 and 2021 (including two La Nina weather events) has initiated substantial recovery of vegetation cover, particularly in the ground layers of the site.
- Species richness was slightly decreased from the previous year although remains considerably higher than the Year 3 and Year 2 monitoring periods. Conditions have been favourable over the last year with above average rainfall. The slight decrease is likely due to natural factors as native species compete for space and nutrients whilst becoming re-established following the drought period.
- The cover of native vegetation has increased for all structural layers apart from native grasses which is slightly decreased from the previous year. The most pronounced increase observed was in the groundcover layers of shrubs and forbs.
- There has been a decrease in the exotic species cover, following the substantial increase recorded in Year 4 (following the break in drought conditions).
- Stock proof fencing around the offset site is in good condition, and repairs have been made (in May 2021) to the 2 sections of fence that were damaged during floods in 2020.
- Fauna habitats across the offset site are somewhat diverse and include chenopods, rocky patches, tussock grasses, clay crevices and some taller shrubs. These habitats have been maintained, and the groundcover and vegetative cover has increased due to higher rainfall in 2020-21.
- Weed infestations across the offset site are still generally low but remain present due to increased rainfall, and are present in several of the drainage line areas. Weed control work was undertaken just prior to this monitoring survey, and results of weed treatments won't be observable until the next round of survey. Additional weed control works are scheduled for early 2022.

The management actions proposed will further assist the natural regeneration with the recent increase in rainfall conditions.

1. Introduction

1.1 Background and study area

In 2014, AGL Energy Limited (AGL) constructed the Broken Hill Solar Plant (the solar plant), a solar photovoltaic (PV) plant with a nominal capacity of 50 MW, at Broken Hill in western NSW as part of the Commonwealth Solar Flagships Program. The solar plant is located on a property to the west of the Broken Hill township at Lot 6806 DP 823918 and is approximately 200 hectares (ha) in area. The location of the solar plant, access and transmission easements and offset site are shown in Figure 1.1.

The project was approved by the NSW Department of Planning and Infrastructure (DP&I) on 27 March 2013. It is a condition of approval (COA) that an Offset Management Package be developed to offset the ecological values lost as a result of the project (COA C5 is provided in Appendix B). AGL engaged the existing lessee of the solar plant site to include a suitable area of land for offsetting within the scope of the project.

The offset site is located 1.5 km west of the solar plant site, comprising the western portion of the same lot, Lot 6806 DP 823918, covering approximately 162 ha (see Figure 1.1).

AGL are responsible for the ongoing management of the offset site.

1.2 Objectives

This report documents the results of the annual (Year 5) ecological monitoring event for the offset site as required under COA C5. Monitoring of the offset site is required to demonstrate an 'improve or maintain' outcome for the identified biodiversity offset values at the offset site and to identify any management or remedial actions required to achieve these outcomes.

Monitoring requires the collection of ecological data, consistent with the methodology described in the Biodiversity Offset Management Plan (BOMP) prepared by NGH Environmental (2013). The results are described and analysed with comparison to benchmark data, the baseline data from the BOMP (NGH 2013), and those of the first, second, third and fourth year ecological monitoring events (Jacobs) to determine if there have been any significant changes in the vegetation and habitat conditions and the consistency of these with the objective of improving or maintaining the biodiversity values on the offset site.

In addition, an evaluation was undertaken of any required management actions and their effectiveness, as outlined in the BOMP (NGH 2013), and the standard management actions required to be undertaken at offset sites outlined in the BioBanking Assessment Methodology (BBAM 2009). This includes management of grazing for conservation, weed control, management of fire for conservation, management of human disturbance, retention of regrowth and remnant native vegetation, replanting or supplementary planting where natural regeneration will not be sufficient, retention of dead timber, erosion control and retention of rocks.

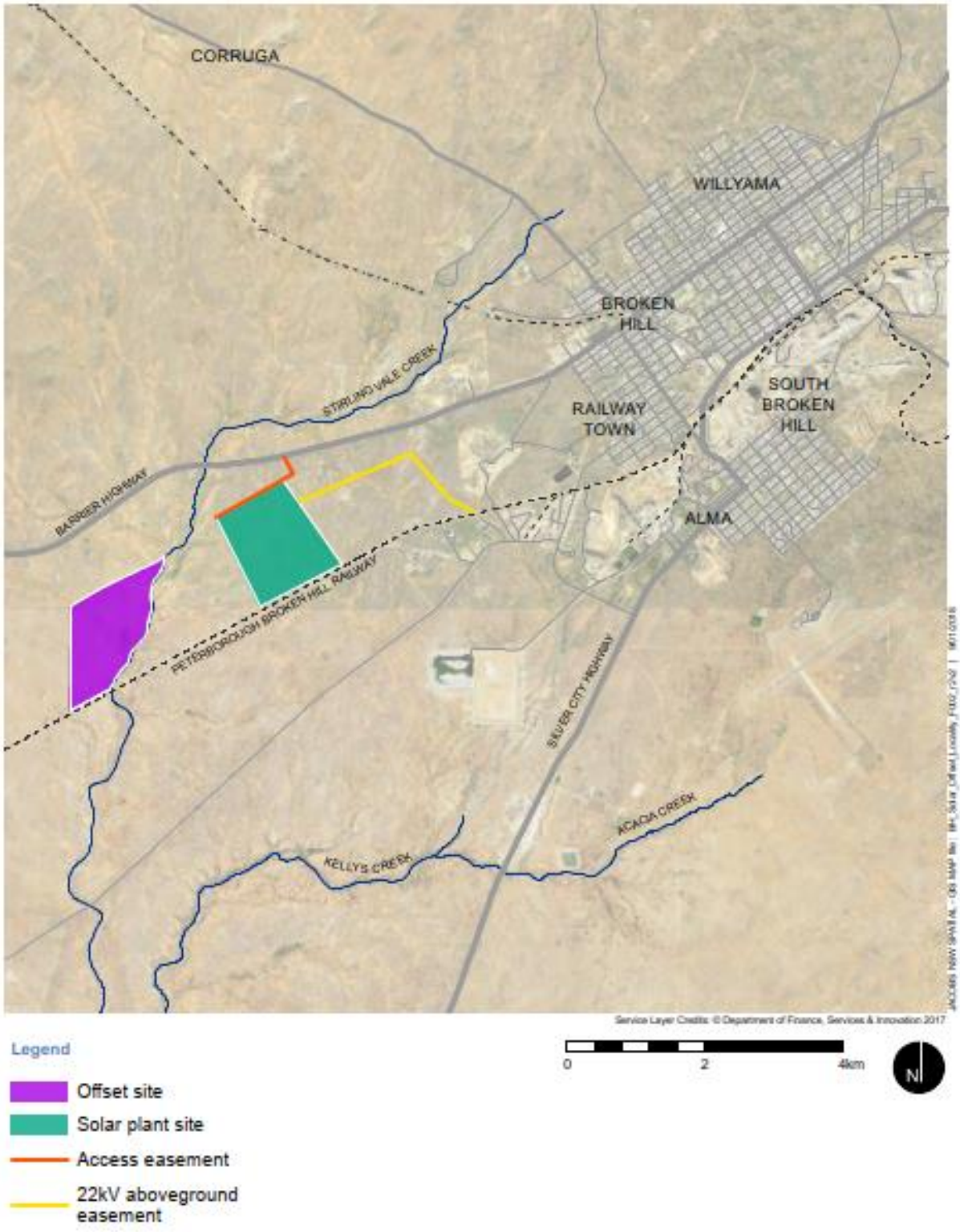


Figure 1.1 Broken Hill Solar Plant and offset site location

2. Monitoring method

2.1 Requirements

The monitoring method is consistent with the methodologies outlined in the BOMP (NGH 2013) and meets the requirements of the COA C5. In particular, COA C5(b) stipulates the requirement of the offset site to achieve an 'improved or maintained' outcome for the biodiversity values of the offset site. Improved or maintained outcomes for the biodiversity values of the offset site have been evaluated through the comparison of monitoring data against the benchmark data, baseline data and the results of the first, second, third and fourth monitoring events for each surveyed vegetation community as well as the evaluation of weed infestation and fauna habitat. An overview of the monitoring methods used include:

- Vegetation condition assessment. Following the methodology used in the BOMP (NGH 2013), an assessment was undertaken using the BioBanking Assessment Methodology (BBAM) (DECC 2009) to collect data on vegetation structure, cover and quality across transects and within monitoring plots. This data was then compared with the NGH (2013) baseline data, where available, and the benchmark data for each vegetation community type using the Vegetation Benchmarks Database (DECC 2008). The BBAM has now been replaced with the Biodiversity Assessment Methodology 2020 (BAM) which no longer uses the Modified Braun Blanquet method to assess floristic cover and abundance. Given that this study originally used the BBAM (with Modified Braun Blanquet cover/abundance data), this method has been continued in order to enable comparison of vegetation condition between previous years. The vegetation condition for December 2021 (Year 5, this report) is compared with:
    - Benchmark data
    - Baseline study (included in the BOMP, NGH 2013)
    - Year 1 monitoring (Jacobs - November 2017)
    - Year 2 monitoring (Jacobs - January 2019)
    - Year 3 monitoring (Jacobs - December 2019)
    - Year 4 monitoring (Jacobs - November 2020)
- Habitat evaluation. Notes on fauna habitat were taken across the broader site while traversing the offset site to reach the monitoring plots. At each monitoring plot detailed notes were taken.
- Fencing evaluation. Fences were assessed through observation by driving and walking around the perimeter of the offset site, looking for any areas requiring maintenance.

2.2 Field survey

The field survey was undertaken by two Jacobs Ecologists, Matt Consterdine and Tim Maher, on 15 December 2021 across the five vegetation types identified within the offset site (listed in Table 2.1 below and shown on Figure 2.2) by NGH (2013). Details on the vegetation types and number of plots sampled is outlined in Table 2-1.

Table 2.1 Vegetation types within the offset site and plots sampled

Vegetation Type (DECC 2008)	PCT ID	Area in offset site (ha)	Monitoring plots sampled by NGH (2013)	Monitoring sampled by Jacobs (2017-2020)	BBAM (DECC 2009) No. of plots required	Threat category (Benson, 2006)*
Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	221	141.8	M03 (1 plot)	M03 & M07 (2 plots)	4-6 plots	Near threatened
Prickly Wattle open shrubland of drainage lines on stony rises and plains of the arid climate zone	136	8.5	M01 (1 plot)	M01 (1 plot)	2-3 plots	Least concern
Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland of semi-arid and arid sandplains and dunes	143	1.9	M04 (1 plot)	M04 (1 plot)	1 plot	Least concern
Mulga - Dead Finish on stony hills mainly of the Channel Country and Broken Hill Complex Bioregions	123	1.5	M02 (1 plot)	M02 (1 plot)	1 plot	Near threatened
Old Man Saltbush shrubland mainly of the semi-arid (warm) climate zone (south western NSW)	159	3.2	Not surveyed by NGH (2013)	M05 & M06 (2 plots)	2 plots	Critically Endangered*

* This category is according to Benson (2006); none of these communities are listed under State or Commonwealth legislation

2.2.1 Vegetation condition assessment and establishment of monitoring plots

BioBanking plots were to be surveyed according to the BioBanking Assessment Methodology (BBAM) (DECC 2009), as outlined in COA C5 (Appendix B) and in the BOMP (NGH 2013).

Floristic data was collected to enable comparison between baseline data and benchmarks recorded in the BOMP (NGH 2013). The four monitoring plots established by NGH (2013), were located at the offset site using recorded GPS coordinates. The three additional plots (M05, M06, M07) were installed during the 2017 monitoring by Jacobs to cover additional vegetation areas and types. All plots were previously marked in the field using wooden stakes driven into the ground to facilitate future replication. Stakes were placed at the start and end of a 50 m transect and their coordinates recorded. Start points were delineated with a silver pin hammered into the top of the stake. A 20 x 20 m quadrat required by the BBAM (DECC 2009) was conducted within an area bounded by the first 20 m of the transect and extending 10 m either side (see Figure 2.1). Where required, stakes that had deteriorated in the field over time were replaced with new, thicker stakes and pins. Photographs were taken at the

start and end of each monitoring plot. The location of all vegetation types and monitoring plots are shown in Figure 2.2.

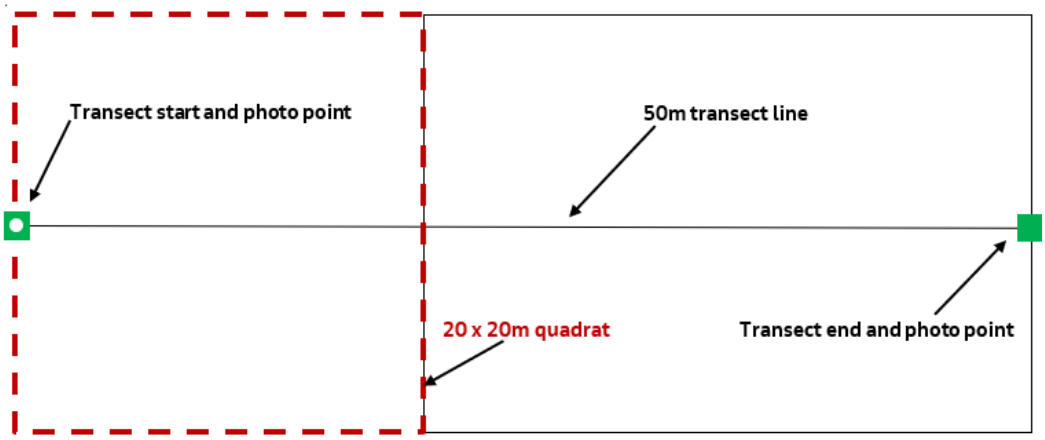


Figure 2-1: Monitoring plot method

Data collected during each monitoring year has been collated into one electronic database using Microsoft Excel, along with the NGH (2013) baseline data and the benchmark data for each vegetation community to enable future analysis of data.

Baseline data collected by NGH (2013) at the offset site was limited to a simple presence absence record of plants within monitoring plots. As such, this does not allow for a more detailed analysis to be undertaken to compare data. Therefore the Modified Braun Blanquet method (see Table 2.2) was used for recording floristic cover/abundance data within each monitoring plot, which allowed for more detailed analysis.

Table 2.2 Modified Braun Blanquet method used for the monitoring survey

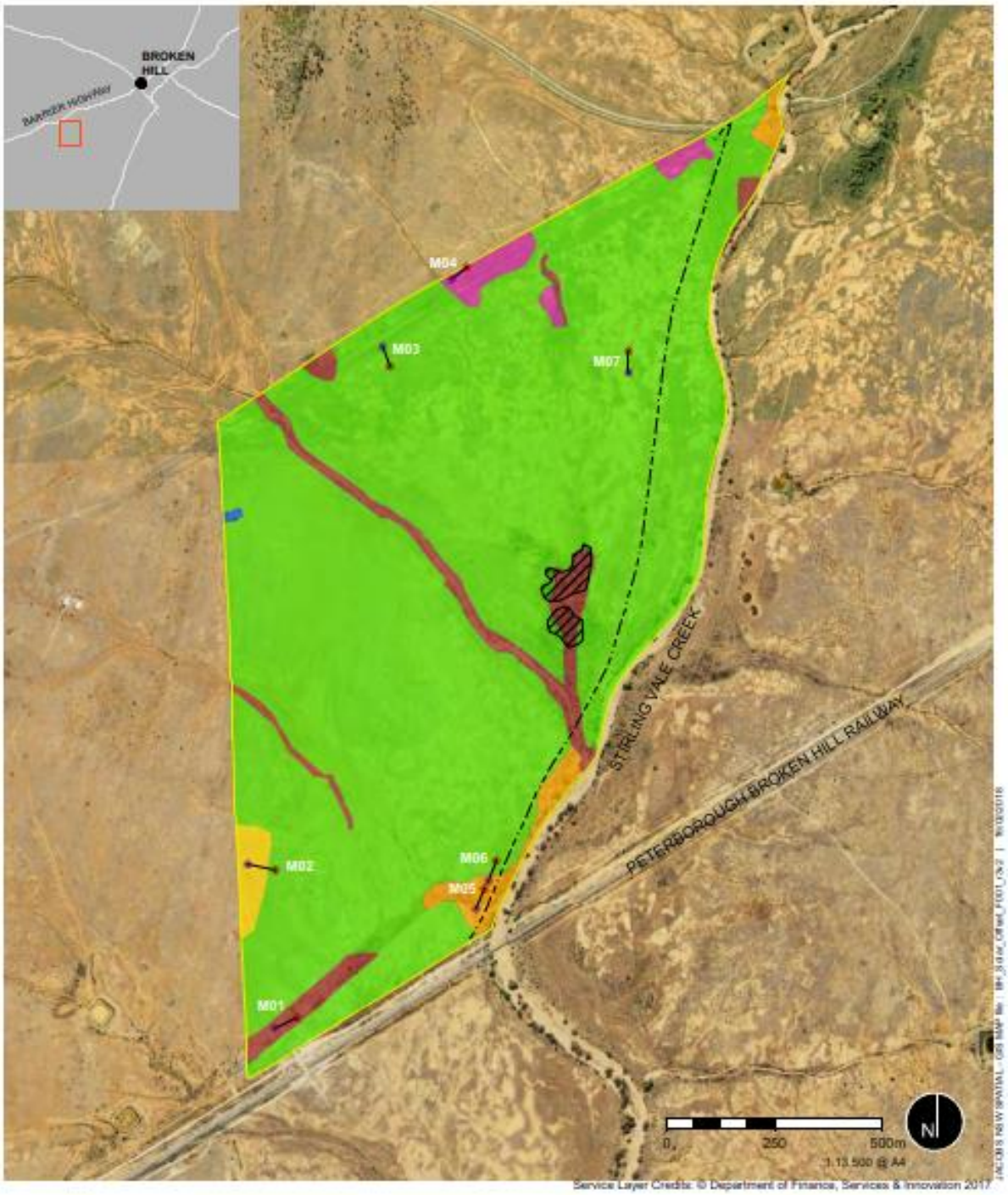
Modified Braun Blanquet	
1	1 to a few individuals present, less than 5% cover
2	Many individuals present, but still less than 5% cover
3	5-<20% cover
4	20-<50% cover
5	50-<75% cover
6	75-100% cover

The coordinates for each monitoring plot are provided in Table 2.3 to enable repeat and consistent monitoring in the future.

Table 2.3 Coordinates for each of the monitoring plots

Plot name	Transect start		Transect end	
	Latitude*	Longitude*	Latitude*	Longitude*
M01	533641.52	6458408.77	533693.98	6458429.85
M02	533599.64	6458791.57	533663.43	6458774.15
M03	533978.53	6459970.07	533992.65	6459922.92
M04	534146.70	6460116.23	534183.12	6460141.86
M05	534122.66	6458659.4	534144.39	6458705.5
M06	534154.88	6458721	534175.37	6458766.9
M07	534543.53	6459880.4	534546.53	6459929.4

* Co-ordinates are in MGA zone 54 relative to the WGS84 datum



Legend

Site boundary

Fence line

Transects

Start

Finish

Monitoring transect

Vegetation

Pepper tree infestation

Vegetation communities

Black bluebush low open shrubland

Mulga - dead finish

Old man saltbush shrubland

Prickly wattle open shrubland

Sandhill wattle tall open shrubland

Senna shrubland

Figure 2.2 Vegetation types and monitoring plots within the Broken Hill Offset Site

2.2.2 Habitat evaluation

Detailed habitat notes were taken at each of the monitoring plot locations and included the percentage cover of the following habitat features within the entire 50 x 20 m plot:

- Tussock grasses
- Chenopod shrubs
- Mulga (or other overstorey species)
- Bare ground
- Cracking clay
- Rocks and logs.

2.2.3 Grazing pressure

Grazing pressure is evaluated by visual inspections for fauna within the offset site.

2.2.4 Fencing evaluation

Fences were inspected for any required maintenance issues whilst driving around the perimeter of the offset site and whilst traversing the site by foot during monitoring surveys.

2.2.5 Data collection and analysis

Data collected during each monitoring year has been collated into one electronic database using Microsoft Excel, along with NGH (2013) baseline data and the benchmark data for each vegetation community to enable future analysis of data. Photographs of each monitoring plot are captured annually using regular photo points.

2.2.6 Climatic conditions

Broken Hill is a typically dry, semi-arid area that experiences low rainfall. Following very dry years of 2018 and 2019, both 2020 and 2021 have had many months of above average rainfall. The rainfall events throughout March, June, July and November 2021 provided significant levels of rainfall, and November rains in particular resulted in vastly improved conditions for plant growth, as observed during the Year 5 survey undertaken in December (see Figure 2.3 below). This has generally maintained the species richness counts from the previous year, as well as contributed to significant growth of native grasses.

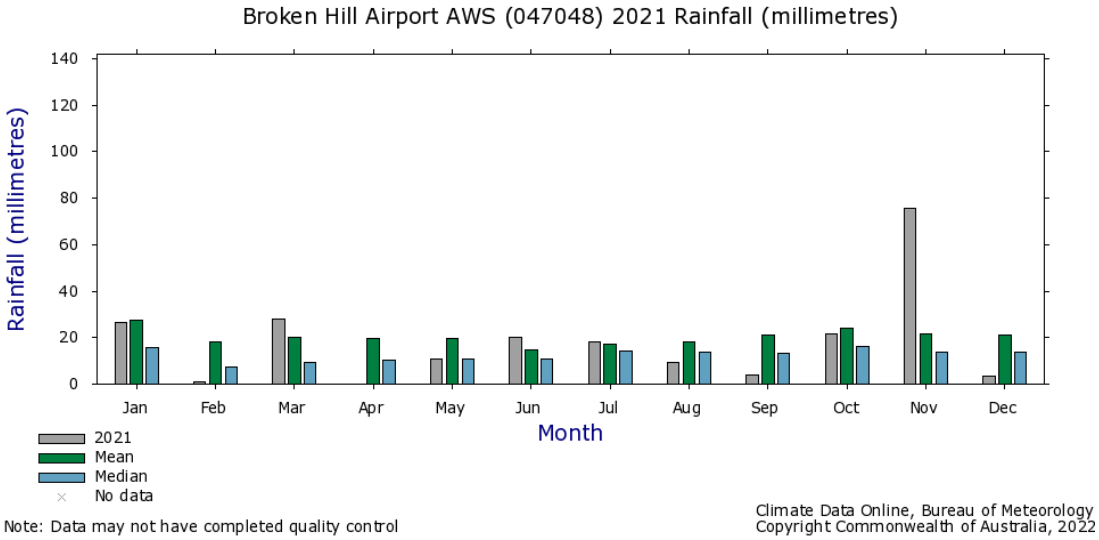


Figure 2.3: Rainfall in Broken Hill in 2021 (source: Australian Bureau of Meteorology)

3. Monitoring results

3.1 Plot data descriptions and benchmark comparisons

The data and description of the monitoring results for each surveyed vegetation community are listed below. Photographs taken at the start and end of each monitoring plot are also provided. A species list specific to the 20m x 20m monitoring plot within the larger transect area is provided in Appendix A.

3.1.1 Black Bluebush low open shrubland

The Black Bluebush low open shrubland community is the dominant vegetation type within the offset site. It is dominated by Black Bluebush (*Maireana pyramidata*) with other chenopod shrubs as sub-dominants including, Saltbushes (*Atriplex* spp.) and Copperburrs (*Sclerolaena* spp.). Grasses were largely absent from this community in the recent drought years of 2018 and 2019 due to lack of rainfall. A return to favourable conditions in 2020 saw a number of native grass species rebound in this community. Whilst native grass species are still present in Year 5, the cover has slightly declined during 2021 (see Plates 1 to 4). *Austrostipa scabra* subsp. *scabra* and *Rytidosperma caespitosum* were commonly recorded. Weed species were not extensive in this community. However, *Carrichtera annua* was present in low abundance in M03.

The monitoring plot data along with the benchmarks for this vegetation type (DECC 2008) are shown in Table 3.1 and Table 3.2. Species richness (the number of native species, shown in table 3.1 as 'Native Spp. #') was higher than the baseline for one of the plots, and greater than the Year 1 survey for the other. No over-storey vegetation was present, which is consistent with the baseline of each plot. Cover of native grass showed slight declines since 2020, although cover remains higher than the dry years of 2018 and 2019. The largest increases were in the shrub-layer vegetation cover. These categories are scoring within benchmark range for the community although are still below the baseline scores for each plot.

The native groundcover other (excluding grasses) category has slightly increased since last year and has approximately 7% cover. For contrast, the drought years of 2018 and 2019 were 0% cover. This cover seems low despite above monthly rainfall over the preceding months. This may suggest that this component of the vegetation may require increased rainfall over a longer period to recover.

Grass cover in both plots is still less than Year 1 monitoring although is above the minimum benchmark cover. As per previous surveys, Hollow Bearing Tree (HBTs) and logs were absent from this community.

Overall, this community continues to recover from the drought years of 2018 and 2019 years and historical grazing pressure. This slight increase in vegetation cover is shown in Table 3.1 and 3.2 below. Monitoring photographs for plot M07 and M03 shown in Plates 1 to 4. The health and condition of native plants has also visibly improved since last year. This is a result of the above average rainfall during 2020 and 2021, as well as exclusion of sheep and goats from the offset site.

Table 3.1 Benchmark and monitoring plot data comparison for Black Bluebush low open shrubland M03 – Broken Hill Offset site

	Native Spp. #	Native Cover				Native Groundcover						HBTs	Logs
		Overstorey		Mid-storey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	13	4%	20%	0%	0%	5%	20%	2%	15%	5%	20%	0	0
Baseline (NGH 2013)	10	0%		0%		52%		24%		0%		0	0
Year 1 Plot M03	13	0%		0%		16%		20%		34%		0	0
Year 2 Plot M03	8	0%		0%		0%		14%		2%		0	0
Year 3 Plot M03	6	0%		0%		0%		14%		0%		0	0
Year 4 Plot M03	12	0%		10%		9%		16%		4%		0	0
Year 5 Plot M03	12	0%		12%		8%		19%		5%		0	0

Table 3.2 Benchmark and monitoring plot data comparison for Black Bluebush low open shrubland M07 – Broken Hill Offset site

	Native Spp. #	Native Cover				Native Groundcover						HBTs	Logs
		Overstorey		Mid-storey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	13	4%	20%	0%	0%	5%	20%	2%	15%	5%	20%	0	0
Baseline (NGH 2013)	n/a	n/a		n/a		n/a		n/a		n/a		0	0
Year 1 Plot M07	8	0%		0%		4%		12%		58%		0	0
Year 2 Plot M07	7	0%		0%		0%		6%		0%		0	0
Year 3 Plot M07	6	0%		0%		0%		5%		0%		0	0
Year 4 Plot M07	9	0%		10%		3%		10%		5%		0	0
Year 5 Plot M07	7	0%		10%		4%		12%		7%		0	0

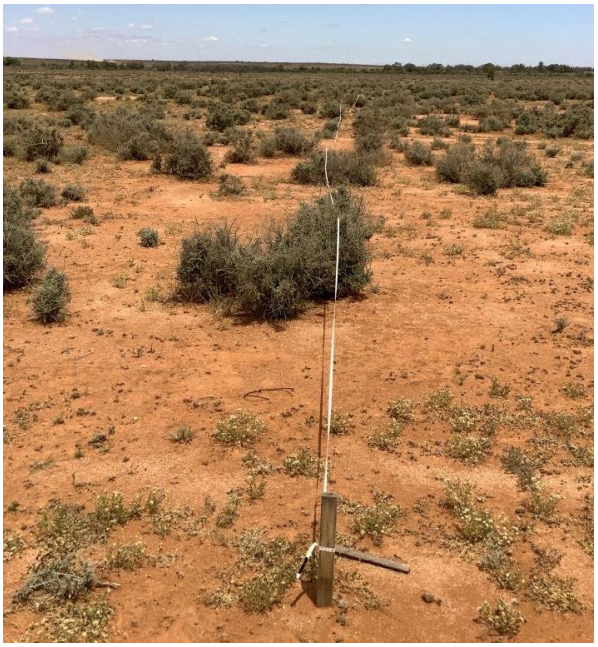


Plate 1 Black Bluebush low open shrubland M03 Year 4 (2020)

Plate 2 Black Bluebush low open shrubland M03 Year 5 (2021)

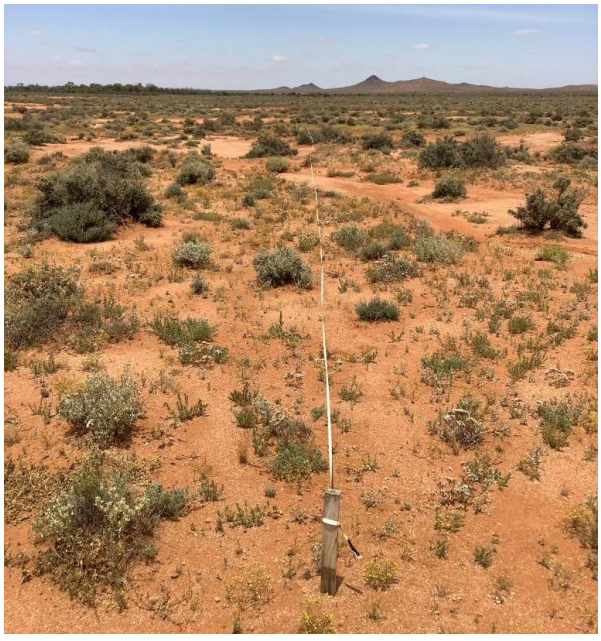


Plate 3 Black Bluebush low open shrubland M07 Year 4 (2020)

Plate 4 Black Bluebush low open shrubland M07 Year 5 (2021)

3.1.2 Mulga-Dead Finish on stony hills

The Mulga-Dead Finish on stony hills community is restricted to a small area on a rise in the west of the offset site where the soils are characteristically shallow and stony. Mulga (*Acacia aneura*) is absent within the offset site; however, it occurs on the property to the west. Dominant shrubs include Dead Finish (*Acacia tetragonophylla*), *Senna artemisioides* subsp. *filifolia* and *Senna phyllodinea*. The ground cover consists of a patchy distribution of grasses, forbs, bare earth and scattered rock. Vegetation is continuing to recover from drought conditions experienced in 2018 and 2019. Weed species *Asphodelus fistulosus* and *Carrichtera annua* are present in low abundance. Vegetation remains in similar condition to last year (Year 4) (See Plates 5 and 6).

The monitoring plot data along with the benchmarks for this vegetation type (DECC 2008) are shown in Table 3.3. Species richness was the highest ever recorded for this plot, above both the baseline and benchmark for this community. No overstorey cover was recorded in this community due to the absence of Mulga within the offset site, which based on the benchmark range, can be typical of the community.

Mid-storey cover and groundcover-shrub covers exceed the benchmarks. Mid-storey cover remains the same as last year. Groundcover-shrub cover has increased slightly on last year's cover score, mainly attributed to increased foliage growth of existing shrubs.

Grass cover increased and is higher than the benchmark for this community. Other native groundcovers (forbs) also increased slightly and is within benchmark percentage range for this community.

Hollow Bearing Trees (HBTs) and fallen logs are absent from this community.

Overall, this community is in moderate condition, with increased species richness and native vegetation cover this year. Weed cover has increased slightly but is not notable. Vegetation in plot M02 has retained health and is shown in Plates 5 and 6. This is a result of the above average rainfall in 2021 and reduced grazing pressure from herbivores.

Plate 5 Mulga - Dead Finish on stony hills M02 Year 4 (2020)

Plate 6 Mulga - Dead Finish on stony hills M02 Year 5 (2021)

Table 3.3 Benchmark and monitoring plot data comparison for Mulga-Dead Finish on stony hills M02 – Broken Hill offset site

	Native Spp. #	Native Cover				Native Groundcover						HBTs	Logs
		Overstorey		Mid-storey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	17	0%	3%	1%	3%	1%	5%	1%	5%	1%	5%	0	3
Baseline (NGH 2013)	15	0%		8%		52%		14%		2%		0	0
Year 1 Plot M02	18	0%		6%		24%		32%		38%		0	0
Year 2 Plot M02	12	0%		4%		0%		10%		0%		0	0
Year 3 Plot M02	9	0%		4%		0%		8%		0%		0	0
Year 4 Plot M02	18	0%		10%		6%		10%		2%		0	0
Year 5 Plot M02	20	0%		10%		10%		11%		3%		0	0

3.1.3 Prickly Wattle open shrubland

The Prickly Wattle open shrubland community typically occurs in drainage lines and depressions across the offset site. Prickly Wattle (*Acacia victoriae*) dominated the mid-storey of this community with no overstorey recorded. Dominant shrubs included; Bladder Saltbush (*Atriplex vesicaria*), Black Bluebush (*Maireana pyramidata*) and Spiny saltbush (*Rhagodia spinescens*). Groundcover is consistent and comprises of shrubs and forbs. Weed cover remains similar to 2020 (Year 4) which increased following drought years (as expected from above average rainfall) (see Plates 7 and 8). Weed species included: *Asphodelus fistulosus*, *Carrichtera annua, Carthamus lanatus, Chloris truncata, Prosopis velutina* and *Rumex crispus,* among others.

The monitoring plot data along with the benchmarks for this vegetation type (DECC 2008) is shown in Table 3.4. The number of native species recorded decreased slightly from 2020, although remains higher than the benchmark and baseline (and most previous monitoring years). Overstorey cover was absent from this community which is consistent with the benchmark and considered typical for this community. Mid-storey cover increased slightly and remains above that of the baseline survey and benchmark values. Groundcover-shrub cover is significantly greater than the benchmark for this community and has increased since last year's monitoring. The cover of grasses increased again and is well within benchmark range for the community (although not at baseline scores yet). Dominant grasses included Speargrass (*Austrostipa scabra* subsp. *Scabra*), Ringed Wallaby Grass (*Rytidosperma caespitosum*) and Windmill Grass (*Chloris truncata*). Native ground cover - other (forbs) increased substantially as a result of recent rainfall, and is well within benchmark values. Hollow Bearing Trees (HBTs) and fallen logs were absent from this community.

Overall, the condition of this community continues to improve following recent drought conditions. Cover percentages of all vegetation categories increased and are within or exceeding the benchmark levels in plot M01. This is likely a result of the above average rainfall and reduced grazing pressure from herbivores. The health and condition of native plants has visibly improved since last year and can be seen Plates 7 and 8.

Plate 7 Prickly Wattle low open shrubland M01 in Year 4 (2020)

Plate 8 Prickly Wattle low open shrubland M01 in Year 5 (2021)

Table 3.4 Benchmark and monitoring plot data comparison for Prickly Wattle open shrubland M01– Broken Hill Offset site

	Native Spp. #	Native Cover				Native Groundcover						HBTs	Logs
		Overstorey		Mid-storey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	11	0%	0.1%	0%	0%	2%	20%	1%	10%	1%	20%	0	0
Baseline (NGH 2013)	12	7%		5%		14%		38%		2%		0	1.5
Year 1 Plot M01	12	10%		16%		8%		32%		28%		0	0
Year 2 Plot M01	11	0%		21%		0%		22%		0%		0	0
Year 3 Plot M01	5	0%		15%		0%		18%		0%		0	0
Year 4 Plot M01	18	0%		20%		5%		20%		5%		0	0
Year 5 Plot M01	16	0%		22%		10%		22%		15%		0	0

3.1.4 Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland

This vegetation type occurs as discrete patches along the northern boundary of the offset site. The mid-storey is dominated by *Senna phyllodinea* and *S. artemisioides* subsp. *filifolia*. Groundcover is dominated by a range of shrubs including; Black Bluebush (*Maireana pyramidata*), Low Bluebush (*M. astrotricha*), Mallee Saltbush (*Atriplex stipitata*) and Spiny saltbush (*Rhagodia spinescens*).

Weed cover decreased slightly compared to last year in this community, with weeds including: Onion weed (*Asphodelus fistulosus*)*, Carrichtera annua*, Paterson's Curse (*Echium plantagineum),* Winged Sea Lavender (*Limonium lobatum*) and Maltese Star-thistle (*Centaurea melitensis*).

The monitoring plot data along with the benchmarks for this vegetation type (DECC 2008) are shown in Table 3.5. The number of species recorded was much higher than benchmark levels and higher than the baseline scores. Overstorey cover was absent from this community which is below the benchmark and baseline data (NGH 2013). At 12%, the mid-storey cover for this community was above the benchmark range, and the highest mid-storey cover score for this community so far. Groundcover-shrub cover was within the benchmark range but is still lower than that recorded during the baseline and Year 1 surveys. However, groundcover-shrub cover increased slightly compared to last year. Following favourable rainfall conditions, the cover of native grasses has improved and is within benchmark values. Similarly, cover of other native groundcover other (forbs) increased slightly since last year and remains just within benchmark values, although is still well below baseline levels. Hollow Bearing Trees (HBTs) and fallen logs were absent from this community.

Overall, this community is still in moderate condition, but the condition in plot M04 has increased since last year (see Plates 9 and 10). This is likely a result of the above average rainfall of and reduced grazing pressure from herbivores.

Species richness is near baseline levels, but native vegetation cover is still substantially lower, particularly in the groundcover layer, which is likely a result of prolonged drought from years 2 (2018) and 3 (2019).

Table 3.5 Benchmark and monitoring plot data comparison for Senna shrubland M04 – Broken Hill Offset site

	Native Spp. #	Native Cover				Native Groundcover						HBTs	Logs
		Overstorey		Mid-storey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	12	1%	14%	1%	8%	5%	25%	2%	15%	2%	25%	0	2
Baseline (NGH 2013)	23	3%		0%		48%		24%		2%		0	0
Year 1 Plot M04	20	0%		10%		0%		34%		24%		0	0
Year 2 Plot M04	19	0%		4%		0%		6%		0%		0	0
Year 3 Plot M04	11	0%		4%		0%		5%		0%		0	0
Year 4 Plot M04	24	0%		10%		8%		10%		5%		0	0
Year 5 Plot M04	21	0%		12%		11%		12%		4%		0	0

Plate 9 Narrow-leaved Hopbush – Scrub Turpentine - Senna Shrubland M04 in Year 4 (2020)

Plate 10 Narrow-leaved Hopbush – Scrub Turpentine - Senna Shrubland M04 in Year 5 (2021)

3.1.5 Old Man Saltbush shrubland

Natural occurrences of the Old Man Saltbush shrubland community are rare within the landscape and due to its reduction in extent and poor representation within the reserve system, it is of conservation concern (Benson 2006) (see Plates 11 to 14). However, the NSW Scientific Committee - final determination states that Old Man Saltbush Shrubland in western NSW is not an endangered ecological community (NSW DPIE, 2019).

This community occurs adjacent to the drainage line along the eastern side of the offset site and has spread to the man-made drainage line in the south of the offset site following disturbance.

The mid-storey of this community is dominated by Old Man Saltbush (*Atriplex nummularia*) and Black Bluebush (*Maireana pyramidata*). Bladder Saltbush (*A. vesicaria*), Ruby Saltbush (*Enchylaena tomentosa*) and Spiny Saltbush (*Rhagodia spinescens*) make up the shrub component of the ground layer. Weed cover has increased in this vegetation community in the past two years, likely a result of the above average rainfall. Exotic species include Ward's Weed (*Carrichtera annua*), Paterson's Curse (*Echium plantagineum*), Winged Sea Lavender (*Limonium lobatum*), Onion weed (*Asphodelus fistulosus*), Saffron thistle (*Carthamus lanatus*), among others. Occasional African Boxthorn (*Lycium ferocissimum*) and Velvet mesquite *(Prosopis velutina)* plants were also recorded in the nearby areas (both species are state and regional weeds to be targeted under Biosecurity Act 2015).

The monitoring plot data along with the benchmarks for this vegetation type (DECC 2008) are shown in Table 3.6 and Table 3.7. This community was not surveyed by NGH (2013) so no baseline data has been collected and as such, the Jacobs (2017) survey data will form the baseline for this community. Species richness remains similar to last year and now exceeds baseline levels (although just below benchmark values).

Overstorey cover was absent from this community, and remains below the benchmark data. Canopy species often associated with Old Man Saltbush shrubland include; *Eucalyptus largiflorens* (Black Box), *E. coolabah* (Coolibah) and *Acacia pendula* (Weeping Myall). The absence of these species from the surrounding areas and locality means that there is limited potential for them to occur within the offset site, and overstorey scores for this community may never reach the benchmark values. Old Man Saltbush shrubland is highly variable and does not always contain Eucalypts or Acacias, meaning that the overstorey benchmark values may be of little relevance to measuring the condition of this community. The River Red Gums (*E. camaldulensis*) along Stirling Vale Creek to the immediate east of the offset site form a separate vegetation community.

Mid-storey cover was significantly greater than the benchmark and has increased slightly since last year's monitoring. Native grass cover remains similar to last year and is near baseline level and within the benchmark range for this community. Groundcover-shrub cover remains similar to Year 4 and has increased since the drought years of 2018 and 2019. It is above the benchmark range, but still well below the baseline cover score for this community. The native groundcover – other (forbs) category was within the benchmarks but not much different from last year and still well below the baseline cover score for this community. Overall, this vegetation community, in plots M05 and M06, is in moderate condition and very similar to last year. There has been a slight decrease in species richness and cover scores. Improved average rainfall and reduced grazing pressure has seen this community improve following recent drought conditions (Plates 12 and 14).

Plate 11 Old Man Saltbush shrubland M05 in Year 4 (2020)

Plate 12 Old Man Saltbush shrubland M05 in Year 5 (2021)

Plate 13 Old Man Saltbush shrubland M06 in Year 4 (2020)

Plate14 Old Man Saltbush shrubland M06 in Year 5 (2021)

Table 3.6 Benchmark and monitoring plot data comparison for Old Man Saltbush shrubland at M05 – Broken Hill Offset site

	Native Spp. #	Native Cover				Native Groundcover						HBTs	Logs
		Overstorey		Mid-storey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	15	2%	20%	0%	3%	0%	10%	1%	20%	0%	5%	0	0
Baseline (NGH 2013)	n/a	n/a		n/a		n/a		n/a		n/a		n/a	n/a
Year 1 Plot M05	9	0%		64%		0%		34%		16%		0	0
Year 2 Plot M05	10	0%		39%		0%		20%		2%		0	0
Year 3 Plot M05	4	0%		30%		0%		20%		0%		0	0
Year 4 Plot M05	12	0%		35%		5%		25%		2%		0	0
Year 5 Plot M05	11	0%		37%		9%		27%		3%		0	0

Table 3.7 Benchmark and monitoring plot data comparison for Old Man Saltbush shrubland at M06 – Broken Hill Offset site

	Native Spp. #	Native Cover				Native Groundcover						HBTs	Logs
		Overstorey		Mid-storey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	15	2%	20%	0%	3%	0%	10%	1%	20%	0%	5%	0	0
Baseline (NGH 2013)	n/a	n/a		n/a		n/a		n/a		n/a		n/a	n/a
Year 1 Plot M06	11	0%		3%		0%		74%		16%		0	0
Year 2 Plot M06	13	0%		10%		0%		22%		0%		0	0
Year 3 Plot M06	11	0%		8%		0%		18%		0%		0	0
Year 4 Plot M06	15	0%		10%		5%		25%		0%		0	0
Year 5 Plot M06	14	0%		11%		4%		24%		2%		0	0

3.2 Weeds and disturbance

Weed infestation across the offset site was low to moderate. Monitoring plots M01, M05 and M06, recorded the greatest coverage of weeds, while M04 and M05 had the greatest diversity of weeds.

The centre of the offset site (see Figure 2.2) still contained the exotic species Peppercorn Tree (*Schinus molle* var. *areira*); however, these showed signs of significant dieback compared to last year, possibly from chemical treatment. The Peppercorn trees, being the only overstorey vegetation (>3m) within the offset site provide shelter from predators and the harsh climatic conditions, particularly for native bird species. Removal of this infestation (mature trees and emerging saplings) should occur gradually while native mid-storey plants gradually grow and replicate the habitat (e.g., *Alectryon oleifolius subsp. canescens, Acacia victoriae, Acacia aneura* and *Acacia tetragonophylla*).

Two of the weeds recorded within the offset site (see Plates 15 and 16); Velvet Mesquite (*Prosopis velutina*) and African Boxthorn (*Lycium ferocissimum*) are declared as state and regional priority weeds under the *Biosecurity Act 2015*, as listed in Appendix 1.1 and 1.2 of the Western Regional Strategic Weed Management Plan 2017-2022 (LLS 2017). Both weeds are also listed as Weeds of National Significance and are required to be eradicated from the land and the land is to be kept free of the plant to mitigate the risk of the plant spreading. These weed species are also recorded on the Biodiversity Assessment Method (BAM) 'High Threat' weeds list.

Recent weed control works were undertaken in November and December 2021. During the monitoring survey, Velvet Mesquite and African Boxthorn plants appeared alive and it is unclear how much chemical these plants have absorbed during the treatment. At the time of monitoring both species persist in small numbers across the offset site, particularly along the eastern and southern drainage lines. It is noted that additional weed control actions are scheduled for early 2022. Results of treatment will be apparent during Year 6 monitoring. Management of these weeds needs to continue to achieve eradication.

In general, spot herbicide-treatment is required for weed species across the offset site (see Appendix A), concentrating on perennial weeds and those areas identified as having the greatest need, i.e. around disturbance areas such as the man-made drainage line to the south of the offset site, along site boundaries adjacent to access roads and other areas disturbed by the formation of tracks.

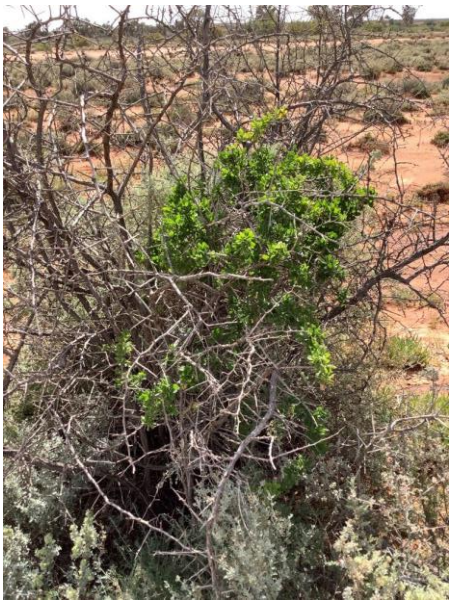


Plate 15: African Boxthorn (*Lycium ferocissimum*) persisting in 2021.

Plate 16: Velvet Mesquite (*Prosopis velutina*) occurs sporadically along drainage lines.

3.3 Fauna Habitats

Table 3.8 shows the percentage habitat cover at each of the monitoring plots surveyed and compares these to the baseline data recorded in the BOMP (NGH 2013) and previous monitoring surveys. Throughout the offset site chenopods provide the greatest habitat, which is comparable to the baseline survey results recorded by NGH (2013). Following drought conditions in 2018 and 2019, tussock grass habitat has increased slightly across the offset site as a result of improved rainfall. However, these levels are still below the baseline survey, and it is expected that a longer period of favourable rainfall will be required for baseline levels to begin to return. Rocky habitat occurs towards the southern end of the offset site. Numerous reptiles were observed using the various habitats across the offset site during the survey.

Overall habitat appears to have been maintained since the baseline surveys undertaken by NGH (2013), with recent increases in vegetative cover of shrubs and groundcover across the offset site (See plates 17 and 18 below). Following recent repairs, the fencing appears to be excluding goats and other herbivores from the offset site, which will assist natural regeneration of the offset site. No non-native grazing animals were recorded during the survey. Kangaroos were observed in small numbers within the offset site. Grazing pressure is considered to be low-moderate, and is notably lower than 2019 (Year 3) due to exclusion of goats and sheep.

Table 3.8 Habitat cover assessment – Broken Hill offset site

	Plot	Year	Habitat component					
			Tussock grasses	Chenopods	Trees/ tall shrubs	Bare ground	Cracking clay	Rocks/ logs
Cover estimates to nearest 5%	M01	BL	5%	40%	15%	60%	0%	5%
		Year 1	0%	50%	15%	45%	0%	10%
		Year 2	0%	25%	10%	50%	0%	10%
		Year 3	0%	20%	10%	60%	0%	10%
		Year 4	2%	40%	15%	40%	0%	10%
		Year 5	20%	44%	16%	26%	0%	10%
	M02	BL	70%	5%	0%	30%	0%	10%
		Year 1	0%	20%	5%	25%	0%	10%
		Year 2	0%	15%	5%	65%	0%	10%
		Year 3	0%	15%	5%	70%	0%	10%
		Year 4	2%	20%	5%	60%	0%	10%
		Year 5	15%	30%	5%	40%	0%	10%
	M03	BL	50%	20%	0%	50%	0%	10%
		Year 1	5%	50%	0%	50%	0%	5%
		Year 2	0%	15%	0%	75%	0%	5%
		Year 3	0%	15%	0%	80%	0%	5%
		Year 4	6%	20%	0%	70%	0%	5%
		Year 5	4%	30%	0%	60%	0%	5%
	M04	BL	60%	20%	0%	40%	0%	0%
		Year 1	0%	25%	5%	40%	0%	0%
		Year 2	0%	10%	5%	70%	0%	0%
		Year 3	0%	10%	5%	80%	0%	0%
		Year 4	4%	15%	8%	70%	0%	2%
		Year 5	6%	24%	8%	60%	0%	2%
	M05	Year 1	0%	10%	5%	10%	0%	0%
		Year 2	0%	10%	5%	30%	0%	0%
		Year 3	0%	10%	5%	60%	0%	0%
		Year 4	0%	15%	8%	40%	10%	4%
		Year 5	4%	18%	8%	34%	8%	4%
	M06	Year 1	0%	10%	5%	10%	0%	0%
		Year 2	0%	5%	5%	40%	0%	0%
		Year 3	0%	10%	5%	70%	0%	0%
		Year 4	0%	20%	5%	60%	0%	5%
		Year 5	2%	26%	5%	56%	0%	5%

Cover estimates to nearest 5%		Year	Habitat component					
			Tussock grasses	Chenopods	Trees/ tall shrubs	Bare ground	Cracking clay	Rocks/ logs
	M07	Year 1	0%	10%	0%	45%	0%	0%
		Year 2	0%	5%	0%	75%	0%	0%
		Year 3	0%	10%	0%	75%	0%	0%
		Year 4	0%	10%	0%	80%	0%	8%
		Year 5	0%	15%	0%	75%	0%	8%

*BL = baseline

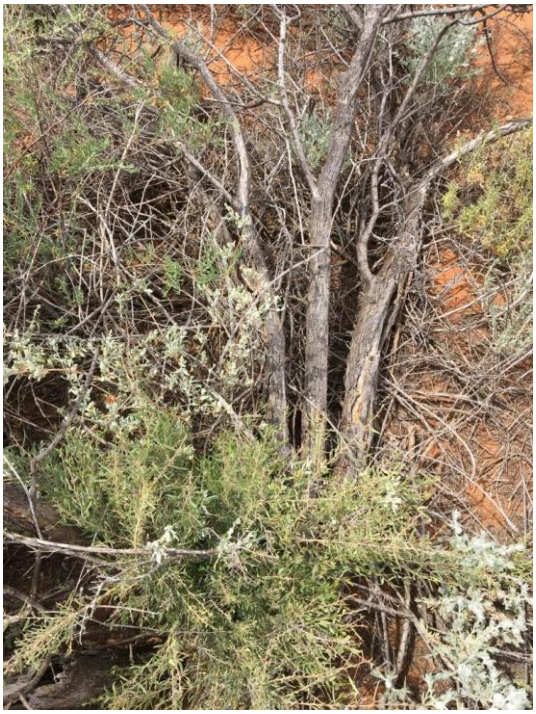


Plate 17: Shelter habitat provided by wood debris and regrowth native shrubs

Plate 18: Shelter habitat provided by chenopod regrowth (recovering from drought)

3.4 Results summary and discussion

The observed changes in the vegetation of the offset site are summarised and discussed below. The summary focuses on the change in species richness and cover of native species and weed species. The photo monitoring shows a general increase in the health and foliage growth of the existing mature plants in the plots particularly compared with 2019 and is consistent with the improve and maintain objective.

3.4.1 Native Species richness

Species richness was slightly decreased from the previous year although remains considerably higher than the Year 3 and Year 2 monitoring periods. Conditions have been favourable over the last year with above average rainfall. The slight decrease is likely due to natural factors as native species compete for space and nutrients whilst becoming re-established following the drought period. Species richness is still higher than benchmark values in plot M01, M02 and M04. In remaining plots, the species richness count is slightly below benchmark levels (see Figure 3.1). The groundcover grass and forb component of the vegetation has increased over the last 18 months with many previously recorded annual and short-lived perennial species recorded that were not present during the drought periods (2018 and 2019).

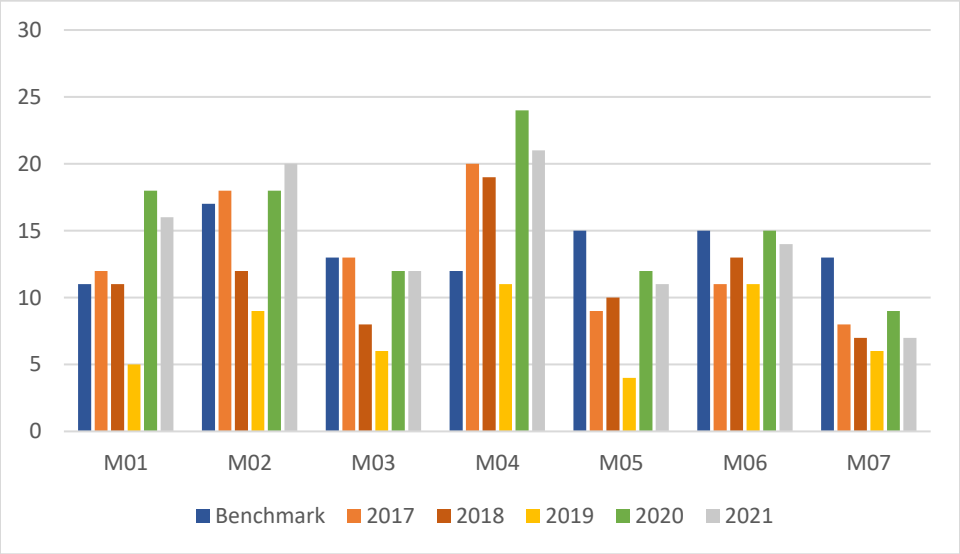


Figure 3-1 Number of native species (richness) over 5-year monitoring period

3.4.2 Cover of native and exotic vegetation

The cover of native vegetation has increased in comparison with last year (Year 4) and is much higher than 2018 and 2019 levels for all structural layers. The most pronounced increase observed was in the groundcover layer. Midstorey - shrub layer cover remains generally the same as last year (with a decrease of 0.2%) (see Figure 3.2).

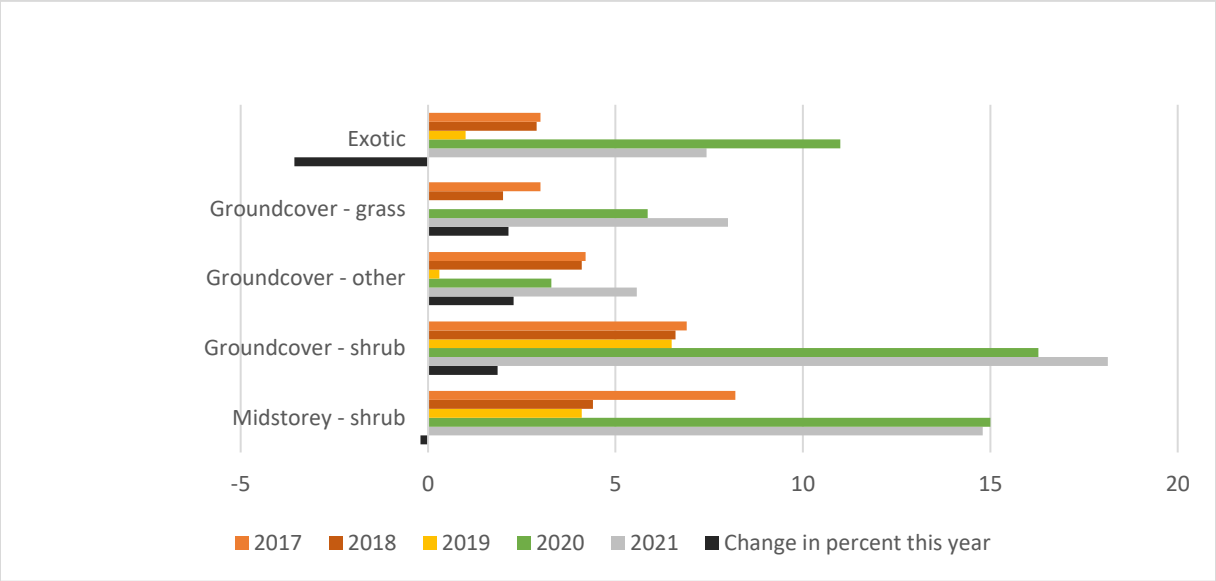


Figure 3-2 Changes in the cover (Braun Blanquet scores) of native and exotic vegetation

Mid-storey and groundcover shrub cover values remain similar to last year and have increased substantially from 2018 / 2019 values. Groundcover-shrub category is generally exceeding benchmark levels for each plant community, and plots M06 and M07 cover percentages remain within the benchmark range (see Figure 3.5).

There has been a decrease in the exotic species cover, following the substantial increase recorded in Year 4 (following the break in drought conditions). This change is likely to be attributable to the combination of natural factors and recent weed management.

The covers of grasses and other groundcovers remains substantially higher than Year 3 (drought) levels and are all within benchmark levels for most plots, except for M07, which did not meet the minimum benchmark for grass cover (see Figure 3.3 and Figure 3.4). M07 plot still contains a large proportion of bare ground and may still be recovering from drought conditions and historical damage from grazing. It is expected that this part of the offset site will continue to improve under favourable climatic conditions and continued exclusion of goats and other grazing animals.

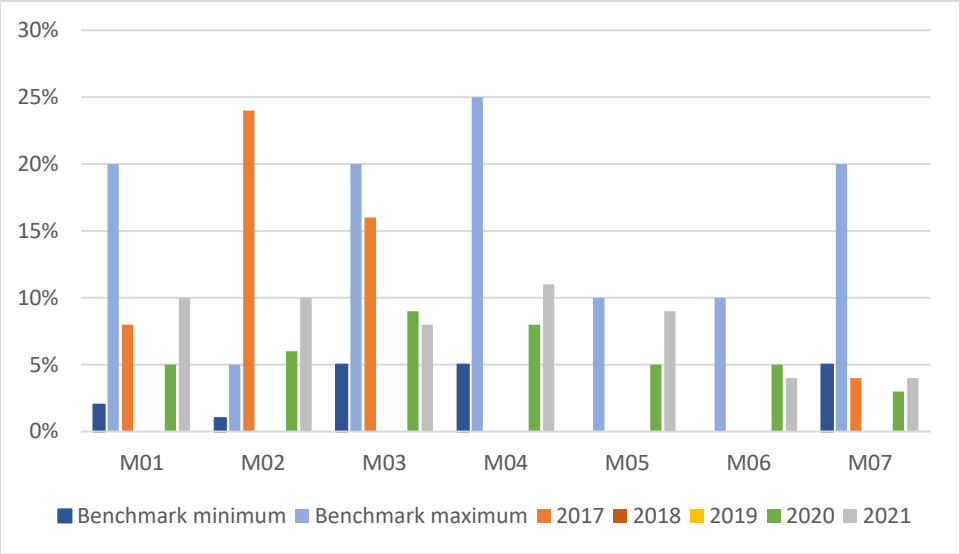


Figure 3-3 Native groundcover - grass (percentage cover)

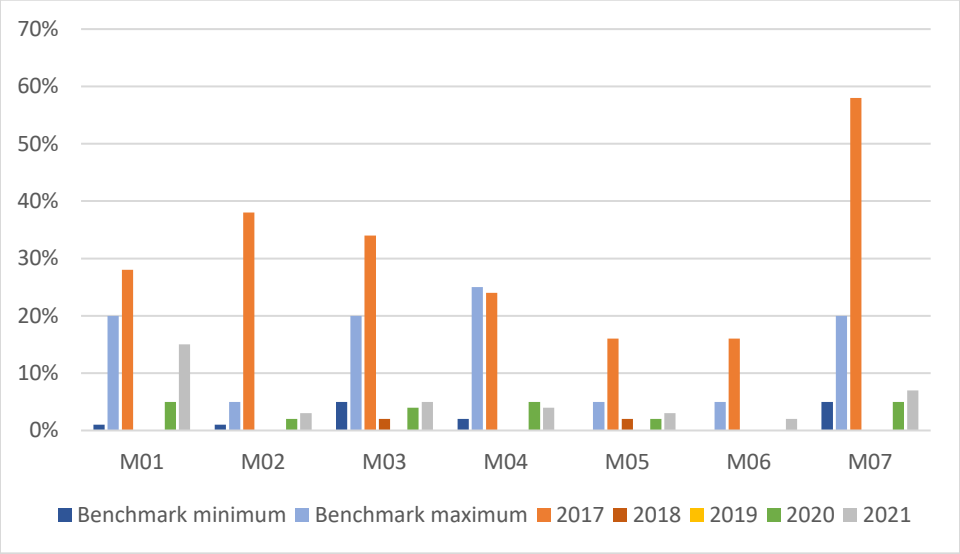


Figure 3-4 Native groundcover - other (percentage cover)

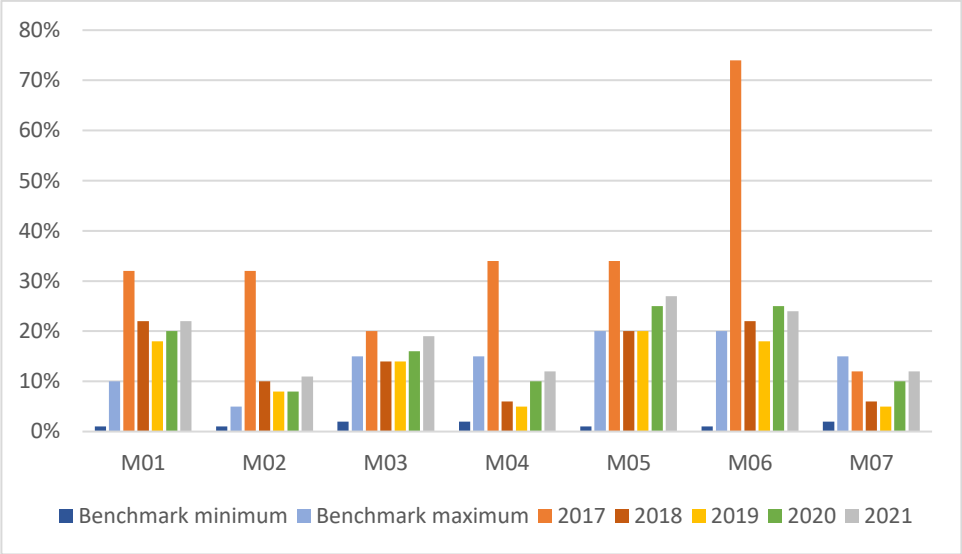


Figure 3-5 Native groundcover - shrubs (percentage cover)

3.4.3 Discussion

Above average rainfall has occurred over the last 18 months in western NSW. The continued favourable weather conditions during 2021 have maintained and improved the post-drought recovery of native vegetation within the offset site compared with the baseline assessment.

Further small increases in native vegetation cover have occurred during 2021, complementing the substantial increases experienced in 2020.

A minor decline in native species richness in many monitoring plots this year is likely a result of natural factors, as native species compete for space and nutrients during post-drought recovery. Plant health appears optimal and most native plants show increased foliage cover. Chenopods, Acacias and Senna shrubs appeared to be seeding and extended periods of average or higher rainfall will likely see further recruitment.

Grazing pressure on grasses and herbs by kangaroos appears sustainable due to more plant biomass being available compared to previous years. No evidence of goat or sheep impacts were observed meaning exclusion fencing is effective.

The monitoring has shown an improvement in overall condition of native vegetation on the offset site. Where percentage covers of native plant stratums are not within benchmark values, they are not far below. This means a continuation of suitable climatic conditions will likely bring the plot measurements toward benchmark values. Continued favourable conditions is likely to yield more meaningful information regarding the improvement or maintenance of biodiversity values as a result of site management.

3.5 Fence maintenance

Stock proof fences were installed around the entire offset site approximately in mid-2017. A combination of ring lock style of fencing and plain and barbed wire strand fencing has been used around the offset site. Fences are generally located on the boundary of the offset site (i.e. the perimeter of the offset site), except for the eastern fence which is between about 50 m and 150 m west of the eastern site boundary as mapped in the Biodiversity Offset Management Plan, Broken Hill Solar Plant (NGH Environmental, 2013).

Gaps beneath the fence previously identified have been fixed and goats and other herbivores appeared to be absent from the offset site. During heavy rain in 2020 two sections of the boundary fence were pushed down by the flow of water and debris, at the intersection with an unnamed tributary of Stirling Vale Creek (see Plates 19 and 20). These sections were repaired in May 2021 (see Plates 21 and 22).

Plate 19: Damaged fence observed in 2020

Plate 20: Damaged fence observed in 2020

Plate 21: Fence repairs made in May 2021

Plate 22: Fence repairs made in May 2021

4. Management Actions

The following management measures in Table 4.1 were outlined in the BOMP (NGH 2013) and were to be actioned and adapted based on annual monitoring results. Table 4.1 provides an evaluation of the need for each management action, the timing, and who is required to undertake the action. Actions undertaken since previous monitoring session and recommended adaptive measures are also described.

Table 4.1 : Management Actions for the Broken Hill offset site

Management measure	Objective	Action	Timing	Actions undertaken by AGL	Actions required in 2022	Adaptive measures / recommended actions for 2022 / Timing
Management Measures of the BOMP (Note: In the first four columns, the original BOMP text is black, while text added since the original BOMP is in blue)						
Weed control	To minimise the occurrence of weeds within the offset site particularly Weeds of National Significance (WoNS) and listed noxious weeds. Target state and regional priority weeds (Mesquite and African Boxthorn) to eliminate from site and prevent spread as required under the *Biosecurity Act* 2015 and the Western Regional Strategic Weed Management Plan 2017 – 2022 (LLS 2017).	Survey to identify target locations for weed control. Weed control using appropriate methodologies considering target species and landscape context. Spot herbicide treatment: foliar spraying or cut/scrape and paint methods.	At establishment of the offset site Ongoing as required During active growth season, which is generally in Spring to early Summer, particularly after rainfall. Should be undertaken in suitable low wind conditions to prevent spray drift to other native species.	Initial spraying of Mesquite and African Boxthorn completed across site in 2018. Targeted weed treatments conducted in November 2019. Targeted weed treatments in May 2020. Targeted weed treatments in November 2020. Targeted weed treatments in November and December 2021.	Yes	Monitoring and treatment of re-shooting weeds and weed seedlings required.

Management measure	Objective	Action	Timing	Actions undertaken by AGL	Actions required in 2022	Adaptive measures / recommended actions for 2022 / Timing
Cat and/or fox control	To minimise the presence of cats and foxes within the offset site.	Conduct baiting or trapping if evidence of cats or foxes is detected within the offset site.	Consideration given to action on the basis of monitoring results. Annual monitoring. Control in response to detection of cats or foxes.	None required at this stage. Re-evaluate during next monitoring event. If evidence of these animals is recorded, spotlighting and/or camera trap surveys would be recommended to inform management.	No	n/a
Rabbit control	To minimise the risk of the offset site becoming a refuge for rabbits. To control rabbit numbers within the offset site and thereby prevent rabbits from substantially impacting on native flora and habitat values.	Conduct baiting or controlled grazing to reduce the ability of the site to act as a refuge to rabbits.	Consideration given to action on the basis of monitoring results. Annual monitoring. Control in response to detection of rabbits.	None required at this stage. Re-evaluate during next monitoring event.	No	n/a
Exclusion of feral goats and livestock	To minimise the presence of feral goats. To continuously exclude large non-native herbivores from the offset site and reduce grazing on native flora.	Install preventative fencing suitable for the target species. Remove goats (by trapping or other means) if detected within the offset site.	At establishment of the offset site. Ongoing as required. In response to detection of feral goats or livestock.	A fence to exclude goats and livestock is present. Allow native vegetation to regenerate over the next year and then re-evaluate fencing effectiveness during next monitoring event. Fence repairs were completed in May 2021 to fix 2 sections of damaged fencing, and is excluding feral animals and other herbivores.	Yes	Fence monitoring and repair of any damage to continue through 2022.

Management measure	Objective	Action	Timing	Actions undertaken by AGL	Actions required in 2022	Adaptive measures / recommended actions for 2022 / Timing
Specialised measures (conducted if required) of the BOMP						
Weed control	To minimise the occurrence of weeds in the creek adjacent to the offset site, particularly Weeds of National Significance (WoNS) and listed noxious weeds.	The creek line adjacent to the site's eastern boundary would be fenced out of the offset site, however weed survey and control would be undertaken along the creek where it adjoins the offset site to ensure weeds do not become established here. Methods would be appropriate to waterways (i.e. control of spray drift).	Ongoing as required	Ongoing weed control. Targeted weed treatments conducted in November 2019. Targeted weed treatments in May 2020. Targeted weed treatments in November 2020. Targeted weed treatments in November and December 2021.	Yes	Monitoring and treatment of re-shooting weeds and weed seedlings required in 2022.
Implementation of controlled burns	To re-introduce a more natural fire regime and assist in the recovery of degraded areas. To improve the natural regeneration of native flora.	If degradation is detected from monitoring, consult with DPIE to determine if burning may be appropriate. Conduct burns as recommended by DPIE.	Ongoing	None required at this stage. Allow native vegetation to regenerate over the next year. Re-evaluate during next monitoring event.	No	n/a
Adapt measures to resident native fauna	To ensure that resident native fauna are not adversely impacted by management actions.	If resident native fauna may be impacted by management actions, adapt actions as	Ongoing as required	n/a	No	n/a

Management measure	Objective	Action	Timing	Actions undertaken by AGL	Actions required in 2022	Adaptive measures / recommended actions for 2022 / Timing
		required to address the risk of impact.				
Additional Management Measures						
Monitoring plot survey	Repeat monitoring plot surveys to evaluate the 'improve or maintain' outcome of biodiversity values at the offset site	Repeat monitoring of all plots within the offset site	Summer	n/a	Yes	If possible time the seasonal survey events to occur within four weeks of a significant rainfall event to better identify the diversity of plant species dormant within the ground layer.
Weed control	Target Peppercorn Tree infestation	Thinning of mature trees without active nests and new saplings to be targeted using hand removal and cut and paint techniques.	During active growth season, which is generally in Spring to early Summer, particularly after rainfall.	Contractor treated peppercorn trees in 2019, 2020 and 2021.	Yes	Undertake further treatment in 2022. Target all saplings.
Weed control	Target onion weed and saffron thistle in general weeding across the offset site	Spot spraying	During active growth season, which is generally in Spring to early Summer, particularly after rainfall. Should be undertaken in suitable low wind conditions to prevent spray drift to other native species.	Ongoing weed spraying. Targeted weed spraying completed across site in 2018, November 2019, May 2020, November 2020, November 2021 and December 2021.	Yes	Target these species when they reappear following rain in 2022. Treatment before seeding is recommended.

5. Conclusions and recommendations

The Year 5 monitoring results show continued improvement in vegetation and habitat across the offset site with regards to native vegetation coverage and quality.

It is evident that native vegetation was significantly impacted by drought in 2018 and 2019 and recent above average rainfall conditions during 2020 and 2021 stimulated the growth of many plant species not seen in Year 2 and 3 monitoring surveys. A slight decrease in native species richness (species count) this year may be due to natural factors as native species compete for space and nutrients whilst becoming re-established following the drought period. It is evident that many chenopods and acacia shrubs have large seed production this year. Continued adequate rainfall would further increase recruitment of shrubs and small trees. The management actions outlined in Table 4.1 will further assist the natural regeneration of the offset site over the next 12 months.

Stock proof fencing around the offset site is in good condition. Repairs have been made (in May 2021) where the fence was previously damaged by flooding in 2020. Biodiversity values of the offset site will continue to improve through the exclusion of goats and other herbivores. No non-native grazing animals were recorded during the survey.

Fauna habitats across the offset site are somewhat diverse and include chenopods, rocky patches, tussock grasses and some taller shrubs. These habitats have been generally maintained, with slight increases of chenopod habitat. Tussock grass habitats will likely improve with the combination of further favourable weather conditions and intact fencing excluding grazing.

Weed infestations across the offset site are still generally low but remain present due to increased rainfall. Weeds of concern in the offset site include the state and regional priority weeds (LLS 2017) Velvet Mesquite and African Boxthorn, which are required to be eradicated from the offset site to prevent further spread to surrounding lands. There has been a slight increase of these species since last year with signs of regrowth particularly in drainage lines. Recently poisoned weeds will be re-evaluated in Year 6 monitoring to determine success rate. It is noted that additional weed control actions are scheduled for early 2022.

Peppercorn Tree infestations within the centre of the offset site have showed some further dieback since last year however require further treatment (if no active birds nests are present). The recommendation remains to control emerging saplings, while gradually removing the adult Peppercorn Trees.

6. References

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Appendix A. Flora species list and opportunistic fauna list

Table A.6.1 Flora species list and 20m x 20m plot survey Modified Braun Blanquet scores

Family	Scientific Name	Common Name	M01	M02	M03	M04	M05	M06	M07	Previously recorded on site
Aizoaceae	*Sarcozona praecox*	Sarcozona	1	2				1	2	x
Amaranthaceae	*Alternanthera angustifolia*						1			x
Anacardiaceae	*Schinus molle* var. *areira**	Peppercorn Tree								x
Apocynaceae	*Rhyncharrhena linearis*	Purple Pentatrope		1						x
Asphodelaceae	*Asphodelus fistulosus**	Onion weed	1			2	2			x
Asphodelaceae	*Bulbine* sp.	Bulbine lily								x
Asteraceae	*Sonchus oleraceus**	Common Sowthistle	1				2			x
Asteraceae	*Brachyscome ciliaris* var. *lanuginosa*		3	1	2	2	1	2	2	x
Asteraceae	*Brachyscome dentata*							1		x
Asteraceae	*Leiocarpa semicalva*		2							x
Asteraceae	*Senecio lanibracteus*									x
Asteraceae	*Xanthium spinosum**	Bathurst Burr								x
Asteraceae	*Carthamus lanatus**	Saffron thistle								x
Asteraceae	*Vittadinia cuneata*	Fuzzweed		1	2	1	1			x
Boraginaceae	*Heliotropium supinum**	Prostrate Heliotrope								x
Boraginaceae	*Echium plantagineum**	Paterson's Curse					2			x
Brassicaceae	*Arabidella* sp.		2				2	1		x
Brassicaceae	*Carrichtera annua**		3	2	2	2	3	2		x
Chenopodiaceae	*Atriplex stipitata*	Mallee Saltbush	2	1		2		1		x
Chenopodiaceae	*Atriplex vesicaria*	Bladder Saltbush	3				2	3	2	x

Family	Scientific Name	Common Name	M01	M02	M03	M04	M05	M06	M07	Previously recorded on site
Chenopodiaceae	*Atriplex nummularia*	Old Man Saltbush					4	2	3	x
Chenopodiaceae	*Dissocarpus paradoxus*	Cannonball Burr	1	1	2	2		2		x
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush		1	1	1	2			x
Chenopodiaceae	*Maireana astrotricha*	Low Bluebush				1		1		x
Chenopodiaceae	*Maireana pyramidata*	Black Bluebush	3	3	4	3	2	4	3	x
Chenopodiaceae	*Maireana lobiflora*					2			2	x
Chenopodiaceae	*Sclerolaena patenticuspis*	Copperburr			2	2		2	4	x
Chenopodiaceae	*Rhagodia spinescens*	Spiny saltbush	3	1		3	1	2		x
Chenopodiaceae	*Maireana coronata*	Crown Fissure-weed			2					
Chenopodiaceae	*Salsola australis*				2	1		1		x
Chenopodiaceae	*Sclerolaena divaricata*	Tangled Copperburr	1	3	1	1	2			x
Convolvulaceae	*Convolvulus remotus*		1	1		1	1			x
Crassulaceae	*Crassula tetramera*									x
Euphorbiaceae	*Euphorbia multifaria*									x
Fabaceae	*Vicia* sp.*						3			x
Fabaceae	*Acacia tetragonophylla*	Dead finish		2						x
Fabaceae	*Acacia victoriae*	Prickly wattle	2	1				1		x
Fabaceae	*Acacia burkittii*	Sand hill wattle								x
Fabaceae	*Acacia oswaldii*	Umbrella wattle		1						x
Fabaceae	*Medicago minima**		1				2	1		x
Fabaceae	*Prosopis velutina***	Velvet mesquite	1							x
Fabaceae	*Senna phyllodinea*			2		3	1			x

Family	Scientific Name	Common Name	M01	M02	M03	M04	M05	M06	M07	Previously recorded on site
Fabaceae	*Senna artemisioides* subsp. *filifolia*			3		2		1		x
Lamiaceae	*Salvia verbenaca**	Vervain								x
Loranthaceae	*Lysiana exocarpi*									x
Malvaceae	*Sida corrugata*	Corrugated sida	2	2		2				x
Malvaceae	*Sida* sp.		2			2				x
Myrtaceae	*Eucalyptus camaldulensis*	River Red Gum								x
Pittosporaceae	*Pittosporum angustifolium*	Weeping pittosporum								x
Poaceae	*Chloris truncata*	Windmill grass	2							x
Poaceae	*Cymbopogon ambiguus*	Scent grass								x
Poaceae	*Rytidosperma caespitosum*	Ringed Wallaby Grass	2	2	1	2				x
Poaceae	*Tragus australianus*	Small Burr grass								x
Poaceae	*Austrostipa scabra* subsp. *scabra*	Speargrass	3	2	2	2		1		x
Poaceae	*Enneapogon avenaceus*	Bottle Washers	1	2	2	2				x
Polygonaceae	*Rumex crispus**	Curled dock								x
Portulacaceae	*Portulaca oleracea*	Pigweed		2						x
Scrophulariaceae	*Eremophila sturtii*	Narrow-leaf Emu Bush								x
Scrophulariaceae	*Myoporum montanum*	Western Boobialla								x
Solanaceae	*Lycium ferocissimum***	African boxthorn					2			x
Solanaceae	*Solanum esuriale*	Quena				2				x
Solanaceae	*Solanum sturtianum*									
Zygophyllaceae	*Tribulus minutus*			1		1				x

* general weed

**state and regional weeds to be targeted (Biosecurity Act 2015)

Appendix B. Condition of Approval (COA) C5

Biodiversity Offset Management Plan

C5. Following final design and prior to the commencement of construction, or as otherwise agreed to by the Director-General, the Proponent shall develop and submit a Biodiversity Offset Management Package for the approval of the Director-General. The package shall detail how the ecological values lost as a result of the Project will be offset. The Biodiversity Offset Management Package shall be developed in consultation with the OEH and shall (unless otherwise agreed by the Director-General) include, but not necessarily be limited to:

(a) an assessment of all native vegetation communities, threatened species habitat and Willyama Common land that will either be directly or indirectly impacted by the proposal;

(b) the objectives and biodiversity outcomes to be achieved (including 'improve or maintain' biodiversity values), and the adequacy of the proposed offset considered;

(c) the final suite of the biodiversity offset measures selected and secured including but not necessarily limited to;

  i) an offset proposal which is supported by a suitable metric method (such as the Biobanking Assessment Methodology);

  ii) details of the relative condition and values of communities on the offset site in comparison to those to be impacted, including all areas of native shrubland in moderate to good condition;

  iii) proposed management actions and expected gains;

(d) the monitoring requirements for compensatory habitat works and other biodiversity offset measures proposed to ensure the outcomes of the package are achieved, including:

  i) the monitoring of the condition of species and ecological communities at offset locations;

  ii) the methodology for the monitoring program(s), including the number and location of offset monitoring sites, and the sampling frequency at these sites;

  iii) provisions for the annual reporting of the monitoring results for a set period of time as determined in consultation with the OEH; and

(e) timing and responsibilities for the implementation of the provisions of the Package.

Land offsets shall be consistent with the *Principles for the use of Biodiversity Offsets in NSW* (NSW Office of Environment and Heritage, June 2011). Any land offset shall be enduring and be secured by a conservation mechanism which protects and manages the land in perpetuity. Where land offsets cannot solely achieve compensation for the loss of habitat, additional measures shall be provided to collectively deliver an improved or maintained biodiversity outcome for the region.

Where monitoring referred to in condition (d) indicates that biodiversity outcomes are not being achieved, remedial actions shall be undertaken to ensure that the objectives of the Biodiversity Offset Package are achieved.

Within one from approval from the Director-General the Proponent shall, in conjunction with the lessee of Western Lands Lease 14240, apply to the Crown Lands Division of the Department of Trade and Investment for a Change of Lease Purpose of Western Land Lease 14240 to appropriately record the biodiversity offset on title and within the lease conditions as a conservation area.