Bird Island BushRAT re-assessments

May 2022

T&M Ecologists Pty Ltd

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Executive Summary

Bird Island (also known as the Northern Breakwater/Revetment or Section Banks), which is situated at the northern end of the Outer Harbor breakwater, provides a significant roost and feeding site for both migratory and non-migratory shorebirds, and is a breeding rookery for seabirds, including Australian Pelican and the endangered Fairy Tern. As such, it has high inherent biodiversity values, and provides habitat for bird species of national and international significance.

This report provides the results of the re-assessment of 4 monitoring sites which were originally established across the vegetation communities on 23rd May 2014. and were re-assessed on 16th March 2022. These sites were assessed using the Bushland Rapid Assessment Technique or 'BushRAT'. This method directs users to establish a photopoint, conduct an inventory of the native and weed species present in a defined area, and assess a number of vegetation condition parameters to help with evaluation and ongoing monitoring of the condition of a site.

The re-assessment of Bird Island using the BushRAT assessment methodology demonstrated that a number of changes may have occurred in the vegetation, some of which can be attributed to natural processes, and some of which may be as a result of anthropogenic intervention. Of the four Management Zones assessed, the two Zones in samphire communities (Communities 1 and 2, Figure 2) remained weed free, and had consistent scores from 2014 to 2022 for BushRAT assessment components. Photopoint images showed an increase in bare ground in Management Zone 1 and that there had been growth and increased cover of *Avicennia marina ssp. marina* (Grey Mangrove) in Management Zone 2. Whilst neither of these changes are of particular concern at this stage, it has been noted that the expansion of mangroves can limit the availability of the open spaces that shorebirds use for roosting and feeding. Shorebirds prefer the security of open spaces with high visibility for the easy detection of approaching predators. As such, ongoing monitoring of mangrove expansion, including use of aerial photography, may be of value to provide an indication of whether shorebird roosting and feeding habitat is being compromised.

There appears to have been a decrease in cover of the high threat woody weed *Lycium ferocissimum* (African Boxthorn) as a result of weed control activities. In better quality habitats (Management Zone 3), lower cover was scored, and in the more disturbed Management Zone 4, photopoint images showed dead, standing Boxthorns which have been left in place to provide nesting/roosting habitat. Within Management Zone 4, cover of weed species was observed to have generally declined, especially *Galenia pubescens* (Galenia), which was scored as decreasing from 26-50% cover to plentiful but cover <1%, and *Malva parviflora* (Marshmallow) scored as reducing from 1-5% cover to <1% cover. Decrease in weed ground cover is seen as a positive outcome which favours the nesting of desirable seabird species.

In Management Zone 3, there was a notable increase in **Cakile maritima* (Beach Rocket). This increase in cover is not considered a high threat at this stage, although vigilance should be maintained to ensure that it does not impact on key seabird breeding habitat (such as open beach areas used by Fairy Terns (*Sternula nereis*)).

1. Introduction

1.1 Purpose and scope of this report

Bird Island (also known as the Northern Breakwater/Revetment or Section Banks) is situated at the northern end of the Outer Harbor breakwater. It is an exposed, artificial island made of coarse shell-grit, clay and sand that extends for approximately 1600m and it has been colonised by indigenous local plant species as well as introduced weedy species. The island also forms a significant roost and feeding site for both migratory and non-migratory shorebirds, and is a breeding rookery for seabirds, including Australian Pelican and the endangered Fairy Tern. As such, it has high inherent biodiversity values, and provides habitat for bird species of both national and international significance.

This report provides the results of the re-assessment of 4 monitoring sites which were originally established across the vegetation communities on 23rd May 2014. These sites were assessed using the Bushland Rapid Assessment Technique or 'BushRAT'.

This report includes:

- Overview of previous baseline data.
- Assessment in the change in condition of key condition indicators for the BushRAT method, including species richness, structural diversity and weed abundance and threat, based on comparison of previous 2014 BushRAT data to data gathered in 2022.
- Evaluation of photopoint data using relevant indicators of change.
- Evaluation of the trajectory of change (positive, neutral, negative), the confidence change is real rather than being an artefact (low, medium, high).
- Assessment of the likely drivers/reasons for change (eg due to management intervention, disturbance, seasonal or climatic factors).

1.2 Field assessment methodology

Initial field assessment was undertaken in May 2014 as part of the development of a Biodiversity Action Plan for Bird Island[1] . BushRAT assessments[2] were undertaken across representative areas of the Island. The BushRAT method establishes a photopoint, conducts an inventory of the native and weed species present in a defined area, and assesses a number of vegetation condition parameters to help with evaluation and ongoing monitoring of the condition of a site. An outline of the method, and the sites established, is provided in Appendix 1.

The BushRATs were re-assessed on 16th March 2022.

[1]T&M Ecologists, 2014. *Bird Island Biodiversity Action Plan*. Report prepared for Natural Resources Adelaide and Mount Lofty Ranges, September 2014.

[2] DEWNR, 2012. NVBMU *BushRAT assessment and scoring Manual*. Unpublished document, Department for Environment, Water and Natural Resources, Waite.

1.3 Bird Island study area

Bird Island is located in the Port River, approximately 15km northwest of Adelaide. It is at the northern end of the Northern Revetment mound (a rock breakwater) about 700 m offshore from Outer Harbor. Figure 1 shows the study area from the 2014 Biodiversity Action Plan.

Figure 1: Bird Island Study Area

2. Survey results

In the original assessments undertaken in 2014, the site was divided into four Management Zones, based upon the vegetation types present and their condition (Figure 2). Table 1 provides a list of native plant species by Management Zone, and Table 2 provides a list of introduced species and cover abundance scores by Management Zone. These Tables are discussed in the individual Management Zone reports.

Table 1: Native species lists for the four Management Zones

Scientific Name	**Common Name**	**1. *Sarcocornia sp. / Tecticornia sp. / Sueda australis* low closed shrubland**		**2. *Sarcocornia sp. / Tecticornia sp.* low closed shrubland with emergent Avicennia marina ssp. marina**		**3. *Atriplex cinerea / Nitraria billardierei* Shrubland**		**4. *Atriplex cinerea / Nitraria billardierei / Lycium ferocissimum* Shrubland**	
		2014	**2022**	**2014**	**2022**	**2014**	**2022**	**2014**	**2022**
Atriplex cinerea	Grey Saltbush					R	R	R	R
Atriplex semibaccata	Creeping Saltbush					Y	Y		Y
Austrostipa sp.	Speargrass					Y	Y		
Avicennia marina ssp. marina	Mangrove			R	R		Y		
Carpobrotus rossii	Karkalla					Y	Y	Y	Y
Enchylaena tomentosa var. tomentosa	Barrier Saltbush					R	R	Y	Y
Ficinia nodosa	Knobby Club-sedge							Y	Y
Myoporum insulare	Native Juniper					R	R	R	R
Nitraria billardierei	Dillon Bush					R	R	R	R
Salsola australis	Tumbleweed								
Sarcocornia quinqueflora	Beaded Glasswort	Y	Y	Y	Y	Y	Y	Y	Y
Sarcocornia blackiana	Thick-head glasswort		Y		Y		Y		
Senecio pinnatifolius var. pinnatifolius						Y	Y	Y	Y
Senecio quadridentatus	Cotton Fireweed					Y			
Spinifex hirsutus	Rolling Spinifex						Y		
Suaeda australis	Austral Seablite	Y	Y			Y	Y		
Tecticornia sp.		Y		Y					
Threlkeldia diffusa	Coast Bonefruit					Y	Y		

Y = present, R = present and noted to be recruiting

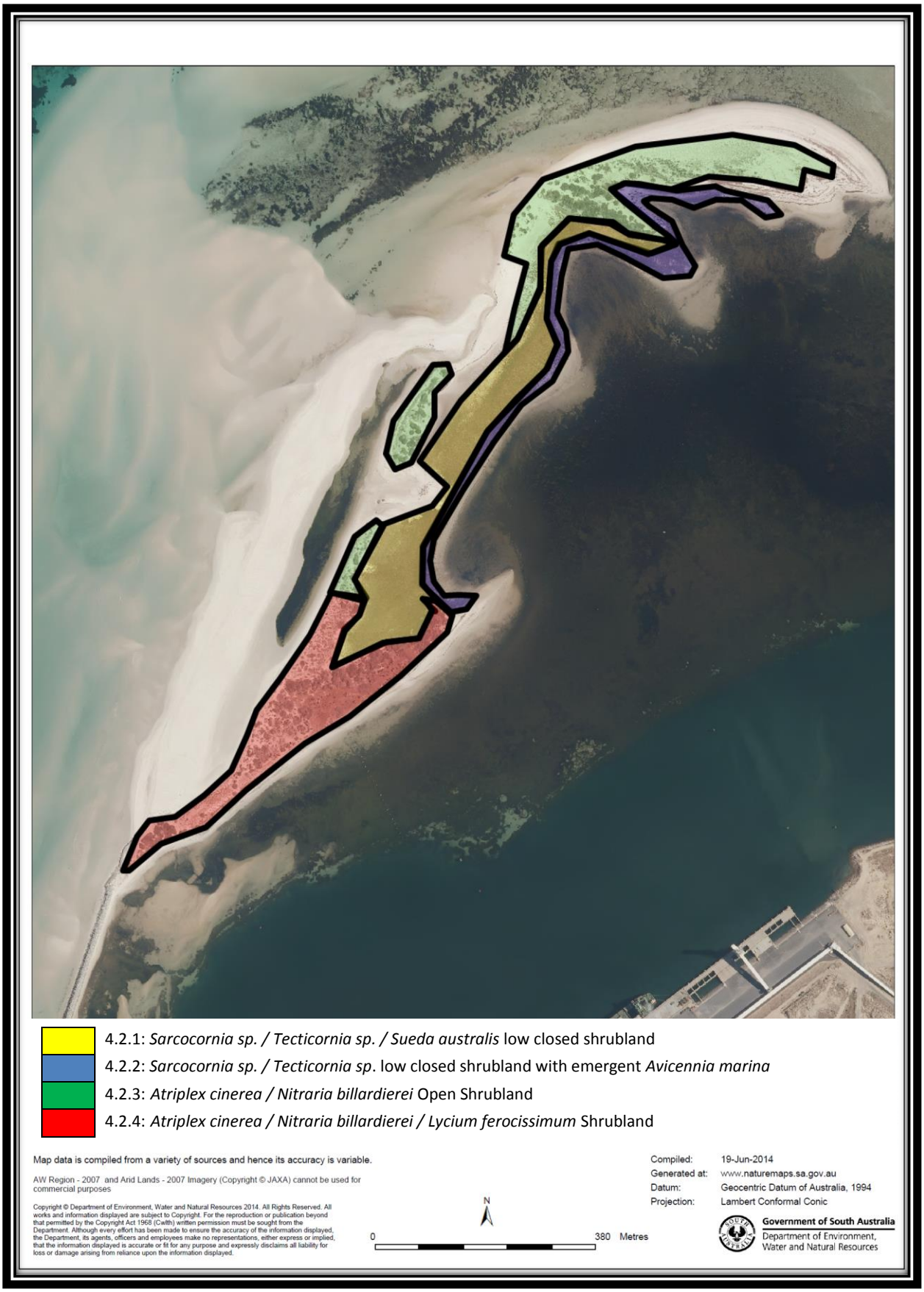


Figure 2: Vegetation Communities / Management Zones of Bird Island

Table 2: Introduced species lists for the four Management Zones

To assist with interpretation, where a species was scored as increasing in cover since the 2014 assessment it has been shaded in red, and where it has was scored as decreasing in cover it has been shaded green.

Scientific Name	Common Name	1. *Sarcocornia sp. / Tecticornia sp. / Sueda australis* low closed shrubland		2. *Sarcocornia sp. / Tecticornia sp.* low closed shrubland with emergent Avicennia marina ssp. marina		3. *Atriplex cinerea / Nitraria billardierei* Shrubland		4. *Atriplex cinerea / Nitraria billardierei / Lycium ferocissimum* Shrubland	
		2014	2022	2014	2022	2014	2022	2014	2022
Ammophila arenaria	Marram Grass					1		1a	
Arctotheca calendula	Cape Dandelion					1a	1a	1a	1a
Cakile maritima ssp. maritima	Beach Rocket					3	4	2	2
Chenopodium murale	Sowbane						1	1a	1
Conyza bonariensis	Tall Fleabane					1	1		
Euphorbia paralias	Sea Spurge					1	1	1a	1
Galenia pubescens var. pubescens	Galenia					1	2	4	1a
Lycium ferocissimum	African Boxthorn					1a	1	3	3
Malva parviflora	Marshmallow							2	1a
Mesembryanthemum crystallinum	Iceplant					1a	1	3	2
Oenothera stricta ssp. stricta	Sweet-scented Evening Primrose								
Oxalis pes-caprae	Soursop							1	1
Reichardia tingitana	Reichardia							1a	1
Senecio pterophorus	South African Daisy								
Sisymbrium erysimoides	Smooth Mustard								
Solanum nigrum	Black-berry Nightshade					1			
Sonchus oleraceus	Milk Thistle					1a			
Thinopyrum junceiforme	Sea Wheat-grass						1a		1a
Urtica urens	Stinging Nettle							1a	1

Cover Rating	
not many, cover <1%	1
Plentiful, cover <1%	1a
Covering 1 - 5%	2
Covering 5 – 25%	3
Covering 26 –50%	4
Covering 51 – 75%	5
Covering > 75%	6

Management Zone 1

First assessment 23rd May 2014

Second assessment 16th March 2022

Vegetation Community: *Sarcocornia sp. / Tecticornia sp. / Sueda australis low closed shrubland*

BCM Benchmark Community: SMLR Co 8.1 - Coastal Samphire Shrublands with Tidal Inundation/Hypersaline

BushRAT vegetation condition attributes

Attribute	2014		2022	
	Raw score	Scaled Score	Raw score	Scaled Score
Native Plant Species Diversity	3	10/15	3	10/15
Weeds	0	15/15	0	15/15
Native Plant Life forms	8	8/10	8	8/10
Regeneration**	2	4/8	2	4/8
Native: Exotic Understorey Biomass		10/10	-	10/10
Bare Ground		2/3		2/3
Grazing Evidence		4/4		4/4
TOTAL VEGETATION CONDITION SCORE		**53/65**		**53/65**

Comparison of BushRAT scores 2014 – 2022

There was no change in the scores for the BushRAT metric in this site from 2014 to 2022. One native plant species, *Sarcocornia blackiana* (Thick-head glasswort) was successfully identified in the 2022 assessment (as per Table 1), but it is considered likely this species was present in 2014, but could not be identified as flowering and fruiting spikes were not present at the time of survey.

Photopoint 1 photograph taken on 23rd May 2014 facing SW at 270084E 6150607S (Zone 54 WGS 84).

Photopoint photograph re-taken on 16th March 2022.

Evaluation of photopoint images

Relevant change indicators	Specific detail	Positive or negative change	Confidence change is real	Confidence change represents long-term change	Possible causative reasons
Bare ground	Higher proportion of visible bare ground present in 2022 than in 2014.	Neutral	High	Low	Changes may reflect slightly different timing of assessments.

Management Zone 2

First assessment 23rd May 2014

Second assessment 16th March 2022

Vegetation Community: *Sarcocornia sp. / Tecticornia sp. low closed shrubland with emergent Avicennia marina ssp. marina*

BCM Benchmark Community: SMLR Co 9 - Mangroves

BushRAT vegetation condition attributes

Attribute	2014		2022	
	Raw score	Scaled Score	Raw score	Scaled Score
Native Plant Species Diversity	3	NA/15	3	NA/15
Weeds	0	15/15	0	15/15
Native Plant Life forms	8	8/10	7	8/10
Regeneration**	1	NA/8	1	NA/8
Native: Exotic Understorey Biomass		10/10	-	10/10
Bare Ground		1/3		1/3
Grazing Evidence		4/4		4/4
TOTAL VEGETATION CONDITION SCORE		**38/42**		**38/42**

NA: Benchmarking Not Applicable for this Vegetation Community

Comparison of BushRAT scores 2014 – 2022

There was no change in the scores for the BushRAT metric in this site from 2014 to 2022. One native plant species, *Sarcocornia blackiana* (Thick-head glasswort) was successfully identified in the 2022 assessment (as per Table 1), but it is considered likely this species was present in 2014, but could not be identified as flowering and fruiting spikes were not present at the time of survey.

Photopoint 2 photograph taken on 23rd May 2014 facing N at 270108E 6150620S (Zone 54 WGS 84).

Photopoint photograph re-taken on 16th March 2022.

Evaluation of photopoint images

Relevant change indicators	Specific detail	Positive or negative change	Confidence change is real	Confidence change represents long-term change	Possible causative reasons
Plant growth	Increase in size and associated cover of Grey Mangrove (*Avicennia marina ssp. marina*).	Neutral, although thick cover of this species may preclude access and feeding for samphire dependent bird species.	High	High	Recruitment of Grey Mangrove is occurring as the substrate associated with Bird Island has stabilised over time.

Management Zone 3

First assessment 23rd May 2014

Second assessment 16th March 2022

Vegetation Community: *Atriplex cinerea / Nitraria billardierei Open Shrubland*

BCM Benchmark Community: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

BushRAT vegetation condition attributes

Attribute	2014		2022	
	Raw score	Scaled Score	Raw score	Scaled Score
Native Plant Species Diversity	12	8/15	14	9/15
Weeds	13	9/15	16	7/15
Native Plant Life forms	9	5/10	10	6/10
Regeneration**	4	4/8	4	4/8
Native: Exotic Understorey Biomass		8/10	-	6/10
Bare Ground		1/3		1/3
Grazing Evidence		4/4		4/4
TOTAL VEGETATION CONDITION SCORE		**39/65**		**37/65**

Comparison of BushRAT scores 2014 – 2022

The overall BushRAT score decreased slightly, although within the scoring components there was a slight increase in native species diversity and native plant lifeforms, and a decrease in the weed score and native:exotic understorey biomass score. With regard to the species diversity change, there were two new species noted in the area (refer Table 1), *Spinifex hirsutus* (Rolling Spinifex) and *Sarcocornia blackiana* (Thick-head glasswort). The former species may have been planted, or naturally recolonised the dune system, and the latter species may have been present in the 2014 assessment, but could not be identified as flowering and fruiting spikes were not present at that time. The presence of the Rolling Spinifex also increased the plant life forms score, as it was a lifeform not scored in the 2014 assessment.

With regard to the scoring components that decreased, there was a change in the scores for weed score and native:exotic understorey, possibly driven by an increase in weed cover, particularly of **Cakile maritima* (Beach Rocket), for which cover was scored as moving from the 5-25% cover category to the 26-50% category. It should also be noted that Table 2 shows that *Ammophila arenaria* (Marram Grass) is no longer present in the Management Zone, but that *Thinopyrum junceiforme* (Sea Wheat-grass) is present, but was not present in 2014. It is considered likely that this is due to a mis-identification of Sea Wheat-grass in the 2014 assessment. It was pleasing to note that **Lycium ferocissimum* (African Boxthorn) was scored at lower levels in 2022 than 2014, indicating that some control for this species may have been undertaken.

Photopoint 3 photograph taken on 23rd May 2014 facing SW at 270517E 6151347S (Zone 54 WGS 84).

Photopoint photograph re-taken on 16th March 2022.

Evaluation of photopoint images

Relevant change indicators	Specific detail	Positive or negative change	Confidence change is real	Confidence change represents long-term change	Possible causative reasons
Presence/density of shrubs	The visible density of shrubs has decreased markedly.	Negative	High	Low	The area where the photopoint was established has been used as a Pelican rookery since the 2014 photopoint was established, and thus changes observed are as a result of the impact of this rookery. Further photopoints have been established to aid in future monitoring (see Appendix 2).
Leaf litter/debris	More leaf litter and debris on the ground.	Negative	High	Low	
Bare ground	Less bare ground present.	Negative	High	Low	

Management Zone 4

First assessment 23rd May 2014

Second assessment 16th March 2022

Vegetation Community: *Atriplex cinerea / Nitraria billardierei / Lycium ferocissimum Open Shrubland*

BCM Benchmark Community: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

BushRAT vegetation condition attributes

Attribute	2014		2022	
	Raw score	Scaled Score	Raw score	Scaled Score
Native Plant Species Diversity	8	5/15	9	6/15
Weeds	27	4/15	20	5/15
Native Plant Life forms	7	4/10	6	3/10
Regeneration**	3	3/8	3	3/8
Native: Exotic Understorey Biomass		3/10	-	4/10
Bare Ground		2/3		2/3
Grazing Evidence		4/4		4/4
TOTAL VEGETATION CONDITION SCORE		**25/65**		**28/65**

Comparison of BushRAT scores 2014 - 2022

The overall BushRAT score has increased slightly. One additional plant species was scored in 2022 (*Atriplex semibaccata* – Creeping Saltbush) (Table 1). The weed score also decreased, with many species scored as lower cover in 2022 than in 2014 (Table 2), especially **Galenia pubescens* (Galenia), which was scored as decreasing from 26-50% cover to plentiful but cover <1%, and **Malva parviflora* (Marshmallow) scored as reducing from 1-5% cover to <1% cover. This is considered to be likely due to weed control activities.

Photopoint 4 photograph taken on 23rd May 2014 facing SW at 269882E 6150323S (Zone 54 WGS 84).

Photopoint photograph re-taken on 16th March 2022.

Evaluation of photopoint images

Relevant change indicators	Specific detail	Positive or negative change	Confidence change is real	Confidence change represents long-term change	Possible causative reasons
Density of woody weeds	Several dead, but still standing **Lycium ferocissimum* (African Boxthorn) are evident in the image.	Positive	High	High	Weed control for African Boxthorn in the site. Dead individuals left standing.
Bare Ground	Increase in bare ground visible in the photopoint image.	Positive	Moderate	Moderate	More visible bare ground may be as a result of weed control activities. More open areas are considered to provide more amenable space for seabird nesting.
Presence of animals	Numerous Silver Gulls (*Chroicocephalus novaehollandiae*) visible in original photograph.	Positive	High	Low	Lack of presence of Silver Gulls likely due to different time of year that assessment was undertaken. If it were a long term change it would be considered a positive outcome as high numbers of Silver Gulls may impact the breeding of less common species.

3. Discussion of changes observed

The re-assessment of Bird Island using the BushRAT assessment methodology demonstrated that a number of changes may have occurred in the vegetation of the island, some of which can be attributed to natural processes, and some of which may be as a result of anthropogenic intervention. Of the four Management Zones assessed, the two Zones in samphire communities (Communities 1 and 2, Figure 2) remained weed free, and had consistent scores from 2014 to 2022 for BushRAT assessment components. Photopoint images showed an increase in bare ground in Management Zone 1 and that there had been growth and increased cover of *Avicennia marina ssp. marina* (Grey Mangrove) in Management Zone 2. Whilst neither of these changes are of particular concern at this stage, it has been noted that the expansion of mangroves can limit the availability of the open spaces that shorebirds use for roosting and feeding. Shorebirds prefer the security of open spaces with high visibility for the easy detection of approaching predators[3]. As such, ongoing monitoring of mangrove expansion, including use of aerial photography, may be of value to provide an indication of whether shorebird roosting and feeding habitat is being compromised.

There appears to have been a decrease in cover of the high threat woody weed **Lycium ferocissimum* (African Boxthorn) as a result of weed control activities. In better quality habitats (Management Zone 3), lower cover was scored, and in the more disturbed Management Zone 4, photopoint images showed dead, standing Boxthorns which have been left in place to provide nesting/roosting habitat. Within Management Zone 4, cover of weed species was observed to have generally declined, especially **Galenia pubescens* (Galenia), which was scored as decreasing from 26-50% cover to plentiful but cover <1%, and **Malva parviflora* (Marshmallow) scored as reducing from 1-5% cover to <1% cover. Carpenter (2008) [4] notes that more open sites are favoured for nesting by terns, whereas areas where weedy ground cover is high favour Silver Gulls. As such, decrease in weed ground cover is seen as a positive outcome to favour more desirable seabird species nesting.

In Management Zone 3, there were poorer scores for weeds and native:exotic understorey, possibly driven by an increase in weed cover, particularly of **Cakile maritima* (Beach Rocket), for which cover was scored as moving from the 5-25% cover category to the 26-50% category. The Metropolitan Adelaide and Northern Coastal Action Plan (2009)[5] notes for this species describe it as "A widespread cosmopolitan plant that is found at the back of the beach and any extremely disturbed dune site. A niche plant coexisting contentedly, rarely invasive, a good soil and dune stabiliser and doesn't appear to be colonising any space at the expense of local indigenous species.". As such it is not considered a high threat at this stage, although vigilance should be maintained to ensure that it does not impact on key seabird breeding habitat (such as open beach areas used by Fairy Terns (*Sternula nereis*).

[3] Purnell, C., Peter, J., Clemens, R. (2013). *Shorebird Population Monitoring within Gulf St Vincent: July 2011 to June 2012 Annual Report*. BirdLife Australia report for the Adelaide and Mount Lofty Ranges Natural Resources Management Board and the Department of the Environment, Water, Heritage and the Arts.

[4] Carpenter, G. (2008), *Birds of the Section Bank, Outer Harbor*. A report prepared by G. Carpenter for Coast and Marine Branch, Department of Environment and Heritage, June 2008.

[5] Caton B., Fotheringham D., Krahnert E., Pearson J., Royal M. and Sandercock R. (2009). *Metropolitan Adelaide and Northern Coastal Action Plan*. Prepared for the Adelaide and Mount Lofty Ranges NRM Board and Department for Environment and Heritage

Appendix 1: Summary of the BushRAT methodology

It is not the intent of this report to provide an extensive overview of the use and application of the BushRAT methodology. A full description of the method and its application can be found within DEWNR (2012)[6]. The following is a simple overview of the contribution of different scoring components to the BushRAT overall score. Note: A low score indicates poor condition for that attribute, a high score indicates good condition. Thus a very high weed score means there are very few weeds, and a very low weed score means there is a profusion of threatening weeds.

Vegetation Condition Scores

<table>
<tr><td>Vegetation condition component</td><td>Overview description</td></tr>
<tr><td>Native Plant Species Diversity (15)</td><td>A count of the number of species present is compared to a “benchmark” value for that vegetation type. This is then allocated a score from 0-15.</td></tr>
<tr><td>Weed Score (15)</td><td>The cover and abundance of all weed species present is recorded as per the cover rating table below. The 5 weeds with the highest product of threat rating and cover are summed to provide a score. This is then compared to a “benchmark” value for that vegetation type, and allocated a score from 0-15.
<table>
<tr><td colspan="2">Cover Rating</td></tr>
<tr><td>not many, cover <1%</td><td>1</td></tr>
<tr><td>Plentiful, cover <1%</td><td>1a</td></tr>
<tr><td>Covering 1 - 5%</td><td>2</td></tr>
<tr><td>Covering 5 – 25%</td><td>3</td></tr>
<tr><td>Covering 26 –50%</td><td>4</td></tr>
<tr><td>Covering 51 – 75%</td><td>5</td></tr>
<tr><td>Covering > 75%</td><td>6</td></tr>
</table></td></tr>
<tr><td>Native Plant Life Forms (10)</td><td>The cover of different native plant life forms is compared to a “benchmark” value for that vegetation type. This is then allocated a score from 0-10.</td></tr>
<tr><td>Regeneration (8)</td><td>The total number of woody native species in juvenile or seedling form is recorded and compared to a “benchmark” value for that vegetation type. This is then allocated a score from 0-8.</td></tr>
<tr><td>Native:exotic Understorey Biomass (10)</td><td>The percentage of the total vegetative biomass of shrubs and groundcover plants < 2m high that is native is noted. This is then allocated a score from 0-10.</td></tr>
<tr><td>Bare Ground (3)</td><td>The percentage of the grounds surface that is truly bare is noted and allocated a score from 0-3.</td></tr>
<tr><td>Tree Health (5)</td><td>Average overall overstorey canopy health is allocated to a category, and then a score from 0-5. NOTE: NOT SCORED FOR COASTAL SHRUBLAND VEGETATION.</td></tr>
</table>

[6] DEWNR (2012). *NVBMU BushRAT assessment and scoring Manual*. Unpublished document, Department for Environment, Water and Natural Resources, Waite.

Tree Hollows (5)	This score relates to the number of small and large tree hollows present, with a rating of 0-5. NOTE: NOT SCORED FOR COASTAL SHRUBLAND VEGETATION.
Fallen timber (5)	This score relates to the amount of branch and trunk sized logs present, with a rating of 0-5. NOTE: NOT SCORED FOR COASTAL SHRUBLAND VEGETATION.
Grazing Evidence (4)	This score relates to evidence of grazing pressure, including pugging, compacting and chewing. The score is from 0-4.

BushRAT Scoresheet

Native Plant Life Forms	Cover Rating			
include height of flowering head & dead branches				
Trees >15 m				
Trees 5 – 15 m				
Trees < 5m				
Mallee > 5m				
Mallee ≤ 5m				
Shrubs > 2 m				
Shrubs 0.5–2m				
Shrubs < 0.5 m				
Herbs				
Mat Plants				
Grasses >0.2m				
Grasses ≤ 0.2m				
'Sedges' > 1m				
'Sedges' ≤ 1m				
Hummock grass				
Vines,scramblers				
Mistletoe				
Ferns				
Grass-trees				
Total				

Cover Rating	
not many, cover <1%	1
Plentiful, cover <1%	1a
Covering 1 - 5%	2
Covering 5 – 25%	3
Covering 26 –50%	4
Covering 51 – 75%	5
Covering > 75%	6

Fallen Timber				
log size refers to that of canopy species (+ emergent species if present)				
Log diameter	None	<1 per 10 adult trees	≥1 per 10 adult trees	Score
Branch-sized	0	1	2	
Trunk sized	0	2	3	

d=dominant, v=voucher, e=edge, p=planted, R=regenerati

Tree Hollows				
Hollow diameter	None	<20 per ha	≥20 per ha	Score
2-10cm	0	1	2	
>10cm	0	2	3	

Native:exotic Understorey Biomass	
include dead material if attached & recognisable as native	
% native	
91%+	10
81-90	9
71-80	8
61-70	7
51-60	6
41-50	5
31-40	4
21-30	3
11-20	2
0-10	1

Bare Ground	
exclude soil crust, litter, exposed rock	
> 51% of site bare ground	2
26-50% bare ground	3
5–25 % bare ground	3
< 5% bare ground	1

Grazing Evidence (*score 4 minus 1 for each sign below*)	
heavy/severe chewing	
widespread pugging/compaction	
grazing animals observed /widespread dung &/or fur;	
active warren/stock camp	

Tree Health (excl. long-dead trees)	
<10% dieback	5
10-25% dieback, few branches dead	4
26-50% dieback, many branches dead	3
51-75% dieback, most branches dead +/- epicormic growth	2
76-99% dieback, most epicormic growth dead	1
100% dieback	0

Date:……

Location Name……

Photo dirn:……..Num……..Easting:……..Northing:…….....

Recorder:…… O/S Cover (%)…….O/S Ave. Ht……

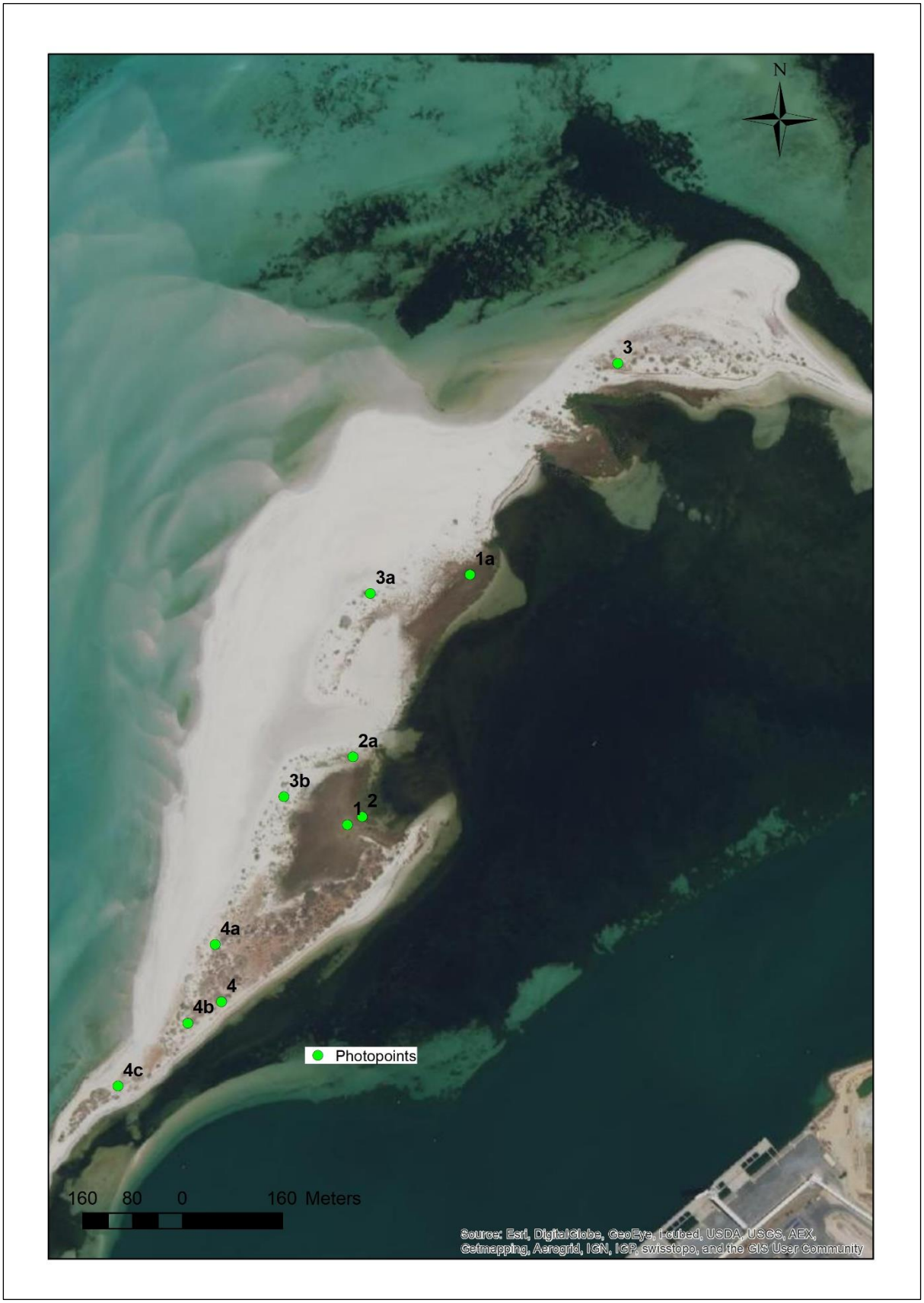
Vegetation Association Description……

NVBMU BushRAT Assessment

Weeds					C			Other Weed species:	C			
Aira sp.				Euphorbia terracina				Plantago lanceolata var.				
Aloe sp.				Galenia pubescens var. pubescens				Polygala myrtifolia				
Ammophila arenaria				Gazania sp.				Polygonum aviculare				
Anagallis arvensis				Genista monspessulana				Polypogon monspeliensis				
Arctotheca calendula				Gomphocarpus cancellatus				Rapistrum rugosum ssp.				
Arctotis stoechadifolia				Hedypnois rhagadioloides ssp.				Reichardia tingitana				
Asparagus asparagoides				Hordeum marinum				Reseda lutea				
Asphodelus fistulosus				Hypochaeris glabra				Retama raetam				
Aster subulatus				Hypochaeris radicata				Rhamnus alaternus				
Atriplex prostrata				Juncus acutus				Romulea rosea var. australis				
Avena sp.				Lactuca serriola f. serriola				Rosa canina				
Brachypodium distachyon				Lagurus ovatus				Rostraria cristata				
Brassica tournefortii				Lampranthus glaucus				Rumex sp.				
Briza maxima				Leptospermum laevigatum				Salvia verbenaca var.				
Briza minor				Limonium companyonis				Scabiosa atropurpurea				
Bromus sp.				Lolium sp.				Silene sp.				
Cakile maritima ssp. maritima				Lycium ferocissimum				Silybum marianum				
Carpobrotus edulis ssp. edulis				Malva dendromorpha				Sisymbrium sp.				
Carthamus lanatus				Malva parviflora				Solanum sp.				
Casuarina glauca				Marrubium vulgare				Sonchus sp.				
Catapodium rigidum				Medicago sp.				Stenotaphrum secundatum				
Chondrilla juncea				Melilotus indicus				Suaeda baccifera				
Chrysanthemoides monilifera ssp.				Mesembryanthemum crystallinum				Tamarix sp.				
Cirsium vulgare				Mesembryanthemum nodiflorum				Tetragonia decumbens				
Conyza sp.				Nicotiana glauca				Thinopyrum sp.				
Coprosma repens				Oenothera stricta ssp. stricta				Trachyandra divaricata				
Cotula coronopifolia				Olea europaea ssp.				Tribulus terrestris				
Cotyledon orbiculata var.				Oncosiphon suffruticosum				Trifolium sp.				
Crassula tetragona ssp. robusta				Opuntia sp.				Vicia sp.				
Cynara cardunculus ssp. flavescens				Osteospermum fruticosum				Vulpia myuros f. myuros				
Cynodon dactylon var. dactylon				Oxalis pes-caprae				Watsonia meriana var.				
Cyperus sp.*				Panicum miliaceum ssp. miliaceum								
Dactylis glomerata				Parapholis incurva								
Diplotaxis tenuifolia				Paspalum distichum								
Dittrichia graveolens				Paspalum vaginatum								
Echium plantagineum				Pennisetum clandestinum								
Ehrharta calycina				Pennisetum setaceum								
Ehrharta villosa var. maxima				Pennisetum villosum								
Emex australis				Phalaris sp.								
Eragrostis curvula				Piptatherum miliaceum								
Euphorbia paralias				Plantago coronopus ssp.								

Appendix 2: Additional photopoints

Figure A2.1 below shows the location of original and additional photopoints for the project.



Photopoint 1a photograph taken on 16th March 2022 facing S at 270280E 6151008S (Zone 54 WGS 84).

Photopoint 2a photograph taken on 16th March 2022 facing S at 270093E 6150716S (Zone 54 WGS 84).

Photopoint 3a photograph taken on 16th March 2022 facing SSW at 270121E 6150978S (Zone 54 WGS 84).

Photopoint 3b photograph taken on 16th March 2022 facing SSW at 269982E 6150652S (Zone 54 WGS 84).

Photopoint 4a photograph taken on 16th March 2022 facing E at 269872E 6150415S (Zone 54 WGS 84).

Photopoint 4b photograph taken on 16th March 2022 facing NE at 269828E 6150289S (Zone 54 WGS 84).

Photopoint 4c photograph taken on 16th March 2022 facing SSW at 269716E 6150188S (Zone 54 WGS 84).