Southport Dunes

Biodiversity Action Plan

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1 INTRODUCTION

Coastal dunes in the Adelaide metropolitan area have been significantly impacted by urbanisation, with very few remnant dunes remaining. The Southport Dunes are one of the best extant examples of dune vegetation. They are an important ecological, recreational and amenity landscape that contributes to the preservation of coastal biodiversity along the Adelaide coastline. The dune system and adjacent waterways have always been a popular area for recreational activities and are under increasing pressure from over-use and the continual encroachment of suburbia[1].

The Southport Dunes are the largest dune landform in the region, being nearly 2 km long, 250 m at its widest, and rising to 20 m. The sand spit on which the dunes lie extends south across the Onkaparinga estuary, indicating a local southerly littoral drift on this section of coast due to waves being refracted by the Noarlunga Reef[2]. This southerly drift is a local reversal of the usual south to north drift along the shores of the Gulf St Vincent. This is due to local inshore refraction of the west-south- westerly swell from the Southern Ocean. The beach is protected by the calcarenite Noarlunga reef near the jetty, but the beach is exposed and moderately energetic opposite the Southport Surf Lifesaving Club[3].

According to the Metropolitan Adelaide and Northern Coastal Action Plan, the Dunes shows high values for several variables: distribution of plant communities rare in SA and communities with more than 50% of their records in this region, sites with threatened fauna, significant reptiles, habitat for species with endangered status, regional abundance, regional coastal distribution, and for habitat for species with coastal dependence, views of the sea and scenic amenity, connectivity, patch shape, availability of publicly owned open space, Aboriginal heritage and European natural heritage are state listed[4].

Issue	Proposed Action	Priority of Action
High % of exotic plants, presence of aggressive weeds	Update and implement the Port Noarlunga Dune Management Plan. Maintain and extend effort in weed control, local species planting and access control	High (Cons./ Threat)
Current instability, (increasing with accelerated sea level rise)	Monitor and actively deal with blow out development using brush matting, sand drift fences and seasonal planting	High (Cons./ Threat)

[1] EDAW (2004). Port Noarlunga Dunes Vegetation Management Plan. Unpublished report prepared for the City of Onkaparinga.

[2] Bourman, R.P., Murray-Wallace, C.V. and Harvey, N. (2016). Coastal Landscapes of South Australia. University of Adelaide, South Australia.

[3] 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

[4] 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

in an area of high conservation values		
Erosion and damage to vegetation from informal pedestrian access and sandboarding	Continue maintenance of existing access controls and boardwalk/steps. Install further fencing and signage to discourage inappropriate access and behaviour. Link in with Ecosurf SLSA education programs	High (Cons./ Threat)
Domestic animals in dunes threaten fauna habitats	Interpretive signage, dogs on leashes, monitoring of native fauna	Medium (Cons.)
Exotic weed infestation threatening remnant vegetation	Weed removal and restoration program as identified within Onkaparinga Estuary Management Plan	High (Cons./ Threat)

2 STUDY AREA

Southport Dunes are located on the northern side of the Onkaparinga River mouth at Port Noarlunga, approximately 30 km south-south-west of the Adelaide city centre. The area that is the subject of this Biodiversity Action Plan is approximately 28 hectares, comprising the land parcel(s) in Table 1 and shown in Figure 1.

Table 1. Land Parcel details for Southport Dunes

Parcel(s)	Title details
H105500 S1621	CR/5753/982

2.1 Current land management

Southport Dunes are under the care and control of the City of Onkaparinga. Organisations that contribute to ongoing management of the biodiversity assets of the Dunes include:

- City of Onkaparinga;
- Green Adelaide - statutory authority;
- Trees for Life – Bush for Life volunteers. This group has a Memorandum of Understanding with Council via Trees for Life who are contracted to support volunteers working in natural areas throughout the City of Onkaparinga region. This formal group arrangement has been ongoing for around 8 years and prior to this a small group of dedicated volunteers were working in the site for about 20 years. The group works between May and October and has historically grown and planted tubestock using local provenance seed. They have regular working bees focussing on herbacous weed removal which are grubbed, bagged and removed from site;
- Environment and Biodiversity Services (EBS). EBS have long-term experience and involvement in the control of weedy grasses in the site, especially Pyp Grass (*Ehrharta villosa var. maxima*), working as a contractor for the City of Onkaparinga

The Southport Lifesaving Club lies at the southern end of the Dunes (see Figure 1). Members of this Club have participated in revegetation planting days in the dunes.

2.2 Surrounding and historical land use

Pre-European Settlement

The Kaurna people are the traditional custodians of the Adelaide Plains and their country extends from Crystal Brook and the Clare Valley in the north to Cape Jervis at the southern end of the Fleurieu Peninsula[5]. Kaurna families and clans generally moved inland to more sheltered locations in the Mount Lofty Ranges foothills in winter, and spent much of the summer fishing and hunting along the coastline of St Vincent Gulf[6]. For Kaurna the coastal region was a prime traditional camping area, rich in coastal resources and one of the summer camping grounds along the coast of Wongga yerlo Western sea (Gulf St Vincent)[7]. They were a very populous society, with more than twenty clans living in tracts of home country that stretched from the foothills of the Mount Lofty Ranges and across the plains to the coastal beaches, estuaries and wetlands. The coastal streams provided watered access routes across these lands.

Some Kaurna places are known, including the sites and springs along the Tjilbruke Dreaming track, and the archaeological campsites and burial sites along the coastal cliffs and dunes of the Adelaide coastline, and throughout the Fleurieu Peninsula[5]. The Port Noarlunga Dunes are recognised as having a long association with the Kaurna people as the coast provided a gathering area that enabled the opportunity to fish, hunt and socialise within a naturally rich environment. The area is linked to a number of Aboriginal myths and stories including the Tjilbruke Story and resultant trail and numerous important women's sites along the Onkaparinga River[8].

Post-European Settlement

European settlement occurred around 1840 with Old Noarlunga becoming the main town and centre for activity within the area. The main transportation method down the Onkaparinga River was with flat-bottomed boats due to the shallow mouth of the estuary. The estuary area appears to have been used extensively for grazing but due to the terrain and lack of any substantial fodder crop it appears that the dunes were not used for this purpose. There is no evidence of building or artifacts relating to European heritage in the Dunes[9]. Aerial imagery of the site from 1949 shows extensive areas of bare sand. This is not considered to be a natural form in the dune system, and likely reflects disturbance through anthropogenic impacts, grazing or introduced animals such as rabbits. Section 5.3 provides a description of typical form of dune shrublands.

[5] Australian Cultural Heritage Management (ACHM). Notes on Aboriginal Cultural Heritage of the Mount Lofty Ranges. Unpublished document prepared for the Mt Lofty Ranges World Heritage Bid.
[6] Tindale, NB 1987. Wanderings of Tjibruki: A Tale of the Kaurna People of Adelaide. Records of the South Australian Museum V20: 5-13.
[7] Telfer, K.W. and Malone, G. (2017). Tulukudangga Spring, Kingston Park and the Tjirbruki Munaintya Cultural Mapping. Report prepared for the City of Holdfast Bay Council.
[8] EDAW (2004). Port Noarlunga Dunes Vegetation Management Plan. Unpublished report prepared for the City of Onkaparinga.
[9] EDAW (2004). Port Noarlunga Dunes Vegetation Management Plan. Unpublished report prepared for the City of Onkaparinga.

Figure 1: Location of Southport Dunes and the area that is the focus of this Biodiversity Action Plan

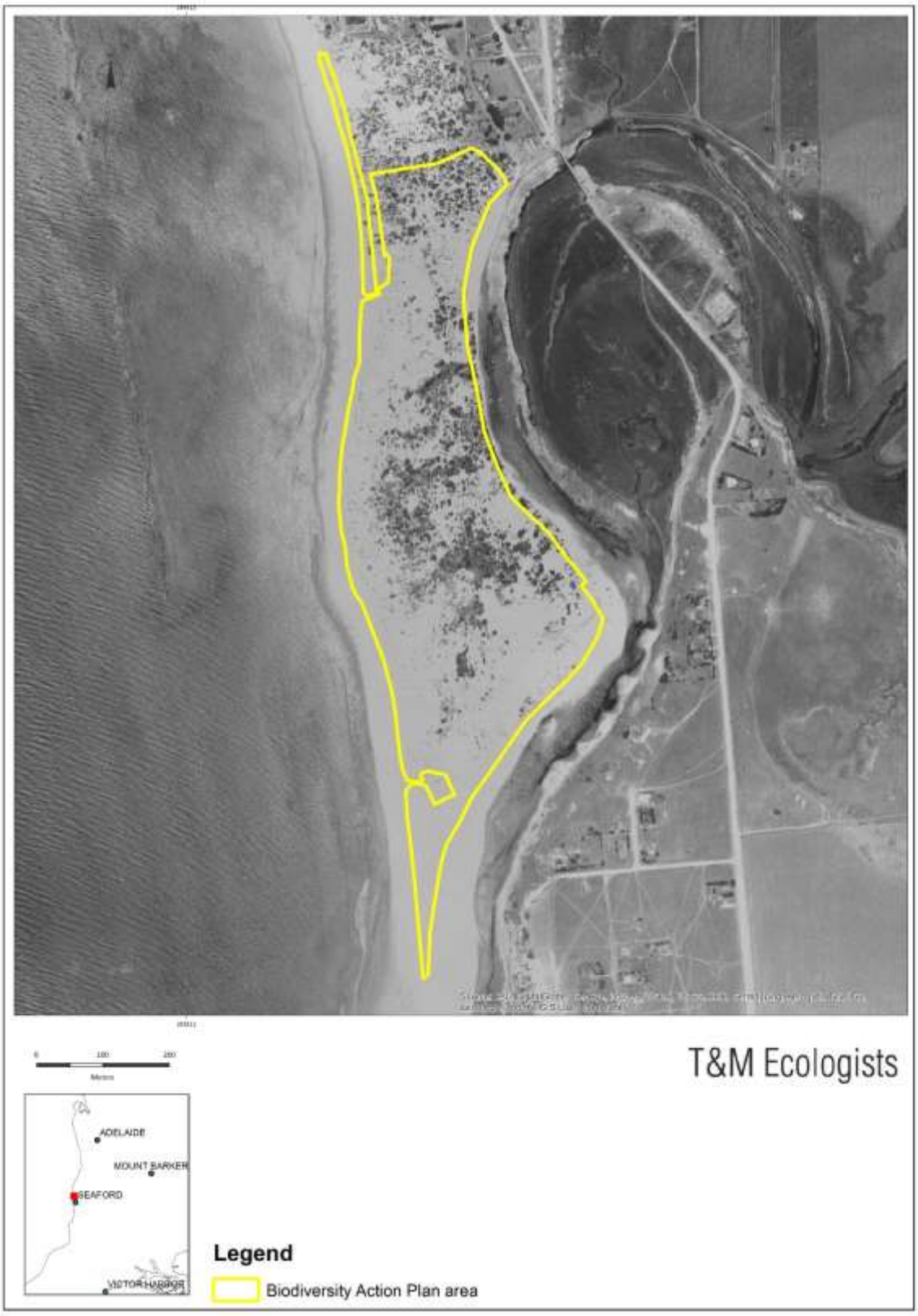

Figure 1b: 1949 aerial imagery of the site

3 ENVIRONMENTAL ASSETS

3.1 Vegetation

The vegetation overall is generally a shrubland to open shrubland, with dominant overstorey comprising a shrubland to open shrubland of Coast Daisy Bush (*Olearia axillaris*), Coast Beard-heath (*Leucopogon parviflorus*), Coastal Wattle (*Acacia longifolia sophorae*) and Common Boobialla (*Myoporum insulare*). The understorey comprises Sea-berry Saltbush (*Rhagodia candolleana ssp. candolleana*), Coast Bonefruit (*Threlkeldia diffusa*) and Thyme Riceflower (*Pimelea serpyllifolia ssp. serpyllifolia*) as dominant smaller shrubs. Groundsel (*Senecio spanomerus*) is a very common groundlayer herb, estimated at about 10% cover in most areas, and Picris, possibly both *Picris squarrosa* (Rare at a state level) and *Picris angustifolia ssp. angustifolia*, also present in patches. The mat plant Native Pigface (*Carpobrotus rossii*) and the sedge/lily Short-stem Flax-lily (*Dianella brevicaulis*) are universally present apart from in foredune habitat, forming cover of up to 5%.

Whilst further fieldwork across several time periods, especially spring, would be required to ensure a comprehensive species list for the site, this assessment located 39 native plant species (Table 2). Due to timing of the survey meaning the species was vegetative, it was difficult to confirm whether the Picris species present in the site was *Picris squarrosa* (Rare at a state level) and/or *Picris angustifolia ssp. angustifolia*, although both species have been observed in the dunes in the past and it is likely both may be present. The State Rare Australian Broomrape (*Orobanche cernua var. australiana*) was noted in several locations. In addition to these species of state conservation significance, there were fifteen other species considered to be rare, vulnerable or endangered at a regional level.

There are a number of highly threatening and/or declared introduced weeds in the dunes, including Pyp Grass (**Ehrharta villosa*), Perennial Veldt Grass (**Ehrharta calycina*), African Boxthorn (**Lycium ferocissimum*), Gazania (**Gazania linearis*), White Arctotis (**Arctotis stoechadifolia*), Dune Onion Weed (**Trachyandra divaricata*) and Skeleton Weed (**Chondrilla juncea*). For most parts of the dunes, introduced species are generally scattered and of low cover. Notable exceptions are large patches of Pyp Grass (**Ehrharta villosa*) on steep dunes in the north eastern corner of the site, and Marram Grass (**Ammophila arenaria*) along the foredunes, on the steep dune faces on the eastern side of the dunes (facing the Onkaparinga Estuary) and in the low dunes to the south of the Southport Surf Lifesaving Club. Whilst eradication from these areas will be a long-term target, it needs to be done concurrently with revegetation with native species, especially the native Rolling Spinifex (*Spinifex hirsutus*), as these weedy grasses are currently performing an important ecological function in holding the sandy soil. The list of introduced species is provided in Appendix 3.

A full list of species observed in the site is provided in Appendix 1. Pre-European vegetation mapping shows the area as an *Olearia axillaris ± Leucopogon parviflorus* Shrubland[10].

Further information about the vegetation currently in the site is provided in Section 5.

[10] www.naturemaps.sa.gov.au visited 6/4/21

Table 2: List of native plant species observed in Southport Dunes

Species	Common Name	Conservation Status			BDBSA	This study
		AUS[11]	SA[12]	AMLR[13]		
Acacia ligulata	Umbrella Bush			RA		X
Acacia longifolia ssp. sophorae	Coastal Wattle			LC	X	X
Acrotriche patula	Prickly Ground-berry			RA		X
Adriana quadripartita	Coast Bitter-bush			RA		X
Alyxia buxifolia	Sea Box			RA		X
Austrostipa flavescens	Coast Spear-grass			LC	X	X
Billardiera cymosa ssp. cymosa	Sweet Apple-berry			LC	X	X
Carpobrotus rossii	Native Pigface			LC	X	X
Crassula decumbens var. decumbens	Spreading Crassula			LC	X	
Crassula sieberiana	Sieber's Crassula			VU	X	
Cynoglossum australe	Australian Hound's-tongue			RA	X	X
Daucus glochidiatus	Native Carrot			LC	X	X
Dianella brevicaulis	Short-stem Flax-lily			NT	X	X
Disphyma crassifolium ssp. clavellatum	Round-leaf Pigface			LC		X
Ficinia nodosa	Knobby Club-rush			LC	X	X
Geranium sp.	Geranium					X
Helichrysum leucopsideum	Satin Everlasting			NT		X
Kennedia prostrata	Scarlet Runner			LC	X	X
Kunzea pomifera	Muntries			RA		X
Leucophyta brownii	Coast Cushion Bush			NT		X
Leucopogon parviflorus	Coast Beard-heath			NT	X	X
Lotus australis	Austral Trefoil			NT		X
Melaleuca lanceolata	Dryland Tea-tree			RA		X
Muehlenbeckia gunnii	Coastal Climbing Lignum			LC	X	X
Myoporum insulare	Common Boobialla			NT		X
Myoporum parvifolium	Creeping Boobialla			VU		X
Nitraria billardierei	Nitre-bush			RA		X
Olearia axillaris	Coast Daisy-bush			NT		X
Olearia ramulosa	Twiggy Daisy-bush			LC	X	
Orobanche cernua var. australiana	Australian Broomrape		R	EN	X	X
Pelargonium australe	Austral Stork's-bill			RA	X	X
Picris sp.	Coast or Squat Picris			RA		X
Picris angustifolia ssp. angustifolia	Coast Picris			RA	X	
Picris squarrosa	Squat Picris		R	EN	X	
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower			NT	X	X

[11] Environment Protection and Biodiversity Conservation Act 1999
[12] Schedules of the National Parks and Wildlife Act 1972 accessed November 2015
[13] Gillam, S. and Urban, R. (2014) *Regional Species Conservation Assessment Project, Phase 1 Report: Regional Species Status Assessments*, Adelaide and Mount Lofty Ranges NRM Region. Department of Environment, Water and Natural Resources, South Australia.

Species	Common Name	Conservation Status			BDBSA	This study
		AUS[11]	SA[12]	AMLR[13]		
Poa poiformis var. poiformis	Coast Tussock-grass			LC		X
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush			LC	X	X
Scaevola crassifolia	Cushion Fanflower			VU		X
Senecio pinnatifolius var. maritimus	Variable Groundsel			RA	X	X
Senecio spanomerus				NT	X	X
Spinifex hirsutus	Rolling Spinifex			LC	X	X
Tetragonia implexicoma	Bower Spinach			LC	X	X
Threlkeldia diffusa	Coast Bonefruit			NT	X	X
Wahlenbergia littoricola	Coast Bluebell			NE		X

Rating codes: LC= Least Concern, NT = Near Threatened; RA = Rare; VU = Vulnerable; EN=Endangered

3.2 Native vertebrate fauna (including fauna of conservation significance)

3.3.1 Terrestrial vertebrates

The Biological Database of South Australia (BDBSA) does not include any formal records for terrestrial vertebrates in the Dune area. However, the area would likely form habitat for a number of small skink and gecko species, including the Four-toed Earless Skink (*Hemiergis peronii*), the Dwarf Skink (*Menetia greyii*), Bougainville's Skink (*Lerista bougainvillii*), Marbled Gecko (*Christinus marmoratus*), and the Three-toed Earless Skink (*Hemiergis decresiensis*). The larger reptile species Sleepy Lizard (*Tiliqua rugosa*), Eastern Bearded Dragon (*Pogona barbata*) and Eastern Brown Snake (*Pseudonaja textilis*) may also be present.

It is considered unlikely that there are any native mammals using the Southport Dunes as habitat.

3.3.2 Birds

A search of the Biological Database of South Australia showed that there have been over 200 bird species recorded from within 5km of the site. However, this would include historical records of species that are no longer present, and seabirds and ocean-going birds that would not use inland habitat. The adjacent Onkaparinga estuary would provide significant habitat for numerous seabirds and waders. Appendix 2 provides a list of the bird species considered likely to be resident or regular visitors to the site, based upon records from the Biological Database of South Australia and an understanding of the habitat preferences of the species present. It is considered likely that more than 15 native species of birds would use the terrestrial habitats present in the Dunes. Most species that would occur in the site are those that are tolerant of urban environments. However, the dunes would also provide habitat for some species not commonly seen in urban areas, such as the state Vulnerable Brown Quail (*Coturnix ypsilophora australis*), which has been reported by volunteers in the site[14].

[14] Matt Endacott, pers. comm.

The Nationally Vulnerable Hooded Plover (Eastern) (*Thinornis rubricollis rubricollis*) was not recorded as utilising this section of coastline in the 2019/20 breeding season[15]. However the beach and dunes should be maintained in a state such that the area could form suitable habitat for the species. The Red-capped Plover (*Charadrius ruficapillus*) is also commonly observed and breeds on the foreshore and around the estuary, and has somewhat similar nesting and behaviour to the Hooded Plover, and would face similar threats as described below. Hooded Plovers make simple nest-scrapes in the sand between the high water mark and the dunes and their well-camouflaged eggs and chicks are extremely difficult to spot, and therefore at great risk of being trampled by visitors to the beach. People, unleashed dogs, horses and vehicles on beaches not only pose a direct threat, but they also disturb incubating adults, resulting in temporary nest abandonment which exposes the eggs to harsh temperatures, and predators such as ravens, gulls, foxes and cats. This is particularly true of disturbances caused by unleashed dogs, where adults spend long periods away from the nest[16]. Chicks cannot fly for five weeks and need to forage on the beach, and they are easily crushed or disturbed by people, dogs and vehicles. If the chicks spend too much time in hiding, they can starve to death or be exposed to harsh temperatures in the absence of brooding. Adult birds also attempt to distract potential threats, leaving the chicks unattended and exposed to predators. In addition, changes to dune structure, such as may be caused by weeds such as Marram Grass (*Ammophila arenaria*) and Sea Wheat Grass (*Thinopyrum junceiforme*) may also impact the availability of suitable nesting habitat for Hooded Plovers. It is estimated that there are 50-70 Hooded Plovers remaining on the Fleurieu coastline[17].

3.3.3 Invertebrates

The shrublands at Southport Dunes would provide habitat for a broad array of invertebrate species. However there has been no specific survey for invertebrates in the Dunes, and no records exist on the Biological Database of South Australia. Table 3 provides a list of butterflies that do or may occur in Southport Dunes, based upon the known distribution of butterflies and the host plants present in the site.

Table 3: Butterflies previously recorded or inferred for Southport Dunes[18]

Species Name	Common Name	Time of year	Food plants	Observed / inferred
Anisynta cynone	Mottled Grass-Skipper	Mar-Apr	Introduced and native grasses	Inferred
Geitoneura klugii	Marbled xenica	Oct – Jan	Native grasses	inferred
Heteronympha merope	Common Brown	Oct-May	Introduced and native grasses	Inferred
Junonia villida	Meadow argus	All year	Scaevola or Introduced plantain & Scabious	Observed

[15] Mead, R. and Maguire, G. (2020). Monitoring Hooded Plovers on the Fleurieu Peninsula: A summary of breeding success for the 2019/20 season. Unpublished report prepared for the Adelaide and Mount Lofty Ranges Natural Resources Management Board.

[16] Mead, R. and Maguire, G. (2020). Monitoring Hooded Plovers on the Fleurieu Peninsula: A summary of breeding success for the 2019/20 season. Unpublished report prepared for the Adelaide and Mount Lofty Ranges Natural Resources Management Board.

[17] Department of the Environment (2014). Conservation Advice *Thinornis rubricollis rubricollis* hooded plover (eastern). Canberra: Department of the Environment.

[18] Table provided by Matt Endacott, Metro Coastal Conservation Officer

Lampides boeticus	Long-tailed Pea Blue	All year	Plants with pea flowers, including Australian Trefoil (*Lotus australis*)	Inferred
Nacaduba biocellata biocellata	Two-spotted Line-blue	All year	Wattles	inferred
Ocybadistes walkeri	Southern Grass-dart	Sep – May	Grasses	inferred
Taractocera papyria	White-banded Grass-dart	Sep-May	Grasses	inferred
Theclinesthes albocincta	Bitter-bush Blue	All year	Adriana quadripartita – plantings have occurred to increase connectivity for the species.	inferred
Theclinesthes miskini miskini	Wattle Blue	All year	Wattles	inferred
Theclinesthes serpentata	Saltbush Blue	All year	Salt bushes (Chenopodiaceae)	Observed
Vanessa kershawi	Australian Painted Lady	All year	Compositae, especially Helichrysum sp.	Inferred
Zizina otis	Common Grass-blue	All year	Plants with pea flowers, including Australian Trefoil (Lotus australis)	Inferred

4 ENVIRONMENTAL THREATS (management issues)

Management issues that are of particular concern in terms of biodiversity conservation in Southport Dunes include:

- weed infestation;
- pest animals;
- inappropriate recreational use, such as sandboarding;
- camping (which is not permitted in the Dunes)
- impacts on significant cultural sites
- erosion;
- inappropriate plantings; and
- unmanaged trails.

4.1 Invasive weeds

Invasive weed species have the potential to dominate the understorey, impact on the overstorey, and reduce habitat values for native fauna, as well as competing with native flora. Table 4 lists the weeds of concern that have been recorded in the area. These are high threat weeds that meet one or more of the following criteria:

- Declared under the *Landscapes South Australia Act 2019;*
- Red Alert weed rating of 3 or more; and/or
- non-indigenous woody and herbaceous species noted to be proliferating in the site.

Table 4: List of Priority Weeds for control in Southport Dunes

Species	Common Name	[19]Red Alert	[20]Declared	Lifeform	Notes[21]
Acacia saligna	Golden Wreath Wattle	2		Shrub	Non-indigenous Australian native. Formerly abundant in more sheltered areas of the dunes, but has been the focus of weed control activities and now at very low levels.
Acacia cyclops	Western Coastal Wattle	3		Shrub	Non-indigenous native species found in sandy environments in western South Australia. Proliferates widely in coastal dune environments. Formerly widespread in the dunes but has been the focus of weed control activities and now at very low levels.
Ammophila arenaria	Marram Grass	2		Perennial Grasss	Marram grass transforms vegetation when it invades temperate coastal sand dunes, modifying dune structure and function[22]. Widespread through southern and eastern sides of the dunes, but scattered elsewhere. Control needs to ensure native species are present so that removal does not cause excessive sand movement.
Arctotis stoechadifolia	White Arctotis	3		Forb	An important weed of coastal sand dunes in south-eastern South Australia, where it forms dense mats that smother native dune vegetation and eliminate indigenous plants through shading and competition for resources. It can also alter the dune structure and cause dunes to develop a steeper slope[23]. Scattered specimens present in the Dunes.
Asparagus asparagoides forma	Bridal Creeper	5	Y	Climber	A winter-growing, summer-dormant climbing perennial. Widespread in South Australia and considered to be a Weed of National Significance. Scattered in more sheltered areas in the Dunes.
Chondrilla juncea	Skeleton Weed	2	Y	Forb	A deep-rooted perennial weed established in the cereal growing areas of South Australia. Scattered in the dunes, but may have the capacity to spread more widely.
Ehrharta calycina	Perennial Veldt Grass	4		Perennial Grasss	Tussock grass that proliferates on sandy soils. Has been demonstrated to rapidly change the composition and dynamics of invaded coastal dune

[19] Refer to Croft, S.J., J.A. Pedler & T.I. Milne (2005 – 2008) Bushland Condition Monitoring Manual. Nature Conservation Society of SA Inc.

[20] Under the *Landscape South Australia Act 2019*

[21] Specific information on Declared plants sourced through Declared Plant Policies in South Australia: https://pir.sa.gov.au/biosecurity/weeds_and_pest_animals/weeds_in_sa/plant_policies

[22] Hayes, M. and Kirkpatrick, J. (2012). Influence of Ammophila arenaria on half a century of vegetation change in eastern Tasmanian sand dune systems. ustralian Journal of Botany 60(5) 450-460.

[23] https://keyserver.lucidcentral.org/weeds/data/media/Html/arctotis_stoechadifolia.htm accessed 26/5/21.

Species	Common Name	[19]Red Alert	[20]Declared	Lifeform	Notes[21]
					systems[24]. Generally scattred, although more prevalent (1-5% cover) on eastern side of the dune system.
Ehrharta villosa var. maxima	Pyp Grass	4		Perennial Grasss	Spreads via a dense network of strong, creeping underground stems (rhizomes). Once established it can easily dominate an area and can result in significant biodiversity loss in coastal sand dunes, as it can seriously inhibit the growth of native vegetation and eliminate smaller indigenous plants through competition for resources. Its mat-forming habit also compromises rehabilitation projects and can have an impact on the structure and dynamics of coastal dunes[25]. Whilst significant infestations still occur in the dunes, especially at the northern end, cover has been greatly reduced through central sections of the dunes as a result of an ongoing control program[26].
Euphorbia paralias	Sea Spurge	3		Forb	Long-lived perennial herbaceous plant. Colonises the foredunes at the back of the beach, forming dense infestations that stabilise the dunes, preventing natural sand movement inland, and creating a different dune structure to that created by native species. This can also decrease the availability of beach nesting sites for shore birds[27]. Widespread and abundant in incipient and primary dunes in Southport Dunes.
Euphorbia terracina	False Caper	3	Y	Forb	A perennial native to the coastal sand dunes bordering the Mediterranean, now widespread in South Australia on sandy and coastal soils. Generally low cover, although abundant on the western side of the Southport Dunes.
Gazania linearis	Gazania	4	Y	Forb	A tough, low-growing perennial with brightly coloured daisy flowers, native to South Africa. It invades coastal habitats, and can severely alter the vegetation structure in plant communities by replacing and suppressing native plants[28]. Scattered only in main dune system, but abundant in narrow strip to the west of the Esplanade.

[24] https://keyserver.lucidcentral.org/weeds/data/media/Html/ehrharta_calycina.htm#:~:text=Perennial%20veldtgrass%20(Ehrharta%20calycina)%20is%20also%20regarded%20as%20being%20invasive,the%20Adelaide%20Hills%20Council%20district. Accessed 26/5/21.

[25] https://keyserver.lucidcentral.org/weeds/data/media/Html/ehrharta_villosa.htm accessed 26/5/21.

[26] Milne, T. (2020). Condition Assessment of Southport Dunes, Port Noarlunga 2020. Unpublished report prepared for Natural Resources Adelaide and Mount Lofty Ranges.

[27] https://keyserver.lucidcentral.org/weeds/data/media/Html/euphorbia_paralias.htm accessed 26/5/21.

[28] https://keyserver.lucidcentral.org/weeds/data/media/Html/gazania_linearis.htm#:~:text=Gazania%20(Gazania%20linearis) %20is%20regarded,open%20woodlands%20in%20inland%20areas accessed 26/5/21.

Species	Common Name	[19]Red Alert	[20]Declared	Lifeform	Notes[21]
Leptospermum laevigatum	Coast Tea-tree	4	Y	Shrub / tree	Coastal tea-tree is a shrub or small tree adapted to coastal habitats, introduced to South Australia from eastern Australia. Present in central section of the dunes, and could spread more widely through sheltered swale environments. Has been the focus of recent control works (see Figures 2a, 2b).
Lycium ferocissimum	African Boxthorn	3	Y	Shrub	African boxthorn is a large spiny shrub, introduced by settlers as a hedge plant and now widespread across South Australia. It invades unimproved grazing land and native vegetation, particularly on coasts and creeklines where it can form dense thickets. Considered a Weed of National Significance. Formerly widespread in the dunes but has been the focus of weed control activities and now at very low levels[29].
Olea europaea	Olive	4	Y	Tree	Olives are evergreen trees that originate from the Mediterranean region. They were first introduced to South Australia in 1836 and have since become naturalised, especially in woodland habitats. Once scattered through the Dunes, but now not detected during field survey[30]. Most likely to proliferate in sheltered swale areas of the Dunes.
Oxalis pes-caprae	Soursob	4		Bulb/forb	Soursob is a bulbous perennial with conspicuous yellow flowers, and is a widespread weed in gardens, broadacre cropping and pasture. The forms of soursob naturalised in Australia do not produce seed, and so it is spread only as bulbs, which are moved in contaminated soil. Generally confined to moist swale areas, where only scattered at the time of survey, but was abundant in the narrow strip to the west of the Esplanade.
Thinopyrum junceiforme	Sea Wheat-grass	4		Perennial Grass	Rhizomatous perennial grass native to Europe. Occurs exclusively on coastal dunes often extending to below the high-water mark[31]. Introduced as a sand-binder, but can modify the dune environment by colonising pre-existing dunes as well as forming new dunes seaward of the existing foredunes[32]. May impact the availability of beach nesting sites for shore birds. Abundant

[29] Milne, T. (2020). Condition Assessment of Southport Dunes, Port Noarlunga 2020. Unpublished report prepared for Natural Resources Adelaide and Mount Lofty Ranges.
[30] Milne, T. (2020). Condition Assessment of Southport Dunes, Port Noarlunga 2020. Unpublished report prepared for Natural Resources Adelaide and Mount Lofty Ranges.
[31] https://vicflora.rbg.vic.gov.au/flora/taxon/3c483050-e1ec-4f5f-b9a7-c0b969a6e315 accessed 26/5/21.
[32] James, K. (2012). Gaining New Ground: Thinopyrum junceiforme, A Model of Success Along the South Eastern Australian Coastline. Unpublished PhD thesis, University of Adelaide.

Species	Common Name	[19]Red Alert	[20]Declared	Lifeform	Notes[21]
					on primary and incipient dune on the seaward side of the Dunes.
Trachyandra divaricata	Dune Onion Weed	4	Y	Forb	A sand binding perennial of coastal dunes, introduced to South Australia from southern Africa. Has the capacity to spread widely through the dune system, but currently only observed as scattered individuals.

Figure 2a: Main infestation of *Leptospermum laevigatum*, photographed June 2020.

Figure 2b: Main infestation of *Leptospermum laevigatum*, photographed 30th April 2021, with areas where species has been treated and/or removed circled in yellow.

4.2 Pest animals

Table 5 lists the introduced animal species that are considered likely to be present in the Dunes.

Table 5: List of introduced animal species present, or considered likely to be present, at Southport Dunes

Species	Common Name
Mammals	
Felis catus	Feral Cat
Mus musculus	House Mouse
Rattus rattus	Black Rat
Canis familiaris	Dog
Vulpes vulpes	Fox
Oryctolagus cuniculus	Rabbit
Birds	
Columba livia	Feral Pigeon
Passer domesticus	House Sparrow
Spilopelia chinensis	Spotted Dove
Sturnus vulgaris	Common Starling
Turdus merula	Blackbird

Of these introduced animals, rabbits pose a significant concern due to potential impacts on regeneration of native species, along with potential grazing of revegetation. No rabbit signs were noted at the time of inspection. Feral cats and foxes that will prey on native fauna are likely to be having the biggest impact on biodiversity in the area. As noted previously, off-leash dogs may also disturb native fauna.

4.3 Recreation activities

Management of pedestrian traffic and inappropriate recreational activities (such as sandboarding) is essential to help prevent unwanted impacts, such as:

- trampling or crushing of vegetation;
- compacting soil, which limits natural regeneration;
- disturbance of soil/erosion, which encourages weeds;
- introduction of weed seed; and
- disturbance/predation on native animals by domestic pets such as dogs
- metal detecting and digging large holes in the dunes, which disturbs native plants and can lead to erosion and safety issues (as the holes are not being refilled).

There are a series of formal trails through the site, as shown in Figure 3a. The trails allow access to the Southport Surf Lifesaving Club and beach at the southern end of the Dunes, and also provide a link from the south to the north of the Dunes. There is still some informal trail use, especially from adjoining properties at the northern end (see Figure 3b), and also areas where pedestrians access the dunes from the beach where there is no fencing (see Figure 3c). Where dunes have been fenced along the base of the foredune, there appears to be reduced impact from foot traffic, and some evidence of recovery of Rolling Spinifex (*Spinifex hirsutus*), which is forming runners that will help to stabilise soil (Figure 3d). In addition, fencing has been put in place toward the crest of the dune in northern sections (see Figure 3e) to help prevent this area being accessed from adjoining shopping and parking areas to the east.

There have also been some illegal camping activities through shrubland in central sections of the Dunes. This illegal camping would have numerous consequences, including erosion, introduction of litter, urination and defecation, and disturbance to fauna.

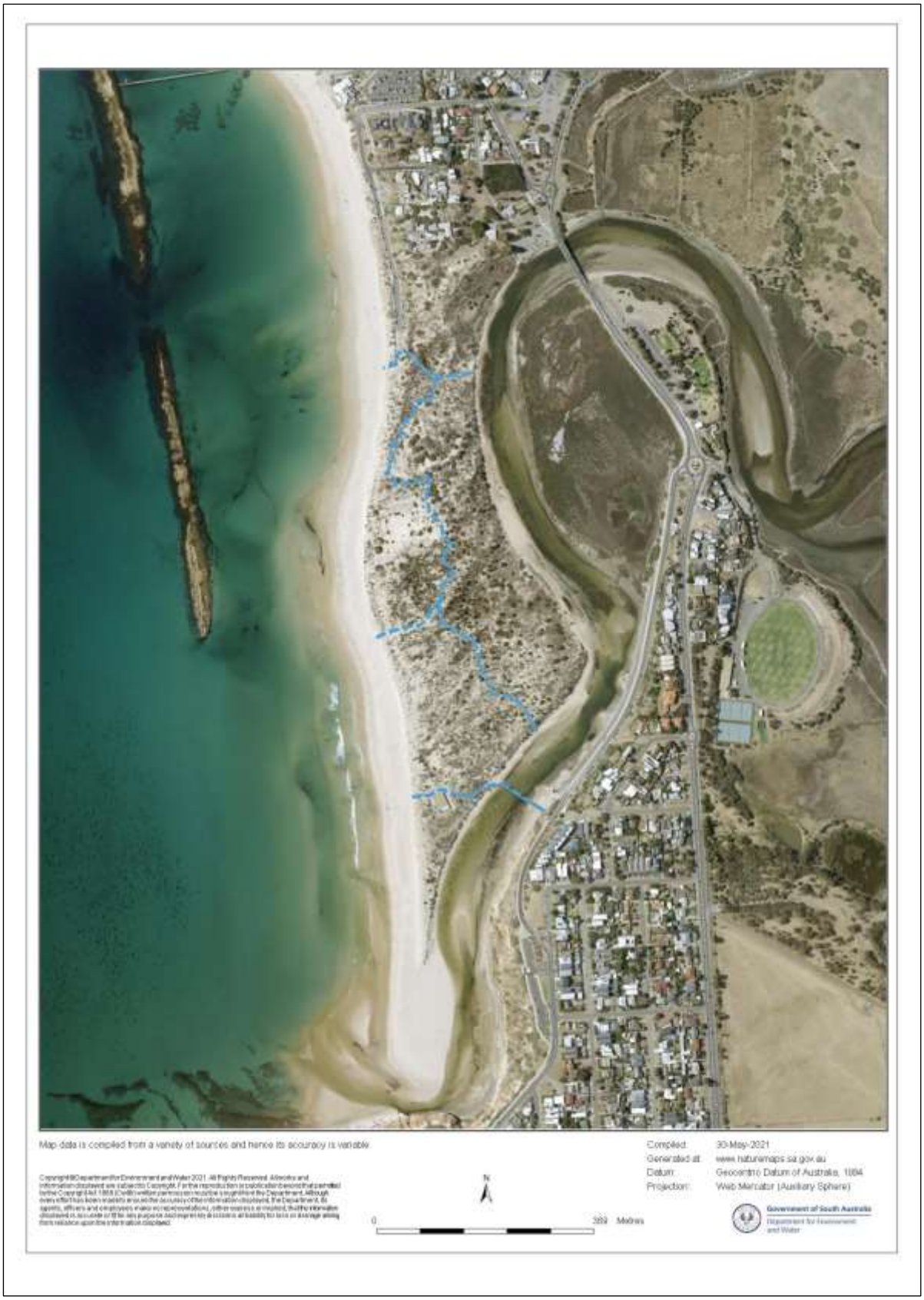

Figure 3a: Existing formal trail network in Southport Dunes (marked as blue dotted lines).

Figure 3b: Informal trails from properties at the northern end of the Dunes. Image taken 30/4/21 facing west at 269589, 6107157 (WGS 84, Zone 54).

Figure 3c: Informal trails into dunes from the beach, where the foredune is unfenced. Image taken 30/4/21 facing north east at 269542, 6106226 (WGS 84, Zone 54).

Figure 3d: Fenced section of foredune, showing little pedestrian traffic and runners of Coastal Spinifex, *Spinifes hirsutus*, beginning to form. Image taken 30/4/21 facing south east at 269531, 6106303 (WGS 84, Zone 54).

Figure 3e: Erosion fencing established to discourage access from shops to the peak of the dunes at the nothern end of the dune system. Cut material also left in place to discourage pedestrian access. Image taken 30/4/21 facing east at 269640, 6107178 (WGS 84, Zone 54).

4.4 Erosion

Dune systems are easily exposed to erosion, particularly if the vegetation that helps bind the soil is damaged or removed. Whilst a degree of natural erosion from wind and water is expected in dune systems, this can be exacerbated by anthropogenic impacts. Figure 4a shows sections of the dune that abut the Onkaparinga on the eastern side of the Dunes, to the east of the Surf Lifesaving Club, where there is ongoing foot traffic that is preventing natural regeneration of remnant vegetation, and leaving extensive areas of bare sand that will easily erode. Figure 4b shows installation of sand dune drift fencing to help reduce erosion, and Figure 4c shown within a fenced area where natural regeneration of Rolling Spinifex (*Spinifex hirsutus*) is helping to stablise dunes. Unfenced areas of the Dunes are principally to the south of the Surf Lifesaving Club, as shown in Figure 4d.

Figure 4a: Lack of plant cover as a result of erosion/foot traffic. Image taken 30/4/21 facing south west at 269653, 6106248 (WGS 84, Zone 54).

Figure 4b:Erosion fencing and pedestrian fencing Image taken 30/4/21 facing north west at 269680, 6106285 (WGS 84, Zone 54).

Figure 4c: Good coverage of *Spinifex hirsutus* and fencing helping stabilise dunes. Image taken 30/4/21 facing south east at 269732, 6106667 (WGS 84, Zone 54).

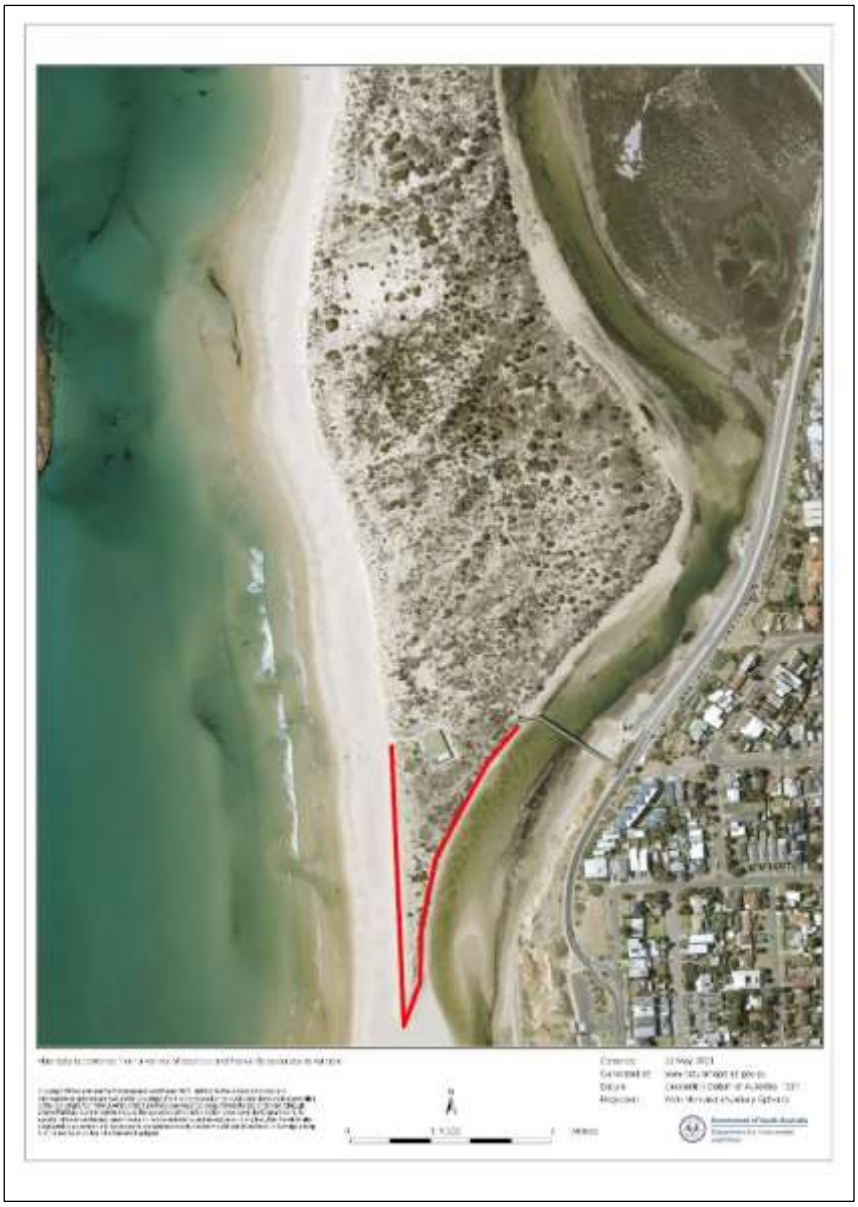

Figure 4d: Unfenced southern sections of the Dunes (marked in red)

4.5 Climate Change

Caton *et al* (2009)[33] provide the following projected conditions in 2030 and 2070 as follows:

a) Sea Level Rise and Storm magnitude

The current mean sea level rise of 3mm/year will accelerate. Sea levels in the region can be expected to be higher in 2030 by + 10cm and in 2070 by + 50cm. Rare intense storms could add a surge height comparable to today's surges of + 0.5m to 1.5m. Although storm frequency may fall, flood heights considered rare to-day will become much more frequent, because of sea level rise.

[33] 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

b) Increasing average temperatures and aridity

Mean annual temperatures are projected to increase to between 0.3 to 0.6°C by 2030 and 1.5 to 2.0°C by 2070. Annual rainfall: changes of -2% to -5% by 2030, and -10% to -20% by 2070 are projected for areas near the coast; greatest decrease is indicated in spring. An increase in potential evapotranspiration of up to 8% adds to the effect of increasing aridity.

c) Run-off regime change

Increasing aridity will be reflected in reduced run off: some seasonal streams will flow for fewer months, others will not flow. The intensity of rare extreme rainfall events will increase, and this will be reflected in flash floods in creeks and storm drains. What are now semi arid creeks will behave more as arid land creeks.

d) Gulf waters change

Gulf waters will become more acid with possible detrimental effects on ecosystems, by mid-century. Surface ocean temperatures are projected to rise by 0.30 C to 0.60 C by 2030, and 1.0 to 1.50 C by 2070, although there is great variation between models for the latter date. Wind speed changes are slight; with small average falls.

With regard to dune environments, the following specific threatening processes may occur as a result of climate change:

- Increasing temperatures and aridity will affect the structure and composition of vegetation communities;
- There will be reductions in geographic range of species and ecological communities and increased risk of extinction for species that are already vulnerable;
- Increasing CO_2 concentrations may impact on germination, establishment, growth and regeneration of native species;
- Highly invasive exotic plant and animal species may become more dominant;
- Beach recession and foredune erosion may be exacerbated.

This plan recognises these potential impacts, and provides actions that will help provide resilience to ongoing effects of climate change.

5 BIODIVERSITY MANAGEMENT STRATEGIES

5.1 Management objectives for the Dunes

Management of the Southport Dunes needs to consider:

- The significant cultural values in the Dunes
- Habitat values for native flora and fauna
- Opportunities for education
- Recreational and amenity values
- The need for cost effective management

The biodiversity management objectives for Southport Dunes are to manage the native vegetation in such a manner as to:

- Prevent any further loss of biodiversity; and
- Strengthen the long term viability of the existing biodiversity assets.

whilst remaining cognisant of the cultural values of the site.

5.2 Management zones

The area has been divided into management zones, to provide context and simplicity for management actions. These Management Zones are shown in Figure 5, and a description of each of the zones, representative photographs, and notes on key issues and actions for each zone is provided in following sections.

Figure 5: Management Zones for Southport Dunes, including locations of representative photopoints

Management Zone 1

Vegetation Association: *Olearia axillaris ± Leucopogon parviflorus, Acacia longifolia sophorae, Myoporum insulare* open shrubland

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

Photograph of this area, taken facing SSW from 269621, 6106373 (Zone 54, WGS84)

Description of this area: This vegetation is the most prevalent vegetation type in the dune area. It is generally associated with dune crests and slopes on white sands. Coast Daisy-bush (*Olearia axillaris*) is a persistent overstorey species throughout, with Coast Beard-heath (*Leucopogon parviflorus*), Coastal Wattle (*Acacia longifolia sophorae*) and Common Boobialla (*Myoporum insulare*) present as co-dominant shrub species in places. This medium to tall shrub layer generally forms cover of around 10-20%. Key small understorey shrubs include Sea-berry Saltbush (*Rhagodia candolleana ssp. candolleana*), Coast Bonefruit (*Threlkeldia diffusa*) and Thyme Riceflower (*Pimelea serpyllifolia ssp. serpyllifolia*), forming collective cover of around 5%. Groundsel (*Senecio spanomerus*) is a very common groundlayer herb, estimated at about 10% cover, and Picris, possibly both *Picris squarrosa* (Rare at a state level) and *Picris angustifolia ssp. angustifolia*, also present in patches. The mat plant Native Pigface (*Carpobrotus rossii*) is also common, forming cover of around 5%, and there are scattered Rolling Spinifex (*Spinifex hirsutus*).

Weeds are generally scattered and of low cover. The area previously had many large patches of Pyp Grass (**Ehrharta villosa*)[34], but ongoing control has reduced this species to scattered patches only. It is considered likely that this species has suppressed natural regeneration of some species, including the dominant medium shrub layer, and sensitive low level replanting of some structural layers may

[34] Kerri Bartley and Matt Endacott pers. comm.

help speed recovery. Other high threat weeds found only as scattered individuals include Gazania (*_Gazania linearis_*), White Arctotis (*_Arctotis stoechadifolia_*), and Skeleton Weed (*_Chondrilla juncea_*). Overall the area is considered to be in good condition.

Key threats in this Management Zone

- High threat weeds
- Extensive sections of bare soil (as a result of Pyp Grass control) may be susceptible to unnaturally high levels of wind erosion

Priority activities in this Management Zone

- Continued control of priority weeds, especially Pyp Grass (*_Ehrharta villosa_*)
- Consider revegetation of the dominant shrub layer in sections where there is a depauperate shrub layer (as a result of long-term Pyp Grass infestation), aiming for an overall tall and medium shrub layer cover of around 30%
- Consider plantings of Rolling Spinifex (*Spinifex hirsutus*) around dune crests, to allow for this species to spread rhizomes downslope and stabilize soil

Management Zone 1.1

Vegetation Association: *Leucopogon parviflorus, Olearia axillaris ± Acacia longifolia sophorae, Myoporum insulare* open shrubland

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

Photograph of this area, taken facing SE from 269738, 6106604 (Zone 54, WGS84)

Description of this area: This vegetation is similar to community 1, although weeds are generally more prominent, with patches of Veldt Grass (**Ehrharta calycina*) and Marram Grass (**Ammophila arenaria*), estimated as 1-5% cover overall, with the latter species particularly prevalent along the dune edges adjacent to the Onkaparinga Estuary. In lower lying swale areas False Caper (**Euphorbia terracina*) is particularly prominent, forming cover of >5% overall. The area also still has scattered patches of Pyp Grass (**Ehrharta villosa*). It is considered likely that this species has suppressed natural regeneration of some species, including the dominant medium shrub layer, and sensitive low level replanting of some structural layers may help speed recovery. Other high threat weeds found only as scattered individuals include Gazania (**Gazania linearis*), and Skeleton Weed (**Chondrilla juncea*). Overall the area is considered to be in poor to moderate condition.

Key threats in this Management Zone

- High threat weeds
- Extensive sections of bare soil (as a result of Pyp Grass control) may be susceptible to unnaturally high levels of wind erosion

Priority activities in this Management Zone

- Continued control of priority weeds, especially Pyp Grass (**Ehrharta villosa*), Veldt Grass (**Ehrharta calycina*) and Marram Grass (**Ammophila arenaria*)
- Consider revegetation of the dominant shrub layer in sections where there is a depauperate shrub layer (as a result of long-term Pyp Grass infestation), aiming for an overall tall and medium shrub layer cover of around 30%
- Plantings of Rolling Spinifex (*Spinifex hirsutus*) around dune crests, to allow for this species to spread rhizomes downslope and stabilize soil

Management Zone 2

Vegetation Association: *Leucopogon parviflorus ± Olearia axillaris* shrubland

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

Photograph of this area, taken facing SW from 269572, 6106627 (Zone 54, WGS84)

Description of this area: This community occurs in lower slopes and swales through central sections of the dunes. Coast Beard-heath (*Leucopogon parviflorus*) is the dominant overstorey species, with Coast Daisy-bush (*Olearia axillaris*) also common as a co-dominant, with a combined overall cover of around 30%. A similar suite of understorey shrubs as community 1 occurs. This area has a good species richness, with 29 species recorded, including main population of the state Rare Australian Broomrape (*Orobanche cernua var. australiana*). Groundsel (*Senecio spanomerus*) is a very common groundlayer herb, estimated at about 10% cover, and there are patches of Satin Everlasting (*Helichrysum leucopsideum*), and a small patch of Australian Hound's-tongue (*Cynoglossum australe*), which is considered an unusual species for a dune system, but the population appears to

be natural. The shrub Prickly Ground-berry (*Acrotriche patula*) was present as several plants, and this species is also relatively uncommon in dune habitats in the Adelaide region.

The lower lying swale areas naturally lend themselves to higher weed cover due to higher soil moisture and nutrient levels. Herbaceous weeds, such as False sowthistle (*Reichardia tingitana*), Soursob (*Oxalis pes-caprae*) and Brassica (*Brassicaceae spp*.), and annual grassy weeds are relatively common in these lower lying areas. High threat weeds are generally scattered and of low cover, including Pyp Grass (**Ehrharta villosa*), Perennial Veldt Grass (**Ehrharta calycina*), White Arctotis (*Arctotis stoechadifolia*) and Bridal Creeper (**Asparagus asparagoides forma*).

Key threats in this Management Zone

- High threat weeds

Priority activities in this Management Zone

- Continued control of priority weeds, especially Pyp Grass (**Ehrharta villosa*), Perennial Veldt Grass (**Ehrharta calycina*), White Arctotis (**Arctotis stoechadifolia*) and Bridal Creeper (**Asparagus asparagoides form a*)

Management Zone 3

Vegetation Association: *Acacia longifolia sophorae ± Olearia axillaris* open to emergent shrubland

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

Photograph of this area, taken facing SSW from 269527, 6106759 (Zone 54, WGS84)

Description of this area: This blowout is an area of high cultural significance. The area is a sand dune "blowout", likely caused by disturbance to the vegetation in the area. There is extensive bare soil, with the dominant low shrub layer of Coastal Wattle (*Acacia longifolia sophorae*) forming around 5% cover. Picris, possibly both *Picris squarrosa* (Rare at a state level) and *Picris angustifolia ssp. angustifolia*, is relatively common, especially on upper slopes of dunes. Other plant lifeforms are generally present, but of low cover, and are expected to become higher density as the site recovers. Pyp Grass (**Ehrharta villosa*) has been treated in this area, but the stems have been left in place to help retain soil, and sand dune drift fencing has been used extensively for erosion control.

Key threats in this Management Zone

- Management activities need to be cognisant of the significant cultural values in this area

Priority activities in this Management Zone

- Avoid any activities that impact on the cultural assets of this management zone
- Strategic revegetation, including plantings of overstorey shrub species on uphill slope of drift fencing (where moisture may accumulate and accelerate growth) and Rolling Spinifex (*Spinifex hirsutus*) around dune crests, to allow for this species to spread rhizomes downslope and stabilize soil

Management Zone 4

Vegetation Association: *Leptospermum laevigatum, Melaleuca lanceolata* woodland / shrubland

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

Photograph of this area, taken facing NNE from 269516, 6106811 (Zone 54, WGS84)

Description of this area: This vegetation occurs through a swale towards the centre of the assessed area. It is likely to be well-meaning revegetation from many years ago, but the dominant species planted, Coastal Tea-tree (**Leptospermum laevigatum*), is now considered a serious weed in coastal dune vegetation. The understorey shrub, sedge and mat plant layer is slightly depauperate in species and cover, likely due to the thick overstorey in patches. Groundsel (*Senecio spanomerus*) is a very common groundlayer herb, estimated at about 10% cover.

Isolated Boxthorn (**Lycium ferocissimum*) and scattered Dune Onion Weed (**Trachyandra divaricata*) and Pyp Grass (**Ehrharta villosa*) were also recorded in this area, all of which are highly threatening weed species.

Key threats in this Management Zone

- Illegal camping
- Ongoing spread of Coastal Tea-tree (*Leptospermum laevigatum*)
- High threat weeds

Priority activities in this Management Zone

- Continued control of priority weeds, especially Boxthorn (**Lycium ferocissimum*), Dune Onion Weed (**Trachyandra divaricata*) and Pyp Grass (**Ehrharta villosa*)
- Staged removal of *Leptospermum laevigatum* with concurrent strategic replacement with native species

Management Zone 5

Vegetation Association: *Leucopogon parviflorus, Olearia axillaris, Acacia longifolia sophorae* open shrubland

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

Photograph of this area, taken facing N from 269608, 6107001 (Zone 54, WGS84)

Description of this area: This section of steep dunes in the north-eastern corner of the assessment area contains a dense infestation of Pyp Grass (**Ehrharta villosa*), and provides an indication of what much of the dunes may have previously resembled before extensive control for this species was undertaken. However, this area has not been a priority for control as the Pyp Grass is holding the sand on the very steep slopes, and preventing sand movement. It is notable that regeneration is low, and many of the structural layers, including shrubs, herbs, mat plants and sedges, are of relatively low cover, which is likely as a result of suppression due to the high cover of Pyp Grass. Figure 6a shows where Pyp Grass control has commenced in this Zone.

Key threats in this Management Zone

- Dense infestation of Pyp Grass (**Ehrharta villosa*) changes dune structure, and prevents natural regeneration of native species. However treatment of this infestation will need to ensure that steep slopes in this Unit do not erode following control.
- Unmanaged public access

Priority activities in this Management Zone

- Progressively treat sections of Pyp Grass and revegetate with Rolling Spinifex (**Spinifex hirsutus*). Treat whole infestation over a number of years (ie only treat and revegetate a small portion each year). Monitor and evaluate progress.

Figure 6a: Section where Pyp Grass contral has commenced (between the two fencelines). Image taken 30/4/21 facing north east at 269580, 6107063 (WGS 84, Zone 54).

Management Zone 6

Vegetation Association: *Ammophila arenaria, Spinifex hirsutus, Thinopyrum junceiform*e tussock grassland

Benchmark Vegetation Community: SMLR Co 7.1 - Coastal Tussock Grasslands

Photograph of this area, taken facing S from 269477, 6106981 (Zone 54, WGS84)

Description of this area: This vegetation is found on the top and front of the primary dune (ie the dune nearest the sea). Constant blasting by wind and salt limits the diversity of species in this zone. The dominant species are the tussock grass Rolling Spinifex (*Spinifex hirsutus*) and the introduced grasses Sea Wheat-grass (**Thinopyrum junceiforme*) and Marram Grass (**Ammophila arenaria*). These introduced species do provide a sand-binding function, although can negatively impact the natural form and function of incipient dunes and foredunes. Two-horned Sea Rocket (*Cakile maritima ssp. maritima*), Sea Spurge (*Euphorbia paralias*) and False Sowthistle (*Reichardia tingitana*) are the other weed species that were sparsely present in this vegetation.

Key threats in this Management Zone

- Sea Wheat Grass (*Thinopyrum junceiforme*) and Marram Grass (*Ammophila arenaria*) are well established, and change the structure and function of the Dune system.
- Unmanaged paths/trails into the dunes (eg see Figure 3c)

Priority activities in this Management Zone

- Revegetate with Rolling Spinifex (*Spinifex hirsutus*) towards the crest of the primary dune, so that rhizomes will grow downslope and stabilize sand. Do not use treeguards.
- When Rolling Spinifex becomes well established, progressively remove Marram Grass and Sea Wheat Grass.
- Fence sections that are currently unfenced on the southern end of this unit

Management Zone 7

Vegetation Association: *Olearia axillaris, Rhagodia candolleana, Nitraria billardieri* low open shrubland

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

Photograph of this area, taken facing S from 269474, 6107169 (Zone 54, WGS84)

Description of this area: This is a narrow section along the seafront towards the Port Noarlunga jetty. It has been exposed to profound disturbance, and Soursob (**Oxalis pes-caprae*) and Gazania (**Gazania linearis*) are prominent in the understorey. Soils are sandy loam. The shrub overstorey is quite open, with Nitre Bush (*Nitraria billardieri*), Coast Daisy-bush (*Olearia axillaris*) and Sea-berry Saltbush (*Rhagodia candolleana ssp. candolleana*) the most common shrub species. Most of the understorey is likely to have been planted. Further revegetation could be undertaken in this area, and as it is considered to be less sensitive to disturbance than dune habitats of other areas assessed, this revegetation could be undertaken by less experienced volunteers such as school groups. Plant life forms that are currently at low levels and could be the focus of revegetation include medium and low shrubs, grasses, sedges, mat plants and herbs.

Key threats in this Management Zone

- High cover of introduced weeds, especially soursob
- Lack of diversity and structure of native plant species

Priority activities in this Management Zone

- Revegetation with a variety of local coastal species, focussing on medium and low shrubs, grasses, sedges, mat plants and herbs.

Management Zone 8

Vegetation Association: *Olearia axillaris, Acacia longifolia sophorae, Rhagodia candolleana* shrubland to open shrubland

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

Photograph of this area, taken facing S from 269603, 6106229 (Zone 54, WGS84)

Description of this area: This area is to the immediate south of the Lifesaving Club, at the southern end of the area assessed. Whilst containing a moderate diversity of native plant lifeforms and species, the area is notable for significant infestation with Marram Grass (**Ammophila arenaria*), estimated at being in excess of 25% cover. However, as the area is relatively low dunes, and exposed to both high tide events as well as flood events through the Onkaparinga River, broad-scale removal of the Marram Grass is not recommended without concurrent revegetation, otherwise large-scale movement of sand may occur.

Key threats in this Management Zone

- High threat weeds
- Erosion on steep eastward facing slopes on the eastern side due to ongoing disturbance by pedestrians (see Figure 4a)
- Low diversity of native species

Priority activities in this Management Zone

- Consider installation of pedestrian fencing on the eastern side of the Dunes
- Revegetate with Rolling Spinifex (**Spinifex hirsutus*). Do not use treeguards
- When Rolling Spinifex becomes well established, progressively remove Marram Grass
- Revegetation to improve diversity, including *Lotus australis* (Australian trefoil), *Leucophyta brownii* (Coast Cushion-bush) and *Pelargonium australe* (Australian Pelargonium).

5.3 Revegetation

Pre-European vegetation mapping of the area indicates that the site was considered likely to principally be an *Olearia axillaris* ± *Leucopogon parviflorus* Shrubland[35]. This community is typical of coastal dune systems on white sands, which are described below.

The foredune (first dune facing the coast) is exposed to constant and severe environmental stresses of high winds, waves, tides, storms and seasonal change[36]. Its stability depends on highly specialised dune plants, with adaptations such as salt tolerance, rapid colonisation, and fibrous root systems. Species richness is generally low, with the most common plants including Rolling Spinifex (*Spinifex hirsutus*), Knobby Club-Rush (*Ficinia nodosa*), and Coast Cushion Bush (*Leucophyta brownii*), along with dwarfed and windswept versions of shrubs more typical of the swale and hind dune communities.

Once past the foredune, a shrubland community, (generally 1-3m high) generally forms in the swale and hind dunes. The following description is based upon information contained within Croft, Pedler and Milne (2006) [37], supplemented by the author's personal experience of coastal communities. Dominant overstorey species include Coast Daisy Bush (*Olearia axillaris*), Coastal Wattle (*Acacia longifolia var. sophorae*), Coast Beard-heath (*Leucopogon parviflorus*), Common boobialla (*Myoporum insulare*). In more sheltered swale areas other less salt-tolerant shrubs, such as Cushion fanflower (*Scaevola crassifolia*), Sea Box (*Alyxia buxifolia*), Coast Bitterbush (*Adriana quadripartita*) and Cup Wattle (*Acacia cupularis*) can occur. The density of this overstorey shrub layer is generally 20-40%. The understorey contains a much higher diversity of species and lifeforms, including:

- low and medium shrubs (<1m) of 5-25% cover, including Sea-berry Saltbush (*Rhagodia candolleana ssp. candolleana*), Thyme Riceflower (*Pimelea serpyllifolia ssp*.), Coast Bonefruit (*Threlkeldia diffusa*) and Ruby Saltbush (*Enchylaena tomentosa*)
- herbs, generally <5% cover overall, including Australian Pelargonium (*Pelargonium australe*), Groundsels (*Senecio pinnatifolius var. maritimus, Senecio spanomerus*), Austral trefoil (*Lotus australis*),
- sedges and lilies of 5-10% cover, including Short-stem Flax-lily (*Dianella brevicaulis*), and Knobby Club-Rush (*Ficinia nodosa*)
- mat plants of around 5% cover, including Karkalla (*Carpobrotus rossii*), Round-leaf Pigface (*Disphyma crassifolium*), Muntries (*Kunzea pomifera*) and Scarlet Runner (*Kennedia prostrata*)
- native grasses and tussocks, with Rolling Spinifex (*Spinifex sericeus*), Coast Spear Grass (*Austrostipa flavescens*) and Coast Tussock-grass (*Poa poiformis*) the most commonly encountered species
- vines and scramblers, generally around 1-5% cover, with Coastal Climbing Lignum (*Muehlenbeckia gunnii*) and Bower Spinach (*Tetragonia implexicoma*)

The open nature of dune shrublands, with patches of open sand between shrubs, needs to be retained, and so if revegetation is undertaken it needs to ensure that plantings are not too dense. In

[35] Woodlands and Shrublands of the Adelaide Plains 1836 accessed through http://spatialwebapps.environment.sa.gov.au/naturemaps/?locale=en-us&viewer=naturemaps 23/4/2020.
[36] Coast Protection Division and Llewyn-Davies Kinhill Pty Ltd (1978). *Fleurieu Coast Protection District Management Plan.* South Australian Coast Protection Board, Adelaide.
[37] Croft, S.J., Pedler, J.A. and Milne, T.I. (2006). *Coastal Vegetation Communities of the Southern Mount Lofty Ranges.* Nature Conservation Society of SA Inc., Adelaide.

a study of the secondary dunes at Tennyson Dunes[38], densities (per hectare) of native plant life-forms were as follows:

- Medium/large overstorey shrubs 230
- low shrubs 2580
- herbs 8050
- sedges/lilies 760
- mat plants 4960
- tussock grasses 5560

5.3.1 Revegetation notes by management zone:

Management Zone 1, 1.1:

Much of the dune system at Southport contains a good representation of this vegetation type. However, there are some sections within Management Zone 1 where the overstorey and understorey cover is considered to be unnaturally low, likely due to disturbance along with long term infestation with Pyp Grass (*Ehrharta villosa*), which forms a dense mat and suppresses natural regeneration of native shrub, forb and geoundcover species. Once this Pyp Grass has been controlled (as it has for many sections of the dunes), the vegetation remaining appears to be somewhat lacking in overstorey and understorey species. Figure 7a and 7b, taken at the same point but facing different directions, shows an area with what is considered a good coverage of native shrub and groundcover species (7a) and where the shrub layer (both medium and small shrubs) appears to be lacking (7b). In these more open areas, revegetation could be undertaken to supplement natural regeneration, but care needs to be taken to retain the characteristic open nature of dune vegetation. Plantings should be cognisant of the target level of cover for structural layers described above.

Management Zone 2:

No revegetation required.

Management Zone 3:

This area is a significant cultural site, and no revegetation should be undertaken in central sections. However, *Spinifex hirsutus* (Rolling spinifex) could be planted on crests to help stabilise sand following removal of *Ehrharta villosa* (Pyp Grass).

Management Zone 4:

In addition, previous revegetation in Management Zone 4 introduced a shrub/small tree component of both indigenous and non-indigenous species, including *Leptospermum laevigatum* (Coastal Tea-tree, which is non-indigenous) and *Melaleuca lanceolata* (Dryland Tea-tree, which is indigenous). The latter species has been recorded from hind-dune habitats at Tennyson, but may not have been part of the original flora at Southport Dunes. The Coastal Tea-tree is a priority for sensitive removal, as it is considered likely to proliferate and spread and impact on other habitats, whereas the Dryland Tea-tree was not noted to be proliferating, and, for the time being, could be left in place with ongoing evaluation of its spread. It is recommended that *Leucopogon parviflorus* (Coast Beard-heath) is planted in place of the removed Coastal Tea-tree. Whilst there is also likely to be natural recovery following removal of the Coastal Tea-tree, it may be beneficial to revegetate with understorey shrubs, sedges and mat plants, using species and cover targets listed previously for these layers as a guide.

Management Zone 5:

[38] T&M Ecologists, 2020. Detailed planting plan Autumn 2020 – Semaphore South. Unpublished report prepared for the Department for Environment and Water.

Significant infestations of *Ehrharta villosa* (Pyp Grass) compromise the natural structure and function of Management Zone 5. However removal of this sand-binding species will need to be cognisant of the need to prevent extensive sand drift. It is recommended that control begins on upper slopes, with concurrent plantings of *Spinifex hirsutus* (Rolling Spinifex), along with overstorey shrubs, understorey shrubs, sedges, forbs and mat plants, using species and cover targets listed previously for these layers as a guide.

Management Zone 6:
The dominant species in this Management Zone are the tussock grass Rolling Spinifex (*Spinifex hirsutus*) and the introduced grasses Sea Wheat-grass (**Thinopyrum junceiforme*) and Marram Grass (**Ammophila arenaria*). These introduced species do provide a sand-binding function, although can negatively impact the natural form and function of incipient dunes and foredunes. Revegetation should focus on establishing Rolling Spinifex (*Spinifex hirsutus*) towards the crest of the primary dune, so that rhizomes will grow downslope and stabilize sand. When Rolling Spinifex becomes well established, Marram Grass and Sea Wheat Grass can progressively be removed.

Management Zone 7:
This area has been quite disturbed, and has high levels of *Oxalis pes-caprae* (Soursob). Plant life forms that are currently at low levels and could be the focus of revegetation include medium and low shrubs, grasses, sedges, mat plants and herbs.

Management Zone 8:
Management Zone 8, whilst containing a generally good cover of medium and low shrubs, lacks diversity of forbs, and could benefit from plantings of species such as *Lotus australis* (Australian trefoil), *Leucophyta brownii* (Coast Cushion-bush) and *Pelargonium australe* (Australian Pelargonium). In addition, *Spinifex hirsutus* (Rolling Spinifex) will need to be planted to offset the removal of the sand binding *Ammophila arenaria* (Marram Grass).

Figure 7a: Section where native vegetation density approaches cover expected in remnant coastal ecosystems. Image taken 30/4/21 facing north west at 269557, 6106559 (WGS 84, Zone 54).

Figure 7b: Section where native vegetation overstorey density is considered lower than expected in remnant coastal ecosystems. Image taken 30/4/21 facing south at 269557, 6106559 (WGS 84, Zone 54).

6 MONITORING

A series of photopoints were established as part of the assessment process, and these images and associated location data are provided in Appendix 3. The location of these photopoints is shown in Figure 5. Bushland Assessments were also undertaken in each Management Zone – these can be used to provide a broad overview of change over time. In addition, a series of targets have been established as part of the Biodiversity Action Plan and are provided in Table 6. These targets can be used to track change, and progress towards the desired goal.

7 BIODIVERSITY ACTION PLAN

Table 6 lists the biodiversity management threats/issues for Southport Dunes, their related objectives, and further actions being proposed, as well as prioritising of these actions. Note that weeds that have been targeted for control over the next 5 years are based on the priority weeds as described in Section 4.1.

Table 6: Biodiversity Action Plan summary table for Southport Dunes

ISSUE/THREAT	5-Yr Objective / Milestone	Proposed actions - what/ where/how	Management Zone(s)	Priority*
High threat woody weeds: *Acacia saligna* *Acacia cyclops* *Lycium ferocissimum* *Olea europaea*	Eradicate these species from Southport Dunes.	Annually patrol dunes, mark all specimens, and hand pull or cut and swab as required.	1-6,8	E
High threat forb and herbaceous weeds: *Trachyandra divaricata* *Gazania linearis* *Arctotis stoechadifolia* *Chondrilla juncea*	Eradicate these species from Southport Dunes.	Annually patrol dunes and hand pull or spot spray if observed	1-6,8	E
High threat perennial grass weed: *Ehrharta villosa*	No live individuals detected in these Management Zones.	Annually patrol dunes. Continue successful approach of slash and follow-up spray, being careful of remnant native plants.	1,1.1,2,3,4,8	E
	Overall cover <5%. Photopoints show increase in native plant species structural diversity. Cover and diversity of species and lifeforms as per 5.3. Improvement in the following Bushland Assessment components: Native species richness Native plant lifeforms score Native:exotic understorey biomass score	Removal of this sand-binding species will need to be cognisant of the need to prevent extensive sand drift, especially on the steep slopes in this Management Zone. It is recommended that control begins on upper slopes, with concurrent plantings of Spinifex hirsutus (Rolling Spinifex), along with overstorey shrubs, understorey shrubs, sedges, forbs and mat plants, using species and cover targets listed previously for these layers as a guide.	5	M
Cultural significance of the Dunes	No discturbance to significant cultural assets in the Dunes.	Esnure significant areas in the dunes are not impacted by management activities.	3	E

ISSUE/THREAT	5-Yr Objective / Milestone	Proposed actions - what/ where/how	Management Zone(s)	Priority*
Erosion issues caused by public access	Dunes fenced. Significant improvement in evidence of foot traffic impacts through photopoints, including decrease in visible signs and increase in cover of native plant species, especially *Spinifex hirsutus* (Rolling Spinifex).	Fence southern section of dunes as per Figure 4d.	5,8	VH
	Reduction in evidence of foot traffic on unconsolidated trails.	Review success of drift fencing as per Figure 3e. Discuss informal trail use with adjoiing landholders (Figure 3b).	1,5	VH
Camping in the Dunes	No evidence of camping in the Dunes.	Patrol and report any camping to Council and Police. Continue removal of *Leptospermum laevigatum* (Coastal Tea-tree), which prvides shelter for camping activities.	4	VH
Non-indigenous tree and shrub plantings: *Leptospermum laevigatum*	Eradicate priority species, and replace with appropriate indigenous shrubs as per target vegetation type densities.	Staged removal, with concurrent revegetation with indigenous shrub species. Aim to have by the end of 5 years (duration of this plan). Remove 20% of biomass of these species per year, with concurrent revegetation. Annually review to ensure planted species are surviving and growing, and soil erosion is not an issue.	4	H
High threat perennial grass weeds: *Ammophila arenaria* *Ehrharta calycina*	Reduction in cover to scattered, <1% cover.	Initially focus on establishing Rolling Spinifex (*Spinifex hirsutus*), so that rhizomes will grow and stabilize sand. When Rolling Spinifex becomes well established, target species can progressively be removed.	1.1,6,8	H
High threat perennial grass /forb weeds in incipient dune/foredune: *Thinopyrum junceiforme* *Euphorbia paralias*	Reduction in cover to scattered, <1% cover.	Initially focus on establishing Rolling Spinifex (*Spinifex hirsutus*), on crests so that rhizomes will grow downslope and stabilize sand. When Rolling Spinifex becomes well established, target species can progressively be removed.	6	M
High threat herbaceous weed: *Euphorbia terracina*	Reduction in cover to numerous, <1% cover	Sensitively spray or hand-pull.	1.1	M
	Cover <1%, few individuals		1,2,3,4,5,8	M

ISSUE/THREAT	5-Yr Objective / Milestone	Proposed actions - what/ where/how	Management Zone(s)	Priority*
Success of recent revegetation	Improvement in following Bushland Assessment components: Native species richness Native plant lifeforms score Weed score Native:exotic understorey biomass score Revegetation reaching maturity, flowering and setting seed.	Annually evaluate success of revegetation, before ordering new seedlings. Ensure evaluation considers target species and cover densities from Section 5.3.	1,1.1,4,5,6,7,8	M
Lack of adaptive management	Progress and success of works undertaken is monitored on an ongoing and regular basis, and actions modified to suit. Plan reviewed on this basis at end of 5 years.	Track progress against 5 year objectives	All	M
		Repeat photopoints every 2 years	All	M

*E = extreme, VH = very high, H = high, M = medium, L = low

Appendix 1: Native Plant and Weed Lists for the Southport Dunes

Table A1: Native plant lists for the site

SPECIES	COMMONNAME	AUS	SA	Region	Previous records	This study	1	1.1	2	3	4	5	6	7	8
Acacia ligulata	Umbrella Bush			RA		X	X	X	X	X		X			X
Acacia longifolia ssp. sophorae	Coastal Wattle			LC	X	X	R	R	R	R		X		X	X
Acrotriche patula	Prickly Ground-berry			RA		X			X						
Adriana quadripartita	Coast Bitter-bush			RA		X	P					P			
Alyxia buxifolia	Sea Box			RA		X			X						
Austrostipa flavescens	Coast Spear-grass			LC	X	X	X		X						
Billardiera cymosa ssp. cymosa	Sweet Apple-berry			LC	X	X			X	X					
Carpobrotus rossii	Native Pigface			LC	X	X	X	X	X	X	X	X	X		X
Crassula decumbens var. decumbens	Spreading Crassula			LC	X										
Crassula sieberiana	Sieber's Crassula			VU	X										
Cynoglossum australe	Australian Hound's-tongue			RA	X	X			X						
Daucus glochidiatus	Native Carrot			LC	X	X	X		X	X	X				
Dianella brevicaulis	Short-stem Flax-lily			NT	X	X	X	X	X	X	X	X		X	X
Disphyma crassifolium ssp. clavellatum	Round-leaf Pigface			LC		X								P	
Ficinia nodosa	Knobby Club-rush			LC	X	X	X	X	X	X	X	X		X	X
Geranium sp.	Geranium					X			X						
Helichrysum leucopsideum	Satin Everlasting			NT		X	X		X	X	X				X
Kennedia prostrata	Scarlet Runner			LC	X	X	X		X		X				
Kunzea pomifera	Muntries			RA		X	X	X	X	X		X			
Leucophyta brownii	Coast Cushion Bush			NT		X			X						
Leucopogon parviflorus	Coast Beard-heath			NT	X	X	X	X	R			X			
Lotus australis	Austral Trefoil			NT		X	X								
Melaleuca lanceolata	Dryland Tea-tree			RA		X	P				P				
Muehlenbeckia gunnii	Coastal Climbing Lignum			LC	X	X	X	X	X					X	X
Myoporum insulare	Common Boobialla			NT		X	X	X	X		X			X	X
Myoporum parvifolium	Creeping Boobialla			VU		X								P	
Nitraria billardierei	Nitre-bush			RA		X								X	
Olearia axillaris	Coast Daisy-bush			NT		X	R	R	R	R	R	X		X	R
Olearia ramulosa	Twiggy Daisy-bush			LC	X										

Orobanche cernua var. australiana	Australian Broomrape		R	EN	X	X			X						
Pelargonium australe	Austral Stork's-bill			RA	X	X		X	X	X					
Picris sp.	Coast or Squat Picris			RA		X	X	X	X	X		X			
Picris angustifolia ssp. angustifolia	Coast Picris			RA	X										
Picris squarrosa	Squat Picris		R	EN	X										
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower			NT	X	X	R	X	R	R					X
Poa poiformis var. poiformis	Coast Tussock-grass			LC		X			X						
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush			LC	X	X	X	X	R		X	R	X	X	R
Scaevola crassifolia	Cushion Fanflower			VU		X	X					X		X	X
Senecio pinnatifolius var. maritimus	Variable Groundsel			RA	X	X							X		
Senecio spanomerus				NT	X	X	X	X	X	X	X		X	X	X
Spinifex hirsutus	Rolling Spinifex			LC	X	X	X	X		X		X	X		
Tetragonia implexicoma	Bower Spinach			LC	X	X			X					X	X
Threlkeldia diffusa	Coast Bonefruit			NT	X	X	R	R	X		X				X
Wahlenbergia littoricola	Coast Bluebell			NE		X	X								

Key to codes: X = present, R = present and noted to be regenerating/recruiting, P = considered to be recently planted in the site, NI = native Australian plant species, but not considered to be indigenous to the area

Table A2: Weed plant lists for the site

Species name	Common Name	Threat SMLR-CO	1	1.1	2	3	4	5	6	7	8
Ammophila arenaria	Marram Grass	4		2					4	1	4
Arctotis stoechadifolia	White Arctotis	3	1		1			1			1
Asparagus asparagoides forma	Bridal Creeper	5			1						
Brassica spp.	Turnip sp.	2	1a	1a			1a	1			
Briza maxima	Large Quaking-grass	2			1a						
Cakile maritima ssp. maritima	Two-horned Sea Rocket	2	1	1		1		1	1a		1
Chondrilla juncea	Skeleton Weed	2	1	1							
Conyza bonariensis	Fleabane	2					1				
Ehrharta calycina	Perennial Veldt Grass	4		2	1						
Ehrharta villosa var. maxima	Pyp Grass	4	1a	1a	1a	2	1	4			1
Euphorbia paralias	Sea Spurge	3				1		1	1a	1	1
Euphorbia terracina	False Caper	3	1a	3	1	1		1			
Gazania linearis	Gazania	3	1	1						3	
Hypochaeris glabra	Smooth Cat's Ear	1			1						
Lactuca serriola forma.	Prickly Lettuce	2			1						
Lagurus ovatus	Hare's Tail Grass	2	1a	1a			1a			1a	1a
Leptospermum laevigatum	Coast Tea-tree	4					3				
Lycium ferocissimum	African Boxthorn	3		1			1				
Oxalis pes-caprae	Soursob	4	1a	1a	1a		1a			3	1
Reichardia tingitana	False Sowthistle	2	1a	1a	1a	1a	1a	1a	1a	1a	1a
Sonchus oleraceus	Common Sow-thistle	1	1a	1a	1a		1a				
Thinopyrum junceiforme	Sea Wheat-grass	4		1					3		
Trachyandra divaricata	Dune Onion Weed	4					1				
Vulpia spp.	Fescue	2			1a						
Graminae sp.	Unidentifiable grass	2	1a	1a	1a		1a	1a		1a	1a

Cover categories: 1 = few individuals, <1%, 1a = plentiful <1%, 2 = 1-5%, 3 = 5-25%, 4 = 26-50%

Appendix 2: Fauna records from within 5km of the site

Records from within 5km of Port Noarlunga Jetty, from Biological Database of South Australia incorporating BirdLife Australia data[39].

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AMPHIBIA	*Crinia signifera*	Common Froglet			66	12/9/2005	
AMPHIBIA	*Limnodynastes dumerilii*	Banjo Frog			3	30/9/2001	
AMPHIBIA	*Limnodynastes tasmaniensis*	Spotted Marsh Frog			53	28/8/2005	
AMPHIBIA	*Litoria ewingii*	Brown Tree Frog			3	12/9/2001	
AMPHIBIA	*Litoria raniformis*	Southern Bell Frog	VU	V	1	9/10/1974	
AVES	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater			4	23/9/2007	
AVES	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill			58	14/9/2013	
AVES	*Acanthiza chrysorrhoa leighi*	Yellow-rumped Thornbill (eastern SA)			1	16/10/2014	
AVES	*Acanthiza lineata*	Striated Thornbill			7	4/10/2004	
AVES	*Acanthiza lineata clelandi*	Striated Thornbill (MLR, SE)			14	4/11/2001	
AVES	*Acanthiza nana*	Yellow Thornbill			10	22/1/2018	
AVES	*Acanthiza pusilla*	Brown Thornbill			2	4/11/2001	
AVES	*Acanthiza pusilla samueli*	Brown Thornbill (MLR)			12	4/11/2001	
AVES	*Acanthiza reguloides australis*	Buff-rumped Thornbill			6	20/7/2004	
AVES	*Acanthiza uropygialis*	Chestnut-rumped Thornbill			2	1/12/1998	
AVES	*Acanthorhynchus tenuirostris*	Eastern Spinebill			5	12/6/2015	
AVES	*Acanthorhynchus tenuirostris halmaturinus*	Eastern Spinebill (KI, MLR, southern FR)			13	4/11/2001	
AVES	*Accipiter cirrocephalus cirrocephalus*	Collared Sparrowhawk			55	14/1/2018	
AVES	*Accipiter fasciatus fasciatus*	Brown Goshawk			30	23/6/2018	
AVES	*Acrocephalus australis australis*	Australian Reed Warbler			244	30/9/2020	
AVES	*Actitis hypoleucos*	Common Sandpiper		R	118	19/3/2018	
AVES	*Aegotheles cristatus cristatus*	Australian Owlet-nightjar			1	1/3/1994	
AVES	*Alauda arvensis arvensis*	Eurasian Skylark			569	27/9/2020	
AVES	*Anas castanea*	Chestnut Teal			56	30/7/2020	
AVES	*Anas gracilis gracilis*	Grey Teal			463	30/9/2020	
AVES	*Anas platyrhynchos platyrhynchos*	Mallard			70	22/6/2014	
AVES	*Anas superciliosa*	Pacific Black Duck			634	30/9/2020	
AVES	*Anas superciliosa superciliosa*	Pacific Black Duck			6	11/1/2020	

[39] These data have been sourced from the South Australian Department for Environment and Water Biological Database of SA. Recordset number DEWNRBDBSA210330-1

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AVES	*Anas superciliosa x platyrhynchos*	Pacific Black Duck x Mallard hybrid			59	27/9/2020	
AVES	*Anhinga novaehollandiae novaehollandiae*	Australasian Darter		R	22	28/10/2015	
AVES	*Anser anser*	Greylag Goose			2	24/2/2008	
AVES	*Anthochaera carunculata*	Red Wattlebird			1885	30/9/2020	X
AVES	*Anthochaera carunculata woodwardi*	Red Wattlebird (MLR, AP, YP, EP, far west, Yellabinna)			6	11/1/2020	
AVES	*Anthochaera chrysoptera*	Little Wattlebird			48	10/9/2015	
AVES	*Anthochaera chrysoptera chrysoptera*	Little Wattlebird (mainland SA)			5	18/8/2005	
AVES	*Anthus australis*	Australian Pipit			20	29/9/2008	
AVES	*Aphelocephala leucopsis leucopsis*	Southern Whiteface			2	4/1/1990	
AVES	*Aphrodroma brevirostris*	Kerguelen Petrel			2	6/9/1973	
AVES	*Apus pacificus pacificus*	Pacific Swift			1	7/6/1994	
AVES	*Aquila audax*	Wedge-tailed Eagle			7	14/11/2011	
AVES	*Ardea alba modesta*	Great Egret			415	30/9/2020	
AVES	*Ardea intermedia plumifera*	Plumed Egret		R	13	10/8/2020	
AVES	*Ardea pacifica*	White-necked Heron			19	18/4/2015	
AVES	*Ardenna tenuirostris*	Short-tailed Shearwater			2	30/4/2020	
AVES	*Artamus cyanopterus*	Dusky Woodswallow			237	30/9/2020	
AVES	*Artamus superciliosus*	White-browed Woodswallow			3	1/12/1998	
AVES	*Aythya australis*	Hardhead			183	30/9/2020	
AVES	*Barnardius zonarius*	Australian Ringneck			2	21/8/1999	
AVES	*Biziura lobata menziesi*	Musk Duck		R	7	26/9/2018	
AVES	*Botaurus poiciloptilus*	Australasian Bittern	EN	E	10	23/1/2004	
AVES	*Bubulcus ibis coromandus*	Eastern Cattle Egret		R	3	13/7/2011	
AVES	*Cacatua galerita*	Sulphur-crested Cockatoo			35	30/9/2020	
AVES	*Cacatua sanguinea sanguinea*	Little Corella			634	27/9/2020	
AVES	*Cacatua sp.*	Cacatua cockatoos and corellas			10	2/4/2012	
AVES	*Cacatua tenuirostris*	Long-billed Corella			24	27/9/2020	
AVES	*Cacomantis flabelliformis flabelliformis*	Fan-tailed Cuckoo			16	10/8/2001	
AVES	*Cacomantis pallidus*	Pallid Cuckoo			12	11/10/2001	
AVES	*Cairina moschata*	Muscovy Duck			6	22/6/2014	
AVES	*Calamanthus campestris*	Rufous Fieldwren			1	21/4/2005	
AVES	*Calidris acuminata*	Sharp-tailed Sandpiper			37	21/1/2008	
AVES	*Calidris ferruginea*	Curlew Sandpiper	CR	E	2	7/1/2007	
AVES	*Calidris ruficollis*	Red-necked Stint			11	14/1/2016	

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AVES	*Caligavis chrysops*	Yellow-faced Honeyeater			2	4/11/2001	
AVES	*Caligavis chrysops samueli*	Yellow-faced Honeyeater (MLR, southern FR)			9	27/4/2003	
AVES	*Carduelis carduelis britannica*	European Goldfinch			369	30/9/2020	
AVES	*Cereopsis novaehollandiae novaehollandiae*	Cape Barren Goose		R	11	17/11/2009	
AVES	*Chalcites basalis*	Horsfield's Bronze Cuckoo			80	24/11/2018	
AVES	*Chalcites lucidus*	Shining Bronze Cuckoo			1	28/3/1999	
AVES	*Chalcites osculans*	Black-eared Cuckoo			4	24/7/1999	
AVES	*Charadrius ruficapillus*	Red-capped Plover			54	7/7/2019	
AVES	*Chenonetta jubata*	Maned Duck			128	27/9/2020	
AVES	*Chlidonias hybrida javanicus*	Whiskered Tern			11	26/9/2018	
AVES	*Chloris chloris*	European (Common) Greenfinch			180	27/9/2020	
AVES	*Chroicocephalus novaehollandiae*	Silver Gull			1618	27/9/2020	X
AVES	*Cincloramphus cruralis*	Brown Songlark			8	20/1/2011	
AVES	*Cincloramphus mathewsi*	Rufous Songlark			8	4/11/2001	
AVES	*Cinclosoma punctatum*	Spotted Quailthrush	ssp	ssp	1	1/3/1994	
AVES	*Circus approximans*	Swamp Harrier			16	10/12/2019	
AVES	*Circus assimilis*	Spotted Harrier			1	28/7/1999	
AVES	*Cisticola exilis exilis*	Golden-headed Cisticola			222	27/9/2020	
AVES	*Cladorhynchus leucocephalus*	Banded Stilt		V	8	5/5/2013	
AVES	*Climacteris picumnus picumnus*	Brown Treecreeper			1	6/4/1991	
AVES	*Colluricincla harmonica*	Grey Shrikethrush			233	30/9/2020	X
AVES	*Colluricincla harmonica harmonica*	Grey Shrikethrush (eastern SA)			6	11/1/2020	
AVES	*Columba livia*	Feral Pigeon			1827	27/9/2020	
AVES	*Coracina novaehollandiae*	Black-faced Cuckooshrike			346	30/9/2020	
AVES	*Cormobates leucophaea grisescens*	White-throated Treecreeper (MLR)			1	1/3/1994	
AVES	*Corvus bennetti*	Little Crow			1	6/12/2009	
AVES	*Corvus coronoides*	Australian Raven			12	2/2/2003	
AVES	*Corvus mellori*	Little Raven			1872	30/9/2020	X
AVES	*Corvus sp.*	Crows			30	26/9/2018	
AVES	*Coturnix pectoralis*	Stubble Quail			21	28/12/2008	
AVES	*Coturnix ypsilophora australis*	Brown Quail		V	10	27/9/2020	X
AVES	*Cracticus torquatus leucopterus*	Grey Butcherbird			1	5/12/1986	
AVES	*Cygnus atratus*	Black Swan			401	30/9/2020	

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AVES	*Dacelo novaeguineae*	Laughing Kookaburra			37	2/8/2014	
AVES	*Daphoenositta chrysoptera pileata*	Black-capped Sittella			7	1/3/1994	
AVES	*Dicaeum hirundinaceum hirundinaceum*	Mistletoebird			20	14/5/2018	
AVES	*Dromaius novaehollandiae*	Emu			1	1/1/1900	
AVES	*Egretta garzetta nigripes*	Little Egret		R	132	30/9/2020	
AVES	*Egretta novaehollandiae*	White-faced Heron			730	30/9/2020	
AVES	*Egretta sacra sacra*	Pacific Reef Heron		R	21	15/5/2015	
AVES	*Elanus axillaris*	Black-shouldered Kite			415	27/9/2020	X
AVES	*Elseyornis melanops*	Black-fronted Dotterel			112	30/9/2020	
AVES	*Eolophus roseicapilla*	Galah			1220	30/9/2020	
AVES	*Eolophus roseicapilla albiceps*	Galah (most of SA)			5	11/1/2020	
AVES	*Epthianura albifrons*	White-fronted Chat			113	7/10/2017	
AVES	*Erythrogonys cinctus*	Red-kneed Dotterel			71	23/2/2017	
AVES	*Eudyptula minor novaehollandiae*	Little Penguin			1	7/8/1936	
AVES	*Euplectes orix*	Southern Red Bishop			1	18/1/1936	
AVES	*Eurostopodus argus*	Spotted Nightjar			1	1/3/1994	
AVES	*Falco berigora*	Brown Falcon			53	15/8/2013	
AVES	*Falco cenchroides*	Nankeen Kestrel			288	12/1/2020	X
AVES	*Falco longipennis*	Australian Hobby			183	21/12/2017	
AVES	*Falco peregrinus macropus*	Peregrine Falcon		R	44	2/3/2019	
AVES	*Falco subniger*	Black Falcon		R	2	8/7/1998	
AVES	*Falcunculus frontatus frontatus*	Eastern Shriketit		R	16	23/6/2018	
AVES	*Fulica atra*	Eurasian Coot			303	30/9/2020	
AVES	*Gallinago hardwickii*	Latham's Snipe		R	15	21/2/2019	
AVES	*Gallinula tenebrosa*	Dusky Moorhen			319	30/9/2020	
AVES	*Gallirallus philippensis mellori*	Buff-banded Rail			6	14/1/2016	
AVES	*Gavicalis virescens*	Singing Honeyeater			603	27/9/2020	X
AVES	*Gavicalis virescens sonorus*	Singing Honeyeater (EP, YP, FR, MN, AP, MM, coastal SE)			6	11/1/2020	
AVES	*Gelochelidon macrotarsa*	Australian Tern			2	28/10/2015	
AVES	*Geopelia cuneata*	Diamond Dove			1	10/2/1983	
AVES	*Geopelia placida placida*	Peaceful Dove			8	18/8/2005	
AVES	*Gerygone olivacea olivacea*	White-throated Gerygone		R	2	18/11/1982	
AVES	*Gliciphila melanops*	Tawny-crowned Honeyeater			6	29/6/1994	
AVES	*Glossopsitta concinna*	Musk Lorikeet			806	27/9/2020	
AVES	*Grallina cyanoleuca*	Magpielark			2216	30/9/2020	X

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AVES	*Gymnorhina tibicen*	Australian Magpie			1894	27/9/2020	X
AVES	*Haematopus fuliginosus fuliginosus*	Sooty Oystercatcher		R	10	28/3/2020	
AVES	*Haliastur sphenurus*	Whistling Kite			13	11/1/2020	
AVES	*Hieraaetus morphnoides*	Little Eagle		V	1	1/3/1994	
AVES	*Himantopus leucocephalus*	White-headed Stilt			498	30/9/2020	
AVES	*Hirundo neoxena neoxena*	Welcome Swallow			1290	27/9/2020	
AVES	*Hydroprogne caspia*	Caspian Tern			149	27/9/2020	
AVES	*Lalage tricolor*	White-winged Triller			20	14/9/2013	
AVES	*Larus dominicanus dominicanus*	Kelp Gull		R	1	9/1/2012	
AVES	*Larus pacificus*	Pacific Gull			31	28/3/2020	
AVES	*Lewin pectoralis pectoralis*	Lewin's Rail		V	1	28/8/2002	
AVES	*Limosa lapponica*	Bar-tailed Godwit	ssp	ssp	1	1/3/1994	
AVES	*Limosa limosa melanuroides*	Black-tailed Godwit		R	3	1/3/1994	
AVES	*Lophoictinia isura*	Square-tailed Kite		E	1	20/2/2015	
AVES	*Macronectes giganteus*	Southern Giant Petrel	EN	V	1	1/1/1900	
AVES	*Malacorhynchus membranaceus*	Pink-eared Duck			24	29/1/2020	
AVES	*Malurus cyaneus*	Superb Fairywren			284	30/9/2020	
AVES	*Malurus cyaneus leggei*	Superb Fairywren (Mainland SA)			35	11/1/2020	
AVES	*Malurus sp.*	fairywrens			1	26/9/2018	
AVES	*Manorina melanocephala*	Noisy Miner			608	9/7/2020	X
AVES	*Melanodryas cucullata cucullata*	Hooded Robin (YP, MN, AP, MLR, MM, SE)		R	4	1/3/1994	
AVES	*Melithreptus brevirostris*	Brown-headed Honeyeater			4	1/3/1994	
AVES	*Melithreptus gularis*	Black-chinned Honeyeater		ssp	384	12/6/2017	
AVES	*Melithreptus lunatus*	White-naped Honeyeater			12	11/1/2013	
AVES	*Melopsittacus undulatus*	Budgerigar			11	3/1/2000	
AVES	*Merops ornatus*	Rainbow Bee-eater			2	4/6/2017	
AVES	*Microcarbo melanoleucos melanoleucos*	Little Pied Cormorant			1284	30/9/2020	
AVES	*Microeca fascinans*	Jacky Winter		ssp	3	29/11/1999	
AVES	*Milvus migrans*	Black Kite			1	17/4/2003	
AVES	*Mirafra javanica*	Horsfield's Bush Lark			1	6/10/2002	
AVES	*Morus serrator*	Australasian Gannet			5	30/4/2020	
AVES	*Myiagra inquieta*	Restless Flycatcher		R	2	20/5/1994	

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AVES	*Myiagra rubecula rubecula*	Leaden Flycatcher			1	19/11/1983	
AVES	*Neochmia temporalis temporalis*	Red-browed Finch			34	30/9/2020	
AVES	*Neophema chrysogaster*	Orange-bellied Parrot	CR	E	2	22/7/1999	
AVES	*Neophema chrysostoma*	Blue-winged Parrot		V	1	5/4/1983	
AVES	*Neophema elegans elegans*	Elegant Parrot		R	23	30/9/2020	
AVES	*Neophema petrophila zietzi*	Rock Parrot		R	1	12/12/1982	
AVES	*Ninox boobook*	Australian Boobook			20	7/7/2013	
AVES	*Nycticorax caledonicus*	Nankeen Night Heron			112	9/7/2020	
AVES	*Nymphicus hollandicus*	Cockatiel			15	2/2/2008	
AVES	*Ocyphaps lophotes*	Crested Pigeon			1909	27/9/2020	X
AVES	*Oreoica gutturalis*	Crested Bellbird			2	24/12/2017	
AVES	*Oxyura australis*	Blue-billed Duck		R	51	30/9/2020	
AVES	*Pachycephala pectoralis*	Australian Golden Whistler			29	10/8/2020	
AVES	*Pachycephala rufiventris rufiventris*	Rufous Whistler			25	14/9/2013	
AVES	*Pachyptila desolata*	Antarctic Prion			2	13/7/1944	
AVES	*Pandion haliaetus cristatus*	Eastern Osprey		E	23	31/10/2013	
AVES	*Pardalotus punctatus*	Spotted Pardalote			21	30/7/2020	
AVES	*Pardalotus striatus substriatus*	Striated Pardalote			95	11/1/2020	
AVES	*Parvipsitta porphyrocephala*	Purple-crowned Lorikeet			760	25/3/2018	
AVES	*Passer domesticus domesticus*	House Sparrow			1886	30/9/2020	
AVES	*Pelecanus conspicillatus*	Australian Pelican			640	30/9/2020	
AVES	*Peltohyas australis*	Inland Dotterel			1	16/10/2014	
AVES	*Petrochelidon ariel*	Fairy Martin			80	30/12/2019	
AVES	*Petrochelidon nigricans*	Tree Martin			115	30/9/2020	
AVES	*Petrochelidon nigricans neglecta*	Tree Martin (all of SA)			6	11/1/2020	
AVES	*Petroica boodang boodang*	Scarlet Robin		R	10	1/3/1994	
AVES	*Petroica goodenovii*	Red-capped Robin			4	16/9/1994	
AVES	*Petroica phoenicea*	Flame Robin		V	1	10/7/1988	
AVES	*Phalacrocorax carbo*	Great Cormorant			100	10/9/2020	
AVES	*Phalacrocorax fuscescens*	Black-faced Cormorant			11	27/9/2020	
AVES	*Phalacrocorax sulcirostris*	Little Black Cormorant			407	30/9/2020	
AVES	*Phalacrocorax varius*	Great Pied Cormorant			76	30/9/2020	
AVES	*Phaps chalcoptera*	Common Bronzewing			28	19/3/2018	
AVES	*Phaps elegans*	Brush Bronzewing			3	1/12/1999	
AVES	*Phylidonyris novaehollandiae*	New Holland Honeyeater			1941	30/9/2020	

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AVES	*Phylidonyris novaehollandiae novaehollandiae*	New Holland Honeyeater (mainland SA)			58	11/1/2020	
AVES	*Phylidonyris pyrrhopterus*	Crescent Honeyeater			1	4/11/2001	
AVES	*Phylidonyris pyrrhopterus halmaturinus*	Crescent Honeyeater (KI and MLR)			14	4/11/2001	
AVES	*Platalea flavipes*	Yellow-billed Spoonbill			72	19/3/2018	
AVES	*Platalea regia*	Royal Spoonbill			204	11/1/2020	
AVES	*Platycercus elegans*	Crimson Rosella			178	30/9/2020	
AVES	*Platycercus elegans fleurieuensis & elegans subadelaidae*	Adelaide Rosellas (MN, AP, MLR)			9	11/1/2020	
AVES	*Platycercus eximius*	Eastern Rosella			64	30/9/2020	
AVES	*Plegadis falcinellus*	Glossy Ibis		R	3	29/11/2005	
AVES	*Pluvialis fulva*	Pacific Golden Plover		R	3	6/3/2001	
AVES	*Podargus strigoides*	Tawny Frogmouth			8	6/12/2017	
AVES	*Podiceps cristatus australis*	Great Crested Grebe		R	11	26/2/2013	
AVES	*Poliocephalus poliocephalus*	Hoary-headed Grebe			178	27/9/2020	
AVES	*Pomatostomus superciliosus*	White-browed Babbler			6	12/5/2010	
AVES	*Pomatostomus superciliosus superciliosus*	White-browed Babbler (southern SA)			1	11/1/2020	
AVES	*Poodytes gramineus goulburni*	Little Grassbird			253	27/9/2020	
AVES	*Porphyrio melanotus melanotus*	Australasian Swamphen			301	30/9/2020	
AVES	*Porzana fluminea*	Australian Crake (Australian Spotted Crake)			42	24/11/2019	
AVES	*Psephotus haematonotus*	Red-rumped Parrot			20	10/12/2019	
AVES	*Psephotus haematonotus haematonotus*	Red-rumped Parrot (eastern SA except NE)			6	1/3/1994	
AVES	*Ptilotula ornata*	Yellow-plumed Honeyeater			1	18/4/1997	
AVES	*Ptilotula penicillata*	White-plumed Honeyeater			774	30/9/2020	X
AVES	*Puffinus gavia*	Fluttering Shearwater			3	27/9/2009	
AVES	*Recurvirostra novaehollandiae*	Red-necked Avocet			4	19/7/2014	
AVES	*Rhipidura albiscapa*	Grey Fantail			77	12/6/2015	X
AVES	*Rhipidura albiscapa alisteri*	Grey Fantail (southern SA)			1	15/8/2013	
AVES	*Rhipidura leucophrys leucophrys*	Willie Wagtail			1552	30/9/2020	
AVES	*Rostratula australis*	Australian Painted-snipe	EN	E	23	1/12/2012	
AVES	*Sericornis frontalis*	White-browed Scrubwren			3	27/9/2020	
AVES	*Sericornis frontalis (NC)*	White-browed Scrubwren			5	1/3/1994	
AVES	*Sericornis frontalis rosinae*	White-browed Scrubwren (MLR)			1	19/11/2015	
AVES	*Smicrornis brevirostris*	Weebill			105	27/9/2020	

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AVES	*Smicrornis brevirostris occidentalis*	Weebill (Yellabinna, Gawler Ranges, EP, YP, southern FR, MN, MLR, MM)			3	14/1/2016	
AVES	*Spatula rhynchotis*	Australasian Shoveler		R	134	30/9/2020	
AVES	*Spilopelia chinensis*	Spotted Dove			2000	30/9/2020	X
AVES	*Stagonopleura bella samueli*	Beautiful Firetail (MLR and KI)		SP	3	22/6/1984	
AVES	*Stictonetta naevosa*	Freckled Duck		V	17	16/10/2014	
AVES	*Stiltia isabella*	Australian Pratincole			1	13/12/2003	
AVES	*Strepera versicolor*	Grey Currawong		ssp	19	27/9/2020	
AVES	*Strepera versicolor melanoptera*	Black-winged Currawong (MLR, MM, SE)			17	23/9/2007	
AVES	*Streptopelia risoria*	Barbary Dove			208	16/11/2014	
AVES	*Sturnus vulgaris vulgaris*	Common Starling			2180	30/9/2020	
AVES	*Sugomel niger*	Black Honeyeater			1	8/11/2011	
AVES	*Tachybaptus novaehollandiae*	Australasian Grebe			244	30/9/2020	
AVES	*Tadorna tadornoides*	Australian Shelduck			9	16/1/2011	
AVES	*Taeniopygia guttata castanotis*	Zebra Finch			4	1/3/1994	
AVES	*Thalassarche chrysostoma*	Grey-headed Albatross	EN	V	1	26/9/2000	
AVES	*Thalasseus bergii cristatus*	Greater Crested Tern			148	28/3/2020	
AVES	*Thinornis cucullatus cucullatus*	Hooded Plover	VU	V	9	28/3/2020	
AVES	*Threskiornis molucca molucca*	Australian White Ibis			617	30/9/2020	
AVES	*Threskiornis spinicollis*	Straw-necked Ibis			25	11/1/2020	
AVES	*Todiramphus sanctus*	Sacred Kingfisher			6	22/2/2005	
AVES	*Tribonyx ventralis*	Black-tailed Nativehen			163	30/12/2019	
AVES	*Trichoglossus haematodus*	Rainbow Lorikeet			1535	30/9/2020	
AVES	*Tringa brevipes*	Grey-tailed Tattler		R	1	1/3/1994	
AVES	*Tringa glareola*	Wood Sandpiper		R	1	1/3/1994	
AVES	*Tringa nebularia*	Common Greenshank			195	27/9/2020	
AVES	*Tringa stagnatilis*	Marsh Sandpiper			26	16/10/2014	
AVES	*Turdus merula merula*	Common Blackbird			1620	30/9/2020	
AVES	*Turnix varius varius*	Painted Buttonquail		R	2	8/4/2012	
AVES	*Turnix velox*	Little Buttonquail			1	29/11/1984	
AVES	*Tyto javanica delicatula*	Eastern Barn Owl			4	23/8/1999	
AVES	*Vanellus miles*	Masked Lapwing			647	30/9/2020	
AVES	*Vanellus miles novaehollandiae*	Spur-winged Plover			6	11/1/2020	
AVES	*Vanellus tricolor*	Banded Lapwing			2	26/10/2009	

Class	Species name	Common name	AUS	SA	Number of records	Date last sighting	May use site as habitat
AVES	*Zanda funerea whiteae*	Yellow-tailed Black Cockatoo		V	28	14/11/2016	
AVES	*Zapornia pusilla palustris*	Baillon's Crake			27	11/2/2018	
AVES	*Zapornia tabuensis*	Spotless Crake		R	8	3/11/2012	
AVES	*Zosterops lateralis*	Silvereye			232	27/9/2020	
AVES	*Zosterops lateralis pinarochrous*	Silvereye (SE, MM, MLR, FR, YP, EP)			6	11/1/2020	X
MAMMALIA	*Antechinus flavipes*	Yellow-footed Antechinus		V	1	1/6/1930	
MAMMALIA	*Arctocephalus forsteri*	Long-nosed Fur Seal (New Zealand Fur Seal)			1	24/5/2011	
MAMMALIA	*Delphinus delphis*	Short-beaked Common Dolphin			12	13/9/2010	
MAMMALIA	*Hydromys chrysogaster*	Water Rat			1	28/5/1993	
MAMMALIA	*Macropus fuliginosus*	Western Grey Kangaroo			1	5/12/2000	
MAMMALIA	*Neophoca cinerea*	Australian Sea Lion	EN	V	1	29/12/1999	
MAMMALIA	*Phascolarctos cinereus*	Koala			5	2/5/2019	
MAMMALIA	*Pteropus poliocephalus*	Grey-headed Flying-fox	VU	R	20	17/3/2020	
MAMMALIA	*Saccolaimus flaviventris*	Yellow-bellied Sheath-tailed Bat		R	1	25/4/1990	
MAMMALIA	*Trichosurus vulpecula*	Common Brushtail Possum		R	1	8/1/1930	
MAMMALIA	*Tursiops aduncus*	Indo-Pacific Bottlenose Dolphin			4	4/5/2009	
REPTILIA	*Caretta caretta*	Loggerhead Sea Turtle	EN	E	2	23/4/2012	
REPTILIA	*Christinus marmoratus*	Marbled Gecko			2	8/12/2016	X
REPTILIA	*Dermochelys coriacea*	Leatherback Turtle	EN	V	1	30/6/1994	
REPTILIA	*Hemiergis peronii*	Four-toed Earless Skink			1	26/10/2014	X
REPTILIA	*Lepidochelys olivacea*	Olive Ridley Turtle			1	23/4/2012	
REPTILIA	*Menetia greyii*	Dwarf Skink			1	26/10/2014	X
REPTILIA	*Morethia adelaidensis*	Adelaide Snake-eye			1	10/9/1967	
REPTILIA	*Pseudonaja textilis*	Eastern Brown Snake			2	24/10/1985	
REPTILIA	*Tiliqua rugosa*	Sleepy Lizard			1	26/10/2014	X
REPTILIA	*Tiliqua scincoides*	Eastern Bluetongue			1	1/1/1950	
REPTILIA	*Tympanocryptis lineata*	Lined Earless Dragon			1	1/1/1950	

Appendix 3: Photopoints established in the site

(note photopoints are additional to those shown in Section 5.2)

Photopoint 1.2, in Community 1, facing SW at 269601, 6106437 (Zone 54, WGS 84)

Photopoint 1.3, in Community 1, facing SSW at 269574, 6106551 (Zone 54, WGS 84)

Photopoint 1.4, in Community 1, facing SSW at 269575, 6106953 (Zone 54, WGS 84)

Photopoint 1.5, in Community 1, facing SSE at 269593, 6107041 (Zone 54, WGS 84)

Photopoint 1.12, in Community 1, facing SE at 269770, 6106559 (Zone 54, WGS 84) on 30/4/21

Photopoint 1.13, in Community 1, facing S at 269815, 6106491 (Zone 54, WGS 84) on 30/4/21

Photopoint 2.2, in Community 2, facing S at 269564, 6106661 (Zone 54, WGS 84)

Photopoint 2.3, in Community 2, facing S at 269634, 6106645 (Zone 54, WGS 84)

Photopoint 4.2, in Community 4, facing NE at 269530, 6108640 (Zone 54, WGS 84) on 30/4/21

Photopoint 5.2, in Community 5, facing NNE at 269593, 6107044 (Zone 54, WGS 84)

Photopoint 6.2, in Community 6, facing S at 269553, 6106159 (Zone 54, WGS 84)

Photopoint 7.2, in Community 7, facing S at 269460, 6107230 (Zone 54, WGS 84)

Photopoint 8.2, in Community 8, facing S at 269568, 6106163 (Zone 54, WGS 84)

Appendix 4: Bushland Assessment data for the site

T&M Ecologists divided the site into assessment areas based largely on the type of vegetation present and the condition of the vegetation. In each of these Management Zones an assessment was undertaken using the "BushRAT" technique developed by the SA Department for Environment, Water and Natural Resources. Eight areas were assessed on 19th June 2020, and an additional area , Management Zone 1.1, was assessed on 30th April 2021. The assessment areas are shown in Figure 3.

The BushRAT technique is derived from the Nature Conservation Society of South Australia's 'Bushland Condition Monitoring' (BCM) methodology, including a Rapid Assessment version (Croft et al, 2005), however it assesses an area of vegetation of one hectare of consistent condition rather than the 30m x 30m quadrats used in the BCM methodology. At least one photopoint was installed in each assessment area, with additional photopoints shown on Figure 3. Details of additional photopoints are provided in Appendix 1.

Three 'components' of the biodiversity value of the site are measured and scored:

- vegetation condition;
- conservation value; and
- landscape context.

For the purposes of this study, only vegetation condition has been scored.

It should be noted that the DEWNR BushRAT system was updated in 2017, and again in early 2019 and re-named "Native Vegetation Bushland Assessment"[40]. This update includes modifications to the scoring sheet and methodology for calculating vegetation condition, conservation significance and landscape context. However, this report has continued to use the BushRAT system as per DEWNR 2012[41], to retain compatibility with data that has previously been collected in coastal sites.

Scoring Components in the BushRAT metric

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)[42]. For this project, only the vegetation condition components of the BushRAT metric were scored (as these are the components that would be expected to change over time with management intervention). The Vegetation Condition Score is from a total of 80 points, or 65 points where the community is a treeless community type (such as coastal shrubland). Table 1 describes the scoring components for Vegetation Condition.

[40] Native Vegetation Management Unit (2017). Native Vegetation Council (NVC) Bushland Assessment Manual. Department for Environment, Water and Natural Resources, Adelaide.
[41] DEWNR (2012) NVBMU BushRAT assessment and scoring Manual. Unpublished document, Department for Environment, Water and Natural Resources, Waite.
[42] DEWNR (2012) NVBMU BushRAT assessment and scoring Manual. Unpublished document, Department for Environment, Water and Natural Resources, Waite.

Table A4.1: Scoring components for the BushRAT metric

Vegetation condition component	Overview description
Native Plant Species Diversity	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.
Weed Score	The cover and abundance of all weed species present is recorded. 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.
Native Plant Life Forms	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.
Regeneration	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.
Native:exotic Understorey Biomass	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.
Bare Ground	The percentage of the grounds surface that is truly bare is noted and allocated a score from 0-3.
Tree Health	Average overall overstorey canopy health is allocated to a category, and then a score from 0-5. Scored only where trees are an expected component of the vegetation community.
Tree Hollows	This score relates to the number of small and large tree hollows present, with a rating of 0-5. Scored only where trees are an expected component of the vegetation community.
Fallen timber	This score relates to the amount of branch and trunk sized logs present, with a rating of 0-5. Scored only where trees are an expected component of the vegetation community.
Grazing Evidence	This score relates to evidence of grazing pressure, including pugging, compacting and chewing. The score is from 0-4.

The following pages provide Bushland Assessment data gathered in the site during field assessment.

Southport Dunes Assessment Area: 1 **Date:** 19 June 2020

Vegetation Association: *Olearia axillaris ± Leucopogon parviflorus, Acacia longifolia sophorae, Myoporum insulare* open shrubland

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

Photograph of this area, taken facing SSW from 269621, 6106373 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 81-90%	Native Understorey Biomass Score (/10):	9
Native Plant species count: 24	Native Plant Species benchmark score (/15):	13
Native Plant Lifeform Cover Score: 16	Native Plant Lifeform benchmark score (/10):	9
Weed abundance and Threat Score: 15	Weed abundance/threat benchmark score (/15):	8
Regeneration score: 4	Regeneration benchmark score (/8)	6
	Grazing Evidence score (/4)	3
	Bare Ground Score (/3)	3
	TOTAL (/65)	**51**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	3	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	2	'Sedges' ≤ 1m	1a
Trees < 5m		Herbs	3	Hummock grass	1
Mallee > 5m		Mat Plants	2	Vines,scramblers	1a
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m	1	Grasses ≤ 0.2m	1	Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%

Southport Dunes Assessment Area: 1.1 **Date:** 28 April 2021

Vegetation Association: *Leucopogon parviflorus, Olearia axillaris ± Acacia longifolia sophorae, Myoporum insulare* open shrubland

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

Photograph of this area, taken facing SE from 269738, 6106604 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 51-60%	Native Understorey Biomass Score (/10):	6
Native Plant species count: 17	Native Plant Species benchmark score (/15):	10
Native Plant Lifeform Cover Score: 16	Native Plant Lifeform benchmark score (/10):	9
Weed abundance and Threat Score: 33	Weed abundance/threat benchmark score (/15):	2
Regeneration score: 3	Regeneration benchmark score (/8)	4
	Grazing Evidence score (/4)	3
	Bare Ground Score (/3)	3
	TOTAL (/65)	**37**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	3	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	2	'Sedges' ≤ 1m	1a
Trees < 5m		Herbs	2	Hummock grass	2
Mallee > 5m		Mat Plants	2	Vines,scramblers	1a
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m	2	Grasses ≤ 0.2m	1	Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%

Southport Dunes Assessment Area: 2 **Date:** 19 June 2020

Vegetation Association: *Leucopogon parviflorus ± Olearia axillaris* shrubland

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

Photograph of this area, taken facing SW from 269572, 6106627 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 71-80%
Native Plant species count: 29
Native Plant Lifeform Cover Score: 15
Weed abundance and Threat Score: 20
Regeneration score: 5

Native Understorey Biomass Score (/10):	8
Native Plant Species benchmark score (/15):	14
Native Plant Lifeform benchmark score (/10):	8
Weed abundance/threat benchmark score (/15):	6
Regeneration benchmark score (/8)	7
Grazing Evidence score (/4)	4
Bare Ground Score (/3)	3
TOTAL (/65)	**50**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	4	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	2	'Sedges' ≤ 1m	1a
Trees < 5m		Herbs	3	Hummock grass	
Mallee > 5m		Mat Plants	1a	Vines,scramblers	1a
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m	1	Grasses ≤ 0.2m	1	Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%

Southport Dunes Assessment Area: 3 **Date:** 19 June 2020

Vegetation Association: *Acacia longifolia sophorae ± Olearia axillaris* open to emergent shrubland

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

Photograph of this area, taken facing SSW from 269527, 6106759 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 21-30%	Native Understorey Biomass Score (/10):	3
Native Plant species count: 15	Native Plant Species benchmark score (/15):	9
Native Plant Lifeform Cover Score: 9	Native Plant Lifeform benchmark score (/10):	5
Weed abundance and Threat Score: 18	Weed abundance/threat benchmark score (/15):	7
Regeneration score: 3	Regeneration benchmark score (/8)	4
	Grazing Evidence score (/4)	4
	Bare Ground Score (/3)	2
	TOTAL (/65)	**34**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	2	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	2	'Sedges' ≤ 1m	1a
Trees < 5m		Herbs	1a	Hummock grass	
Mallee > 5m		Mat Plants	1a	Vines,scramblers	1
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m		Grasses ≤ 0.2m		Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%

Southport Dunes Assessment Area: 4 **Date:** 19 June 2020

Vegetation Association: *Leptospermum laevigatum, Melaleuca lanceolata* woodland / shrubland

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

Photograph of this area, taken facing NNE from 269516, 6106811 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 61-70%
Native Plant species count: 12
Native Plant Lifeform Cover Score: 13
Weed abundance and Threat Score: 27
Regeneration score: 2

Native Understorey Biomass Score (/10):	7
Native Plant Species benchmark score (/15):	8
Native Plant Lifeform benchmark score (/10):	8
Weed abundance/threat benchmark score (/15):	4
Regeneration benchmark score (/8)	3
Grazing Evidence score (/4)	4
Bare Ground Score (/3)	3
TOTAL (/65)	**37**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	2	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	2	'Sedges' ≤ 1m	1a
Trees < 5m		Herbs	3	Hummock grass	
Mallee > 5m		Mat Plants	2	Vines,scramblers	
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m	1	Grasses ≤ 0.2m	1	Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%

Southport Dunes Assessment Area: 5 **Date:** 19 June 2020

Vegetation Association: *Leucopogon parviflorus, Olearia axillaris, Acacia longifolia sophorae* open shrubland

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

Photograph of this area, taken facing N from 269608, 6107001 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 11-20%	Native Understorey Biomass Score (/10):	2
Native Plant species count: 13	Native Plant Species benchmark score (/15):	8
Native Plant Lifeform Cover Score: 8	Native Plant Lifeform benchmark score (/10):	4
Weed abundance and Threat Score: 27	Weed abundance/threat benchmark score (/15):	4
Regeneration score: 1	Regeneration benchmark score (/8)	2
	Grazing Evidence score (/4)	4
	Bare Ground Score (/3)	1
	TOTAL (/65)	**25**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	3	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	1a	'Sedges' ≤ 1m	1
Trees < 5m		Herbs	1a	Hummock grass	
Mallee > 5m		Mat Plants	1	Vines,scramblers	
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m		Grasses ≤ 0.2m		Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%

Southport Dunes Assessment Area: 6 **Date:** 19 June 2020

Vegetation Association: *Ammophila arenaria, Spinfix hirsutus, Thinopyrum junceiform*e tussock grassland

Benchmark Vegetation Community: SMLR Co 7.1 - Coastal Tussock Grasslands

Photograph of this area, taken facing S from 269477, 6106981 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 21-30%	Native Understorey Biomass Score (/10):	3
Native Plant species count: 5	Native Plant Species benchmark score (/15):	9
Native Plant Lifeform Cover Score: 4	Native Plant Lifeform benchmark score (/10):	4
Weed abundance and Threat Score: 35	Weed abundance/threat benchmark score (/15):	0
Regeneration score: NA	Regeneration benchmark score (/8)	NA
	Grazing Evidence score (/4)	4
	Bare Ground Score (/3)	3
	TOTAL (/65)	**23**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	1a	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	1	'Sedges' ≤ 1m	
Trees < 5m		Herbs		Hummock grass	
Mallee > 5m		Mat Plants		Vines,scramblers	
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m		Grasses ≤ 0.2m		Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%

Southport Dunes Assessment Area: 7 **Date:** 19 June 2020

Vegetation Association: *Olearia axillaris, Rhagodia candolleana, Nitraria billardieri* low open shrubland

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

Photograph of this area, taken facing S from 269474, 6107169 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 11-20%	Native Understorey Biomass Score (/10):	2
Native Plant species count: 13	Native Plant Species benchmark score (/15):	8
Native Plant Lifeform Cover Score: 9	Native Plant Lifeform benchmark score (/10):	5
Weed abundance and Threat Score: 30	Weed abundance/threat benchmark score (/15):	3
Regeneration score: 0	Regeneration benchmark score (/8)	0
	Grazing Evidence score (/4)	4
	Bare Ground Score (/3)	1
	TOTAL (/65)	**23**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	2	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	2	'Sedges' ≤ 1m	1a
Trees < 5m		Herbs	1a	Hummock grass	
Mallee > 5m		Mat Plants	1a	Vines,scramblers	1
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m		Grasses ≤ 0.2m		Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%

Southport Dunes Assessment Area: 8 **Date:** 19 June 2020

Vegetation Association: *Olearia axillaris, Acacia longifolia sophorae, Rhagodia candolleana* shrubland to open shrubland

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

Photograph of this area, taken facing S from 269603, 6106229 (Zone 54, WGS84)

BushRAT assessment data:

Native understorey biomass: 41-50%	Native Understorey Biomass Score (/10):	5
Native Plant species count: 13	Native Plant Species benchmark score (/15):	8
Native Plant Lifeform Cover Score: 12	Native Plant Lifeform benchmark score (/10):	7
Weed abundance and Threat Score: 30	Weed abundance/threat benchmark score (/15):	3
Regeneration score: 2	Regeneration benchmark score (/8)	3
	Grazing Evidence score (/4)	4
	Bare Ground Score (/3)	3
	TOTAL (/65)	**33**

Structural Diversity Plant Lifeforms data:

Lifeform	Cover	Lifeform	Cover	Lifeform	Cover
Trees >15 m		Shrubs 0.5–2m	3	'Sedges' > 1m	
Trees 5 – 15 m		Shrubs < 0.5 m	2	'Sedges' ≤ 1m	1a
Trees < 5m		Herbs	2	Hummock grass	
Mallee > 5m		Mat Plants	1a	Vines,scramblers	1
Mallee ≤ 5m		Grasses >0.2m		Mistletoe	
Shrubs > 2 m		Grasses ≤ 0.2m		Ferns	

Cover categories: 1 = not many, cover <1%, 1a = plentiful but low cover (<1%), 2 = covers 1-5%, 3 = covers 6-25%, 4 = covers 26-50%