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Aldinga Washpool & Blue Lagoon

Revegetation plan

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\GLOSSARY AND ABBREVIATION OF TERMS

BDBSA	Biological Database of South Australia (managed by DEWNR)
CPB Act	Coast Protection Board Act 1972
DEWNR	Department of Environment, Water and Natural Resources
DoEE	Department of the Environment and Energy
EBS	EBS Ecology
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
HA	Heritage Agreement
NPW Act	*National Parks and Wildlife Act 1972*
NRM Act	*Natural Resources Management Act 2004*
SEB	Significant Environmental Benefit
ssp.	Sub-species
spp.	Species (plural)
var.	Plant variety

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1 INTRODUCTION

EBS Ecology were engaged by the AMLR NRM Board to develop a vegetation planting plan for the Aldinga Washpool, Blue Lagoon and surrounding areas known as the study area (Figure 1). This plan is intended to implement an action from the earlier Washpool Lagoon and Environs Management Plan (QED 2007) for a revegetation strategy to assist with active management and recovery of the Washpool Lagoon and Environs with respect to its health, integrity and sustainability. The Washpool Lagoon Restoration Action Plan (SKM, 2008) also recommended a revegetation proposal to guide planting works. For detailed background information relating to the Washpool and Blue Lagoon areas please refer to those documents.

The study area is currently under varying tenure with a variety of historical land use. The revegetation plan will seek to define and consolidate these areas with a goal to enhance and restore the structural vegetation communities present. Detailed botanical, ecological and environmental assessments within and surrounding the study area have been undertaken which provided up-to-date data on site vegetation communities and locations of significant species currently within the Washpool and Blue Lagoon. These have in turn, informed revegetation strategies as part of this plan. The reports primarily addressed and reviewed as part of this plan were;

- Environmental Water Requirements of Aldinga Scrub, Blue Lagoon and the Washpool, Report to The City of Onkaparinga and The Onkaparinga Catchment Water Management Board Ecological Associates 2003;
- Washpool Lagoon and Environs Management Plan, report to City of Onkaparinga and Planning SA, QED Pty Ltd in association with Green Environmental Consultants, Epawe and Graham Carpenter 2007.
- Washpool Lagoon Restoration Action Plan, Report to City of Onkaparinga, SKM, 2008
- Silver Sands Catchment Stormwater Management Plan, Report to City of Onkaparinga, Southfront URPS 2016
- Washpool Lagoon Vegetation Survey and Mapping 2016, Report to AMLRNRM Board, T&M Ecologists

Most recently a vegetation survey was undertaken on behalf of the AMLR NRM Board by T&M Ecologists (2017). This also compared condition to earlier vegetation mapping (Durant 2008). Vegetation was mapped into twelve distinct associations, of which nine were considered to be indigenous vegetation types.

- +/- *Leucopogon parviflorus* +/- *Olearia axillaris* Shrubland
- +/- *Tecticornia* spp. +/- *Sarcocornia* spp. Low Shrubland
- *Gahnia filum* Sedgeland
- *Bolboschoenus caldwellii* +/- *Typha domingensis* Sedgeland
- *Duma florulenta* Shrubland
- *Baumea juncea* +/- *Ficinia nodosa* Sedgeland

- *Wilsonia* spp. +/- *Hemichroa pentandra* Herbland
- *Atriplex paludosa* ssp. *cordata* Low Shrubland
- Mixed Native and Non-native Grassland
- Non-native Grasslands and Herbland
- *Enchylaena tomentosa* Low Open shrubland
- +/- *Phalaris aquatica* +/- *Dactylis glomerata* +/- *Piptatherum miliaceum* Tussock Grassland

Figure 1. Washpool and Blue Lagoon Study area.

2 PRINCIPLES OBJECTIVES AND CONSTRAINTS

2.1 Key principles and restoration objectives

The Washpool Lagoon and Environs Management Plan identified the need for habitat enhancement and management including rehabilitation and revegetation, improvement and creation of diverse habitats and use of local native plant species. There are a limited number of undeveloped remaining shorebird/ wading bird habitats within Gulf St. Vincent and greater metropolitan Adelaide. This highlights the need to actively rehabilitate and restore the site for those species as opposed to the usual bulk revegetation. The Washpool Lagoon and Environs Management Plan (QED, 2007) outlines that the revegetation strategy must ensure that the Study Area will in time:

- Contain a characteristic assemblage of the species that occur in the reference ecosystems and that provide appropriate plant community structure;
- Consist of locally indigenous species to the greatest practicable extent;
- Include all functional groups necessary for the continued development and/or stability of the restored ecosystem or, if they are not, the missing groups have the potential to colonize by natural means;
- Be a physical environment that is capable of sustaining reproducing populations of the species necessary for its continued stability or development along the desired trajectory;
- Be integrated into a larger ecological matrix or landscape, with which it interacts through abiotic and biotic flows and exchanges;
- Have potential threats, to the health and integrity of the restored ecosystem from the surrounding landscape, eliminated or reduced as much as possible;
- Be sufficiently resilient to endure the normal periodic stress events in the local environment that serve to maintain the integrity of the ecosystem;
- Be self-sustaining to the same degree as its reference ecosystems, and has the potential to persist indefinitely under existing environmental conditions.

Nevertheless, aspects of its biodiversity, structure and functioning may change as part of normal ecosystem development, and may fluctuate in response to normal periodic stress and occasional disturbance events of greater consequence and should aim to incorporate recreational and cultural opportunities and needs that are consistent with restoration objectives.

2.2 Why revegetation is required

Previous plans have been thorough in describing the requirements for a planting plan in enhancing the values of the Washpool and Blue Lagoon areas. As described in QED (2007), Birdlife, in particular waterbird breeding opportunities are a key indicator that reflects the health of the Washpool Lagoon ecological system. Other specific parameters are summarised below.

2.2.1 Enhance habitat value

The conservation value of the Washpool Lagoon is enhanced by the waterbirds it supports (Ecological Associates, 2003). Planting design that can optimise waterfowl and shorebird use, especially maintaining open roost areas, maintaining distances of any overstory or tall shrub layers away from lagoon and lagoon edges will increase the wetland avian fauna values. The maintaining of open space adjacent to water, and open space for roosting or the encouragement of natural restoration of saltmarsh which is a low lying habitat which can be utilised by shorebirds should be integrated into landscape design.

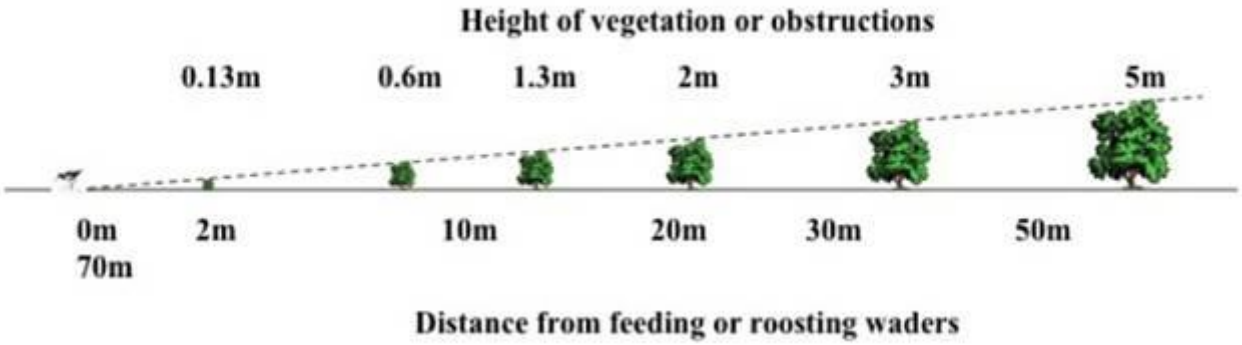
Enhancing the habitat value of the area can also be increased with diversity in structures such as fallen timber, range of plant lifeforms, and physical elements in the longer term such as hollows. Many studies support the hypothesis of increased structural diversity with an increase in fauna richness. Native fringing vegetation provides a range of habitats for many species of flora and fauna, particularly species that are restricted to moist or aquatic environments. The shade from fringing vegetation is important in reducing water temperature (Hill and Payton, 2000). Lower temperatures also reduce the risk of algal blooms which becomes of higher consequence with the predicted global warming forecast (Paerl and Huisman, 2008).

2.2.2 Enhance biodiversity

Plantings would consider additional species communities not represented currently but which are present in the adjoining reserve areas such as the Aldinga Scrub CP. They also aim to provide a range of species and lifeforms with a staged planting schedule. This considers elements such as soil microbes and fungal associations which are enhanced following initial establishment of pioneer species. Free-living microbes strongly regulate plant productivity through the mineralization of nutrients that can sustain plant productivity (Van der Heijden, Bardgett & Van Straalen, 2008). Soil microbes, including microbial pathogens, are also important regulators of plant community dynamics and plant diversity, determining plant abundance (Van der Heijden, Bardgett & Van Straalen, 2008). This may include inconspicuous species such as herbaceous perennials which are small in size and can fill micro-niches as they become available.

Planting design should seek to maximise wildlife benefit and a key focus of management planning at this site identified in previous plans are waterbird habitat values. Shorebird habitats should provide a mosaic of suitable roosting and feeding habitats (Purnell et al 2017). Of consideration in restoration planning for the washpool is that shorebird feeding and roost sites require that they are;

- Free of dense vegetation >10cm in height.
- Have open uninterrupted views.
- Have large areas of shallow water (<20cm in depth).
- Maximise surface area of shoreline.
- Close in proximity to alternate feeding and roosting sites.
- Sheltered from wind.



2.2.3 Protection and enhancement of cultural landscapes

Given the high levels of degradation since the early 1900's including removal of dune remnants in the south esplanade area, protection of existing cultural values in the study area are important in considering the restoration., The study areas significant cultural sites are not unreasonably disturbed or obstructed as part of any plantings,

2.2.4 Enhance connectivity

Restoration should seek to provide connectivity between the Aldinga scrub and Willunga range through continuous plantings along the foreshore reserves, catchment corridors and Sellicks Beach. This would be undertaken considering the pre-European vegetation communities historically present in the area. The richness of species within remnants is strongly associated with the size of remnants. Studies such as Palmer et al. (2008), Shanahan et al. (2010) and Brooker, Brooker and Cale (1999) show that large connected remnants contribute to increased dispersal and abundance of local avian species including other ecological groups such as migratory species

2.2.5 Provide the largest area (shape and size) possible

Although there is a large number of conflicting studies in terms of patch size and shape the generally accepted evidence suggests that revegetation in large patches provides habitat for many species of bird and some arboreal marsupials. Species richness of birds tends to be greater in revegetated areas that are large, wide, structurally complex, old and near remnant vegetation (Munro, Lindenmayer & Fischer, 2007). The planting scheme will endeavour to cover the largest expanse potentially available. This allows for the existing seedbank potential to recolonise areas with appropriate management. Saltmarsh species are particularly successful at this given the right flow regimes and weed management. This would also be conducted in order to reduce the edge effect scale by having the smallest possible edge to area ratio which reduces the capacity for limiting factors such as invasion of pest plants, animals and pathogens.

2.2.6 Enhance functionality to landscape systems such as runoff improvement, sedimentation and stability

Plantings which contribute to functional improvements such as stormwater purification and de-sedimentation of suspended solids are known as vegetation filter strips (VFS). These enhance the condition of wetland environments and reduces impacts to species reliant on water sources as part of

habitat requirements. VFS serve a number of functions related to reducing poor quality runoff including (1) decreasing runoff transport capacity, enhancing infiltration, and behaving as a herbicide sink where plant uptake is enhanced (Krutz et al, 2005). Plantings which will remove nutrient load and suspended solids will be targeted to provide specific filtering roles along the boundaries of the study area while reducing fire risk and allowing access.

Riparian vegetation slows overland movement of water resulting in sediments and nutrients being deposited on land prior to reaching the stream channel. This effect is known as buffering. Grasses, rushes, and sedges are most effective in achieving this buffering effect. Many species of rushes and sedges can strip nutrients from soil and water, storing significant amounts in stems and rhizomes. They also support bacterial and invertebrate communities that help to break down nutrients and other pollutants. The wider the buffer zone, the more effective it will be at retaining nutrients and sediment.

2.3 Goals and objectives

2.3.1 Contribute to and enhance natural regeneration

It would be considered beneficial if the natural area continues to become important as a refuge site and provide additional resources such as seed resources for other local projects. This would determine that any new plantings are done so in keeping with local provenance wherever possible and where the species are no longer available for seed eg: species determined locally extinct, may require locating form nearest conventional resource. Opportunities should be maintained to allow for natural regeneration of saltmarsh and other species which have high waterfowl habitat and conservation values. The areas of *Wilsonia* and *Hemichroa* should be particularly adept at regenerating in the absence of significant weed competition, nutrient loads from grazing animals and disturbance.

The primary measure considered effective for the natural regeneration of saltmarsh communities is returning natural inundation regimes which exclude exotic species, increase shrub health and provision of habitat values.

2.3.2 Pattern and sequence of revegetation

Areas of land void of vegetation cover should be managed to minimise weed proliferation and erosion of the soil profile. These areas can offer important waterfowl and wader roost sites and open space management should be a key consideration in coastal wetland areas such as the wetland which have waterbird habitat management as a key focus. The preferential areas for the revegetation project are assessed on the individual merits and constraints of the site.

The baseline strategy would be aligned with the following not including the consultation process where individuals and groups can contribute to the key outcomes and methods;

- In line with the key objectives in the first instance, Enhance the biodiversity, habitat value and connectivity by restoration of vegetation communities to the area surrounding the Washpool and Blue Lagoon. This will have the knock on benefits to desirable objectives of providing additional run off filtering services, increased productivity through birds etc and screening amenity.

- Introduce clumps of plantings of understorey species and grasses that enhances biodiversity while still allowing adequate management of the site such as weed management until overstorey plants get established.
- Infill planting of existing areas within the lagoon where there are rises and highly degraded patches

2.3.3 Reduction of exotic cover

The ratio of native to exotic biomass should be increased to enhance the resilience of the landscape as well as allowing for the natural regeneration as discussed in point 1 above. The reduction in exotic thatch levels aids in the natural recovery and is managed through weed control programs, reduction of nutrient loads and access management.

2.3.4 Create sites that can support locally extinct, endangered of vulnerable species

The establishment of sites that encourages the reinstatement and enhancement of conservation significant plant populations is a primary objective of the site in the longer term. New plantings as part of this plan can allow for new micro climes and niches that will enable the establishment of state, regional and locally important species.

Fauna species are also able to be included as part of threatened species recovery. The Yellowish Sedge-Skipper (*Hesperilla flavescens flavia*) butterfly has not been seen on the Adelaide plains for a number of years and is presumed to be locally extinct. The northern areas AMLRNRM has been scoping feasibility of reintroductions of this species linked to *Gahnia* restoration in the northern coastal plains to re-create sedgeland of Thatching Grass (*Gahnia filum*) which the butterfly requires to lay eggs and as food for the caterpillar,

The feasibility study determined that reintroduction of the Yellowish Sedge-skipper is possible with appropriate preparation and management and that several sites within the northern Adelaide coastal plains could host the reintroduction. Healthy populations of the Skipper exist in Thatching Grass sedgeland on southern Yorke Peninsula that could be used as donor populations for reintroduction. The Washpool site may also be suitable for future reintroduction and planting has a focus on re-establishing this community.

2.4 Key project constraints

Potential constraints to achieving the objectives are provided below.

2.4.1 Future proofing, ie Climate change

Over the last century global average sea level rose by 1.7 [1.5 to 1.9] mm per year and in recent years (between 1993 and 2010) this rate has increased to 3.2 [2.8 to 3.6] mm per year (Department of Environment and Energy, 2017). At a local scale this has been exceeded with the Bureau of Meteorology establishing a highly accurate network of tide gauges around Australasia as part of its Australian Baseline Sea Level Monitoring (SEAFRAME) Project. Tide monitoring gauges were installed at Thevenard (near Ceduna) in March 1992 and at Port Stanvac (south of Adelaide) in June 1992. (BOM, 2011)

From 1992 until November 2010 measured sea level rise at Port Stanvac averaged 4.7mm per year (the Port Stanvac gauge was decommissioned in 2010 with the closure of the refinery). At Thevenard (from

1992 until August 2014) sea levels have risen an average of 5.4mm per year. While sea level rise of 5mm per year may not seem significant in itself, a general rule of thumb is that sandy coastlines will typically recede by about 50 to 100 times the amount of sea level rise. Thus, mean sea level rise of just 5mm per year, or 100mm over the last 20 years, translates to potential coastal recession in the order of 5 to 10 metres over that period. It should also be noted that sea level rise of 5mm per year since 1992 represents a significant acceleration compared with the average rise over the 20th Century of 1.5mm per year (Coastal Protection Board, 2016).

South Australia became the first Australian state to incorporate measures addressing climate change adaptation into its coastal planning and development policy. The Coast Protection Board's Policy on Coast Protection and New Coastal Development 1991 requires coastal development to allow for future sea level rise up to 1m by 2100, based on projections outlined in the First Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 1990) This has influenced development of the South Australian coastline ever since but also has implications for coastal ecological communities including coastal groundwater systems and coastal lakes. In particular, future sea level rise and coastal erosion will result in increased frequency and intensity of salt water incursions which is almost certain to impact on the Washpool during times of storm surge. The impact of flooding and erosion can be reduced through the protection of the cobble ridge system which fronts the Aldinga Washpool. This system is under threat from vehicle compaction as well as unauthorised removal of rocks from the beach for private landscaping. Efforts to reduce these impacts will aid in increasing the resilience of this system to erosion and storm water incursion.

2.4.2 Stormwater management in terms of urban growth strategies

Water is likely to be higher for longer dependent on the sea level and how quickly the outflow can disperse. This will impact planting design by not allowing non frangible shrubs and trees to be planted in areas where flow will occur during flood events. Changes to natural hydrology such as groundwater expression have been altered due to extraction and subsequent seawater incursion. Allowing recharge while enabling effective dispersal of increased stormwater during flood events will guide the planting schedule in some areas.

2.4.3 Pest animal and plant species

The potential for pest plants and animals will guide planting schedules so that maintenance can be undertaken until establishment. Weeds compete with native vegetation and restrict natural regeneration. They are a significant factor in the degradation of remnant vegetation and are a major threat to biodiversity. In addition, they are a major economic costs including the considerable amount of time and labour community groups and landholders spend controlling weeds.

2.4.4 Siltation

Siltation of the Washpool means that there is a large expanse of area that is formed with alluvial deposits and ensure that soil nitrogen availability is higher than that found in natural soil horizons. This means these areas are likely to support aggressive annual exotic herbaceous and grass species growth.

The siltation has changed the hydrology through filling of the basin and will be considered as part of the planting schedule. Previous management strategies have outlined a number of actions to remediate sedimentation. Planting strategies may need to be adaptive to accommodate implementation of future works.

2.4.5 Bushfire hazard management

Bushfire hazard management in terms of suitable buffers in regard to housing and truck access and turning points is given consideration in terms of planting design and layout. Refer to Appendix 3 for further background on this matter.

2.4.6 Plant pathogens/diseases

Phytophthora is recognised and considered as part of the planting and maintenance program and will be managed through contractual arrangements in terms of awareness and adoption of pest management plans associated with the planting.

2.4.7 Practical constraints relating to species availability

There is some potential the proposed vegetation communities would provide issues in regards to species availability. Most shrub and woodland community species would be readily available however sourcing suitable levels of native grass seed of suitable provenance may cause some issues. There should be suitable resources locally available for shrub seed collection or cutting selection. Consultation with local growers and on ground project staff with known locations of plant populations should be encouraged.

Detailed records of seed source locations need to be made available to ensure site can be used as a seed source into the future. The term ‘provenance’ is used to acknowledge differences in adaptation characteristics that can develop within a species. The concept of provenance has emerged to describe the patterns of localised genetic variation that can be exhibited by a species over its full geographic range. This unique genetic variation found within a species and within an area, is of value and has significant preservation value. Seed (or plants grown from such seed) collected from a remnant population of provenance is therefore one of the basic tools in ensuring successful regeneration and restoration of indigenous communities.

In terms of collection locations for the Washpool / Blue Lagoon project, “local provenance” is interpreted to mean either as close as possible to the site, or preferably, within the local catchment. The Model Code of Practice -for Community Based Collectors and Suppliers of Native Plant Seed (Flora Bank, 1999) is the best reference source for suitable methods pertaining to sustainable seed collection.

3 PLANTING PLAN

3.1 Revegetation plan details

3.1.1 General description

As described in EAC 2011, the existing Washpool and Blue Lagoon site has high ecological value as a seasonal wetland and associated vegetation communities which have been otherwise largely cleared or highly modified in the local area. The surrounding sections of the Washpool are low in ecological diversity being used long term for agriculture and recreation which has not maintained indigenous vegetation communities.

The revegetation plan and planting scheme is intended to recreate and integrate with remnant local vegetation communities in terms of over, mid and understorey species which are realistically achieved in terms of germination, growth and sustainability. The Southern Kaurna Place Names Project (2014) had the following extract taken from Morphett (1827).

> *A gentle slope, called by the natives 'Aldinghi Plains'. The upper part consists of the same sort of land as the hills – [by which he means "covered with a very nice herbage, and much more bare of trees than we have hitherto seen" further south] – and would do admirably for sheep-runs in winter. The lower part is impregnated with salt, being beneath the level of the sea at spring-tides, and this imparts a brackish taste to the rains, which collect there during the winter months, and form a small lake.*
>
> *This place has a very singular and interesting aspect from the sea. The sloping grassland in front, without a single tree for three or four miles square, of a beautifully bright green in winter and spring, and a golden colour during the hotter months, – [He probably heard about this from his guide Bates] – is surrounded by finely wooded eminences, and a bold range of hills beyond.*

Other descriptions include statements such as "English gentlemen's park", density of grasses that made passage difficult and a general lack of tree cover over than small groves. This would indicate that tall dense grass species such as *Themeda triandra* (Kangaroo Grass), *Aristida australis* (Three Awn) and potentially *Poa labillardieri* (Tussock Grass) would have been dominant components of this landscape in the areas surrounding the riparian zones. As a result the planting plan will focus on recreating that dominant cover in areas currently used for pasture and cropping with a restoration focus on areas which are currently subject to natural (altered) wetting and drying regimes.

3.1.2 Access

Current vehicle access is available from Button Road, Norman Road and Justs Road. Car access from the adjoining beachfront is wholly accessible for the study area sections adjacent to the beach. Large parts of the existing study area are not public access and the majority of visitors to the Washpool are on foot.

3.1.3 Landuse

A variety of land uses are currently being undertaken, however once the planting plan is implemented it is anticipated that much of the area will be considered a reserve for conservation and rehabilitation would be progressed in consultation with relevant land managers.

3.2 Revegetation methods

The following general principles have been applied:

- Try to mimic the natural patchiness of the vegetation but with a layout that allows effective management. This results in strip spraying with curved lines approximately 5m in width that allows slashing between rows and delineates plantings. As cover increases, natural regeneration into inter strip spaces can occur.
- Trees and shrubs should have a tree guard placed around each plant (this is not always necessary for understorey / groundcovers, dependent on cost and funding availability).
- Revegetation of understorey species will generally occur in clumps of 12 or more individuals allowing establishment of large patches encouraging dispersal and habitat.
- Clumps should be planted in areas that were dominated by exotic cover and where no native understorey occurs.
- An excess of plants has been built in to the numbers of species being planted to cope with a potential 25% loss of plants.
- Consideration of fire management is taken into account when designing revegetation layouts.
- Maintenance of space free from dense vegetation and vegetation below 30 centimetres and maintenance of areas of open uninterrupted views to enhance waterfowl roosting sites should also be a key consideration adjacent to the lagoon.

3.2.1 Site preparation and planting

Areas where revegetation is to occur will need to be adequately prepared by controlling exotic species and unwanted competitors. Knockdown herbicide applications occurring two to three weeks before planting is scheduled to begin is recommended. This is summarised below;

- Mark strips / areas with marker stakes, applying a 5 metre width strip alternated with 5 m unsprayed areas.
- Ensure weather conditions are appropriate for spraying.
- Ensure viticulture friendly herbicides are used (eg: no ester or volatile solvent based sprays)
- The first weed spray should be undertaken in the spring prior to the planting period. The preferred herbicide is a glyphosate based herbicide such as Weedmaster Duo® (360g/L glyphosate) or Roundup Biactive® (360g/L glyphosate), diluted at a rate of 1L per 100L of water, plus a metsulfuron methyl “spike” at a rate of 10g per 100L of water. The spike is recommended to accelerate brown out and visibility of sprayed area.

- Inspect the site to analyse the effectiveness of the initial weed spraying. If control has not been 100% effective or more weeds have germinated since, then a second spray event may be needed in the pre planting period to ensure 100% control and reduction of the seed bank.
- Planting should occur at least two to three weeks after the second weed spraying event has occurred and after control.
- It is recommended that a watering regime be put in place if necessary for at least at the initial planting stage and the following summer period.

Additional management may be required as once off or ongoing measures. Timing of potential management issues is summarised below in Table 1.

Table 1. Indicative timing for management practices to ensure successful establishment of revegetation

Weeds	Calendar Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Slashing of annual exotic grass species for native grass encouragement									✓			
Slashing of areas post seed maturation for native grass species												✓
Pre planting herbaceous and grass exotic species control									✓	✓		
Woody weed control	✓										✓	✓
Rabbit Control,(low feed availability, timing dependent)		✓	✓									
Revegetation site preparation			✓	✓	✓							
Revegetation planting						✓	✓					
Follow up Broadleaf herbicide control								✓				
Follow up inter row slashing Herbaceous weed control								✓	✓	✓		
Watering, 10L / per plant x 6	✓	✓	✓									

3.3 Vegetation community summary

The vegetation communities present on site as well as the potential reconstruction community composition within the project site are summarised below (Table 2). These communities were broadly identified as part of the current management plan as well as landscape and surrounding areas coupled with the primary soil types and management landscapes they are associated with (Adapted from Croft et al, (2005)).

Table 2. Revegetation communities highlighted as part of existing landscape in the Aldinga Washpool area.

	Vegetation Community	Dominant soil types	Management landscape	Action
1	*Coastal Dune and Cliff Vegetation*			
1.1	*Atriplex cinerea (Coastal Salt Bush) +/- Olearia axillaris (Coastal Daisy Bush)* Shrubland	• Carbonate sands associated with moderate energy coastline	Secondary dune system	Revegetation / weed control
2	*Samphire*			
2.1	*Tecticornia* spp. +/- *Sarcocornia* spp. Low Shrubland	• Saline clays subject to storm surges and supra tide influences	Temperate tidal saltmarsh	Weed management
2.2	*Wilsonia* spp. +/- *Hemichroa pentandra* Herbland	• Saline clays subject to storm surges and supra tide influences Saline clay soils	Temperate Saltmarsh	Weed management
3	*Wetland Vegetation*			
3.1	*Gahnia filum* (Chaffy Saw Sedge) Sedgeland	• Wet poorly drained soils, potentially persist through groundwater expression	Brackish ephemeral swamps and wetlands	Increase extent, Revegetation
3.2	*Myoporum insulare* (Boobialla), *Atriplex paludosa* (Marsh Saltbush) *Gahnia filum* (Chaffy Saw Sedge) Low Open Shrubland	• Wet poorly drained soils, potentially persist through groundwater expressio	Brackish ephemeral swamps and wetlands	Increase extent, Revegetation
3.3	*Bolboschoenus caldwellii* +/- *Typha domingensis* Sedgeland	• Wet poorly drained soils subject to rainfall runoff	Brackish / fresh ephemeral swamps and wetlands	Weed management
3.4	*Duma florulenta* (Lignum) Shrubland	• Wet poorly drained soils • Loam over poorly structured clay • Shallow loam over calcrete • Deep loams	Watercourses and Freshwater swamps	Weed management
4	*Grassy Very Open woodland*			
4.1	*Austrostipa scabra ssp. Themeda triandra, Aristida australis, Poa labillardieri Open Grassland +/- Eucalyptus microcarpa / E. porosa*	• Loam over clay, • Shallow loam over calcrete	Low slopes	Revegetation / Reconstruction
4.2	*Eucalyptus porosa +/- Eucalyptus microcarpa / Allocasuarina verticillata Low Open Woodland*	• Loam over clay, • Shallow loam over calcrete	Northern sand rises	Revegetation / Reconstruction

3.4 Revegetation community descriptions

Communities designated as revegetation in the action column of Table 2 are described below including intact/semi intact benchmark communities, methods of planting, species composition and number as well as planting structures.

3.4.1 Revegetation Community 1.1 Atriplex cinerea (Coastal Salt Bush) +/- Olearia axillaris (Coastal Daisy Bush) Shrubland

Benchmark community: Existing sections of Aldinga beachfront, Existing examples are largely degraded with high exotic grass and herbaceous species cover in inter shrub spaces. It should be noted that the use of local *Carpobrotus rossii* (pigface) pieces or cuttings should ensure hybridised material is not used. Pure forms of *Carpobrotus rossii* should now be collected from The Coorong area where it is known to be of consistent taxonomy. Due to considerable backcrossing, qualitative assessment of local propagative material is not a suitable method.

Description: This community is recorded largely along the areas where moderate to high energy beaches occur leading to sand deposition in the form of a fore dune dominated by spinifex grading into swales and secondary dune dominated by the community (Berkinshaw, 2009).

Restoration target: Reintroduction of overstorey species at natural densities to allow for increased competition against exotic understorey species and annual exotic grasses. A significant part of the restoration plan for this community will be ongoing weed control and management to ensure that establishment of overstorey species occurs and are able to naturally regenerate. This community also aims to reduce the wind speed in the areas immediately east of the low dune to aid wading bird habitat.

Planting methods: The most efficient method of revegetation in a secondary dune system would be the use of tube-stock and planting carried out using Pottiputki and or Hamilton planters. Each plant would be planted with a 75mm x 11 x 25mm stake and corflute guard. After two years these should be removed and recycled.

Access to some areas of the dune system should be restricted for vehicle and or heavy equipment due to soft sand profiles and sensitivity associated with existing native vegetation. Therefore, foot access maybe the only way to access some parts of the community. This would minimise disturbance to the dune system structure and to any remnant vegetation. In areas of high wind erosion of the dune system (dune matting) may be required to minimise sand drift.

Figure 2. Benchmark community structure for dune vegetation from Aldinga area.

Table 3. Potential species revegetation list for community 1.1

Species	Common	Plants per Ha
Tall Shrubs		
Olearia axillaris	Coastal Daisy Bush	100
Atriplex cinerea	Coast Saltbush	100
Acacia cupularis	Cup Wattle	20
Acacia longifolia var. sophorae	Coastal Wattle	10
Low Shrubs / Sedges		
Dianella brevicaulis	Flax lily	200
Rhagodia candolleana ssp. candolleana	Sea berry Saltbush	200
Leucophyta brownii	Cushion Bush	150
Adriana quadripartita	Coast Bitter-bush	100
Ficinia nodosa	Knobby club rush	100
Austrostipa flavescens	Spear Grass	100
Enchylaena tomentosa	Ruby Saltbush	70
Forbs/ Groundcovers		
Carpobrotus rossii	Pigface	50
Pelargonium australe	Australian Cranes bill	50
Kennedia prostrata	Running Postman	25
Threlkeldia diffusa	Coastal Bonefruit	25
Total	1300 plants or one per 8m^2	

3.4.2 Revegetation community 3.1: Gahnia filum (Chaffy Saw Sedge) Sedgeland

Benchmark Community: Existing Washpool wetland areas. This community is almost always accompanied by fringing Swamp paperbark communities where extensively represented in the southern Fleurieu and south-east. There is little evidence to suggest that Swamp Paperbark has ever formed a significant part of the Washpool and Blue Lagoon areas and therefore is omitted from the community structure description for this plan.

Description: Fringing communities of the saline wetlands however requires freshwater incursion during winter to ensure ongoing health.

Restoration Target: To provide a dominant overstorey of *Gahnia filum* (Cutting Grass) sedgeland which is often exclusive of significant weed cover due to inundation and competition. Perennial grass control will be the focus of early plantings especially species such as *Parapholis recurva* (Curly Rye-grass) which provide dense mats and exclude establishment of native species.

Planting method: Vehicle access should be minimised and planting carried out manually using Tube-stock or small cell trays using Pottiputki or Hamilton planters. Each plant should be accompanied by a paper guard and two bamboo stakes. Optional guarding including the use of coreflutes where deemed necessary or no guards in areas where infill planting to assist with natural regeneration can be used. Plantings should be evenly spaced throughout with the intention that plants naturally regenerate to benchmark densities given a natural flood / drying regime. The plantings can be merged into existing native vegetation without damage utilising this method. Plantings will contribute to functional improvements such as stormwater purification and de-sedimentation of suspended solids including vegetation filter strips.

Figure 3. *Gahnia filum* (Chaffy Saw Sedge) sedgeland community

Table 4. *Gahnia filum* (Chaffy Saw Sedge) community revegetation species list and number per hectare.

Species	Common	Plants per Ha
Sedges		
Gahnia filum	Chaffy Saw Sedge	500
Cyperus gymnocaulos	Spiny Flat-sedge	200
Bolboschoenus caldwellii	Salt Club-rush	200
Baumea juncea	Bare Twig-rush	200
Groundcovers, Forbs		
Suaeda australis	Austral Seablite	500
Rhagodia candolleana ssp. candolleana	Sea berry saltbush	200
Threlkeldia diffusa	Coastal Bonefruit	200
Total	2000 plants or one / 5m^2	

3.4.3 Revegetation community 3.2: Myoporum insulare (Boobialla), Atriplex paludosa (Marsh Saltbush) Gahnia filum (Chaffy Saw Sedge) Low Open Shrubland

Benchmark Community: Areas adjoining the zone which is flooded annually will support a more diverse range of species which will tolerate irregular inundation for shorter periods and are a slightly higher elevation than the *Gahnia* sedgeland. This community is also intended to be tolerant of hypersaline conditions. The very low shrub/tree cover will act as additional habitat for bird roosting and as a nectar source for the Sedge skipper butterfly. It is intended that this community plays a small part of the overall washpool area to allow ideal conditions for the widest range of wetland avian species.

Description: Community exists as fringing area of Samphire saltmarshes where saline conditions persist however inundation is not as severe or frequent as the Samphire dominant areas which have a higher tolerance to inundation.

Restoration target: The goal of enhancing this community is to provide increased resilience in the face of rising sea levels and increased sea water incursion. A variety of chenopod and succulent saline tolerant herbs and shrubs enables the natural transitional changes as areas become more or less frequently inundated.

Planting method: Due to the muddy nature of saltmarshes, vehicle access should be minimised and planting carried out manually using Tube-stock and Pottiputki and Hamilton planters Each tree and shrub plant would be planted with a 75mm x 11 x 25mm stake and corflute guard. Sedges and groundcovers should be accompanied with a small cardboard guard and twin bamboo stakes or alternatively, use corflute guards for all plants which will increase the cost. After two years these should be removed and recycled.

Table 5. *Myoporum insulare* (Boobialla), *Atriplex paludosa* (Marsh Saltbush) *Gahnia filum* (Chaffy Saw Sedge) Low Open Shrubland revegetation species list and number per hectare.

Species	Common	Plants per Ha
Trees		
Myoporum insulare	Boobialla	10
Melaleuca halmaturorum	Swamp Paperbark	5
Shrubs		
Atriplex paludosa	Marsh Saltbush	100
Maireana oppositifolia	Salt Bluebush	100
Rhagodia candolleana	Sea-berry Saltbush	100
Nitraria billardierei	Nitre Bush	50
Sedges		
Juncus kraussii	Sea Rush	100
Gahnia filum	Chaffy Saw Sedge	100
Groundcovers, Forbs		
Suaeda australis	Austral Seablite	200
Disphyma crassifolium	Round-leaved Pigface	200
Threlkeldia diffusa	Coastal Bonefruit	200
Total	1165 plants /ha or 1 per 8.5m^2	

Figure 4. Example of fringing *Myoporum* vegetation leading into ephemeral wetland areas.

3.4.4 Revegetation Community 4.1: Austrostipa scabra ssp., Themeda triandra, Aristida australis, Poa labillardieri Open Grassland +/- Eucalyptus microcarpa / E. porosa

Benchmark community: Very few remnants of this community remain, being highly sought after during settlement for the use of agriculture. Subsequent pasture improvement such as the use of phosphate derived fertilisers has meant that natural grasslands were largely destroyed. Some local road reserves support significant *Austrostipa* communities however these are likely to be fragments only and represent the most disturbance resistant species. This community structure is derived from historical accounts and aimed at providing a dense cover on soils that are devoid of significant nutritional value in order to outcompete annual exotic grass species. It would be expected that *Austrostipa scabra* ssp. would be the dominant cover with patches of *Themeda triandra* and *Aristida australis* forming grove like areas of approximately 20x20m in size. This make up is typical of grassland communities often observed in the mid north of the state and on the Fleurieu Peninsula at areas like Red Creek and Sandergrove. As this community is not otherwise represented locally, this is the most likely benchmark to work with. It is uncommon for these particular sub dominant species to occur as an even mix within *Austrostipa* dominant areas and therefore the clumping or grove like target is suggested here.

Restoration target: The plan approach aims to establish a dominant grassland community as per historical descriptions. There are two pathways to achieving this, one of which is expensive and significantly disturbs the existing soil but provides exceptional results and the other is a bilateral approach whereby plants are introduced as cell stock on a patchy basis and management actions such as crash grazing or slashing timing can then enhance the cover of native grasses over time.

Planting methods:

Option 1: Strip the upper 100-150 mm of topsoil and expose the sub soil horizon. Direct seeding through either hydro seeding or hand broadcasting and follow up scarifying of the sub soil is highly effective at achieving up to 100% indigenous cover within 24 months. Sowing rates are ideally around 10 – 15 kg / ha. Strip spray alternate 5m width lines along contour avoiding straight line of sight. Once strip spray control is undertaken, use a grader to remove top soil horizon in autumn and then manage as per options described above. Windrow is the most cost efficient and manageable method. Scarification of the sub soil horizon should be followed with broadcasting of seed by hand in late autumn / winter. The topsoil inter-strips can be windrowed and planted with tube stock, left fallow for ongoing annual grass control or removed from the site altogether following establishment of the inter rows from follow on planting or natural regeneration of indigenous grass species. Some infill plantings of overstorey tree species should be incorporated a very small grove like areas of 10-20 trees in an area of 10m x 5m. Groves of overstorey should be planted at the required numbers in clumps with a corflute guard and hardwood 750 x 25 x 11mm hardwood stake.

Option 2: Spray halos with a knockdown herbicide following procedures for pre planting. Spray at the rate of 4 patches per hectare with a 10m radius, Infill plant cell stock grasses in clumps of 1 tray (40 cell Hiko or similar) per 3x3m area at a rate of 10 trays per halo. Manage slashing by removing seed heads of early maturing exotic grasses such as *Avena* in early spring and allow full maturation of native grasses in early / mid-summer before slashing again at a height of 200mm or above.

Figure 5. Example of stripped and seeded *Austrostipa* grassland within infill planting of overstorey trees and shrubs.

Table 6. *Austrostipa scabra ssp., Themeda triandra, Aristida australis, Poa labillardieri* Open Grassland +/- *Eucalyptus microcarpa / E. porosa*.

Species	Common	Plants per Ha / Seeding rate /Ha Option 1	Plants per hectare Option 2
Trees			
Eucalyptus porosa	Mallee Box	5	5
Eucalyptus microcarpa	Grey Box	5	5
Shrubs			
Acacia pycnantha	Golden Wattle	10	10
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush	20	20
Groundcovers, Forbs			
Austrostipa scabra ssp.	Spear Grass	50%	600
Anthosachne scabra	Wheat Grass	10%	200
Themeda triandra	Kangaroo Grass	10%	200
Rytidosperma caespitosum	Wallaby Grass	10%	200
Austrostipa drummondii	Cottony Spear-grass	5%	160
Aristida australis	Bristle Grass	5%	80
Poa labillardieri	Tussock Grass	5%	80
Vittadinia cuneata	New Holland Daisy	5%	80
	Total mix weight	10kg/ha	
	Total number infill plants / ha	40	1640

3.4.5 Revegetation community 4.2: Eucalyptus porosa +/- Eucalyptus microcarpa Low Open Woodland

Benchmark community: Potential remnant community at Sellicks Hill in degraded condition and small sections adjacent to Cox Road, Aldinga Scrub CP. No significant and non-degraded benchmarks occur locally however the desired outcome is a moderate overstorey cover with an open grassy / chenopod shrub understorey of moderate complexity. It may be the longer term goal to continue to introduce more understorey species as time goes on to enhance the structural values of the community dependent on the level of natural regeneration (ie: species such as *Clematis microphylla*, *Olearia pannosa*, additional *Austrostipa* spp., *Dodonaea hexandra / baueri*, through seed broadcasting).

Description: This plant community is distributed along the length of the Mount Lofty Ranges and Southern Flinders. With moderate rainfall in semi-arid areas on undulating plains and on lower to mid slopes with shallow loamy soils.

Restoration target: The plan approach aims to reinstate *Eucalyptus porosa* and *microcarpa* communities which are assumed to have covered some extent in this locale. The eastern extent of the Aldinga Scrub adjacent and including the Cox Road reserve have remnant and intact overstorey of this species. Grey Box, by way of occupying the best tracts of land being the hills face and foot slopes of ranges, are almost always extensively cleared. *Eucalyptus porosa* (Mallee Box) has been included for some areas where sandier soil profiles exist as these are more dominant on the poorer sand profiles and isolated low rises.

Planting method: Knockdown spray 5m width alternate strips avoiding straight lines. Forestry tube stocks can be used and planted directly into pre-sprayed areas using Hamilton's accompanied with a corflute guard and hardwood 750 x 25 x 11mm hardwood stake. Where ground has been compacted and or rocky it may be necessary to pre drill planting holes with heavier equipment i.e.; motorised Auger (single operator manual Auger or dingo style Auger). Where necessary allow for wetting agents / fertilizers to be used helping with early establishment of plantings.

Figure 6. Degraded local *Eucalyptus microcarpa* (Grey Box) community, Aldinga CP.

Table 7. *Eucalyptus microcarpa* (Grey Box) +/- *E. porosa* (Mallee Box) revegetation community species list and numbers per hectare

Species	Common	Plants per Ha
Trees		
Eucalyptus microcarpa	Grey Box	20
Callitris gracilis	Southern Cypress Pine	20
Eucalyptus porosa	Mallee Box	20
Allocasuarina verticillata	Drooping She-oak	20
Shrubs		
Acacia pycnantha	Golden Wattle	30
Bursaria spinosa ssp. spinosa	Sweet Bursaria	30
Groundcovers, Forbs		
Dianella revoluta var. revoluta	Black-anther Flax-lily	40
Atriplex suberecta	Lagoon Saltbush	40
Tetragonia implexicoma	Bower spinach	40
Vittadinia australasica	New Holland Daisy	40
Enchylaena tomentosa var. tomentosa	Ruby Saltbush	40
Atriplex semibaccata	Berry Saltbush	40
Total	380 pants /ha or 1 plant per 26m^2	

4 PLANTING STAGES

4.1 Precincts

The site has been divided into five precincts so that targeted management can occur dependent on association with the level of costs, management, extent of revegetation required and tenure procurement. Precincts 4 and 5 are largely vacant or agricultural land and therefore are requiring extensive work in terms of planning, preparation and maintenance. Precincts 1 and 2 are less intensive in revegetation requirements but may require more work in terms of ongoing maintenance and weed control in areas that have semi intact vegetation present.

A staged planting approach is proposed with a 5 year timespan. The approach is based on improving and enhancing semi-intact areas as the first priority with weed control and supplementary planting consolidating the primary habitats present within the Washpool area.

The precincts and order of staging revegetation are shown below in Figure 7. A summary of the areas highlighted for revegetation area shown below in Table 8.

Table 8. Precinct area summary.

Precinct	Nomenclature	Stage	Area vegetation (ha)
1	Washpool Central	1	10.04
2	Washpool South	2	7.97
3	Blue Lagoon	2	1.86
4	Washpool East	Years 3 and 5 under Option 1 utilised or year 4 if Option 2	26.73
5	Norman Road	Year 4 if Option 1 utilised, Year 3 if Option 2	13.85
		Total	60.45

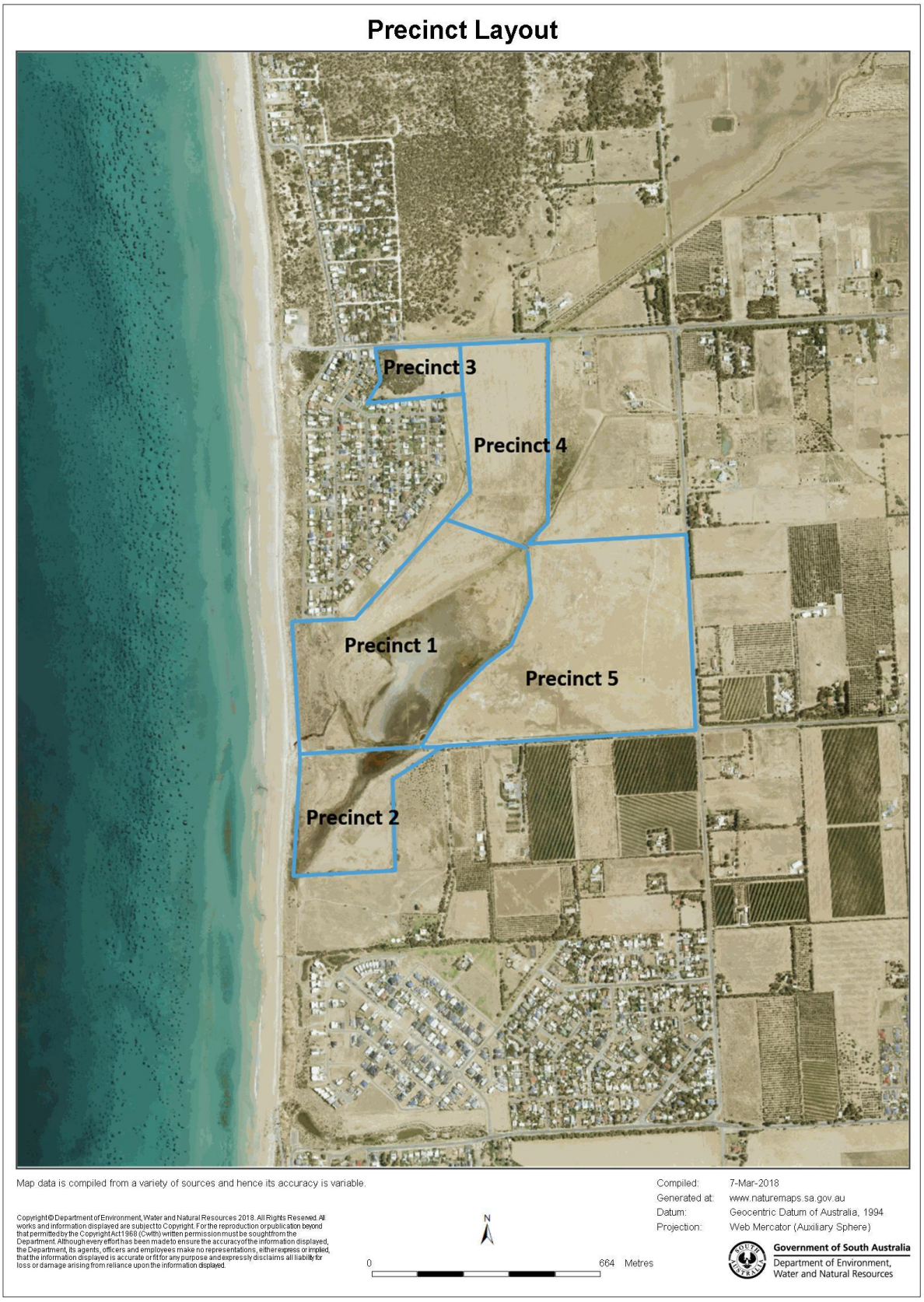


Figure 7. Precinct layout for Blue Lagoon and Washpool sites.

4.2 Precinct 1, Washpool central

The Washpool area has been highly altered in recent history by the influence of soil batters and water diversion within the Washpool Blue Lagoon catchment. A series of channels near the altered outlet site are influenced by saltwater intrusion during storm events. A change in elevation due to constant deposition of soil and alluvial material from cleared foothill environments has meant that water depth is likely to have been significantly altered. Removal of sand material from the residential and adjoining areas has left an altered structure to that present on the northern side of Norman road, Aldinga.

Based on the knowledge of modelled flood magnitudes based on one in 20 and 100 year events, the potential vegetation community structure tolerance to flooding and wetting can be ascertained. For example, areas which are inundated in 1 in 20 year events are likely to be too wet for Mallee Box and Pink Gum communities while being more likely to support Red Gum communities. Areas flooded during 1 in 100 year events will likely support the more dry tolerant species. Areas in between these areas are hard to quantify as to what vegetation structure will persist given the altered soil structure however over time a natural progression and regeneration given adequate weed management should transition to a natural mix consistent with surrounding intact areas.

Table 9. Precinct 1 Washpool central vegetation community area summary

Vegetation community	Area (Ha)	% of total area
3.1 Gahnia filum (Chaffy Saw Sedge) Sedgeland	0.6	6
3.2 Myoporum insulare (Boobialla), *Atriplex paludosa* (Marsh Saltbush) *Gahnia filum* (Chaffy Saw Sedge) Low Open Shrubland	9.4	94
Total	10.0	100

Figure 8. Precinct 1 planting plan.

Table 10. Planting schedule for Precinct 1, Washpool central.

Community	Species	Common	Number / hectare	Area for revegetation (ha)	Total indiv. requirement precinct 3	Unit price ($)	Total
3.1	*Gahnia filum*	Chaffy Saw Sedge	500	9.4	4700	2.6	12,220
3.1	*Cyperus gymnocaulos*	Spiny Flat-sedge	200	9.4	1880	2.6	4,888
3.1	*Bolboschoenus caldwellii*	Salt Club-rush	200	9.4	1880	2.6	4,888
3.1	*Baumea juncea*	Bare Twig-rush	200	9.4	1880	2.6	4,888
3.1	*Suaeda australis*	Austral Seablite	500	9.4	4700	2.6	12,220
3.1	*Rhagodia candolleana ssp. candolleana*	Sea berry saltbush	200	9.4	1880	2.6	4,888
3.1	*Threlkeldia diffusa*	Coastal Bonefruit	200	9.4	1880	2.6	4,888
3.2	*Myoporum insulare*	Boobialla	10	0.6	6	6	36
3.2	*Melaleuca halmaturorum*	Swamp Paperbark	5	0.6	3	6	18
3.2	*Atriplex paludosa*	Marsh Saltbush	100	0.6	60	6	360
3.2	*Maireana oppositifolia*	Salt Bluebush	100	0.6	60	6	360
3.2	*Rhagodia candolleana*	Sea-berry Saltbush	100	0.6	60	6	360
3.2	*Nitraria billardierei*	Nitre Bush	50	0.6	30	6	180
3.2	*Juncus kraussii*	Sea Rush	100	0.6	60	6	360
3.2	*Gahnia filum*	Chaffy Saw Sedge	100	0.6	60	6	360
3.2	*Suaeda australis*	Austral Seablite	200	0.6	120	6	720
3.2	*Disphyma crassifolium*	Round-leaved Pigface	200	0.6	120	6	720
3.2	*Threlkeldia diffusa*	Coastal Bonefruit	200	0.6	120	6	720
						Total planting cost incl. labour	$53,074

4.3 Precinct 2, Washpool south

This precinct is heavily influenced by saline conditions however some groundwater expression occurs with small patches of *Typha domingensis* and *Baumea juncea* which are consistent with freshwater environments. These are present as isolated small occurrences indicating the remaining area is saline with patches of halophytic tolerant species such as *Wilsonia humilis, Tecticornia quinqueflora, Suaeda australis* and *Gahnia filum* more dominant. This is an area of mixed structure therefore with the natural outflow area diverted slightly north. The constant filling and drying of brackish water means that the salinity in this section is most likely consistently increasing without the flushing action of this section of the Washpool. Small areas of this precinct have been marked for low Shrubland communities to act as refuge and roosting sites without compromising open spaces preferred by wetland species.

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Table 11. Precinct 2, Washpool south vegetation community area summary.

Vegetation community	Area (Ha)	Area for revegetation	% of total area
1.1 Leucopogon parviflorus (Coastal Bearded Heath) +/- *Olearia axillaris* (Coastal Daisy Bush) Shrubland	0.9	0.9	11.25
3.1 Gahnia filum (Chaffy Saw Sedge) Sedgeland	3.6	3.6	45
3.2 Myoporum insulare (Boobialla), *Atriplex paludosa* (Marsh Saltbush) *Gahnia filum* (Chaffy Saw Sedge) Low Open Shrubland	0.7	0.7	8.7
4.1: Austrostipa scabra ssp., Themeda triandra, Aristida australis, Poa labillardieri Open Grassland +/- Eucalyptus microcarpa / E. porosa (Option 2)	2.8	2.8	35
Total	8.0	6.6	100

Figure 9. Precinct 2 planting plan.

Table 12. Plant schedule for Precinct 2, Washpool south.

Community	Species	Common	Number / %kg hectare	Area for revegetation (ha)	Total requirement precinct 2 (indiv/kg)	Unit price	Total
3.1	*Gahnia filum*	Chaffy Saw Sedge	500	3.6	1800	2.6	4,680
3.1	*Cyperus gymnocaulos*	Spiny Flat-sedge	200	3.6	720	2.6	1,872
3.1	*Bolboschoenus caldwellii*	Salt Club-rush	200	3.6	720	2.6	1,872
3.1	*Baumea juncea*	Bare Twig-rush	200	3.6	720	2.6	1,872
3.1	*Suaeda australis*	Austral Seablite	500	3.6	1800	2.6	4,680
3.1	*Rhagodia candolleana ssp. candolleana*	Sea berry saltbush	200	3.6	720	2.6	1,872
3.1	*Threlkeldia diffusa*	Coastal Bonefruit	200	3.6	720	2.6	1,872
4.1	*Eucalyptus porosa*	Mallee Box	5	2.8	14	6	84
4.1	*Eucalyptus microcarpa*	Grey Box	5	2.8	14	6	84
4.1	*Acacia pycnantha*	Golden Wattle	10	2.8	28	6	168
4.1	*Rhagodia candolleana ssp. candolleana*	Sea-berry Saltbush	20	2.8	56	6	336
4.1	*Austrostipa scabra ssp.*	Spear Grass	800	2.8	2240	2.6	5,824
4.1	*Themeda triandra*	Kangaroo Grass	200	2.8	560	2.6	1,456
4.1	*Rytidosperma caespitosum*	Wallaby Grass	200	2.8	560	2.6	1,456
4.1	*Austrostipa drummondii*	Cottony Spear-grass	160	2.8	448	2.6	1,165
4.1	*Aristida australis*	Bristle Grass	80	2.8	224	2.6	582
4.1	*Poa labillardieri*	Tussock Grass	80	2.8	224	2.6	582
4.1	*Vittadinia cuneata*	New Holland Daisy	80	2.8	224	2.6	582
1.1	*Olearia axillaris*	Coastal Daisy Bush	100	0.9	90	6	540
1.1	*Atriplex cinerea*	Coast Saltbush	100	0.9	90	6	540
1.1	*Acacia cupularis*	Cup Wattle	20	0.9	18	6	108
1.1	*Acacia longifolia var. sophorae*	Coastal Wattle	10	0.9	9	6	54
1.1	*Dianella brevicaulis*	Flax lily	200	0.9	180	6	1,080
1.1	*Rhagodia candolleana ssp. candolleana*	Sea berry Saltbush	200	0.9	180	6	1,080
1.1	*Leucophyta brownii*	Cushion Bush	200	0.9	180	6	1,080
1.1	*Adriana quadripartita*	Coast Bitter-bush	150	0.9	135	6	810

Community	Species	Common	Number / %kg hectare	Area for revegetation (ha)	Total requirement precinct 2 (indiv/kg)	Unit price	Total
1.1	*Ficinia nodosa*	Knobby club rush	100	0.9	90	6	540
1.1	*Enchylaena tomentosa*	Ruby Saltbush	70	0.9	63	6	378
1.1	*Kennedia prostrata*	Running Postman	50	0.9	45	6	270
1.1	*Carpobrotus rossii*	Pigface	50	0.9	45	6	270
1.1	*Pelargonium australe*	Australian Cranes bill	50	0.9	45	6	270
3.2	*Myoporum insulare*	Boobialla	10	0.7	7	6	42
3.2	*Melaleuca halmaturorum*	Swamp Paperbark	5	0.7	3.5	6	21
3.2	*Atriplex paludosa*	Marsh Saltbush	100	0.7	70	6	420
3.2	*Maireana oppositifolia*	Salt Bluebush	100	0.7	70	6	420
3.2	*Rhagodia candolleana*	Sea-berry Saltbush	100	0.7	70	6	420
3.2	*Nitraria billardierei*	Nitre Bush	50	0.7	35	6	210
3.2	*Juncus kraussii*	Sea Rush	100	0.7	70	6	420
3.2	*Gahnia filum*	Chaffy Saw Sedge	100	0.7	70	6	420
3.2	*Suaeda australis*	Austral Seablite	200	0.7	140	6	840
3.2	*Disphyma crassifolium*	Round-leaved Pigface	200	0.7	140	6	840
3.2	*Threlkeldia diffusa*	Coastal Bonefruit	200	0.7	140	6	840
						Total	$42,953

4.4 Precinct 3, Blue Lagoon

The Blue Lagoon area community structure is largely driven by fresh or brackish water which may be as a result of groundwater expression and surface water flows. As a result, the community structures are driven more towards freshwater woodland dominated by *Eucalyptus camaldulensis* (River Red Gum) as well as transitional zones between adjoining remnant sand dunes (*Eucalyptus fasciculosa*, Pink Gum) and areas not inundated for extended periods (*Eucalyptus leucoxylon* ssp. *leucoxylon*, Blue Gum). The intergrade between the saline and brackish communities to woodland communities is difficult to manage however they are generally distinct and where the boundary is in relation to the precinct is most likely roughly aligned with the area that is used for cropping. This area is defined based largely on the Aldinga Scrub CP being similar in terms of topography and hydrology.

Table 13. Precinct 3, Blue Lagoon Vegetation community area summary.

Vegetation community	Area (Ha)	% total reveg area
3.2 *Myoporum insulare* (Boobialla), *Atriplex paludosa* (Marsh Saltbush) *Gahnia filum* (Chaffy Saw Sedge) Low Open Shrubland	0.86	47
4.2 Eucalyptus porosa +/- Eucalyptus microcarpa / Allocasuarina verticillata Low Open Woodland	0.99	53
Total	1.86	100

Figure 10. Precinct 3 planting plan layout.

Table 14. Planting schedule for Precinct 3, Blue Lagoon.

Community	Species	Common	Number hectare/	Area for revegetation (ha)	Total indiv. requirement precinct 4	Unit price ($)	Total
3.2	*Myoporum insulare*	Boobialla	10	0.86	8.6	6	51
3.2	*Melaleuca halmaturorum*	Swamp Paperbark	5	0.86	4.3	6	25
3.2	*Atriplex paludosa*	Marsh Saltbush	100	0.86	86	6	516
3.2	*Maireana oppositifolia*	Salt Bluebush	100	0.86	86	6	516
3.2	*Rhagodia candolleana*	Sea-berry Saltbush	100	0.86	86	6	516
3.2	*Nitraria billardierei*	Nitre Bush	50	0.86	43	6	258
3.2	*Juncus kraussii*	Sea Rush	100	0.86	86	6	516
3.2	*Gahnia filum*	Chaffy Saw Sedge	100	0.86	86	6	516
3.2	*Suaeda australis*	Austral Seablite	200	0.86	172	6	1,032
3.2	*Disphyma crassifolium*	Round-leaved Pigface	200	0.86	172	6	1,032
3.2	*Threlkeldia diffusa*	Coastal Bonefruit	200	0.86	172	6	1,032
4.1	*Eucalyptus microcarpa*	Grey Box	20	0.99	19.8	6	118
4.1	*Callitris gracilis*	Southern Cypress Pine	20	0.99	19.8	6	118
4.1	*Eucalyptus porosa*	Mallee Box	20	0.99	19.8	6	118
4.1	*Allocasuarina verticillata*	Drooping She-oak	20	0.99	19.8	6	118
4.1	*Acacia pycnantha*	Golden Wattle	50	0.99	49.5	6	297
4.1	*Bursaria spinosa ssp. spinosa*	Sweet Bursaria	50	0.99	49.5	6	297
4.1	*Dianella revoluta var. revoluta*	Black-anther Flax-lily	50	0.99	49.5	6	297
4.1	*Vittadinia cuneata var. cuneata*	Fuzzy-New Holland Daisy	50	0.99	49.5	6	297
4.1	*Enchylaena tomentosa var. tomentosa*	Ruby Saltbush	50	0.99	49.5	6	297
4.1	*Atriplex semibaccata*	Berry Saltbush	50	0.99	49.5	6	297
						Total planting cost incl. labour	$8,269

4.5 Precinct 4 Norman Road

This precinct earmarked for year 4 of the planting project provides a challenging area for regeneration of natural community structure. This is due to lack of connectivity to other patches and the fragmented area to the north of Norman Road, the historical land use and changes to the natural soil structure. This area will provide an opportunity to intergrade from the wooded areas of the Aldinga CP to the lower growing shrublands and sedge lands associated with areas which are periodically inundated. The outcome may be altered to align with stormwater management as development proceeds in the area.

Table 15. Revegetation planting schedule for precinct 4, Norman Road

Vegetation community	Area (Ha)	% total reveg area
3.1 Gahnia filum (Chaffy Saw Sedge) Sedgeland	5.4	39
3.2 *Myoporum insulare* (Boobialla), *Atriplex paludosa* (Marsh Saltbush) *Gahnia filum* (Chaffy Saw Sedge) Low Open Shrubland	5.14	37
4.2 Eucalyptus porosa +/- Eucalyptus microcarpa / Allocasuarina verticillata Low Open Woodland	3.31	24
Total	13.85	100

Figure 11. Precinct 4 Norman Road planting layout

Community	Species	Common	Number hectare/	Area for revegetation (ha)	T re
4.1	*Eucalyptus microcarpa*	Grey Box	20	3.31	
4.1	*Callitris gracilis*	Southern Cypress Pine	20	3.31	
4.1	*Eucalyptus porosa*	Mallee Box	20	3.31	
4.1	*Allocasuarina verticillata*	Drooping She-oak	20	3.31	
4.1	*Acacia pycnantha*	Golden Wattle	50	3.31	
4.1	*Bursaria spinosa ssp. spinosa*	Sweet Bursaria	50	3.31	
4.1	*Dianella revoluta var. revoluta*	Black-anther Flax-lily	50	3.31	
4.1	*Vittadinia cuneata var. cuneata*	Fuzzy-New Holland Daisy	50	3.31	
4.1	*Enchylaena tomentosa var. tomentosa*	Ruby Saltbush	50	3.31	
4.1	*Atriplex semibaccata*	Berry Saltbush	50	3.31	
3.1	*Myoporum insulare*	Boobialla	10	5.14	
3.1	*Melaleuca halmaturorum*	Swamp Paperbark	5	5.14	
3.1	*Atriplex paludosa*	Marsh Saltbush	100	5.14	
3.1	*Maireana oppositifolia*	Salt Bluebush	100	5.14	
3.1	*Rhagodia candolleana*	Sea-berry Saltbush	100	5.14	
3.1	*Nitraria billardierei*	Nitre Bush	50	5.14	
3.1	*Juncus kraussii*	Sea Rush	100	5.14	
3.1	*Gahnia filum*	Chaffy Saw Sedge	100	5.14	
3.1	*Suaeda australis*	Austral Seablite	200	5.14	
3.1	*Disphyma crassifolium*	Round-leaved Pigface	200	5.14	
3.1	*Threlkeldia diffusa*	Coastal Bonefruit	200	5.14	
3.2	*Gahnia filum*	Chaffy Saw Sedge	500	5.4	
3.2	*Cyperus gymnocaulos*	Spiny Flat-sedge	200	5.4	
3.2	*Bolboschoenus caldwellii*	Salt Club-rush	200	5.4	
3.2	*Baumea juncea*	Bare Twig-rush	200	5.4	
3.2	*Suaeda australis*	Austral Seablite	500	5.4	
3.2	*Rhagodia candolleana ssp. candolleana*	Sea berry saltbush	200	5.4	
3.2	*Threlkeldia diffusa*	Coastal Bonefruit	200	5.4	
					T

4.6 Precinct 5 Washpool east

This precinct was highly degraded and used primarily for grazing. The remnant vegetation within this precinct is limited to *Wilsonia* and *Hemichroa* herb lands which are remnant on patches of heavy saline clays which drain poorly and remain wet for extended periods. Weed cover within these patches is low due to the high salinity which excludes all but the most halophytic exotic species such as *Spergularia marina*.

Restoration of these areas will be largely due to forming a fringing sedgeland which would have largely been the pre clearance vegetation present. Extensive tracts of *Gahnia filum* are persisting in the Button Road reserve adjacent to the low lying saline areas which support *Wilsonia* and *Hemichroa* herb land. The density of the plantings surrounding these intact areas is intended to provide a buffer and allow for some natural regeneration.

Table 16. Precinct 5, Washpool east vegetation community summary.

Vegetation community	Area (Ha)	Area for revegetation	% of total area
3.1 Gahnia filum (Chaffy Saw Sedge) Sedgeland	16.1	16.1	60
4.1: *Austrostipa scabra ssp., Themeda triandra, Aristida australis, Poa labillardieri Open Grassland +/- Eucalyptus microcarpa / E. porosa Option 1 phase 1*	10.7	Half area as interstrips = 5.35 for phase 1	20
4.1: *Austrostipa scabra ssp., Themeda triandra, Aristida australis, Poa labillardieri Open Grassland +/- Eucalyptus microcarpa / E. porosa Option 1 phase 2*	10.7	Other half = 5.35 phase 2	20
4.1: Austrostipa scabra ssp., Themeda triandra, Aristida australis, Poa labillardieri Open Grassland +/- Eucalyptus microcarpa / E. porosa Option 2	10.7	10.7	40
Total option 1	26.8	26.8	100
Total option 2	26.8	26.8	100

Figure 12. Precinct 5 planting plan layout.

Table 17. Planting schedule for Precinct 5, Washpool east Option 1.

Community	Species	Common	Number / %kg hectare	Area for revegetation (ha)	Total requirement Precinct 1 (ind/kg)	Unit price ($)	Total ($)
3.1	*Gahnia filum*	Chaffy Saw Sedge	500	16.1	8050	2.6	20,930
3.1	*Cyperus gymnocaulos*	Spiny Flat-sedge	200	16.1	3220	2.6	8,372
3.1	*Bolboschoenus caldwellii*	Salt Club-rush	200	16.1	3220	2.6	8,372
3.1	*Baumea juncea*	Bare Twig-rush	200	16.1	3220	2.6	8,372
3.1	*Suaeda australis*	Austral Seablite	500	16.1	8050	2.6	20,930
3.1	*Rhagodia candolleana ssp. candolleana*	Sea berry saltbush	200	16.1	3220	2.6	8,372
3.1	*Threlkeldia diffusa*	Coastal Bonefruit	200	16.1	3220	2.6	8,372
4.1	*Eucalyptus porosa*	Mallee Box	5	5.35	26.75	6	160.5
4.1	*Eucalyptus microcarpa*	Grey Box	5	5.35	26.75	6	160.5
4.1	*Acacia pycnantha*	Golden Wattle	10	5.35	53.5	6	321
4.1	*Rhagodia candolleana ssp. candolleana*	Sea-berry Saltbush	20	5.35	107	6	642
4.1	*Austrostipa scabra ssp.*	Spear Grass	60%/kg	5.35	48.15	150	7,222
4.1	*Themeda triandra*	Kangaroo Grass	10%/kg	5.35	8.02	150	1,203
4.1	*Rytidosperma caespitosum*	Wallaby Grass	10%/kg	5.35	8.02	150	1,203
4.1	*Austrostipa drummondii*	Cottony Spear-grass	5%/kg	5.35	4.01	150	601
4.1	*Aristida australis*	Bristle Grass	5%/kg	5.35	4.01	150	601
4.1	*Poa labillardieri*	Tussock Grass	5%/kg	5.35	4.01	150	601
4.1	*Vittadinia cuneata*	New Holland Daisy	5%/kg	5.35	4.01	150	601
						Tube planting incl labour phase 1	$97,041.5
						+ scarification and hand broadcasting grass seed mix phase 1	$18,320
						Tube planting incl labour phase 2	$3,080
						+ scarification and hand broadcasting grass seed mix phase 2	$21,984
						Total planting cost precinct 1 Option 1 phase 1	$115,361
						Total planting cost precinct 1 Option 1 phase 2	$25,064
						Total	$140,425

Table 18. Planting schedule for Precinct 5, Washpool east Option 2.

Community	*Species*	Common	Number / %kg hectare	Area for revegetation (ha)	Total requirement Precinct 5 (ind	Unit price ($)	Total ($)
3.1	*Gahnia filum*	Chaffy Saw Sedge	500	16.1	8050	2.6	20,930
3.1	*Cyperus gymnocaulos*	Spiny Flat-sedge	200	16.1	3220	2.6	8,372
3.1	*Bolboschoenus caldwellii*	Salt Club-rush	200	16.1	3220	2.6	8,372
3.1	*Baumea juncea*	Bare Twig-rush	200	16.1	3220	2.6	8,372
3.1	*Suaeda australis*	Austral Seablite	500	16.1	8050	2.6	20,930
3.1	*Rhagodia candolleana ssp. candolleana*	Sea berry saltbush	200	16.1	3220	2.6	8,372
3.1	*Threlkeldia diffusa*	Coastal Bonefruit	200	16.1	3220	2.6	8,372
4.1	*Eucalyptus porosa*	Mallee Box	5	10.7	26.75	6	160.5
4.1	*Eucalyptus microcarpa*	Grey Box	5	10.7	26.75	6	160.5
4.1	*Acacia pycnantha*	Golden Wattle	10	10.7	53.5	6	321
4.1	*Rhagodia candolleana ssp. candolleana*	Sea-berry Saltbush	20	10.7	107	6	642
4.1	*Austrostipa scabra ssp.*	Spear Grass	800	10.7	8560	2.6	22,256
4.1	*Themeda triandra*	Kangaroo Grass	200	10.7	2140	2.6	5,564
4.1	*Rytidosperma caespitosum*	Wallaby Grass	200	10.7	2140	2.6	5,564
4.1	*Austrostipa drummondii*	Cottony Spear-grass	160	10.7	1712	2.6	4,451
4.1	*Aristida australis*	Bristle Grass	80	10.7	856	2.6	2,225
4.1	*Poa labillardieri*	Tussock Grass	80	10.7	856	2.6	2,225
4.1	*Vittadinia cuneata*	New Holland Daisy	80	10.7	856	2.6	2,225
					Total planting cost precinct 1 Option 2		$129,514

5 MONITORING

The Washpool and Blue Lagoon study area has pre-existing ecological values and is a diverse area with interlinking aspects that are complex in nature. Stormwater run-off, groundwater expression, sea level intrusion and variable adjoining land uses drive a dynamic system. Interactions between biological communities and the wetland are not well understood and monitoring is required to determine whether or not assumptions made in planning are suitable or adequate.

The monitoring plan has been designed to:

- Identify any concerns before they become magnified and are able to be rectified or addressed;
- Provide performance standards which can be measured and provide evaluation;
- Identify and prioritise future requirements and initiatives by assessing patterns;
- Develop responsive feedback to adjust management practices.

Monitoring of environmental parameters is proposed be undertaken at selected sites and set timeframes before and after management changes, where possible. Long-term repeatable sampling will enable comparison of results between sampling periods, the aim being to better understand the inter-relationships between environmental parameters so management can be altered accordingly.

The proposed monitoring sites include representation of the habitats present and under rehabilitation. Preferably, each parameter would be evaluated at repeat locations.

Table 19. Summary of proposed monitoring extent and quantity to demonstrate success of planting plan.

Parameter	Indicator	Purpose	Frequency
Indigenous cover	Vegetation extent and density on aerial imagery	Track change over time as a large scale qualitative measure over time	As new imagery becomes available or annually through fly over photography
Vegetation Quality	Bushland Assessment Method functional attributes	Measure of functional attributes and limitations against benchmarks for region	Biennial
Birds (Bush birds and Waders)	Diversity and abundance of species present	Demonstrate whether vegetation function attributes such as connectivity correlates with increased habitat value	Bi-annual
Breeding birds	Number of species utilising Washpool area for breeding	Indicate whether increased vegetation cover and function enhances habitat quality	Bi-annual
Water quantity	Water depth	Evaluate relationship with other parameters such as vegetation, community structure and avian presence	Quarterly
Frogs	Number of different frog calls/species seen	Demonstrate if revegetation lead to changes in amphibian activity	Annual

5.1 Performance standards

5.1.1 Vegetation

Performance standard: Consistent annual improvement of vegetation condition score based on benchmarked attributes and non-benchmarked attributes scored from direct field observations.

Monitoring sites will be established at existing bushRAT locations around the wetland and adjoining revegetation areas. Vegetation Monitoring ideally would be undertaken in late spring.

5.1.2 Birds

Performance standard: Increased species richness and utilisation by indigenous avian species across seasons / year.

Species, numbers and breeding observations can be recorded by members of the community and Birds SA. There will also be an opportunity to include any counts in line with the Shorebirds 2020 national shorebird monitoring.

5.1.3 Frogs

Performance standard: Increased abundance and species composition of amphibian species throughout seasons / year.

Amphibian monitoring will be incorporated as part of the frog watch census (http://www.frogwatchsa.com.au). Surveys to be undertaken consistently with dates determined by prevailing weather conditions (still night following rain). Additional monitoring may be undertaken prior to and after a change in water management.

Table 20. Monitoring requirement summary.

Parameter	Baseline Data	Description of ongoing monitoring	Location
Vegetation	Bushland condition monitoring benchmark communities SMLR	Reporting of bushland condition monitoring sites and qualitative measure of photo points	Permanent markers
Birds	Review of previous data	Field Survey	Pathway Transect
Frogs	Frogwatch	Field Survey	Repeat locations/Pathway Transect
Water depth	Historical measures	Quarterly measures	Permanent markers

6 MAINTENANCE

One of the keys to the success of revegetation is the follow up maintenance which includes additional watering, weed control, possibly insect control, re-installation of tree guards and stakes and removal of tree guards and stakes. The maintenance of the revegetation plots can be programmed in advance, however the program should monitored and remain flexible to allow for weather conditions. For example during hot summers and periods of low rainfall the plantings may need additional watering and during periods of high rainfall additional weed control events may be required. The replacement of tree guards and stakes may occasionally be required due to vandalism or strong winds. Guards and stakes should be ready to be removed approximately 18 months after the initial planting; again, this will need to be monitored. A summary of the maintenance schedule is tabled below in Table 21.

Table 21. Annual maintenance schedule

Event	Timing	Year 1	Year 2	Year 3	Year 4	Year 5
Watering	Late Spring / Summer	✓				
Pest management	As required	✓	✓			
Tree guard maintenance	Bi-monthly	✓				
Follow up weed control	Quarterly	✓	✓	✓	✓	✓
Follow up infill planting as result of monitoring	Annual, Winter		✓	✓		
Tree guard and rubbish removal	Annual			✓	✓	✓
Repair of damage through human activity, storms etc.	As required	✓	✓	✓	✓	✓
Pruning, maintenance of fire breaks, slashing	As required		✓	✓	✓	✓

7 COSTING SUMMARY

Table 22. Cost summary planting precincts 1-5.

Area	Action	Year				
		1	2	3	4	5
Fence removal	Removal of internal fences to allow consistent spraying strips and management	5,000.00				
Pest management	Removal of woody weeds and declared species prior to ground disturbance	1,760.00	1,500.00			
Pre planting spraying	Application of knock down herbicide and strip spraying of relevant areas 2 applications including chemical @ $105/Ha	1,249.00	836.85	2,814.00	1,453.20	609
Planting, Precinct 1	Planting as per plan, Washpool central year 1	53,074.00				
Planting, Precinct 2	Planting as per plan, Washpool south year 2		42,953.00			
Planting, Precinct 3	Planting as per plan, Blue lagoon year 1		8,269.00			
Planting Precinct 5 Option 1	Option 1 to split planting into 2 inter-strips, years 3 and 5			115,361.00		25,064.00
Planting Precinct 4 Option 1	Plant precinct 4 Norman Road as the inter year (4) under option 1				71,555.00	
Planting, Precinct 5 Option 2	Option 2 to condense planting Washpool East into single year using tube stock				129,514.00	
Planting Precinct 4 Option 2	Plant precinct 4 Norman Road as priority to precinct 5 under option 2			71,555.00		
Maintenance	guard collection, re- staking etc,		5,280.00	10,500.00	10,500.00	10,500.00
Maintenance	Slashing of Exotic grasses in Native grass areas $500/day		1,000.00	2,000.00	2,000.00	2,000.00
Maintenance	Spot Spraying		1,000.00	1,000.00	1,000.00	1,000.00
Monitoring	Annual monitoring program field survey and report		3,840.00	3,840.00	3,840.00	3,840.00
	Total Option 1	$61,083	$64,679	$135,515	$90,348	$43,013
	Total Option 2	$61,083	$64,679	$91,709	$148,307	$17,949

8 REFERENCES

Aldinga Washpool Lagoon (2017) History of the Washpool, The Tjirbruke Dreaming Track & Cultural revival. Online resource viewed 5th July, 2017. <<http://aldingaWashpool.net/index.php/history>>

Australian Cultural Heritage Management (2009) *An Aboriginal (Kaurna) Cultural Heritage Assessment for the proposed reinstatement of the Aldinga Washpool, South Australia, stage 1*.

Brooker, L. Brooker, M. Cale, P. (1999) Animal dispersal in fragmented habitat: Measuring Habitat Connectivity, Corridor Use, and Dispersal Mortality. *Conservation Ecology* online 3(1)

Bureau of Meteorology (1992) The Australian Baseline Sea level Monitoring Projects Annual Sea Level Data Summary Report July 2010 – June 2011. Department for Environment and Energy (2017) Sea Level. Online resource viewed 5th July, 2017. <http://www.environment.gov.au/climate-change/climate-science/climate-change-future/sea-level>

Coastal Protection Board (2016), Coastal Protection Board Policy Document. Revised 29 July, 2016.

Ecological Associates (2003) *Environmental Water Requirements of Aldinga Scrub, Blue Lagoon and the Washpool.* The City of Onkaparinga and The Onkaparinga Catchment Water Management Board

Flora Bank (1998) The Model Code of Practice for Community Based Collectors and Suppliers of Native Seed. Online resource viewed 5th July, 2017. <http://www.florabank.org.au/files/documents/Model%20Code%20of%20Practice%20for%20community-based%20collectors%20and%20suppliers%20of%20native%20plants.pdf>

Getz, D. Brown, G. (2006) Critical success factors for wine tourism regions: a demand analysis. *Tourism Management* Volume 27, Issue 1, Pages 146-158

Goolwa Wellington Local Action Planning SA (2010) Windbreaks and Shelterbelts. Online resource accessed 5th July 2017 <http://www.gwlap.org.au/publications.php>

Hill, A. Payton, J.D. (2000) Effect of plant fill ratio on water temperature in constructed wetlands, Bioresource Technology Volume 71, Issue 3, Pages 283-289

Krutz, L.J, Senseman S.A, Zablotowicz R.A, Matocha M.A, (2005) Reducing herbicide runoff from agricultural fields with vegetative filter strips: a review. Weed Science, 53:353–367.

Morphett 1837, SA: Latest Information... contained in a letter written by Mr Morphett, Gliddon, London: 9-10.

Munro NT, Lindenmayer DB, Fisher J (2007) Faunal response to revegetation in agricultural areas of Australia: a review. *Ecological Management and Restoration* 8:199–207

Paerl, H.W. Huisman, J (2008) Blooms Like It Hot. Science Magazine. Vol 320 4

Purnell, C., Peter, J., Clemens, R. 2017. Shorebird Population Monitoring within Gulf St Vincent: July 2015 to June 2016 Annual Report. BirdLife Australia report for the Adelaide and Mount Lofty Ranges Natural Resources Management Board.

QED Pty Ltd (2007) *Washpool Lagoon and Environs Management Plan*. In association with Green Environmental Consultants, Epawe and Graham Carpenter

Schultz, C., 2014, Place Name SUMMARY (PNS) 4.04.01/03 WAKONDILLA / WANGKONDILLA (last edited: 5/12/2014), Kaurna Warra Pintyanthi, The Southern Kaurna Place Names Project.

Shanahan, D. Miller, C. Possingham, H. Fuller, R. (2011) The influence of patch area and connectivity on avian communities in urban revegetation. *Biological Conservation* V 144, pp 722-729

Sinden, J. Jones, R. Hester, S. Odom, D. Kalisch, C, James, R. Cacho, O. (2004) The economic impact of weeds in Australia. Report to the CRC for Australian Weed Management

SKM (2008) Washpool Lagoon Restoration Action Plan. Report to the City of Onkaparinga.

City of Onkaparinga (2016) Silver Sands Catchment Stormwater Management Plan.

T & M Ecologists (2016) Washpool Lagoon Vegetation Survey and Mapping 2016. Report to Natural Resources, Adelaide and Mount Lofty Ranges.

Van der Heijden, M.G.A Bardgett, R.D. Van Straalen, N.M. (2008) The unseen majority: soil microbes as drivers of plant diversity and productivity in terrestrial ecosystems Ecology Letters, 11: 296–310

Van Oosterzee, P. (2000) Ecotourism and biodiversity conservation - two way track. *Pacific Conservation Biology* 6(2) 89 - 93

9 APPENDICES

Planting methods

Forestry Tube Stock

Forestry tube stocks are a standard pot for growing large quantities of trees, designed for the forestry industry to deliver the strongest healthiest plants giving them the best chance of surviving transplanting. Measuring 50x50mm square at the top and 120mm long and tapering.

Hiko

Hiko are a smaller pot size ideal for growing small shrubs and grasses. On average 40-50mm in diameter at the top and 50-100mm long and tapering.

Hamilton Tree Planters

Hamilton tree Planters are a specifically designed tool for planting Forestry tube stock and Hiko, makes a planting hole the right shape and depth for the seedling type, eliminating air gaps, planting depth is determined by how far the planter is pushed into the ground. Minimising ground disturbance around the planting area. The Hamilton Tree Planter is used by pushing the tube template into the ground using foot pedals. The template removes a divot the size of the seedling tube to be planted. The seedling tube is then inserted and watered in. Square (Hamilton) and round (Hiko).

Pottiputki Tree Planter

A Pottiputki planter consists of a hollow tube with a duck bill end that is driven into the ground by foot and levered open to create a hole suitable for the seedling. The seedling is then dropped down the tube into the hole and pressed into place with foot pressure. Soils must be reasonably friable. (Ideal in sandy areas)

Tree Guards

Tree Guards are used for three main reasons:

- As protection against differing climatic conditions such as frost or strong winds.
- As protection against grazing animals such as rabbits, sheep, cattle etc.
- As a barrier to prevent damage by machinery, example: brush cutters and weed spraying as part of maintenance program.
- There are several different configurations of tree guards available all are secured to the ground using bamboo sticks or timber steaks. There are various styles of guards available etc.: Cardboard, Plastic film, Corflute, and Open mesh.

Vegetation Filter Strips

Vegetation filter strips, or buffer strips, are barriers that intercept or slow water flow, thereby reducing erosive capacity and increasing sedimentation. (VFS) is an area of vegetation designed to remove sediment and other pollutants from surface water runoff through filtration, deposition, infiltration, adsorption, decomposition, and/or volatilization. Filter strips were originally used as an agricultural treatment practice, but have more recently evolved into an urban practice. Within an agricultural context, vegetative filter strips are generally referred to as banded areas of planted or indigenous vegetation which are positioned between a potential pollutant source area (cropland) and a surface water body that receives runoff

Construction of VFS could be done by following a contour across the area affected by the water shed, with a surface scraping 100mm deep and 22 metres wide being optimal Yu and Benelmouffok (1990) with the over-burden / top soil pushed to the downstream side. The scraped area can then be scarified and native grasses / plants planted directly into the scarified soil at high densities.

Vegetation filter strips are most effective in reducing sediment and nutrients in runoff water if flow is dispersed along the length of the strip. When flow through the filter strip is concentrated, the filter is less effective.

Buffers

A bushfire buffer zone is intended to provide strategically located fuel reduced areas that decrease the potential for large bushfires to develop across the landscape. Bushfire Buffer Zone's will typically be located in bushland at the urban fringe or close to rural assets and will complement Asset Protection Zones. They provide areas that assist in making bushfire suppression activities more effective and safer for firefighters. A Bushfire Buffer Zone may also be used in large areas of native vegetation (e.g. farmland, reserves or parklands) that protect community assets across the landscape. These areas of native vegetation will typically be modified yet they will still provide for significant biodiversity value. (Natural Resources SA)

Edge effects

Minimising edge-effects - an edge-effect is an 'artificial' ecotone between the remnant natural ecosystem and the adjacent, often anthropogenically changed ecosystem (Winning 1997), and is often characterised by disturbances such as weed infestation, dumped rubbish and partial clearing. Applying buffer zones to contain edge-effects can be important for sensitive areas of small size, such as small, disconnected wetlands, or narrow water courses.

Residential Housing

Where residential housing boarders the project area there should be a minimum 5metre buffer strip in from the boundary. This area could be planted with native grasses, groundcovers and low shrubs provided it varies from adjoining planted area. This would also give access through the site for firefighting and service vehicles conducting maintenance.

Tracks / Boundaries

Tracks and other Boundary though and or across the site could be managed in the same manner.

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