




City of Holdfast Bay

Warriparri (Sturt Creek) Biodiversity Corridor Site Plans



T&M Ecologists Pty Ltd

January 2019

Document Information	
Client	City of Holdfast Bay
Issue Date	28/1/19
Version	1.1
Author	Tim Milne
Title	Director
Signature	
Verified by	Sarah Telfer
Title	Director

Document History	
Version	Issue Date
1.0	18/1/19
1.1	28/1/19

T&M Ecologists Pty Ltd have prepared this report for the sole purposes of the Client for the specific purpose only for which it is supplied. We accept no liability for any direct or consequential loss arising from the transmission of this information to third parties. This report is current at the date of writing only and T&M Ecologists Pty Ltd will not be responsible for informing of any future changes in circumstances which may affect the accuracy of the information contained in this report. T&M Ecologists Pty Ltd does not offer or hold itself out as offering any advice relating to legal or regulatory implications.

Certain assumptions have been made in the preparation of this report. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

T&M Ecologists Pty Ltd
 5/26 Hack St
 Mount Barker, South Australia 5251
 Telephone: (08) 8185 3225
 tim.milne@tmecologists.com.au

Contents

1. Introduction	4
1.1 Potential for use of land managed by SA Water as part of the project.....	5
2. Individual plans for each specified site	10
2.1 Shannon Avenue Reserve	10
2.2 Blackburn Avenue Reserve	14
2.3 Fordham Reserve	17
2.4 Stewart Avenue Reserve	21
2.5 Bob Lewis Reserve	24
2.6 Summary of costs.....	27
3. Monitoring and evaluating outcomes for the project	28
3.1 Photopoints.....	28
3.2 Repeat Assessment of Biodiversity Baseline Data	29
3.3 Bird monitoring	29

1. Introduction

The City of Holdfast Bay comprises 14 square kilometres and is home to approximately 37,000 people who all reside within 2.5 kilometres of the nine-kilometre stretch of coastline. It boasts a rich heritage, beautiful natural environment, high-quality recreational and community facilities, and a small light industrial area.

The City of Holdfast Bay Council area is highly urbanised. In 2018 Milne^{1,2} conducted an inventory of the biodiversity values of Council reserves and other areas of non-privately held land within the City of Holdfast Bay area. This inventory demonstrated that reserves in the south of the Council area, such as Gilbertson Gully, Barton Gully and Kingston Cliff Face had the highest biodiversity values, as these reserves contained areas of remnant vegetation. Northern and central areas of the Council area had reserves that were generally highly modified, with little remnant vegetation remaining (Figure 1).

The City of Holdfast Bay's current Strategic Plan sets out the following specific biodiversity targets:

1. PROTECTING BIODIVERSITY

- Increase native flora (species and population) in natural areas: target increase – 10%
- Increase native fauna habitats in natural areas: target increase – 10%

2. BUILDING AN ENVIRONMENTALLY RESILIENT CITY

- Maintain our dune systems and increase recreational beach widths

To meet Biodiversity Target 1, the City of Holdfast Bay will need to undertake biodiversity management and improvement programs. Due to the highly urbanised nature of the Council area in general, options for broadscale biodiversity programs were noted to be limited. However it was recognised that there were opportunities for biodiversity works (principally revegetation) associated with the reserves and other public land in association with Warriparrri (Sturt Creek) in the northern section of the Council area. These areas were seen to be favourable for a biodiversity focus as they:

- include several reserves in close proximity;
- provide a linkage from the Adelaide Airport/Patawolong River mouth with remnant patches in the hills face zone; and
- provide opportunities for revegetation in conjunction with other authorities (e.g. SA Water)¹.

Most of these reserves currently have minimal biodiversity values, generally comprising a mown introduced grass understorey with an overstorey generally comprising non-indigenous tree species. The intent of revegetation programs in these reserves would be to retain much of this green space, but to use edges and boundaries of reserves to increase habitat values for fauna through plantings of native flora species.

¹ Milne, T. (2018). City of Holdfast Bay Biodiversity Baseline Data Study: Priority Sites. Unpublished report prepared for the City of Holdfast Bay.

² Milne, T. (2018). City of Holdfast Bay Biodiversity Baseline Data Study: Phase 2 All Remaining Reserves. Unpublished report prepared for the City of Holdfast Bay.

Pre-European vegetation mapping along this part of Warriparri shows a mix of:

- *Lignum (Duma florulenta)* Shrublands,
- *Callitris gracilis* (Southern Cypress Pine),
- *Allocasuarina verticillata* (Drooping Sheoak),
- *Banksia marginata* (Silver Banksia) Woodland, and
- *Acacia cupularis/ligulata* (Umbrella Bush), *A. acinacea* (Wreath Wattle), *Pomaderris paniculosa* (Mallee Pomaderris) Shrubland³.

However, given the level of soil disturbance that resulted from the digging of the Warriparri drain, coupled with highly modified waterflow patterns, some of these vegetation types may no longer be feasible under current conditions. It is recommended that a revegetation program should focus on the development of an open woodland of *Callitris gracilis* (Southern Cypress Pine), *Allocasuarina verticillata* (Drooping Sheoak), *Banksia marginata* (Silver Banksia) and scattered Mallee Box (*Eucalyptus porosa*), with a range of low shrubs, grasses and herbs in the understorey.

This report maps specific locations, and presents revegetation species lists, including lifeforms and planting densities, for reserves along Warriparri that have been identified by Council staff as being appropriate for revegetation⁴. The areas for revegetation are shown in Figure 2. To ensure good biodiversity outcomes from any revegetation undertaken, along with ensuring that maintenance (and therefore ongoing cost) is minimised, the following broad principles have been applied to the revegetation programs designed for each reserve:

- Overstorey (tree and shrub) layer is composed of plant species at similar densities to the woodland and shrubland vegetation types that would once have occurred in the area.
- Understorey (low shrub, lily, creeper, forb and grass) comprises plant species that would once have occurred in the area⁵, with a particular focus on species that are hardy, and will provide specific habitat attributes to support native fauna.
- Revegetation to be undertaken in a manner that minimises ongoing maintenance (e.g. by use of mulch to prevent weed proliferation).

1.1 Potential for use of land managed by SA Water as part of the project

The specific plans provided here detail revegetation to be undertaken in Council reserves. There may be opportunities to collaborate with SA Water along the narrow strip of land they manage adjacent to the Warriparri drain (Figure 3), provided this is in line with SA Water's management framework for this area. This strip of land, on both sides of the drain, is generally about 10 to 15 metres wide. Currently these areas are regularly mowed, with scattered tree plantings over a principally introduced grass and mat plant (mostly *Galenia sp.*) understorey. Figure 4 provides an indicative image of this SA Water managed land.

One possible approach could be to revegetate using a similar suite of species proposed for individual sites in Section 2 of this report, but in patches (say 10-15 m by 5 m), spaced 10-15 m apart, leaving

³ Government of South Australia (2000). Forests and Woodlands of the Adelaide Plain in 1836 – a native vegetation planting guide. Government of South Australia, Adelaide.

⁴ Specific reserves detail provided by Ben Hall, Technical Arboriculture Officer, City of Holdfast Bay.

⁵ Using "Government of South Australia (2000). Forests and Woodlands of the Adelaide Plain in 1836 – a native vegetation planting guide. Government of South Australia, Adelaide", and existing records derived from Naturemaps and Milne^{1,2} for the City of Holdfast Bay area.

adequate space to enable mowers to move around patches. Whilst these areas would potentially provide habitat values for native fauna, ongoing maintenance would be relatively cost effective for SA Water. These areas would improve connectivity and area of potential habitat. It is recommended that SA Water be contacted to discuss the potential options for revegetation in these narrow strips adjoining Warriparri. **However, it should be noted that populations of the State Endangered Black Cotton Bush (*Maireana decalvans*) were found in this SA Water Land, and revegetation would need to ensure no negative impact on these plants.** Milne⁶ provides an overview of the location of these populations, but it may be worthwhile conducting a thorough audit of these subpopulations if revegetation works do go ahead.



Figure 4: Typical section of SA Water managed land adjacent to Warriparri drain

⁶ Milne, T. (2018). City of Holdfast Bay Biodiversity Baseline Data Study: Priority Sites. Unpublished report prepared for the City of Holdfast Bay.

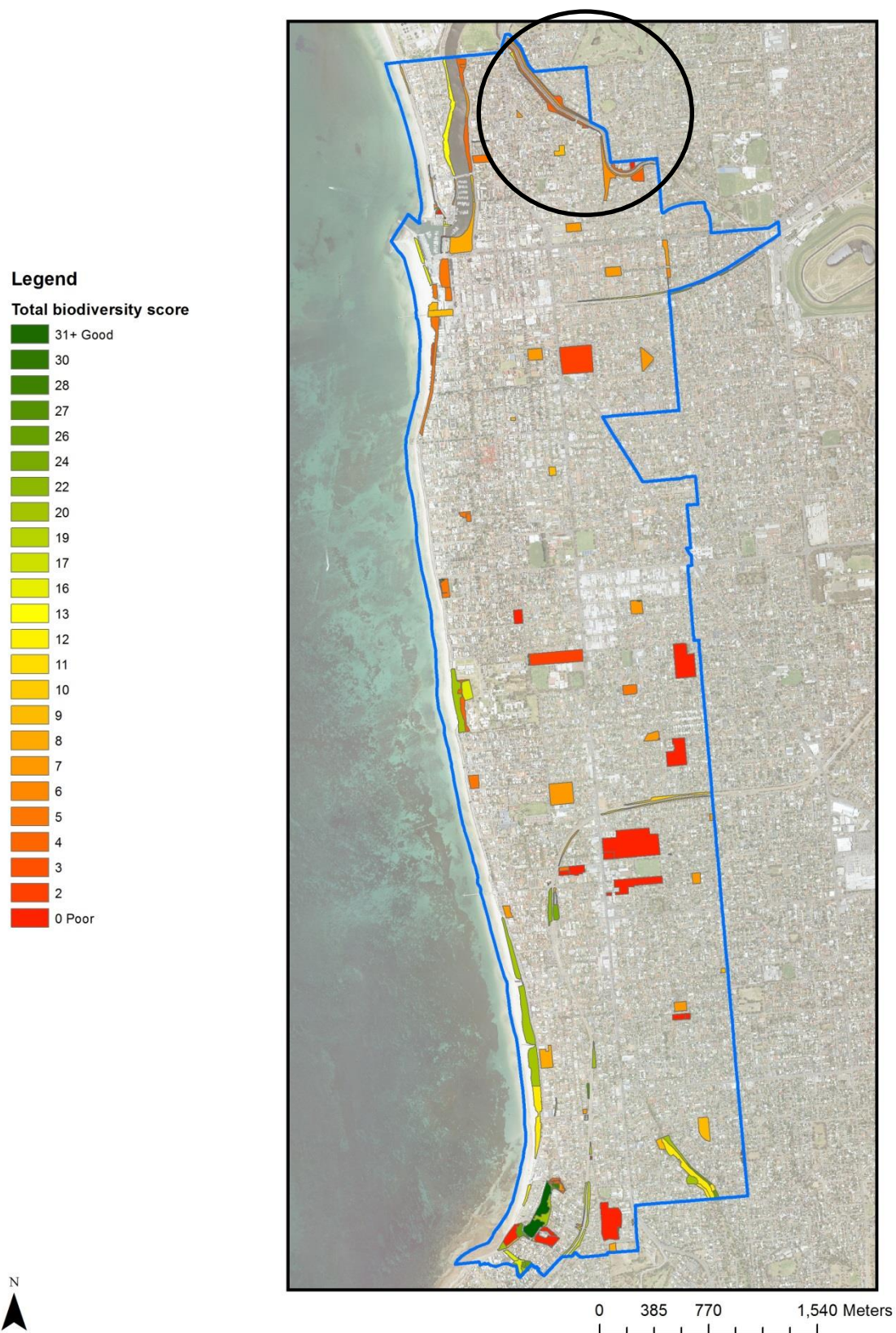


Figure 1: Biodiversity ratings for City of Holdfast Bay reserves and other public land. The section for biodiversity corridor works is circled.

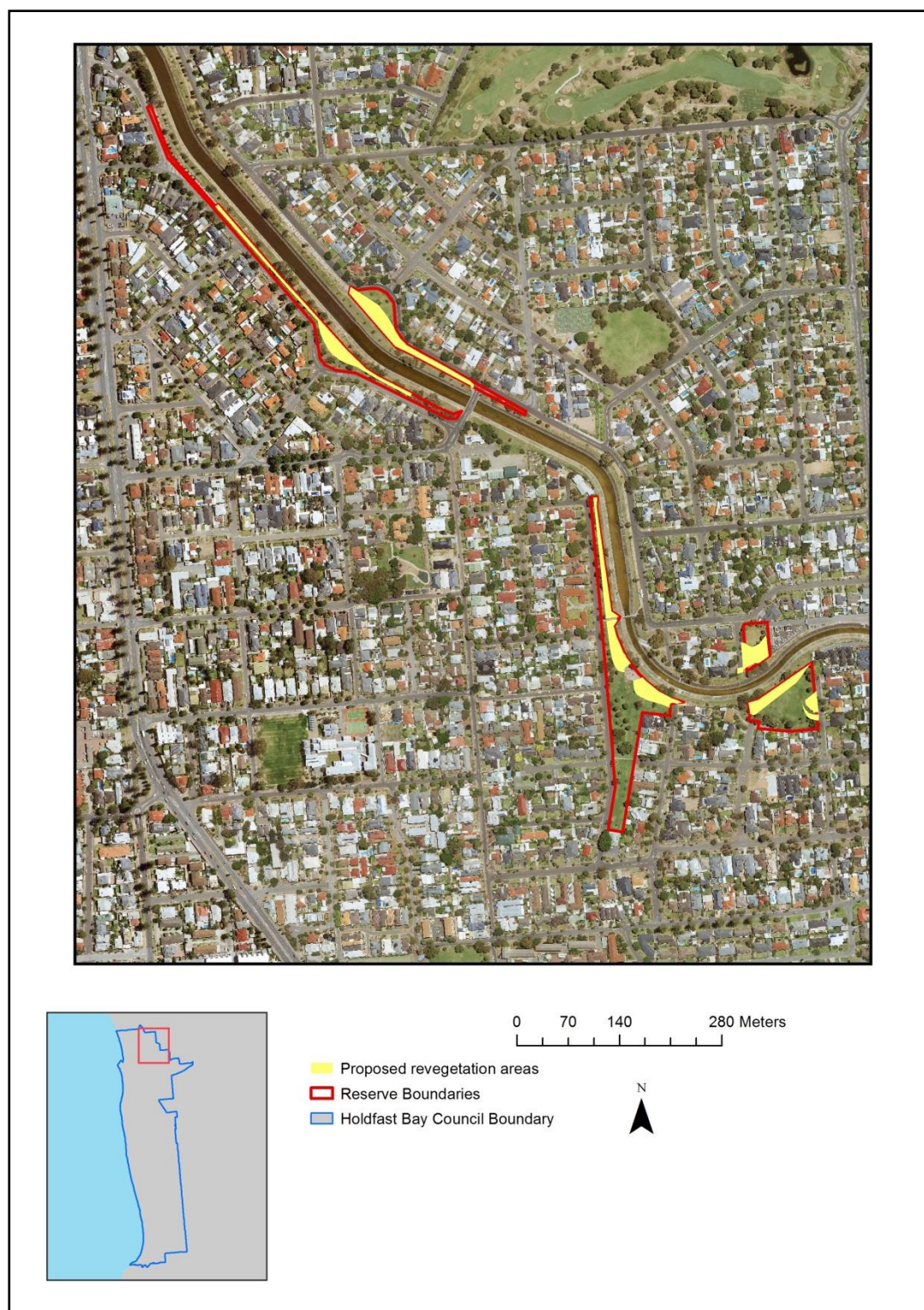


Figure 2: Identified areas for revegetation within specified reserves.

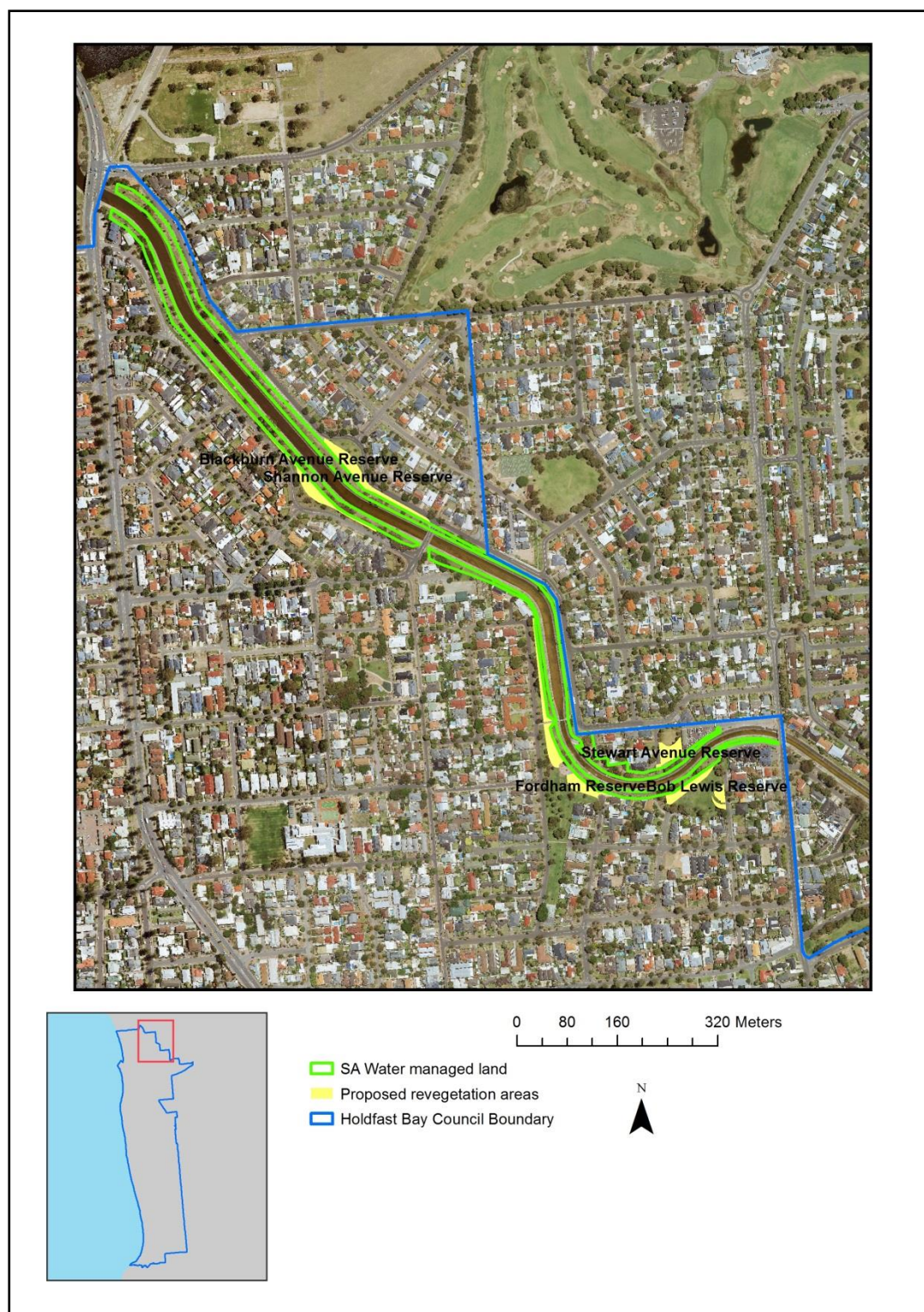


Figure 3: Areas of SA Water managed land adjacent to Warriparri

2. Individual plans for each specified site

2.1 Shannon Avenue Reserve

Total area for revegetation (as shown in Figure 5): 2,346m²

Indicative site photograph (February 2018)



Location of photograph (WGS 84) Easting: 273656

Northing: 6127828

Direction: SE

Suggested list of revegetation species, including numbers to be planted:

SPECIES	COMMONNAME	Lifeform	Number*
<i>Eucalyptus camaldulensis</i> ssp. <i>camaldulensis</i>	River Red Gum	TT	5
<i>Allocasuarina verticillata</i>	Drooping Sheoak	MT	15
<i>Callitris gracilis</i>	Southern Cypress Pine	MT	15
<i>Eucalyptus porosa</i>	Mallee Box	MT	15
<i>Acacia pycnantha</i>	Golden Wattle	ST	15
<i>Pittosporum angustifolium</i>	Native Apricot	ST	15
<i>Adriana quadripartita</i>	Coast Bitter-bush	TS	25
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria	TS	40
<i>Olearia axillaris</i>	Coast Daisy-bush	TS	40
<i>Acacia acinacea</i>	Wreath Wattle	MS	40
<i>Acacia cupularis</i>	Cup Wattle	MS	15
<i>Dodonaea viscosa</i> ssp. <i>spatulata</i>	Sticky Hop-bush	MS	15
<i>Scaevola crassifolia</i>	Cushion Fanflower	MS	15
<i>Acrotriche patula</i>	Prickly Ground-berry	LS	40
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	LS	40
<i>Eutaxia microphylla</i>	Common Eutaxia	LS	40
<i>Goodenia amplexans</i>	Clasping Goodenia	LS	40
<i>Leucophyta brownii</i>	Coast Cushion Bush	LS	75
<i>Pultenaea largiflorens</i>	Twiggy Bush-pea	LS	75
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush	LS	50
<i>Scaevola albida</i>	Pale Fanflower	LS	75
<i>Chrysocephalum apiculatum</i>	Common Everlasting	FO	120
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	FO	120
<i>Lotus australis</i>	Austral Trefoil	FO	120
<i>Pelargonium australe</i>	Austral Stork's-bill	FO	120
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy	FO	60
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	FO	60
<i>Austrostipa elegantissima</i>	Feather Spear-grass	TG	60
<i>Austrostipa eremophila</i>	Rusty Spear-grass	TG	60
<i>Austrostipa flavescens</i>	Coast Spear-grass	TG	60
<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass	TG	120
<i>Themeda triandra</i>	Kangaroo Grass	TG	120
<i>Enneapogon nigricans</i>	Black-head Grass	LG	120
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	LG	120
<i>Dianella brevicaulis</i>	Short-stem Flax-lily	LSE	120
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily	LSE	120
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge	LSE	60
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush	LSE	60
<i>Atriplex semibaccata</i>	Berry Saltbush	MP	25
<i>Einadia nutans</i> ssp. <i>nutans</i>	Climbing Saltbush	MP	75
<i>Billardiera cymosa</i> ssp. <i>cymosa</i>	Sweet Apple-berry	VI	25
<i>Hardenbergia violacea</i>	Native Lilac	VI	75
<i>Myoporum parvifolium</i>	Creeping Boobialla	VI	25
Total			2,550

* Number of tubestock for initial planting

Lifeform codes: TT – tall tree >15m, MT – medium tree 5-15m, ST – small tree <5 metres, TS – tall shrub >2m, MS – medium shrub 1-2m, LS – low shrub <1m, FO – forb, TG – tall grass >40cm, LG – low grass <40cm, LSE – low sedge < 1m, MP – mat plant, VI – vine/climber/scrambler

Site preparation:

Groundcover in this site is principally introduced grasses and mat plants on a sandy loam soil. The site will need to be prepared by spraying out these introduced plants, and, to prevent weed proliferation in the longer term, appropriate sterile mulch should be applied to a depth of 10 cm.

Indicative costing for this site:

Initial costs:

Site preparation (spraying and mulch):

Spray out site: broad-scale spraying of site with herbicide prior to planting could be undertaken by Council works staff using Council equipment⁷

Volume of mulch required: 235m³ (for 10cm depth)

Mulch cost: (based on \$69.54m³)⁸: \$16,314

Tubestock and planting costs:

Tubestock: \$5,123

Planting costs (@\$3.50 per plant): \$8925

Ongoing maintenance: Council will need to consider whether ongoing maintenance is undertaken by Council staff, or whether a contractor is required given the size of areas and number of plants involved. The following costs are based upon 2 years of watering, four times per year (November, December, January, February), and weed control 4 visits per year for 2 years, with contractor based on a \$55 per hour rate:

Maintenance costs:

Watering costs (based on one minute per plant), eight visits, \$55 per hour: \$18,700

Weed control costs (for 2 years only), eight visits, \$55 per hour: \$9350

⁷ Ben Hall pers. comm.

⁸ Costing includes delivery and blown in with the Powerscaper (ie spread on site). Estimate provided by Dylan Digby, Jeffries Landscaping.

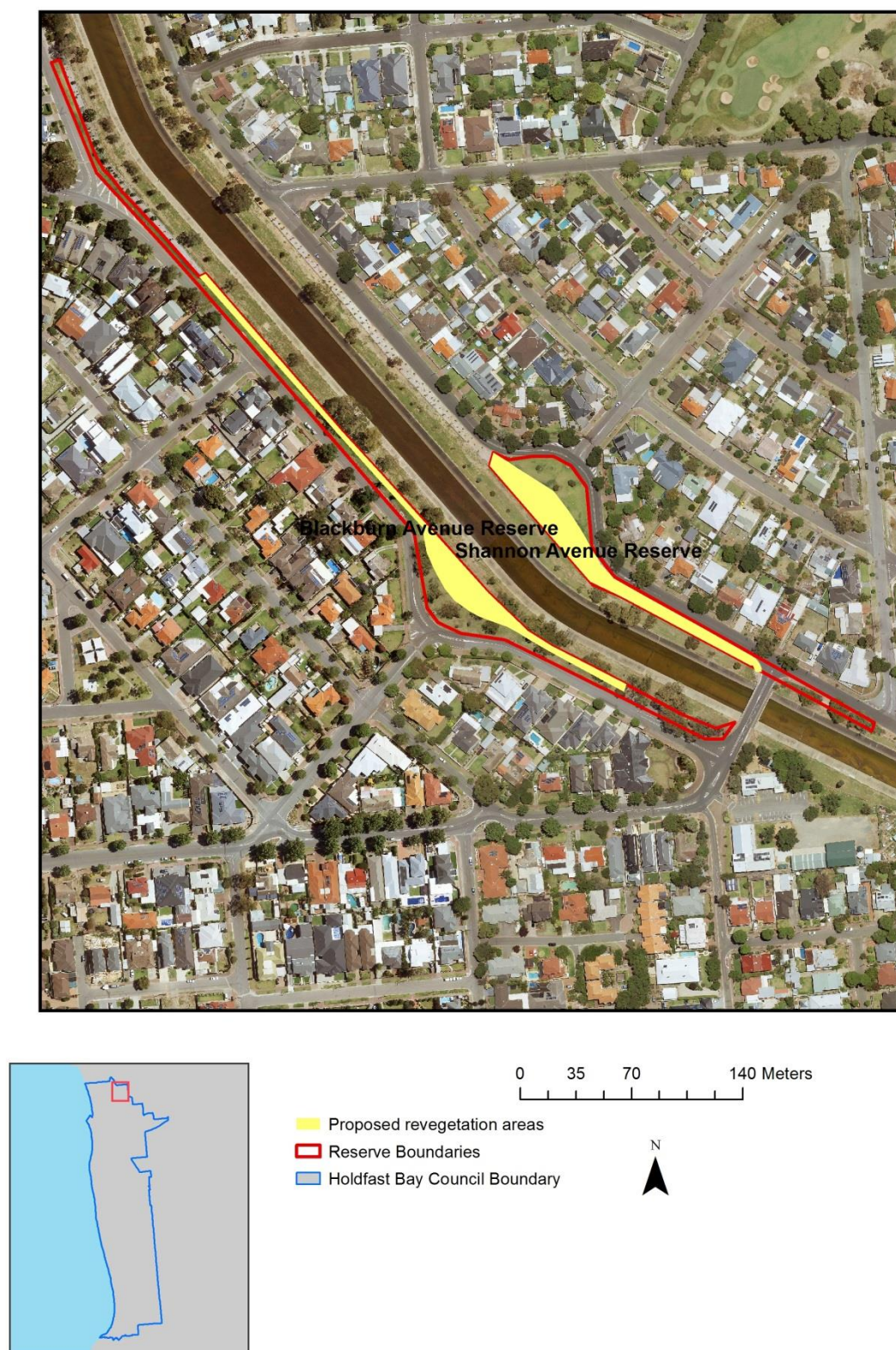


Figure 5: Shannon Avenue Reserve and Blackburn Avenue Reserve

2.2 Blackburn Avenue Reserve

Total area for revegetation (as shown in Figure 5): 2,285m²

Indicative site photograph (February 2018)



Location of photograph (WGS 84) Easting: 273590

Northing: 6127794

Direction: SSE

Suggested list of revegetation species, including numbers to be planted:

SPECIES	COMMONNAME	Lifeform	Number*
<i>Eucalyptus camaldulensis</i> ssp. <i>camaldulensis</i>	River Red Gum	TT	5
<i>Allocasuarina verticillata</i>	Drooping Sheoak	MT	15
<i>Callitris gracilis</i>	Southern Cypress Pine	MT	15
<i>Eucalyptus porosa</i>	Mallee Box	MT	15
<i>Acacia pycnantha</i>	Golden Wattle	ST	15
<i>Pittosporum angustifolium</i>	Native Apricot	ST	15
<i>Adriana quadripartita</i>	Coast Bitter-bush	TS	25
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria	TS	35
<i>Olearia axillaris</i>	Coast Daisy-bush	TS	35
<i>Acacia acinacea</i>	Wreath Wattle	MS	35
<i>Acacia cupularis</i>	Cup Wattle	MS	15
<i>Dodonaea viscosa</i> ssp. <i>spatulata</i>	Sticky Hop-bush	MS	15
<i>Scaevola crassifolia</i>	Cushion Fanflower	MS	15
<i>Acrotriche patula</i>	Prickly Ground-berry	LS	35
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	LS	35
<i>Eutaxia microphylla</i>	Common Eutaxia	LS	35
<i>Goodenia amplexans</i>	Clasping Goodenia	LS	35
<i>Leucophyta brownii</i>	Coast Cushion Bush	LS	70
<i>Pultenaea largiflorens</i>	Twiggy Bush-pea	LS	70
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush	LS	50
<i>Scaevola albida</i>	Pale Fanflower	LS	70
<i>Chrysocephalum apiculatum</i>	Common Everlasting	FO	115
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	FO	115
<i>Lotus australis</i>	Austral Trefoil	FO	115
<i>Pelargonium australe</i>	Austral Stork's-bill	FO	115
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy	FO	60
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	FO	60
<i>Austrostipa elegantissima</i>	Feather Spear-grass	TG	60
<i>Austrostipa eremophila</i>	Rusty Spear-grass	TG	60
<i>Austrostipa flavescens</i>	Coast Spear-grass	TG	60
<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass	TG	115
<i>Themeda triandra</i>	Kangaroo Grass	TG	115
<i>Enneapogon nigricans</i>	Black-head Grass	LG	115
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	LG	115
<i>Dianella brevicaulis</i>	Short-stem Flax-lily	LSE	115
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily	LSE	115
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge	LSE	60
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush	LSE	60
<i>Atriplex semibaccata</i>	Berry Saltbush	MP	25
<i>Einadia nutans</i> ssp. <i>nutans</i>	Climbing Saltbush	MP	70
<i>Billardiera cymosa</i> ssp. <i>cymosa</i>	Sweet Apple-berry	VI	25
<i>Hardenbergia violacea</i>	Native Lilac	VI	70
<i>Myoporum parvifolium</i>	Creeping Boobialla	VI	25
Total			2,440

* Number of tubestock for initial planting

Lifeform codes: TT – tall tree >15m, MT – medium tree 5-15m, ST – small tree <5 metres, TS – tall shrub >2m, MS – medium shrub 1-2m, LS – low shrub <1m, FO – forb, TG – tall grass >40cm, LG – low grass <40cm, LSE – low sedge < 1m, MP – mat plant, VI – vine/climber/scramber

Site preparation:

Groundcover in this site is principally introduced grasses and mat plants on a loamy soil. The site will need to be prepared by spraying out these introduced plants, and, to prevent weed proliferation in the longer term, appropriate sterile mulch should be applied to a depth of 10 cm.

Indicative costing for this site:

Initial costs:

Site preparation (spraying and mulch):

Spray out site: broad-scale spraying of site with herbicide prior to planting could be undertaken by Council works staff using Council equipment⁹

Volume of mulch required: 229m³ (for 10cm depth)

Mulch cost: (based on \$69.54m³)¹⁰: \$15,890

Tubestock and planting costs:

Tubestock: \$4,901

Planting costs (@\$3.50 per plant): \$8,540

Ongoing maintenance: Council will need to consider whether ongoing maintenance is undertaken by Council staff, or whether a contractor is required given the size of areas and number of plants involved. The following costs are based upon 2 years of watering, four times per year (November, December, January, February), and weed control 4 visits per year for 2 years, with contractor based on a \$55 per hour rate:

Maintenance costs:

Watering costs (based on one minute per plant), eight visits, \$55 per hour: \$17,893

Weed control costs (for 2 years only), eight visits, \$55 per hour: \$8947

⁹ Ben Hall pers. comm.

¹⁰ Costing includes delivery and blown in with the Powerscaper (ie spread on site). Estimate provided by Dylan Digby, Jeffries Landscaping.

2.3 Fordham Reserve

Total area for revegetation (as shown in Figure 6): 3,149m²

Indicative site photograph (February 2018). (Note that a new photopoint should be established in this site, as the photopoint shown will not include the area that will be revegetated. It has been included here to provide context to the general nature of the reserve).



Location of photograph (WGS 84) Easting: 274017 Northing: 6127291 Direction: S

Suggested list of revegetation species, including numbers to be planted:

SPECIES	COMMONNAME	Lifeform	Number*
<i>Eucalyptus camaldulensis</i> ssp. <i>camaldulensis</i>	River Red Gum	TT	10
<i>Allocasuarina verticillata</i>	Drooping Sheoak	MT	20
<i>Callitris gracilis</i>	Southern Cypress Pine	MT	20
<i>Eucalyptus porosa</i>	Mallee Box	MT	20
<i>Acacia pycnantha</i>	Golden Wattle	ST	20
<i>Pittosporum angustifolium</i>	Native Apricot	ST	20
<i>Adriana quadripartita</i>	Coast Bitter-bush	TS	35
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria	TS	50
<i>Olearia axillaris</i>	Coast Daisy-bush	TS	50
<i>Acacia acinacea</i>	Wreath Wattle	MS	50
<i>Acacia cupularis</i>	Cup Wattle	MS	20
<i>Dodonaea viscosa</i> ssp. <i>spatulata</i>	Sticky Hop-bush	MS	20
<i>Scaevola crassifolia</i>	Cushion Fanflower	MS	20
<i>Acrotriche patula</i>	Prickly Ground-berry	LS	50
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	LS	50
<i>Eutaxia microphylla</i>	Common Eutaxia	LS	50
<i>Goodenia amplexans</i>	Clasping Goodenia	LS	50
<i>Leucophyta brownii</i>	Coast Cushion Bush	LS	95
<i>Pultenaea largiflorens</i>	Twiggy Bush-pea	LS	95
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush	LS	65
<i>Scaevola albida</i>	Pale Fanflower	LS	95
<i>Chrysocephalum apiculatum</i>	Common Everlasting	FO	160
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	FO	160
<i>Lotus australis</i>	Austral Trefoil	FO	160
<i>Pelargonium australe</i>	Austral Stork's-bill	FO	160
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy	FO	80
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	FO	80
<i>Austrostipa elegantissima</i>	Feather Spear-grass	TG	80
<i>Austrostipa eremophila</i>	Rusty Spear-grass	TG	80
<i>Austrostipa flavescens</i>	Coast Spear-grass	TG	80
<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass	TG	160
<i>Themeda triandra</i>	Kangaroo Grass	TG	160
<i>Enneapogon nigricans</i>	Black-head Grass	LG	160
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	LG	160
<i>Dianella brevicaulis</i>	Short-stem Flax-lily	LSE	160
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily	LSE	160
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge	LSE	80
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush	LSE	80
<i>Atriplex semibaccata</i>	Berry Saltbush	MP	35
<i>Einadia nutans</i> ssp. <i>nutans</i>	Climbing Saltbush	MP	95
<i>Billardiera cymosa</i> ssp. <i>cymosa</i>	Sweet Apple-berry	VI	35
<i>Hardenbergia violacea</i>	Native Lilac	VI	95
<i>Myoporum parvifolium</i>	Creeping Boobialla	VI	35
Total			3,360

* Number of tubestock for initial planting

Lifeform codes: TT – tall tree >15m, MT – medium tree 5-15m, ST – small tree <5 metres, TS – tall shrub >2m, MS – medium shrub 1-2m, LS – low shrub <1m, FO – forb, TG – tall grass >40cm, LG – low grass <40cm, LSE – low sedge < 1m, MP – mat plant, VI – vine/climber/scramber

Site preparation:

Groundcover in this site is principally introduced grasses and mat plants on a sandy loam soil. The site will need to be prepared by spraying out these introduced plants, and, to prevent weed proliferation in the longer term, appropriate sterile mulch should be applied to a depth of 10 cm.

Indicative costing for this site:

Initial costs:

Site preparation (spraying and mulch):

Spray out site: broad-scale spraying of site with herbicide prior to planting could be undertaken by Council works staff using Council equipment¹¹

Volume of mulch required: 315m³ (for 10cm depth)

Mulch cost: (based on \$69.54m³)¹²: \$21,898

Tubestock and planting costs:

Tubestock: \$6,749

Planting costs (@\$3.50 per plant): \$11,760

Ongoing maintenance: Council will need to consider whether ongoing maintenance is undertaken by Council staff, or whether a contractor is required given the size of areas and number of plants involved. The following costs are based upon 2 years of watering, four times per year (November, December, January, February), and weed control 4 visits per year for 2 years, with contractor based on a \$55 per hour rate:

Maintenance costs:

Watering costs (based on one minute per plant), eight visits, \$55 per hour: \$24,640

Weed control costs (for 2 years only), eight visits, \$55 per hour: \$12,320

¹¹ Ben Hall pers. comm.

¹² Costing includes delivery and blown in with the Powerscaper (ie spread on site). Estimate provided by Dylan Digby, Jeffries Landscaping.



Figure 6: Fordham, Stewart Avenue and Bob Lewis Reserves

2.4 Stewart Avenue Reserve

Total area for revegetation (as shown in Figure 6): 1,050m²

Indicative site photograph (February 2018)



Location of photograph (WGS 84) Easting: 274176

Northing: 6128204

Direction: SE

Suggested list of revegetation species, including numbers to be planted:

SPECIES	COMMONNAME	Lifeform	Number*
<i>Eucalyptus camaldulensis</i> ssp. <i>camaldulensis</i>	River Red Gum	TT	5
<i>Allocasuarina verticillata</i>	Drooping Sheoak	MT	10
<i>Callitris gracilis</i>	Southern Cypress Pine	MT	10
<i>Eucalyptus porosa</i>	Mallee Box	MT	10
<i>Acacia pycnantha</i>	Golden Wattle	ST	10
<i>Pittosporum angustifolium</i>	Native Apricot	ST	10
<i>Adriana quadripartita</i>	Coast Bitter-bush	TS	15
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria	TS	20
<i>Olearia axillaris</i>	Coast Daisy-bush	TS	20
<i>Acacia acinacea</i>	Wreath Wattle	MS	20
<i>Acacia cupularis</i>	Cup Wattle	MS	10
<i>Dodonaea viscosa</i> ssp. <i>spatulata</i>	Sticky Hop-bush	MS	10
<i>Scaevola crassifolia</i>	Cushion Fanflower	MS	10
<i>Acrotriche patula</i>	Prickly Ground-berry	LS	20
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	LS	20
<i>Eutaxia microphylla</i>	Common Eutaxia	LS	20
<i>Goodenia amplexans</i>	Clasping Goodenia	LS	20
<i>Leucophyta brownii</i>	Coast Cushion Bush	LS	35
<i>Pultenaea largiflorens</i>	Twiggy Bush-pea	LS	35
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush	LS	25
<i>Scaevola albida</i>	Pale Fanflower	LS	35
<i>Chrysocephalum apiculatum</i>	Common Everlasting	FO	55
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	FO	55
<i>Lotus australis</i>	Austral Trefoil	FO	55
<i>Pelargonium australe</i>	Austral Stork's-bill	FO	55
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy	FO	30
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	FO	30
<i>Austrostipa elegantissima</i>	Feather Spear-grass	TG	30
<i>Austrostipa eremophila</i>	Rusty Spear-grass	TG	30
<i>Austrostipa flavescens</i>	Coast Spear-grass	TG	30
<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass	TG	55
<i>Themeda triandra</i>	Kangaroo Grass	TG	55
<i>Enneapogon nigricans</i>	Black-head Grass	LG	55
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	LG	55
<i>Dianella brevicaulis</i>	Short-stem Flax-lily	LSE	55
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily	LSE	55
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge	LSE	30
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush	LSE	30
<i>Atriplex semibaccata</i>	Berry Saltbush	MP	15
<i>Einadia nutans</i> ssp. <i>nutans</i>	Climbing Saltbush	MP	35
<i>Billardiera cymosa</i> ssp. <i>cymosa</i>	Sweet Apple-berry	VI	15
<i>Hardenbergia violacea</i>	Native Lilac	VI	35
<i>Myoporum parvifolium</i>	Creeping Boobialla	VI	15
Total			1,245

* Number of tubestock for initial planting

Lifeform codes: TT – tall tree >15m, MT – medium tree 5-15m, ST – small tree <5 metres, TS – tall shrub >2m, MS – medium shrub 1-2m, LS – low shrub <1m, FO – forb, TG – tall grass >40cm, LG – low grass <40cm, LSE – low sedge < 1m, MP – mat plant, VI – vine/climber/scramber

Site preparation:

Groundcover in this site is principally introduced grasses and mat plants on a sandy loam soil. The site will need to be prepared by spraying out these introduced plants, and, to prevent weed proliferation in the longer term, appropriate sterile mulch should be applied to a depth of 10 cm.

Indicative costing for this site:

Initial costs:

Site preparation (spraying and mulch):

Spray out site: broad-scale spraying of site with herbicide prior to planting could be undertaken by Council works staff using Council equipment¹³

Volume of mulch required: 105m³ (for 10cm depth)

Mulch cost: (based on \$69.54m³)¹⁴: \$7,302

Tubestock and planting costs:

Tubestock: \$2,500

Planting costs (@\$3.50 per plant): \$4,358

Ongoing maintenance: Council will need to consider whether ongoing maintenance is undertaken by Council staff, or whether a contractor is required given the size of areas and number of plants involved. The following costs are based upon 2 years of watering, four times per year (November, December, January, February), and weed control 4 visits per year for 2 years, with contractor based on a \$55 per hour rate:

Maintenance costs:

Watering costs (based on one minute per plant), eight visits, \$55 per hour: \$9,130

Weed control costs (for 2 years only), eight visits, \$55 per hour: \$4,565

¹³ Ben Hall pers. comm.

¹⁴ Costing includes delivery and blown in with the Powerscaper (ie spread on site). Estimate provided by Dylan Digby, Jeffries Landscaping.

2.5 Bob Lewis Reserve

Total area for revegetation (as shown in Figure 6): 1,581m²

Indicative site photograph (February 2018). (Note that a new photopoint should be established in this site, as the photopoint shown will not include the area that will be revegetated. It has been included here to provide context to the general nature of the reserve.)



Location of photograph (WGS 84) Easting: 274048

Northing: 6127307

Direction: SSW

Suggested list of revegetation species, including numbers to be planted:

SPECIES	COMMONNAME	Lifeform	Number*
<i>Eucalyptus camaldulensis</i> ssp. <i>camaldulensis</i>	River Red Gum	TT	5
<i>Allocasuarina verticillata</i>	Drooping Sheoak	MT	10
<i>Callitris gracilis</i>	Southern Cypress Pine	MT	10
<i>Eucalyptus porosa</i>	Mallee Box	MT	10
<i>Acacia pycnantha</i>	Golden Wattle	ST	10
<i>Pittosporum angustifolium</i>	Native Apricot	ST	10
<i>Adriana quadripartita</i>	Coast Bitter-bush	TS	20
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria	TS	25
<i>Olearia axillaris</i>	Coast Daisy-bush	TS	25
<i>Acacia acinacea</i>	Wreath Wattle	MS	25
<i>Acacia cupularis</i>	Cup Wattle	MS	10
<i>Dodonaea viscosa</i> ssp. <i>spatulata</i>	Sticky Hop-bush	MS	10
<i>Scaevola crassifolia</i>	Cushion Fanflower	MS	10
<i>Acrotriche patula</i>	Prickly Ground-berry	LS	25
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	LS	25
<i>Eutaxia microphylla</i>	Common Eutaxia	LS	25
<i>Goodenia amplexans</i>	Clasping Goodenia	LS	25
<i>Leucophyta brownii</i>	Coast Cushion Bush	LS	50
<i>Pultenaea largiflorens</i>	Twiggy Bush-pea	LS	50
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush	LS	35
<i>Scaevola albida</i>	Pale Fanflower	LS	50
<i>Chrysocephalum apiculatum</i>	Common Everlasting	FO	80
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	FO	80
<i>Lotus australis</i>	Austral Trefoil	FO	80
<i>Pelargonium australe</i>	Austral Stork's-bill	FO	80
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy	FO	40
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	FO	40
<i>Austrostipa elegantissima</i>	Feather Spear-grass	TG	40
<i>Austrostipa eremophila</i>	Rusty Spear-grass	TG	40
<i>Austrostipa flavescens</i>	Coast Spear-grass	TG	40
<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass	TG	80
<i>Themeda triandra</i>	Kangaroo Grass	TG	80
<i>Enneapogon nigricans</i>	Black-head Grass	LG	80
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	LG	80
<i>Dianella brevicaulis</i>	Short-stem Flax-lily	LSE	80
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily	LSE	80
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge	LSE	40
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush	LSE	40
<i>Atriplex semibaccata</i>	Berry Saltbush	MP	20
<i>Einadia nutans</i> ssp. <i>nutans</i>	Climbing Saltbush	MP	50
<i>Billardiera cymosa</i> ssp. <i>cymosa</i>	Sweet Apple-berry	VI	20
<i>Hardenbergia violacea</i>	Native Lilac	VI	50
<i>Myoporum parvifolium</i>	Creeping Boobialla	VI	20
Total			1,705

* Number of tubestock for initial planting

Lifeform codes: TT – tall tree >15m, MT – medium tree 5-15m, ST – small tree <5 metres, TS – tall shrub >2m, MS – medium shrub 1-2m, LS – low shrub <1m, FO – forb, TG – tall grass >40cm, LG – low grass <40cm, LSE – low sedge < 1m, MP – mat plant, VI – vine/climber/scramber

Site preparation:

Groundcover in this site is principally introduced grasses and mat plants on a sandy loam soil. The site will need to be prepared by spraying out these introduced plants, and, to prevent weed proliferation in the longer term, appropriate sterile mulch should be applied to a depth of 10cm.

Indicative costing for this site:

Initial costs:

Site preparation (spraying and mulch):

Spray out site: broad-scale spraying of site with herbicide prior to planting could be undertaken by Council works staff using Council equipment¹⁵

Volume of mulch required: 158m³ (for 10cm depth)

Mulch cost: (based on \$69.54m³)¹⁶: \$10,994

Tubestock and planting costs:

Tubestock: \$3,425

Planting costs (@\$3.50 per plant): \$5,968

Ongoing maintenance: Council will need to consider whether ongoing maintenance is undertaken by Council staff, or whether a contractor is required given the size of areas and number of plants involved. The following costs are based upon 2 years of watering, four times per year (November, December, January, February), and weed control 4 visits per year for 2 years, with contractor based on a \$55 per hour rate:

Maintenance costs:

Watering costs (based on one minute per plant), eight visits, \$55 per hour: \$12,503

Weed control costs (for 2 years only), eight visits, \$55 per hour: \$6,252

¹⁵ Ben Hall pers. comm.

¹⁶ Costing includes delivery and blown in with the Powerscaper (ie spread on site). Estimate provided by Dylan Digby, Jeffries Landscaping.

2.6 Summary of costs

Item	Shannon Avenue	Blackburn Avenue	Fordham	Bob Lewis	Stewart Avenue
Spray out site	\$231.47	\$207.93	\$286.56	\$113.45	\$95.55
Mulching	\$16,314.08	\$15,889.89	\$21,898.15	\$10,994.27	\$7,301.70
Tube stock	\$5,122.50	\$4,901.25	\$6,749.25	\$3,425.25	\$2,500.50
Planting	\$8,925.00	\$8,540.00	\$11,760.00	\$5,967.50	\$4,357.50
Tree guards and stakes	\$3,264.00	\$3,123.20	\$4,300.80	\$2,182.40	\$1,593.60
Watering (2 years)	\$18,700.00	\$17,893.33	\$24,640.00	\$12,503.33	\$9,130.00
Weed control (2 years)	\$9,350.00	\$8,946.67	\$12,320.00	\$6,251.67	\$4,565.00
TOTAL	\$61,907.05	\$59,502.27	\$81,954.76	\$41,437.87	\$29,543.85
TOTAL OVERALL	\$274,345.80				

3. Monitoring and evaluating outcomes for the project

It is recommended that the City of Holdfast Bay establish a monitoring protocol to ensure that elected members of Council, along with council staff, can receive feedback on the success of project implementation. Good monitoring processes will also allow for learnings from the project to be applied to other sites / future projects. The following are suggested monitoring methods that could be implemented.

3.1 Photopoints

Patrick et al (2001)¹⁷ provide a good overview of the benefits of photopoint monitoring. These include:

- Ease of use. Taking images for photopoints requires relatively little training even for inexperienced users.
- No particular prior knowledge or skills are required.
- Equipment is inexpensive and easily obtained.
- They provide a standardized and precisely replicable result that can be achieved by different personnel at different points in time.
- They require relatively small effort to repeat future photographs.
- Photographs provide a long-term permanent visual record of site conditions irrespective of changes in staff and expertise.
- Time-series photographs are an effective communication tool when dealing with the public and decision-makers compared to other tools such as charts, tables and graphs.

For this project it is recommended that the City of Holdfast Bay establish at least one photopoint per site prior to works being undertaken. It is recommended that a photopoint board is included within the site photograph, as this helps to ensure that the photograph metadata stays with the photograph. Attributes that should be included on the photopoint board at a minimum should include reserve name, date, GPS location and direction of photograph.

For the purposes of this project, the following indicators of change could be used to assess success of the revegetation works (based on attributes developed by O'Connor and Bond (2007)¹⁸):

Description of indicators of change that could be used to compare photopoints

Indicator of change	Description and use of indicator
Presence/density of trees	The presence and density of trees – bearing in mind the initial target of an open woodland vegetation type for the sites.
Diversity of trees	The number of different species of trees that can be detected.
Presence/density of shrubs	The presence and density of shrubs - reflecting that a moderate shrub layer (20-40% cover) was an initial target.
Diversity of shrubs	The number of different species of shrubs that can be detected.
Presence/density of grasses and/or herbaceous species	The presence and density of grasses and/or herbs.

¹⁷ Patrick, W.M., Corey, L. and Barraclough, L. (2001). A User Guide to Photopoint Monitoring Techniques for Riparian Areas- Field Test Edition Aqua-Tex Scientific Consulting Ltd. 390- 7th Avenue Kimberley, B.C. V1A 2Z7 May 2001

¹⁸ O'Connor, P.J. and Bond, A. (2007). Maximising the effectiveness of photopoint monitoring for ecological management and restoration. Ecological Management and Restoration 8(3): 228-233.

Indicator of change	Description and use of indicator
Diversity of grasses and/or herbaceous species	The number of different species of grasses and/or herbaceous species.
Survival of plants (survivorship)	Number of plants that can be detected as surviving from examination of previous photographs.
Plant growth	Degree of growth of plants over time.
Flowering and fruiting plants	Whether any species can be identified that are flowering or fruiting. May be difficult to detect in many cases, but an indicator of success, for example, in revegetation projects where planted stock become reproductive.
Presence/density/diversity of perennial grass and herbaceous weeds	The presence, density and/or diversity of different perennial grass/herbaceous weed species that are present.
Presence/density/diversity of annual grass and herbaceous weeds	The presence, density and/or diversity of different annual grass and herbaceous weed species that are present.

3.2 Repeat Assessment of Biodiversity Baseline Data

The methodology used by Milne^{19,20} generated a biodiversity score (as shown in Figure 1) for all reserves in the City of Holdfast Bay area using a metric based upon a combination of the following attributes:

- the number of native plants present;
- the type and cover of weeds present;
- the number of native plant life forms present; and
- the proportion of the understorey biomass that was native.

This scoring method could be repeated following revegetation works to generate a new score for the areas where work has been undertaken. This score could also be used towards the broader City of Holdfast Bay targets for increasing native fauna habitats (as per Section 1).

3.3 Bird monitoring

The monitoring protocols described in Section 3.1 and 3.2 assume provision of habitat will provide outcomes for fauna – so, for example, the provision of a variety of new native plant lifeforms in an area that was previously denuded is expected to provide an increase in the native fauna using the area. However, it may be valuable to incorporate additional monitoring to provide evidence that this is in fact the case. Birds are considered to be the best taxa to use for this project, as they will readily recolonise areas, can move through landscape, are readily observed, and are intrinsically appealing to most people.

City of Holdfast Bay could approach this monitoring in a variety of ways. At its simplest, anecdotal observations from Council on-ground works staff could be used to provide a simple form of feedback. A more comprehensive process would incorporate a BACI design (before, after, control, impact), where an experienced ornithologist could undertake surveys before and after revegetation works were undertaken, with a control in adjoining areas of reserve where no revegetation has been undertaken. Twenty minute searches repeated in triplicate each year have previously been used for

¹⁹ Milne, T. (2018). City of Holdfast Bay Biodiversity Baseline Data Study: Priority Sites. Unpublished report prepared for the City of Holdfast Bay.

²⁰ Milne, T. (2018). City of Holdfast Bay Biodiversity Baseline Data Study: Phase 2 All Remaining Reserves. Unpublished report prepared for the City of Holdfast Bay.

bird monitoring in the Mount Lofty Ranges.²¹ Whilst this type of approach would still be indicative rather than comprehensive (due to small datasets, limited areas of revegetation and the small number of sites), it would still provide feedback on improved habitat values of the revegetated areas.

²¹ Szabo, Judit K., Vesk, Peter A., Baxter, Peter W. J. and Possingham, Hugh P. (2011). Paying the extinction debt: Woodland birds in the Mount Lofty Ranges, South Australia. *Emu* 111 (1) 59-70.