

# Welcome to Pine Gully

Marni naa pudni  
Kaurna yarta-ana



## PINE GULLY MASTERPLAN

FEBRUARY 2021

## Acknowledgement of Country

The City of Holdfast Bay acknowledges the Kaurna People as the traditional owners and custodians of the land. We respect the spiritual relationship with Country that has developed over thousands of years, and the cultural heritage and beliefs that remain important to the Kaurna People today.

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# SUMMARY

**Pine Gully is one of four designated natural areas in our city. It is a natural space for the community to enjoy, and provides habitat for local wildlife.**

Pine Gully is located between Kingston Crescent, Myrtle Road and Pine Avenue in Kingston Park.

Managing the gully to ensure sustainable use into the future is a priority of the City of Holdfast Bay. This masterplan has been developed to provide objectives and strategies to manage Pine Gully for the community.

The masterplan for Pine Gully has involved an assessment of opportunities and constraints, together with reviews of the environment, landscape and infrastructure. The recommendations that have been developed from the masterplan process will protect and enhance the local biodiversity, improve access and safety for the community, and improve the amenity and beauty of Pine Gully.

Pine Gully is a natural, steeply sloped space that follows an ancient watercourse, and it is likely that the area was visited by the Kaurna People. After European settlement, the gully had some of the native vegetation cleared. Aleppo pines have self sown around the gully and have assisted with slope stabilisation. There is the opportunity to improve the local biodiversity by selectively removing non-native plants and planting appropriate local native species.

The gully has a number of informal trails throughout, including in some steeply sloped areas, which contribute to erosion. There is the opportunity to formalise some of the trails in the flatter sections of the gully and improve access points to the area for the community. Access to unsafe trails in steep areas will be restricted to allow revegetation to occur. This will assist with reducing erosion, improving revegetation effort, and enhancing the visitor experience.

Stormwater harvesting and reuse opportunities have been considered for Pine Gully, however the implementation of any reuse scheme is unlikely to be viable. The recommendations from the masterplan focus on reducing erosion and improving water quality, through appropriate revegetation, bank stability and trail improvements, and some stormwater infrastructure upgrades.

Implementing the masterplan recommendations will increase the appeal of the area and contribute to enhancing the enjoyment that residents and others gain from using the gully. This masterplan provides the direction to ensure the sustainable use of Pine Gully for future generations.

# ABOUT THE MASTERPLAN

## PURPOSE

This document is a high-level plan that sets the objectives and strategies to manage Pine Gully for the community of the City of Holdfast Bay.

## VISION

Our vision for Pine Gully is to:

- Protect and enhance local biodiversity
- Provide a natural space for the community to enjoy
- Improve amenity and beauty
- Connect people with nature in different settings
- Encourage appropriate use of the natural space
- Manage stormwater in a sustainable way

## MASTERPLAN PROCESS

The masterplan for Pine Gully has involved the assessment of the opportunities and constraints of the area, as well as reviews of the existing environment, landscape, and infrastructure. Recommendations for stormwater management, landscape and vegetation have been developed, and are outlined in this document.

## INTEGRATION WITH OTHER STRATEGIES AND PLANS

This masterplan has been considered in conjunction with a number of Council's existing strategies and plans, including:

- Environment Strategy 2020
- Open Space and Public Realm Strategy 2018 - 2030
- Masterplans for Barton Gully and Gilbertson Gully.





Figure 1. Location of Pine Gully (outlined in red); area in orange is owned by Mrs Mary Trott. The portion of orange inside the red line is the area under care and control of the City of Holdfast Bay.

# ABOUT PINE GULLY

Pine Gully is located between Kingston Crescent, Myrtle Road and Pine Avenue in Kingston Park, and is one of four designated natural areas in our city. Pine Gully is a significant natural space that follows an ancient seasonal watercourse through a residential area.

The gully does not currently allow for defined access to the beach, but there is an informal trail network that does provide beach-access.

Pine Gully ownership is complex and includes land under the care and control of the City of Holdfast Bay (donated by Mrs Mary Trott), portions owned by the City of Holdfast Bay, and portions owned by a number of private owners but unfenced due to the steep slope of the land. In Figure 1, the area shown as orange, is land owned by Mrs Mary Trott, of which a portion in the gully is under the care and control of the City of Holdfast Bay

## HISTORY

Prior to European settlement, Pine Gully was a place where the Kurna People of the Adelaide Plains would frequent and camp during the summer months. The gully would have supported local native wildlife and been vegetated with local species, which would have provided important food resources and shelter. Pine Gully is also located close to the sacred Tijlbruke Springs.

After Europeans settled in South Australia, clearing of some of the native vegetation occurred. Following a natural watercourse with increased flow as a result of urbanisation, the gully is prone to erosion during rainfall, particularly with the removal of native vegetation.

## ACTIVITIES UNDERTAKEN

Revegetation was undertaken in the 1970s by community groups, using species that were recommended by the Adelaide Botanic Gardens and considered to be appropriate at the time. Aleppo pines, which have self-sown, now provide a valuable food source for the native yellow-tailed black cockatoo, which is listed as 'Vulnerable' under the National Parks and Wildlife Act.

The main pathway through the gully, in the southern area, was recently upgraded, along with new location signs.

Careful removal of some non-native trees and recent revegetation has been undertaken by Council and volunteers consistent with this masterplan's recommendations.

Some temporary fencing has been installed to discourage bicycle access, which was uncontrolled and causing significant erosion.

Some areas of the gully have been filled with material from when Brighton Road was constructed, and from a previous housing estate. This fill is unlikely to have been compacted and accordingly has a high risk of erosion.

Council has undertaken an on-site consultation with the Kurna Nation and received advice about the proposed works.



# OPPORTUNITIES AND CONSTRAINTS



Figure 2. Opportunities and constraints.

## KEY

1. Sediment removal upstream of the headwall and reprofiling the channel upstream with revegetation. High-energy environment with moderate sediment loads. Insufficient area for secondary or tertiary water quality treatment. Reduce blockage risk at the headwall
2. Removal of selected Aleppo pines to reduce fire risk and help increase light penetration to the bottom of the gully to support revegetation
3. Reprofile channel and rock armour base. Revegetation along the channel. Rock size to be confirmed based on design velocity. Reconfigure stormwater outlets from adjacent properties into the rock armouring
4. Remove section of fence spanning the channel or replace with more appropriate structure. Confirm boundary location and fencing with property owner
5. Extend existing pipe with drop structure to reduce energy at stormwater outlets to open the channel



The various opportunities and constraints presented by the site have been evaluated in terms of stormwater management, landscape and vegetation. A summary of the evaluation is provided below, with the locations of the opportunities and constraints shown in the attached plan (refer to Figure 2). It is also important, given the cultural significance of the site, that any planned works carried out in the area be planned in consultation with Kaurua representatives. A review of Pine Gully was undertaken with Kaurua representatives in September 2019.

## STORMWATER MANAGEMENT

Pine Gully is quite steep in places, with a large, steep upstream catchment and therefore, when it rains, water flows quickly through the gully, causing erosion and carrying vegetative material and sediment out of the gully into Gulf St Vincent.



Figure 3. Erosion on steep embankment.

There is the opportunity to improve the management of stormwater within the gully by implementing measures that reduce erosion and improve the quality of the water before it leaves the gully.

Additional stormwater infrastructure improvements, such as installing new underground stormwater pipes, rock lining segments of the watercourse, rock-check dams along the bed of the drainage watercourse, together with revegetation of eroded sections of the watercourse with native species and reshaping of embankments to provide increased bank stability, need to be implemented to reduce erosion. In addition, collecting gross pollutants prior to discharge to the ocean is an integral part of the stormwater solution, and this may include a gross pollutant trap (GPT) between the gully and the outfall to the coast.

Together with the watercourse improvements, a number of property drainage outlets create localised erosion and are unsightly. These will need to be addressed as part of the masterplan works.

Access to undertake watercourse rehabilitation will be a significant challenge due to the steep slopes and existing vegetation and, accordingly, it will need to be completed as an early task to allow revegetation of disturbed surfaces.

Refer to Appendix A for further information on the identified stormwater improvements.

The viability of harvesting stormwater from Pine Gully for re-use (such as irrigation) was evaluated – refer to Appendix to Appendix B for details. The evaluation determined that the opportunity for stormwater harvesting and re-use is limited due to factors such as the steepness of the gully and lack of suitable areas for stormwater capture and storage. There may be the opportunity to utilise a storage tank located on the adjacent caravan park for some stormwater capture, however additional water treatment would be required before re-use.

## LANDSCAPE

Pine Gully is constrained by the steep embankments that are significantly eroded in areas, whilst the remaining embankments and watercourse, particularly on the southern slopes, are heavily infested with weed species making much of the gully inaccessible.

Plants suitable for the sloping site will help to maintain the integrity of the soil and mitigate further erosion. Currently, the Aleppo pines drop significant pine needles that, in combination with the low light from the extensive tree canopy, reduce opportunity for understorey revegetation. Maintaining soil stability whilst revegetating will also be important, to ensure that additional erosion does not occur before new plantings are established.

There are a number of informal trails that traverse the southern and flatter part of the gully, with some native vegetation. Multiple narrow, unformed trails currently traverse the steep slopes of the gully, causing erosion, particularly those that have been utilised by mountain and BMX bike riders (refer Figure 4). There is the opportunity to formalise existing sections of the trail network within the flatter sections of the gully and close off access to the unsafe steeper trails. This includes a short new path through the flat section of the upper southern part of the gully.



Figure 4. Informal bike trail.

Paths are proposed to be low-key unsealed trails constructed from materials such as cement-treated sands or cement-treated rubble. The paths would be typically 1.0 to 1.5 m wide. Where possible, the paths will be designed so that they are accessible for all ambulant users. Small sections of paths to vantage points will be prioritised for wheelchair access where possible.

Educational signage could be provided throughout the site to coincide with the restoration and revegetation works. Interpretative signage could include information about:

- Weed control
- Kurna and European history
- Native flora and fauna
- Water management and treatment
- The role of volunteers and friends groups, providing contact details to encourage involvement.

The gully has been assessed for recreational use by BMX and mountain bikes and found that it is not an appropriate location for either of these uses. Use by cyclists on trails within the gully is not recommended due to conflicts with pedestrians on the narrow trails. The proposed educational signage at entry points to the gully could incorporate information about appropriate use.

There are a number of old fences that may be on current or former property title alignments. One in particular crosses the watercourse and has created a drop step in the watercourse. Removal or management of the fences is considered highly desirable.

## VEGETATION

There are several areas of revegetation already on the site, however, additional areas would benefit from rehabilitation and planting of indigenous vegetation. There are many established Aleppo pines (*Pinus halepensis*) across the site. These trees create a carpet of pine needles that inhibit understorey growing conditions, with a large part of the site underneath the pine trees devoid of any other vegetation. They are a declared weed in South Australia and present a significant fire hazard.



Figure 5. Aleppo pine.

Slopes that currently do not have any indigenous vegetation could be revegetated to stabilise and encourage water infiltration. This would need to be carefully staged with uplifting of the Aleppo pine canopy to allow more light to the understorey area. The watercourse is currently inundated with large woody weeds and weed tree species due to garden escapees and seeds that have been introduced through the stormwater systems as well as via wind and birds. These will all need to be removed to enable the stormwater infrastructure to be installed. However, two river red gums have been identified in the watercourse, and it is proposed that these remain.





Figure 6. Steep slope.

Control of weeds and establishment of new, appropriate vegetation can be challenging due to the steep site and restricted access in some areas. A biodiversity management plan, including weed control and management recommendations, will be prepared and implemented, to protect the revegetated areas and reduce re-infestation by unwanted plants.

The control of any potential bushfires in the gully is also a consideration, given the limited access and steep slopes. The bushfire risk can be reduced through careful selection of appropriate plants for revegetation and removal of fire-prone plant species, such as Aleppo pines. Improved access and more formal trails within the gully will also improve bushfire control. Where tree removal is proposed, stumps and root structure will remain to maintain slope and soil stability.

The opportunity to improve the existing biodiversity within the gully by continuing to revegetate areas and remove unwanted plant species will also increase the bank stability. In addition, this will enhance the natural beauty of the area and encourage native animal and bird species. Revegetation activities are planned progressively in the future.



Figure 7. Pine Gully revegetation.



# VEGETATION ZONES



Figure 8. Vegetation zones.

## KEY

### ZONE A – HIGH WIND EXPOSURE

- Steep slopes with extensive bare soils and exposure to strong coastal wind
- Revegetate with species that will survive the harsh conditions on the slopes, possibly kangaroo grass and creeping boobialla

### ZONE B – ROADSIDE GRASSES

- Significant introduced grass biomass requires ongoing control
- Monitor revegetation and infill as required, aiming for open coastal shrubland
- Brushcutting to focus on a late winter cut for annual grassy weeds
- For dense native grass patches wait until after grasses have set seed in summer

### ZONE C – GOOD NATIVE STRUCTURE

- Moderate to good diversity of species and lifeforms
- Significant remnant vegetation
- Remove individual scattered Aleppo pines
- Consider replacing *Atriplex nummularia* with *Nitraria billardierei*
- Consider sensitive bushcare approach. Focus on grassy and herbaceous weeds to allow remnant understorey to thrive

#### **ZONE D – RECENT REVEGETATION**

- Presence of Aleppo pines is inhibiting potential for restoration, consider staged removal
- Revegetate with open woodland of *Allocasuarina verticillata*
- Monitor *Acacia paradoxa* and *Acacia pycnantha* cover and remove as required to keep open formation
- Control grassy weeds and soursobs
- Brushcutting to focus on a late winter cut for annual grassy weeds
- For dense native grass patches wait until after grasses have set seed in summer

#### **ZONE E – OPEN AREA**

- Monitor revegetation and infill as required with native grasses, wildflowers and lilies
- Control herbaceous weeds

#### **ZONE F – SOUTHERN EDGE OF DRAINAGE LINE**

- Lack of native plant species in all structural layers
- Revegetate aiming for a shrubland with emergent sheoaks (*Allocasuarina verticillata*)

#### **ZONE G – WATERCOURSE**

- Lack of native plant species in all structural layers
- Ongoing control of woody weed seedlings
- Revegetate with native wetland sedge and rush species

#### **ZONE H – STEEP NORTHERN BANKS**

- Remove olives and revegetate where removal has occurred
- Up-prune and selective removal of Aleppo pines to reduce fire risk and increase light into the understorey
- Revegetate where Aleppo pines have been removed, using species that appear to be able to tolerate the thick pine needle layer, such as ruby saltbush (*Enchylaena tomentosa* var. *tomentosa*), sea-berry saltbush (*Rhagodia candolleana* ssp. *candolleana*) and native grasses

Pine Gully has been divided into eight distinct vegetation zones, based on the existing vegetation and landscape features. These vegetation zones will be used to assist with revegetation and weed control, which will be guided by a detailed biodiversity action plan. The following vegetation zones are shown in Figure 8:

- Zone A: High wind exposure
- Zone B: Roadside grasses
- Zone C: Good native structure
- Zone D: Recent revegetation
- Zone E: Open area
- Zone F: Southern edge of drainage line
- Zone G: Watercourse
- Zone H: Steep northern banks

A description of each zone and proposed management actions for each of the zones are provided in Appendix C. The list of plant species to be removed or controlled is provided in Appendix D, and plants to be used for revegetation are provided in Appendix E

# MASTERPLAN RECOMMENDATIONS



Figure 9. Pine Gully masterplan recommendations.

## KEY

- |  |   |   |
|--|---|---|
| 1. Define entry  | 5. Existing Pine Gully steps  | 10. Watercourse with rock check dams                        |
| 2. Revegetate to define entry and demolish existing plinth and reinstall seat with inground footings, and align with trail | 6. New tree planting along steep embankments. Selective removal of Aleppo pines | 11. Undertake pest plant removal and re-vegetate embankment |
| 3. Relocated rock/signage to highlight trail into gully  | 7. Retain link to Pine Avenue   | 12. Realign trail   |
| 4. Trail link to coast trail   | 8. Define existing access into site   | 13. Earthworks, lay back top of embankment                  |
|  | 9. Informal trails upgraded   |   |



The masterplan for Pine Gully has been based on findings from assessment of the opportunities and constraints, existing environment, landscape, and infrastructure.

The recommendations outlined in this section provide direction to enhance the existing biodiversity, improve stormwater management and improve access for the community to enjoy the natural environment provided by Pine Gully. Figure 9 shows the location for each of the recommendations.

## STORMWATER MANAGEMENT

Stormwater management within the gully will focus on stabilising embankments, reducing erosion, and improving water quality. Landscaping elements and vegetation will be used to assist with achieving these goals, in addition to the repair/remediation and installation of new stormwater infrastructure. An assessment of stormwater capture and reuse opportunities has indicated that, based on economics, aesthetics and low water demand for revegetation species, it is not viable to capture water for re-use within the gully.

## LANDSCAPE

Trails will be formalised to reduce erosion and improve establishment of revegetated areas. Access to unsafe trails will be prevented in steeper areas, allowing revegetation and bank stabilisation to occur. A new trail is proposed to link Pine Avenue east with the coast. Educational signage will be installed to highlight the key features of the area, such as the vegetation, water management, Kauria and European history and local volunteer groups.

## VEGETATION

A biodiversity management plan will be developed and implemented, including removal and treatment of priority weeds. Revegetation will continue in the identified vegetation zones with appropriate plant species as described in Appendix E.

## CONCLUSION

Pine Gully is a natural space that is enjoyed by the local community. Implementing the masterplan recommendations will increase the appeal of the area, improve the biodiversity and contribute to enhancing the enjoyment that residents and others gain from using the gully. The masterplan provides direction to ensure the sustainable use of Pine Gully for future generations.

# IMPLEMENTATION AND FUNDING

The proposed works are planned to be coordinated and funded by Council with work completed by contractors with support from local volunteers. External grant funding would be actively sought as available.

Major works such as watercourse rehabilitation would be implemented initially, and other works undertaken in stages over a number of years.

It is expected that the capital works within Pine Gully would cost in the order of \$550,000 - \$600,000.

A draft implementation plan is included in Appendix F.

# APPENDICES

Appendix A – Identified stormwater improvements

Appendix B – Stormwater re-use assessment

Appendix C – Vegetation zone management actions

Appendix D – Vegetation for removal

Appendix E – Vegetation to be used for revegetation and biodiversity improvement

Appendix F – Draft implementation plan



# APPENDIX A

## IDENTIFIED STORMWATER IMPROVEMENTS

### GROSS POLLUTANT TRAP

A gross pollutant trap (GPT) downstream from Pine Gully Pine Gully could reduce the gross pollutant load from all contributing catchments entering the coastal catchment. Management of pollution from the upstream catchment (refer following figures) will assist in maintaining the watercourse in good condition.

The gully and creek generate sediment and vegetation loads that should reduce with uptake through vegetation and other watercourse stabilisation measures.

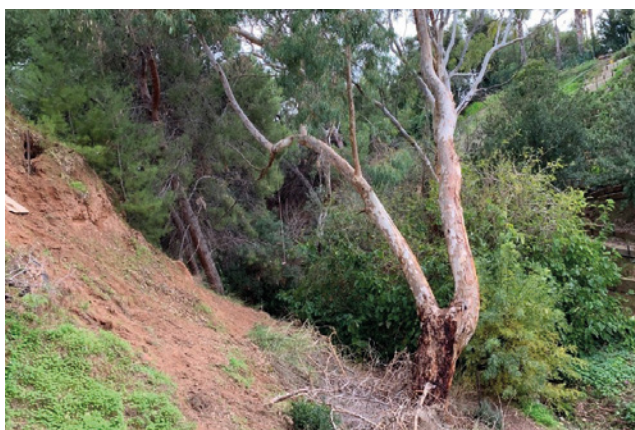


Figure 10. Downstream of upstream outfall.



Figure 11. Upstream outfall.

### DROP PITS

An engineering survey of the watercourse bed profile in the reserve indicates a steep bed grade (approximately 17%) immediately downstream of the 750 mm reinforced concrete pipe (RCP) drain outlet into the reserve. This grade, in combination with high flows, leads to severe scour issues as evidenced on site. In order to mitigate this problem, it is proposed to have three drop pits with a 1050 mm diameter pipe entering the gully in a 2100x600 mm culvert. This will reduce velocities of the discharge flows as well as transition flows onto a flatter downstream grade of the watercourse. This extension of the stormwater pipe will allow a particularly steep and unstable section of the gully to be filled to improve the overall amenity and access.

### GULLY WATERCOURSE EROSION

The watercourse through the gully shows signs of erosion at several locations of both bed and creek batters (refer Figure 10). It is recommended that eroded areas be remediated, and erosion protection measures implemented to minimise future ongoing erosion. The following solutions are proposed:

- Rock beaching upstream and downstream
- Turf reinforcement mat with vegetation.

# APPENDIX B – STORMWATER RE-USE ASSESSMENT

## CATCHMENT SIZE

Approximately 99 hectares.

## CATCHMENT TYPE

- 89 hectares rural, relatively steep with rainfall runoff discharging quickly once catchment is wet.
- 10 hectares urban, relatively steep, with rainfall runoff discharging quickly
- Potential runoff for capture.
- 50ML per year.

## PEAK FLOW

- The peak flow within Pine Gully at the downstream end of the gully in a 5 year ARI is around 2 m<sup>3</sup>/s and 3 m<sup>3</sup>/s in a 100 year event limited by the upstream pipe capacity.

Implementing a viable stormwater harvesting and re-use scheme requires a balance between engineering feasibility and the economics of the scheme.

The determination of harvestable volumes of stormwater for re-use schemes includes an engineering assessment of a range of implementation and practicality factors, including:

- Total catchment runoff, and importantly the flow profile (i.e. proportion of low base flows versus peak flows)
- Size and capacity of wetlands/retardation basins to capture and treat runoff (land availability considering site constraints)
- Diversion weir capacity
- Wetland abstraction rates (i.e. diversion from the wetland to either storage or directly to demand)
- Storage of the harvested volumes for a time when demand requires
- Overall demand.

Based on this assessment of the Pine Gully site, a range of factors were identified that would limit the potential for stormwater harvesting, including:

- Catchments are generally steep and responsive, meaning runoff will pass through the site quickly and over a short period, limiting opportunities for harvesting.

- Site constraints, such as topography and shape, and existing and desired aesthetic appeal of the site including revegetation during community programs, mean that provision of retardation/storage of surface water and wetland treatment will be substantially constrained without wholesale landscape changes and/or increased risk of flooding impacts on adjacent properties.
- Geological profiles in these locations would mean any managed aquifer recharge (MAR) schemes to provide a longer-term storage would be in fractured rock, which, traditionally, is less suited to MAR schemes. With the gully in an elevated position and so close to the coast, this substantially increases the likelihood that any stored water would dissipate to the coast and be lost. Furthermore, hydrogeological investigations would be costly, when balanced against the relatively small volumes of water that could be captured. It is understood that several springs exist along this section of the coast, one of which has cultural significance, and a fractured rock MAR scheme may impact on these springs.

Further high-level catchment and site assessments to investigate the potential and practicality of stormwater harvesting at the sites is summarised below.

## SITE CONSTRAINTS AND OPPORTUNITIES

- Constrained site with existing community plantings and aesthetic appeal.
- Limited space for storage and treatment of stormwater.
- 100kL underground storage tank located in the adjacent caravan park may provide stormwater storage opportunities but would require treatment of any harvested water.

## CONCLUSION

As the gully is currently not irrigated and revegetation is proposed with drought-tolerant native species, the conclusion from this high-level assessment is that based on economics, aesthetics and water for irrigation, it is not viable to capture water for re-use within the gully.

# APPENDIX C – VEGETATION ZONES MANAGEMENT ACTIONS

## ZONE A – HIGH WIND EXPOSURE

This is a highly exposed area with steep slopes and large bare areas of exposed soil. Good coverage of indigenous coastal shrubs in parts with patchy native grasses. Revegetation efforts appear to be limited by high exposure and shallow soils.

### Recommended management actions:

- Revegetate with species that will survive the harsh conditions on the slopes, possibly kangaroo grass and creeping boobialla.
- Control foot traffic.



Figure 12. Zone A high wind exposure.

## ZONE B – ROADSIDE GRASSES

This narrow strip has been revegetated with a range of appropriate local coastal shrubs and patches of native grasses. There is a significant biomass of introduced grasses, which requires control.

### Recommended management actions:

- Brushcutting regime to focus on a late winter brushcut for annual grassy weeds, but in areas with dense native grasses no slashing again until after grasses have set seed in summer.
- Monitor revegetation for success and infill as required, aiming for an open coastal shrubland.



Figure 13. Zone B roadside grasses.



## ZONE C – GOOD NATIVE STRUCTURE

This area has the best condition remnant vegetation in Pine Gully, with a moderate to good species diversity. There are scattered Aleppo pines and some planted non-indigenous species that may require control.

### Recommended management actions:

- Remove individual scattered Aleppo pines.
- Control planted non-indigenous native species. Consider replacing *Atriplex nummularia* with *Nitraria billardierei*.
- Consider sensitive bushcare weeding approach in this area – focussing on grassy and herbaceous weeds, to allow the remnant understorey to thrive.



Figure 14. Zone C native vegetation.

## ZONE D – RECENT REVEGETATION

This area has an overstorey of Aleppo pines, which cause significant shading deposit large amounts of needles. The understorey is dominated by introduced grassy weeds with scattered low native shrubs and perennial grasses. A large stand of athel pines has been removed and significant revegetation has been undertaken.

### Recommended management actions:

- Consider staged removal of Aleppo pines.
- Revegetate with open woodland of sheoaks (*Allocasuarina verticillata*).
- Monitor *Acacia paradoxa* and *Acacia pycnantha* cover and remove as required to keep open formation.
- Control grassy weeds and soursobs.
- Brushcutting to focus on a late winter cut for annual grassy weeds but in dense native grass patches wait until after grasses have set seed in summer.



Figure 15. Zone D revegetation.

## ZONE E – OPEN AREA

This is an open flat area where a large olive has been removed followed by substantial revegetation with a good diversity of native species and lifeforms.

### Recommended management actions:

- Monitor revegetation and infill as required with native grasses, wildflowers and lilies.
- Control herbaceous weeds.



Figure 16. Zone E revegetation.

## ZONE F – SOUTHERN EDGE OF DRAINAGE LINE

This is the lower section of the southern slope above the watercourse. Overstorey is predominantly Aleppo pines with scattered olive and buckthorn. There are scattered native plants on the uphill side but in general there is a lack of native plant species in all structural layers.

### Recommended management actions:

- Revegetate aiming for a shrubland with emergent sheoaks (*Allocasuarina verticillata*).
- Ongoing control of woody weed seedlings.



Figure 17. Zone F vegetation on batter and drainage line.



## ZONE G – WATERCOURSE

This is the highly modified, ephemeral stormwater course that runs through the site. There was a dense overstorey of introduced trees that have now mostly been removed, with a few river red gums scattered throughout. There is little plant cover on the ground, except at the eastern end where there is a predominance of morning glory that needs to be controlled. There is a lack of native plant species in all structural layers. The watercourse has significant erosion.

### Recommended management actions:

- Ongoing control of woody weed seedlings.
- Control the morning glory.
- Revegetate with native wetland sedge and rush species.



Figure 18. Zone G drainage line.

## ZONE H – STEEP NORTHERN BANKS

This is the northern side of the watercourse with steep slopes and a dense cover of Aleppo pines, under which there is a heavy layer of needles. There is little other vegetation other than some scattered native shrubs. Olives are dominant at the western end of this zone and there are patches of *Agave americana*.

### Recommended management actions:

- Remove olives and revegetate where removal has occurred.
- Up-prune and selective removal of Aleppo pines to reduce fire risk and increase light into the understorey.
- Revegetate where Aleppo pines have been removed, using species that appear to be able to tolerate the thick pine needle layer, such as ruby saltbush (*Enchylaena tomentosa* var. *tomentosa*), sea-berry saltbush (*Rhagodia candolleana* ssp. *candolleana*) and native grasses.



Figure 19. Zone H dense Aleppo pines.

# APPENDIX D – VEGETATION FOR REMOVAL OR CONTROL

The following trees and shrubs are invasive and/or non-native. They will be gradually replaced with more appropriate species (refer Appendix E) or controlled.

| COMMON NAME            | BOTANICAL NAME                    | COMMENT  | STATUS                     |
|------------------------|-----------------------------------|--|----------------------------|
| Western coastal wattle | <i>Acacia cyclops</i>             | Sleeper woody weed. Becomes dominant. Needs checking for seedlings |                            |
| Aloe                   | <i>Agave americana</i>            | Requires careful removal due to thorns and caustic sap             |                            |
| Galenia                | <i>Aizoon (Galenia) pubescens</i> | Can assist in reducing soil erosion                                |                            |
| Bridal creeper         | <i>Asparagus asparagoides</i>     | Potentially highly invasive climber                                | WONS* and SA declared weed |
| Mustard weed           | <i>Brassica sp.</i>               | Spreads by seed  |                            |
| Boxthorn               | <i>Lycium ferocissimum</i>        | Seeds poisonous to people  | WONS* and SA declared weed |
| Olive                  | <i>Olea europaea</i>              |  | SA declared weed           |
| Carrion flower         | <i>Orbea variegata</i>            |  | SA declared weed           |
| Sour sobs              | <i>Oxalis pes-caprae</i>          |  |                            |
| Date palm              | <i>Phoenix dactylifera</i>        |  |                            |
| Aleppo pine            | <i>Pinus halepensis</i>           |  | SA declared weed           |
| Rice millet            | <i>Piptatherum milliaceum</i>     | Spreads in clumps on moist soils, prolific seed production         |                            |
| Castor oil plant       | <i>Ricinus communis</i>           | Seeds poisonous to people  |                            |
| Peppertree             | <i>Schinus molle</i>              | Becomes dominant   |                            |
| Athel pine             | <i>Tamarix aphylla</i>            | SA declared weed   | WONS* and SA declared weed |

\* WONS = Weed of National Significance

# APPENDIX E – VEGETATION FOR REVEGETATION AND BIODIVERSITY IMPROVEMENT

The following plant species present a mix of trees, shrubs and groundcovers that are suitable for use in revegetating Pine Gully.

| TYPE                   | COMMON NAME           | BOTANICAL NAME  |
|------------------------|-----------------------|---|
| Trees                  | Drooping she-oak      | <i>Allocasuarina verticillata</i>                         |
|                        | Silver banksia        | <i>Banksia marginata</i>                                  |
|                        | Southern cypress pine | <i>Callitris gracilis</i>                                 |
|                        | River red gum         | <i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i> |
|                        | Dryland tea tree      | <i>Melaleuca lanceolata</i>                               |
|                        | Native apricot        | <i>Pittosporum angustifolium</i>                          |
|                        | Quandong              | <i>Santalum acuminatum</i>                                |
| Large to medium shrubs | Wreath wattle         | <i>Acacia acinacea</i>                                    |
|                        | Coast umbrella bush   | <i>Acacia cupularis</i>                                   |
|                        | Pale turpentine bush  | <i>Beyeria lechenaultii</i>                               |
|                        | Christmas bush        | <i>Bursaria spinosa</i>                                   |
|                        | Common fringe-myrtle  | <i>Calytrix tetragona</i>                                 |
|                        | Dwarf hakea           | <i>Hakea rugosa</i>                                       |
|                        | Nitre bush            | <i>Nitraria billardieri</i>                               |
| Small shrubs           | Prickly ground-berry  | <i>Acrotriche patula</i>                                  |
|                        | Ruby saltbush         | <i>Enchylaena tomentosa</i>                               |
|                        | Mallee bush-pea       | <i>Eutaxia microphylla</i>                                |
|                        | Rohrlach's bluebush   | <i>Maireana rohrlachii</i>                                |
|                        | Mallee pomaderris     | <i>Pomaderris paniculosa</i> ssp. <i>paniculosa</i>       |
|                        | Seaberry saltbush     | <i>Rhagodia candolleana</i> ssp. <i>candolleana</i>       |
|                        | Coast twinleaf        | <i>Zygophyllum billardieri</i>                            |
|                        | Forked twinleaf       | <i>Zygophyllum confluens</i>                              |
|                        | Pale twinleaf         | <i>Zygophyllum glaucum</i>                                |

| TYPE  | COMMON NAME                   | BOTANICAL NAME                                |
|---|-------------------------------|---|
| Ground covers/climbers/<br>sedges/grasses/forbs | Short-stem flax-lily          | <i>Dianella brevicaulis</i>                   |
|   | Common vanilla-lily           | <i>Arthropodium strictum</i>                  |
|   | Berry saltbush                | <i>Atriplex semibaccata</i>                   |
|   | Feather spear-grass           | <i>Austrostipa elegantissima</i>              |
|   | Rusty spear-grass             | <i>Austrostipa eremophila</i>                 |
|   | Coast spear-grass             | <i>Austrostipa flavescens</i>                 |
|   | Tall spear-grass              | <i>Austrostipa nodosa</i>                     |
|   | Bulbine-lily                  | <i>Bulbine bulbosa</i>                        |
|   | Lemon beauty-heads            | <i>Calocephalus citreus</i>                   |
|   | Pink garland-lily             | <i>Calostemma purpureum</i>                   |
|   | Notched sedge                 | <i>Carex bichenoviana</i>                     |
|   | Love creeper                  | <i>Comesperma volubile</i>                    |
|   | Spiny flat-sedge              | <i>Cyperus gymnocaulos</i>                    |
|   | Stiff flat-sedge              | <i>Cyperus vaginatus</i>                      |
|   | Black-anther flax-lily        | <i>Dianella revoluta</i> var. <i>revoluta</i> |
|   | Climbing saltbush             | <i>Einadia nutans</i> ssp. <i>nutans</i>      |
|   | Black grass saw-sedge         | <i>Gahnia lanigera</i>                        |
|   | White goodenia                | <i>Goodenia albiflora</i>                     |
|   | Cut-leaf goodenia             | <i>Goodenia pinnatifida</i>                   |
|   | Native lilac                  | <i>Hardenbergia violacea</i>                  |
|   | Pale rush                     | <i>Juncus pallidus</i>                        |
|   | Sticky sword-sedge            | <i>Lepidosperma viscidum</i>                  |
|   | Native flax                   | <i>Linum marginale</i>                        |
|   | Scented mat-rush              | <i>Lomandra effusa</i>                        |
|   | Hard mat-rush                 | <i>Lomandra multiflora</i> ssp. <i>dura</i>   |
|   | Austral trefoil               | <i>Lotus australis</i>                        |
|   | Wingless fissure-plant        | <i>Maireana enchylaenoides</i>                |
|   | Coastal climbing lignum       | <i>Muehlenbeckia gunnii</i>                   |
|   | Creeping boobialla            | <i>Myoporum parvifolium</i>                   |
|   | Coast tussock-grass           | <i>Poa poiformis</i>                          |
|   | Yellow-tails                  | <i>Ptilotus angustifolius</i>                 |
|   | Common wallaby grass          | <i>Rytidosperma caespitosa</i>                |
|   | Pale fanflower                | <i>Scaevola albida</i>                        |
|   | Kangaroo grass                | <i>Themeda triandra</i>                       |
|   | Narrow-leaf New Holland daisy | <i>Vittadinia blackii</i>                     |



# APPENDIX F – DRAFT IMPLEMENTATION PLAN

| ITEM   | SCOPE   | PROGRAM                    | BUDGET ESTIMATE                                |
|--|---|----------------------------|--|
| Watercourse rehabilitation                     | <i>Complete rehabilitation of the watercourse including tree removal, pipe extension and rock lining.</i>                                       | 2020/2021 and 2021/2022 FY | \$250,000 - \$300,000                          |
| Removal of Aleppo pines and other weed species | <i>Removal of some Aleppo pines and other weeds for fire safety and understorey improvement. Lift the canopy of the remaining Aleppo pines.</i> | 2020/2021 and ongoing      | \$100,000                                      |
| Revegetation                                   | <i>Revegetation of the gully based on the zones.</i>  | 2020/2021 and ongoing      | \$100,000                                      |
| Informative and Interpretative signage         | <i>Supply and install signage</i>   | 2020/2021 and ongoing      | \$50,000                                       |
| Paths  | <i>Construct improved trails within the gully.</i>  | 2021/2022 and ongoing      | \$50,000                                       |
| Ongoing maintenance                            | <i>Weed management and revegetation</i>   | 2022/2023 ongoing          | \$20,000 / year increase in operational budget |

Note:

- Budget is subject to annual Council approval and is a total budget exclusive of any grant or other external funding.
- The above costs are capital costs for new works. Existing assets will be renewed as part of Council's asset management planning.
- Path from base is grant funded.





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