Jack Mears Spring Rehabilitation Landscape Management Plan

Shire of Collie

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Prepared for

Shire of Collie

Prepared by

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Quality Information

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Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
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1.0 Introduction

1.1 Background

SWCC Consulting (SWCC) has been engaged by the Shire of Collie (the Shire) to undertake an assessment of Jack Mears Spring and the surrounding reserve. The project area is illustrated in Figure 1. The intent of this document is to detail the potential for environmentally sensitive flora or fauna communities that may utilise the Spring and the surrounding reserve, note any areas of degradation, and define prioritised actions to address areas of concern.

SWCC understands that this work is being undertaken partly due to the recommendations of the Shire's Weeds and Waterways Advisory Committee. A component of this project was to investigate the occurrence and identification of aquatic macro-invertebrates within the spring-fed stream and to determine their conservation status if present.

1.2 Scope

This scope of works that has contributed to this management plan can be summarised as follows (further details are available within Section 2.0):

- Undertake a desktop threatened species search;
- The completion of an on-ground site assessment of the project area;
- Aquatic macro-invertebrate sampling and identification;
- Community consultation; and
- Delivery of a Rehabilitation and Landscape Management Plan for Jack Mears Spring Reserve.

1.3 Licences and Approvals

The aquatic macro-invertebrate sampling was conducted under a Department of Parks and Wildlife (DPaW) licence to retain specimens.

1.4 Survey Limitations

SWCC has been able to complete the scope of work as described above, however works were executed under the following limitations:

- Timing of the project saw the infield assessment undertaken in January 2017. As such a detailed flora and fauna assessment was not considered. Spring being the optimum time for such an activity; and
- SWCC Consultation with Traditional Owners was limited to one in-field consultation with Aboriginal (Noongar) community members.

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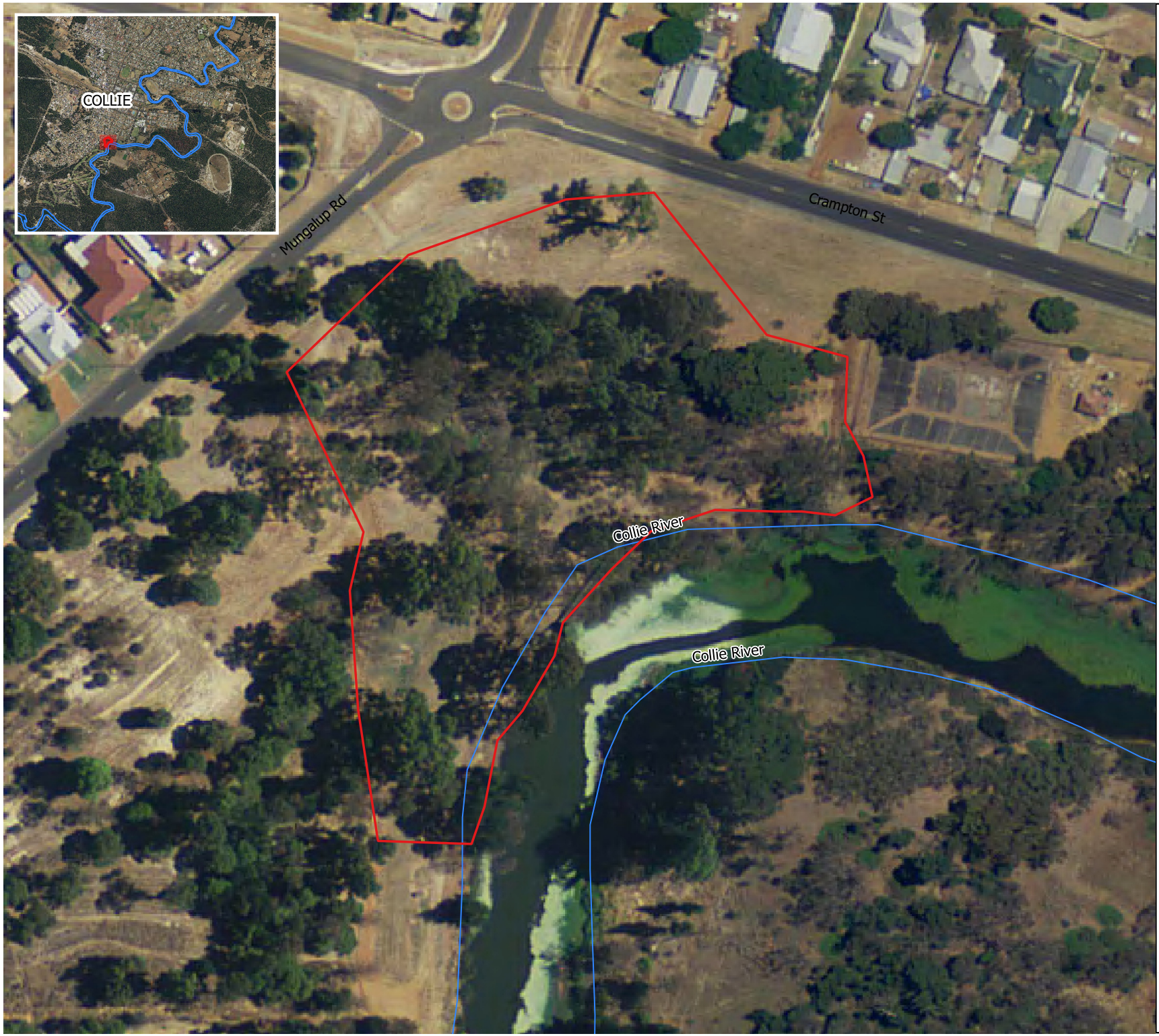

Figure 1:
Jack Mears Spring Site Location

Legend

- Project boundary
- Water Courses (DPaW, 2007)

N

0 10 20 30 40 m

SWCC CONSULTING

Projection: Universal Transverse Mercator Zone 50
Datum: Geocentric Datum of Australia 1994
Date Printed: 2/02/2017
Aerial imagery: Dec 2013

2.0 Methodology

As per section 1.2 the scope of the project is made up of a number of desktop and in-field activities. Various parameters have been assessed to contribute to this Management Plan. The following sections detail the methodology for each project component.

2.1 Threatened and Priority Flora, Fauna and Ecological Community Search

A search of online resources was undertaken to determine the pre-occurrence or potential existence of threatened species (flora and fauna) or listed ecological communities within proximity to the Project Area. The search included the following databases:

- Matters of national environmental significance and other matters protected by the *Environment Protection and Biodiversity Conservation Act* (1999) (EPBC Act) within a 1 km buffer of the project area (Department of the Environment and Energy 2016).
- DPaW database search for threatened and priority flora, fauna and ecological communities within a 2.5 km buffer of the project area (Parks and Wildlife 2016; Parks and Wildlife 2015). This search included the following databases:

- Threatened (Declared Rare) and Priority Flora database; and
- Western Australian Herbarium Specimen database.

2.2 Site Assessment

The site assessment undertaken on 16 January 2017, was made up of two components and included a visual monitoring assessment of the project area; and macro-invertebrate sampling of the spring channel. These are described further in the following sections.

2.2.1 Visual Monitoring

The Visual Monitoring technique is a field based rapid assessment tool developed by SWCC to visually assess and award a score to various landscape contributors. The following components are assessed using the Visual Monitoring tool:

- Vegetation components (overstorey, understorey and ground cover where applicable);
- Presence of exotic weed and feral animal species;
- Surface stability and erosion issues;
- Presence of available microhabitat; and
- Disturbance factors.

Each of these subcomponents is awarded a score to generate an overall result for a site. This allows comparison between different zones and over time. It also allows the identification of areas requiring remediation as indicated by low scores. In terms of Visual Monitoring a landscape that is on a trajectory towards a functioning and resilient system would have:

- Diversity of overstorey and understorey vegetative components which are mature and reproducing;
- Diversity of ground cover components with good soil coverage and leaf litter contribution;
- Lack of weeds and / or site disturbance associated with feral animal activity;
- Stable surface nature with organic matter (i.e. topsoil with organic content);
- Lack of features attributable to erosion;
- Lack of soil compaction and slow to nil water runoff;
- High availability of microhabitat components; and
- Lack of disturbance factors including rubbish and physical disturbance such as uncontrolled fire or vandalism.

To rationalise the project area, visual monitoring was undertaken across the following zones (see Figure 2):

- Spring fed stream and damp zone;
- Diversion drain zone;
- Central flat zone; and
- Upper riparian zone.

2.2.2 Macro-invertebrate Sampling

The aquatic invertebrate survey of the spring channel was undertaken by Aquatic Ecologist Dr Robyn Paice to determine the presence of a shrimp species that had been previously sighted by a community member. Two-minute sweep-net sampling was undertaken at three sample sites along the small spring-fed stream. Each sample site is described in Table 1, and their locations can be seen on Figure 2.

The length of stream sampled at each site varied between three and five metres. This was due to dense vegetation growth limiting accessibility to the stream. Sampling included all habitats present at each site, including agitation of aquatic vegetation, kick sampling of stream bed, and sweeping in open channels. Live-picking of aquatic invertebrates was completed on-site for each sample to obtain specimens for each taxa present.

Table 1: Macro-invertebrate Sample Site Description

Site	Location	Description
A	Stream headwaters	Groundwater meets the surface at this point, the stream is narrow (0.3m) and shallow (0.1m)
B	Mid-stream	Wider (to 0.7m) and deeper (to 0.5m) channel with slower flow.
C	Upstream from Collie River outflow	Variable depth (0.05 – 0.3m) with pool and riffle sections.

Plate 1: Macro-invertebrate sampling of the Spring fed Stream

Plate 2: Live Picking of Aquatic Invertebrates

2.3 Community Consultation

Consultation with the Collie community was completed following the site assessment. The consultation included an infield meeting with local Noongar community members, including Traditional Owners, and a public notice in the Collie Mail to promote public awareness.

Select Noongar community representatives as identified by the Shire of Collie, were invited to attend an on-ground discussion on the proposed management recommendations that came out of the site assessment. This was an opportunity to receive feedback on the proposed actions and to incorporate the expectations of the Traditional Owners to ensure any potential risks to cultural heritage are adequately managed.

SWCC posted a public notice which appeared in the Collie Mail on 26 January 2017. The notice invited community comment on the Rehabilitation Landscape Management Plan up until 3 February 2017. A copy of the public notice is provided within Appendix A. The public notice and request for comment was extended to the Shire website and Facebook page, Collie Visitor Centre website and the Collie River Valley email newsletter.

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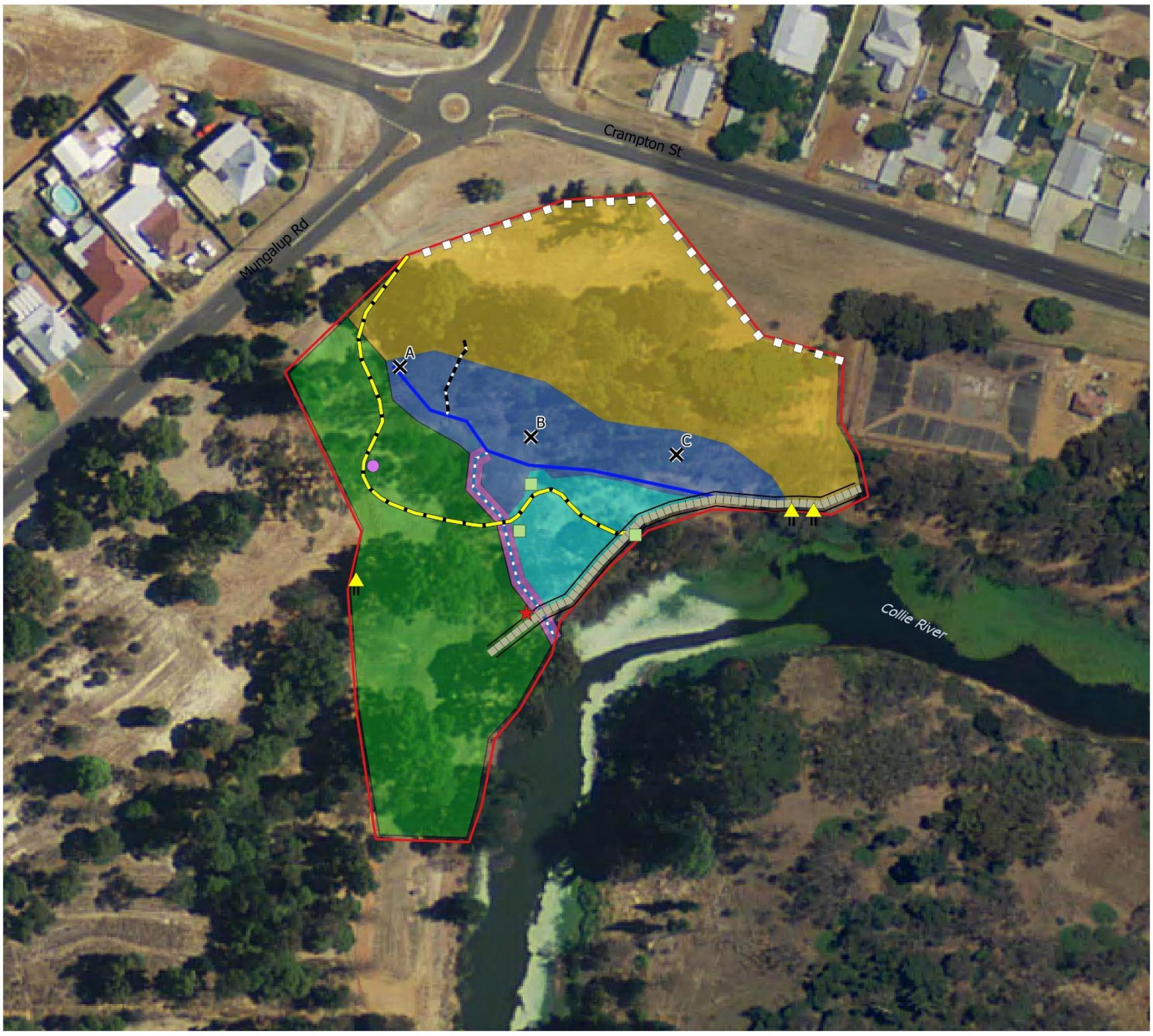

Figure 2:
Site Attributes Jack Mears Spring

Legend

- Project boundary

Water features:

- Diversion drain
- Jack Mears Spring
- Stormwater drain

Zones:

- Spring-fed stream and Damp zone
- Reserve flat zone
- Upper riparian zone
- Diversion drain zone
- Public open space zone
- Walk trail / boardwalk
- Proposed path
- Interpretive signage
- Jack Mears Spring plaque
- Sample points
- Proposed bollards
- Acacia longifolia parent tree
- Minor gully erosion

N

0 10 20 30 40 m

SWCC CONSULTING

Projection: Universal Transverse Mercator Zone 50
Datum: Geocentric Datum of Australia 1994
Date Printed: 27/02/2017
Aerial imagery: Dec 2013

Action and Description	Priority
Project Area Recommendations	
Construct an interpretive walking path from the road verge across the headwaters of the spring and the Jack Mears plaque, past the three Aboriginal cultural interpretive signs and back to the board walk along the Collie River. Path curbing is recommended to prevent grass encroachment over the path.	High
Removal of the mature *A longifolia* trees as identified on Figure 2. Removal of these trees will limit ongoing germination (see Plate 6).	High
Remove tree guards from past revegetation efforts.	High
A qualified professional to undertake a structural assessment of the boardwalk and gazebo to ensure public safety.	Med
Boardwalk seating to allow pedestrians to rest and appreciate the natural area.	Low
Upper Riparian Zone Recommendations	
Implement a weed control program targeting Watsonia, Sydney Golden Wattle, African lovegrass, Tandier Pea, and grass species to promote past revegetation efforts.	High
Infill planting along the upper embankment of this zone to promote understorey establishment and to encourage wildlife.	High
Habitat enhancement via nesting boxes and timber placement to encourage native fauna to the area and provide shelter from potential predators.	Med
Install bollards to delineate verge grass from the native vegetation area and revegetation works. This would protect native plants from verge mowing activities and encourage pedestrians to walk around the revegetation area.	Med
Blue gum removal to prevent spread via seed.	Low
Spring Fed Stream and Damp Zone Recommendations	
Weed control would need to include manual removal (targeting Cotton bush, juvenile *A. longifolia*); slashing via brushcutter (grass species); Cut and paste application (woody weeds); and Herbicide application (post slashing).	High
The planting of rushes and sedges at high densities (4 plants per m^2) along the stream channel.	High
Habitat enhancement (placement of rock and large woody debris) within and along the spring channel to provide additional substrate and shelter to fauna occurring within the stream.	Med
investigate the possibility of relocating the storm water flow to another discharge location (see Figure 2 and Plate 8). Water Sensitive Urban Design principles should be considered.	Med
Reserve Flat Zone Recommendations	
The area is mulched and planted out with a selection of native understorey species to not impede the view from the boardwalk (1 plant per 2-3 m^2).	High
Weed control to remove grass and flat weed competition prior to the proposed planting and mulching.	High
Blue gum removal to prevent spread via seed.	Low
Diversion Drain Zone Recommendations	
Implement a seasonal weed control program. Spring control to target new season germinants. Summer control to allow herbicide application when there is no water flow.	High
Planting the either side of the bank at high densities (4 plants per m^2) will allow natives to outcompete weed species and provide nutrient stripping and stabilisation benefits.	High
Public Open Space Zone Recommendations	
Install and maintain a public bin at the bin station adjacent to the car park. but there was no bin present at the time of the site assessment.	Med
As a public open space a mowed and maintained area may encourage people to picnic and use the area more regularly.	Med
Numerous blue gum trees occur within this area. Blue gum removal is recommended to prevent spread via seed.	Low

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3.0 Results

3.1 Threatened and Priority Flora, Fauna and Ecological Community Search

The search of online resources returned no known occurrences of threatened or priority ecological communities recorded within 5 kilometres of the project area.

Table 2 details the results for the database search for threatened and priority fauna in relation to the project area and combines the results from the DPaW database search (2.5 km radius of the project area) and the EPBC Act Protected Matters Report (1 km radius of the project area). The species listed may occur within the project area, or have suitable habitat in proximity to the site. Where a year has been provided in the *Presence / Last Record* column, this refers to the last confirmed record of an occurrence within the search area.

The information supplied should be regarded as an indication only of threatened and priority fauna that may be present.

Table 2: Threatened Fauna Database Search Results

Scientific Name	Common Name	Conservation Code DPaW	EPBC Status	Presence / Last record
BIRD				
Botaurus poiciloptilus	Australasian Bittern	-	Endangered	Species or species habitat may occur within area
Calidris ferruginea	Curlew Sandpiper	-	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	Vulnerable	Vulnerable	2010
Calyptorhynchus baudinii	Baudin's cockatoo	Endangered	Vulnerable	2010
Calyptorhynchus latirostris	Carnaby's cockatoo	Endangered	Endangered	2007
Ixobrychus flavicollis australis	Black bittern (southwestern subpop)	Priority 1	-	1937
Leipoa ocellata	Malleefowl	-	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis	Eastern Curlew	-	Critically Endangered	Species or species habitat may occur within area
MAMMAL				
Dasyurus geoffroii	Chuditch, western quoll	Vulnerable	Vulnerable	2007
Falsistrellus mackenziei	Western false pipistrelle	Priority 4	-	2010
Hydromys chrysogaster	Water-rat	Priority 4	-	-
Isoodon obesulus fusciventer	Southern brown bandicoot	Priority 4	-	2010
Macropus Irma	Western brush wallaby	Priority 4	-	1899

Scientific Name	Common Name	Conservation Code DPaW	EPBC Status	Presence / Last record
Myrmecobius fasciatus	Numbat, walpurti	Endangered	-	1966
Phascogale tapoatafa subsp.	South-western brush-tailed phascogale	Vulnerable	-	2010
Pseudocheirus occidentalis	Western ringtail possum	Endangered	Vulnerable	2010
Setonix brachyurus	Quokka	Vulnerable	Vulnerable	1899
FISH				
Geotria australis	Pouched lamprey	Priority 1		1915
Nannatherina balstoni	Balston's pygmy perch	-	Vulnerable	Species or species habitat may occur within area

Results of the DPaW and EPBC Threatened (Declared Rare) and Priority Flora search is provided within Table 3. Table 3 combines the results from the DPaW database search (2.5 km radius of the project area) and the EPBC Act Protected Matters Report (1 km radius of the project area).

There were no species recorded as Threatened within the search area, only Priority species occur within the search area. Note that DPaW provides the following disclaimer that should be considered when reviewing the threatened and priority flora listed… "*The information supplied should be regarded as an indication only of the Threatened and Priority flora that may be present and may be used as a target list in any surveys undertaken*."

Table 3: Threatened Flora Database Search Results

Scientific Name	Common Name	Conservation Code DPaW	EPBC Status	Flowering period
Adenanthos cygnorum subsp. Chamaephyton	-	Priority 3	-	July to Jan
Caladenia validinervia	Orchid species	Priority 1	-	Sept, Oct
Calothamnus graniticus subsp. leptophyllus	-	Priority 4	-	June to Aug
Diuris micrantha	Dwarf Bee-orchid	-	Vulnerable	Sept, Oct
Grevillea ripicola	Collie Grevillea	Priority 4	-	April, Oct or Nov
Hemigenia rigida	-	Priority 1	-	Aug to Jan
Hypolaena robusta	-	Priority 4	-	Sept, Oct
Pultenaea skinneri	Skinner's Pea	Priority 4	-	July to Sep
Synaphea hians	-	Priority 3	-	Jul to Nov

3.2 Visual Monitoring

Table 4 provides an interpretation guide for the visual monitoring scores. Details for the Visual Monitoring attributes for the project zones have been presented within Table 5. The total scores indicate the relative condition for each domain out of a possible total of 99.

Table 4: Visual Monitoring Score Interpretation

Survey score	Interpretation
Score < 40	Poor – degraded and require high degree of active land management
Score 41 - 70	Satisfactory – require varying degrees of active land management
Score 71 – 90	Good – require maintenance works (e.g. small scale weed control)
Score >90	Excellent – does not require active management

All project zones have returned as a Satisfactory condition, requiring varying degrees of active management to improve condition. The significant weed burden and diversity of weeds present are the main factors impacting the scores across domains. Other attributes that have influenced scores in specific zones are summarised below:

- Upper Riparian Zone:

- Presence of weeds including but not limited to Watsonia, *Acacia longifolia*, African lovegrass, Tandier pea, blue gums and grass species.
- A lack of microhabitat to support and shelter native fauna.
- Minor gully erosion from a stormwater drain that discharges downstream of the spring headwaters.

- Spring Fed Stream and Damp Zone:

- Severe weed growth smothering the stream channel and past revegetation efforts;
- Weeds include but not limited to grass species, blackberry, tagasaste, *A. longifolia*, cotton bush.
- Lack of native rush and sedge species to streamline the channel banks;
- Numerous loose tree guards littering the channel and the project area.

- Reserve Flat Zone:

- Poor to nil presence of understorey species.

- Diversion Drain Zone:

- Minor gully erosion from surface runoff from the adjacent open space and driveway.
- Weed species including *A. longifolia,* blackberry, bulrush, grass species and *Juncus microcephalus.*

Table 5: Visual Monitoring results for the Jack Mears Spring Project Area

Zone	Overstorey Vegetation	Understorey Vegetation	Ground Cover	Weed Species	Feral Animal	Surface Stability	Micro-habitat	Disturbance	TOTAL SCORE
Total Possible Score	**12**	**12**	**15**	**12**	**6**	**27**	**9**	**6**	**99**
Spring Channel and Damp Zone	12	6	8	2	6	24	6	5	**69**
Diversion Drain	11	7	10	2	6	20	4	4	**64**
Reserve Flat	7	2	5	5	6	22	1	5	**53**
Upper Riparian Zone	11	8	9	0	6	23	2	5	**64**

The total scores for each zone can be interpreted based on the following scale:

- <40 – Poor
- 41 – 70 – Satisfactory
- 71 – 90 – Good
- >90 – Excellent

3.3 Macro-invertebrate Sampling

A total of 22 aquatic invertebrate taxa were found across the three sample sites. Specimens were preserved in ethanol and most identified to at least family level, with macrocrustaceans identified to species. Log abundance was determined across sites through counting and estimation of number of individuals for each taxa. Log abundance was classified as 1-10; 11-100; 101-1000; and >1000. Aquatic invertebrates found and their relative log abundance are presented within Table 6.

Perthia acutitelson was found at relatively high abundance. This species was most abundant in the headwater at site A. This species, an Amphipod is often referred to as shrimp, and may be the organism responsible for anecdotal shrimp sightings by community members.

Table 6: Aquatic invertebrate taxa found in Jack Mears Spring January 2017

Taxonomy and Species Name	Common Name	Log Abundance
Subphyllum CRUSTACEA Class MALACOSTRACA		
Order AMPHIPODA		
Perthiidae		
Perthia acutitelson	Amphipod	101-1000
Order DECAPODA		
Parastacidae	Freshwater crayfish	
Cherax quinquecarinatus	Gilgie	1-10
Cherax destructor	Yabby	1-10
Subclass COPEPODA		
Order CALANOIDA		
Calanoida sp	Calanoid copepod	1-10
Class OSTRACODA		
Cyprididae sp.	Seed shrimp	11-100
Class INSECTA		
Order COLEOPTERA	Beetles	
Curculionidae	Weevils	1-10
Hydrophilidae	Water scavenger beetles	
Helochares tenuistriatus		1-10
Paracymus pygmaeus		1-10
Order HEMIPTERA	True bugs	
Hemiptera sp.		1-10
Notonectidae	Backswimmers	
Paranisops sp.		1-10
Order DIPTERA	True flies	
Chironomidae	Non-biting midge larvae	
Chironomonas sp.		11-100
Chironominae sp.		101-1000
Orthocladinae sp.		11-100

Taxonomy and Species Name	Common Name	Log Abundance
Tanypodinae sp.		11-100
Culucidae	Mosquito larvae	
Anopheles sp		11-100
Culex sp.		101-1000
Simulidae	Black fly larvae	
Simulinae sp.		101-1000
Tipulidae	Crane fly larvae	1-10
Order PLECOPTERA sp.	Stonefly larvae	1-10
Order ZYGOPTERA sp.	Damselfly larvae	1-10
Class ARACHNIDA		
Order ACARINA	Water mite	1-10
Class GASTROPODA		
Pomatiopsidae	Aquatic snails	
Potamopyrgus sp.		1-10

3.4 Community Consultation

At the time of writing this Management Plan, SWCC had not received any community feedback as a result of the public notification. The infield consultation with local Noongar community representatives was held on 2 February 2017 and was attended by the following personnel:

- Joe Northover – Traditional Owner;
- David Mears – Traditional Owner;
- Cedic Ugle – Traditional Owner;
- Andrew Dover – Shire of Collie;
- Nerilee Boshammer – SWCC Consulting; and
- Travis Drysdale – SWCC Consulting.

A follow up meeting between James Kahn (Traditional Owner) and Andrew Dover was undertaken to discuss the project concept. Following submission of the Draft Management Plan, SWCC presented the recommendations to the Collie Weeds and Waterways Advisory Committee. Feedback from these consultation events are detailed within Section 4.0.

4.0 Discussion

4.1 Threatened and Priority Flora, Fauna and Ecological Community Search

The search returned no known occurrences of threatened or priority ecological communities within 5 kilometres of the project area.

A total of 19 fauna species and nine flora species classified as Threatened or Priority species have been known or have the potential to occur within 2.5 kilometres of the project area. These species should be used as a guide should an onsite flora and fauna survey ben considered. The identification of threatened flora and fauna within the project area was not considered given the limitations defined under Section 1.4.

The project area has the potentially support some of the threatened fauna species listed with some mature hollow bearing trees noted onsite.

4.2 Visual Monitoring

Based on the following scale, the total scores have been calculated for each zone to allow comparison between the various zones within the site:

- <40 – Poor
- 41 – 70 – Satisfactory
- 71 – 90 – Good
- >90 – Excellent

All zones assessed via visual monitoring returned a satisfactory rating. Indices that performed well across the site included:

- Overstorey vegetation, being well represented by *Eucalyptus rudis, E. marginata* and *Melaleuca rhaphiopylla.*
- Surface stability, only minor and localised areas of gully erosion were noted. These are present due to surface water flow being channelled to discharge locations in the Spring and Diversion drain (refer to Section 0 for more information).
- Lack of overt feral animal activity evident.
- Lack of significant disturbance (i.e. off-road vehicles, vandalism).

Weed Species was the poorest ranked sub-category across all zones assessed. SWCC understands that past efforts have been made to control weeds and revegetate the site which included a prescribed burn undertaken in April 2013. A CapeLife (2014) activity report provided by the Shire summarises weed control works undertaken in November 2014, with the planting of wetland species occurring on the same day. There is no evidence of weed control efforts since this date, this is evident by the weed burden present onsite during the site assessment.

Revegetation efforts have contributed positively to the scores achieved by select zones in the Understorey and Ground Cover sub-categories. However, the limited weed control may have impacted upon revegetation efforts. As a result, the project area has a diverse presence of exotic plants that will require ongoing control efforts. Specific details on the recommendations for weed control are provided within Section 0.

4.3 Macro-invertebrate Sampling

The objective of the macro-invertebrate sampling was to determine the presence (if any) and status of a shrimp species that was anecdotally sighted by a community member.

Perthia acutitelson an Amphipod, was found in relatively high abundance at the spring headwater, sample site A (refer to Figure 2). The species was quite conspicuous at the headwaters which is the most accessible part of the spring fed stream. The amphipod is up to 15mm in length and was easily observed by shifting small rocks or wood pieces.

Amphipods are often referred to as shrimp, this finding is supported by anecdotal sightings of amphipods by community members. Although this species is not formally listed as threatened, it is nonetheless interesting because it does form part of Aquatic Root Mat Communities in caves of the Leeuwin-Naturaliste Ridge, which are listed as Critically Endangered Threatened Ecological Communities (DPaW, 2017; English and Blyth, 2000). Furthermore, it is considered a Gondwanan relict, occurring for over 100 million year since the existence of the Gondwanan supercontinent (English and Blyth, 2000).

Other observed crustaceans included the native Gilgie (*Cherax quinquecarinatus*) and introduced Yabby (*Cherax destructor*), however these are well-known and unlikely to draw attention as a possible rare species. Microcrustaceans were found, but these are difficult to see without a microscope and unlikely to be the source of the anecdotal shrimp reports.

Dipteran larvae were the most abundant group of invertebrates present at the site overall, but only at the lower sites B and C, with few present at site A. All these organisms were very small, possibly a result of the relatively cool and shaded conditions. The single specimens of damselfly larvae and stonefly larvae were also very small. Few predatory invertebrates were found, in the form of adult Dytiscidae beetles and backswimmers (Notonectidae). However, four large Western Pygmy Perch (*Nannoperca vittata*) were caught during sampling, and these are likely to be the dominant predators in the stream. This may also contribute to the small size of larval organisms encountered.

Plate 3: The Amphipod *Perthia acutitelson*

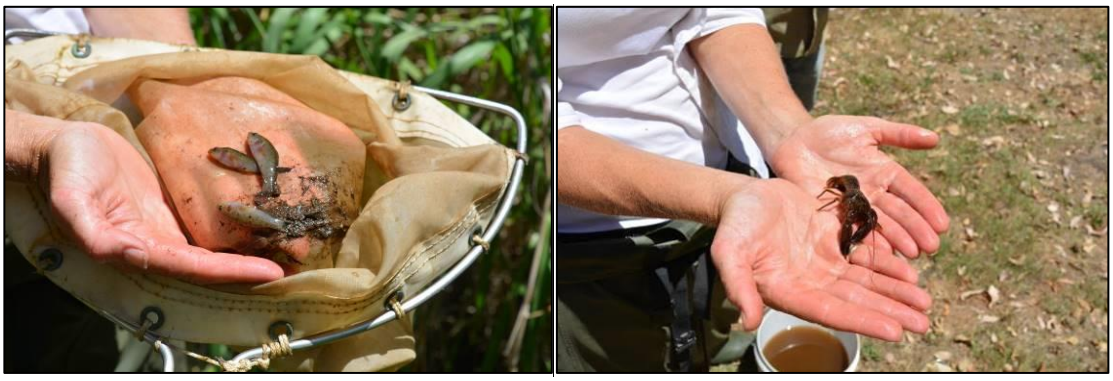

Plate 4: Western pygmy perch and Gilgie recovered from Sample Site B

4.4 Community Consultation

The project scope, site assessment methodology and proposed actions (as detailed in Section 5.0) were explained to the Traditional Owners present during the infield consultation. Participants were invited to provide feedback for discussion and consideration.

The Traditional Owners offered their support to the Project and had no opposition to the proposed actions discussed. The project area is a Registered Site (Site ID 4699) with the Department of Aboriginal Affairs due to its historical use as a fresh water source; proximity to the Collie River; and proximity to an historic camp location. Given this cultural significance, Traditional Owners advised that a Site Monitor would be required to identify artefacts that may be unearthed should earthworks be required as part of the proposed actions. Traditional Owners consider earthworks as the potential to cause significant ground disturbance such as soil excavation with machinery, but excluded planting activities. Table 7 details suggestions from Traditional Owners to improve site amenity and are offered for the Shire's consideration. This Table includes SWCC's perspective based on proposed implementation.

Table 7: Traditional Owner Suggestions to Improve Site Amenity

Suggestion	SWCC Consulting Response
The potential for barbeques to be installed in the public open space zone	Suggestion considered outside of SWCC's scope. For Shire consideration
The establishment of soft grasses in the public open space zone	Suggestion incorporated in Public Open Space recommendations (see Table 13
Up lighting of significant trees within the project area	Suggestion considered outside of SWCC's scope. For Shire consideration.
Consider a rock base in the diversion drain to impede erosion	SWCC consider the drain to be stable and the establishment of a rock base not required.

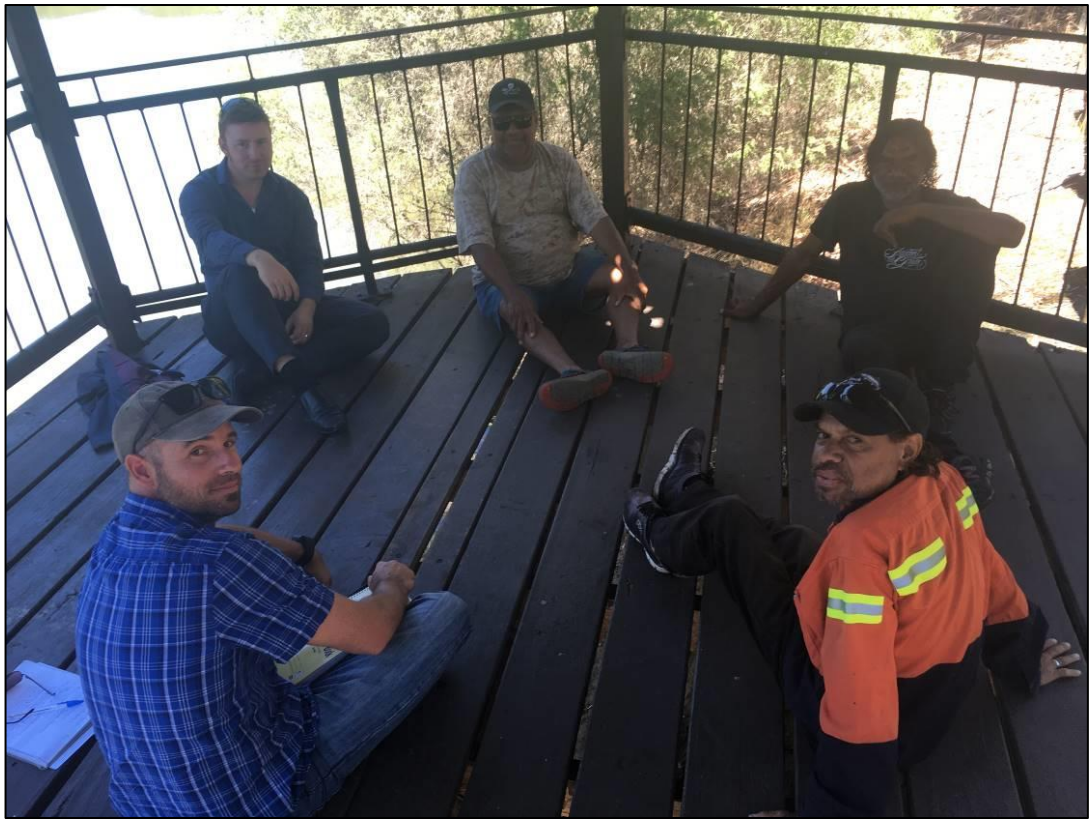

Plate 5: In Field Consultation with Traditional Owners

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5.0 Conclusion and Recommendations

The Jack Mears Spring Reserve has cultural significance and environmental values that are worthy of protection and enhancement. The community interest is apparent from historic volunteer efforts that have occurred in stages. Work in the area has been sporadic, with limited intervening maintenance. Subsequently the site has again become excessively overgrown with weeds and is now littered with tree guards from past revegetation works.

The following sections provide recommended actions to address areas of degradation, enhance the environmental values and to improve the aesthetic outlook of the reserve. Recommendations have been prioritised as High, Medium or Low based on the potential impact of action implementation.

The zones referenced below are illustrated within Figure 2. Weed control is an action that is required across the project area and is discussed further in the following sections. Appendix B provides a list of the weeds that were recorded during the site assessment.

5.1 Jack Mears Spring Reserve

The recommendations within Table 8 are not specific to one zone but could be applied across the project area.

Table 8: Project Area Recommended Actions

Action	Description	Priority
Install an interpretive walking path	Construct a walking path from the road verge that guides pedestrians across the headwaters of the spring and the Jack Mears plaque and leads people past the three Aboriginal cultural interpretive signs and back to the board walk along the Collie River. SWCC recommend this path is formalised by curbing to prevent grass encroachment over the path and to encourage pedestrian not to stray into vegetated areas. Site monitor/s will be required onsite should excavation be required for this activity.	High
Removal of the *Acacia longifolia* parent trees	Several mature *A longifolia* trees occur on the outskirts of the project area. These trees are the seed source for the germinants that occur throughout the damp zone and along the stream channel. Removal of these trees will limit ongoing germination (see Plate 6).	High
Tree guard removal	The project area is littered with tree guards from past revegetation efforts. The guards look unsightly, may encourage other littering and may eventually enter the Collie River.	High
Boardwalk stability assessment	The boardwalk and gazebo appear aged and unstable in some areas. SWCC suggest a qualified professional undertake a structural assessment to ensure public safety.	Med
Boardwalk Seating	The boardwalk is an elevated platform that overlooks the river and project area. Select areas would benefit from seating to allow pedestrians to rest and appreciate the natural area. The client has suggested an option to convert the historic sign structure in the Public Open Space zone to a swing chair if structurally sound.	Low

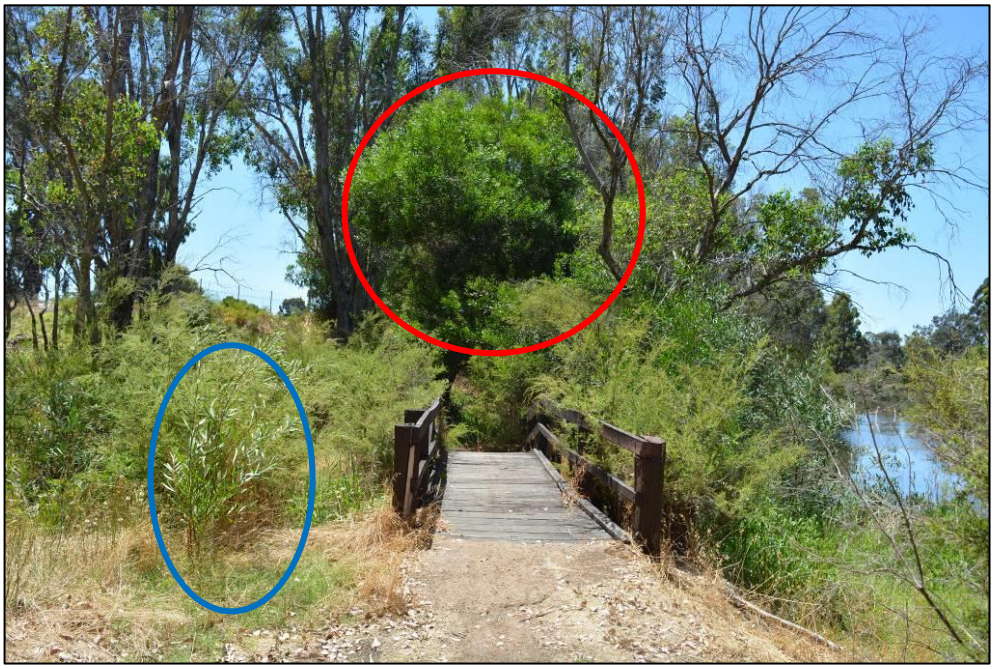

Plate 6: *Acacia longifolia* (Sydney Golden Wattle) Parent Tree (red) and Germinants (blue)

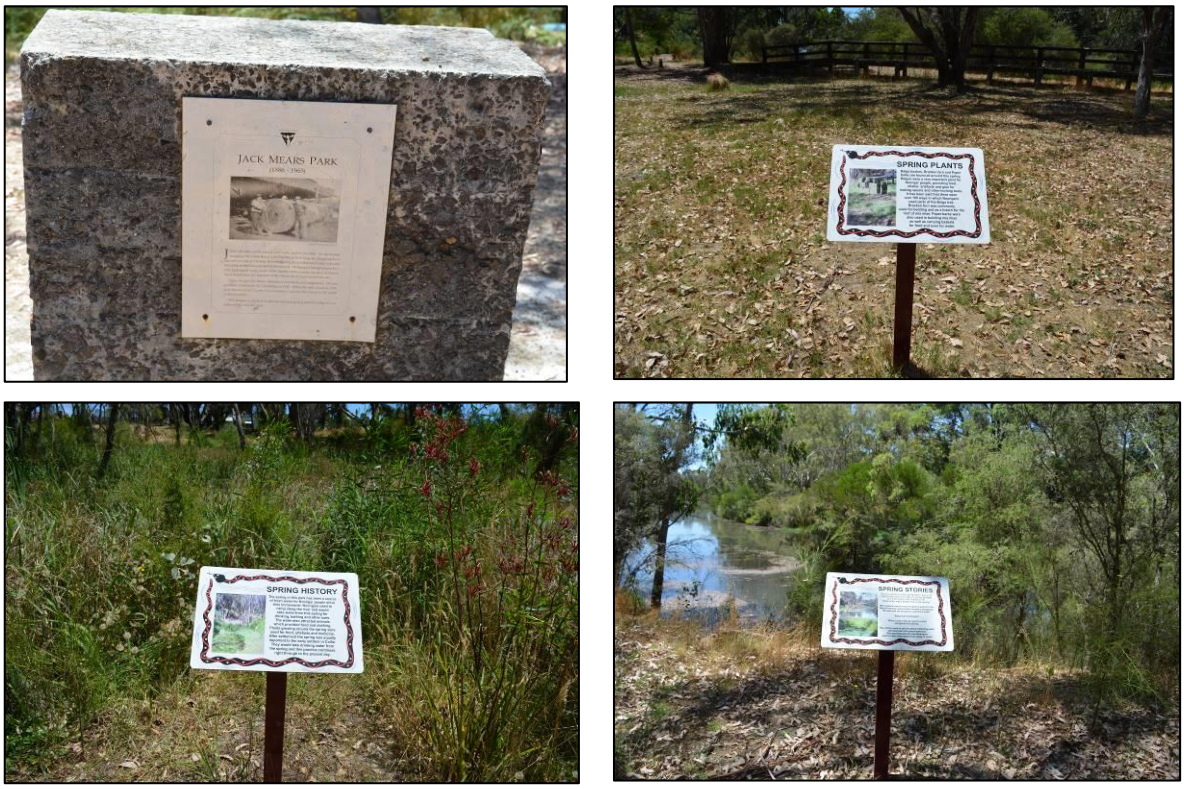

Plate 7: The Proposed Walking Path Would Lead Pedestrians Past these Interpretive Signs

5.1.1 Upper Riparian Zone

Table 9 details the recommended actions specific to the Upper Riparian Zone. The improvement and management of the upper riparian area is an important requirement to sustain the ecological value of the spring stream and its catchment.

Table 9: Upper Riparian Zone Recommended Actions

Action	Description	Priority
Weed control	Implement a weed control program targeting Watsonia, Sydney Golden Wattle, African lovegrass, Tandier Pea, and grass species to promote past revegetation efforts.	High
Supplementary planting	Infill planting along the upper embankment of this zone to promote understorey establishment and to encourage wildlife.	High
Habitat enhancement	Nesting boxes and timber placement would encourage native fauna to the area and provide areas of shelter from potential predators.	Med
Define native vegetation border	Bollards to delineate verge grass from the native vegetation area and revegetation works. This would protect native plants from verge mowing activities and encourage pedestrians to walk around the revegetation area.	Med
Blue gum removal	Blue gum removal to prevent spread via seed.	Low

5.1.2 Spring Fed Stream and Damp Zone

The fresh water supplied from the spring is supporting an excessive weed burden along the stream and the damp zone. There is a clear delineation of vegetation growth between the damp zone and the upper riparian zone as mapped on Figure 2. Revegetation efforts have occurred within this zone, though the weed growth is smothering out native plants and in places covers the stream entirely. Table 10 details the recommended actions specific to the spring fed stream and associated damp zone.

Table 10: Spring Fed Stream and Damp Zone Recommended Actions

Action	Description	Priority
Weed control	Weed control efforts here would require a staged and committed effort to remove weeds to promote native species and revegetation efforts. A holistic approach including all methods of weed control would be required to before any planting could be considered. Weed control would need to include: - Manual removal (targeting Cotton bush, juvenile *A. longifolia*) - Slashing via brushcutter (grass species) - Cut and paste application (woody weeds) and - Herbicide application (post slashing). Some damage to past planting efforts can be expected from this control program, however it may be more cost effective to replace the plants lost rather than attempting to avoid them during slashing and herbicide application activities.	High
Riparian planting	SWCC recommend the establishment of wetland species within this zone. The planting of rushes and sedges at high densities (4 plants per m^2) along the stream channel supported by the implementation of a weed control program would allow establishment to out compete weed species. The planting of wetland shrub and tree species in the damp zone to support the existing transition species may be beneficial.	High
Habitat enhancement	The select placement of rock and large woody debris within and along the spring channel would provide additional substrate and shelter to support	Med

Action	Description	Priority
	aquatic invertebrates and other fauna that are known to occur within the stream.	
Stormwater Drain and Gully Erosion	Figure 2 and Plate 8 shows the location of a stormwater drain that discharges downstream of the spring headwaters. It is assumed that this is run off from the road catchment. A small gully has eroded below the discharge point that may require stabilisation works in the future. SWCC suggest the Shire investigate the possibility of relocating the storm water flow to another discharge location. There is a risk that pollution from this point source may negatively impact the reserve area and the water quality of the stream. The Shire should consider Water Sensitive Urban Design principles to filter stormwater prior to discharge into the environment.	Med

Plate 8: Stormwater discharge point and minor gully erosion

5.1.3 Reserve Flat

Table 11 details the recommended actions specific to the reserve flat. Plate 9 illustrates the lack of understorey species present within this zone.

Table 11: Reserve Flat Recommended Action

Action	Description	Priority
Understorey establishment	The proposed walk path winds through this area leading people past the Aboriginal interpretive signs. SWCC propose the remaining area is mulched and planted out with a selection of native understorey species (1 plant per 2-3 m^2). Understorey species should be chosen to not impede the view from the boardwalk across to the Spring (<1.5m tall). Mulching will provide ongoing weed control and maintain soil moisture.	High
Weed control	Required to remove grass and flat weed competition prior to the proposed planting and mulching.	High
Blue gum removal	Blue gum removal to prevent spread via seed.	Low

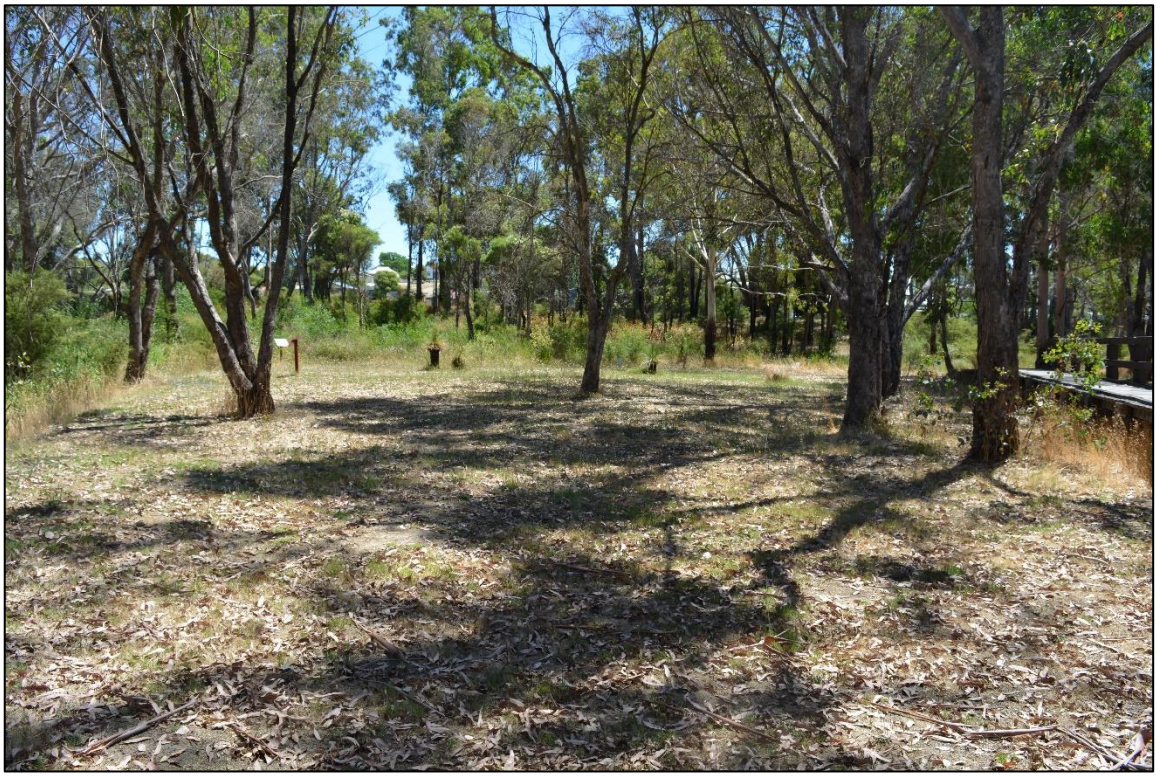

Plate 9: Reserve Flat Zone void of Understorey Species

5.1.4 Diversion Drain

Table 12 details the recommended actions specific to the diversion drain.

Table 12: Diversion Drain Recommended Actions

Action	Description	Priority
Weed Control	Seasonal weed control is required. Spring weed control to target new season germinants. Summer weed control is recommended to allow herbicide application when there is no water flow.	High
Rush and sedge planting	Planting the either side of the bank at high densities (4 plants per m^2) will allow natives to outcompete weed species and provide nutrient stripping and stabilisation benefits.	High
Gully stabilisation	Surface flow from the POS and carpark area appears to concentrate and flow into one point of the diversion drain. A minor gully has formed, though it seems relatively stable and localised. The gully would benefit from the planting described above.	Low

5.1.5 Public Open Space

Table 13 details the recommended actions specific to the public open space.

Table 13: Public Open Space Recommended Actions

Action	Description	Priority
Install a public bin	Litter was prevalent in this area (see Plate 10). A bin station is present adjacent to the car park but there was no bin present at the time of the site assessment.	Med
Maintain turf area	As a public open space a mowed and maintained area may encourage people to picnic and use the area more regularly.	Med
Blue gum removal	Numerous blue gum trees occur within this area. Blue gums are not native to Western Australia and can displace native species. They shed their bark in long strips and can appear unsightly.	Low

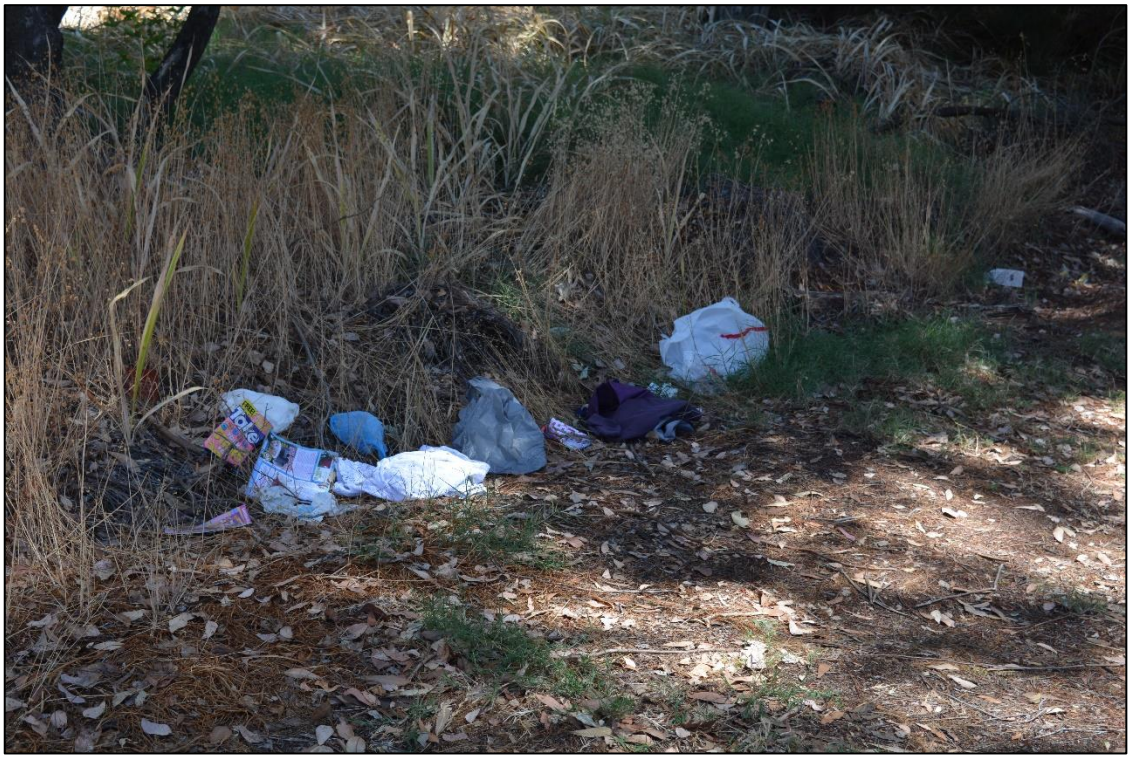

Plate 10: Rubbish dumped within the Public Open Space Zone

6.0 References

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Appendix A

Collie Mail Public Notice

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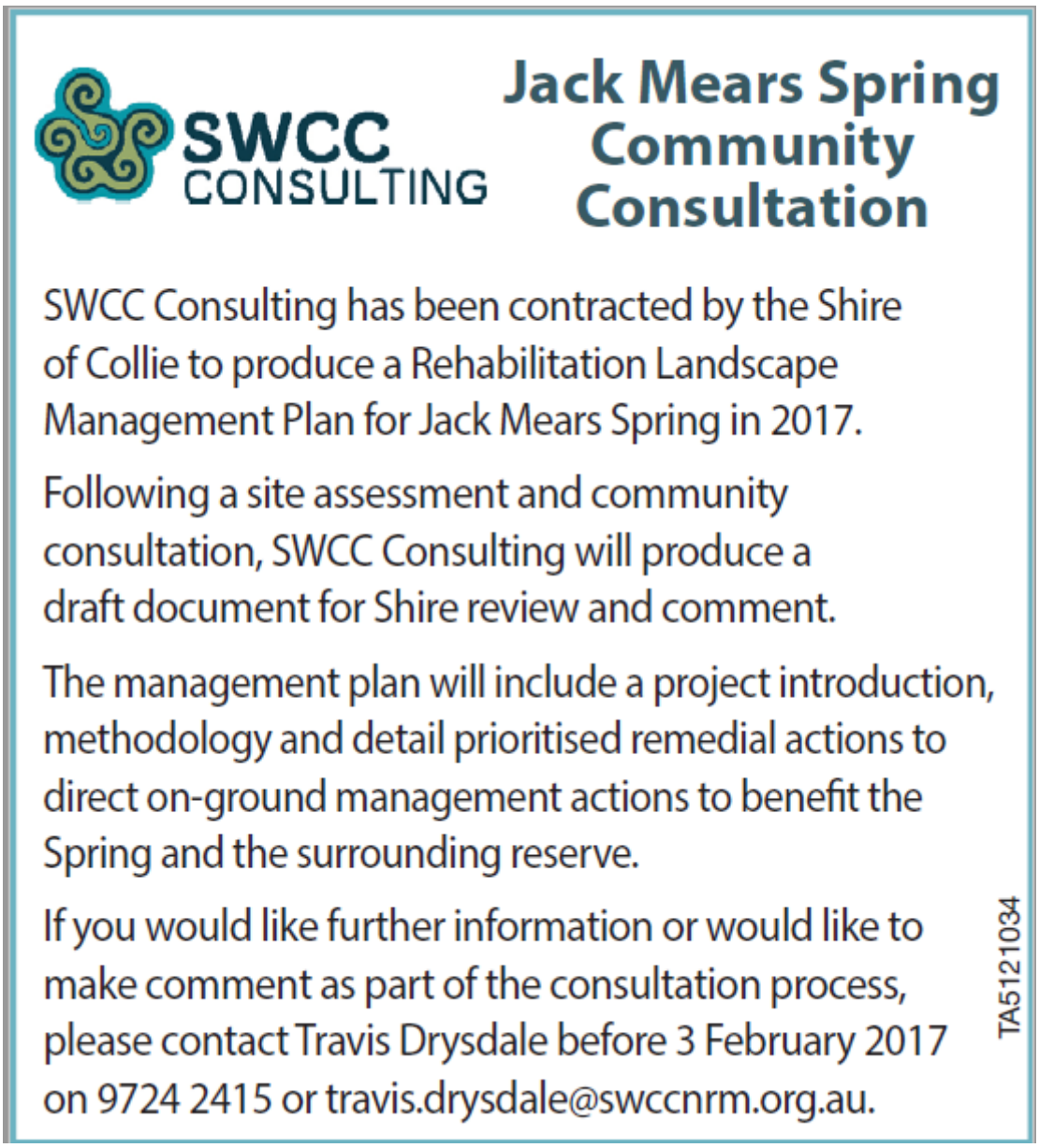
SWCC
CONSULTING
Jack Mears Spring Community Consultation
SWCC Consulting has been contracted by the Shire of Collie to produce a Rehabilitation Landscape Management Plan for Jack Mears Spring in 2017.
Following a site assessment and community consultation, SWCC Consulting will produce a draft document for Shire review and comment.
The management plan will include a project introduction, methodology and detail prioritised remedial actions to direct on-ground management actions to benefit the Spring and the surrounding reserve.
If you would like further information or would like to make comment as part of the consultation process, please contact Travis Drysdale before 3 February 2017 on 9724 2415 or travis.drysdale@swccnrm.org.au.
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Appendix B

Weed Species List

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Scientific Name	Common Name
Acacia longifolia	Sydney golden wattle
Avena fatua	Wild oat
Cytisus proliferus	Tagasaste
Cynodon dactylon	Green couch
Eragrostus curvula	African lovegrass
Gomphocarpus fruticosus	Cotton bush
Hypochaeris radicata	Flatweed
Lathyrus tingitanus	Tandier pea
Paspallum sp.	Paspallum
Pennisetum clandestinum	Kikuyu
Rubus anglocandicans	Black berry
Typha orientalis	Bulrush
Watsonia meriana	Watsonia