

City of Gosnells

# Shreeve Road Reserve Wetland Management Plan

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September 2012



99 C Lord Street  
Whiteman  
Ph: (08) 9209 2767  
Fax: (08) 9209 2768

City of Gosnells

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**Report prepared for:** City of Gosnells  
**Report Prepared by:** Natural Area Consulting  
99C Lord St  
Whiteman, WA 6068  
[consulting@naturalarea.com.au](mailto:consulting@naturalarea.com.au)

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## Executive Summary

Shreeve Road Reserve Wetland (SRRW) is an important natural remnant located within the City of Gosnells. The Reserve occupies a total area of 12.5 hectares and has been identified as an area of high priority for conservation in the Biodiversity Conservation Management Plan 2010 (City of Gosnells, 2010).

SRRW is listed as a conservation category dampland (unique feature identifier (UFI 14878) on the Department of Environment and Conservation's Geomorphic Wetland Swan Coastal Plain Dataset, and has significant conservation value for both flora and fauna. It was determined in 1999 by the Environmental Protection Authority and subsequent Ministerial Statement 502 on the City of Gosnells' Town Planning Scheme Amendment number 478 to be set aside and managed for the purpose of conservation.

In a survey of remnant vegetation in the City of Gosnells west of the Darling Scarp the vegetation at Shreeve Road Reserve Wetland was been described as being "*mostly... in very good to excellent condition, or excellent to pristine! It contains some of the best condition vegetation seen during the survey*" (Trudgen & Keighery 1995). Since this survey surrounding urban development and residential activity has brought many new pressures to the Reserve that require active management.

The Site is part of the Southern River Vegetation Complex and is situated on a Bassendean dune system which is the oldest dune formation on the Swan Coastal Plain. Two soil types were identified to occur within the Reserve:

- Bassendean B1 Phase, and
- Bassendean B3 Phase

The entire wetland is a surface expression of groundwater, with water levels varying according to the season and rainfall. The region typically has a high water table, with depth to groundwater as low as a metre in places. It is understood that the hydrology of the wetland has significantly changed following the urban development of the catchment which has resulted in permanent water occurring in the north east corner of the Reserve. Permanent inundation has been suggested as the causative agent in the matter of a number of tree deaths, particularly of Sheoak, *Allocasuarina fraseriana*.

Two fires have occurred within the Reserve in the past five years. Approximately 5,800 m<sup>2</sup> within the southern portion of the Reserve was burnt in 2009 and 6,000 m<sup>2</sup> along the western boundary of the Reserve in 2011. Regeneration has occurred within the burnt areas with recruitment and resprouting from native species observed at both sites. Significant numbers of fire responsive weeds including *Acacia longifolia* and *Eucalyptus camaldulensis* have also germinated in these areas.

A total of seventy eight (78) species from twenty nine (29) families were recorded on site during opportunistic surveys of the Reserve, noting that a targeted survey during the optimal time of year would identify a higher species diversity. A total of seven (7) vegetation communities were recognised to occur within the Reserve and are identified as:

- *Baumea articulata* Sedgeland,
- *Eucalyptus marginata/Allocasuarina fraseriana* Woodland,
- *Kunzea glabrescens* Closed Tall Scrub,

- *Melaleuca preissiana* Forest,
- *Melaleuca preissiana* Woodland,
- *Melaleuca raphiophylla* Forest, and
- *Pericalymma ellipticum* / *Hakea varia* heath.

A buffer extends around the site boundary to the west and south that is designed to minimise impacts from surrounding residential areas.

Bushland condition varies widely with ratings ranging from excellent to completely degraded, according to the vegetation condition rating scale documented in Bush Forever (Government of Western Australia, 2000). The majority of the site is assessed to be in a very good condition owing to a healthy over storey with minimal disturbances identified. Degraded zones were mostly located in the peripheral areas of the site. Weeds were identified to occur across the site with the most significant infestations located in areas that have been previously disturbed or burnt. The two highest priority weeds for control were identified as the Arum Lily (*Zantedeschia aethiopica*) and Watsonia (*Watsonia meriana* var. *bulbillifera*). These weeds were found in small concentrations but have a high potential to make a significant impact in the future and are therefore the highest priority for control. Twenty two (22) high priority weed species were also identified across the site. These species are identified as currently or potentially having a significant impact.

A total of twenty (20) fauna species were identified opportunistically within the Reserve. Of these the Bandicoot (*Isodon obesulus fusciventer*) was deemed to be the most significant due to its listing as a Priority 5 species under the *Wildlife Conservation Act 1950* (WA).

The two most significant introduced fauna identified were the European Fox (*Vulpes vulpes*) and the European Rabbit (*Oryctolagus cuniculus*). These two species have the potential to affect the biodiversity of the Reserve through competition for habitat, food, predation and grazing. It is likely that domestic cats and dogs also frequent the site which has the potential to significantly impact native fauna species.

In addition to the designated access tracks within the Reserve, there were several unmanaged/undesirable paths within the vegetation that is of concern. Rubbish and cubby construction was relatively intensive throughout the site, with numerous cubbies located within the *Melaleuca raphiophylla* forest areas.

It is recommended that strategies to improve and maintain the biodiversity of Shreeve Road Reserve Wetland should primarily focus on:

- weed control,
- revegetation,
- introduced fauna management,
- access management,
- tree mortality,
- hydrology,
- fire management, and
- rubbish removal and cubby dismantling.

## Summary of Recommendations

The table below is a summary of the management recommendations described in Section 5 of the Plan. The table prioritises management recommendations with high priority actions to be considered for action in the short-term.

No	Management Recommendation	Priority (H, M, L)
<b>Weed Control</b>		
5.1.1.1	Allow sufficient resources for the implementation of weed strategies for the Reserve. This includes adequate resources for subsequent years following initial 'primary treatment'. Indicative costing for each strategy is provided in Appendix 9. Costing for follow-up weed control activities should be established in consultation with a suitably qualified and experienced environmental weed control contractor as part of annual review of weed control activities.	H
5.1.1.2	Implement Strategy 1 & Strategy 2 of the weed control programme. Strategy 1 is the highest priority; however, both strategy 1 & 2 need to be implemented.	H
<b>Revegetation</b>		
5.2.1	As part of bushland restoration works undertake works described in Section 5.2. Revegetation works should be initiated with highest priority areas first (Stage 1).	M
5.2.2	All plants propagated for revegetation work should use local provenance seed or cuttings. Planning for revegetation should allow for at least one season of seed collection prior to plant propagation for revegetation works. It is preferable that two or more seasons of seed collection be completed to maximise species diversity as seed production can vary significantly year to year.	H
5.2.3	Consider involving local schools and the residential community in revegetation activities where appropriate opportunities arise.	M
5.2.5.1	The areas affected by fire should continue to be monitored to ensure natural regeneration is occurring. If these areas fail to return to a stable natural state revegetation or direct seeding should be considered to maintain the vegetation condition.	H
<b>Native Fauna Management</b>		
5.3.1	Consider undertaking fauna surveys to establish a baseline of fauna diversity for the Reserve.	L
<b>Introduced Fauna Management</b>		
5.4.1.1	Investigate opportunities for a regional approach to fox management. Should feasible opportunities arise develop an appropriate feral animal management plan for the Reserve and surrounding area in conjunction with relevant stakeholders.	L
5.4.1.2	Should the control of introduced mammals be undertaken, rabbit and fox control should be undertaken simultaneously to reduce potentially counterproductive repercussions from targeting one species only.	L
5.4.2.1	The potential impact domestic animals have on the biodiversity of the Reserve should be mitigated through interpretive material and the provision of signage that encourages responsible pet ownership.	M



No	Management Recommendation	Priority (H, M, L)
<b>Access Management</b>		
5.5.1	To deter uncontrolled access into sensitive wetland areas consider terminating the board walk at the north west corner of the Reserve at a viewing platform. It is also recommended that the existing path along the agricultural drain be formalised and terminate at a viewing platform.	M
<b>Tree Mortality</b>		
5.6.1	Consider undertaking soil testing for <i>Phytophthora cinnamomi</i> in areas where tree mortality is occurring. Should <i>Phytophthora cinnamomi</i> be detected susceptible vegetation communities within the Reserve should be mapped and appropriate management actions implemented.	M
5.6.2	Continue existing photo monitoring in areas where tree decline has been observed as per the Shreeve Road Reserve Fire Management Action Plan.	H
<b>Hydrology</b>		
5.7.1	In association with an appropriately qualified consultant or research institute develop and implement a monitoring programme to enable accurate assessment of the impact of changed hydrology on the wetland's health.	M
<b>Fire Management</b>		
5.8.1	Fire management should be followed as per the Shreeve Road Wetland Fire Management Plan 2009. The Reserve should be monitored for factors that may exacerbate the fire risk such as excessive weed growth or accumulation of woody debris.	H
<b>Rubbish and Cubby Construction</b>		
5.9.1	The rubbish located within the Reserve should be removed. Cubbies should be dismantled in a timely manner to discourage further access to the site and future cubby constructions. The City should undertake periodic checks of the <i>Melaleuca raphiophylla</i> forest in the summer months to remove any new constructions	M

## 1.0 Introduction

The Shreeve Road Reserve Wetland occupies an area of approximately 12.5 hectares which is managed by the City of Gosnells, with the exception of 1.3 ha in private ownership. The site has been identified as an area of high priority for conservation by the Biodiversity Conservation Management Plan 2010 (City of Gosnells, 2010).

Natural Area Consulting (NAC) was commissioned by the City of Gosnells to prepare a management plan for the wetland in order to maintain and improve biodiversity values of the site. The Reserve is situated approximately 17 km south east of the Perth Central Business District in the suburb of Canning Vale (Figure 1). It is bounded by Shreeve Road to the north and Waterperry Drive to the south east and west (Figure 2).

This plan provides:

- background information about the Shreeve Road Reserve Wetland,
- the management objective for the site,
- the scope of works associated with preparation of the management plan,
- information about the current site characteristics,
- the methodology and outcomes of the site assessment process,
- recommended management strategies, and
- a prioritised summary of recommended management actions.

### 1.1 Background Information

The Shreeve Road Reserve Wetland is listed as a conservation category dampland (unique feature identifier (UFI 14878) on the Department of Environment and Conservation's Geomorphic Wetland Swan Coastal Plain Dataset. Components of the wetland are also described as resource enhancement (UFI 7358) and multiple use (UFI 14877) (Figure 3). A dampland is defined as a seasonally waterlogged basin, with groundwater coming to the surface during winter months or after significant rainfall events (Hill, Semeniuk, Semeniuk and Del Marco, 1996). Surface water may also be present for short periods during the year. Definitions of the wetland management categories are provided in Table 1.

**Table 1: Wetland Management Categories**

Management Category	General Description	Management Objectives
C – Conservation	Wetlands that support a high level of ecological attributes and functions	Considered to be the highest priority wetlands in terms of protection, with the aim of preserving wetland values and function in the longer term
R – Resource enhancement	Wetlands that may have been partially modified but still support substantial ecological attributes and functions	Considered to be priority wetlands, with the aim of improving their conservation values through restoring wetland structure, function and biodiversity, and providing protection in the longer term
M – Multiple use	Wetlands that are highly modified with few important ecological attributes and functions remaining	Use, development and management of the wetland area should be considered in the context of ecologically sustainable development and best practice catchment management; wetlands can be considered in strategic planning terms, such as drainage and town planning

(Source: Water and Rivers Commission, 2001)

The Reserve includes bushland and wetland areas that are ecologically important and provide a refuge for flora and fauna. The site is also important as it provides both passive and active forms of recreation to the local community.

## **1.2 Location and Tenure**

The land is designated public ownership as Crown Reserves 38134 and 47209 managed by the City of Gosnells. An area of 1.3 ha is under private ownership on Lot 1 Shreeve Road (Figure 2) and as such is not subject to this management plan.

## **1.3 Management Plan Objective**

Shreeve Road Reserve Wetland is identified as a Management Category 1 Site in the City's Biodiversity Conservation Management Plan. Analysis of the ecological value of the 38 Local Natural Areas under the City's management shows that Shreeve Road Reserve is amongst those with the highest biodiversity values. The major aim of the Shreeve Road Reserve Wetland Management Plan is to maintain and enhance the various ecological functions and high biodiversity values associated with the wetland and surrounding vegetation within the Reserve. This has been achieved through:

- the identification of threatening processes that occur within the wetland and associated bushland,
- providing clear management recommendations to reduce negative impacts associated with the various threatening processes, and
- providing strategies to improve degraded areas within the Reserve and maintain and protect priority areas (i.e. the wetland and those areas with a high level of vegetation condition).

## **1.4 Scope of Works**

In the context of the management plan objective, NACs scope of works included the following:

- detailed weed mapping,
- detailed vegetation condition mapping,
- prioritisation and prescription of the management of individual environmental weed species to reduce key ecological impacts,
- identification of recommendations regarding threatening processes occurring within the Reserve - notably, observed changes to the wetland's hydrology,
- identification, opportunistically, through direct observation or interpretation, of fauna occurrences within the bushland,
- provision of long-term bushland regeneration strategies that focus on weed control and assisted regeneration principles,
- identification of management actions and provision of appropriate recommendations to ensure the sustainability of areas of vegetation in very good to excellent condition,
- provision of a map overlay of an aerial photo of the study area, describing vegetation, communities, significant areas of disturbance, management infrastructure and vegetation condition, and
- consideration and discussion regarding public access to the Reserve, both current and potential.



**Figure 1**

**Location: Shreeve  
Road Reserve Wetland**  
Client  
City of Gosnells



Natural Area Consulting  
99C Lord St,  
Whiteman, WA, 6068  
naturalareaconsulting.com.au 08 9209 2767



Created by: AD  
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Date: February 2012  
Imagery Source: NearMap.com





**Figure 2**



**Location: Shreeve  
Road Reserve Wetland**  
Client  
City of Gosnells

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Drawing No.: 01  
Date: February 2012  
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## 2.0 Current Site Characteristics

This section describes the current site characteristics at the Shreeve Road Reserve Wetland and associated bushland. These characteristics, along with human access, will influence the nature and scale of threatening processes and negative impacts experienced within the Reserve.

### 2.1 Regional Context

According to Interim Biogeographical Regionalisation of Australia (IBRA) descriptions, Perth is located within the Swan Coastal Plain region. The Swan Coastal Plain comprises two major divisions, namely Swan Coastal Plain 1 – Dandaragan Plateau and Swan Coastal Plain 2 – Perth Coastal Plain. The Shreeve Road Reserve Wetland site is located within the Perth subregion, which is broadly characterised as including areas of Jarrah and Banksia woodlands on sandy soils in a series of sand dunes, along with wetland areas, often within the interdunal swales. Paperbarks (*Melaleuca raphiophylla*) and other species tolerant of wetter conditions dominate (Mitchell, Williams and Desmond, 2002).

### 2.2 Climate

The climate experienced in the area is Mediterranean, with dry, hot summers and cool, wet winters. According to the Bureau of Meteorology (2011), the

- average rainfall as measured at the Perth Airport Observatory is 728 mm pa, with the majority falling between May and August;
- average maximum temperature ranges from 17.7 °C in winter to 33.4 °C in summer, with the highest recorded maximum being 46.7 °C;
- average minimum temperatures range from 8.2 °C in winter to 17.6 °C in summer, with the lowest recorded minimum being -1.3 °C; and
- predominant wind directions include morning easterlies and westerly sea breezes during summer months when the risk of fire is greatest, with an average wind speed of 23.8 kmh and gusts of more than 100 kmh, particularly during storm events.

### 2.3 Vegetation

Shreeve Road Reserve Wetland is located in a vegetation region defined as the Southern River Complex. This system is characterised by open woodland of *Corymbia calophylla*, *Eucalyptus marginata* and *Banksia* species. Wetland areas are fringed by woodland of *Eucalyptus rudis* and *Melaleuca raphiophylla* (Government of Western Australia, 2000).

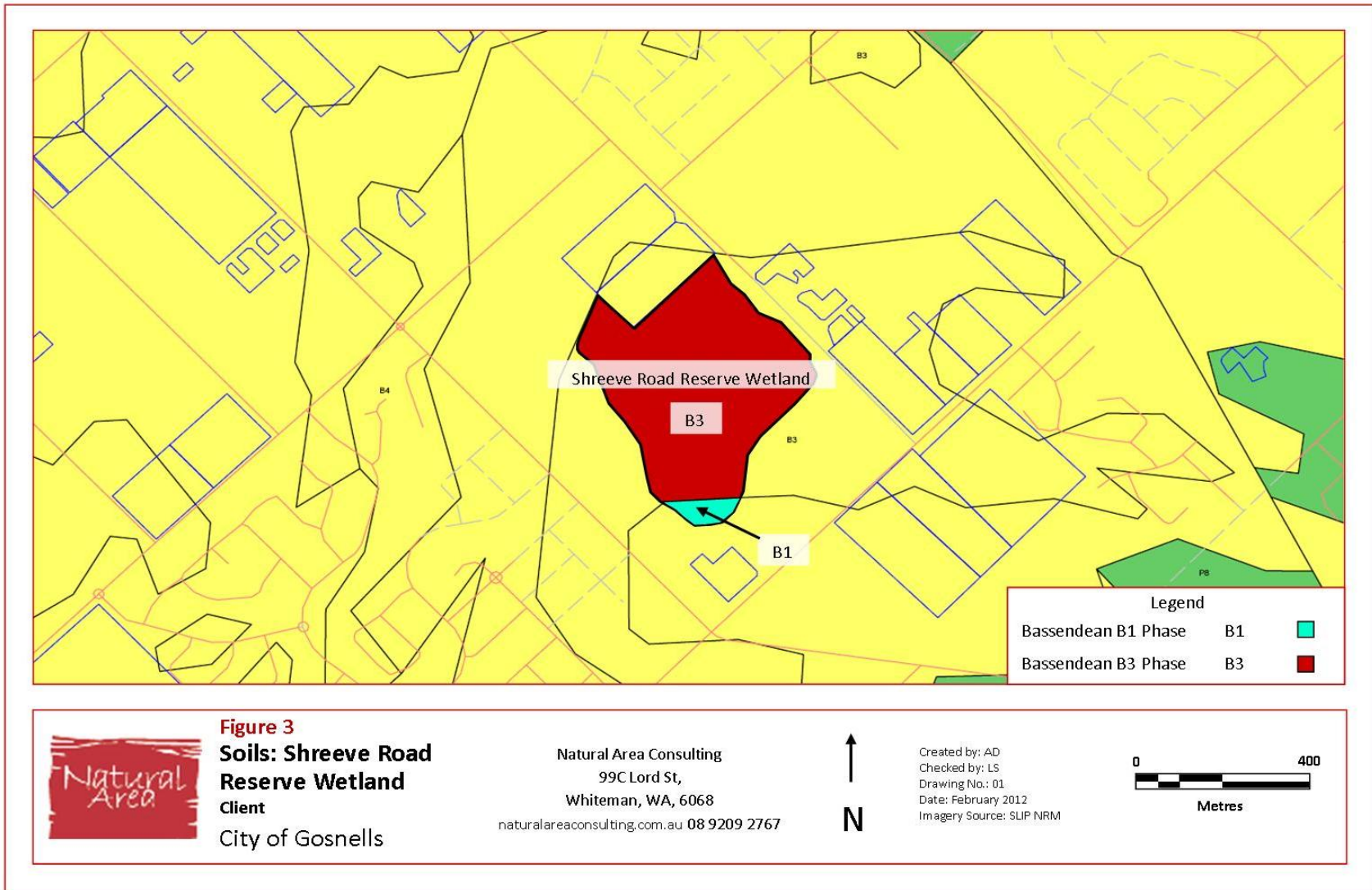
### 2.4 Topography and Soils

The Reserve is situated on the Bassendean dune system which is the oldest dune formation on the Swan Coastal Plain. It is characterised by leached sands with low levels of nutrients and acidic soils. According to the SLIPs NRM Portal (Department of Agriculture and Food, 2012a), the site is dominated by the B3 Phase soil type, although the B1 Phase soils were identified to occur in the southern region of the Reserve (Figure 3). A description of each soil type is provided in Table 2. The site is relatively flat with topography ranging from 18 – 20 m AHD (Alan Tingay and Associates, 1999).

**Table 2:** Soil Types – Shreeve Road Reserve Wetland

Map Unit	Name	Description
212Bs__B1	Bassendean B1 Phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; Banksia dominant
212Bs__B3	Bassendean B3 Phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam

(Source: Department of Agriculture and Food, 2012b)





## 2.5 Hydrology

Wetland Base (Department of Agriculture and Food, 2012b) indicates that the Shreeve Road Reserve Wetland is a seasonal conservation category dampland. The majority of the site is considered to be a wetland except for an area in the southern extremity of the Reserve (Figure 3). Before the development of the surrounding urban catchment, the wetland experienced little or no standing water in summer. This situation has changed so that the regular seasonal drying no longer occurs in some places.

The entire wetland is a surface expression of groundwater, with water levels varying according to the season and rainfall. The region typically has a high water table, with depth to groundwater as little as a metre in places (Water and Rivers Commission, 1997; Department of Environment, 2004). Ground water movement is in a north easterly direction towards the Southern River which forms part of the Canning River catchment (Department of Environment, 2004).

It is the City of Gosnells' understanding that the hydrology of the wetland has changed due to the urban development of the surrounding area. An agricultural drain which was originally designed to be decommissioned during the development of drainage infrastructure in the wetland's buffer remained to accommodate emergency overflow of stormwater from the lined constructed basins (Figure 4). This drain has however been observed to continually flow during winter as a result of leakage and backflow from the adjoining constructed basins within the wetland buffer. It is the City's understanding that leakage from the adjoining constructed basins is due to the poor connection and design of the basins. It is also the City's understanding that the change in the wetland's hydrology, post urbanisation, is generally a result of this leakage. Recent studies on changing ground water levels across Canning Vale were undertaken by the City's Technical Services unit which included the monitoring of a bore on Waterperry Drive. Preliminary data indicates a significant rise in ground water level at this location and therefore any potential change in groundwater levels may be adding to the issue associated with leakage from constructed basins (Rees and Dames, 2012, personal communication).

Possible indicators of the wetlands change in hydrology are based on observations and through limited monitoring carried out by the City of Gosnells and include the following:

- deaths of *Allocasuarina fraseriana*,
- deaths of *Pericalymma ellipticum*,
- increased observations of algal growth, and
- surface water year round.



**Figure 4:** Agricultural Drain

A portion of the wetland comprises a series of three lined detention basins that occur in the buffer on the southern side of the Reserve and extend in a series towards the north west. The bushland areas within the Reserve also occur on designated wetlands. These areas are likely to experience wetter soils during winter months and periods of high rainfall without filling with water. As a dampland, the three basins would occasionally contain surface water during winter and dry out during warmer months.

A permanently wet area exists in the *Baumea articulata* sedgeland in the north west of the site that contained open water during NAC site assessment activities to an approximate depth of 20 – 30 cm in February 2012. The presence of the *Baumea articulata* (Figure 10) made it difficult to determine the extent of the open water. The size and extent of *Baumea articulata* in this area is reflected in the occurrence of permanent surface water and permanently saturated soil.

Hydrological changes will have management implications for the wetland areas across the site. Potential outcomes include:

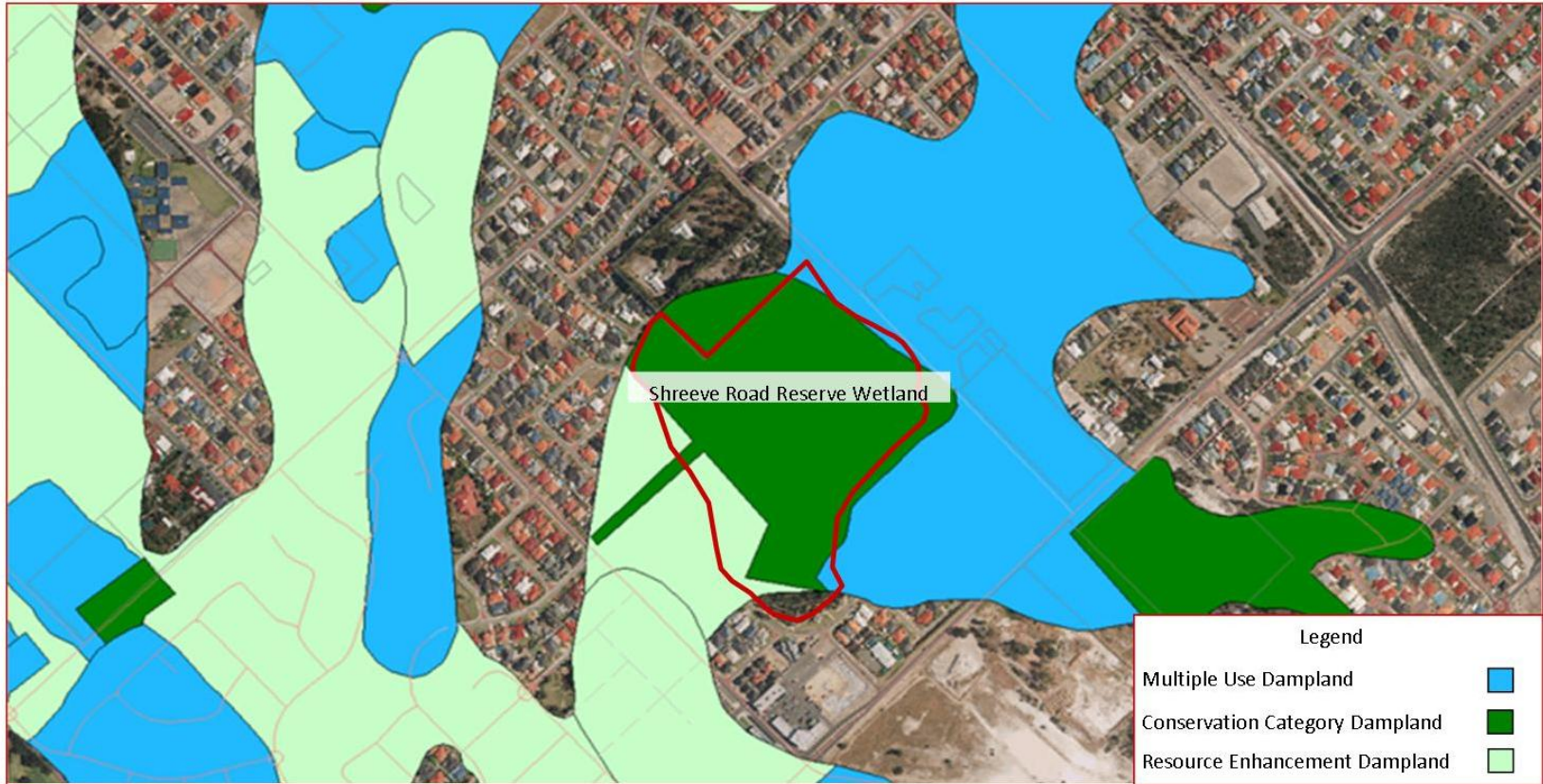
- changes to vegetative zones and flora species present, such as flora species that can tolerate:
  - increased inundation (Figure 5),
  - variable depths to groundwater, and/or
  - areas that are, or were once wetter than they are currently,
- changes to fauna species associated with potential changes in habitat and/or vegetation,
- death of species such as *Melaleuca raphiophylla* that cannot tolerate permanently inundated conditions for extended periods (i.e.: greater than 2 – 3 years),
- increased potential for pests such as midge and mosquitoes breeding in areas of permanent water during warmer months,
- an increase in the density of aquatic weeds such as *Typha orientalis*,
- alterations to fire fuel loads and zones due to altered vegetation, and
- location of fire breaks and emergency access ways in the event of fire at the site.



**Figure 5:** Waterlogged Vegetation

## **2.6 Aboriginal Heritage**

The Aboriginal Heritage Inquiry System (Department of Indigenous Affairs, 2012) did not identify any Aboriginal heritage sites within the Shreeve Road Reserve Wetland (Appendix 7).

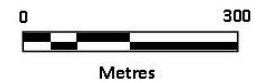


**Figure 6**  
**Wetland Areas:**  
**Shreeve Road Reserve**  
**Wetland**  
Client  
City of Gosnells

Natural Area Consulting  
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Whiteman, WA, 6068  
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## 2.7 Fire

Fire is a natural occurrence in Australian ecosystems; however, in an urban setting the disturbance has the potential to promote fire prone weeds such as Perennial Veldt Grass (*Ehrharta calycina*) that may compromise natural regeneration. There is also a risk of smoke and ember attack from fire within the Reserve to surrounding residents.

A Fire Management Action Plan was prepared for the Shreeve Road Reserve Wetland by the City of Gosnells (2009). The Reserve was assessed as having an extreme fire risk rating within the *Melaleuca raphiophylla* forest and a high fire risk over the shrubland/woodland areas. Approximately 5,800 m<sup>2</sup> was burnt in 2009 and 6,000 m<sup>2</sup> in 2011 (Figure 9) (NearMap, 2012). Regeneration has occurred within the area burnt during the 2009 fire, with an understory of *Lepidosperma longitudinale* and an over storey of *Melaleuca preissiana* being the dominant species (Figure 7). Some other post fire regeneration species identified were *Acacia saligna*, *Astartea scoparia* and some *Xanthorrhoea preissii*.

Of note is the prolific post fire germination of high priority weeds *Eucalyptus camaldulensis* and *Acacia longifolia* that has been observed by the City in these areas. This has occurred in an area that is currently mapped as being in Very Good condition. This suggests that a high level of management intervention has ensured that vegetation condition has remained Very Good. It also highlights the importance and need for an adaptive response to weed management.

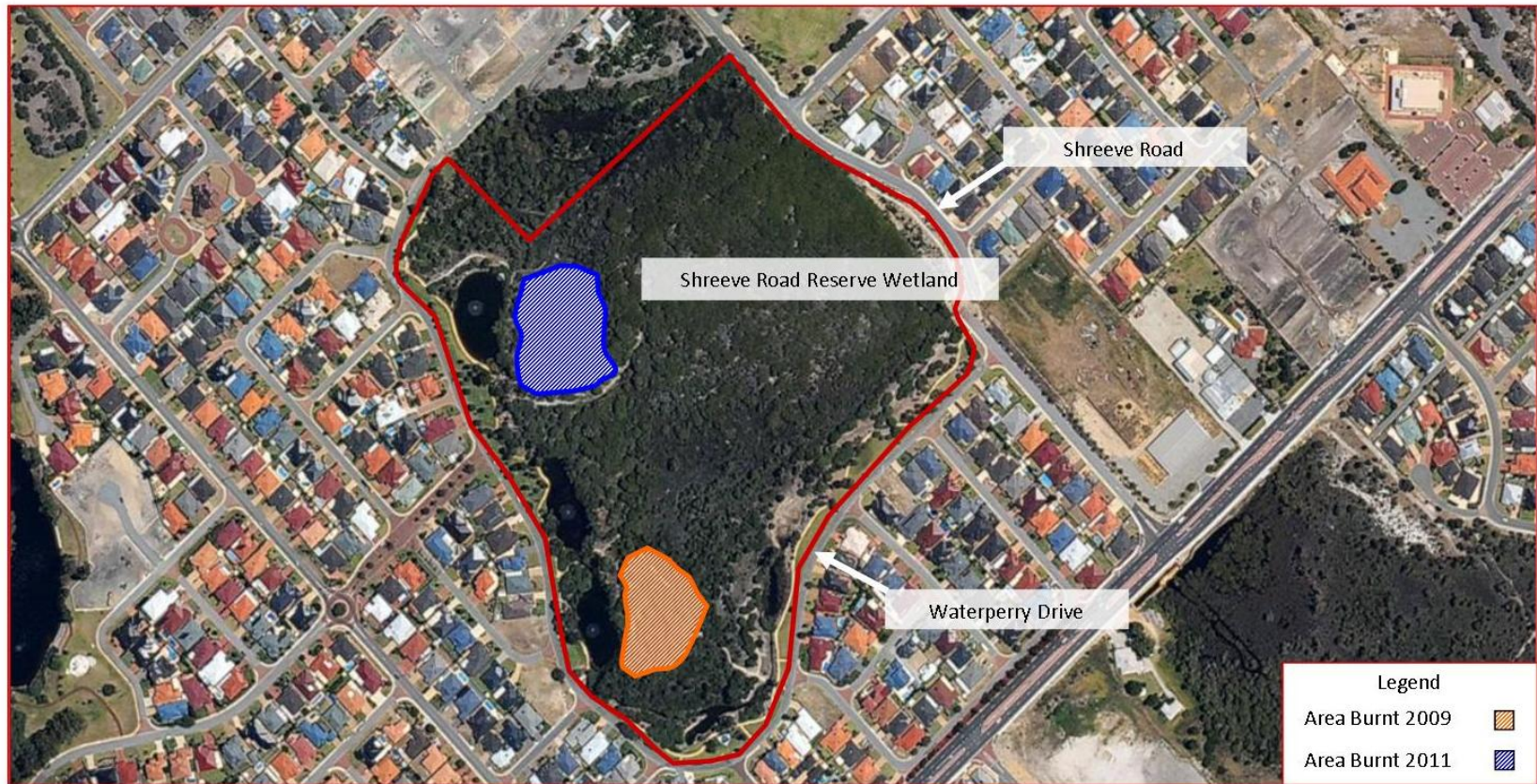
Within the 2011 fire affected area, regeneration is still in its initial stages with early epicormic growth observed from the *Melaleuca preissiana* (Figure 8) and resprouting from *Hakea varia* and *Lepidosperma longitudinale* (Figure 9). Post fire germination from seed was minimal at the time of the surveys (December 2011 and February 2012) due to the recent nature of the fire; however it is expected that *Acacia saligna* and *Pericalymma ellipticum* will be observed in future surveys.



**Figure 7:** Regeneration of *Melaleuca preissiana* Woodland from 2009 Fire



**Figure 8:**      Regeneration of *Pericalymma ellipticum* / *Hakea varia* Heath 2011 Fire



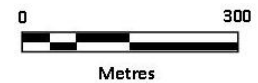
**Figure 9**  
**Recent Fires: 2009 and 2011**  
Client  
City of Gosnells



Natural Area Consulting  
99C Lord St,  
Whiteman, WA, 6068  
naturalareaconsulting.com.au 08 9209 2767



Created by: AD  
Checked by: LS  
Drawing No.: 01  
Date: February 2012  
Imagery Source: Slip NRM



### 3.0 Site Assessment Methodology

In order to determine the most appropriate management options for an area, it is necessary to know current site conditions and environmental values. A Botanist (Jacquie Milner) and a Biologist (Alex Devine) from Natural Area Consulting surveyed the site on two separate days, one in December 2012 and one in February 2012, to assess the following:

- identification of weeds species present along with their density,
- vegetation types and condition,
- identification of flora species present,
- opportunistic observation of fauna species present,
- Aboriginal heritage considerations,
- hydrological changes to the wetland basins within the Reserve, and
- assessment of threatening processes and evidence of disturbances.

The methodology for each activity is summarised in Table 3.

**Table 3: Site Assessment Methodology**

Activity	Method
Weed mapping	The site was systematically traversed to obtain a list of weeds present within the study site. Weed populations were assessed for density and mapped using a Trimble® GPS and later plotted on MapInfo.
Vegetation condition	Vegetation condition was assessed using the Keighery scale of bushland condition (Appendix 1) and mapped using GPS.
Vegetation communities	The distinct vegetation communities found within the Reserve were ascertained by traversing the site and identifying the dominant flora species, along with other structural elements using the categorisation attributed to Keighery in Bush Forever Volume 2 (Appendix 2). Communities were mapped using GPS.
Fauna survey	The presence of fauna within the wetland was assessed opportunistically while conducting field work. Fauna were also identified through the interpretation of diggings, scats and tracks. A desktop survey was also conducted using NatureMap (2012) to indicate species likely to occur within the Reserve (Appendix 10).
Hydrology	An assessment of the hydrology associated with the wetland basins on the Reserve involved visual observation of the site, along with a review of known data and information from other available sources.
Disturbances	Evidence of disturbances and threatening processes were observed during field work and mapped using GPS. Disturbances noted included feral animals, tracks, rubbish dumping (including soil), and unmanaged access.

### 3.1 Limitations

Despite the site assessments being carried out by experienced personnel, there are a number of limitations associated with them. These include the following:

- the flora survey was undertaken at a time that is outside of what is considered the optimal time of year for the south west botanical region of Western Australia, so it is possible that some



species of flora were not presenting at the time of each visit to the site, especially those that present during late winter to early spring (August to September). However, it is estimated that around 85% of species present in the subject site were seen during the survey activities,

- there is the potential for a greater number of fauna species to be present at the site, as observations were opportunistic rather than involving targeted searches, and
- the accuracy of some database information is unknown, with some carrying out-of-date species names, information or similar.

## 4.0 Survey Results

The results of site assessment activities are provided in this section.

### 4.1 Species Composition

Seventy eight species (78) from twenty nine (29) families were recorded on site. A list of species identified is presented in Appendix 3. It should be noted this list was compiled by observation and would not provide the same numbers of species as a formal floristic survey. The species present as well as those seen in adjoining areas were taken into account when compiling a revegetation list for the area.

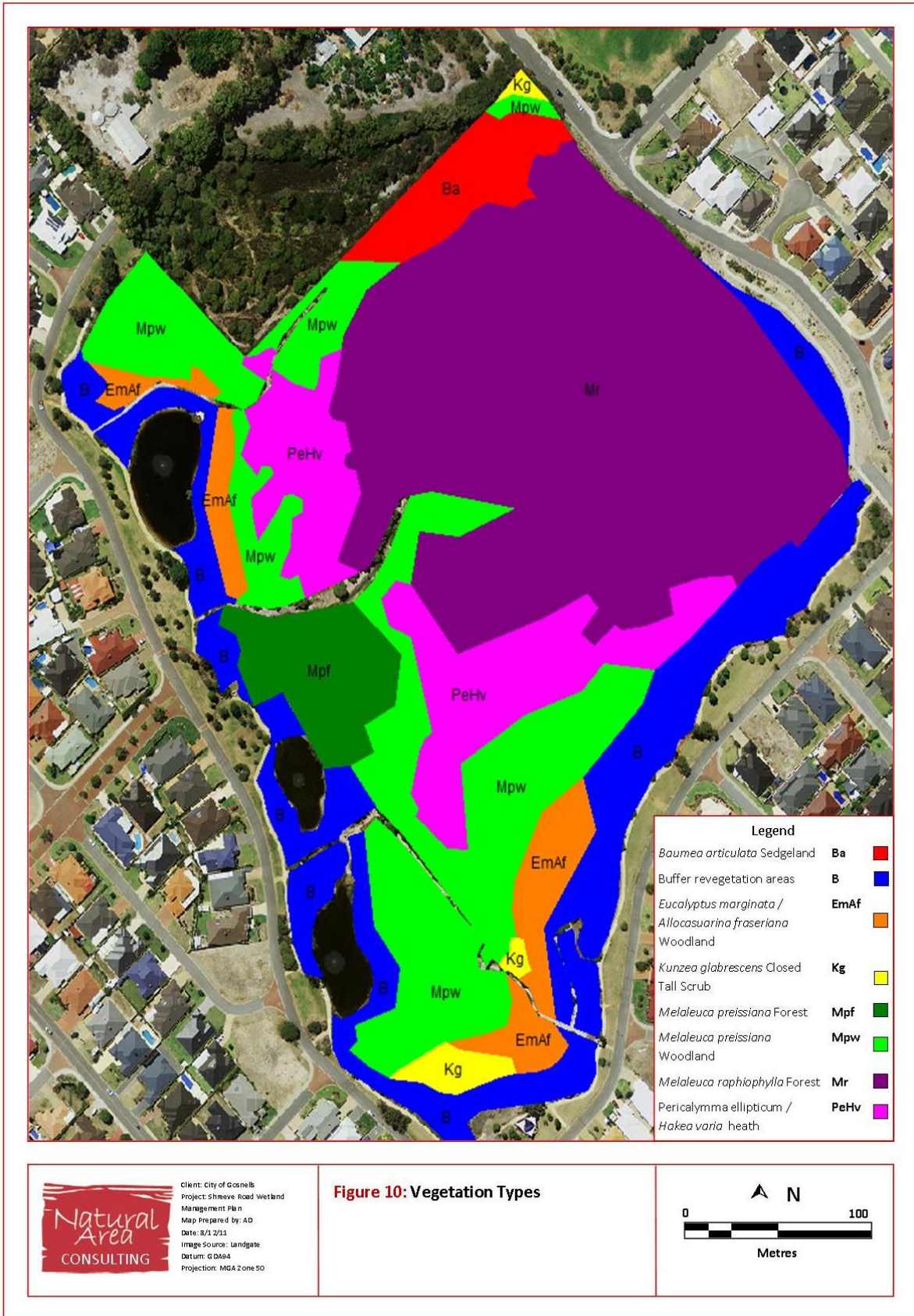
### 4.2 Vegetation Communities

Vegetation found within Shreeve Road Reserve Wetland is consistent with the Southern River Complex described as open woodland of *Corymbia calophylla*, *Eucalyptus marginata* and *Banksia* species with wetland areas dominated by *Eucalyptus rudis* and *Melaleuca raphiophylla* (Government of Western Australia, 2000). A vegetation community can be described as an assemblage of plant species that interact with each other and their environment. A total of seven (7) native vegetation communities were identified within the Shreeve Road Reserve Wetland. The different vegetative units within the Reserve are representative of the different environmental conditions, which in Shreeve Road is primarily based on hydrology of the wetland system. Vegetation communities are outlined in Table 4 and illustrated in Figure 10.

**Table 4:** Vegetation Communities

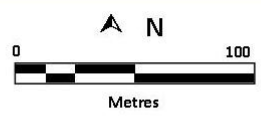
Vegetation Community	Description
<i>Baumea articulata</i> Sedgeland	Found in the northern section of the wetland in areas with high levels of inundation.
<i>Eucalyptus marginata</i> <i>/Allocasuarina fraseriana</i> Woodland	A dryland community located south and west of the wetland with an open overstorey with a shrubby understorey.
<i>Kunzea glabrescens</i> Closed Tall Scrub	Located in the peripheral zones of the wetland on dry upland areas.
<i>Melaleuca preissiana</i> Forest	An area characterised by a dense over storey of <i>Melaleuca preissiana</i> with reduced understorey. Located in close proximity to drain and experiences water logging for extended periods.
<i>Melaleuca preissiana</i> Woodland	Characterised by a <i>Melaleuca preissiana</i> over storey with an open canopy. The understorey is composed of a mix of dense shrubs and sedges.
<i>Melaleuca raphiophylla</i> Forest	This community occupies a large area of the site located in areas that receive extended periods of inundation in the winter and then dry out during the summer. It features a dense canopy of <i>Melaleuca raphiophylla</i> and has a virtually absent understorey. This lack of understorey is a result of the seasonal inundation and low light penetration.
<i>Pericalymma ellipticum</i> / <i>Hakea varia</i> heath	This vegetation type is a typical dampland community and is representative of a high water table and seasonally waterlogged soils. The vegetation is relatively low and dense. Plants in these areas are not typically inundated for extended periods of time.

<b>Buffer revegetation areas</b>	Located around the perimeter of the wetland within the wetland buffer, this area is planted with landscape species not necessarily endemic to the area and also includes lawn.
----------------------------------	--




 Client: City of Gosnells  
 Project: Shreeve Road Wetland Management Plan  
 Map Prepared by: AD  
 Date: 8/1 2/11  
 Image Source: Landgate  
 Datum: GDA84  
 Projection: MGA Zone 50

**Figure 10: Vegetation Types**



### 4.3 Bushland Condition

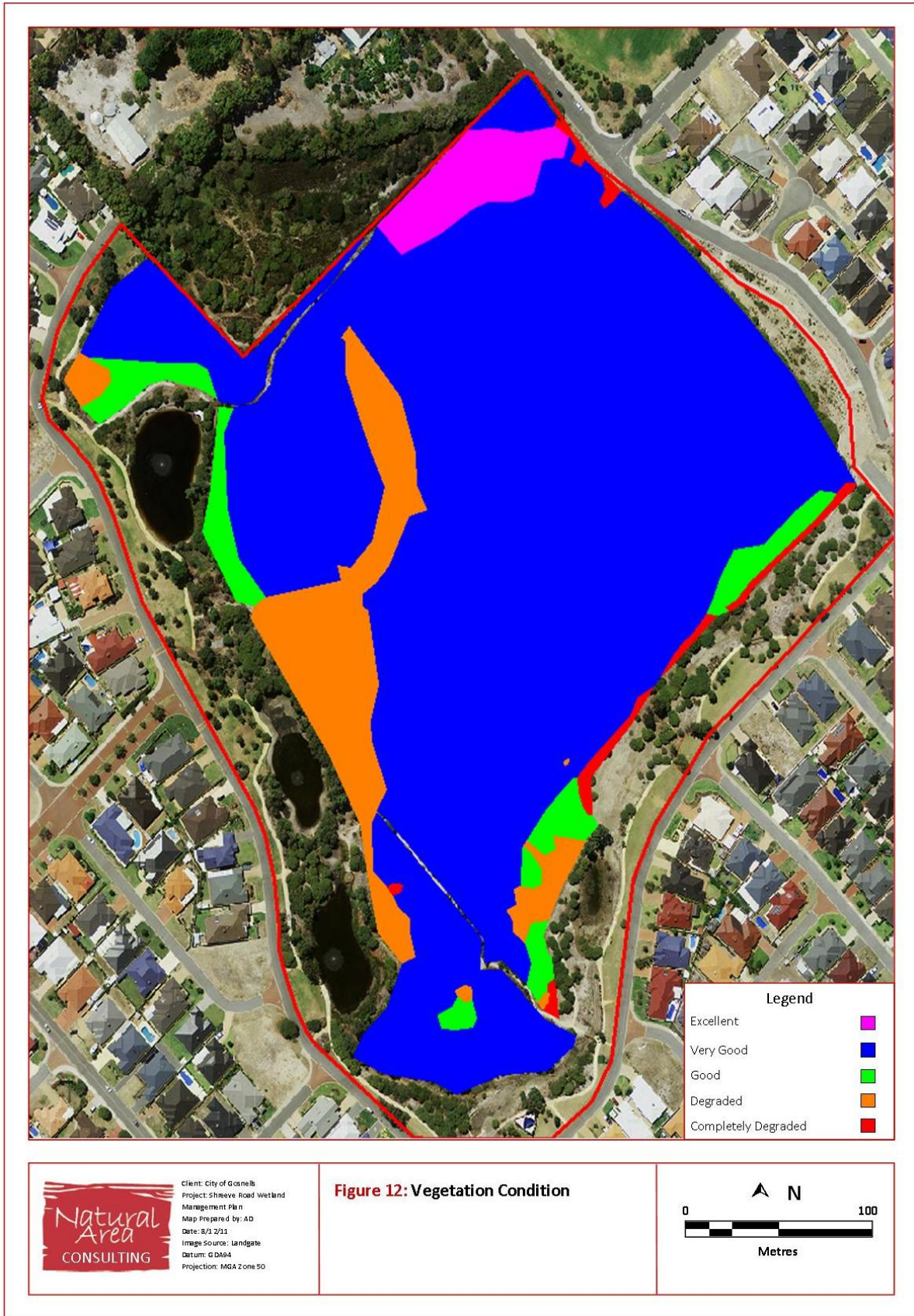
Bushland condition was variable across the site with areas ranging from excellent to completely degraded (Figure 12). The majority of the site was deemed to be in a very good condition owing to a healthy over storey with minimal disturbances identified. A description of the vegetation condition of the site is presented in Table 5.

**Table 5: Vegetation Condition Ratings**

Bushland Condition	Description
Excellent	The <i>Baumea articulata</i> sedgeland at the northern end of the site was identified as being in excellent condition with very little disturbance and a dense covering of vegetation.
Very good	The majority of the site was deemed to be in a very good condition with noticeable signs of disturbance but with a largely intact vegetation structure.
Good	Some areas at the periphery of the site were deemed to be in a good condition with a basic vegetation structure with multiple disturbances such as aggressive weeds and track formation.
Degraded	Vegetation classed as degraded had a basic vegetation structure severely impacted by disturbance. Areas of this nature were found around the agricultural drain and next to the wetland buffer. Aggressive weeds were highly prolific in these regions.
Completely degraded	Located in peripheral parts of the site vegetation structure was almost completely absent. Areas of this nature are dominated by invasive weed species and lack natives almost entirely (Figure 11).



**Figure 11:** Completely Degraded Vegetation Located at Southern Periphery of Reserve



#### 4.4 Environmental Weeds

A list of environmental weeds was compiled during site assessments in December 2011 and February 2012. As these surveys were conducted in the summer populations of winter or spring active weeds may have been reduced. The priority ratings for each weed species was determined taking into consideration the following resources:

- the *Environmental Weed Strategy of Western Australia* (EWSWA) (CALM, 1999),
- Invasive Plant Prioritisation Process for DEC – ‘*An integrated approach to Environmental Weed Management in WA*’ (DEC 2009), and
- observations made on site.

Consideration was given to the current and potential future impact of each species on the Reserve in determining their priority rating. A prioritised list of major weeds identified is provided in Section 5.

The two highest priority weeds for control were identified as Arum Lily (*Zantedeschia aethiopica*) and Watsonia (*Watsonia meriana* var. *bulbillifera*). These weeds were found in small concentrations but have a high potential to make a significant impact in the future and are therefore the highest priority for control. An additional 22 high priority weed species were also identified across the site. These species are identified as currently or potentially having a significant impact.

#### 4.5 Fauna

Outcomes of the NatureMap database search are provided in Appendix 10. Observations of fauna were made opportunistically whilst conducting field work and also from interpretation of diggings, scats and tracks. Table 6 summarises the opportunistic fauna sightings. Within the *Melaleuca raphiophylla* forest numerous burrows were noticed in the sediment, indicating that the area is being utilised by freshwater crayfish (e.g.: *Cherax* sp., Gilgie) (Figure 13).

**Table 6:** Fauna Observed – Shreeve Road Wetland

Species	Common Name	Conservation Category (if applicable)
<i>Acrocephalus australis</i>	Reed Warbler	
<i>Anas superciliosa</i>	Pacific Black Duck	
<i>Chelodina oblonga</i>	Oblong Tortoise	
<i>Chenonetta jubata</i>	Wood Duck	
<i>Cherax</i> sp.	Gilgie	
<i>Crinia insignifera</i>	Sandplain Froglet	
<i>Ctenotus fallens</i>	West Coast Ctenotus	
<i>Fulica atra</i>	Eurasian Coot	
<i>Gallinula tenebrosa</i>	Moorhen	
<i>Isoodon obesulus</i>	Bandicoot	Priority 5
<i>Litoria adelaidensis</i>	Slender Tree Frog	
<i>Lichmera indistincta</i>	Brown Honeyeater	
<i>Lichenostomus virescens</i>	Singing Honeyeater	
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	
<i>Platalea flavipes</i>	Yellow Billed Spoonbill	
<i>Poliiocephalus poliocephalus</i>	Hoary Headed Grebe	
<i>Porphyrio porphyrio</i>	Purple Swamphen	

Species	Common Name	Conservation Category (if applicable)
<i>Rhipidura leucophrys</i>	Willie Wagtail	
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	
<i>Threskiornis molucca</i>	White Ibis	



**Figure 13:** Gilgie Claw (*Cherax sp.*)

#### 4.6 Introduced Fauna Identified

Introduced fauna were identified to occur throughout the site from diggings, scats and tracks. Three species of introduced animals were noted to inhabit the Shreeve Road Reserve Wetland:

- European Fox (*Vulpes vulpes*),
- European Honey Bee (*Apis mellifera*), and
- European Rabbit (*Oryctolagus cuniculus*).

A large fox burrow was located (Figure 14) within the Reserve with household rubbish located around the area indicating the animals are supplementing their diet with household waste. Feral bees were also observed to be nesting in rubbish (Figure 20), and which compete with native species for resources and pose a public safety risk. Shreeve Road Reserve is utilised by residents to exercise their dogs and there is a high likelihood that domestic cats visit the reserve. Domestic animals may chase and injure native wildlife reducing the capacity of the Reserve to support populations of native animals.





**Figure 14:** Fox Burrow

## 4.7 Hydrological Observations

Observations of the Shreeve Road Reserve Wetland occurred over two days in November 2011 and February 2012. In the early summer the *Melaleuca raphiophylla* forest was inundated with water approximately 20 cm deep. The north eastern side of the wetland was also inundated with an approximate water depth of 40 – 50 cm in areas dominated by the sedge, *Baumea articulata*. When the site was surveyed in late summer the *Melaleuca raphiophylla* forest had no surface water while the *Baumea articulata* sedgeland was still inundated to a depth of approximately 20 – 30 cm. This extended period of inundation may relate to:

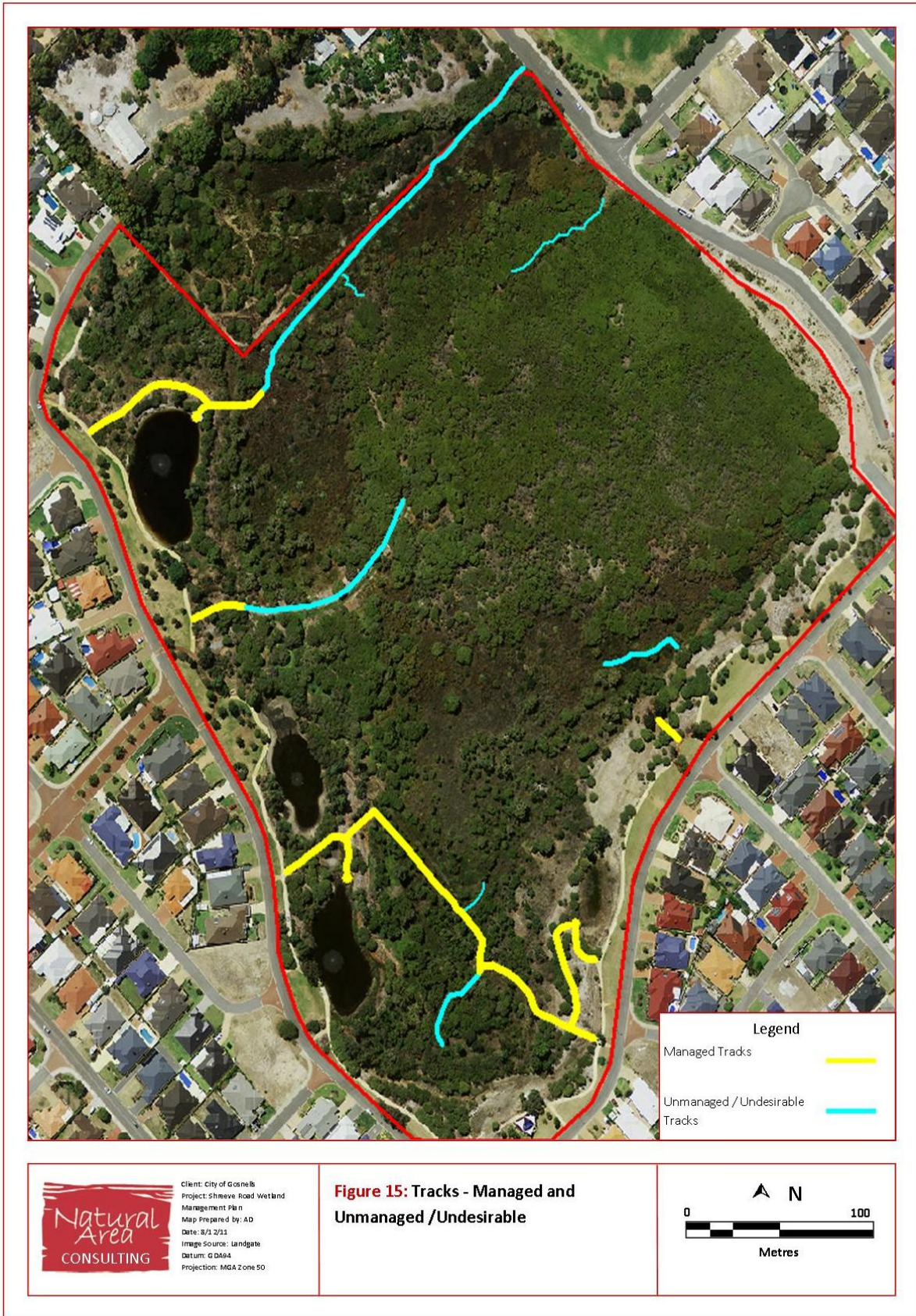
- hydrological changes within the wider catchment area associated with changed land use from rural to urban (residential),
- increased stormwater or other drainage entering the wetland from surrounding areas and,
- observations being made during a year characterised by unseasonal precipitation (Appendix 4), with higher than average rainfall occurring between September and December 2011 (Bureau of Meteorology, 2012).

## 4.8 Disturbances

Disturbances were noted to occur across the site relating to undesirable and unmanaged public access, tree deaths, rubbish dumping, and cubby construction activity.

### 4.8.1 Unmanaged/Undesirable Access

The formation of tracks through native vegetation can degrade bushland by damaging plants, hindering growth and promoting weed infestation. Track formation was apparent across the site with varying degrees of severity. The *Melaleuca raphiophylla* forest had numerous light tracks, however the lack of understorey associated with the vegetation community means that the level of disturbance was considered to be minimal. The formation of a large track and associated peripheral activity in the south west of the site has reduced understorey growth and promoted weed infestation into areas of bushland in very good condition. A map of managed and unmanaged/undesirable Access is presented in Figure 15.



#### 4.8.2 Tree Mortality

Tree death was noted to occur within the *Eucalyptus marginata/Allocasuarina fraseriana* Woodland (Figures 16 & 17). These deaths may relate to environmental stresses including but not limited to:

- the presence of dieback (*Phytophthora cinnamomi*) and,
- change in wetland hydrology.

Limited assessment for *Phytophthora* dieback (*Phytophthora cinnamomi*) was carried out by the City of Gosnells in May 2006 to determine the cause of death of a number of *Allocasuarina fraseriana* trees along the south west side of the Reserve, with soil and tissue samples being analysed. Results were negative, but not considered conclusive due to sampling factors (Glevan, 2006).



**Figure 16:** Tree Deaths within *Eucalyptus marginata/Allocasuarina fraseriana* Woodland



### 4.8.3 Cubby Houses and Associated Rubbish

Across the site were numerous cubby houses; various types of rubbish were associated with these including smoking implements, construction waste and general rubbish (Figure 18). These activities pose a threat to the surrounding residential area and the Reserve through increased risk of fire, rubbish accumulation and formation of tracks. Antisocial behaviour may also impact on the Reserve's recreational amenity. Locations of individual cubby houses are presented in Figure 19.



**Figure 18:** Cubby Houses and Associated Rubbish



#### 4.8.4 Rubbish

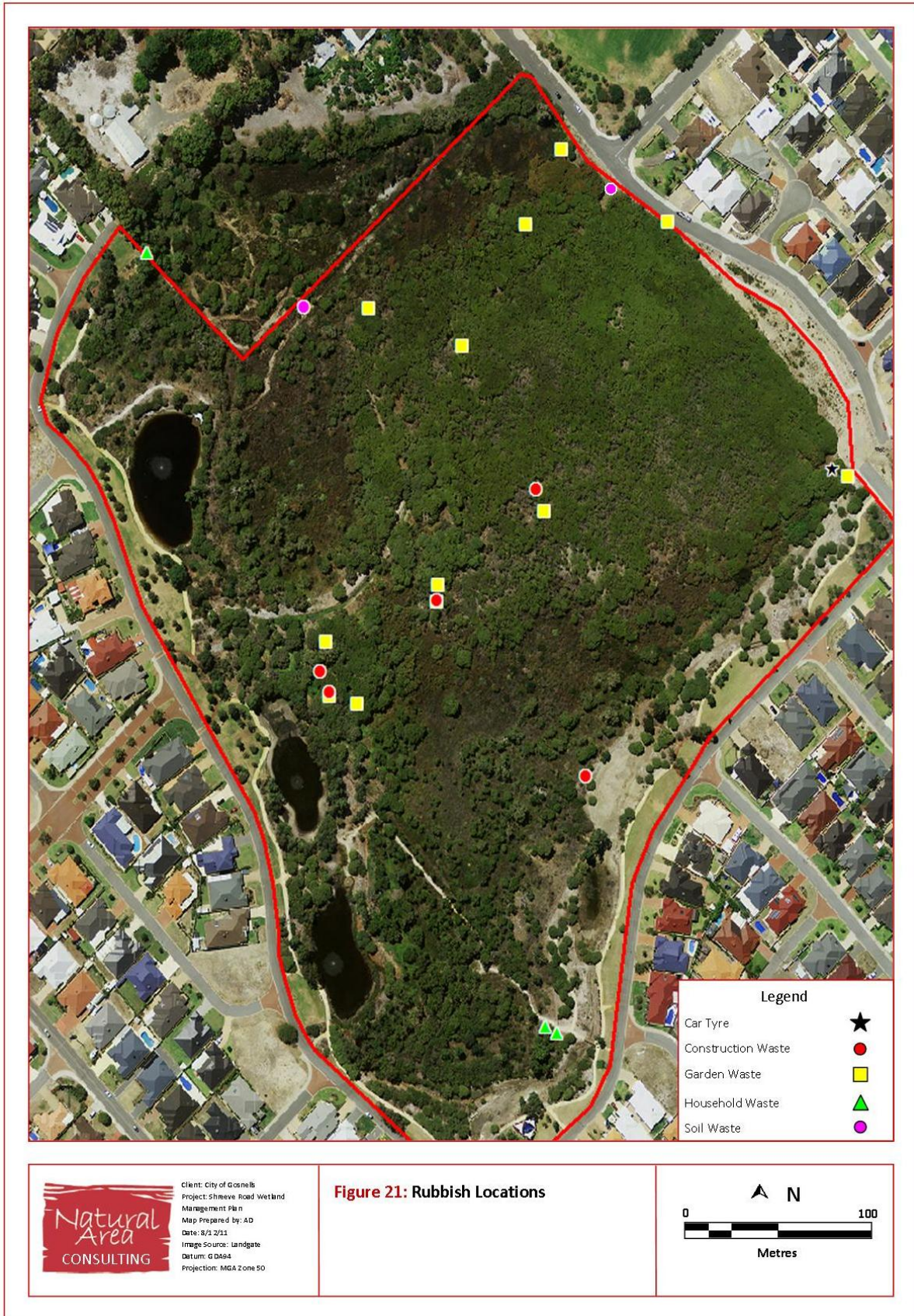
Rubbish was noted to occur across the site (Figure 20) and was generally categorised as:

- car tyres,
- construction waste,
- garden waste,
- household waste, and
- soil waste.

The presence of waste diminishes the visual amenity of a conservation reserve, promotes ecosystem disturbance and provides a habitat for introduced animals such as bees (*Apis mellifera*). The location of significant rubbish is presented in Figure 21.



**Figure 20:** Examples of Household Rubbish





## 5.0 Management Strategies

In order to improve and maintain the wetland's biodiversity values management strategies will need to be implemented. Each of the below management strategies addresses a specific threat to the Reserve and includes the following areas of management:

- weed management,
- revegetation,
- introduced fauna,
- access management,
- tree mortality,
- hydrology,
- fire management, and
- rubbish and cubby construction.

The major focus of the plan will initially be weed management and revegetation. Fauna management is considered at this stage of the Reserve's management to be a low priority issue. This is due to the need to address other management issues as a priority and it also recognises that feral fauna management will require intervention in an integrated regional approach involving multiple stakeholders.

### 5.1 Weed Management

Weed invasion is one of the Reserve's highest priority threats. Despite current management intervention weed invasion in certain areas of the Reserve was found to be high and will require a concerted effort to significantly reduce this threat. Two weed control strategies have been proposed for the Reserve in recognition that complete control for the site may be cost prohibitive. Strategy 1 provides a short-term programme for the control of species of critical importance for the Reserve while Strategy 2 provides for a comprehensive weed control programme.

It is important that the weed control programme is able to be adapted and responsive to changing conditions; for example, weed control following fire. The significance of this is best illustrated through the proliferation of *Eucalyptus camaldulensis* and *Acacia longifolia* following fire in 2009. An adaptive weed control programme should be implemented by a suitably qualified and experienced weed contractor in order to maintain and improve the environmental values of the site. This should take the form of both manual and chemical treatment to control:

- broadleaf weeds,
- geophytic weeds,
- grasses, and
- woody weeds.

Weed control will be guided by the weed maps (Appendix 5) and the prioritised species list in Table 10. Note that many weed control chemicals can result in the death of wetland fauna, with glyphosate biactive being the only herbicide that can be used in and around wetland areas where there is standing water or saturated soil. Weed control in Shreeve Road Reserve Wetland should involve two programmes:

- General maintenance weed control programme. This programme takes a reserve wide approach to weed management focusing on the weed species that pose the most significant threat to the Reserve's biodiversity first.

- Revegetation works weed control programme. Weed control for revegetation areas will require a more diligent and focused effort on the area being revegetated. It is also recommended that a thorough programme is provided 1 year prior to planting to help deplete weed seed bank in an effort to increase revegetation success and increase likelihood of complete weed eradication from the area.

### 5.1.1 General Maintenance Weed Control Programme

An existing adaptive weed control programme is currently implemented for the Reserve. Weed control should continue across the site as part of an ongoing maintenance programme. It should however be noted that the extent of weed infestations across the Reserve demands that a significant effort is required in the 'primary treatment' of the Reserve. The 'primary treatment' means the first weeding treatment of the parent generation of weeds. This treatment will also require that thorough 'secondary treatment' occurs across the Reserve to sufficiently deplete the weed seed bank in the soil. For example, *Acacia longifolia* will remain in the soil for 10 or more years. (Florabase, 2012) It is therefore critical that sufficient resources be allocated to subsequent years of weed control and recommended that once the weed control programme has been initiated that it is committed to on a long-term basis and subject to annual review.

Targeted management should commence as soon as possible, in line with timings recommended in Appendix 6. Two strategies for weed treatment have been provided, with Strategy 1 targeting a small number of high priority species and Strategy 2 targeting all high priority weeds found within the Reserve. The strategies provide a coordinated approach to weed management based on treatment method (see Tables 7 & 8). Strategy 1 provides a less comprehensive, short-term programme, focusing on the management of high priority weeds considered critical for immediate management. High priority weeds omitted from Strategy 1 include Blackberry (*Rubus fruticosus*), *Typha orientalis* and Pampas Grass (*Cortaderia selloana*). In the context of the Reserve these species are not considered critical for immediate management. Strategy 2 provides an optimal control programme. Strategy 1 should only be considered an interim programme until sufficient funds are sourced to implement a comprehensive programme (Strategy 2) for the Reserve.

**Recommendation 5.1.1.1:** Allow sufficient resources for the implementation of weed strategies for the Reserve. This includes adequate resources for subsequent years following initial 'primary treatment'. Indicative costing for each strategy is provided in Appendix 9. Costing for follow-up weed control activities should be established in consultation with a suitably qualified and experienced environmental weed control operator as part of annual review of weed control activities.

#### Strategy 1:

##### Critical Short-term Weed Control Programme

At a minimum initial targeted weed control in Shreeve Road Reserve Wetland should involve the treatments identified in Table 7. The control of Arum Lily (*Zantedeschia aethiopica*) and Watsonia (*Watsonia meriana* var. *bulbillifera*) have been identified as being very high priority due to their potential to spread throughout the Reserve and the current ease of treatment. Weed treatment should also continue to include all weeds within the two burn areas to aid in the natural revegetation of the site. A price schedule for this weed control programme is provided in table 12. This strategy involves treating a select group of weeds in order to be most cost effective. The major omissions with this treatment strategy are grasses, bulbs, *Cyperus* weeds, Blackberry (*Rubus fruticosus*), *Typha orientalis* and Pampas Grass (*Cortaderia selloana*).

**Table 7: Weed Treatment programme for Selected Key Weeds (Strategy 1)**

Treatment Type	Examples Targeted Species	Application Method and Comments
2,2 DPA	Watsonia and African Corn Flag	Spot spray
2,4 –D or picloram/triclopyr wipe	Arum Lilly	2,4 –D: semi selective picloram/triclopyr wipe: non selective
Glyphosate biactive spray	Annual and perennial grass and broadleaf weeds	Spot spray
Hand weeding	Carnation Weed, Fleabane, Pigface	Gloves required due to caustic sap of Carnation Weed
Woody weed control	Woody weeds and trees	Cut and paint or basal bark

**Strategy 2:****Full Weed Control**

In order to treat the majority of weeds present within the Reserve in an efficient way a programme must be undertaken to treat specific types of weeds. An example of the treatments required for the entire Reserve is provided in Table 8. These treatments can be undertaken as required in addition to those listed in Strategy 1.

**Table 8: Full Weed Treatment Programme (Strategy 2)**

Treatment Type	Example Targeted Species	Application Method and Comments
2,2 DPA	Watsonia and African Corn Flag	Spot spray
3,4 –D or picloram/triclopyr wipe	Arum Lilly	Semi selective picloram/triclopyr wipe: Non selective
Glyphosate biactive spray	Annual and perennial grass and broadleaf weeds	Spot spray
Hand weeding	Carnation Weeds, Fleabane, Pigface	Gloves required due to caustic sap of Carnation Weed
Metsulfuron	Annual broadleaf weeds and bulbs	Spot spray
Selective grass spray	Annual and perennial grasses	Spot spray, or overall spray in broad leaf host situations
Slash then spray with glyphosate biactive (Typha can be wiped with glyphosate)	Blackberry, Typha and Pampas Grass	Typha control best undertaken during Summer
Woody weed control	Woody weeds and trees	Cut and paint or basal bark

**Recommendation 5.1.1.2:** Implement Strategy 1 & Strategy 2 of the weed control programme. Strategy 1 is the highest priority; however, both strategy 1 & 2 need to be implemented.

**5.1.2 Weed Priority Ranking**

The priority rating of each weed that was identified during the field survey was assessed using the following Resources:

- Appendix 3 of the Environmental Weed Strategy of Western Australia (EWSWA) (CALM, 1999),
- DEC's Invasive Plant Prioritisation Process, and
- observations made onsite relating to each species current impact on the Reserve.

### Environmental Weed Strategy of Western Australia (EWSWA)

EWSWA is aimed at providing a direction and an approach to managing environmental weeds in Western Australia. The criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity are based on:

- invasiveness – ability to invade bushland in good or excellent condition or ability to invade waterways;
- distribution – wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world; and
- environmental impacts – ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community.

Species are ranked depending on whether they answer yes or no to the above criteria (Table 9).

**Table 9:** Implications for weeds according to their priority rating

Rating	Yes	No	Implications
High	Yes to all three criterion	-	Weed is prioritised for control and or research
Moderate	Yes to two criteria	No to one	Control and research should be undertaken if funds are available but the species should at least be monitored
Low	Yes to one	No to two	Monitoring and control where appropriate
Mild	Yes to none	No to three	Low level monitoring

### Invasive Plant Prioritisation Process for DEC

The Invasive Plant Prioritisation Process is an update to EWSWA and is designed to provide an integrated approach to weed management in WA. This document details the relative impact of each weed species including:

- ecological impact,
- rate of dispersal, and
- general trend.

### Observations made on site

During the survey of the site Natural Area Consulting staff collected data for each weed species relating to:

- species,
- location,
- density,
- invasiveness and,
- potential impact of weeds observed.

This information was used to map weed locations (Appendix 5) and provide site specific recommendations for weed control. A list of invasive weeds is presented in Table 10, with priority ratings and comments for each species. Labels beside each species denote if treatment strategy 1 or 2 will control that particular infestation.

**Table 10:** Implications for Weeds According to their Priority Rating

\* Weeds Treated with Strategy 1  
 † Additional Weeds Treated with Strategy 2

Species and Treatment Strategy	Common Name where applicable	EWSWA Priority Rating
<b>Very High Priority Weeds</b>		
<i>Watsonia meriana</i> var. <i>bulbillifera</i> *	Watsonia	High
<i>Zantedeschia aethiopica</i> *	Arum Lily	High
<b>High Priority Weeds</b>		
<i>Acacia longifolia</i> *	Sydney Golden Wattle	High
<i>Asparagus asparagoides</i> †	Bridal Creeper	High
<i>Avena barbata</i> †	Bearded Oats	Moderate
<i>Brassica tournefortii</i> †	Mediterranean Turnip	High
<i>Carpobrotus edulis</i> *	Pigface	Moderate
<i>Cortaderia selloana</i> †	Pampas Grass	High
<i>Cynodon dactylon</i> *	Couch Grass	Moderate
<i>Ehrharta calycina</i> †	Perennial Veldt	High
<i>Ehrharta longifolia</i> *	Annual Veldt	Low
<i>Eragrostis curvula</i> *	Love Grass	High
<i>Eucalyptus camaldulensis</i> *	Rivergum	Unavailable
<i>Euphorbia terracina</i> †	Geraldton Carnation Weed	High
<i>Ficus carica</i> *	Edible Fig	Moderate
<i>Fumaria capreolata</i> †	Fumaria	Mild
<i>Paspalum dilatatum</i> †	Paspalum	Moderate
<i>Pennisetum clandestinum</i> *	Kikuyu	Unavailable
<i>Raphanus raphanistrum</i> *	Wild Radish	Mild
<i>Rubus fruticosus</i> †	Blackberry	Low
<i>Schinus terebinthifolia</i> *	Japanese Pepper Tree	Moderate
<i>Solanum nigrum</i> *	Nightshade	Moderate
<i>Stenotaphrum secundatum</i> *	Buffalo Grass	Moderate
<i>Typha orientalis</i> †	Bulrush	High
<b>Moderate Priority Weeds</b>		
<i>Briza maxima</i> †	Blowfly Grass	Moderate
<i>Briza minor</i> †	Shivery Grass	Moderate
<i>Carduus pycnocephalus</i> *	Slender Thistle	Moderate
<i>Conyza bonariensis</i> *	Fleabane	Low
<i>Cyperus eragrostis</i> †	Umbrella Sedge	Moderate
<i>Cyperus polystachyos</i> †	Bunchy Sedge	Unavailable
<i>Gladiolus caryophyllaceus</i> †	Pink Gladiolus	Moderate
<i>Gladiolus undulatus</i> †	Wavy Gladiolus	Moderate
<i>Gomphocarpus fruticosus</i> *	Cottonbush	Moderate
<i>Holcus lanatus</i> *	Yorkshire Fog	Moderate
<i>Hypochaeris radicata</i> *	Flat Weed	Moderate

Species and Treatment Strategy	Common Name where applicable	EWSWA Priority Rating
<i>Juncus microcephalus</i> *	Juncus	Mild
<i>Lactuca serriola</i> *	Prickly Lettuce	Moderate
<i>Rumex crispus</i> *	Curled Dock	Mild
<i>Persicaria lapathifolia</i> *	Pale Knotweed	Unavailable
<i>Phytolacca octandra</i> *	Inkweed	Mild
<i>Polypogon monspeliensis</i> †	Annual Beard Grass	Moderate
<i>Sonchus oleraceus</i> *	Sowthistle	Moderate
<b>Low Priority / Indirect Impact Weeds</b>		
<i>Anagallis arvensis</i> *	Orange Pimpernel	Unavailable
<i>Asparagus officinalis</i> *	Garden Asparagus	Low
<i>Digitaria ciliaris</i> †	Summer Grass	Low
<i>Echinochloa crus-gavonis</i> *	South American Barnyard Grass	Low
<i>Lotus angustissimus</i> *	Narrow-leaf Trefoil	Low
<i>Lythrum hyssopifolia</i> *	Lesser Loosestrife	Unavailable
<i>Physalis peruviana</i> *	Cape Gooseberry	Moderate

### 5.1.3 Weed Control schedule and Costings

A timeline for weed control works as part of site maintenance is provided in Table 11. A summary of estimated costs associated with the implementation of the weed control costs is provided in Table 12, with full costing available in Appendix 9. The density of weed populations will dictate the level of investment required to manage the Reserve in subsequent years.

**Table 11: Weed Treatment Schedule**

Treatment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2,2 DPA (Strategy 1,2)												
2,4 -D (Strategy 1,2)												
Glyphosate biactive spray (Strategy 1,2)												
Hand weeding (Strategy 1,2)												
Metsulfuron (Strategy 2)												
Selective grass spray (Strategy 2)												
Slash then spray with glyphosate biactive (timing dependent on species) (Strategy 2)												
Triasulfuron (Strategy 2)												
Woody weed control (Strategy 1,2)												

**Table 12: Indicative Cost for Proposed Weed Control Strategies**

Strategy	Total Cost	Frequency
Strategy 1 - Minimum weed control	\$12,264.00	Annually
Strategy 2 - Comprehensive weed control	\$22,688.00	Annually

### 5.1.4 Weed Control within Revegetation Areas

Weed control should occur in the revegetation areas to maximise the survival of plantings. It is recommended weed control is initiated 1 year prior to revegetation and involve the following treatments:

- glyphosate biactive,
- quizalofop / fusilade (non wetland areas),
- woody weed (cut and paint or basal bark), and
- hand weeding.

Costing for weed control have been incorporated into estimated revegetation pricing in Section 5.3. Weed control for revegetation is costed separately from site maintenance treatments due to the intensive nature of works in the lead up to revegetation as well as allowing flexibility in weed control approach. A breakdown of indicative costs for weed control within revegetation areas is provided in Appendix 9.

**Recommendation 5.1.4.1:** Weed control should be initiated 1 year prior to all major revegetation works. Weed control should occur for three years, with monitoring at the end of the schedule to guide subsequent management practices.

## 5.2 Revegetation Strategy

Revegetation of the site is recommended to improve and maintain biodiversity within the Reserve. Zones for revegetation works were chosen on the basis of improving significant degraded areas that are in close proximity to areas of bushland in good or better condition because of their risk to adjacent bushland areas. Due to their size, changes in wetland hydrology and degraded condition, these areas require intervention beyond weed control. Planting will occur within different vegetation communities using species suitable for the vegetation community and altered hydrology (Figure 22). Revegetation areas have been prioritised into stages according to aesthetics and potential to degrade other zones. This is based upon the level of exposure of the rehabilitation site and the perceived ecological benefit to the Reserve. Six areas within the wetland have been proposed for revegetation works (see Figure 22):

- degraded drain area,
- *Melaleuca preissiana* Woodland,
- *Melaleuca preissiana* Forest,
- *Eucalyptus marginata* /*Allocasuarina fraseriana* Woodland area 1,
- *Eucalyptus marginata* /*Allocasuarina fraseriana* Woodland area 2, and
- *Kunzea glabrescens* Closed Tall Scrub.

The recommended species for revegetation are provided in Tables 13 - 19, along with a description to identify the plant form and approximate planting densities. Approximate quantities for each species have been included allowing for a 20% mortality rate. The species suggested represents an ideal revegetation list assuming all species are available; however, numbers can be substituted where required. It is recommended that seed stock is sourced from within the Reserve where available. Planning for revegetation should allow for at least one season of seed collection prior to plant propagation for revegetation works. It is preferable that two or more seasons of seed collection has been completed to maximise species diversity as seed production can vary significantly from year to year.

In order to maximise revegetation success insure the biodiversity value of the site, it is recommended that:

- all plants be propagated using local provenance seed or cuttings
- rehabilitation areas likely to be disturbed are fenced during establishment
- are planted without plastic tree guards and monitored for signs of herbivore damage

Note: that watering may be required during warmer months if planting occurs during a particularly dry year.

There are a number of schools within close proximity of the Reserve. School participation in planting activities presents an opportunity to engage local school aged children with the Reserve and help promote an awareness of its ecological importance. Participation of the local community can also provide necessary voluntary contribution to grant proposals for on ground works. It is recommended that, where appropriate opportunities arise, local schools and the residential community are invited to participate in tree planting activities.

**Recommendation 5.2.1:** As part of bushland restoration works undertake works described in Section 5.2. Revegetation works should be initiated with highest priority areas first (Stage 1).



**Recommendation 5.2.2:** All plants propagated for revegetation work should use local provenance seed or cuttings. Planning for revegetation should allow for at least one season of seed collection prior to plant propagation for revegetation works. It is preferable that two or more seasons of seed collection has been completed to maximise species diversity as seed production can vary significantly year to year.

**Recommendation 5.2.3:** Consider involving local schools and the residential community in revegetation activities where appropriate opportunities arise.



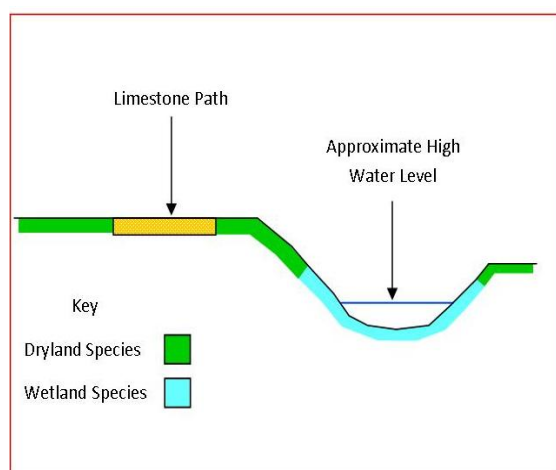
### 5.2.1 High Priority Revegetation

#### Stage 1:

#### Degraded Drain Area

This revegetation site consists of an old agricultural drain with a sandy unstable edge. The agricultural drain represents a degraded incursion into an area that is otherwise predominantly in very good condition. Consequently it presents a source of weed seed to surrounding areas. Installation of a limestone path is included as part of the revegetation strategy for this area (see Figure 23).

There are high concentrations of weeds associated with the drain edge and the path. It is recommended revegetation works are undertaken to stabilise the drain edge, promote habitat and shade out the weed species present in this area. Revegetation species close to the drain edge should be able to tolerate periodic inundation while those along the path and above the high water level must be able to survive extended dry periods. Species selected for this revegetation area has been divided into wetland and dryland species (Tables 13 and 14). Planting densities have been recommended at 1 plant per m<sup>2</sup>. This revegetation zone has a high density of weeds and as such weed control should take place 1 year prior to planting. Due to the low density of native species two glyphosate biactive treatments would be the most effective to establish revegetation plants.



**Figure 23:** Drain Planting Zones

**Table 13:** Revegetation Species Degraded Drain Wetland at Approximately 1 Plant/m<sup>2</sup>

Species	Form	Plant Numbers
<i>Astartea scoparia</i>	Large shrub	50
<i>Banksia littoralis</i>	Tree	30
<i>Baumea juncea</i>	Small clumping plant	250
<i>Bolboschoenus caldwellii</i>	Medium clumping plant	150
<i>Calothamnus lateralis</i>	Medium shrub	50
<i>Centella asiatica</i>	Ground cover	100
<i>Lepidosperma longitudinale</i>	Medium clumping plant	100
<i>Melaleuca preissiana</i>	Tree	40
<i>Pericalymma ellipticum</i>	Medium shrub	50
<i>Taxandria linearifolia</i>	Medium shrub	50
<b>Total</b>		<b>870</b>

**Table 14:** Revegetation Species Degraded Drain Dryland at Approximately 1 Plant/m<sup>2</sup>

Species	Form	Plant Numbers
<i>Acacia pulchella</i>	Small shrub	100
<i>Acacia saligna</i>	Tree	50
<i>Astartea scoparia</i>	Large shrub	100
<i>Banksia littoralis</i>	Tree	30
<i>Calothamnus lateralis</i>	Medium shrub	50
<i>Dianella revoluta</i>	Medium clumping plant	100
<i>Hakea varia</i>	Large shrub	50
<i>Hardenbergia comptoniana</i>	Ground cover	100
<i>Hemiandra pungens</i>	Ground cover	40
<i>Hypocalymma angustifolium</i>	Medium shrub	100
<i>Jacksonia furcellata</i>	Large shrub	100
<i>Kennedia prostrata</i>	Ground cover	100
<i>Kunzea glabrescens</i>	Large shrub	50
<i>Melaleuca preissiana</i>	Tree	50
<i>Patersonia occidentalis var occidentalis</i>	Small clumping plant	100
<i>Regelia ciliata</i>	large shrub	100
<b>Total</b>		<b>1220</b>

**Stage 2:*****Melaleuca preissiana* Forest**

This zone is characterised by a thick over storey of *Melaleuca preissiana* with a reduced weedy understorey. This area has been classified as degraded and would benefit from the planting of species tolerant to periodic inundation and reduced light levels (Table 15). Weed control should take place one year prior to planting involving the removal of woody weeds and an herbicide application of glyphosate biactive.

**Table 15:** Revegetation Species *Melaleuca preissiana* Forest at Approximately 1 Plant/ 2 m<sup>2</sup>

Species	Form	Plant Numbers
<i>Aotus gracillima</i>	Medium shrub	100
<i>Astartea scoparia</i>	Large shrub	50
<i>Bolboschoenus caldwellii</i>	Medium clumping plant	275
<i>Calothamnus lateralis</i>	Medium shrub	50
<i>Centella asiatica</i>	Ground cover	250
<i>Lepidosperma longitudinale</i>	Medium clumping plant	75
<i>Lobelia anceps</i>	Ground cover	250
<i>Melaleuca preissiana</i>	Tree	100
<i>Melaleuca raphiophylla</i>	Tree	100
<i>Melaleuca teretifolia</i>	Large shrub	50
<b>Total</b>		<b>1300</b>

**Stage 3:****Melaleuca preissiana Woodland**

This area is located between the artificial wetland in the southwest of the site and the limestone managed access track. The vegetation condition within this area is degraded; however there is also a small patch of completely degraded vegetation. This zone is in close proximity to vegetation classed as very good and as such should be revegetated to avoid further loss of condition. Due to the high densities of weeds this site must receive one year of weed treatment prior to planting. The species selected for this area are adapted to damp soils and reduced light infiltration (Table 16).

**Table 16:** Revegetation Species *Melaleuca preissiana* Woodland Approximately 1 Plant/ 2 m<sup>2</sup>

Species	Form	Plant Numbers
<i>Acacia pulchella</i>	Small shrub	20
<i>Acacia saligna</i>	Tree	50
<i>Adenanthos obovatus</i>	Medium shrub	20
<i>Aotus gracillima</i>	Medium shrub	40
<i>Astartea scoparia</i>	Large shrub	20
<i>Banksia littoralis</i>	Tree	30
<i>Baumea preissii</i>	Medium clumping plant	40
<i>Boronia crenulata</i>	Medium shrub	20
<i>Bolboschoenus caldwellii</i>	Medium clumping plant	100
<i>Calothamnus lateralis</i>	Medium shrub	20
<i>Centella asiatica</i>	Ground cover	100
<i>Conostylis juncea</i>	Small clumping plant	20
<i>Dampiera linearis</i>	Small shrub	50
<i>Daviesia physodes</i>	Medium shrub	20
<i>Dianella revoluta</i>	Medium clumping plant	20
<i>Eutaxia virgata</i>	Medium shrub	20
<i>Hakea varia</i>	Large shrub	50
<i>Hemiandra pungens</i>	Ground cover	10
<i>Hypocalymma angustifolium</i>	Medium shrub	50
<i>Jacksonia furcellata</i>	Large shrub	10
<i>Kunzea glabrescens</i>	Large shrub	50
<i>Lepidosperma longitudinale</i>	Medium clumping plant	50
<i>Lobelia anceps</i>	Ground cover	50
<i>Meeboldina scariosa</i>	Large clumping plant	20
<i>Melaleuca lateritia</i>	Large shrub	20
<i>Melaleuca preissiana</i>	Tree	50
<i>Melaleuca raphiophylla</i>	Tree	30
<i>Melaleuca teretifolia</i>	Large shrub	20
<i>Patersonia occidentalis var occidentalis</i>	Small clumping plant	20
<i>Pericalymma ellipticum</i>	Medium shrub	20
<i>Phlebocarya ciliata</i>	Small clumping plant	20
<i>Regelia ciliata</i>	large shrub	50
<i>Thysanotus multiflorus</i>	Small clumping plant	20
<i>Xanthorrhoea preissii</i>	Medium shrub	20
<b>Total</b>		<b>1150</b>

## 5.2.2 Moderate Priority

### Stage 4:

#### *Eucalyptus marginata* / *Allocasuarina fraseriana* Woodland Area 1 and 2

These two areas are located adjacent to two formalised paths that enter the Shreeve Road Wetland Reserve. Area 1 is located in the south east of the site while area 2 is located in the north western pocket. Both of these zones have vegetation condition ranging from completely degraded to good. Weed control should occur for one year prior to planting in this stage to improve the survival of plantings. Mortality in this vegetation type may be related to altered hydrology. As such, the majority of species that have been selected are able to tolerate variable water table height (Tables 17 & 18).

**Table 17:** Revegetation Species *Eucalyptus marginata* / *Allocasuarina fraseriana* Woodland Area 1 at Approximately 1 Plant/2 m<sup>2</sup>

Species	Form	Plant Numbers
<i>Acacia pulchella</i>	Small shrub	50
<i>Acacia saligna</i>	Tree	50
<i>Acacia stenoptera</i>	Small shrub	50
<i>Adenanthos obovatus</i>	Medium shrub	50
<i>Allocasuarina fraseriana</i>	Tree	50
<i>Anigozanthos manglesii</i>	Small clumping plant	10
<i>Arnocrinum preissii</i>	Small clumping plant	20
<i>Billardiera heterophylla</i>	Medium shrub	20
<i>Bossiaea eriocarpa</i>	Small shrub	50
<i>Calytrix fraseri</i>	Large Shrub	50
<i>Dampiera linearis</i>	Small shrub	25
<i>Dasyopogon bromeliifolius</i>	Small clumping plant	20
<i>Daviesia physodes</i>	Medium shrub	20
<i>Dianella revoluta</i>	Small clumping plant	50
<i>Eucalyptus marginata</i>	Tree	50
<i>Eucalyptus todtiana</i>	Tree	10
<i>Gastrolobium capitatum</i>	Small shrub	25
<i>Gompholobium tomentosum</i>	Small shrub	50
<i>Haemodorum spicatum</i>	Small clumping plant	25
<i>Hemiandra pungens</i>	Ground cover	50
<i>Hovea trisperma</i>	Small shrub	25
<i>Hypocalymma angustifolium</i>	Medium shrub	25
<i>Hypolaena exsulca</i>	Medium clumping plant	10
<i>Jacksonia furcellata</i>	Large shrub	25
<i>Kennedia prostrata</i>	Ground cover	25
<i>Kunzea glabrescens</i>	Large shrub	25
<i>Nuytsia floribunda</i>	Tree	10
<i>Patersonia occidentalis</i>	Small clumping plant	50
<i>Scholtzia involucrata</i>	Small shrub	50
<i>Thysanotus multiflorus</i>	Small clumping plant	25
<i>Tricoryne elatior</i>	Small shrub	10
<i>Xanthorrhoea preissii</i>	Large clumping plant	20
	<b>Total</b>	<b>1025</b>

**Table 18:** Revegetation Species *Eucalyptus marginata* /*Allocasuarina fraseriana* Woodland Area 2 at Approximately 1 Plant/4 m<sup>2</sup>

Species	Form	Plant Numbers
<i>Acacia pulchella</i>	Small shrub	25
<i>Acacia saligna</i>	Tree	25
<i>Acacia stenoptera</i>	Small shrub	25
<i>Adenanthos obovatus</i>	Medium shrub	25
<i>Allocasuarina fraseriana</i>	Tree	25
<i>Anigozanthos manglesii</i>	Small clumping plant	5
<i>Arnocrinum preissii</i>	Small clumping plant	10
<i>Billardiera heterophylla</i>	Medium shrub	10
<i>Bossiaea eriocarpa</i>	Small shrub	20
<i>Calytrix fraseri</i>	Large shrub	20
<i>Dampiera linearis</i>	Small shrub	20
<i>Dasyogon bromeliifolius</i>	Small clumping plant	10
<i>Daviesia physodes</i>	Medium shrub	10
<i>Dianella revoluta</i>	Medium Clumping	20
<i>Eucalyptus marginata</i>	Tree	20
<i>Eucalyptus todtiana</i>	Tree	10
<i>Gastrolobium capitatum</i>	Small shrub	20
<i>Gompholobium tomentosum</i>	Small shrub	20
<i>Haemodorum spicatum</i>	Small clumping plant	20
<i>Hemiandra pungens</i>	Ground cover	20
<i>Hovea trisperma</i>	Small shrub	20
<i>Hypocalymma angustifolium</i>	Medium shrub	25
<i>Hypolaena exsulca</i>	Medium Clumping	5
<i>Jacksonia furcellata</i>	Large shrub	10
<i>Kennedia prostrata</i>	Ground cover	20
<i>Kunzea glabrescens</i>	Large shrub	10
<i>Nuytsia floribunda</i>	Tree	5
<i>Patersonia occidentalis</i>	Small clumping plant	20
<i>Scholtzia involucrata</i>	Small shrub	20
<i>Thysanotus multiflorus</i>	Small clumping plant	20
<i>Tricoryne elatior</i>	Small shrub	5
<i>Xanthorrhoea preissii</i>	Large clumping plant	10
	<b>Total</b>	<b>530</b>

### 5.2.3 Low Priority

#### Stage 5:

#### ***Kunzea glabrescens* Closed Tall Scrub**

This revegetation area is located on the north eastern boundary of the Reserve and consists of a completely degraded pocket within vegetation of very good condition. This area has high densities of couch grass (*Cynodon dactylon*), and disturbance is most likely a result of soil dumping. The site should be treated by removing the soil waste and revegetating the area. This revegetation zone has been identified as low priority as the weed levels appear stable and the site has a low profile. Species suggested are provided in Table 19 with weed control recommended several weeks prior to planting.

**Table 19:** Revegetation Species *Kunzea glabrescens* Closed Tall Scrub at Approximately 3 Plants/2 m<sup>2</sup>

Species	Form	Plant Numbers
<i>Jacksonia furcellata</i>	Large clumping plant	25
<i>Juncus pallidus</i>	Medium Clumping Plant	20
<i>Kennedia prostrata</i>	Ground cover	25
<i>Kunzea glabrescens</i>	Large shrub	50
<i>Scholtzia involucrata</i>	Small shrub	25
<i>Thysanotus multiflorus</i>	Small clumping plant	25
<b>Total</b>		<b>170</b>

### 5.2.4 Proposed Revegetation Works Schedule and Costings

A recommended timeline for revegetation works of Stages 1-5 is provided in Tables 20-24. A summary of estimated costs associated with the implementation of the revegetation is provided in Table 25 with a breakdown of costs available in Appendix 9. Seed Collection should commence in the summer of 2012 to ensure sufficient time for propagation. Seed should be sourced from within the Reserve or if unavailable from suitable sites within the local area.

**Table 20:** Revegetation Schedule Year 1 (2014)

Treatment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Glyphosate biactive spray Stage 1 & 2												
Hand weeding Stage 1												
Woody Weed removal Stage 2												

**Table 21:** Revegetation Schedule Year 2 (2015)

Treatment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Glyphosate biactive Stage 1 & 2												
Hand weeding Stage 1												
Revegetation Stage 1 & 2												
Revegetation Stage 1 & 2 Wetland Areas												



**Table 22: Revegetation Schedule Year 3 (2016)**

Treatment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Glyphosate biactive spray Stage 3 & 4												
Hand weeding Stage 3 & 4												
Selective grass spray Stage 3 & 4												
Woody weed removal stage 3 & 4												

**Table 23: Revegetation Schedule Year 4 (2017)**

Treatment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Glyphosate biactive spray Stage 3 & 4												
Hand weeding Stage 3 & 4												
Revegetation stage 3 & 4												
Revegetation Stage 3 Wetland Areas												
Selective grass spray Stage 3 & 4												

**Table 24: Revegetation Schedule Year 5 (2018)**

Treatment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Glyphosate biactive spray Stage 5												
Revegetation Stage 5												
soil removal Stage 5												

**Table 25: Indicative Revegetation Costings per Revegetation Area**

Area	Total Cost	Priority	Implementation Years
Stage 1	\$13,626.00	High	2014-2015
Stage 2	\$8,179.00	High	2014-2015
Stage 3	\$9,860.00	High	2016-2017
Stage 4	\$13,420.00	Moderate	2016-2017
Stage 5	\$1,791.00	Low	2018

### 5.2.5 Future Revegetation Works

Several other low priority areas were identified during the site assessment that may benefit from revegetation in the long term including the wetland buffer and small fire affected pockets of vegetation. The wetland buffer surrounds the majority of the Site and is designed to provide recreational opportunities and to protect the wetland from the effects of urbanisation. In places this transitional zone has high densities of weeds and low diversity of native species. Revegetation activities in this area should focus on returning endemic plants to the area while maintaining good aesthetics. A revegetation plan should be developed once areas identified for revegetation in this Plan have been successfully implemented. The areas affected by fire should continue to be monitored to ensure natural regeneration is occurring. If these areas fail to return to a stable natural state revegetation or direct seeding should be considered to maintain the vegetation condition.

**Recommendation 5.2.5.1:** The areas affected by fire should continue to be monitored to ensure natural regeneration is occurring. If these areas fail to return to a stable natural state revegetation or direct seeding should be considered to maintain the vegetation condition.

### 5.3 Native Fauna Management

The Quenda (*Isoodon obesulus fusciventer*) has been recorded at the Reserve (City of Gosnells, 2009). Evidence of diggings was noted during the site assessment, however no animals were sighted. It is generally accepted that Local Government's expertise does not include fauna management and that the impact on fauna is incidental to habitat value. It is, however, recommended that the City seek opportunities for fauna study / survey of the Reserve to establish a baseline for fauna diversity. In order to maintain the significant biodiversity found within Shreeve Road Reserve Wetland habitat must be maintained through good management practices relating to:

- weed control,
- revegetation,
- fire management, and
- the mitigation of other threatening processes.

**Recommendation 5.3.1:** Consider undertaking fauna surveys to establish a baseline of fauna diversity for the Reserve.

### 5.4 Feral Fauna

The impact of feral fauna on the reserve is unknown. During the site assessment evidence of foxes was apparent in the presence of numerous scats and a den. Foxes have the potential to reduce biodiversity by preying on native fauna such as the Oblong Tortoise, Quenda and ground dwelling birds. The control of fox numbers is difficult due to the highly mobile nature of populations and as such management should be undertaken on a regional level rather than at the reserve level. Fox numbers are closely related to the abundance of rabbits, which in disturbed areas are their key prey source. If the number of rabbits is depleted predation pressure on native fauna can be increased. A control programme for foxes may also result in a corresponding increase in the rabbit population. It is therefore recommended that the control of both foxes and rabbits takes place simultaneously to reduce predation pressure on native animals. The population also needs to be managed in a way that is consistent with an urban setting, such as:

- 1080 egg baiting,
- soft jaw traps, and
- den fumigation.

Any potential control programme should be carefully assessed and be dependent on the participation of other stakeholders and the capacity for long-term monitoring of the population.

The Reserve should also be monitored for bee hives and if detected removed in a timely manner by a licensed contractor. The presence of rabbits was noted through the observation of scats and a warren. Rabbits have the potential to diminish the success of revegetation, promote weed growth, damage vegetation and provide a stable food source for the fox population. Viable control methods include:

- Pindone® baiting,
- fumigation, and
- trapping.

**Recommendation 5.4.1.1:** Investigate opportunities for a regional approach to fox management. Should feasible opportunities arise develop an appropriate feral animal management plan for the Reserve and surrounding area in conjunction with relevant stakeholders.

**Recommendation 5.4.1.2:** Should the control of introduced mammals be undertaken, rabbit and fox control should be undertaken simultaneously to reduce potential counterproductive repercussions from targeting one species only.

### **Domestic Animals**

Dogs were observed during site assessment activities being exercised within the Reserve, and when allowed to run loose, they can interfere with native wildlife. The City of Gosnells is responsible for enforcing and administering the *Dog Act 1976*. Shreeve Road Reserve is not a designated dog exercise area. The Dog Act states that a dog shall not be in a public place unless it is held by a person who is capable of controlling the dog. A dog is only exempt from this requirement if it is in a specified Dog Exercise Area.

It is recommended that signage be installed advising owners of the environmentally sensitive nature of the site and that dogs be confined to a leash in the Reserve at all times. Domestic cats pose a threat to the Reserve's native fauna. Control of domestic cats accessing the Reserve is difficult. To help reduce any potential impact that domestic cats are having on the Reserve's native fauna it is recommended that any strategy implemented that targets domestic owner's focus on interpretive material including pamphlets and/or signage.

**Recommendation 5.4.2.1:** The potential impact domestic animals have on the biodiversity of the Reserve should be mitigated through interpretive material and the provision of signage that encourages responsible pet ownership.

## **5.5 Access Management**

The perimeter of the site is fenced; however unmanaged access to sensitive ecological areas remains an ongoing management issue. Uncontrolled access can readily occur from either the drain or the boardwalk that terminates at a set of stairs (Figures 24 & 25). The boardwalk that currently terminates at the set of stairs at the North West corner of the Reserve connects to an historic fire access track which connected to Shreeve Rd. The fire access track no longer serves its purpose due to the track being un-trafficable year round due to permanent inundation and because the boardwalk prevents fire vehicle access. Accordingly, the track is no longer maintained for pedestrian access and the majority of the track is experiencing natural regeneration. In its current form the boardwalk invites people to enter sensitive areas within the wetland in an unmanaged manner. It is recommended that the stairs are removed and replaced with a viewing platform to deter uncontrolled access. It is also recommended that appropriate signage be installed to promote public awareness of keeping to the managed access tracks. The informal path along the historic agricultural drain also presents similar management issues. It is recommended that it be formalised and also terminate at a viewing platform.



**Figure 24:** Boardwalk Terminating at Steps Providing Direct Access to Wetland



**Figure 25:** Drain Path Providing Direct Access to Wetland in Summer

**Recommendation 5.5.1:** To deter uncontrolled access into sensitive wetland areas consider terminating the board walk at the north west corner of the Reserve at a viewing platform. It is also recommended that the existing path along the agricultural drain and be formalised and terminate at a viewing platform.

## 5.6 Tree Mortality

The loss of trees has implications for the aesthetic and ecological values of the site. At present, tree mortality appears to be limited to *Allocasuarina fraseriana* and *Eucalyptus marginata* (Jarrah). It is recommended that soil testing for *Phytophthora* dieback takes place so that further management strategies can be identified and implemented. Should Dieback be identified as the most likely cause for tree mortality its management could include:

- mapping and isolating affected areas,
- the application of a foliar phosphite spray, and
- direct stem injection of phosphite into affected trees.

The apparent rising groundwater table could also be contributing to tree death through water logging and depriving the roots of oxygen. Assessment of available groundwater data may assist with determining whether or not this is the case. More detailed vegetation assessments may also be

warranted. The establishment of photo monitoring in areas identified to be experiencing tree deaths would be a cost effective method to measure tree health or decline in key areas identified in Figure 17.

**Recommendation 5.6.1:** Consider undertaking soil testing for *Phytophthora cinnamomi* in areas where tree mortality is occurring. Should *Phytophthora cinnamomi* be detected susceptible vegetation communities within the Reserve should be mapped and appropriate management actions implemented.

**Recommendation 5.6.2:** Continue existing photo monitoring in areas where tree decline has been observed as per the Shreeve Road Reserve Fire Management Action Plan.

## 5.7 Hydrology

Further hydrological investigations are recommended to determine the nature and extent of alterations to the wetland system, and thus what implications are likely for ongoing management.

**Recommendation 5.7.1:** In association with an appropriately qualified consultant or research institute develop and implement a monitoring programme to enable accurate assessment of the impact of changed hydrology on the wetland's health.

## 5.8 Fire Management

Fire management should be followed as per the Shreeve Road Reserve Wetland Fire Management Plan 2009. The Reserve should be monitored for excessive weed growth that may constitute a fire risk. Some trees that have been killed by fire may need to be removed.

**Recommendation 5.8.1:** Fire management should be followed as per the Shreeve Road Wetland Fire Management Plan 2009. The Reserve should be monitored for factors that may exacerbate the fire risk such as excessive weed growth or accumulation of woody debris.

## 5.9 Rubbish and Cubby Construction

Rubbish accumulation and cubby construction should be monitored by the City's Natural Areas Team and removed in a timely manner to discourage undesirable access to the wetland area. Soil waste should be removed to promote restoration of affected areas. Works to remove waste can be undertaken by the City of Gosnells maintenance teams or a private contractor.

**Recommendation 5.9.1:** The rubbish located within the Reserve should be removed. Cubbies should be dismantled in a timely manner to discourage further access to the site and future cubby constructions. The City should undertake periodic checks of the *Melaleuca raphiophylla* forest in the summer months to remove any new construction.

## 6.0 Success Criteria and Maintenance

The implementation of the Shreeve Road Reserve Wetland Management Plan is priority based, however it is also dependant on resource allocation to the Reserve. The success of the implementation of this management plan relates to the;

- success of revegetation,
- improvement in vegetation condition of the Reserve,
- reduction of weed species diversity and density within the Reserve, and
- reduced occurrence of disturbance sites such as cubby areas.

In order to monitor the success of the management strategies, monitoring in relation to set criteria may be undertaken. It is recommended that formal monitoring take place every six months for a two year period after rehabilitation, and take into account the following:

- an aim of 80% survival rates for plantings,
- improved species diversity,
- noticeable growth rates (percentage cover over a set area) of plantings to be seen,
- the establishment of one plant per m<sup>2</sup> over the revegetated areas,
- weed coverage to be less than 10%,
- weed species to comprise less than 5% of the total species composition, and
- no woody weeds to be present on site.

It is also recommended that informal monitoring of the of the revegetation areas be undertaken quarterly to ensure that any issue arising such as plant death or grazing can be rectified in a timely manner. An example informal monitoring sheet is provided in Appendix 8.

Maintenance of the site should also take place two – three times a year for at least two years, with frequency being adjusted according to site conditions. Activities undertaken at this time may include:

- weed control,
- rabbit control,
- waste management,
- supplementary plantings and,
- rectifying any issues raised by formal or informal monitoring.

Monitoring of rehabilitation outcomes can be undertaken through the setting up of a series of 5 m x 5 m quadrats to assess:

- planting success (mortality),
- species diversity, and
- weed coverage.

One quadrat per hectare is recommended.

## 7.0 References

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## Appendix 1: Vegetation Condition Rating Scale

Category	Description
1 Pristine	Pristine or nearly so, no obvious signs of disturbance.
2 Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3 Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4 Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
5 Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
6 Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

(Source: Government of Western Australia, 2000)

## Appendix 2: Bush Forever Vegetation Structural Classes

Vegetation Structural Classes				
Life Form/Height Class	Canopy Percentage Cover			
	100 – 70%	70 – 30%	30 - 10%	10 – 2 %
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland
Trees 10 – 30 m	Closed forest	Open forest	Woodland	Open woodland
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland
Tree Mallee	Closed tree mallee	Tree mallee	Open tree mallee	Very open tree mallee
Shrub Mallee	Closed shrub mallee	Shrub mallee	Open shrub mallee	Very open shrub mallee
Shrubs over 2 m	Closed tall scrub	Tall open scrub	Tall shrubland	Tall open shrubland
Shrubs 1 – 2 m	Closed heath	Open heath	Shrubland	Open shrubland
Shrubs under 1 m	Closed low heath	Open low heath	Low shrubland	Low open shrubland
Grasses	Closed grassland	Grassland	Open grassland	Very open grassland
Herbs	Closed herbland	Herbland	Open herbland	Very open herbland
Sedges	Closed sedgeland	Sedgeland	Open sedgeland	Very open sedgeland

(Source: Government of Western Australia, 2000)

## Appendix 3: Flora Species List

Family	Species	Common Name
<b>Monocotyledons</b>		
ARACEAE	* <i>Zantedeschia aethiopica</i>	Arum Lily
ASPARAGACEAE	* <i>Asparagus asparagaceae</i>	Bridal Creeper
	* <i>Asparagus officinale</i>	Garden Asparagus
	<i>Lomandra sericea</i>	
	<i>Thysanotus multiflorus</i>	
	<i>Thysanotus sp.</i>	
COLCHICACEAE	<i>Burchardia congesta</i>	
CYPERACEAE	<i>Baumea articulata</i>	
	<i>Baumea preissii</i>	
	<i>Bolboschoenus caldwellii</i>	
	* <i>Cyperus eragrostis</i>	Umbrella Sedge
	* <i>Cyperus polystachyos</i>	Bunchy Sedge
	<i>Lepidosperma longitudinale</i>	
	<i>Lepidosperma squamatum</i>	
	<i>Schoenoplectus validus</i>	
	<i>Schoenus efoliatus</i>	
DASYPOGONACEAE	<i>Dasyopogon bromeliifolius</i>	
HAEMODORACEAE	<i>Anigozanthos flavidus</i>	
	<i>Anigozanthos manglesii</i>	
	<i>Conostylis juncea</i>	
	<i>Haemodorum spicatum</i>	
	<i>Phlebocarya ciliata</i>	
HEMEROCALLIDACEAE	<i>Arnocrinum preissii</i>	
	<i>Dianella revoluta</i>	
	<i>Tricoryne elatior</i>	
IRIDACEAE	* <i>Gladiolus caryophyllaceus</i>	Pink Gladiolus
	* <i>Gladiolus undulatus</i>	Wavy Gladiolus
	<i>Patersonia occidentalis</i>	

	<i>Patersonia occidentalis var occidentalis</i>	
JUNCACEAE	* <i>Juncus microcephalus</i>	
	<i>Juncus pallidus</i>	
ORCHIDACEAE	<i>Microtis media</i>	
POACEAE	<i>Amphipogon laguroides</i>	
	<i>Amphipogon turbinatus</i>	
	* <i>Avena barbata</i>	Wild Oats
	<i>Briza maxima</i>	
	<i>Briza minor</i>	
	* <i>Cortaderia selloana</i>	Pampas Grass
	* <i>Cynodon dactylon</i>	Couch Grass
	* <i>Digitaria ciliaris</i>	Summer Grass
	* <i>Echinochloa crus-parvonis</i>	South American Barnyard Grass
	* <i>Ehrharta longifolia</i>	Annual Veldt
	<i>Ehrharta calycinus</i>	
	<i>Eragrostis curvula</i>	
	* <i>Holcus lanatus</i>	Yorkshire Fog
	<i>Lachnagrostis filiformis</i>	
	* <i>Paspalum dilatatum</i>	
	* <i>Pennisetum clandestinum</i>	Kikuyu
	* <i>Polypogon monspeliensis</i>	Annual Beard Grass
	* <i>Stenotaphrum secundatum</i>	Buffalo Grass
RESTIONACEAE	<i>Desmocladus fascicularis</i>	
	<i>Hypolaena exsulca</i>	
	<i>Leptocarpus laxus</i>	syn L. diffusus
	<i>Lyginia imberbis</i>	
	<i>Meeboldina scariosa</i>	
TYPHACEAE	* <i>Typha orientalis</i>	
XANTHORRHOEACEAE	* <i>Phormium sp</i>	New Zealand Flax
	<i>Xanthorrhoea brunonis</i>	
	<i>Xanthorrhoea preissii</i>	
	<b>Dicotyledons</b>	
AIZOACEAE	* <i>Carpobrotus edulis</i>	Pigface

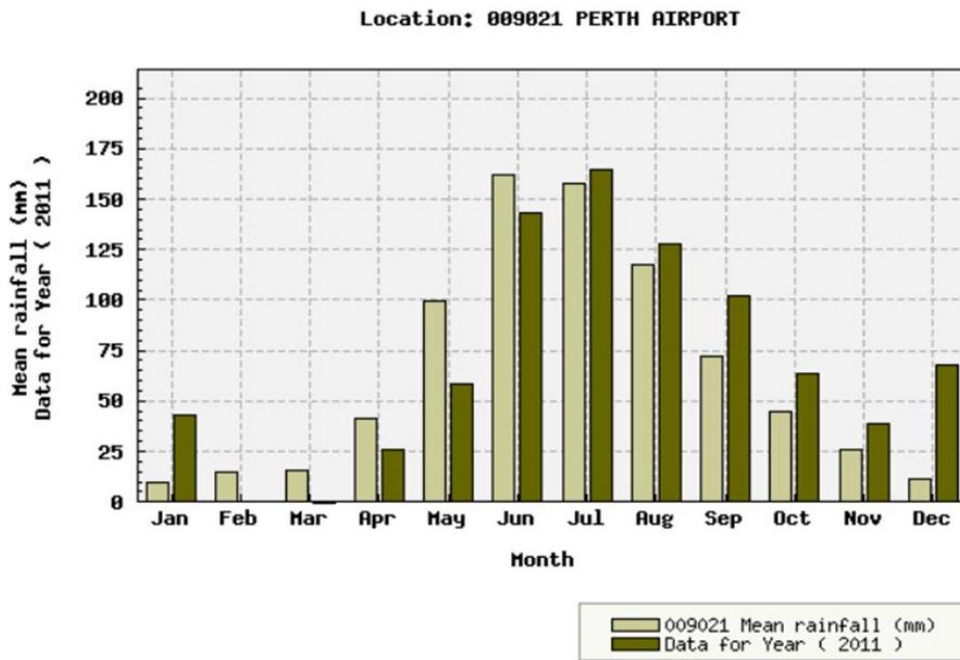
ANACARDIACEAE	<i>*Schinus terebinthifolia</i>	Japanese Pepper Tree
APIACEAE	<i>Centella asiatica</i>	
	<i>Platysace compressa</i>	
	<i>Xanthosia huegelii</i>	
ASCLEPIADACEAE	<i>*Gomphocarpus fruiticosus</i>	Cottonbush (DP)
ASTERACEAE	<i>*Carduus pycnocephalus</i>	Slender Thistle
	<i>*Conyza bonariensis</i>	Fleabane
	<i>*Hypochaeris radicata</i>	
	<i>*Lactuca serriola</i>	Prickly Lettuce
	<i>*Sonchus oleraceus</i>	Sowthistle
BRASSICACEAE	<i>*Brassica tournefortii</i>	
	<i>*Raphanus raphanistrum</i>	Wild Radish
CAMPANULACEAE	<i>Lobelia anceps</i>	
CASUARINACEAE	<i>Allocasuarina fraseriana</i>	
ERICACEAE	<i>Leucopogon australis</i>	
EUPHORBIACEAE	<i>*Euphorbia communis</i>	Castor Oil
	<i>*Euphorbia terracina</i>	Geraldton Carnation Weed
FABACEAE	<i>*Acacia longifolia</i>	Sydney Wattle
	<i>Acacia pulchella</i>	
	<i>Acacia saligna</i>	
	<i>Acacia stenoptera</i>	
	<i>Aotus gracillima</i>	
	<i>Bossiaea eriocarpa</i>	
	<i>Eutaxia virgata</i>	
	<i>Gastrolobium capitatum</i>	
	<i>Jacksonia furcellata</i>	
	<i>Kennedia prostrata</i>	
	<i>*Lotus angustissimus</i>	
FUMARIACEAE	<i>*Fumaria capreolata</i>	

GOODENIACEAE	<i>Dampiera linearis</i>	
	<i>Gompholobium tomentosum</i>	
	<i>Goodenia sp.</i>	
LAMIACEAE	<i>Hemiandra pungens</i>	
LAURACEAE	<i>Cassytha racemosa</i>	
LORANTHACEAE	<i>Nuytsia floribunda</i>	
LYTHRACEAE	* <i>Lythrum hissopifolia</i>	
MORACEAE	* <i>Ficus carica</i>	Edible Fig
MYRTACEAE	<i>Astartea scoparia</i>	
	<i>Calothamnus lateralis</i>	
	* <i>Eucalyptus camaldulensis</i>	River Gum
	<i>Eucalyptus gomphocephala</i>	
	<i>Eucalyptus marginata</i>	
	<i>Eucalyptus todtiana</i>	
	<i>Hypocalymma angustifolium</i>	
	<i>Kunzea glabrescens</i>	
	<i>Melaleuca incana ssp incana</i>	
	<i>Melaleuca lateritia</i>	
	<i>Melaleuca preissiana</i>	
	<i>Melaleuca raphiophylla</i>	
	<i>Melaleuca teretifolia</i>	
	<i>Pericalymma ellipticum</i>	
	<i>Regelia ciliata</i>	
	<i>Scholtzia involucrata</i>	
PHYTOLACCACEAE	* <i>Phytolacca octandra</i>	Inkweed
PITTOSPORACEAE	<i>Billardiera heterophylla</i>	
POLYGONACEAE	* <i>Persicaria lapathifolia</i>	Pale Knotweed
	* <i>Rumex crispis</i>	Curled Dock
PRIMULACEAE	* <i>Lysimachia arvensis</i>	Orange Pimpernel
PROTEACEAE	<i>Adenanthos obovatus</i>	

	<i>Hakea varia</i>	
ROSACEAE	* <i>Rubus fruticosus</i>	Blackberry
RUTACEAE	<i>Boronia crenulata</i>	
SOLANACEAE	* <i>Physalis peruviana</i>	Cape Gooseberry
	* <i>Solanum nigrum</i>	Nightshade
STYLIDACEAE	<i>Stylidium repens</i>	
	<i>Stylidium sp.</i>	
THYMELAECEAE	<i>Pimelea lanata</i>	

## Appendix 4: Rainfall Data 2011

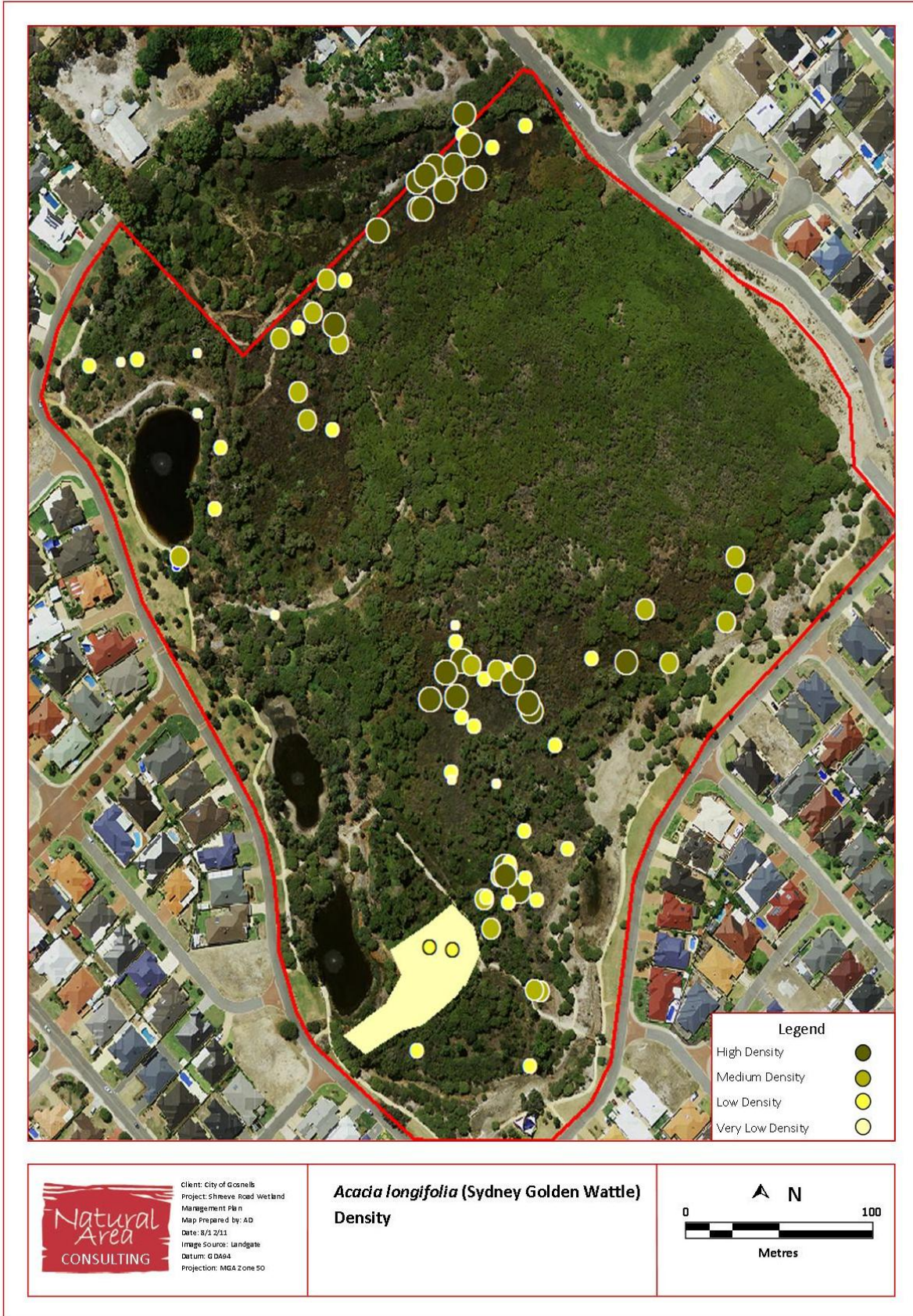
Mean Monthly Rainfall Data for 2011 and Mean Monthly Rainfall Data 1944 - 2012



Source: Bureau of Meteorology, 2012

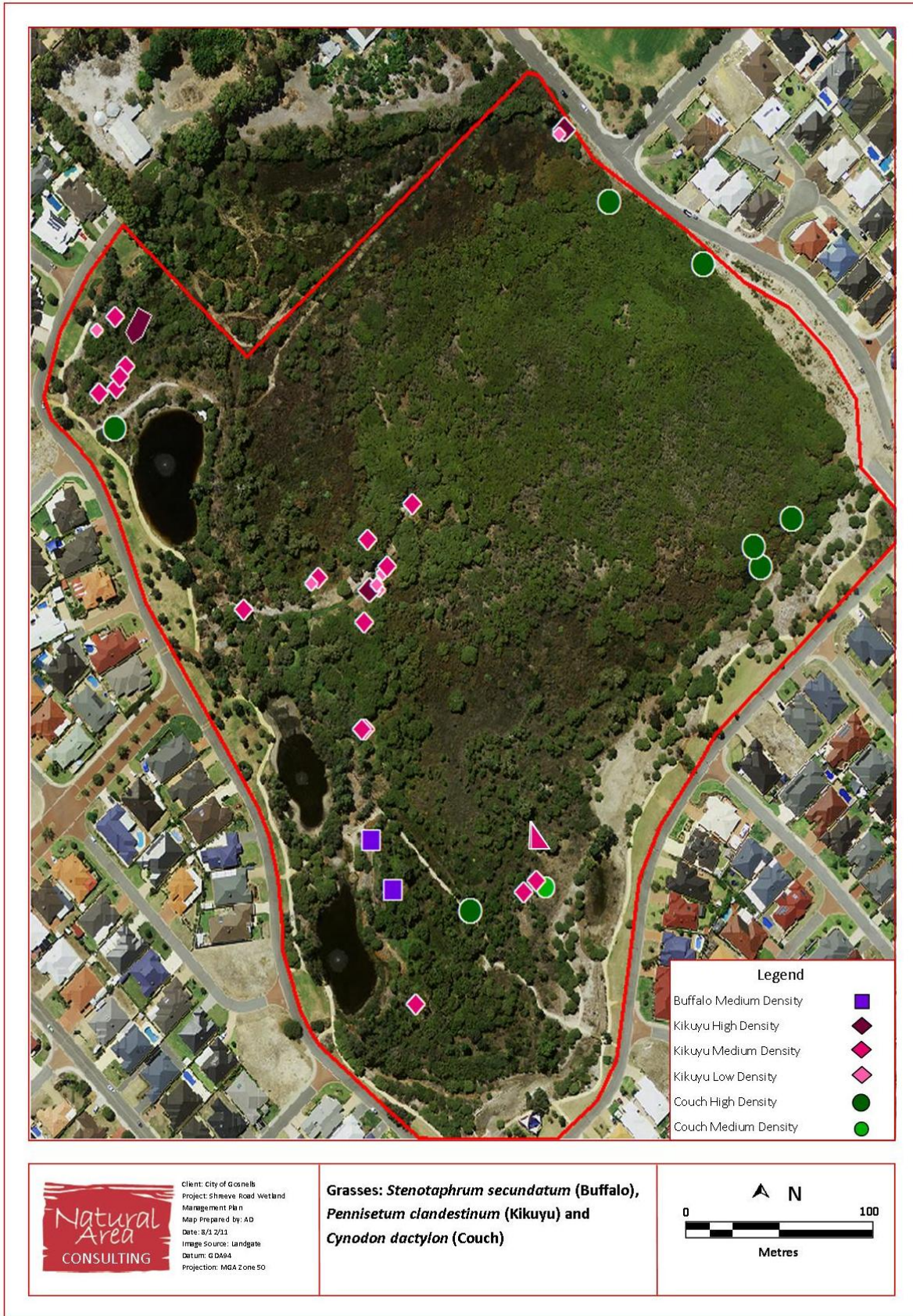


## **Appendix 5: Weed Maps**

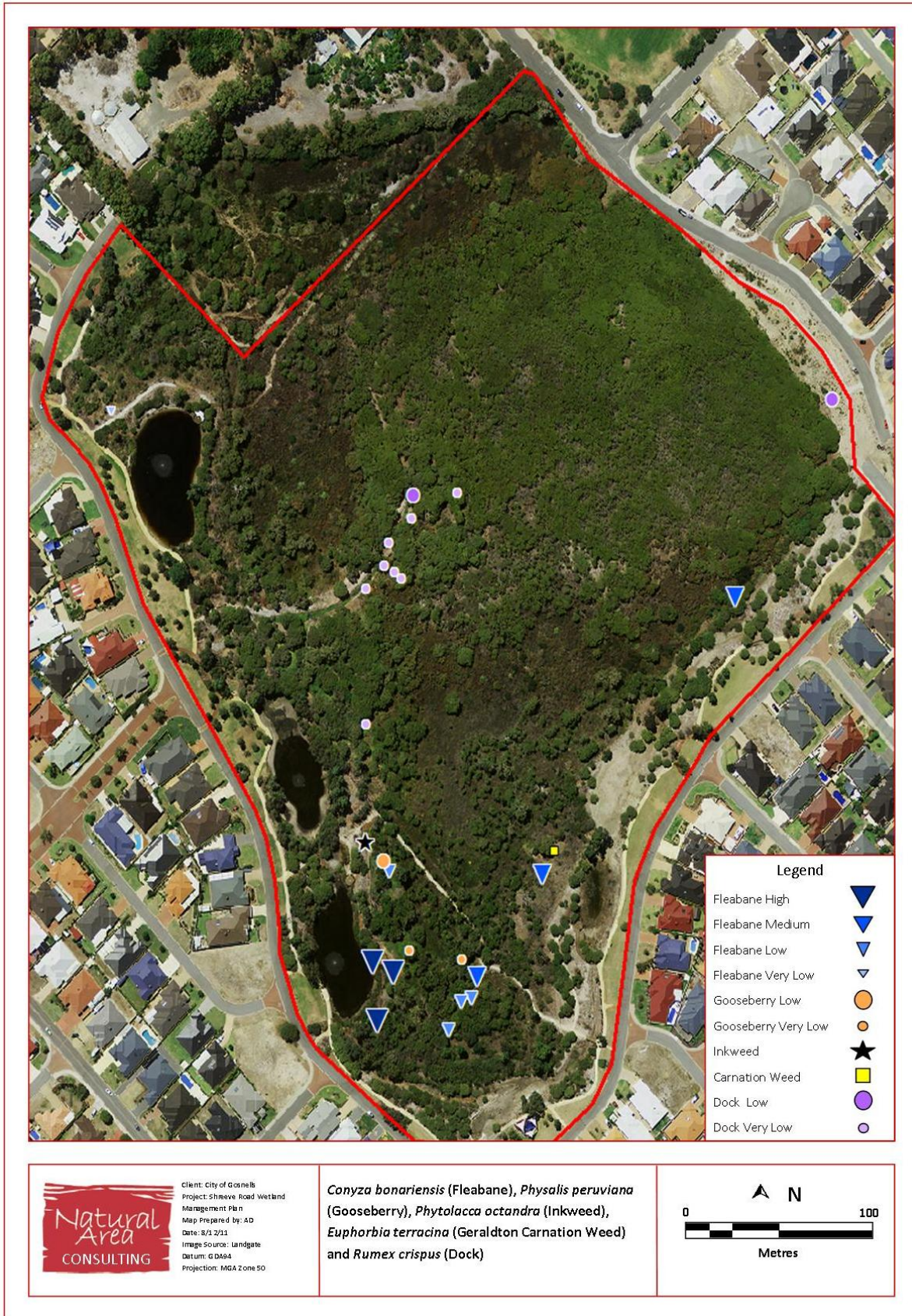








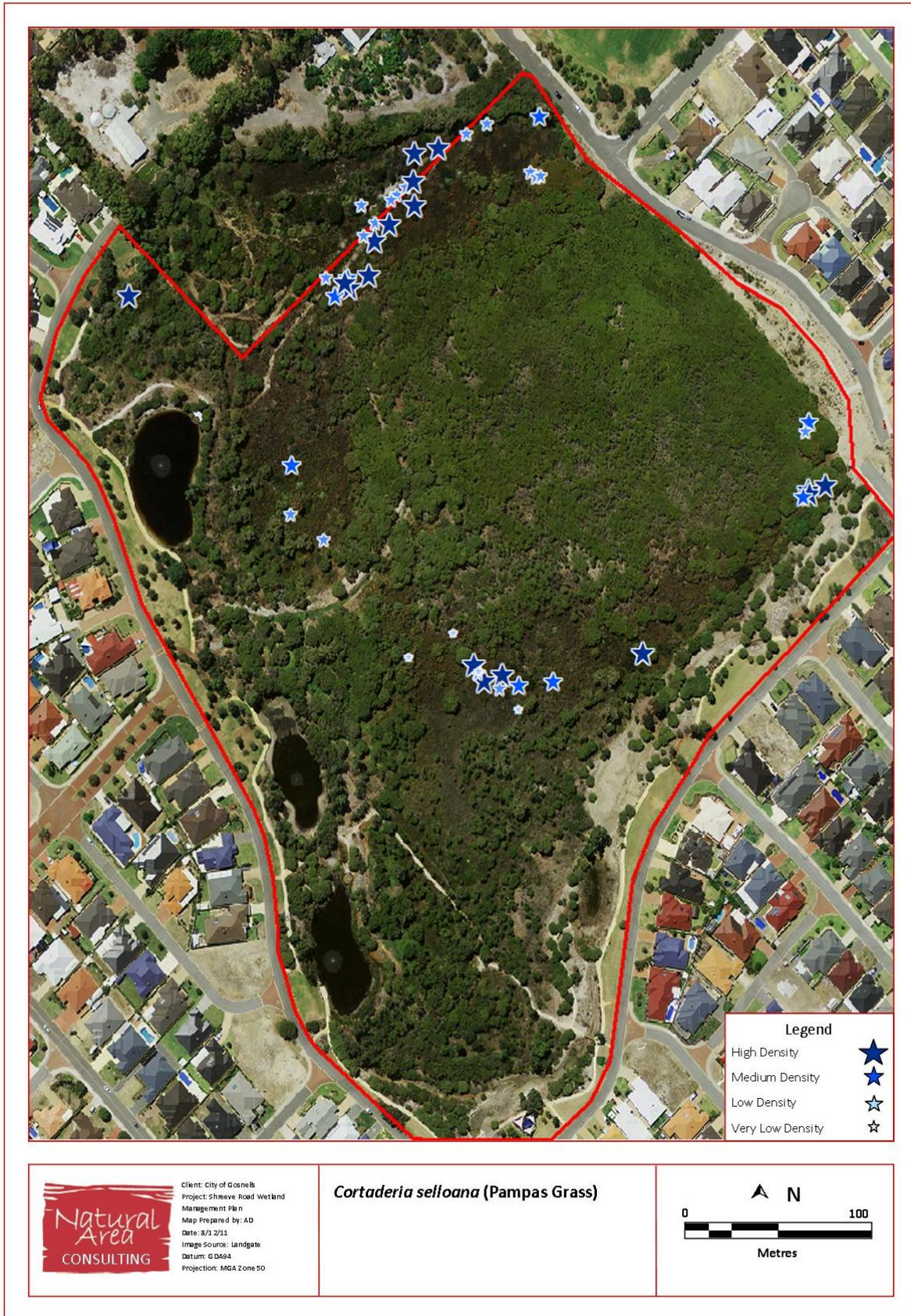


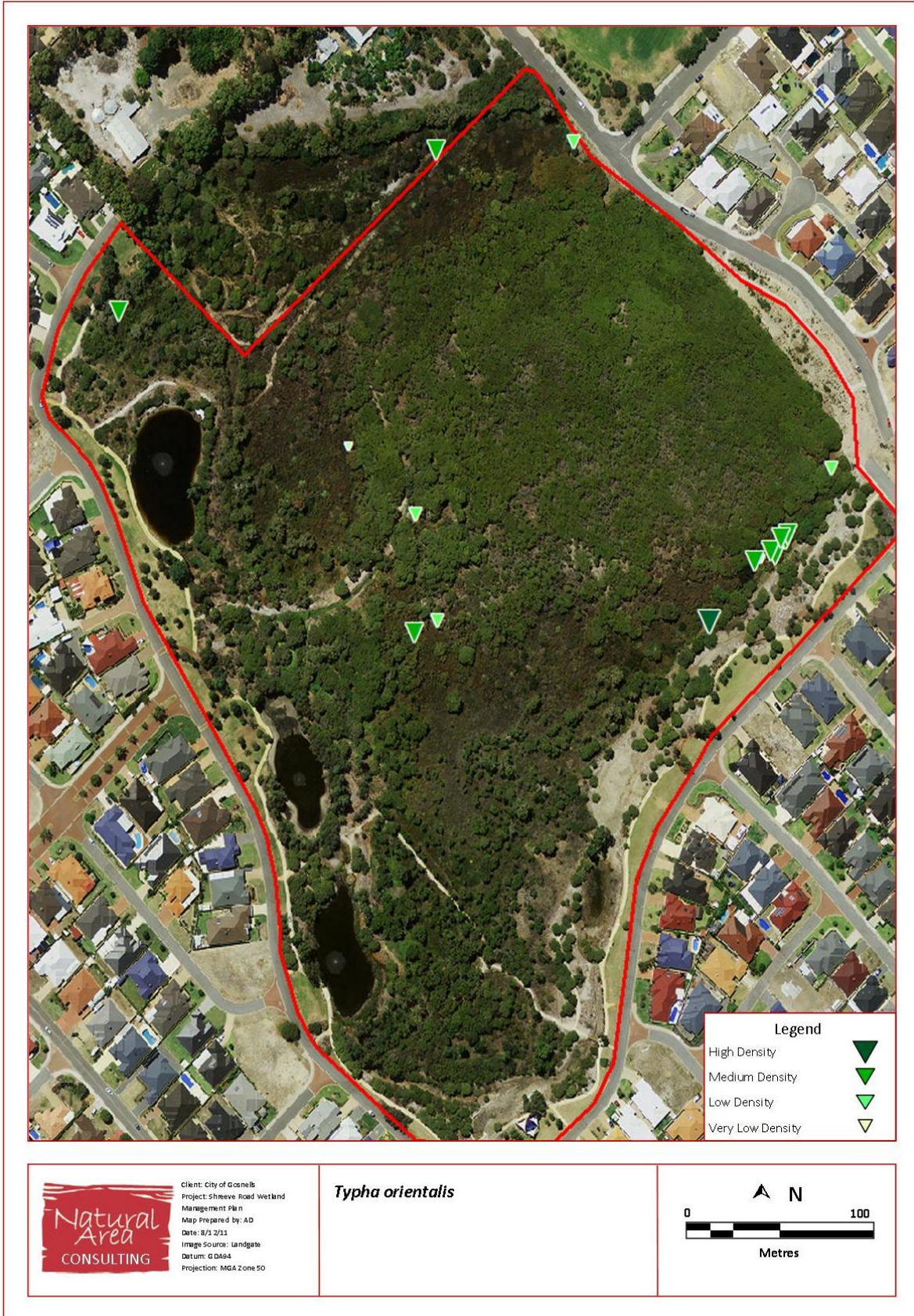














## Appendix 6: Weed Control Methodology

### Weed Control Methodology

Species	Common Name	Control Method	Timing
<i>Acacia longifolia</i>	Sydney Golden Wattle	Hand pull seedlings; basal bark or fell - picloram/triclopyr; cut and paint – glyphosate biactive in wet areas	March - July
<i>Anagallis arvensis</i>	Orange Pimpernel	Management unknown, spot spray with glyphosate at a rate of 1%	June - November
<i>Asparagus asparagoides</i>	Bridal Creeper	Spray metsulfuron methyl 0.2g/15L + Pulse®	July-August
<i>Asparagus officinalis</i>	Garden Asparagus	Management unknown, spot spray with glyphosate at a rate of 1%	July - August
<i>Avena barbata</i>	Bearded Oats	Selective spot spray - quizalofop (100g/L) or fusilade (8mL +100mL spray oil in 10L water); non-selective - spray glyphosate (450g/L)	July - October
<i>Brassica tournefortii</i>	Mediterranean Turnip	Manual methods appear to be the most effective means of control, roll up large mats removing all roots and stem fragments and remove from site; Follow up with removal of any germinating plants, otherwise spray with 0.5g of Logran in 10L of water	July – September (prior to formation of seed pods)
<i>Briza maxima</i>	Blowfly Grass	Hand pull, fusilade® forte 16ml/10L + wetting agent	June - September
<i>Briza minor</i>	Shivery Grass	Hand pull, fusilade® forte 16ml/10L + wetting agent	July - September
<i>Carduus pycnocephalus</i>	Slender Thistle	Hand pull, 50% glyphosate applied by wick, 0.5% glyphosate spot spray, Lontrel® 10ml/10L + wetting agent spot spray	Manual: Sept-Jan; Herbicide: July-Nov
<i>Carpobrotus edulis</i>	Pigface	Manual methods appear to be the most effective means of control. Roll up large mats removing all roots and stem fragments and remove from site. Follow up with removal of any germinating plants. Otherwise spray with glyphosate at 2% + surfactant	June - October
<i>Conyza bonariensis</i>	Fleabane	Hand remove, 25ml/10L glyphosate when plants are small, 50% glyphosate to wipe stem	June - September
<i>Cortaderia selloana</i>	Pampas Grass	Cut out small plans - do not leave uprooted plants on the ground , they can resprout; remove flower heads -	July - November

<i>Species</i>	<b>Common Name</b>	<b>Control Method</b>	<b>Timing</b>
		slash and burn clumps and spray regrowth with 1% glyphosate. Treat young plants with 0.5% Fusilade® + spray oil; may need more than one application	
<i>Cynodon dactylon</i>	Couch Grass	Hand remove small infestations, spot spray fusilade forte at 8mL/L + wetting agent or 1% glyphosate in last spring/ summer and autumn, paint runners or crowns with 50% glyphosate.	November - February
<i>Cyperus eragrostis</i>	Umbrella Sedge (Nut Grass)	Hand remove small/isolated plants ensuring tubers and rhizomes are removed, apply Glyphosate before 5th leaf stage, alternatively use Sempra® spot spray 1.3g / 100 square metres i.e.: 10 litres that will treat 100 square metres	November - February
<i>Cyperus polystachyos</i>	Bunchy Sedge (Nut Grass)	Hand remove small/isolated plants ensuring tubers and rhizomes are removed, apply glyphosate before 5th leaf stage	hand remove small/isolated plants ensuring tubers and rhizomes are removed. Apply Glyphosate before 5th leaf stage
<i>Digitaria ciliaris</i>	Summer Grass	Hand removal, 1% glyphosate spray in spring	September - November
<i>Ehrharta calycina</i>	Perennial Veldt	Spot spray fusilade® 8mL/L (4L/ha) + wetting agent; spray regrowth and seedlings 4-6 weeks after fire	June - August (prior to flower formation)
<i>Ehrharta longifolia</i>	Annual Veldt	Spot spray fusilade® 8mL/L (4L/ha) + wetting agent; spray regrowth and seedlings 4-6 weeks after fire	June - August (prior to flower formation)
<i>Eragrostis curvula</i>	Love Grass	Cut out small plants and infestations. Spray with 1-2% glyphosate when green or actively growing	September - November
<i>Eucalyptus camaldulensis</i>	Rivergum	Hand pull seedlings; basal bark or fell - picloram/triclopyr; cut and paint – glyphosate bioactive in wet areas	March - July

<i>Species</i>	Common Name	Control Method	Timing
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	Large infestations - spot spray till run off with herbicide Metsulfuron methyl 0.1g/15L or Metsulfuron methyl + 1% glyphosate before flowering, follow up with hand removal for at least 5 years	June - August
<i>Gladiolus caryophyllaceus</i>	Pink Gladiolus	Wipe individual leaves with glyphosate 10% or spray dense infestations in degraded areas with 1% glyphosate just on flowering at corm exhaustion	July - September
<i>Gladiolus undulatus</i>	Wavy Gladiolus	Spot spray Metsulfuron methyl 0.2g/15L + Pulse®+ 1% glyphosate	July-August
<i>Gomphocarpus fruticosus</i>	Cottonbush	Foliar spray with 1.5% glyphosate or cut and paint using 50% glyphosate	June - December
<i>Ficus carica</i>	Edible Fig	Hand remove small infestations, stem inject 50% glyphosate and foliar spray 10% glyphosate, basal bark stems <30cm diameter	December - February
<i>Fumaria capreolata</i>	Fumaria	Metsulfuron methyl 0.1g/15L + wetting agent or 0.5% glyphosate	July - September
<i>Holcus lanatus</i>	Yorkshire Fog	Remove isolated plants before they set seed, spray glyphosate 0.5% in spring or when the first seed head appears for optimal translocation to roots, regular slashing reduces its vigour	September-December
<i>Hypochaeris radicata</i>	Flat Weed	Hand remove small infestations, wipe rosettes with 30% glyphosate, or Lontrel® 10ml/10L +wetting agent for dense infestations	May - September
<i>Juncus microcephalus</i>	Juncus	Dig out isolated plants, 2% glyphosate + wetting agent in late summer/autumn if surface water present, in dry conditions apply spring/early summer	September - April
<i>Lactuca serriola</i>	Prickly Lettuce	Hand remove small infestations, spray till run off with glyphosate or metsulfuron methyl 5g/ha + surfactant	September - November
<i>Leptospermum laevigatum</i>	Victorian Teatree	Hand pull seedlings; basal bark or fell - picloram®/triclopyr®; cut and paint – glyphosate biactive in wet areas	July - October

<b>Species</b>	<b>Common Name</b>	<b>Control Method</b>	<b>Timing</b>
<i>Lotus angustissimus</i>	Narrow-leaf Trefoil	Spot spray 60g/ha Logran® or 200g/ha Lontrel®	June – December (when actively growing)
<i>Paspalum dilatatum</i>	Paspalum	Dig out small infestations ensure rhizome removal, early head stage spray 10ml/L glyphosate; established plants spray fusilade® forte 16ml/L + wetting agent or 1% glyphosate before flowering, cut near ground level and wipe with 10% glyphosate	November - March
<i>Pennisetum clandestinum</i>	Kikuyu	spray 1% glyphosate or fusilade® forte 16ml/L + wetting agent 2-3 times over growing season	Year Round
<i>Phytolacca octandra</i>	Inkweed	Hand pulling is ineffective if the root is not removed and allowed to re-grow, dig out isolated plants and cut root at least 5 cm below ground level, otherwise spray with 1% glyphosate + Pulse®, read the manufacturers' instructions	October-December
<i>Polypogon monspeliensis</i>	Annual Beard Grass	Spot spray 1% glyphosate	June - October
<i>Raphanus raphanistrum</i>	Wild Radish	Hand remove isolated plants several times throughout the year; spot spray 1% glyphosate before flowering	June - October (prior to flowering)
<i>Rubus fruticosus</i>	Blackberry	Hand pull small plants. Cut and paint 20-50% glyphosate. Spray regrowth with at 0.5m with metsulfuron methyl 1g/10L + wetting agent	August - January
<i>Rumex crispus</i>	Curled Dock	Spot spray 1% glyphosate at early bud stage	August-November
<i>Schinus terebinthifolius</i>	Japanese Pepper Tree	Hand pull seedlings; basal bark or fell - picloram®/triclopyr®; cut and paint – glyphosate biactive in wet areas	Year round
<i>Solanum nigrum</i>	Nightshade	Manually remove plants before flowering; 1L/ha Starane® applied when actively growing; will only germinate in bare soil	manual: June - November; Herbicide: July-December
<i>Sonchus oleraceus</i>	Sowthistle	Manually remove isolated plants, spray small areas till run off with 100ml Tordon®75-D + 25ml wetting agent in 10L water, in Bushland spray 80ml 2,4-DB plus 25 ml wetting agent in 10L water	June - August



<i>Species</i>	<b>Common Name</b>	<b>Control Method</b>	<b>Timing</b>
<i>Stenotaphrum secundatum</i>	Buffalo Grass	spray 1% glyphosate or 13mL/L Fusilade Forte® + wetting agent	November-May
<i>Typha orientalis</i>	Bulrush	Roundup Biactive® 13ml/L when actively growing (complete coverage necessary)	December-February
<i>Watsonia meriana</i> <i>var. bulbifera</i>	Watsonia	wipe leaves with 10% glyphosate or spray 2,2 DPA 10g/L + Pulse® just as flower spikes emerge	September
<i>Zantedeschia aethiopica</i>	Arum Lily	Mechanical removal only effective if all the root fragments are removed, 1g Chlorsulfuron + 10ml 2,4-D amine +25 ml Pulse® per 10L water or 1 g metsulfuron + Pulse®; spray in late winter until leaves are just wet, repeat annually, in sensitive areas wipe the formula on.	Late winter

#### Weed Control Notes

The *Acacia longifolia* (Sydney Golden Wattle) and *Eucalyptus camaldulensis* (Red River Gum) present on site should be treated with a cut and paint methodology as outlined in *Bushland Weeds, A Practical Guide to their Management*, (Brown and Brooks, 2002), on an ongoing basis. This will involve:

- felling the plants close to the ground level (5 – 15 cm) using a chainsaw,
- painting the entire surface of the cut stump with garlon® (picloram®/triclopyr®) and diesel or glyphosate bi-active, ensuring the vascular cambium is well covered, and
- removal of all cut material from site.

Smaller saplings can also be removed by hand pulling or cut and painting with hedge trimmers.

A herbicide application targeting grasses should then be undertaken with a selective herbicide such as Quizalofop (1 L per ha) or Fusilade (1.24 – 1.65 L per ha). This should be undertaken in June/July before the grasses set seed.

It is recommended that all other weed species present, including herbs and small shrubs, be treated as outlined in the above Table, treatment methodologies and application rates are taken from;

- Bushland Weeds (Brown and Brooks, 2002),
- Western Weeds, a guide to the weeds of Western Australia (Hussey, Keighery, Dodd, Lloyd and Cousens, 2007),
- Southern Weeds and their control (Moore and Wheeler, 2008) and
- FloraBase (DEC, 2012).

Weeds Controlled under Treatment 1

Species and Treatment Strategy	Common Name where applicable	EWSWA Priority Rating	DEC Swan Region Environmental Weed List			NAC Description and General Comments
			Ecological Impact H: high M: medium L: low U: unknown	Rate of dispersal R: rapid M: moderate S: slow	General trend D: decreasing, S: stable I: increasing U: unknown	
<b>Very High Priority Weeds</b>						
<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Watsonia	High	H	R	I	Very High priority for control
<i>Zantedeschia aethiopica</i>	Arum Lily	High	H	R	I	Very High priority for control
<b>High Priority Weeds</b>						
<i>Acacia longifolia</i>	Sydney Golden Wattle	High	H	M	I	High priority for control
<i>Carpobrotus edulis</i>	Pigface	Moderate	H	S	I	High priority for control
<i>Cynodon dactylon</i>	Couch Grass	Moderate	H	R	I	High priority for control
<i>Ehrharta longifolia</i>	Annual Veldt	Low	H	R	S	High priority for control
<i>Eragrostis curvula</i>	Love Grass	High	H	R	I	High priority for control
<i>Eucalyptus camaldulensis</i>	Rivergum	Unavailable	M	S	I	High priority for control
<i>Ficus carica</i>	Edible Fig	Moderate	H	R	I	High priority for control
<i>Pennisetum clandestinum</i>	Kikuyu	Unavailable	H	S	I	High priority for control
<i>Raphanus raphanistrum</i>	Wild Radish	Mild	U	M	I	High priority for control
<i>Schinus terebinthifolia</i>	Japanese Pepper Tree	Moderate	H	M	I	High priority for control

Species and Treatment Strategy	Common Name where applicable	EWSWA Priority Rating	DEC Swan Region Environmental Weed List			NAC Description and General Comments
			Ecological Impact H: high M: medium L: low U: unknown	Rate of dispersal R: rapid M: moderate S: slow	General trend D: decreasing, S: stable I: increasing U: unknown	
<i>Solanum nigrum</i>	Nightshade	Moderate	M	R	I	High priority for control
<i>Stenotaphrum secundatum</i>	Buffalo Grass	Moderate	H	S	I	High priority for control
<b>Moderate Priority Weeds</b>						
<i>Carduus pycnocephalus</i>	Slender Thistle	Moderate	H	R	I	Moderate Impact
<i>Conyza bonariensis</i>	Fleabane	Low	L	M	I	Moderate Impact
<i>Gomphocarpus fruticosus</i>	Cottonbush	Moderate	H	R	I	Moderate Impact
<i>Holcus lanatus</i>	Yorkshire Fog	Moderate	H	U	I	Moderate Impact
<i>Hypochaeris radicata</i>	Flat Weed	Moderate	H	U	I	Moderate Impact
<i>Juncus microcephalus</i>	Juncus	Mild	U	R	I	Moderate Impact
<i>Lactuca serriola</i>	Prickly Lettuce	Moderate	H	R	I	Moderate Impact
<i>Rumex crispus</i>	Curled Dock	Mild	U	R	I	Moderate Impact
<i>Persicaria lapathifolia</i>	Pale Knotweed	Unavailable	U	U	U	Moderate Impact
<i>Phytolacca octandra</i>	Inkweed	Mild	U	M	I	Moderate Impact
<i>Sonchus oleraceus</i>	Sowthistle	Moderate	U	R	S	Moderate Impact
<b>Low Priority / Indirect Impact Weeds</b>						
<i>Anagallis arvensis</i>	Orange Pimpernel	Unavailable	U	R	I	No direct impact
<i>Asparagus officinalis</i>	Garden Asparagus	Low	L	R	I	No direct impact
<i>Echinochloa crus-galli</i>	South American Barnyard Grass	Low	L	M	S	No direct impact
<i>Lotus angustissimus</i>	Narrow-leaf Trefoil	Low	H	R	I	No direct impact
<i>Lythrum hyssopifolia</i>	Lesser Loosestrife	Unavailable	M	M	I	No direct impact
<i>Physalis peruviana</i>	Cape Gooseberry	Moderate	U	R	I	No direct impact

Weeds Controlled under Treatment 2

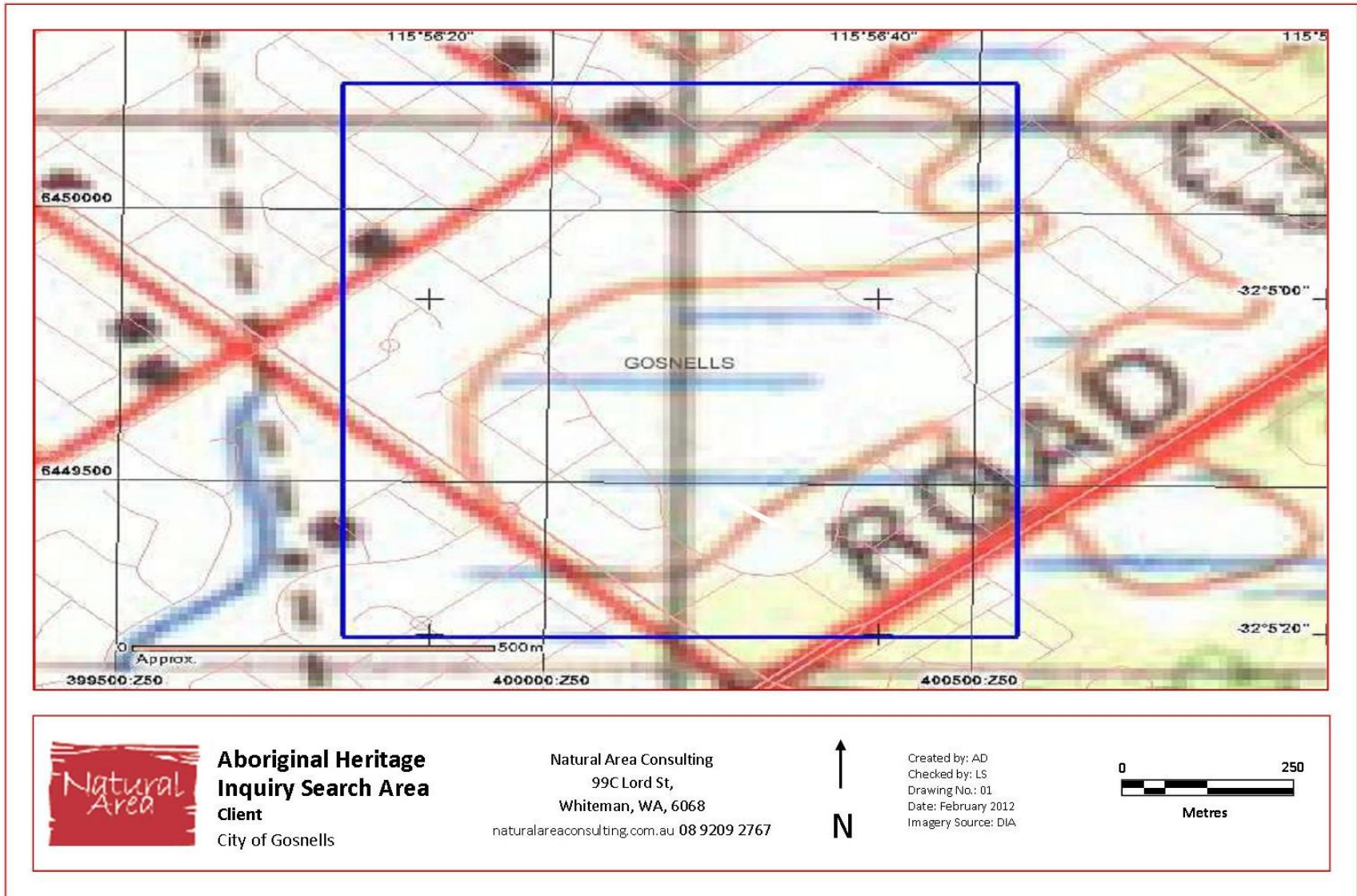
Species and Treatment Strategy	Common Name where applicable	EWSWA Priority Rating	DEC Swan Region Environmental Weed List			NAC Description and General Comments
			Ecological Impact H: high M: medium L: low U: unknown	Rate of dispersal R: rapid M: moderate S: slow	General trend D: decreasing, S: stable I: increasing U: unknown	
<b>Very High Priority Weeds</b>						
<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Watsonia	High	H	R	I	Very High priority for control
<i>Zantedeschia aethiopica</i>	Arum Lily	High	H	R	I	Very High priority for control
<b>High Priority Weeds</b>						
<i>Acacia longifolia</i>	Sydney Golden Wattle	High	H	M	I	High priority for control
<i>Asparagus asparagoides</i>	Bridal Creeper	High	H	R	I	High priority for control
<i>Avena barbata</i>	Bearded Oats	Moderate	H	R	I	High priority for control
<i>Brassica tournefortii</i>	Mediterranean Turnip	High	H	R	I	High priority for control
<i>Carpobrotus edulis</i>	Pigface	Moderate	H	S	I	High priority for control
<i>Cortaderia selloana</i>	Pampas Grass	High	H	R	S	High priority for control
<i>Cynodon dactylon</i>	Couch Grass	Moderate	H	R	I	High priority for control
<i>Ehrharta calycina</i>	Perennial Veldt	High	H	R	S	High priority for control
<i>Ehrharta longifolia</i>	Annual Veldt	Low	H	R	S	High priority for control
<i>Eragrostis curvula</i>	Love Grass	High	H	R	I	High priority for control

Species and Treatment Strategy	Common Name where applicable	EWSWA Priority Rating	DEC Swan Region Environmental Weed List			NAC Description and General Comments
			Ecological Impact H: high M: medium L: low U: unknown	Rate of dispersal R: rapid M: moderate S: slow	General trend D: decreasing, S: stable I: increasing U: unknown	
<i>Eucalyptus camaldulensis</i>	Rivergum	Unavailable	M	S	I	High priority for control
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	High	H	R	I	High priority for control
<i>Ficus carica</i>	Edible Fig	Moderate	H	R	I	High priority for control
<i>Fumaria capreolata</i>	Fumaria	Mild	H	R	I	High priority for control
<i>Paspalum dilatatum</i>	Paspalum	Moderate	H	M	I	High priority for control
<i>Pennisetum clandestinum</i>	Kikuyu	Unavailable	H	S	I	High priority for control
<i>Raphanus raphanistrum</i>	Wild Radish	Mild	U	M	I	High priority for control
<i>Rubus fruticosus</i>	Blackberry	Low	H	M	I	High priority for control
<i>Schinus terebinthifolia</i>	Japanese Pepper Tree	Moderate	H	M	I	High priority for control
<i>Solanum nigrum</i>	Nightshade	Moderate	M	R	I	High priority for control
<i>Stenotaphrum secundatum</i>	Buffalo Grass	Moderate	H	S	I	High priority for control
<i>Typha orientalis</i>	Bulrush	High	H	R	I	High priority for control
<b>Moderate Priority Weeds</b>						
<i>Briza maxima</i>	Blowfly Grass	Moderate	H	R	I	Moderate Impact
<i>Briza minor</i>	Shivery Grass	Moderate	U	R	I	Moderate Impact

Species and Treatment Strategy	Common Name where applicable	EWSWA Priority Rating	DEC Swan Region Environmental Weed List			NAC Description and General Comments
			Ecological Impact H: high M: medium L: low U: unknown	Rate of dispersal R: rapid M: moderate S: slow	General trend D: decreasing, S: stable I: increasing U: unknown	
<i>Carduus pycnocephalus</i>	Slender Thistle	Moderate	H	R	I	Moderate Impact
<i>Conyza bonariensis</i>	Fleabane	Low	L	M	I	Moderate Impact
<i>Cyperus eragrostis</i>	Umbrella Sedge	Moderate	U	M	I	Moderate Impact
<i>Cyperus polystachyos</i>	Bunchy Sedge	Unavailable	U	M	I	Moderate Impact
<i>Gladiolus caryophyllaceus</i>	Pink Gladiolus	Moderate	H	M	I	Moderate Impact
<i>Gladiolus undulatus</i>	Wavy Gladiolus	Moderate	H	R	I	Moderate Impact
<i>Gomphocarpus fruticosus</i>	Cottonbush	Moderate	H	R	I	Moderate Impact
<i>Holcus lanatus</i>	Yorkshire Fog	Moderate	H	U	I	Moderate Impact
<i>Hypochaeris radicata</i>	Flat Weed	Moderate	H	U	I	Moderate Impact
<i>Juncus microcephalus</i>	Juncus	Mild	U	R	I	Moderate Impact
<i>Lactuca serriola</i>	Prickly Lettuce	Moderate	H	R	I	Moderate Impact
<i>Rumex crispus</i>	Curled Dock	Mild	U	R	I	Moderate Impact
<i>Persicaria lapathifolia</i>	Pale Knotweed	Unavailable	U	U	U	Moderate Impact
<i>Phytolacca octandra</i>	Inkweed	Mild	U	M	I	Moderate Impact
<i>Polypogon monspeliensis</i>	Annual Beard Grass	Moderate	M	R	I	Moderate Impact
<i>Sonchus oleraceus</i>	Sowthistle	Moderate	U	R	S	Moderate Impact
<b>Low Priority / Indirect Impact Weeds</b>						
<i>Anagallis arvensis</i>	Orange Pimpernel	Unavailable	U	R	I	No direct impact
<i>Asparagus officinalis</i>	Garden Asparagus	Low	L	R	I	No direct impact
<i>Digitaria ciliaris</i>	Summer Grass	Low	L	U	U	No direct impact
<i>Echinochloa</i>	South American	Low	L	M	S	No direct impact

Species and Treatment Strategy	Common Name where applicable	EWSWA Priority Rating	DEC Swan Region Environmental Weed List			NAC Description and General Comments
			Ecological Impact H: high M: medium L: low U: unknown	Rate of dispersal R: rapid M: moderate S: slow	General trend D: decreasing, S: stable I: increasing U: unknown	
<i>crus-pavonis</i>	Barnyard Grass					
<i>Lotus angustissimus</i>	Narrow-leaf Trefoil	Low	H	R	I	No direct impact
<i>Lythrum hyssopifolia</i>	Lesser Loosestrife	Unavailable	M	M	I	No direct impact
<i>Physalis peruviana</i>	Cape Gooseberry	Moderate	U	R	I	No direct impact

## Appendix 7: Aboriginal Heritage Inquiry Location





## Appendix 8: Monitoring Report Template

### Monitoring Report

2012

General Site Monitoring		Photo Record
Fencing – detail location and type of damage (if any)		
Rubbish – detail location and type on map		
Fire Risk – detail type, level (low, med, high) and location on map		
Signs of Dieback – details type and location		
Erosion/soil stabilisation – detail type and extent on map		
Weeds – detail type and level of infestation on map		
Fauna – General – detail types of animals present from scats and tracks		
Planting Works		
Condition of revegetation plantings		
Approx. Survival rate		
Signs of damage/vandalism		

### Actions Proposed

Description

## Appendix 9: Indicative Costings

(Note: Costs are indicative and have not been indexed, weed control costs are for one year of treatment)

### Minimum Control for Selected Species (Strategy 1)

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<b>Priority Weed Control</b>				
2,2 DPA	80.00	hr	8	\$640.00
2,4 –D	80.00	hr	8	\$640.00
Glyphosate spray	78.00	hr	48	\$3,744.00
Hand weeding	75.00	hr	32	\$2,400.00
Woody weed removal	80.00	hr	48	\$3,840.00
<b>Total</b>				<b>\$11,264.00</b>

### Full Weed Control for Majority of Weed Species (Strategy 2)

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<b>Full Weed Control</b>				
2,2 DPA	80.00	hr	8	\$640.00
2,4 –D	80.00	hr	8	\$640.00
Glyphosate spray	78.00	hr	64	\$4992.00
Hand Weeding	75.00	hr	32	\$2400.00
Metsulfuron	75.00	hr	32	\$2400.00
Quizalofop 100g/L	82.00	hr	48	\$3936.00
Slash then spray with glyphosate biactive	80.00	hr	48	\$3840.00
Woody weed control	80.00	hr	48	\$3840.00
<b>Total</b>				<b>\$22,688.00</b>

### Revegetation Costing Stage 1: Drain at approximately 1 Plant / m<sup>2</sup>

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<b>Stage 1 Weed Control</b>				
Glyphosate biactive spray (2 treatments)	78.00	hr	32	\$2,496.00
Hand weeding (2 treatments)	80.00	hr	16	\$1,280.00
<b>Total</b>				<b>\$3,776.00</b>
<b>Stage 1 Supply of tubestock Revegetation Species Wetland</b>				
<i>Astartea scoparia</i>	\$2.00	ea	50	\$100.00

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<i>Banksia littoralis</i>	\$2.50	ea	30	\$75.00
<i>Baumea juncea</i>	\$3.50	ea	250	\$875.00
<i>Bolboschoenus caldwellii</i>	\$3.50	ea	150	\$525.00
<i>Calothamnus lateralis</i>	\$2.00	ea	50	\$100.00
<i>Centella asiatica</i>	\$2.50	ea	100	\$250.00
<i>Lepidosperma longitudinale</i>	\$5.50	ea	100	\$550.00
<i>Melaleuca preissiana</i>	\$2.00	ea	40	\$80.00
<i>Pericalymma ellipticum</i>	\$2.50	ea	50	\$125.00
<i>Taxandria linearifolia</i>	\$2.50	ea	50	\$125.00
<b>Total</b>			<b>870</b>	<b>\$2,805.00</b>
<b>Stage 1</b>				
<b>Supply of tubestock Revegetation Species Dryland</b>				
<i>Acacia pulchella</i>	\$2.00	ea	100	\$200.00
<i>Acacia saligna</i>	\$2.00	ea	50	\$100.00
<i>Astartea scoparia</i>	\$2.00	ea	100	\$200.00
<i>Banksia littoralis</i>	\$2.50	ea	30	\$75.00
<i>Calothamnus lateralis</i>	\$2.00	ea	50	\$100.00
<i>Dianella revoluta</i>	\$3.50	ea	100	\$350.00
<i>Hakea varia</i>	\$2.00	ea	50	\$100.00
<i>Hardenbergia comptoniana</i>	\$2.00	ea	100	\$200.00
<i>Hemiandra pungens</i>	\$3.50	ea	40	\$140.00
<i>Hypocalymma angustifolium</i>	\$2.50	ea	100	\$250.00
<i>Jacksonia furcellata</i>	\$2.50	ea	100	\$250.00
<i>Kennedia prostrata</i>	\$2.00	ea	100	\$200.00
<i>Kunzea glabrescens</i>	\$2.00	ea	50	\$100.00
<i>Melaleuca preissiana</i>	\$2.00	ea	50	\$100.00
<i>Patersonia occidentalis var occidentalis</i>	\$2.50	ea	100	\$250.00
<i>Regelia ciliata</i>	\$2.50	ea	100	\$250.00
<b>Total</b>			<b>1220</b>	<b>\$2,865.00</b>
<b>Plant Installation</b>				
Plant Installation	2.00	ea	2090	<b>\$4,180.00</b>
<b>Grand Total</b>				
<b>Grand Total Revegetation Stage 1</b>				<b>\$13,626.00</b>

**Revegetation Costing Stage 2: *Melaleuca preissiana* Forest at approximately 0.5 Plants / m<sup>2</sup>**

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<b>Stage 2</b>				
<b>Weed Control</b>				
Glyphosate biactive spray (2 treatments)	78.00	hr	16	\$624.00
Woody weed removal (1 treatment)	80.00	hr	16	\$1,280.00
<b>Total</b>				<b>\$1,904.00</b>
<b>Stage 2</b>				
<b>Supply of tubestock Revegetation Species <i>Melaleuca preissiana</i> Forest</b>				
<i>Aotus gracillima</i>	\$3.50	ea	100	\$350.00
<i>Astartea scoparia</i>	\$2.00	ea	50	\$100.00
<i>Bolboschoenus caldwellii</i>	\$3.50	ea	275	\$962.50
<i>Calothamnus lateralis</i>	\$2.00	ea	50	\$100.00
<i>Centella asiatica</i>	\$2.50	ea	250	\$625.00
<i>Lepidosperma longitudinale</i>	\$5.50	ea	75	\$412.50
<i>Lobelia anceps</i>	\$2.50	ea	250	\$625.00
<i>Melaleuca preissiana</i>	\$2.00	ea	100	\$200.00
<i>Melaleuca raphiophylla</i>	\$2.00	ea	100	\$200.00
<i>Melaleuca teretifolia</i>	\$2.00	ea	50	\$100.00
<b>Total</b>			<b>1300</b>	<b>\$3,675.00</b>
<b>Plant Installation</b>				
Plant Installation	2.00	ea	1300	\$2,600.00
<b>Grand Total</b>				
<b>Grand Total Revegetation Stage 2</b>				<b>\$8,179.00</b>

**Revegetation Stage 3: *Melaleuca preissiana* Woodland approximately at 0.5 Plants / m<sup>2</sup>**

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<b>Stage 3</b>				
<b>Weed Control</b>				
Glyphosate application (2 treatments)	78.00	hr	16	\$1,248.00
Hand weeding (2 treatments)	75.00	hr	16	\$1,200.00
Quizalofop application (2 treatments)	82.00	hr	16	\$1,312.00
Woody weed removal (1 treatment)	80.00	hr	8	\$640.00
<b>Total</b>				<b>\$4,400.00</b>
<b>Stage 3</b>				
<b>Supply of tubestock Revegetation Species <i>Melaleuca preissiana</i> Woodland</b>				
<i>Acacia pulchella</i>	\$2.00	ea	20	\$75.00
<i>Acacia saligna</i>	\$2.00	ea	50	\$140.00

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<i>Adenanthos obovatus</i>	\$9.00	ea	20	\$70.00
<i>Aotus gracillima</i>	\$3.50	ea	40	\$350.00
<i>Astartea scoparia</i>	\$2.00	ea	20	\$40.00
<i>Banksia littoralis</i>	\$2.50	ea	30	\$250.00
<i>Baumea preissii</i>	\$3.50	ea	40	\$70.00
<i>Boronia crenulata</i>	\$3.50	ea	20	\$275.00
<i>Bolboschoenus caldwellii</i>	\$3.50	ea	100	\$50.00
<i>Calothamnus lateralis</i>	\$2.00	ea	20	\$70.00
<i>Centella asiatica</i>	\$2.50	ea	100	\$70.00
<i>Conostylis juncea</i>	\$3.50	ea	20	\$100.00
<i>Dampiera linearis</i>	\$5.50	ea	50	\$35.00
<i>Daviesia physodes</i>	\$2.50	ea	20	\$125.00
<i>Dianella revoluta</i>	\$3.50	ea	20	\$25.00
<i>Eutaxia virgata</i>	\$3.50	ea	20	\$100.00
<i>Hakea varia</i>	\$2.00	ea	50	\$275.00
<i>Hemiandra pungens</i>	\$3.50	ea	10	\$125.00
<i>Hypocalymma angustifolium</i>	\$2.50	ea	50	\$110.00
<i>Jacksonia furcellata</i>	\$2.50	ea	10	\$50.00
<i>Kunzea glabrescens</i>	\$2.00	ea	50	\$100.00
<i>Lepidosperma longitudinale</i>	\$5.50	ea	50	\$60.00
<i>Lobelia anceps</i>	\$2.50	ea	50	\$40.00
<i>Meeboldina scariosa</i>	\$5.50	ea	20	\$50.00
<i>Melaleuca lateritia</i>	\$2.50	ea	20	\$50.00
<i>Melaleuca preissiana</i>	\$2.00	ea	50	\$110.00
<i>Melaleuca raphiophylla</i>	\$2.00	ea	30	\$125.00
<i>Melaleuca teretifolia</i>	\$2.00	ea	20	\$110.00
<i>Patersonia occidentalis var occidentalis</i>	\$2.50	ea	20	\$70.00
<i>Pericalymma ellipticum</i>	\$2.50	ea	20	\$75.00
<i>Phlebocarya ciliata</i>	\$5.50	ea	20	\$140.00
<i>Regelia ciliata</i>	\$2.50	ea	50	\$70.00
<i>Thysanotus multiflorus</i>	\$5.50	ea	20	\$350.00
<i>Xanthorrhoea preissii</i>	\$3.50	ea	20	\$40.00
		<b>Total</b>	<b>1150</b>	<b>\$3,160.00</b>
<b>Plant Installation</b>				
Installation	2.00	ea	1150	<b>\$2,300.00</b>
<b>Grand Total</b>				

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<b>Grand Total Revegetation Stage 3</b>				<b>\$9,860.00</b>

Revegetation Stage 4: *Eucalyptus marginata* / *Allocasuarina fraseriana* Woodland Area 2 at approximately 0.25 Plants / m<sup>2</sup>

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<b>Stage 4</b>				
<b>Weed Control area 1 and 2</b>				
Glyphosate application (2 treatments)	78.00	hr	16	\$1,248.00
Hand Weeding (2 treatments)	75.00	hr	16	\$1,200.00
Quizalofop application (2 treatments)	82.00	hr	16	\$1,312.00
Woody Weed Removal (1 treatment)	80.00	hr	8	\$640.00
<b>Total</b>				<b>\$4,400.00</b>
<b>Stage 4</b>				
<b>Supply of tubestock <i>Eucalyptus marginata</i> / <i>Allocasuarina fraseriana</i> Woodland area 1</b>				
<i>Acacia pulchella</i>	\$2.00	ea	50	\$100.00
<i>Acacia saligna</i>	\$2.50	ea	50	\$125.00
<i>Acacia stenoptera</i>	\$3.50	ea	50	\$175.00
<i>Adenanthos obovatus</i>	\$9.00	ea	50	\$450.00
<i>Allocasuarina fraseriana</i>	\$2.00	ea	50	\$100.00
<i>Anigozanthos manglesii</i>	\$2.00	ea	10	\$20.00
<i>Arnocrinum preissii</i>	\$3.50	ea	20	\$70.00
<i>Billardiera heterophylla</i>	\$3.50	ea	20	\$70.00
<i>Bossiaea eriocarpa</i>	\$2.50	ea	50	\$125.00
<i>Calytrix fraseri</i>	\$5.50	ea	50	\$275.00
<i>Dampiera linearis</i>	\$5.50	ea	25	\$137.50
<i>Dasyogon bromeliifolius</i>	\$9.00	ea	20	\$180.00
<i>Daviesia physodes</i>	\$2.50	ea	20	\$50.00
<i>Dianella revoluta</i>	\$3.50	ea	50	\$175.00
<i>Eucalyptus marginata</i>	\$3.50	ea	50	\$175.00
<i>Eucalyptus todtiana</i>	\$2.00	ea	10	\$20.00
<i>Gastrolobium capitatum</i>	\$5.50	ea	25	\$137.50
<i>Gompholobium tomentosum</i>	\$3.50	ea	50	\$175.00
<i>Haemodorum spicatum</i>	\$3.50	ea	25	\$87.50
<i>Hemiandra pungens</i>	\$3.50	ea	50	\$175.00
<i>Hovea trisperma</i>	\$2.50	ea	25	\$62.50
<i>Hypocalymma angustifolium</i>	\$2.50	ea	25	\$62.50
<i>Hypolaena exsulca</i>	\$5.50	ea	10	\$55.00

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<i>Jacksonia furcellata</i>	\$2.50	ea	25	\$62.50
<i>Kennedia prostrata</i>	\$2.00	ea	25	\$50.00
<i>Kunzea glabrescens</i>	\$2.00	ea	25	\$50.00
<i>Nuytsia floribunda</i>	\$9.00	ea	10	\$90.00
<i>Patersonia occidentalis</i>	\$2.50	ea	50	\$125.00
<i>Scholtzia involucrata</i>	\$5.50	ea	50	\$275.00
<i>Thysanotus multiflorus</i>	\$5.50	ea	25	\$137.50
<i>Tricoryne elatior</i>	\$3.50	ea	10	\$35.00
<i>Xanthorrhoea preissii</i>	\$3.50	ea	20	\$70.00
<b>Total</b>			<b>1025</b>	<b>\$3,897.50</b>
<b>Stage 4</b>				
<b>Supply of tubestock <i>Eucalyptus marginata</i> / <i>Allocasuarina fraseriana</i> Woodland area 2</b>				
<i>Acacia pulchella</i>	\$2.00	ea	25	\$50.00
<i>Acacia saligna</i>	\$2.50	ea	25	\$62.50
<i>Acacia stenoptera</i>	\$3.50	ea	25	\$87.50
<i>Adenanthos obovatus</i>	\$9.00	ea	25	\$225.00
<i>Allocasuarina fraseriana</i>	\$2.00	ea	25	\$50.00
<i>Anigozanthos manglesii</i>	\$2.00	ea	5	\$10.00
<i>Arnocrinum preissii</i>	\$3.50	ea	10	\$35.00
<i>Billardiera heterophylla</i>	\$3.50	ea	10	\$35.00
<i>Bossiaea eriocarpa</i>	\$2.50	ea	20	\$50.00
<i>Calytrix fraseri</i>	\$5.50	ea	20	\$110.00
<i>Dampiera linearis</i>	\$5.50	ea	20	\$110.00
<i>Dasyogon bromeliifolius</i>	\$9.00	ea	10	\$90.00
<i>Daviesia physodes</i>	\$2.50	ea	10	\$25.00
<i>Dianella revoluta</i>	\$3.50	ea	20	\$70.00
<i>Eucalyptus marginata</i>	\$3.50	ea	20	\$70.00
<i>Eucalyptus todtiana</i>	\$2.00	ea	10	\$20.00
<i>Gastrolobium capitatum</i>	\$5.50	ea	20	\$110.00
<i>Gompholobium tomentosum</i>	\$3.50	ea	20	\$70.00
<i>Haemodorum spicatum</i>	\$3.50	ea	20	\$70.00
<i>Hemiandra pungens</i>	\$3.50	ea	20	\$70.00
<i>Hovea trisperma</i>	\$2.50	ea	20	\$50.00
<i>Hypocalymma angustifolium</i>	\$2.50	ea	25	\$62.50
<i>Hypolaena exsulca</i>	\$5.50	ea	5	\$27.50
<i>Jacksonia furcellata</i>	\$2.50	ea	10	\$25.00
<i>Kennedia prostrata</i>	\$2.00	ea	20	\$40.00

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<i>Kunzea glabrescens</i>	\$2.00	ea	10	\$20.00
<i>Nuytsia floribunda</i>	\$9.00	ea	5	\$45.00
<i>Patersonia occidentalis var occidentalis</i>	\$2.50	ea	20	\$50.00
<i>Scholtzia involucrata</i>	\$5.50	ea	20	\$110.00
<i>Thysanotus multiflorus</i>	\$5.50	ea	20	\$110.00
<i>Tricoryne elatior</i>	\$3.50	ea	5	\$17.50
<i>Xanthorrhoea preissii</i>	\$3.50	ea	10	\$35.00
<b>Total</b>			<b>530</b>	<b>\$2,012.50</b>
<b>Plant Installation</b>				
Plant Installation	2.00	ea	1555	<b>\$3,110.00</b>
<b>Grand Total</b>				
<b>Grand Total Revegetation Stage 4</b>				<b>\$13,420.00</b>

Revegetation Costing Stage 5: Species *Kunzea glabrescens* Closed Tall Scrub at approximately 1.5 Plants / m<sup>2</sup>

Item	Unit Cost \$	Unit	No	Cost (excl. GST)
<b>Stage 5</b>				
<b>Weed Control and Soil Removal</b>				
Glyphosate biactive spray (1 treatment)	\$78.00	hr	8	\$624.00
Soil removal	\$75.00	hr	4	\$300.00
<b>Total</b>				<b>\$924.00</b>
<b>Supply of tubestock <i>Kunzea glabrescens</i> Closed Tall Scrub</b>				
<i>Jacksonia furcellata</i>	\$2.50	ea	25	\$62.50
<i>Juncus pallidus</i>	\$2.00	ea	20	\$40.00
<i>Kennedia prostrata</i>	\$2.00	ea	25	\$50.00
<i>Kunzea glabrescens</i>	\$2.00	ea	50	\$100.00
<i>Scholtzia involucrata</i>	\$5.50	ea	25	\$137.50
<i>Thysanotus multiflorus</i>	\$5.50	ea	25	\$137.50
<b>Total</b>			<b>170</b>	<b>\$527.50</b>
<b>Plant Installation</b>				
Plant installation	2.00	ea	170	<b>\$340.00</b>
<b>Grand Total</b>				
<b>Grand Total Revegetation Stage 5</b>				<b>\$1,791.00</b>



## Appendix 10: NatureMap Desktop Survey

<b>Animalia</b>
1. 24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill)
2. 24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)
3. 24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)
4. 25536 <i>Accipiter fasciatus</i> (Brown Goshawk)
5. 25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)
6. 24312 <i>Anas gracilis</i> (Grey Teal)
7. 24316 <i>Anas superciliosa</i> (Pacific Black Duck)
8. 24561 <i>Anthochaera carunculata</i> (Red Wattlebird)
9. 25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)
10. 24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo) <b>T</b>
11. 24321 <i>Chenonetta jubata</i> (Australian Wood Duck)
12. 24399 <i>Columba livia</i> (Domestic Pigeon)
13. 25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)
14. 25592 <i>Corvus coronoides</i> (Australian Raven)
15. 25595 <i>Cracticus tibicen</i> (Australian Magpie)
16. 25596 <i>Cracticus torquatus</i> (Grey Butcherbird)
17. 30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)
18. 25622 <i>Falco cenchroides</i> (Australian Kestrel)
19. 25727 <i>Fulica atra</i> (Eurasian Coot)
20. 25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)
21. 25530 <i>Gerygone fusca</i> (Western Gerygone)
22. 24443 <i>Grallina cyanoleuca</i> (Magpie-lark)
23. 25734 <i>Himantopus himantopus</i> (Black-winged Stilt)
24. 24491 <i>Hirundo neoxena</i> (Welcome Swallow)
25. 24153 <i>Isoodon obesulus</i> subsp. <i>fusciventer</i> (Quenda) <b>P5</b>
26. 24581 <i>Lichenostomus virescens</i> (Singing Honeyeater)
27. 25661 <i>Lichmera indistincta</i> (Brown Honeyeater)
28. 25654 <i>Malurus splendens</i> (Splendid Fairy-wren)
29. 24598 <i>Merops ornatus</i> (Rainbow Bee-eater)
30. 25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)
31. 25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)
32. 25682 <i>Pardalotus striatus</i> (Striated Pardalote)
33. 24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)
34. 24409 <i>Phaps chalcoptera</i> (Common Bronzewing)
35. 24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)
36. 25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)
37. 24771 <i>Porzana tabuensis</i> (Spotless Crane)
38. 25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)

39. 25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)
40. 25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)
41. 25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)
42. 25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe)
43. 24331 <i>Tadorna tadornoides</i> (Australian Shelduck)
44. 24844 <i>Threskiornis molucca</i> (Australian White Ibis)
45. 24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)
46. 25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)
47. 25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)
48. 25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye)
<b>Plantae</b>
49. 1775 <i>Adenanthos cygnorum</i> (Common Woollybush)
50. 1728 <i>Allocasuarina fraseriana</i> (Sheoak)
51. 17234 <i>Austrostipa compressa</i>
52. 1800 <i>Banksia attenuata</i> (Slender Banksia)
53. 1834 <i>Banksia menziesii</i> (Firewood Banksia)
54. 740 <i>Baumea arthropphylla</i>
55. 1417 <i>Blancoa canescens</i> (Winter Bell)
56. 1586 <i>Caladenia discoidea</i> (Dancing Orchid)
57. 1596 <i>Caladenia huegelii</i> (Grand Spider Orchid) <b>T</b>
58. 1132 <i>Centrolepis mutica</i>
59. 1280 <i>Chamaescilla corymbosa</i> (Blue Squill)
60. 806 <i>Cyperus polystachyos</i> (Bunchy Sedge) <b>Y</b>
61. 1218 <i>Dasypogon bromeliifolius</i> (Pineapple Bush)
62. 1637 <i>Diuris purdiei</i> (Purdie's Donkey Orchid) <b>T</b>
63. 1639 <i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid) <b>T</b>
64. 5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)
65. 5216 <i>Hybanthus calycinus</i> (Wild Violet)
66. 7408 <i>Lobelia tenuior</i> (Slender Lobelia)
67. 5980 <i>Melaleuca thymoides</i>
68. 1550 <i>Patersonia occidentalis</i> (Purple Flag)
69. 974 <i>Schoenus benthamii</i> <b>P3</b>
70. 983 <i>Schoenus cruentus</i>

**Conservation Codes**

- T - Rare or likely to become extinct
- X - Presumed extinct
- IA - Protected under international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5
- Y** – Introduced