SHIRE OF BUSSELTON

RESERVE 22952 LAYMAN ROAD, WONNERUP MANAGEMENT PLAN

'CAPTAIN BAUDIN RESERVE'

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1. INTRODUCTION

1.1 Background

This report has been prepared in response to the Shire of Busselton's consultancy brief for the preparation of a Management Plan for Captain Baudin Reserve (↑22952) Layman Road, Wonnerup. The Reserve adjoins the Vasse - Wonnerup Estuary and is predominantly located within the coastal foreshore environment.

1.2 Purpose and Scope

The purpose of this Management Plan is to provide clear guidelines for maintaining and improving the conservation values of the Reserve. It will also assist in the future planning and development within, and adjacent to, the Reserve to ensure sustainable use of the coastal environment.

The principal objective of this management plan is to collate the biophysical and social values of the Reserve to determine appropriate strategies for its future recreational use and protection of the environmental values. The following aspects have been addressed in this plan:

- The existing biophysical environment including a description of the soils, landform, hydrology, vegetation and fauna.
- The existing social, cultural and recreational use and values associated with the Reserve.
- Management of issues identified from site inspections and community and relevant stakeholder consultation.
- Prioritisation of recommendations for the future use and protection of the Reserve.

1.3 Approach to the Study

A site reconnaissance was undertaken in November 1999 to identify broad vegetation zones, define areas of disturbance and establish the relationship between the Reserve and the surrounding land uses. Aerial photography, in conjunction with the field assessment, was used to delineate vegetation types at the site.

Relevant studies of the area and map data have been consulted for background information.

Liaison with the Shire of Busselton and key community groups has been conducted throughout the study and suggestions and recommendations incorporated into the plan where appropriate.

A detailed flora and fauna was not required by the Shire as part of this Management Plan.

1.4 Relevant Studies

Increased pressure on coastal foreshore areas in the Wonnerup area resulted in the preparation of the Forrest Beach and Wonnerup Dunes Access Study by *ecologia* Environmental Consultants in 1997 on behalf of the Shire of Busselton (*ecologia*, 1997). The principal objective of the study was to identify existing uses and access points, determine potential future activities and use levels and to recommend assess management and control strategies in the coastal foreshore area. Part of the study included an assessment of the future access requirements from Baudin Reserve to the coast.

No recommendations were presented for Baudin Reserve, however the study proposed the formalisation of tracks and the establishment of a dual use path in the coastal foreshore area. These recommendations will provide a basis for some of the suggestions relating to access, parking and related infrastructure presented in this management plan.

2. DESCRIPTION OF THE STUDY SITE

Captain Baudin Reserve (Reserve 22952) encompasses approximately 5.3ha of dense, near coastal vegetation located between the Vasse Estuary and Layman Road, Wonnerup and approximately 0.8ha to the north of Layman Road in the Shire of Busselton.

The site is reserved under the local scheme for the purposes of 'Camping and Recreation' although its current use is generally limited to bush walking, local access to the beach and fishing in the adjoining estuary.

Residential lots are located to the west of the Reserve with larger rural lots located to the east. The coastal foreshore reserve is separated from the camping reserve by Layman Road. The northern section of the Reserve is currently being investigated to allow for the establishment of a rest area incorporating picnic facilities and direct access to the beach. The eastern section adjoining Lot 70 is being investigated as part of the realignment of Layman Road and may be resumed as part of this study.

Baudin Reserve is currently vested with the Shire of Busselton with all management requirements initiated by the council. The council currently receives assistance from members of the Wonnerup Residents Association to manage aspects of the Reserve.

3. SITE APPRAISAL OF BIOPHYSICAL ELEMENTS

3.1 Climate

The south-west region is characterised by a Mediterranean climate with hot dry summers and cool wet winters. During summer the weather is controlled by high pressure systems producing temperatures up to 46°C with an average temperature of 29°C in Perth and 26°C in Albany. The average maximum temperature recorded at Busselton, the closest weather station to the project area, is 22.1°C (*ecologia,* 1997).

In winter the high pressure systems are weaker being dominated by low pressure systems producing cool, wet conditions. Temperatures may fall as low as 0°C and reach up to 18°C, with an average minimum of 9°C in Perth and 6°C at Albany. The average minimum temperature recorded at Busselton is 7.9°C.

The annual winter rainfall for the southwest region ranges from 1375mm near the coast to less than 500mm to the east of the Darling Scarp. The average annual rainfall recorded at Busselton is 821mm (*ecologia*, 1997).

3.2 Topography and Landforms

The study area and surrounding region is characterised by low-lying, flat topography where low coastal dunes (up to 2m) are interspersed by large shallow estuaries. The low coastal dunes in the adjoining coastal foreshore reserve continue to northern boundary of Baudin Reserve. Towards the southern boundary of the study area the dunal system recedes gently to the riparian area of the Vasse estuary.

3.3 Geology and Geomorphology

Geographe Bay is an extension of the Swan Coastal Plain with the study area located within the Safety Bay Sand geological unit. The Safety Bay unit is characterised by unconsolidated calcareous sand which is generally composed of well sorted, white, medium grained quartz and shell debris of aeolian origin. This unit forms the most southerly occurrence of the Quindalup Dunes.

The shore parallel dunes in the study area are representative of a relict foredune plain often characteristic of rapidly prograding shorelines of the Quindalup Dune System. The foredune plain in the study area is unique in that it forms a barrier between the coast and the Vasse estuarine system (*ecologia*, 1997).

3.4 Hydrology

The study area directly abuts the Vasse estuarine system located in the widest swale at the southern extent of the foredune plain. The south-eastern corner of the study area forms a minor depression and is occasionally inundated during peak water levels. This area is dominated by sedges and paperbarks tolerant of seasonal inundation.

The importance of the Wonnerup-Vasse Estuarine system as a habitat for waterbirds is recognised through its listing as a Wetland of International Importance Especially as a Waterfowl Habitat under the Ramsar Convention, adopted in 1971.

3.5 Vegetation and Flora

The vegetation of the study area is representative of the Drummond Botanical District of the Swan Coastal Plain. Specifically, the site comprises the Quindalup Dune System which is characterised by plants tolerant of highly alkaline, poorly developed soils. The vegetation of the study area was surveyed originally by Smith in 1973 and more recently by *ecologia* in 1997. Both surveys identified the study area as a Peppermint (*Agonis flexuosa*) Low Woodland.

An inspection of the main plant species was requested as part of the scope of works for this study. The inspection was carried out in November 1999 and revealed that the structural unit defined as a Peppermint Low Woodland by Smith (1973) and *ecologia* (1997) is more appropriately defined as a Peppermint Low Open Forest as a result of its dense canopy cover (30-70%). In addition, this unit can be further divided into an *Acacia saligna* and *Spyridium globulosum* Shrubland along the periphery of Layman Road and a *Lepidosperma gladiatum* (Coastal Sword Sedge) Sedgeland with occasional Peppermints and Mohan (*Melaleuca viminea*) over introduced plants in the southeastern area of the site.

The Shrubland along Layman Road extends up to 20m from the road edge. In general, *Beyeria viscosa*, Hop Bush (*Alyxia buxifolia*) and Dampier's Rose (*Diplolaena dampieri*) co-dominate with *Acacia saligna* and *Spyridium globulosum* with more open patches dominated by a Sedgeland of Coastal Sword Sedge with *Juncus kraussii*, *Acanthocarpus preissii* and introduced grasses and herbs. A high level of disturbance is evidenced in this unit as a result of the proximity of the road. In particular, aggressive weeds such as Bearded Oat (*Avena barbata*), *Euphorbia peplus*, *Fumaria capreolata* and *Pelargonium capitatum* and Hare's Tail (*Lagurus ovatus*) proliferate.

Inland from the *Acacia* Shrubland, most of the study area supports a Peppermint Low Open Forest. The Peppermint trees dominate the overstorey vegetation with an *Acacia littorea, Spyridium globulosum* and *Rhagodia baccata* Open Heath forming the middle stratum. Included in this layer is Hop Bush, *Acacia saligna*, Dampier's Rose, Coastal Beard Heath (*Leucopogon parviflorus*) and *Hibbertia cuneiformis.* The understorey is dominated by introduced plants including Arum Lily (*Zantedeshia aethiopica*), Bearded Oat, *Euphorbia peplus*, *Crepis* sp., *Fumaria capreolata*, *Pelargonium capitatum*. Coastal Sword Sedge is emergent in this unit where the introduced plants are not so prolific. Creepers such as Dodder Laurel (*Cassytha racemosa*) and the invasive Bridal Creeper (*Asparagus asparagoides*) are spread throughout this vegetation unit.

In the southeastern corner of the Reserve, there is a deadwater area which is seasonally inundated. This area is dominated by a Sedgeland of Coastal Sword Sedge with occasional Peppermints and Mohan over introduced plants.

The vegetation types at the Reserve are shown in Figure 2.

3.6 Reserve Condition

Most of the study area has been threatened by one or more disturbances which have affected its ability to maintain itself. In relation to the Reserve, the following disturbances have resulted in the degradation of the vegetation and bushland habitat:

- Partial clearing, ie for the establishment of tracks, firebreaks.
- Fragmentation, ie isolation, bushland bordered by cleared pastures, roads, rural lots.
- Weed invasion.
- Impact of animals, such as cats, dogs, foxes, rabbits.
- Removal and dumping of soil, garden refuse and litter.
- Changes in water regimes.
- Access in the past by 4WD vehicles and trail bikes.

In most cases, one disturbance can initiate other disturbances. For example, the establishment of informal tracks and fire-breaks can cause the introduction or increase of weeds in the area.

A number of aggressive weeds are prominent in the Reserve, including Arum Lily, Bridal Creeper, Rose Pelargonium, Pampas Grass, Petty Surge (*Euphorbia peplus*), Plantago (*Plantago lanceolata*) and Wild Fumitory (*Fumaria capreolata*). The invasion of these plants into the Reserve is generally extensive, particularly Arum Lily which forms monospecific stands having out-competed most of the native vegetation present in the understorey.

The condition of the vegetation at the study site is shown in Figure 3 and is based on the condition scale used in Bushplan (Government of WA, 1998) as shown in the following table.

TABLE 1
VEGETATION CONDITION SCALE

Pristine	Pristine or nearly so, no obvious signs of disturbance
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive
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.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate. 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.
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.
Completely Degraded	The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

3.7 Vertebrate Fauna

A comprehensive field survey to identify the vertebrate fauna populations in the Reserve was beyond the scope of this management plan. However, observations on habitat type and any other signs of fauna presence were noted during the site visit. In addition, the F.A.W.N.A Inc group (Fostering and Assistance to Wildlife Needing Aid: Mabel Bell and Suzanne Becker) volunteered to carry out a site visit and compile a list of common species seen in the Reserve. The list is contained in Appendix 4.

There are a wide variety of water birds associated with the Wonnerup-Vasse Estuary. The Estuary is recognised through its listing as a Wetland of International Importance Especially as a Waterfowl Habitat under the Ramsar Convention. Although it adjoins (i.e. is not part of) the Reserve, the Reserve provides important native habitat for nesting, protection, feeding and maintenance of water quality.

Marsupials known to occur in the foreshore Reserve include the Quenda or Southern Brown Bandicoot (*Isoodon obesulus*) and the Western Ringtail Possum (*Pseudocheirus occidentalis*). Quokkas (*Setonix brachyurus*) were also recorded from the area at the time of European settlement although have been largely extinct from the mainland since the 1960s.

It was indicated that the Quenda was once very abundant in the Reserve and that populations have been significantly reduced due to disturbance by feral animals and dogs and also the loss of native habitat by weed invasion. The development of surrounding land and loss of suitable habitat would also be a factor in their demise.

4. EXISTING FACILITIES AND INFRASTRUCTURE

4.1 Access and Parking

Access to the Reserve is via Layman Road or from the cul de sac at Estuary View Drive. A main access path dissects the Reserve from these entry points. A small path has deviated from the main path and provides access to the periphery of the estuary. Aerial photos taken in 1996 of the Reserve identify a number of other informal paths through the reserve, particularly one aligned parallel with Layman Road. This path is now completely vegetated and was not recognised as an access path during the November site visit. Parking is currently permitted along the Reserve of Layman Road, in the existing sealed area (former road pavement) and on road verges.

The existing informal access paths through the Reserve are shown in Figure 3.

4.2 Fencing

At present the Reserve is not fenced apart from the western boundary adjoining Lot 18. Access to the Reserve is therefore uncontrolled at present which has probably contributed to the establishment of informal paths through the Reserve.

A pine bollard has been installed at the western entry to the Reserve to prevent 4WD and vehicle access. Vehicles are, however permitted access to the Reserve from Layman Road.

4.3 Signage

A sign identifying the Reserve as 'Captain Baudin Reserve' is located along Layman Road. No other signs, particularly maintenance or interpretative signs, are present at the periphery of the Reserve or at the existing rest area adjacent to Layman Road.

4.4 Pollution Control

The absence of active management at the Reserve precludes the placement of bins at the site and refuse collection. The formalisation of paths and installation of board walks and lookout points, as recommended in this Management Plan, is likely to increase recreational use of the Reserve. The installation of bins at the periphery of the Reserve to cater for this increased use is discussed in Section 7.

4.5 Fire Management

Access to the Reserve in the event of a fire is currently via Layman Road which follows the coastal extent of the site or Estuary View Drive if the fire poses a hazard to adjoining residential properties. The informal paths located within the Reserve can be accessed by vehicles in the event of a fire.

5. SOCIAL AND RECREATIONAL VALUES

5.1 Recreational Values

Captain Baudin Reserve provides for a limited variety of recreational pursuits, as a result of the nature of the site, in relation to access, vegetation coverage, absence of facilities and a small local population. The primary recreational uses of the Reserve are bushwalking, bird watching, walking dogs, fishing in the adjacent estuary and provision of access to the beach. Camping is sometimes carried out in the Reserve.

Although no formal consultation was required to be carried out for the Management Plan, a few key persons were nominated by the Shire of Busselton to be contacted for their input. These persons provided comments regarding the existing use of the Reserve and their preferred use of the area in the future. Most residents suggested that infrastructure in the Reserve should be upgraded such as paths, provision of picnic facilities, a bird lookout area and bins. Litter, weeds, feral animal control and gathering of youths at night were highlighted as the main problems. It was indicated that there is a perceived threat of fire for locals situated close to the Reserve.

Several residents expressed a desire to see the condition of the Reserve upgraded to increase the once abundant Quenda populations. One suggested that the reservation be upgraded to conservation purposes with an intention to rehabilitate the habitat and provide strict access controls (i.e. cat proof fence) for the release of the Quenda.

5.2 Aboriginal Heritage

A search of the Aboriginal Site Register was conducted to determine the significance of the Reserve to Aboriginal persons. A number of sites were identified in the vicinity but no sites have been formally recorded as occurring at Captain Baudin Reserve. Sites recorded in the vicinity of the Reserve have been registered with the Aboriginal Affair Department and include:

- a burial site on Armitage Drive;
- a camping ground and fish traps located on the southern banks of the Abba River;
- skeletal remains identified during operations at the Cable Sands mining site; and
- and quartz artefacts identified near the Bussell Highway near the Ludlow River.

During consultation however, one of the local Aboriginal spokespersons indicated that the Reserve holds particular significance as it is believed to contain the burial remains of Aboriginal persons massacred along the Vasse-Wonnerup Estuary around the time of European settlement. It is therefore recommended that any future proposed ground disturbing activities be kept to a minimum in the section of the Reserve immediately adjoining the Vasse Estuary.

6. OPPORTUNITIES AND CONSTRAINTS

This management plan, in conjunction with community consultation, has identified a number of potential options for the management of the Reserve. These are as follows:

OPTION A **Conservation Reserve** – Reserve managed principally for the purpose of conservation with the rehabilitation of the Peppermint (*Agonis flexuosa*) habitat an important priority. Fencing of the Reserve to provide a refuge and release site of Quendas (*Isoodon obesulus*).

The installation of a 2m high ring-lock fence (Possibly with locked gates) would effectively prevent access of feral animals and domestic dogs and cats into the Reserve but would also restrict any recreational use of the Reserve, such as bushwalking, bird watching and fishing.

OPTION B **Passive Recreation Reserve** – Reserve management for the principal purpose of recreation. All walk trails formalised using crushed limestone and/or raised board walks, particularly immediately adjacent to the estuary. Installation of a lookout point at the deadwater overlooking the Vasse Estuary to be used for bird watching and fishing. Rehabilitation of the site, particularly weed control, to be implemented and revegetation using local native species in areas where aggressive weeds have been removed. Investigate the feasibility of developing the majority of the area of Reserve to the north of Layman Road for car parking, beach access, rest area and dual use path whilst ensuring the retention of any Peppermint trees.

OPTION C **Combination of Recreation and Conservation** – Rehabilitation of the site implementing weed removal and revegetation, fencing of the Reserve with a 1m high post and wire fence and installation of pedestrian friendly gates to prevent 4WD/bikes and dogs. All walk trails formalised using crushed limestone and/or raised board walks, particularly immediately adjacent to the estuary. Installation of a lookout point at the deadwater overlooking the Vasse Estuary to be used for bird watching and fishing. Investigate the feasibility of amalgamating the area north of Layman Road with the coastal foreshore area and utilising the existing rest area to develop car parking, beach access, rest area and dual use path facilities (designs to be determined by Council in conjunction with Layman Road re-alignment plans).

Option A, whilst ensuring the rehabilitation of the Reserve for conservation purposes, is not in accordance with the existing reservation of the site. Importantly, the viability of the Reserve for conservation purposes is questionable as a result of the Reserve's small size, isolation from other bushland remnants, high boundary to area ratio, present condition and anticipated time frame and cost associated with restoring the natural habitat. In addition, this option precludes the use of the Reserve for recreational purposes.

Option B proposes to upgrade existing facilities and infrastructure to improve the accessibility of the site to local residents and the wider community. Despite the fact

that this is consistent with the existing reservation, the options proposed will not ensure the long-term viability of the bushland. On this basis, modification and integration of the two options presented above appears to be the most appropriate strategy for the management of the Reserve. The implementation of Option C will ensure that the infrastructure allows for passive recreation while limiting existing disturbances which have resulted in its degraded condition. In accordance with the recommended use of the Reserve it is proposed that the reservation of the site be changed from 'Camping and Recreation' to 'Foreshore Preservation and Recreation' under the local scheme.

The recommended Option C and associated management strategies for the Reserve is presented visually in Figure 4.

7. MANAGEMENT OF ISSUES

The description of the existing environment provided in the preceding sections, together with an appreciation of the site's opportunities and constraints, provides the basis for developing management strategies for the Reserve at Wonnerup. This section discusses the key issues and proposes strategies that will ensure the integrity and viability of the Reserve is maintained and enhanced.

7.1 Landscape and Vegetation Protection

This management plan does not propose any concepts which will result in the loss or degradation of native vegetation. Proposals such as the installation and upgrading of paths will not involve any clearing of vegetation as existing paths and cleared areas will be used. The installation of fences along the margin of the paths will assist in restricting pedestrians from trampling vegetation.

The installation and upgrading of paths and board-walks will maintain the natural topography of the site wherever possible. If it is determined that soil will need to imported for the construction of the paths, it should be obtained from a dieback and weed-free source.

A detailed flora survey conducted of the Reserve by *ecologia* in 1997 as part of a wider area did not record any flora species of significance as listed on the Declared Rare and Priority Flora database (Department of Conservation and Land Management, 1998). Therefore, no specific management strategies in relation to significant flora will be required.

7.2 Access and Recreation Management

7.2.1 Pedestrian Access and Dual Use Paths

Pedestrian and dual use paths are an integral component of foreshore Reserve areas. They provide safe and controlled access through the Reserve as well as providing linkages to nearby amenities and adjoining areas, including the coastal foreshore area.

Formalised paths direct pedestrian access through fragile bushland areas and riparian vegetation when combined with the strategic placement of fences. The formal access ways become a significant management tool to preserve the vegetation and landform characteristics of the reserve.

The Reserve Management Plan (Figure 4) proposes to upgrade the existing path within the Reserve which provides suitable access from local residences to the coast. A lookout point is proposed to be located at the estuary from a path deviating from the main access path. At the estuary it is recommended that the lookout form an enclosed platform so that activities such as bird watching and fishing can be controlled from one point.

The dual use path, board-walk and look out point should use materials which are visually unobtrusive and sympathetic with the local environment. All wooded

materials should be treated to ensure they are non-flammable. In addition, the board walk should be installed with a balustrade to prevent access to potentially fragile areas of the Reserve.

7.2.2 Parking and Vehicle Access

There should be no vehicle access into the Reserve other than for maintenance or fire fighting purposes.

A small number of parking bays should be provided at the rest area on Layman Road, however it is anticipated that recreational use of the foreshore reserve will be predominantly by local residents and the community of Wonnerup.

7.2.3 Fencing

Install fencing (1m high ringlock – specifications shown in Appendix 3) around the perimeter of the Reserve and spring loaded gates (a continuation of the ring lock fencing used) at the access point on Estuary View Drive and Layman Road. The access paths through the Reserve may also be fenced to prevent trampling of vegetation and establishment of additional paths. It may be appropriate to use pine bollards with a horizontal beam across the top in this instance.

The raised viewing platform should be balustraded to restrict access to the tidal flats and riparian vegetation.

7.2.4 Signage, Bins and Associated Infrastructure

Signs can be used as a passive method of access control directing foreshore users to particular access points. Signs can also be used to indicate the location of amenities, permitted or restricted activities in the foreshore Reserve, and any other information appropriate to foreshore recreation.

Signs should be erected at strategic points in the Reserve to provide information and discourage random movement through the Reserve and tidal area. Directional and interpretive signage should be installed at appropriate locations indicating the direction to the viewing platform and walking paths in the Reserve. An orientation map may be erected at the rest area providing directions to the viewing platforms and entry point to the Reserve.

Signs should make use of simple messages, or internationally recognised symbols, to convey information in an easy to read manner. Colours and materials used in construction should blend with the foreshore environment.

7.3 Weed Control

All bushland and coastal areas have to varying degrees become invaded by exotic species generally originating from Mediterranean Europe and South Africa. The deliberate or accidental introduction of these species has greatly affected the ability of bushland to maintain itself. Alteration of the bushland ecosystem by the direct action of humans such as vegetation clearing, soil disturbance, increased frequency/intensity

of fires, additional nutrient inputs and dumping of garden refuse are factors which contribute to progressively give advantage to exotic species over native vegetation.

At the study area, vegetation trampling, vegetation clearing on adjoining land and resultant spread of invasive species appear to be the principal factors contributing to heavy infestations of annual and perennial weeds. In particular, trampling as a result of poorly designated paths or lack of formalised paths have significantly increased densities of weeds in the Reserve. Probably the most contributing factor is the absence of active management to restrict or limit the level of disturbance and resultant invasion of weeds.

Based on these primary factors, the best methods to keep weeds out of urban bushland is to restrict the principal measures which introduce them in the first place. For example, ensure disturbance is kept to a minimum by rationalising paths, fire breaks and roads and prohibit dumping of garden refuse in the bushland Reserve. In addition, while the invasion of weeds from areas outside the Reserve can not be controlled, the success of potential invasion can be contained. For example, the application of mulch at the periphery of the Reserve adjacent to Layman Drive and on any cleared areas to the east and west of the Reserve can be an effective method for restricting the establishment of weeds.

The most common and aggressive weeds in the Reserve are discussed in Section 3.6. Appropriate methods of weed control for each of these species are outlined in Appendix 1 with suitable weed removal techniques identified in Appendix 2. The following section provides the basic principles of bush regeneration irrespective of the method employed to remove a particular species of weed.

In most instances it is not possible, nor desireable, to remove all weeds during one site visit as the factors contributing to weed invasion will be continually operating. Therefore, for a successful weed control program it will be important to re-weed the site on a regular basis. The program should focus on implementing the following principles:

- Work from areas in good condition towards weed infested areas;
- Ensure minimal disturbance to soil and native vegetation;
- Let the rate of regeneration of native plants determine the rate of weed removal (as appropriate); and
- Implement a long term maintenance program to monitor weed control methods and native flora regeneration.

The following management recommendations are suggested for the Reserve:

1. The control of invasive weeds should be a major priority in the management of the Reserve.
2. Investigate the feasibility and implications of extending the native understorey layer to the road kerbing so that the road acts as a firebreak.

3. Weed control measures should be specific to particular weed species and ecosystems. Special care should be taken when controlling weeds in wetland environments with priority given to manual elimination of weeds in these areas. Where herbicide is required for large infestations, ensure appropriate selection and application to avoid contamination of surface waters.

4. All of the herbicides identified in the Appendices for weed control in the Reserve will not impact on the wetland environment, however care should be taken to avoid native species.

5. Weed control programs should not be undertaken in isolation but as a component of a vegetation rehabilitation program.

6. Provide active local residents interested in undertaking weed control measures in the Reserve with the weed control information contained in the appendices of this document.

7.4 Revegetation

An important component of bushland management and rehabilitation is the actions which take place following weed control. Revegetation using local native species, as listed below, in areas which have been cleared of weeds will be an important step in controlling additional weed invasion in the long-term.

TABLE 2
REVEGETATION LIST

Adjacent to Layman Road	Peppermint Low Open Forest	Immediately Adjacent to the Vasse Estuary
Understorey Species		
Lepidosperma gladiatum	*Lepidosperma gladiatum*	*Lepidosperma gladiatum*
Acanthocarpus preissii		*Gahnia trifida*
		Juncus kraussii
Mid-Stratum		
Spyridium globulosum	*Hibbertia cuneiformis*	*Acacia littorea*
Acacia cyclops	*Acacia saligna*	*Exocarpus sparteus*
Acacia saligna	*Diplolaena dampieri*	
Diplolaena dampieri	*Rhagodia baccata*	
Beyeria viscosa	*Hardenbergia comptoniana*	
Leucopogon parviflorus	*Phyllanthus calycinus*	
Scaevola crassifolia		
Rhagodia baccata		
Overstorey		
	Agonis flexuosa	*Melaleuca viminea*

7.5 Vertebrate Fauna

Enhancement of habitat and controlling of access, as outlined in Section 8 of this Management Plan, are the main factors that will promote the use of the Reserve by the

resident fauna (including invertebrates). The removal of weeds and replanting of native species in particular will provide additional habitat for terrestrial fauna.

In regards to the water birds, it is particularly important is that the fringing vegetation remains undisturbed where in good condition and be enhanced where it is not. Controlled access with the use of boardwalk viewing platforms will greatly assist in maintaining this fringing zone.

Maintaining and enhancing the condition of the Peppermint (*Agonis flexuosa*) Low Open Forest will promote the survival of the Western Ringtail Possum in the Reserve. They are highly arboreal: feeding, resting and socialising in the canopy as much as possible Strahan (1995). Peppermint leaves are the major dietary component. Increasing the density of Peppermint trees by planting will help to reduce the need for the possums to come down from the canopy where they are often eaten by foxes. In dense coastal Peppermint forest, home ranges are about 0.5 –1.5ha.

Factors influencing the survival of the Quenda in the Reserve include the presence and condition of suitable habitat, the size of the Reserve and access to adjoining habitat, the control of feral animals and dogs and restricting areas of disturbance by humans.

Preferred habitat for the Quenda, as described in Strahan (1995), is sandy soil with scrubby vegetation and/or areas with low ground cover that are burnt from time to time. The increased vegetation and insect diversity (i.e. food) during the early stages of regeneration after fire are very favourable although as the vegetation approaches maturity the food source is reduced. Frequent small scale fires are therefore important in maintaining a stable population. During the day the Quenda sleeps in a nest on the ground and at night hunts for insects, earthworms, fungi and other subterranean plant material. The home range of a large adult is in the order of 7ha, although these home ranges may overlap when there is a good food supply.

Given the size of the Captain Baudin Reserve (5ha) and the lack of habitat in adjoining lands it is unlikely that the Quenda population will recover to its original size. However, revegetation with local native species, the removal of weeds and providing controlled access by the use of a 1m high fence and gates will increase the likelihood of the Quenda returning in larger numbers. Consideration will need to be given as to the type of fencing used so as to allow the Quenda to move on and off the Reserve for foraging purposes.

7.6 Mosquito Control

The wetland environment adjacent to the Reserve presents a suitable environment for the breeding of mosquitoes which may also be a vector for associated diseases. To prevent breeding of mosquitoes in the Reserve it is recommended that the establishment of paths and board walks ensure that there will be no potential ponding of water.

The Shire of Busselton should be consulted to provide information on the most up-to-date control techniques.

7.7 Aboriginal Heritage

As the Reserve may contain the burial remains of Aboriginal persons, it is recommended that earthworks and construction be kept to a minimum in the section of the Reserve immediately adjoining the Vasse Estuary.

7.8 Fire Protection Strategies

Should a wildfire occur in the Reserve, attempts should be made to confine its impact by utilising existing access paths, the existing road network and surrounding roads as fire fighting access ways. In the event of a fire, it is anticipated that Peppermint trees (*Agonis flexuosa*) will lessen the spread of the fire as these plants are recognised as fire retardant species.

The access path which traverses the western portion of the Reserve should be upgraded retaining its current width so that fire vehicles can gain access to this area of the Reserve. A firebreak is proposed to be constructed along the eastern boundary of the Reserve (in the road reserve) which will also give access to persons crossing the estuary. In addition, adjoining all pedestrian access gates should be a gate which can be opened in the event of a fire or for maintenance purposes only. The type of fencing recommended for installation at the reserve is discussed in Section 8.2.2 and shown in Appendix 3.

Prescribed burning and open fires should be prohibited throughout the foreshore Reserve and adjoining rest area as fires expose areas to the invasion of weeds and pedestrian access.

8. RECOMMENDATIONS

The future use of Captain Baudin Reserve should cater for passive recreational pursuits in conjunction with the rehabilitation of the site to ensure the long-term viability of the bushland remnant. The management strategies presented in Section 8 are summarised below and are allocated a H, M or L for High Medium and Low priority respectively.

1. Amend the Shire of Busselton Town Planning Scheme reservation of Captain Baudin Reserve from 'Camping and Recreation' to 'Foreshore Preservation and Protection'. (H)

2. Investigate the feasibility of amalgamating the area north of Layman Road with the coastal foreshore area. (H)

3. Minimise the clearing of any vegetation by confining the installation and upgrading of informal access paths to existing pathways or already cleared areas. (H)

4. Ensure all soils imported for the construction of paths in the study area are obtained from a dieback and weed-free source. (H)

5. Formalise the main access path through the Reserve using crushed limestone and enclose with 1m high ring-lock fencing (large size to enable passage of native fauna movement) or pine bollards. (M)

6. Construct boardwalk or crushed limestone path with an associated lookout point adjacent to estuary in the deadwater area, as shown in Figure 4. The dual use path, board-walk and look out point should use appropriate materials. A balustrade should be installed along the boardwalk. (L)

7. Restrict vehicle access into the Reserve other than for maintenance or fire fighting purposes. (H)

8. Provide a small number of parking bays at the rest area on Layman Road (designs to be decided by Council in conjunction with Layman Road re-alignment plans). (M)

9. Install 1m high ring-lock fencing at the periphery of the Reserve (excluding estuary side). Install spring-loaded gates at entry points. In addition, install a locked gate for vehicle entry adjacent to the pedestrian access points. (M)

10. Upgrade rest area to include picnic tables/chairs, bins, signage and lighting (designs to be determined by Council in conjunction with Layman Road re-alignment plans). Enclose parking area using 0.5m high pine bollards to prevent access into foreshore area. (M)

11. Install directional (showing Reserve access points) and interpretative signage, for example, providing a description of environmental attributes of the Reserve and rehabilitation strategies currently in progress at locations identified in Figure 4. (L)

12. Commence weed control strategies during the appropriate season. Allow appropriate timeframe to elapse to implement revegetation using local native species – refer to species list in Section 7.4. Conduct on-going weed control strategies as required. (M)

13. Minimise breeding of mosquitoes in the Reserve by establishing paths and board walks such that there will be no potential ponding of water. (M)

14. Minimise any future proposed ground disturbing activities in the section of the Reserve immediately adjoining the Vasse Estuary as this area may contain the burial remains of Aboriginal persons. (H)

15. Upgrade the main access path through the Reserve retaining its current width so that fire vehicles can gain access. (M)

16. Construct a firebreak along the eastern boundary of the Reserve (in the road reserve). (H)

17. Install a locked gate for vehicle access next to all pedestrian access gates to be opened in the event of a fire or for maintenance purposes only. (H)

18. Prohibit prescribed burning and open fires throughout the foreshore Reserve and adjoining rest area. (H)

19. Review Management Plan five years after adoption and monitor the status of the Reserve on an annual basis. (M)

REFERENCES

Department of Conservation and Environment (1983) Coastal Management Plan Kalbarri Townsite. (Appendices – Fencing Specifications) Bulletin 145.

Dixon, B. and Keighery, G. (1995) Suggested Methods to Control Weeds. In: Scheltema, M. and Harris, J. (1995) Managing Perth's Bushlands.

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FIGURES

APPENDICES

APPENDIX 1

CONTROL TECHNIQUES FOR PROBLEM PLANTS AT BAUDIN RESERVE

Botanical Name	Degree of Infestation	Comments	Method	Weed Remove Techniques
Arum Lily *Zantedeschia aethiopica* 	Extensive	Replaces native species mainly in highly disturbed sites. Seed spread by birds.	1, 2, 3	Good seed production and extensive underground tubers ensure removal, whether manually or by chemical application, a difficult task. In most instances, chemical application is more effective as the tuber is usually killed. Several applications may be necessary. **Chemical Removal** Recommended herbicides (John Pearce, Ag WA, pers comm) include Glean, Ally or Brushoff. These chemicals are exempt from the Poisons Schedule and are virtually non-toxic. During application, native vegetation should be avoided as the chemicals may be non-selective to some species. Whilst the herbicides break down rapidly in water, they tend to remain in alkaline soils up to a few months. During this time, revegetation using native species should be avoided, however regeneration of new growth of Arum Lily prevented by manual removal. Glean, Ally or Brushoff **20g/ha (1 in 50 L water)** plus wetter. Spot spray from April to November when plants are 8 to 12cm high. Respray 2 months later to get missed growth. Try to spray before flowering (spring to early summer) to stop seed set. **In wetland areas use the herbicide without a surfactant to avoid destroying populations of frogs and tadpoles etc**. The herbicide will form a pool at the leaf base and be absorbed into the plant. **Manual Removal** The tuber of the Arum Lily needs to be completely removed from the soil. In dry areas use a Peter Lever (shown left) to dig a narrow channel next to the stem until the main tuber is reached. Do not remove the main tuber from the soil, but carefully excavate around and under it to locate secondary tubers. Remove all of the tubers by bagging and disposing off site.
Bridal Creeper *Asparagus asparagoides*	Patchy	Smothers small plants by climbing or trailing over the ground. Seed spread by birds.	1, 2, 3	Glyphosate 360 at 1 in 100 water when actively growing between July and September. Repeat applications are usually necessary. Ally can also be used with similar results at rates of 2.5 to 5g/ha in 250L water. As plants are usually under trees and shrubs they are difficult to dig out. However, young plants are easily removed by hand. Mats of Bridal Creeper can be rolled up and destroyed. Treat any regrowth as above.
Rose Pelargonium *Pelargonium capitatum*	Extensive	Smothers small native plants. Colonises natural bare sandy areas, therefore destroys natural habitat of burrowing snakes etc.	2, 3	Difficult to control. Pull plants in autumn/winter when soil is damp. Plant will reshoot if stem is broken at or below ground level. Secondary weedy is important but good control can be achieved. No specific data for herbicide control. Suggest Ally/Brushoff 5g/ha. Glyphosate 1 in 100 in early September (add wetting agent). Apply with wick applicator. Repeat applications may be necessary.
Plantago *Plantago lanceolata*	Isolated	Common on disturbed sites.	1, 2, 3	Remove populations by hand. Make sure the taproot is removed. Wipe or spot spray with Glyphosate.

Botanical Name	Degree of Infestation	Comments	Method	Weed Remove Techniques
Petty Surge *Euphorbia peplus*	Isolated	Only tends to be a problem in highly disturbed areas where it gets extra moisture and nutrients.	1, 2, 3	Pull out small populations before it goes to seed. Wear gloves to protect your skin from the plant's sap. No specific information on herbicide control. Suggest Sprayseed 10-15mL in 10L water + 25% wetter using knapsack. Apply when actively growing.
Giant Reed or Bamboo *Arundo donax* 	Isolated	Difficult to control. Serious weed.	1, 2, 3	Cut down or burn, spray regrowth when 0.5-1.0m high, thoroughly wetting foliage use Glyphosate 360, 110mL in 10L water + wetter (dilution 1%). Repeat application may be necessary.
Fumaria *Fumaria capreolata*	Widespread	Large colonies suppress native flora, mainly in highly disturbed areas.	1, 2, 3	Small populations can be pulled by hand, best when the plants are large but before seeding in spring. Knapsack Glyphosate 75-100mL in 15L of water. Spray any time when actively growing in winter.
Hare's Tail Grass *Lagurus ovatus*	Widespread	Competes with native plants.	1, 2, 3, 4	Spray with Fusilade or similar herbicide at 2-4L/ha in winter.

KEY TO METHOD OF CONTROL:

1. Hand weeding, pulling, digging.
2. Herbicide wipe, stem injection or cut stump method.
3. Spot spraying.
4. Blanket spraying.

Techniques and photographs sourced from Dixon and Keighery In: Scheltema and Harris (1995) and Western Weeds (Hussey *et al*., 1997)

Note: It is strongly recommended that the herbicides are applied by appropriately trained personnel.

APPENDIX 2

WEED REMOVAL TECHNIQUES

APPENDIX 2
WEED REMOVAL TECHNIQUES

Adapted from Scheltema & Harris (1995) Managing Perth's Bushlands: Perth's Bushlands and How to Manage Them. Greening Western Australia, Perth.
For further information refer to the above text.

Physical Weed Removal

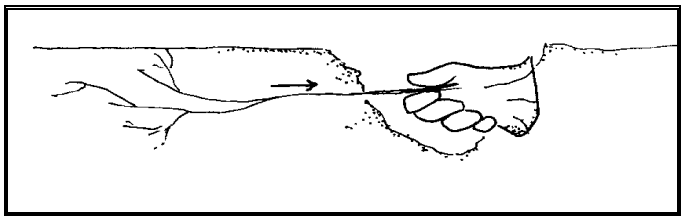
Hand Weeding

Small soft weeds, seedlings, annuals and tufted grasses that root directly from the base and have shallow roots can be pulled by hand.

For seedlings and small plants, hold the plant at ground level and pull. Note that the stem may break and reshoot if you hold the plant higher up the stem.

For larger plants, hold the stem at ground level and gently rock the plant back and forth until it comes away cleanly. If the plant has a spreading root system it may be necessary to pull individual lateral roots.

Always pull roots horizontally through the soil towards the stem of the plant, as this causes the least disturbance to the soil and reduces the chance of the roots breaking. Never pull large lateral roots upwards as they may break and will then need to be dug out.



Replace any disturbed soil and lightly sweep the mulch back over the spot. If this is not possible leave the weeded seedlings and soft leafy weeds on the ground. Larger plants with substantial roots should be left upside down on a rock or a branch so their roots do not come into contact with the soil. Plants that spread readily from cuttings should be removed from the site after being pulled up.

Removal With a Knife or a Trowel

This technique is useful for small soft leafy plants with a large root system or tap root, or for perennials which rely on a swollen root system.

Use one hand to push a narrow trowel or knife into the soil next to the plant. The knife should be pushed in with the side of the blade towards the plant. Push the handle towards the plant and pull the blade out of the soil.

Repeat at right angles and then carefully remove the plant. If the plant does not move, repeat the action around the other side of the plant, remembering to push the knife towards the plant.

Repair any disturbance to the soil or mulch.

The Crowning (or Pudding Basin) Cut

This is a useful technique for weeds which have their growing points below the surface, that is plants which have crowns, corms, rhizomes and clumped or tufted fibrous root systems. Examples include bamboo (*Arundo donax*), pampas grass (*Cortaderia selloana*) and paspalum (*Paspalum dilatatum*).

To use this technique, grasp the leaves or stem and hold them tightly so that the base of the plant is visible. (Plants with sharp leaves and stems should be cut back first before getting close to the base).

Insert either a knife or a lever close to the base of the plant at a slight angle, with the tip under the root system.

Cut through the roots close to the crown or the rhizome. Depending on the size of the plant, two or more cuts may be needed to sever all the roots.

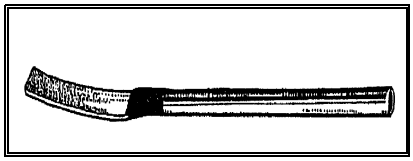
Remove the plant. Make sure that the hard 'crown' or base of the plant where the roots begin is completely removed, as the plant will usually re-shoot if any is left in the ground.

Digging out the Entire Plant

Plants with bulbs, corms or small tubers, such as watsonia and onion weed, must be completely removed from the soil. The reproductive parts of these plants can form small off-shoot bulbs or growing points which can form a new plant if broken off.

It is generally difficult to control these plants manually. Successful control methods for bulbous plants usually involving the application of herbicides. A description of manual control is provided for use in situations where there are small populations of weeds or where herbicides cannot be applied.

Prepare the area by moving back mulch and other vegetation. Use a trowel, Peter lever or a larger shovel to dig a narrow channel next to the stem until the main bulb is reached. Check the soil for adjoining bulbils. If bulbils are present, they must be removed together with soil, bagged and removed from the site. Check periodically for any regrowth.



Peter Lever

Plants which form tubers are especially difficult to eradicate manually as they may have several tubers connected by thin roots. Secondary tubers can develop even when buried deep in the soil. To remove tubers, clear a space around the plant and excavate down to the first tuber. Do not remove the tuber from the soil, but carefully excavate around and under it to locate secondary tubers. Remove all tubers, being careful not to leave any portion in the soil.

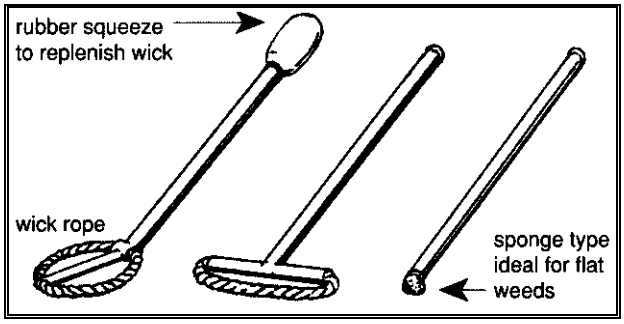
Chemical Weed Control

Herbicide Wipe

In this method the herbicide is applied by touching the weed species using either a wick applicator, a modified waterproof glove, or with foam attached to a modified hand sprayer.

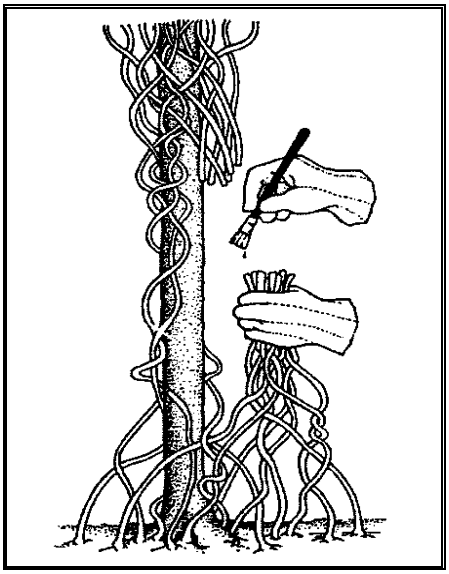
To modify a hand sprayer to use for wiping, attach a piece of foam over the nozzle. Re-moisten the foam by squeezing the trigger on the sprayer. Fill the hand sprayer with herbicide and wipe the herbicide-soaked foam attached to the sprayer against the weeds.

To modify a glove for applying herbicide, attach foam to the palm area of a waterproof (pesticide resistant) glove and wipe the herbicide-soaked foam against weeds. Re-moisten the foam on the glove from a small container such as a liquid detergent bottle (remove label and mark 'poison' on the bottle). For larger infestations dip the glove in a bucket containing herbicide. Be careful of any dripping and spillages.



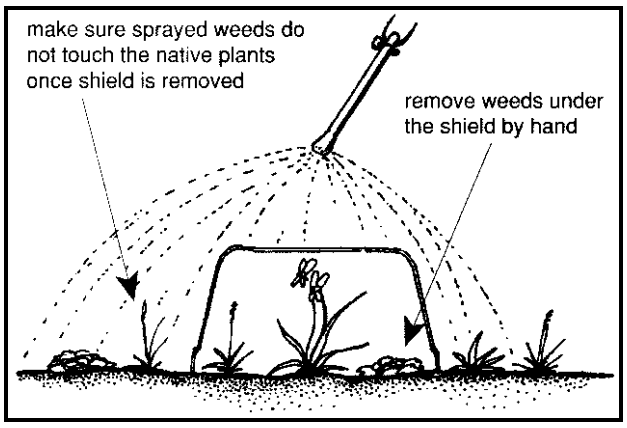
Cut Stump Method

Another variation is to cut down the tree or shrub and immediately paint herbicide onto the freshly cut surface using a paint brush. This method can also be used on creepers such as Bridal Creeper. Cut the vines and paint the cut stems with herbicide.



Spot Spraying

Another method of applying herbicides is to spot spray. Take care to avoid spraying non-target species unless using selective herbicides such as Fusilade. Special shields can be purchased or made to protect non-target species from the herbicide.



Blanket Spraying

Blanket spraying may be an option in areas of dense weeds with no native species present, or alternatively, when spraying with a selective herbicide such as Fusilade.

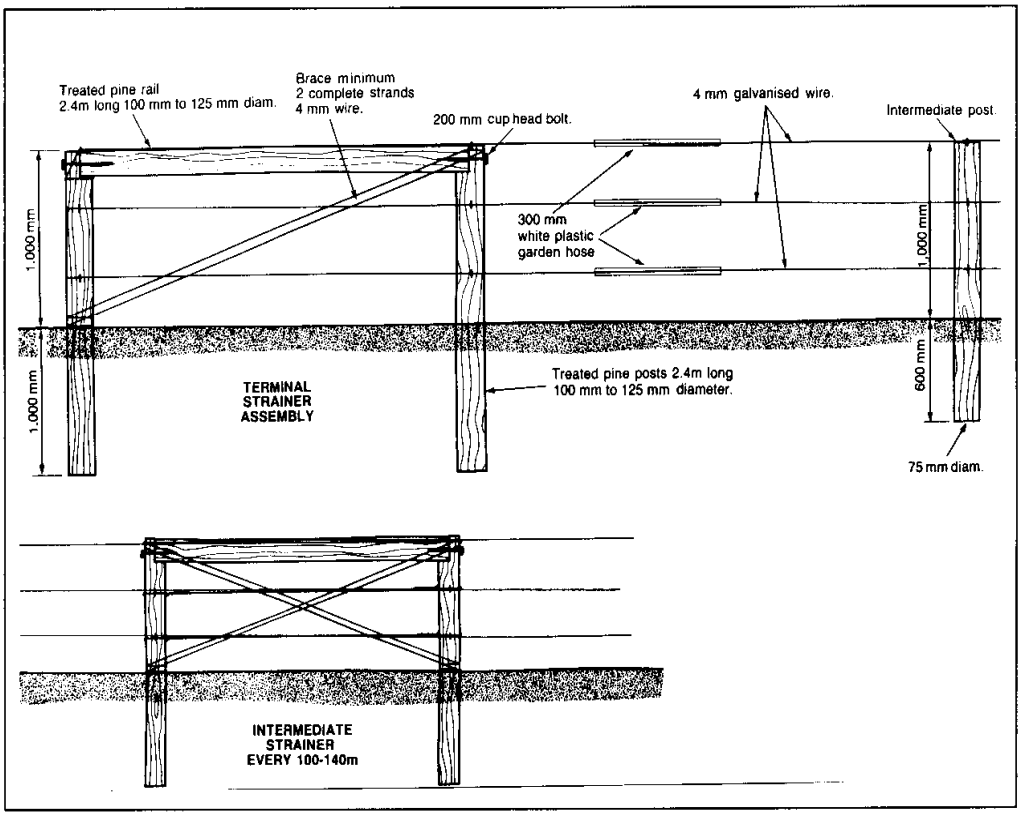
For selective blanket spraying use Fusilade at a rate of 2L to 4L/ha in 300L to 400L of water and add a wetting agent such as Agral 60 at the rate of 1mL in 1,000 millilitres. Other selective herbicides such as Targa, Sertin, and Verdict may also be suitable. Spray when the weed is actively growing (early June to no later than mid-August, or as specified).

Note: Weed control should be appropriately recorded to ensure an accurate history of weed management is maintained. See Dixon and Keighery In: Scheltema and Harris (1995) for more information.

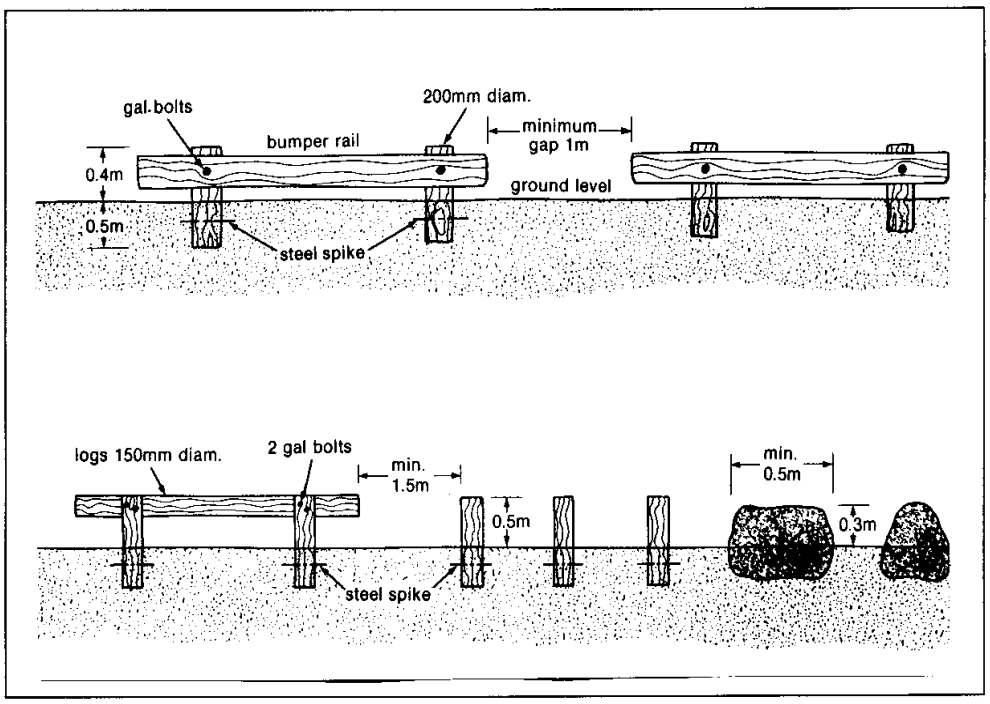
APPENDIX 3

FENCE AND GATE SPECIFICATIONS

APPENDIX 3
FENCING AND GATE SPECIFICATIONS
(Source: CALM, 1983)



Post and Wire Fence to be installed at the boundary of the Reserve



Picnic area bollards and parking bumper rails

APPENDIX 4

FAUNA LIST
(Recorded by Local Residents)

APPENDIX 4
CAPTAIN BAUDIN RESERVE - FAUNA SURVEY
(F.A.W.N.A Inc.) - November 1999

BIRDS
Silver Eye
Willy Wagtail
Grey Fantail
King Fishers
Wattle Birds
Magpie
Swallow
Crow
Blackfaced Cuckoo Shrike
Golden Whistler
Whistling Kite
Rainbow Bird

WATER BIRDS
Australian Pelican
Australian Darter
Whitefaced Heron
? Spoonbill
? Cormorant
Pacific Black Duck
Australian Shell Duck
Australian Grey Teal
Musk Duck
Hardhead
? Grebe
Dusky Moorhen

REPTILES
Bobtail Lizard
? Spiny Lizard
? Skinks
Long-necked Tortoise

FROGS
All Sorts

SPIDERS
Golden Orb
Christmas

INSECTS
Cicada
Butterflies
Dragon Flies

Reported by residents

Birds
Mud Lark
Kookaburra
Splendid Blue Wren
Buff - banded Rail

Reptiles
Dugite
Tiger Snake

Marsupials
Western Ring-tail Possum
Quenda

FERAL ANIMALS

Rabbits
Dogs
Foxes
Cats

? = unsure of which species within the group.