VEGETATION MANAGEMENT PLAN

FOR

PROPOSED AGED CARE FACILITY

AT

64-72 WARNERS BAY ROAD, WARNERS BAY

Prepared by:

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Site Details:	64-72 Warners Bay Road, Warners Bay
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Prepared for:	Bupa Care Services C/-APP Corporation
Reference No.	Warners Bay – APP
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Preface

This Vegetation Management Plan (VMP) provides background information and identifies a range of management actions to guide the future management of the site's riparian corridor and any other areas where vegetation is to be retained or rehabilitated, to promote flora and fauna conservation and the long term ecological stability of the site and surrounding areas.

Qualifications

This report was written by Lizzie MacDonald and Sarah Jones. The academic qualifications and professional experience of consultants involved in the project are documented in Appendix A.

Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL100533;
- Animal Research Authority (Trim File No: TRIM 11/5655) issued by NSW Department of Primary Industries; and
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: TRIM 11/5655) issued by Department of Primary Industries.

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1 INTRODUCTION

1.1 Purpose

Firebird ecoSultants Pty Ltd has been engaged by Bupa Australia to prepare a Vegetation Management Plan (VMP) for a proposed aged care facility development at 64-72 Warners Bay Road, Warners Bay (Lot 11 DP 656806, Lot 1, DP 515152, Lot 2 DP 515152, Lot 3 DP 515152 and Lot 4 DP 515152) ('the site') (see site plans in Appendix B). The purpose of this VMP is to provide a plan for the protection, rehabilitation and management of approximately 0.5 hectares of riparian native vegetation within the site. This VMP has been prepared in accordance with the *Vegetation Management Plan Guideline* (Lake Macquarie City Council (LMCC), 2012).

The specific aims of this VMP are to:

- Describe the existing riparian zone vegetation and the vegetation to be retained;
- Outline the vegetation to be cleared, the footprint of construction activities and the areas proposed to be rehabilitated;
- Provide details on protection measures for the site's riparian zone;
- Provide details on target weed species and weed control measures;
- Provide details on revegetation measures, including plant species composition, planting layout / densities and planting methods.
- Outline maintenance requirements for rehabilitated areas.
- Describe monitoring methodology, performance evaluation and reporting requirements.

1.2 Management Objectives

The objectives of this VMP are to:

- Maintain the site in a relatively weed free condition;
- Protect flora and fauna and their habitats within the site's riparian zone and any other areas of the site where native vegetation is to be retained or rehabilitated; and
- Implement monitoring and reporting strategies.

The VMP is composed of the following management strategies:

- Vegetation protection measures to provide for the protection of the site's riparian zone, during construction and in perpetuity;
- A weed management strategy, which will guide the control of exotic weed species on the site;

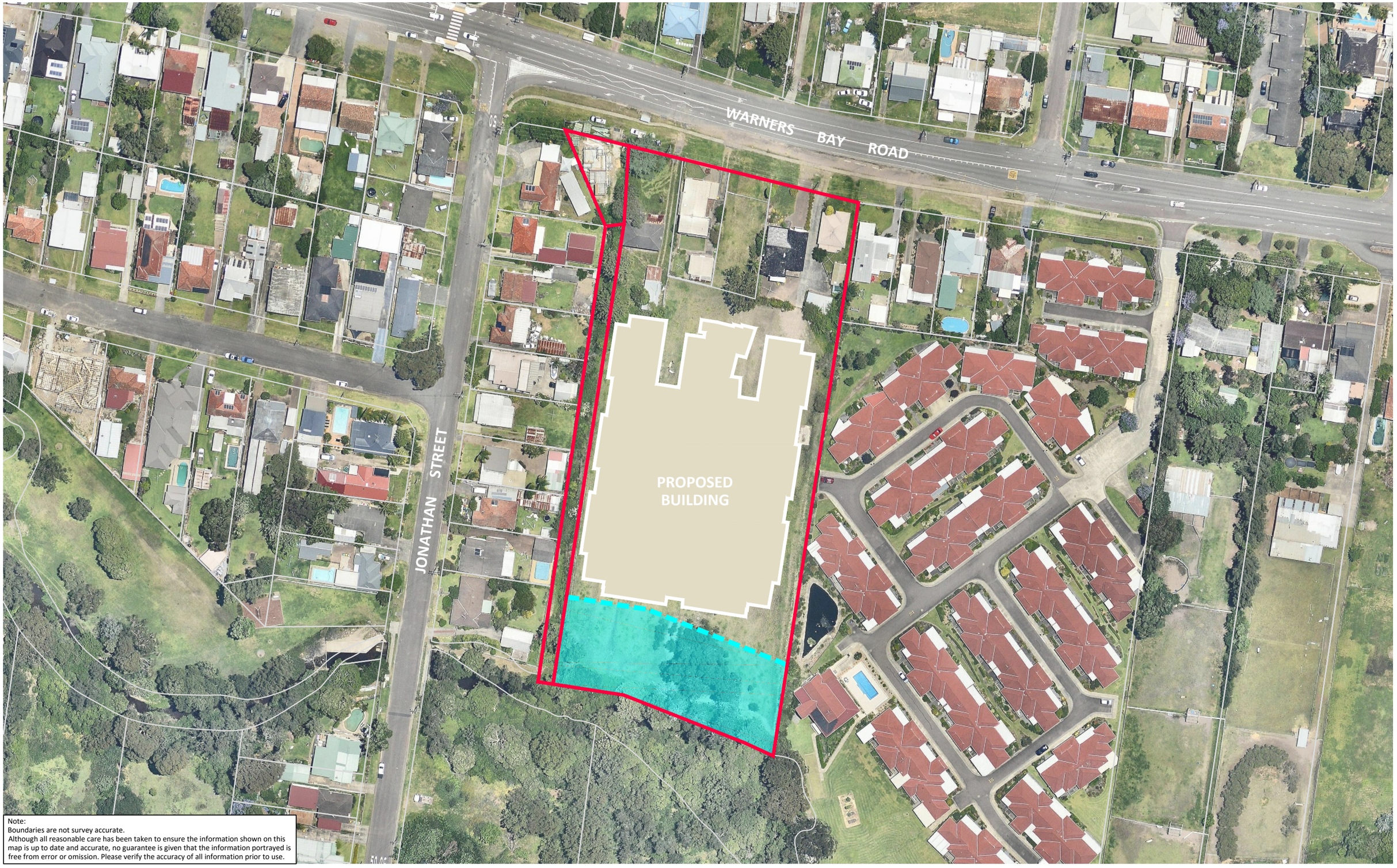
- A revegetation strategy, which will guide the restoration of the site's Vegetated Riparian Zone (VRZ) through planting with endemic, native plant species; and
- A monitoring and reporting program.

1.3 Existing Environment

The site fronts Warners Bay Road along its northern boundary, backs onto South Creek (3rd order stream) along its southern boundary and is bounded to the east and west by residential development. The site's current zoning under the Lake Macquarie Local Environmental Plan (LEP) 2014 includes R2 Low Density Residential (fronting Warners Bay Road and Lot 11 DP 656806) and RU4 Primary Production Small Lots (rear of the site). The offsite riparian corridor, adjacent to the southern boundary of the site, is zoned E2 Environmental Conservation.

The site currently contains three houses and associated buildings along the northern boundary, a stormwater easement along the western boundary and a large mainly cleared area that is currently being used as a horse paddock. A 30 m wide area along the southern boundary is part of the South Creek riparian zone. This area is mainly cleared, however a stand of *Casuarina glauca* (Swamp She-oak) occurs in the centre of this area and a mix of native and exotic flora species occur along the back boundary.

The portion of the site, to which this VMP applies, includes the full length of the riparian zone along the southern boundary, with a width of 30 m. This area represents the site's VRZ and is designed in accordance with the NSW Office of Water (2012) *Guidelines for Riparian Corridors on Waterfront Land*. Of further note, the proposal may seek to pipe the western boundary stormwater easement; if this occurs, the area will be revegetated and the strategies outlined in this VMP will also apply here. See Figure 1-1 for a site map and an indication of the areas to which this VMP applies.



Note:
Boundaries are not survey accurate.
Although all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

FIGURE 1-1:SITE MAP

CLIENT	Client
SITE DETAILS	No.64 Warners Bay Road Warners Bay
DATE	23 June 2016

Legend

- Subject Site
- 30m Vegetated Riparian Zone

NORTH

0 20 40 60

SCALE 1200 @ A3

PIXELDRAFTING

Ref No 1684 B

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firebird

1.4 Methodology

1.4.1 Literature Review

The preparation of this VMP included a literature review to determine the most up to date methods of weed control for exotic species present on the site and to help determine appropriate endemic, native species for planting. Sources referred to included, but were not limited to:

- Vegetation Mapping of Lake Macquarie LGA, Stages 1-5 (Bell and Driscoll, 2014)
- NSW WeedWise (NSW Department of Primary Industries (DPI), 2015)
- Noxious and Environmental Weed Control Handbook, 6th Edition (Ensbey, 2014)
- Six Maps Vegetation Map Viewer (Office of Environment and Heritage, 2015)

1.4.2 Site Inspection

A site inspection was undertaken on 10th December 2015. The purpose of this inspection was to:

- Identify flora species within and adjacent to the site, in order to confirm the vegetation community(ies) present;
- Identify areas of weed invasion;
- Map Weeds of National Significance (WONS) and noxious weeds, identified within the Lake Macquarie Local Control Area, under the NSW *Noxious Weeds Act 1*993 (NW Act);
- Inspect adjacent, offsite vegetation community(ies) to determine appropriate, endemic species for planting within the site; and
- Establish photo reference points for monitoring purposes.

Where possible, assessment methodology was undertaken in accordance with the *Lake Macquarie City Council Flora and Fauna Survey Guidelines Version 4.2, December 2012* (Lake Macquarie City Council, 2012). Given the relatively small area, the survey was undertaken using the "Random Meander Technique" described by Cropper (1993). Whilst survey work was undertaken within the bounds of the site, consideration has also been afforded to areas outside the site in order to appreciate the environmental context of the locality.

2 VEGETATION PROTECTION MEASURES

2.1 Protection of the Riparian Zone during Construction Works

The measures outlined in Table 2-1 are designed to protect the site's riparian zone during construction works.

Table 2-1: Protection Measures for the Riparian Zone

Action	Timing	Responsibility
Clearing limits must be identified on all design, construction and operational drawings. Clearing limits are to be delineated by installing high-visibility flagging tape with "No-Go" signage attached, as shown on the drawings.	Check and verify clearing limits, five days prior to the commencement of clearing. High visibility flagging tape and "No-Go" signage will be maintained until the date of construction completion.	Site Foreman.
Appropriate sediment and erosion controls will be implemented during the initial stages of construction. This will include sediment fencing, diversion drains and the use of geotextile fabric.	Prior to commencement of construction.	Environmental Manager.
Emergency response protocols, to address any potential contaminant spill or leak, will be clearly articulated in construction and operational plans.	Prior to commencement of construction.	Environmental Manager.
Earthworks (and all works in the vicinity of drainage lines) will be undertaken during dry weather conditions, where possible. Clearing of vegetation should not be undertaken during overland flow events.	During construction.	Environmental Manager.
Soil or mulch stockpiles will be located away from the riparian corridor and key stormwater flow paths, to limit potential transport of these substances to the drainage line.	During construction.	Environmental Manager.

2.2 Weed Control during Construction Works

The measures outlined in Table 2-2 are designed to limit the spread of weeds during construction works.

Table 2-2: Weed Control Measures

Action	Timing	Responsibility
All construction machinery used within the study area, to remove weeds, is to be thoroughly cleaned by removing all plant material and soil (potentially containing weed seeds and propagules).	During construction.	Environmental Manager.
Equipment used for treating weed infestation will be cleaned prior to moving to a new area within the site, to minimise the likelihood of transferring plant material	During construction.	Environmental Manager.

2.3 Protection of the Riparian Zone in Perpetuity

The on-ground measures outlined in this VMP will be combined with a restrictive covenant under Section 88B of the *Conveyancing Act 1919*. This will ensure that the site's riparian zone is protected in perpetuity.

3 REHABILITATION OF THE RIPARIAN ZONE

The following on-ground rehabilitation measures, including weed control and revegetation, are proposed for the site's riparian zone.

3.1 Site Establishment

3.1.1 Defining Borders

The northern boundary of the site's riparian zone is not well defined on the ground. Appropriate fencing or signage should be erected so that the area to be rehabilitated is clearly defined from the area to be developed. This may also apply to the eastern boundary of the stormwater easement, if this area is to be revegetated. It is suggested that a footpath could act as a 'barrier' in association with appropriate signage, indicating that the area to the south of the path should not be traversed.

If any fencing is to be used, it should be designed so that it does not restrict the movement of native fauna. Note that the current fence along the southern boundary of the site contains, in some parts, mesh and other restrictive barriers. This fence should be removed entirely, so that it allows free movement of native fauna.

3.1.2 Photo Reference Points

Two photo reference points have been established on the eastern and western sides of the riparian zone (see Figure 3-1). These photo reference points are to be used as a visual assessment of the progress of the works outlined in the VMP. From each photo reference point, a photo has been taken from the point, into the area to be rehabilitated (see Appendix C). Due to the small size of the site, these photo reference points have not been marked on the ground. Rather, their locations can be identified at later stages using Figure 3-1 and the GPS locations provided in Table 3-1.

Table 3-1: Photo Reference Points and GPS Locations

Photo Reference Point	Easting	Northing
Photo reference point 1	373997.28	6349624.02
Photo reference point 2	374061.37	6349606.36

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Boundaries are not survey accurate.
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FIGURE 3-1: PHOTO REFERENCE POINTS

CLIENT Bupa
SITE DETAILS No.64 Warners Bay Road Warners Bay
DATE 28 June 2016

Legend
Subject Site
Photo Reference Point

NORTH
0 20 40 60
SCALE 1200 @ A3

PIXELDRAFTING

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Ref No 1684 B

3.2 Weed Management Strategy

3.2.1 Weed Distribution within the Site

The site contains a high abundance and diversity of weed species. The exotic canopy species, *Jacaranda mimosifolia* (Jacaranda) and *Salix babylonica* (Weeping Willow) are scattered along the southern boundary. This area also contains a small tree layer of *Solanum mauritianum* (Wild Tobacco) and *Sambucus nigra* (Elderberry) and a dense understorey of *Lantana camara* (Lantana) and *Cestrum parqui* (Green Cestrum). The ground layer consists mainly of *Cenchrus clandestinus* (Kikuyu), *Tradescantia* spp. (Wandering Jew), *Conyza sumatrensis* (Tall Fleabane) and *Verbena bonariensis* (Purpletop).

The western boundary stormwater easement contains dense infestations of *Ageratina adenophora* (Crofton Weed), *Chrysanthemoides monilifera* subsp. *rotundata* (Bitou Bush), *Colocasia esculenta* (Taro), *L. camara* (Lantana) and *Ipomoea cairica* (Coastal Morning Glory).

Several species recorded on the site are listed as WONS or as noxious in the Lake Macquarie LGA. Refer to Table 3-2 for a list of WONS and noxious weeds recorded and Figure 4-1 for their locations within the relevant areas of the site. For a full list of recorded weed species, see the flora species list in Appendix D.

Table 3-2: Weeds of National Significance (WONS) and Noxious Weeds Recorded on the Site

Species	Common Name	Category	Legal Requirements
Ageratina adenophora	Crofton Weed	Noxious Class 4	Locally Controlled Weed - *The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread.*
Chrysanthemoides monilifera subsp. *Rotundata*	Bitou Bush	WONS/Noxious Class 4	Locally Controlled Weed - *The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread.*
Senecio madagascariensis	Fireweed	WONS/Noxious Class 4	Locally Controlled Weed - *The plant must not be sold, propagated or knowingly distributed.*
Lantana camara	Lantana	WONS	N/A
Cestrum parqui	Green Cestrum	Noxious Class 4	Regionally Controlled Weed -*The plant must be fully and continuously suppressed and*

Species	Common Name	Category	Legal Requirements
			destroyed
Carduus nutans	Nodding Thistle	Noxious Class 4	Locally Controlled Weed *The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread*
Salix species	Willows	WONS/Noxious Class 4	Locally Controlled Weed *The plant must not be sold, propagated or knowingly distributed*

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FIGURE 4-1: LOCATION OF WEEDS OF NATIONAL SIGNIFICANCE AND NOXIOUS WEEDS

CLIENT	Bupa
SITE DETAILS	No.64 Warners Bay Road Warners Bay
DATE	28 June 2016

Legend
- Subject Site
- Weed

NORTH

0 20 40 60

SCALE 1200 @ A3

PIXELDRAFTING

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3.2.2 Initial and Ongoing Weed Management Procedures

Weeds compete with newly established plants for moisture. Many weed species are more efficient at drawing moisture from the soil than new seedlings, typically resulting in reduced growth of native seedlings. Weed removal should be undertaken prior to revegetation and in accordance with the NW Act.

Weed management should be undertaken by a locally based, suitably qualified bushland regeneration company. The initial site visit should focus primarily upon controlling mature individuals. Priority should be given to the WONS and noxious weeds listed in Table 2-2; however, as common best practice, weed management should also aim to control all environmental weeds on the site.

Ongoing maintenance should occur for the remainder of the three year period of the VMP, to diminish the soil seed bank of weeds; plants should not be allowed to achieve a reproductive stage in their life cycles. During the first year, site visits should occur at least twice each month with the visits spread out approximately every two weeks. This is especially required during the warmer, wetter months in spring and summer, as some annual weed species can grow and develop seed within a three week period.

After the first year, provided that weed abundances have diminished, site visits should occur once a month for the remainder of the VMP's three year period. If, during the monitoring and reporting process (see Section 2.3), the bushland management or ecological consultant determines that weed populations have been reduced to minor occurrences, site visits can be scaled back to once every two months.

The following sequential steps are recommended for each site visit:

1. Areas with relatively low weed abundance should be targeted first, so as to contain existing infestations. Reproductively mature plants should also be removed as a priority.
2. Works should include a sweep of the entire area to remove weeds in areas where use of herbicide will have an unacceptable toll on native plants. Any weeds occurring within tree guards or within dense patches of native plants (including native grasses) should be removed by hand.
3. Works should then include a sweep of the entire site, treating or removing all weeds in open areas.

3.2.3 Weed Control Techniques

Weed management should integrate a variety of control techniques, taking into account knowledge of the specific biological and ecological characteristics of the weed species present. In this case, a combination of chemical and physical removal should be incorporated. Appendix E provides a list of weed control techniques for each species recorded in the site. Control techniques for other commonly occurring species are also included, in the event that any species were overlooked during the site inspection.

Chemical removal should involve the use of a non-selective Glyphosphate herbicide, with a surfactant that is formulated for use in environmentally sensitive areas. Care

should be taken to avoid herbicide drift onto non-target species. For instance, spraying should be done only with a knapsack sprayer or smaller spraying device; a cone shield should be used, where necessary; and spraying should be done only on days with low wind speeds.

Note that, under the *Pesticides Act 1999*, there can be legal restrictions and permit requirements for use of specific herbicides for specific plants; chemical labels and permit requirements always need to be researched prior to herbicide application. Some control methods listed in Appendix E will require a permit from the Australian Pesticides and Veterinary Management Authority.

3.3 Revegetation Strategy

3.3.1 Native Vegetation within the Site and Surrounding area

The riparian zone within the site is mainly cleared. Native species occurrences are limited to a stand of *Casuarina glaucina* (Swamp She-oak) in the centre of the area, some individuals of *Melaleuca styphelioides* (Prickly-leaved Paperbark) and *Eucalyptus piperita* (Sydney Peppermint) along the back boundary and some occurrences of native climbers including *Passiflora herbertiana* (Native Passionfruit), *Parsonisa straminea* (Common Silkpod) and *Cayratia clematidea* (Native Grape). Native species recorded in the western boundary stormwater easement included *Sambucus gaudichaudiana* (White Elderberry), *Typha orientalis* (Bullrush), *Cyathea australis* (Rough Tree Fern) and *Hypolepis muelleri* (Harsh Ground Fern). Refer to Appendix D for a full list of recorded flora species within the site.

The off-site South Creek riparian corridor, adjacent to the site's southern boundary, contains dense infestations of mid stratum exotic species including *L. camara* (Lantana). Native species recorded here included *M. styphelioides* (Prickly-leaved Paperbark) in the mid stratum and *C. glaucina* (Swamp She-oak), *Angophora floribunda* (Rough-barked Apple), *E. tereticornis* (Forest Red Gum), *E. resinifera* (Red Mahogany), *E. piperita* (Sydney Peppermint) and *Corymbia maculata* (Spotted Gum) in the upper stratum. This area has been previously mapped as MU11 Coastal Sheltered Apple – Peppermint Forest (Bell and Driscoll, 2014). It is considered though that the vegetation here would be consistent with MU38 Redgum Rough-barked Apple Forest, with potentially some intergrade with MU11 Coastal Sheltered Apple – Peppermint Forest. Redgum Rough-barked Apple Forest is an Endangered Ecological Community (EEC) as it falls within the listing of River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions, under the *Threatened Species Conservation Act (1995)* (TSC Act).

3.3.2 Revegetation Species

Appendix F provides a list from which species to be planted should be selected. This list is based on observations of species recorded on the site and in the surrounding areas of intact native vegetation, as well as on vegetation community descriptions from Bell and Driscoll's (2014) mapping of the area. In this case, the list includes species typical of Redgum Rough-barked Apple Forest. Note that *C. glaucina* (Swamp She-oak) has not been included in the planting list as it is already well represented within the site.

3.3.3 Plant Provenance

All tubestock should be of local provenance, and sourced from nurseries that specialise in growing seedlings of native plants with seed sourced from local bushland, to avoid planting of human created cultivars. It is likely that not all species will be available from nurseries. For this reason it is not expected that all species will be planted; however it is important to note that as many species as are available from the list should be planted, to maximise biodiversity and resilience of the vegetation community.

3.3.4 Planting Density Guide

Planting is only required in areas that do not already contain native vegetation in a particular strata; however as the site is mainly cleared, plantings of species in all strata is required in much of the area. Table 3-3 contains an approximate guide on appropriate planting densities. Groundcover individuals can be planted clumped within each square metre to allow ease of access for weed control of the site.

Table 3-3: Planting Density Guide

Stratum	Planting Density
Upper Stratum - Tree Canopy	1 unit/20 m² in open areas
Mid Stratum 1 - Small Tree	1 unit/10 m²
Mid Stratum 2 – Shrubs	1 unit/5 m²
Lower Stratum – Groundcover	4 units/1 m²

3.3.5 Planting Methods

For optimal results, the following steps should be followed when planting tube stock:

1. Water plants the day before, and prior to, planting.
2. Holes for tube stock should be dug deep enough so that at least a few centimetres of the plant are below the soil surface.
3. When remove the seedling from the pot, aim to keep the main root ball undisturbed.
4. When planting, replace the soil around the seedling and press the soil down to remove air pockets.
5. Plants should be watered immediately after planting

6. A layer of organic mulch, leaf litter or layers of wet newspaper should be placed around the plant, to reduce water loss and inhibit weed growth. Note that mulch should not be used near the edge of a water course if a sediment fence or screen is not used. This may apply to plantings along the southern most edge of the site.
7. A tree guard should be placed around each plant (or clump of groundcover plants), to protect from herbivory and herbicide drift.

3.3.6 Plant Protection

Stakes and ties should be used if necessary to assist in plant growth and protection. Tubestock may require protection with a polysleeve or tree guard from animal grazing. Smaller guards may be required to prevent rabbits or hares from destroying young plants. Tree guards also aid in moisture retention

3.3.7 Maintenance of Plantings

During weed control site visits, the contracted bushland regeneration team should monitor the plantings for death of individual plants. Any dead plants should be replaced during subsequent site visits, with another individual of the same vegetation form.

3.3.8 Watering

If soil is dry at the time of planting, each tubestock plant should be watered within two hours of planting. Watering of plants may (depending on local climactic condition) be required several times throughout the first 12 months following planting.

3.3.9 Timing

Planting should occur no later than six months after completion of primary weeding and ideally in autumn when climatic conditions are the most stable for new plantings. Planting should occur in spring if the timing of the construction period does not allow for autumn planting.

4 MONITORING AND REPORTING

4.1.1 Monitoring

A monitoring program will be undertaken measure the success of revegetation efforts. Monitoring will include qualitative (visual/photographs) and quantitative (statistical/quadrats) assessment.

A qualified bushland management or ecological consultant will carry out a monitoring program to ensure the measures outlined in this VMP are implemented in relation to the works schedule (see Appendix G). The monitoring program will be carried out every six months, until the end of the three year duration of the VMP.

Aspects of the monitoring program will include the following:

- A photograph at each photo reference point for a visual assessment of site progress;
- Estimates of the success rate of plantings and natural regeneration, and assessment of plant replacement requirements;
- Estimates of weed abundance and locations of WONS and noxious weeds; and
- Recommendations for corrective measures and/or vegetation management.

4.1.2 Reporting

Monitoring reports are to be submitted to Lake Macquarie City Council (LMCC) twice per year. These reports should detail the progress of the revegetation works, including the need for any replacement plantings and additional weed control. Reports will also contain a photographic record of the photo point monitoring. A final report certifying the completion of the works will be submitted to LMCC at the end of the VMP period.

The reports should be based around the points outlined in Section 2.3.1 and the performance criteria outlined in the works schedule in Appendix F. The final summary report must be submitted to LMCC for approval, and will certify completion of the works or recommendations for further vegetation management at the end of the period. Council may also recommend further works and monitoring to be undertaken following submission of the final report.

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APPENDIX A QUALIFICATIONS

Curriculum Vitae

Sarah Jones
Bushfire Consultant / Ecologist

Qualifications / Licences

- Fire Protection Authority of Australia (FPAA) Member
- BPAD- A (Alternate Solutions) Bushfire Planning and Design Certified Practitioner – Certification No: PBD-PA-26512
- Graduate Diploma in Design for Bush Fire Prone Areas (University of Western Sydney)
- Bachelor of Environmental Science (The University of Newcastle)
- RFS / PIA NSW Consulting Planners Bushfire Training Course
- NSW Scientific Licence SL100533
- NSW Drivers Licence (Class C)
- WorkCover NSW OHS General Induction for Construction Work in NSW

Areas of Expertise

Sarah Jones is an ecologist and bushfire planning specialist with over 14 years ecological experience within both the consulting, and the government sector. Sarah has an extensive range of Ecological Assessment reporting experience and ecological field experience. Experience within the consulting industry has primarily included a wide range of flora assessment disciplines as required by a wide range of public and private clients. Sarah has a strong grounding in threatened flora species, endangered ecological communities and populations. She has experience in the preparation of environment impact assessments in terrestrial environments, constraints and opportunities reporting, fauna monitoring and survey, vegetation and conservation management plans, Part 3A and Section 5A Assessments under the EP&A Act, Local Environment Studies, Review of Environmental Factors, Referrals, and Species Impact Statements.

Employment History

Bushfire Consultant & Ecologist
Firebird ecoSultants Pty Ltd
Jan 2011 to present

Consultant Role Development Planner – (Flora and Fauna)
Lake Macquarie City Council
Currently June 2013 – Until December 2014
August - October 2012

Senior Bushfire Consultant / Ecologist
RPS Group plc.
June 2006 to Jan 2011

Development Planner (Flora & Fauna)
Lake Macquarie City Council
Jan 2005 to Sept 2005
Bushfire Consultant / Ecologist

Ecologist / Bushfire Consultant
Harper Somers O'Sullivan
Jan 2001 to Jan 2005

Ecologist
Ecotone Environmental Consultants, Waratah, NSW
Jan 2001 – Nov 2001

Volunteer Environmental Educator
Community Partnership Newcastle City Council
Sept 2000 – Dec 2000

Firebird ecoSultants Pty Ltd
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Curriculum Vitae

Lizzie MacDonald
Ecologist
B.Sc, GradCert.EnvMgt&Sus

Qualifications / Licences

- Bachelor of Science (Macquarie University)
- Graduate Certificate in Environmental Management and Sustainability (University of Newcastle)
- Niche Wildlife School, General Survey & ID Management
- WorkCover NSW, National WHS General Construction Induction Training

Areas of Expertise

Lizzie MacDonald is an ecologist with over 10 years of experience in the environmental management field; she has worked extensively in the government and non-profit sectors and has recently entered the world of consulting. In particular, Lizzie has a strong background in conservation management planning, ecological field surveys and biodiversity assessment, monitoring and reporting.

Lizzie's experience in the consulting industry has included environmental impact assessment, flora and fauna survey and monitoring, targeted threatened species survey and monitoring, vegetation and conservation management plans, Review of Environmental Factors, constraints and opportunities reporting and Part 3A and Section 5A assessments under the *Environmental Planning and Assessment Act 1975*. Lizzie is also an experienced fauna handler and has supervised tree clearing works.

Employment History

Ecologist
Firebird ecoSultants Pty Ltd
Aug 2015 to present

Ecologist
Fraser Ecological
Jan 2015 – Sep 2015

Project Officer (Biodiversity and Sustainable Agriculture)
NSW Department of Primary Industries
Dec 2008 – Jan 2013

Conservation Management Officer (Fisheries)
NSW Department of Primary Industries
Jun 2008 to Dec 2008

Project Officer (Aquaculture)
NSW Department of Primary Industries
Jan 2008 – Jun 2008

Research Assistant
Humane Society International
2004-2007

APPENDIX B SITE PLANS

APPENDIX C PHOTO REFERENCE POINTS

Photo Reference Point 1

Looking southeast into site from western side.

Photo Reference Point 2

Looking southwest into site from eastern side.

APPENDIX D RECORDED FLORA SPECIES

Family	Species	Common Name	Weeds
Adoxaceae	*Sambucus gaudichaudiana*	White Elderberry	
	Sambucus nigra	Elderberry	Environmental weed
Apocynaceae	*Parsonisa straminea*	Common Silkpod	
Araceae	*Colocasia esculenta*	Taro	Environmental weed
Asteraceae	*Carduus nutans*	Nodding Thistle	Class 4
	Chrysanthemoides monilifera subsp. *rotundata*	Bitou Bush	Class 4/WONS
	Conyza sumatrensis	Tall Fleabane	Environmental weed
	Ageratina adenophora	Crofton weed	Class 4
	Bidens pilosa	Cobbler's Pegs	Environmental weed
	Senecio madagascariensis	Fireweed	Class 4/WONS
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda	Environmental weed
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle	Environmental weed
Casuarinaceae	*Casuarina glauca*	Swamp She-oak	
Commelinaceae	*Tradescantia fluminensis*	Wandering Jew	Environmental weed
Convolvulaceae	*Ipomoea cairica*	Coastal Morning Glory	Environmental weed
Cyatheaceae	*Cyathea australis*	Rough Tree Fern	
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern	
Fabaceae	*Erythrina x sykessi*	Common Coral Tree	Environmental weed
Lauraceae	*Cinnamomum camphora*	Camphor laurel	Environmental weed
Moraceae	*Morus* spp.	Mulberry Tree	Environmental weed
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Paperbark	
	Eucalyptus piperita	Sydney Peppermint	
	Eucalyptus tereticornis	Forest Red Gum (OFFSITE)	

	Eucalyptus resinifera	Red Mahognay (OFFSITE)	
	Angophora floribunda	Rough-barked Apple (OFFSITE)	
	Corymbia maculata	Spotted Gum (OFFSITE)	
Passifloraceae	*Passiflora herbertiana*	Native Passionfruit	
Poaceae	*Cenchrus clandestinus*	Kikuyu	Environmental weed
	Paspalum orbiculare	Ditch Millet	
Salicaceae	*Salix babylonica*	Weeping Willow	Class 4/WONS
Solanaceae	*Cestrum parqui*	Green Cestrum	Class 3
	Solanum mauritianum	Wild Tobacco	Environmental weed
Typhaceae	*Typha orientalis*	Bullrush	
Verbenaceae	*Lantana camara*	Lantana	WONS
	Verbena bonariensis	Purpletop	Environmental weed
Vitaceae	*Cayratia clematidea*	Native Grape	

Class 3 – Species listed as a Class 3 noxious weed in the Lake Macquarie LGA
Class 4 – Species listed as a Class 4 noxious weed in the Lake Macquarie LGA
WONS – Weed of National Significance

APPENDIX E WEED CONTROL TECHNIQUES

Family	Species	Common Name	Status	Control Technique
Acanthaceae	*Asystasia gangetica*	Chinese Violet	Class 1	• Seedlings can be hand pulled; however this can be difficult due to deep root system and brittle stems. Bag and remove plant pieces from site.
	Thunbergia alata	Black Eyed Susan		• Hand pull or dig up juveniles. • Foliar spray.
	Sambucus nigra	Elderberry		• For seedlings and juveniles, hand weed or foliar spray. • Various chemical control methods for larger individuals including drill-injection and cut and paint.
Araceae	*Colocasia esculenta*	Taro		• For individual plants and small infestations, dig up and dry out rhizome. • Foliar spray. • Cut and paint.
	Zantedeschia aethiopica	Arum Lilly		• Small infestation may be dug out. Remove entire rhizome and destroy off-site. • Foliar spray.
Asparagaceae	*Protasparagus aethiopicus*	Asparagus Fern	Class 2	• For small infestations, plants may be dug out. Digging out larger infestations would result in unacceptable soil disturbance. Rhizomes, tubers and fruits should be bagged and removed from site. • Foliar spray. • Cut and paint. • Cut and scrape vine stems with undiluted Glyphosphate.
Asteraceae	*Carduus nutans*	Nodding Thistle	Class 4	• Spot spray juvenile plants. • Dig up mature plants, removing at least the top 10 cm of root system.

	Chrysanthemoides monilifera subsp. *rotundata*	Bitou Bush	Class 4	• Hand weed seedlings • Slash using brushcutter, or hand cut with loppers, and spray regrowth foliage. • Cut near ground level and paint with undiluted Glyphosphate and spray regrowth foliage.
	Conyza sumatrensis	Tall Fleabane		• Hand weed. • Foliar spray.
	Ageratina adenophora	Crofton weed	Class 4	• Hand weed. • Foliar spray. • Slash large individuals with brushcutter and spray regrowth foliage.
	Bidens pilosa	Cobbler's Pegs		• Hand weed. • Foliar spray.
	Senecio madagascariensis	Fireweed	Class 4/WONS	• Hand weed. • Foliar spray.
Basellaceae	*Anredera cordifolia*	Madiera Vine		• Cut and scrape vine stems with undiluted Glyphosphate. • Foliar spray. • Small infestations, or regrowth after spraying, can be hand removed. Bag and remove tubers, bulbs, and all vegetative material. Cutting and pulling vines from canopy should be avoided as this disperses viable bulbs.
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda		• For seedlings and juveniles, hand weed or foliar spray • Various chemical control methods for larger individuals, including drill-injection and cut and paint.
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle		• Cut and scrape vine stems with undiluted Glyphosphate. • Hand weed seedlings. • Spray low lying foliage, regrowth foliage and seedlings. • Roots of plant can be dug up with mattock or other

				digging device.
Commelinaceae	*Tradescantia fluminensis*	Wandering Jew		• Hand weed. Bag and remove all plant parts. • Foliar spray.
Convolvulaceae	*Ipomoea cairica*	Coastal Morning Glory		• Hand weed. • Foliar spray.
Euphorbiaceae	*Ricinus communis*	Castor Oil Plant		• Individuals and small infestations may be hand pulled, ensuring roots are removed. • Cut and paint. • Foliar spray.
Fabaceae	*Erythrina x sykessi*	Common Coral Tree		• For seedlings and juveniles, hand weed or foliar spray. • Various chemical control methods for larger individuals including drill-injection and cut and paint.
Hypericaceae	*Hypericum perforatum*	St John's Wort	Class 3	• Foliar spray. • Hand weeding ineffective, as plants will grow from root buds, unless entire root structure is removed.
Lauraceae	*Cinnamomum camphora*	Camphor laurel		• For seedlings and juveniles, hand weed or foliar spray. • Various chemical control methods for larger individuals including drill-injection and cut and paint.
Lomariopsidaceae	*Nephrolepis cordifolia*	Fishbone Fern		• Plants can be easily dug up or hand pulled. Water tubers will not regrow; however as they are closely attached to the thin rhizome, it is best to remove as much of the root network as possible. Bag and remove plant parts. • Foliar spray.
Moraceae	*Morus* spp.	Mulberry Tree		• For juveniles, hand pull or foliar spray. • Various chemical control methods for larger individuals, including cut and paint and basal bark treatment.
Ochna serrulata	*Ochna serrulata*	Mickey Mouse Plant		• Hand pulling (even for tiny seedlings) is ineffective due to the extended taproot.

				• Chemical control methods for both juveniles and mature plants include cut and paint and basal bark treatment. • Follow up treatment may be needed on regrowth stems around base of plant.
Oleaceae	*Olea europaea* spp. *africana*	African Olive		• For juveniles, hand pull or foliar spray. • For larger individuals, cut stems and paint with undiluted Glyphosphate.
	Ligustrum lucidum	Broad-leaved Privet		• For juveniles and regrowth foliage, hand pull or foliar spray. • For larger individuals, cut stems and paint with undiluted Glyphosphate.
	Ligustrum sinense	Small-leaved Privet		• For juveniles and regrowth foliage, hand pull or foliar spray. • For larger individuals, cut stems and paint with undiluted Glyphosphate.
Poaceae	*Cenchrus clandestinus*	Kikuyu		• Hand weed. • Foliar spray.
	Cortaderia selloana	Pampas Grass		• Hand weed. • Foliar spray.
Rosaceae	*Rubus fruticosus*	Blackberry	Class 4/WONS	• Protective clothing needed due to thorns. • Use loppers to cut close to stem base and apply undiluted Glyphosphate. Bag and remove cut foliage. • Spray regrowth.
Salicaceae	*Salix babylonica*	Weeping Willow	Class 4/WONS	• For juvenile and seedlings, foliar spray or hand weed. Bag and remove plant parts. • Kill larger individuals with stem injection. Leave trees for 12 months after herbicide application to ensure successful kill. • Remove and destroy live plant/twig fragments.

Solanaceae	*Cestrum parqui*	Green Cestrum	Class 3	• Foliar spray. • Dig up plants, removing all yellow roots. Remove and destroy roots.
	Solanum mauritianum	Wild Tobacco		• Additional PPE (dust mask, long sleeve shirt/pants, gloves) required as plant may shed fine hairs. • Hand weed juveniles. • Mature individuals can be cut and painted with undiluted Glyphosphate.
Verbenaceae	*Lantana camara*	Lantana	WONS	• Hand weed juveniles and regrowth. • Foliar spray. • Slash using brushcutter, or hand cut with loppers, and spray regrowth foliage. • Cut near ground level and paint with undiluted Glyphosphate. Some individuals will have stumps which will still regrow foliage, spray regrowth foliage.
	Verbena bonariensis	Purpletop		• Hand weed. • Foliar spray.

Class 1 – Species listed as Class 1 Noxious Weed in the Lake Macquarie LGA
Class 3 – Species listed as Class 3 Noxious Weed in the Lake Macquarie LGA
Class 4 – Species listed as Class 4 Noxious Weed in the Lake Macquarie LGA
WONS – Weed of National Significance

APPENDIX F REVEGETATION SPECIES LIST

Suitable Planting Species for Redgum Rough-barked Apple Forest

Form	Family	Species	Common Name
Tree	Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
	Myrtaceae	*Angophora floribunda*	Rough-barked Apple
	Myrtaceae	*Eucalyptus resinifera subsp. resinifera*	Red Mahogany
	Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Small Tree	Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree
	Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Paperbark
	Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark
	Casuarinaceae	*Allocasuarina littoralis*	Forest She-oak
Shrub	Myrtaceae	*Leptospermum polygalifolium*	Tantoon
	Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush
	Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop Bush
	Mimosoideae	*Acacia implexa*	Hickory Wattle
	Mimosoideae	*Acacia longifolia*	Sydney Golden Wattle
	Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum
	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
	Santalaceae	*Exocarpus cupressiformis*	Native Cherry
	Rosaceae	*Rubus parvifolius*	Native Raspberry
Ground fern	Dennstaedtiaceae	*Pteridium esculentum*	Bracken Fern
	Pteridaceae	*Adiantum aethiopicum*	Common Maidenhair
Grass	Poaceae	*Imperata cylindrical*	Blady Grass
	Poaceae	*Oplismenus aemulus*	

	Poaceae	*Entolasia stricta*	Wiry Panic
	Poaceae	*Entolasia marginata*	
	Poaceae	*Themeda australis*	Kangaroo Grass
	Poaceae	*Microlaena stipoides var. stipoides*	Weeping Grass
	Poaceae	*Aristida vagans*	Threeawn Speargrass
Graminoid	Lomandraceae	*Lomandra longifolia*	Spiny-head Mat Rush
	Phormiaceae	*Dianella caerulea* var. *assera*	Blue Flax-lily
	Phormiaceae	*Dianella caerulea* var. *caerulea*	Blue Flax-lily
Sedge	Cyperaceae	*Gahnia clarkei*	Tall Saw Sedge
Herb	Violaceae	*Viola hederacea*	Ivy-leaved Violet
	Haloragaceae	*Gonocarpus tetragynus*	
	Lobeliaceae	*Pratia purpurascens*	Whiteroot
	Geraniaceae	*Geranium homeanum*	
	Apiaceae	*Hydrocotyle sibthorpioides*	
Climber	Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
	Convolvulaceae	*Polymeria calycina*	
	Vitaceae	*Cayratia clematidea*	Native Grape
	Menispermaceae	*Stephania japonica var. discolor*	Snake Vine
	Fabaceae	*Glycine clandestina*	Twinning Glycine
	Fabaceae	*Glycine microphylla*	Small-leaf Glycine

APPENDIX G SCHEDULE OF WORKS

Year	Action	Responsibility	Performance Criterion	Timing (since commencement of VMP)
Year 1	**Site establishment** Demarcation of site boundaries between areas to be rehabilitated and areas to be developed. Removal of any fencing that restricts wildlife movement.	Property owner or subcontractor	Signage or fencing installed along northern boundary of rehabilitation area and, if applicable, eastern boundary of stormwater easement. Fencing restrictive to wildlife movement, removed from southern boundary of site.	Immediately
	Primary weed control Site visits twice a month to remove main weed infestations and, in particular mature individuals of WONS and noxious weeds.	Bush regeneration contractor	Main weed infestations and WONS and noxious weeds removed from site. Reproductively mature plants absent.	6 months
	Revegetation works Plant where there are gaps in each vegetation strata, using the revegetation species list in Appendix E. This is required in much of the site.	Bush regeneration contractor	Native plants have been planted where there are gaps in any vegetation strata and where species diversity is lacking.	6 months
	Monitoring and reporting	Ecological or bushland management consultant	First biannual inspection completed and progress report submitted to Council.	6 months
	Secondary weed control Site visits once a month or once every two months, if weed populations have been reduced to minor occurrences.	Bush regeneration contractor	Weed regrowth removed. Control of annual weeds has commenced.	12 months
	Maintenance of plantings Plants watered when drought stressed, during site visits. Dead plants replaced.	Bush regeneration contractor	No gaps occurring in plantings. Plants in good health.	12 months
	Monitoring and reporting	Ecological or bushland management consultant	Second biannual inspection completed and progress report submitted to Council.	12 months
Year 2	**Secondary weed control** Site visits once a month or once every two months, if weed populations have been reduced to minor occurrences.	Bush regeneration contractor	Weed regrowth removed. Annual weeds controlled.	18 months
	Maintenance of plantings Plants watered when drought stressed, during site visits.	Bush regeneration contractor	No gaps occurring in plantings. Plants in good health.	18 months

	Dead plants replaced.			
	Monitoring and reporting	Ecological or bushland management consultant	Third biannual inspection completed and progress report submitted to Council.	18 months
	Secondary weed control Site visits once a month or once every two months, if weed populations have been reduced to minor occurrences.	Bush regeneration contractor	100% eradication of noxious and transformer weeds. >90% native groundcover.	24 months
	Maintenance of plantings Plants watered when drought stressed, during site visits. Dead plants replaced.	Bush regeneration contractor	>80% survivorship of native plantings.	24 months
	Monitoring and reporting	Ecological or bushland management consultant	Fourth biannual inspection completed and progress report submitted to Council.	24 months
Year 3	**Tertiary weed control** Site visits once a month or once every two months, if weed populations have been reduced to minor occurrences.	Bush regeneration contractor	100% eradication of noxious and transformer weeds. >90% native groundcover.	30 months
	Maintenance of plantings Plants watered when drought stressed, during site visits. Dead plants replaced.	Bush regeneration contractor	No gaps occurring in plantings. Plants in good health.	30 months
	Monitoring and reporting	Ecological or bushland management consultant	Fifth biannual inspection completed and progress report submitted to Council.	30 months
	Tertiary weed control Site visits once a month or once every two months, if weed populations have been reduced to minor occurrences.	Bush regeneration contractor	100% eradication of noxious and transformer weeds. >90% native groundcover.	36 months
	Maintenance of plantings Plants watered when drought stressed, during site visits. Dead plants replaced.	Bush regeneration contractor	>80% survivorship of native plantings.	36 months
	Monitoring and reporting	Ecological or bushland management consultant	Final inspection completed and final summary report submitted to Council.	36 months