CONACHER TRAVERS

environmental consultants

ecological site management plan

BEVIAN ROAD CONCEPT APPLICATION
BEVIAN ROAD, ROSEDALE

SEPTEMBER 2007

ECOLOGICAL SITE MANAGEMENT PLAN (ESMP)

BEVIAN ROAD CONCEPT APPLICATION
LOT 2 DP 627034, LOT 2 DP 623340
LOTS 11, 29, 32, 72, 102, 118, 119 AND 213 DP 755902
BEVIAN ROAD, ROSEDALE

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EXECUTIVE SUMMARY

This Ecological Site Management Plan has been prepared by *Conacher Travers Pty Ltd* on behalf of *Marsim (*trading as *Nature Coast Developments Pty* Ltd) for the land contained within Lot 2 DP 627034, Lot 2 DP 623340, Lots 11, 29, 32, 72, 102, 118, 119 and 213 DP 755902 Bevian Road, Rosedale, hereafter referred to as 'the subject site' or 'the site'. The subject site occupies an area of 173.59 hectares and is situated within the Eurobodalla Local Government Area (LGA). Figure 1 depicts the subject site location, whilst Figure 2 provides an aerial appraisal of the site.

The Bevian Road Concept Application seeks the approval of two specific plans referred to collectively as 'The Concept Approval Plans'. Specifically these are:

- 'The Constraints Map' (Figure 3 attached) – a plan of the net developable area
- 'The Plan of Subdivision' (Figure 4 attached) – an 806 lot residential subdivision and 15 community lots. *NB: this is a concept layout only, a detailed DA will be lodged once the concept has been approved.*

The ESMP has been prepared to provide ongoing management of the ecological features of the subject site during pre-construction, construction and post-construction phases. This ESMP provides a framework in which to coordinate and implement all relevant management plans for the site within the context of a residential and rural-residential style development. The plans include;

1. Fuel Management Plan
2. Tree Removal/Retention/Revegetation Plan
3. Restoration Management Plan
4. Stormwater Management Plan
5. Works Environment Protection Plan
6. Water Quality and Flora and Fauna Monitoring Plan

This ESMP integrates management of the site to achieve conservation objectives, bushfire protection, maintenance of ecological processes, protection of riparian zones and the regeneration of native vegetation.

The ESMP has been split into four (4) parts to enable readers to refer to pertinent sections as needed.

Part 1– Background Information and Management Issues
Background information for all community readers including related management plans, the role of the ESMP and title management.

Part 2– Ecological Management Strategy
The conservation management approach and an appropriate site management framework. The site management framework incorporates validation and verification tasks that audit the implementation of works on site and identify critical performance criteria.

Part 3– Site Management Specifications

Weed control, bush regeneration, revegetation, tree removal, sediment and erosion control and hazard reduction specifications for critical ecological and bushfire protection tasks.

The objectives of the ESMP are as follows;

The ESMP focuses largely on vegetation protection, management and restoration as the primary means of offsetting the negative impacts on the proposed development. Most importantly the ESMP allows for the offsetting of low condition endangered ecological communities to enhance the buffer between the development precincts and areas of ecological sensitivity. The following strategies have been adopted to achieve the aims of the ESMP. These strategies include;

1. Protect vegetation within conservation areas and riparian zones.
2. Protect and maintain habitat connectivity through the site for native fauna species.
3. Encourage natural regeneration of all native vegetation within the conservation areas to achieve a net positive outcome.
4. Protect trees and encourage the regrowth of locally occurring trees.
5. Ensure effective ecological functioning of the landscape and protect any adjacent downstream habitats from negative activities within lots, including Bevian Swamp and Saltwater Creek.
6. To undertake noxious weed control using low impact methods.
7. Comply with the Bushfire Protection Assessment and Fuel Management Plan using low impact fuel reduction methods whilst maintaining essential ecological function.
8. Manage adverse ecological impacts of the development including activities related to hazard reduction, tree removal, trimming of tree limbs, cut and fill works, landscaping, road construction, building, stormwater and drainage works.
9. To promote the regeneration of threatened species and endangered ecological communities.
10. To minimise activities that will adversely affect the habitat or migration of fauna within Lots.
11. To comply with audits as may be undertaken by the appointed Project Ecologist to achieve the aims of this Ecological Site Management Plan.
12. To ensure timely implementation of emergency procedures to prevent contamination of sensitive areas (sediment, chemicals, waste, fill).
13. Provide specific sub-plans for effective implementation of the ‘conditions of consent’.
14. Identify terms for positive and negative covenants that apply to each lot for ongoing protection of the site’s habitat and ecological functions in perpetuity.

This Ecological Site Management Plan also confers responsibilities onto the proponent to facilitate the communication and implementation of the Ecological Site Management Plan by:

- Ensuring Conservation Area boundaries are clearly located using permanent boundary markers and signage.
- Protecting nominated regeneration/revegetation zones from slashing and grazing.

- Ensuring timely implementation of fuel reduction works.
- Providing information material to promote the regeneration of remnant native vegetation.
- Providing information material on low impact fuel management methods.
- To retain a Project Ecologist to audit and issue compliance certificates as required.

Works onsite are structured within an overall Ecological Site Works Program that is consistent with construction phasing and the conditions of approval. Key stages include;

- pre-construction works,
- construction works, and
- post-construction works.

This program involves a high degree of project management on-ground prior to and during the construction program by the appointed Project Ecologist to ensure implementation of the ESMP in its entirety.

Finally, the ESMP also identifies the monitoring, auditing and reporting regimes that will be required for the subdivision which remain the responsibility of the developer.

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SECTION 1 INTRODUCTION

1.1 INTRODUCTION

This Ecological Assessment has been prepared by *Conacher Travers Pty Ltd* on behalf of *Marsim (*trading as *Nature Coast Developments Pty* Ltd) for the land contained within Lot 2 DP 627034, Lot 2 DP 623340, Lots 11, 29, 32, 72, 102, 118, 119 and 213 DP 755902 Bevian Road, Rosedale, hereafter referred to as 'the subject site' or 'the site'. The subject site occupies an area of 173.59 hectares and is situated within the Eurobodalla Local Government Area (LGA).

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This ESMP ensures that the environmental strategies identified throughout the relevant management plans are implemented within the context of the development phasing in accordance with the conditions of approval.

Aims

The aims of the ESMP include:

- To provide a management framework for the identified environmental strategies pertaining to the site.
- To provide the developer, Council, regulatory authorities, construction personnel and Lot owners with an operational plan for the ecological management and sensitive development of the site in perpetuity.
- To identify measures to protect the environmental values of the site.

Objectives

The objectives of the ESMP include:

1. Protect vegetation within conservation areas and riparian zones.
2. Protect and maintain habitat connectivity through the site for native fauna species.
3. Encourage natural regeneration of all native vegetation within the conservation areas to achieve a net positive outcome.
4. Protect trees and encourage the regrowth of locally occurring trees.
5. Ensure effective ecological functioning of the landscape and protect any adjacent downstream habitats from negative activities within lots, including Bevian Swamp and Saltwater Creek.
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9. To promote the regeneration of threatened species and endangered ecological communities.
10. To minimise activities that will adversely affect the habitat or migration of fauna within Lots.
11. To comply with audits as may be undertaken by the appointed Project Ecologist to achieve the aims of this Ecological Site Management Plan.
12. To ensure timely implementation of emergency procedures to prevent contamination of sensitive areas (sediment, chemicals, waste, fill).
13. Provide specific sub-plans for effective implementation of the 'conditions of consent'.
14. Identify terms for positive and negative covenants that apply to each lot for ongoing protection of the site's habitat and ecological functions in perpetuity.

1.2 THE ECOLOGICAL SITE MANAGEMENT PLAN

The Ecological Site Management Plan (ESMP) is the operational management plan that integrates subdivision works with ecological management to achieve stated conservation outcomes. It firmly entrenches ecological management within all development activities on the site through the preparation of critical site management plans; and verification, auditing and compliance reporting program. The ESMP requires that any future proposed development applications submit a site construction plan for Council approval that is consistent with the ESMP.

This ESMP forms the umbrella document for relevant management plans that have been prepared for the site. These plans and related reports include;

- Flora and Fauna Assessment (*Conacher Travers* 2007a)
- Conservation Land Use Management Plan (*Conacher Travers* 2007c)
- Ecological Assessment (*Conacher Travers* 2007d)
- Fuel Management Plan (*Conacher Travers* 2007e)
- Bushfire Protection Assessment (*Conacher Travers* 2007f)
- Report on Geotechnical Investigation – Report on Rosedale Urban Release Area (*Douglas Partners* 2002)
- Flora and Fauna Assessment (*Gunninah Environmental Consultants* 2002)
- Flood Impact Assessment (*Patterson Britton* 2007a)
- Water Management Report (*Patterson Britton* 2007b)

Whilst the ESMP can be used as a stand alone environmental control and management tool, it should be read with reference to the above supporting documents.

The ESMP specifically addresses:

- Management and restoration of native vegetation not affected by development
- Tree removal and protection zones including exclusion fencing
- Construction management to minimise impacts on the site's natural features in particular to protect existing trees
- Noxious and environmental weed management
- Vertebrate pest species management
- Integration of ecological management with construction management
- Landscaping within and between lots consistent with habitat protection and fuel management requirements
- Fuel management including specific hazard reduction approaches that minimise soil disturbance and promote the regrowth of native ground-layer vegetation
- Cut and fill works and the provision of relevant sediment erosion control measures
- Ongoing water quality, aquatic habitat and threatened species monitoring program

1.3 COMMUNITY TITLE MANAGEMENT

The proposed development is to be administered under the provisions of Community Title. This approach allows for ongoing regulation of activities, including maintenance within the entire development area, within individual allotments, within bushfire protection areas, conservation areas and within common community association areas. This approach also provides substantial benefits in terms of regulating the impact of the development on the natural environment.

Land retained in shared ownership by the members of the Community Title Scheme is known as Association Property. It is commonly referred to as the Community Lot.

The Community Management Statement binds the Community Associations with any subsidiary schemes and each owner/occupier, mortgagee in possession and/or lessee of a Lot.

The Community Association may, on its behalf or on behalf of each subsidiary scheme, contract with third parties to:

(a) Provide management, operational, maintenance and other services in connection with Community Property
(b) Provide transport services inside and outside the community scheme (to the owners or occupiers of lots)
(c) Provide a letting service to owners of Lots
(d) Provide other services or amenities to community Property, Common Property and/or the owners and occupiers of Lots

SECTION 2 SITE DESCRIPTION

2.1 LOCATION

The proposed Bevian Road, Rosedale development or subject site is opposite Barlings Beach, situated on the northern side of George Bass Drive, approximately 1.5 km to the west of Rosedale and 1.5 km to the north-east of Tomakin. The subject site comprises fragmented patches of remnant bushland with expansive areas of cleared land used for agricultural purposes making up the majority of the site. The site encompasses an area of 173.59 hectares.

The planning and cadastral details of the subject site are provided in Table 1.1 while Table 1.2 summarises the geographical characteristics of the site.

Table 2.1 - Site Details

Location / Lots	Lot 2 DP 627034, LOT 2 DP 623340, LOTS 11,29, 32, 72, 102, 118, 119 and 213 DP 755902, Bevian Road, Rosedale
Area	173.59ha
Topographic Map	Mogo 1:25000
Grid Reference	247500E 6033000N
Local Government Area	Eurobodalla
Existing Land Use	Stock agistment
Zoning	Zone 10 – Urban Expansion, 1(a) – Environmental Constraints, 1(c) – Rural Small Holdings and 7(a) – Environment Protection (Wetlands) under the Eurobodalla Rural Local Environmental Plan (1987).
Proposed Development	Urban development

Table 2.2 - Site Characteristics

Elevation	10m AHD within the Bevian Swamp to 100 m (AHD) on the ridge within the north-western section of the subject site.
Topography	Gently undulating to steep land with a network of drainage lines. A ridge traversing the central portion of the site in an east west direction divides the site into two catchments.
Slope	Gradients of the subject site range from steep 20^{o} in the upper slopes to less than 5^{o} within the floodplain of the Bevian Swamp.
Aspect	Generally south-east, northern slopes of central ridge have a northerly aspect.

Table 2.2 - Site Characteristics (Cont.)

Soil Type	Soils in the southern portion of the site are alluvial, which are derived from quaternary sediments. The soils consist of gravel, sands and silts and are moderately deep and clayey with no rock outcrops. Soils in the northern portion of the site are coalluvial and are derived from the Wagona and Bogolo formations.
Catchment	North – 'Saltwater Creek' and South – 'Bevian Wetland'
Drainage	The northern half of the site drains south east into Saltwater Creek, whilst the southern half of the site drains south into the Bevian Wetland.
Vegetation Structure	Open Forest, Woodland, Cleared Land and Wetland

2.2 ENVIRONMENTAL VALUES

The environmental values associated with the subject site have been confirmed through a series of environmental studies carried out over a number of years. The resulting values include:

- Spotted Gum/Ironbark vegetation, which provides refuge and a foraging resource for threatened species and native fauna
- Banksia Scrub vegetation, which is considered to be regionally significant
- Potential groundwater resources
- Groundwater dependent ecosystems
- Salt Water Creek ICOLL
- TSC Act 1995 Endangered Ecological Communities, Swamp Oak Floodplain Forest, Riverflat Eucalypt Forest on Coastal Floodplains and Freshwater Wetlands on Coastal Floodplains
- Preliminary listed EPBC Act 1999 Endangered Ecological Community - Dry Gully Rainforest
- Bevian Wetland – SEPP 14 wetland
- Aboriginal heritage sites
- Reestablishment of 'healthy' riparian zones

A number of threatened fauna species and endangered ecological communities have been identified within the site and the local area. These include:

- Powerful Owl
- Glossy Black-Cockatoo
- Eastern Freetail-bat
- Greater Broad-nosed Bat
- Eastern Bentwing-bat
- Yellow-bellied Glider

- Swamp Oak Floodplain Forest (*TSC Act* 1995)
- Riverflat Eucalypt Forest on Coastal Floodplains (*TSC Act* 1995)
- Freshwater Wetlands on Coastal Floodplains (*TSC Act* 1995)
- Dry Rainforest of the South East Forests (EPBC Act 1999 – Preliminary Listing)

The existing remnant vegetation along the north and western boundaries of the site have marginal connectivity to the Mogo State Forest.

2.3 VEGETATION CONDITION

The site landscape is characterised by extensive clearing with fragmented areas of natural and disturbed vegetation. Fragmented remnants form the eastern, north eastern and north western boundaries of the property. The remaining areas comprise cleared land with scattered trees, currently being subjected to grazing by cattle.

Overall the vegetation within the site is considerably disturbed. Within each vegetation community varying levels of disturbance have occurred.

Vegetation Community Number	Name	Condition
1	Spotted Gum Ironbark Open Forest / Woodland	Has been disturbed by partial clearing and under-scrubbing.
2	Blackbutt Woodland	Has been disturbed by under-scrubbing and cattle grazing.
3 *	Dry Gully Rainforest	Generally undisturbed.
4	Banksia Scrub	Has been disturbed by the construction of an informal vehicular track through its centre. This track is currently unused and regrowth of the vegetation is occurring.
5 **	Swamp Oak Open Forest	Highly disturbed with no shrub layer and a sparse groundcover due to cattle grazing. This vegetation, surrounding the Bevian Wetland, has been disturbed by the construction of Bevian Road along its western and along part of its northern boundary.
5a **	Disturbed Swamp Oak Open Heath	Highly disturbed regrowth variation of community 5.
6	Aquatic Herbfield	Has been partially trampled by cattle along the edge of the dams where weed incursion is high.
6a **	Natural Freshwater Wetland	Relatively undisturbed and in good condition.
7	Grassland with Scattered Trees	Contains many pasture weeds along roadsides, dams and drainage lines. The area surrounding the nursery contains a number of planted exotics and natives.

8 **	Disturbed Redgum Open Woodland	This vegetation community is the result of extensive clearing and agricultural activities including grazing that exhibits a very sparse canopy layer and an absence in the shrub layer.
9 **	Closed Swamp paperbark Scrub	This community is in good condition exhibiting little disturbance.
9a **	Disturbed Swamp Paperbark Open Heath	An understorey generally dominated by a mixture of exotic herbs and pasture grasses caused from previous clearing and grazing.

* Preliminary EEC
** EEC

2.4 CONSERVATION ZONES

The long term conservation of remnant vegetation, EEC's, threatened species and their habitats is considered to be a high priority for maintaining local biodiversity. A conservation network will be integrated within the site to offset the impacts of development. Protection is ensured through the retention of remnant vegetation, protection to Bevian Wetland and the revegetation of riparian areas, which will in turn create wildlife corridors to remnant vegetation offsite.

Riparian Zones

The more prominent riparian zone running in the northern portion of the site is a critical corridor between the northern and southern catchments that protects part of the Saltwater Creek Catchment (ICOLL status). This riparian zone creates an additional East to West habitat link across the site.

The riparian zones will be maintained and enhanced with appropriate buffer zones. Buffer zones will ensure adequate vegetation is present to maintain the water quality of the site. The objective of the buffer zones are to stabilise the drainage lines and create a protective corridor for ecological functions.

Remnant vegetation

The following vegetation remnants will be protected within conservation zones across the site.

Banksia Scrub vegetation community is considered to be regionally significant. This vegetation community is under threat from processes such as clearing and urban development and will be protected on the "Knoll" within an open space zone.

Freshwater Wetland (Bevian Swamp), Swamp Oak Open Forest and Regrowth Redgum Open Woodland, all of which are listed as endangered

ecological communities, will be protected as offset within the Bevian Swamp conservation zone.

Spotted Gum/Ironbark vegetation community provides important habitat by way of shelter and denning sites for arboreal animals. This is also the case for the Blackbutt Woodland vegetation community. These remnants will be protected within conservation ones in the site.

Endangered Ecological Communities

Swamp Oak Open Forest, Disturbed Redgum Open Woodland and Natural Freshwater Wetland vegetation correspond with the endangered ecological communities, listed under the NSW Threatened Species Conservation Act 1995, Swamp Oak Floodplain Forest (SOFF), River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF) and Freshwater Wetlands on Coastal Floodplains (FWCF) respectively. These vegetation communities are associated with Bevian Wetland and will be conserved within the conservation zone.

Dry Gully Rainforest corresponds to the *EPBC Act* preliminary listed endangered ecological community, Dry Rainforest of the South East Forests. This vegetation community occurs as a small fragment in the north western corner of the site and will be conserved within a conservation zone.

Bevian Wetland

The Bevian Wetland is a freshwater wetland and is identified under State Environmental Planning Policy 14 – Coastal Wetlands (SEPP 14) as Wetland No. 197. The Bevian Wetland is of high regional significance due to the listing as a SEPP 14 wetland and the diversity of habitat for flora and fauna present within this wetland.

Nearby Conservation Reserves

The nearest conservation reserves are Illawong and Broulee Island Nature Reserves located approximately 5 km to the south. Murramarang National Park is located approximately 15 km to the north of the subject site.

Mogo State Forest is located adjoining the subject site in the north west and covers an area of approximately 15,500 ha.

Bateman's Bay Marine Park

The Bateman's Bay marine park encompasses the majority of the Eurobodalla Shire coastal zone. From north of Bateman's Bay to Rosedale Beach it is zoned Habitat Protection and from Jimmies Island at the southern end of Rosedale Beach to Burrewarra Point it is zoned as a Sanctuary Zone.

Saltwater Creek ICOLL

The Saltwater Creek catchment forming the northern section of the subject site contains the upper tributaries of Saltwater Creek, which discharge over Barling's Beach into the South Pacific Ocean. The catchment drains from several small drainage lines, which flow generally to the south east to Saltwater Creek. There are two farm dams located on this drainage line in the north of the subject site. To the south of the old nursery there is another tributary of Saltwater Creek which initially flows in a southerly direction and contains one farm dam in the upper reaches of this tributary. The creek then turns to the east in which two more farm dams have been constructed. To the south another tributary of Saltwater Creek flows in an easterly direction from Bevian Road into a small farm dam. From this farm dam two smaller drainage lines, which were dry at the time of the survey, flow in different directions one to the north east and one to the south east into Saltwater Creek.

2.5 BUSHFIRE RISK

The subject site has a variable level of threat (low to extreme) from bushfires impacting from outside the property boundary. Predominant vegetation cover across the site consists of cleared and managed grassland which was formerly grazed for agricultural use.

Remnant vegetation along the eastern and western boundaries will be retained within the post development landscape along with revegetated riparian zones, ecological corridors and areas of open space. These areas may pose a minor threat during the event of bushfire and as such appropriate Asset Protection Zones (APZs) have been applied.

The topography of the surrounding area has a southern aspect with localised ridge-tops achieving highest elevations approximately 300 metres to the north. This ridgeline extends down the north-western boundary and influences the topography and drainage within the remainder of the site.

Consequently, forest vegetation within Mogo State Forest to the west present a threat to the western boundary, especially from north-westerly winds.

Rural lands to the north provide disturbed vegetation connectivity to remnant vegetation to the north. Similarly to the east, rural residential development contains remnant forested areas which could potentially transfer the passage of bushfires threatening the development from the east.

During the period from June 2000 to June 2004, approximately 107,000 hectares of land within Eurobodalla Shire was burnt by bushfires. This

includes approximately 83,600 hectares which was burnt by wildfires triggered by lightning events (Eurobodalla Shire Council 2004).

The subdivision has been designed to provide sufficient separation from bushland in the event of a major bushfire and residents are encouraged under this ESMP to maintain their properties in accordance with the **Fuel Management Plan** (*Conacher Travers* 2007e)**.** The Fuel Management Plan outlines bushfire and fuel management measures that are to be undertaken within the Community Association managed areas and within individual lots.

SECTION 3 CONSERVATION AND LAND USE MANAGEMENT STRATEGY

3.1 THE CONSERVATION STRATEGY

The conservation strategy for this site represents a modern approach focussed on ecologically sensitive development.

The primary conservation strategy relates to the dedication and perpetual management of conservation zones for the protection of ecological functioning. These areas include the Bevian Wetland, riparian zones and ecological corridors containing good condition remnant vegetation. Habitat enrichment will also be undertaken to enhance the quality of the corridors such that viable canopy and understorey habitat is formed in the medium term.

Bushfire protection is of primary concern within the site and vegetation within close proximity to the future dwellings will require management to reduce the bushfire threat. A major conservation strategy for this project relates to the maintenance of ecological functioning within areas of vegetation managed for asset protection purposes, hence the need to retain/revegetate canopy and understorey revegetation compliant with fuel management specifications in asset protection zones.

This ESMP aims to conserve and enhance existing areas of regrowth and remnant vegetation in a post development landscape, to establish viable ecological corridors and to conserve areas of habitat for the threatened fauna species Powerful Owl, Glossy Black-Cockatoo, Greater Broad-nosed Bat, Eastern Freetail-bat, Eastern Bentwing-bat and Yellow-bellied Glider.

Flora Conservation
Native flora is to be conserved within the site by the establishment of Conservation Areas and by situating the building envelopes so as to conserve the ecologically significant trees and areas of high regeneration potential. Furthermore, invasive noxious and environmental weed species with the potential to spread into conservation areas are to be removed from these areas so as to maintain the integrity of native vegetation. Endangered ecological communities will be regenerated within areas not impacted by development to enhance native buffers bordering ecologically sensitive habitat such as Bevian Wetland.

Fauna Conservation
Fauna habitats are to be conserved or enhanced to conserve fauna habitat and ecologically significant trees containing hollows. The incorporation of "within-lot habitat" will assist in providing suitable foraging habitat for locally occurring native fauna species. Furthermore, the retention of up to 25% of the understorey in landscaped beds within the asset protection zones will assist in providing further habitat connectivity and shelter. In designing the flora and fauna conservation measures, a deliberate strategy has been to achieve a net positive outcome for all threatened flora and fauna species and endangered ecological communities.

3.2 SITE CONSTRAINTS SUMMARY

The site's constraints have been defined by:-

- Riparian zones, which in places form highly eroded gullies
- Bevian Wetland (SEPP 14 Wetland)
- Threatened fauna species and their habitats
- Endangered Ecological Communities
- Remnant native vegetation
- Required Asset Protection Zones which manage potential bushfire threats from adjacent vegetation
- Steep slopes and visible ridge lines
- Potential bushfire threats
- Archaeological pads
- Viable development footprints and urban design
- Stormwater treatment and storage

Figure 3 (Constraints Plan) identifies critical site constraints that have influenced the subdivision layout, the identification of conservation areas and ecological corridors.

3.3 CORE CONSERVATION MEASURES

The core conservation measures for the development and long-term management of this site include;

- The dedication of conservation zones to be managed in perpetuity by the Community Association
- Protection of threatened fauna species and their habitats
- Retention and protection of remnant vegetation within conservation areas
- Revegetation of riparian zones improving water quality and enhancing connectivity within and offsite
- Protection of Bevian Wetland and associated endangered ecological communities
- Maintained or improved water quality within and leaving the site

- Maintained water quantities within and leaving the site
- The retention of within-lot habitat for native flora and fauna as a connected conservation area
- The protection of habitat trees and canopy that provide arboreal connectivity
- Defining fuel management specifications that promote retention of native vegetation
- Implementation of a noxious and environmental weed control program
- Implementation of a pest fauna control program
- Management of all construction and landscaping works to minimise adverse environmental impacts
- Establishment of a biological monitoring program
- Establishment of a development monitoring, auditing and compliance certification process for reporting to Council

The ESMP will achieve these outcomes through integrated development and conservation design and the implementation of site management procedures to minimise adverse environmental impacts of the development.

3.4 ECOLOGICALLY SIGNIFICANT TREES

Trees which contain hollows are considered to be significant due to their role in providing roosting sites for fauna. All significant trees are to be retained unless they are considered to be unsafe or will need to be removed to accommodate dwellings, roads or services. Any hollows that need to be removed are to be relocated into conservation zones and hollows are to be replaced by appropriately dimensioned artificial nest boxes and placed in nearby trees.

If any identified hollow bearing trees are to be removed, it is recommended that the tree be inspected before removal by a suitably qualified fauna ecologist. If occupied by breeding native fauna the tree removal is to be postponed until young have matured. The fauna ecologist should be present during tree removal to provide for the welfare of affected fauna. Section 5.4 provides further details regarding removal of hollow bearing trees.

A **Tree Management Plan** (Schedule 4) including the identification and prioritisation of habitat trees will be updated prior to commencement of tree removal works for the subdivision. This Tree Management Plan will form the primary basis for protection of trees onsite. Except for trees identified for removal on the Tree Management Plan, all canopy and sub-canopy trees are to be retained. Within asset protection zones vegetation (especially canopy trees) will be allowed to regenerate to meet the required fuel tonnage specifications of asset protection zones. Foliage cover, tree

density and canopy separation will be used as primary performance criteria of the asset protection zones.

A fauna ecologist is to locate appropriate trees and locations for installing artificial nest boxes where required.

3.5 CONSTRUCTION IMPACT MITIGATION

The mitigation of potential adverse impacts associated with construction works will be implemented through the following procedures:

- Implementation of erosion and sediment control measures during construction including installation of hay bale reinforced filter fences adjacent to Conservation Areas, overland flows, drainage lines and creeks.
- Identification and marking of areas to be protected.
- Provision of **Tree Protection Zones (TPZ's)** to ensure significant trees are retained undamaged on site. Excepting trees approved for removal as part of building applications, all trees within development Lots will be subject to TPZ's (Section 5.3) which are distinct from Conservation Areas.
- Avoidance of soil compaction within TPZ's.
- Delineation and fencing of Conservation Areas and ecological corridors.

Partial clearing of vegetation within building areas is expected within development precincts. The application of correct clearing techniques incorporating the following is recommended;

1. Avoidance of **Tree Protection Zones (TPZs)**
2. Protection of Conservation Areas, ecologically significant trees and within lot vegetation during clearing operations
3. All trees to be removed (subject to council tree preservation orders) must be replaced at a ratio of 2:1 using locally occurring native species (Section 5.12)
4. Appropriate chipping or mulching of cleared vegetation and spreading of woodchips or mulch to control erosion and weeds
5. Removal of weeds and weed propagules in such a manner that they are not spread to other areas
6. Application of low impact weed control methods (Section 5.6)
7. Retention of natural logs and rocks
8. Seeding on all bare soils using a mixture of Japanese Millet, Rye Corn and native grasses

3.6 VEGETATION MANAGEMENT

3.6.1 Ecological Site Management Timeline

A proposed Works Program (Table 5.1) and a general Ecological Site Management Program (Appendix 2) has been provided to define the timing and order of implementation for all Ecological Site Management Works. The general site management approach and specifications are discussed in sections 5.1 to 5.12 which provide a framework for implementing all the relevant works.

3.6.2 Commencement of Bush Regeneration Works

The Ecological Site Management Program requires commencement of primary regeneration, revegetation, weed control and seed collection works prior to the commencement of construction works. All bush regeneration works are to be under taken and supervised by qualified and experienced bush regeneration staff with a minimum TAFE Certificate III in Bush Regeneration or Conservation and Land Management – Natural Areas or equivalent qualifications.

3.6.3 Weed Control

The common noxious and environmental weeds of the site are Bitou Bush, Kikuyu, White Clover, Pennywort, Sharp Rush, Blackberry, Purple Top and Lantana. Major weed incursions occur within the Grassland with Scattered Trees vegetation community which occupies the majority of the site.

Landscaping should predominantly use locally occurring indigenous species, garden weeds are to be minimised and managed as part of the landscape maintenance works.

Natural regeneration of native vegetation is to be promoted by avoiding activities that limit the regrowth of native species or favour the establishment of weed species. Such activities include:

- Spreading of mulch in areas of high native regrowth potential
- Scalping or low cut mowing or slashing
- Laying lawn in close proximity to bushland interfaces
- Application of fertilisers (artificial or animal manures) within 50m or in close proximity to any drainage lines
- Planting of invasive landscape species
- Trampling of plants and compaction of soil
- Irrigation that promotes weed growth or exceeds the absorption capacity of the soil
- Sedimentation or importation of soil that is high in inorganic or organic nutrients – Native Plant Soil Mix that is available from all major landscape supplies, is preferable

- Grazing or keeping domestic animals that deliver high loads of manure
- Application of grey waters or drainage from animal enclosures directly onto soil without treatment for removal of nutrients

Nutrient management from any activity on-site generally requires all drainage to be collected, filtered and treated prior to release to ensure that nutrient concentrations within the soil profile are not elevated above natural soil conditions onsite.

A **Restoration Management Plan** (Schedule 3) has been prepared which identifies the areas of fuel reduction and the positive and negative actions that pertain to the development.

3.6.4 Protection of Native Understorey during Building Construction

All building works are to be restricted within 10-15 metres of the proposed building footprints (known as the construction zone) such that all native ground covers retained on site are able to regenerate to provide a serviceable grass layer within the post construction landscape. Any native top soil that is likely to be disturbed is to be stripped from the 'construction zone' and stockpiled for respreading after the completion of building works.

Native grass seeding at the ratio of 40-80 kg/hectare is to be undertaken and protected during germination and establishment (3-9 months) in disturbed areas or where soils are bare. All landscaping is to be done in an environmentally sensitive manner to minimise disturbance to regenerating vegetation and native species.

The placement of turf is encouraged in areas within close proximity (10-15 metres) to dwellings to provide suitable open space areas. Buffalo Grass is a preferred species due to its low spreading rate and ease of control. Kikuyu and couch grasses are prohibited under this ESMP.

3.6.5 Access and Signage

Conservation Areas and ecological corridors are to be maintained as an area protected from detrimental impacts of construction works, vegetation clearance, motor vehicles, rubbish dumping and nutrient run-off. Appropriate signage and bollards are to be installed to define the boundaries of Conservation Areas and ecological corridors.

Signage will be strategically placed to notify permitted and prohibited activities within or adjacent to these zones.

An example of the sign that will be placed around Conservation Areas is provided below.

CONSERVATION AREA

Prohibited activities
Disturbance of any native vegetation
Excavation or vehicular access
Disposal of liquid or solid wastes
Mulching
Livestock grazing
Hazard reduction

3.7 SITE SPECIFIC FIRE MANAGEMENT PLAN

A **Fuel Management Schedule (Schedule 2)** has been prepared by *Conacher Travers* who are experienced and qualified ecologists in fire management. This plan has been prepared in accordance with the NSW RFS – Planning for Bushfire Protection (2006) guidelines.

The recommended fire management regime is also identified to avoid adversely affecting the ecological functions of vegetation with Conservation Areas.

3.7.1 Ecological Fire Return Periods

The ecological fire return period recommended for the Conservation Area is to be no less than 8 years and no greater than 30 years.

As asset protection zones have been provided for within the development, fuel reduction burns are not required within the nominated Conservation Areas or ecological corridors.

For the purpose of maintaining essential ecological functions and threatened species habitat that depend on burns, ecological burns are recommended if the conservation areas have not been burnt for 15-30 years through natural wildfire events.

Ecological burns are to be undertaken in accordance with the Eurobodalla Bushfire Management Plan. Consultation with Eurobodalla Council and the NSW Rural Fire Service is to be undertaken and burns undertaken in accordance with an approved fire permit.

3.7.2 Tree Removal for Asset Protection Zones

In accordance with the Fuel Management Schedule, trees requiring removal (greater than 150mm dbh) that exceed the RFS standards for tree retention within asset protection zones have been identified on the Tree Management Schedule (Schedule 4). The density of trees permissible to be

retained in close proximity to the building envelope, have also been identified on Schedule 4.

3.8 WORKS ENVIRONMENT PROTECTION PLAN

The Works Environment Protection Plan provides for primary and secondary levels of environmental protection. Primary protection measures such as exclusion fences, grassed swales, basins and sediment fences are identified to manage the export of sediment or contaminants from key disturbance areas.

Secondary protection measures are identified on-site as works are undertaken with the primary aim or reinforcing primary protection measures where site conditions potentially result in significant levels of sediment deposition or contamination. Secondary protections measures also include Tree Protection Fences immediately adjacent to any disturbed areas. Trees to be removed will be marked individually by the Project Ecologist. Any groups of trees and areas of understorey to be protected will be identified by barrier taping during vegetation removal and earth works.

The location of all road-works, fire-trails, services and effluent treatment areas are to be designed cognisant of the site's ecological constraints and significant trees.

SECTION 4 SITE MANAGEMENT FRAMEWORK

4.1 INTRODUCTION

The ESMP has been integrated within an **Environmental Management System** that is controlled by the conditions of consent and release of the construction and occupation certificates. The environmental management system is identified below.

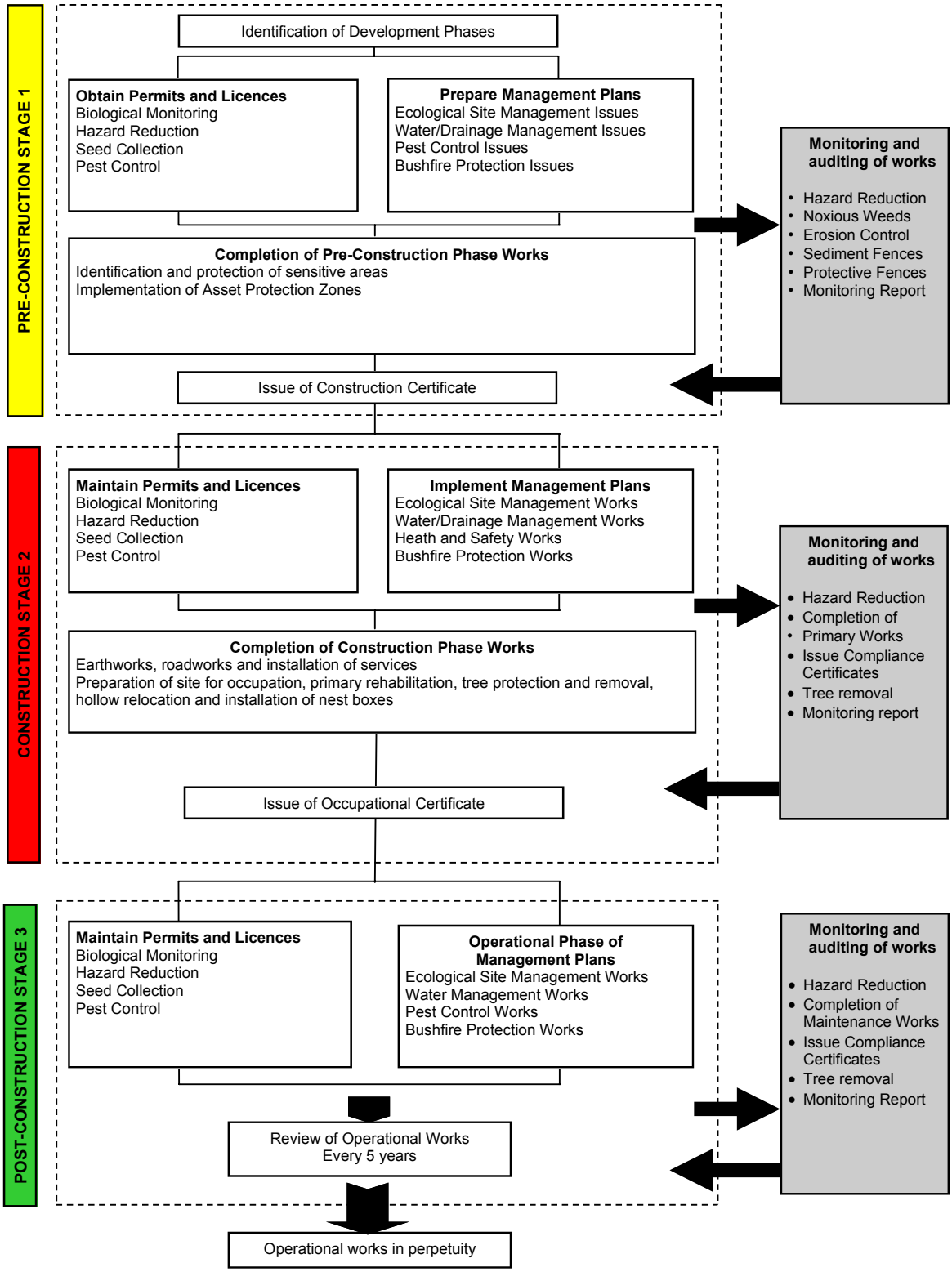
The release of the construction and occupation certificates marks the completion of specific tasks and the commencement of next stage of works. Compliance certificates are issued at critical points of the preconstruction, construction and post-construction stages.

4.2 KEY SITE MANAGEMENT STRATEGIES

The following site management strategies will be implemented as part of the overall environmental management system:

- Preparation of plans identifying the protection of vegetation, bushfire protection, tree protection, civil works and associated services.
- Provide suitable access for the purposes of ongoing management including weed, pest control, vegetation management and bushfire hazard management to all areas.
- Provide suitable landscaping with plantings of endemic trees and shrubs suitable for the creation of native species habitat.
- Implement appropriate management actions and ongoing maintenance to ensure protection and survival of the revegetated and restored areas.
- Maintain the ecological functioning of fauna links.
- Maintain and enhance the ecological functioning of the native canopy.
- Restore degraded habitats to enhance the ecological functioning of fauna links.
- Appoint a Project Ecologist to oversee all works within the site prior, post and during construction phases.
- Stipulate environmental performance criteria for all works on-site and establish penalties for breaches in the event of damage to any environmentally sensitive feature on-site.
- Prepare site construction plans that have been verified by the Project Ecologist as being consistent with this ESMP.

ENVIRONMENTAL MANAGEMENT SYSTEM



4.3 VALIDATION AND VERIFICATION WORKS

A validation and verification regime is an integral process of an Environmental Management System. In this case, validation and verification tasks have been identified for pre-construction, construction and post-construction phases of the subdivision.

4.3.1 Preconstruction Phase Validation and Verification Tasks

1. Inspect trees prior to removal for the presence of roosting fauna, provide alternative roost sites (eg. artificial nest boxes) and relocate dismantled hollows.
2. Prepare site construction plans to be approved by the Project Ecologist.
3. Undertake benchmark weed mapping to identify changes in weed distribution and the effectiveness of weed control operations.
4. Audit the implementation of all protective measures.
5. Monitor water quality in Saltwater Creek and Reedy Creek ICOLLS.
6. Audit vegetation management works.
7. Issue compliance certificates for all critical works including protective fences, sediment and erosion control works, tree protection and hazard reduction.

4.3.2 Construction Phase Validation and Verification Tasks

1. Monitor compliance with tree protection, environmental protection, erosion control and cut and fill requirements.
2. Undertake monitoring of all works by the Project Ecologist to identify any adverse ecological influences.
3. Monitoring the impact of construction activities on soil and water acid balance (pH).
4. Undertake water quality monitoring to identify significant changes in the water quality potentially due to drainage, cut and fill works.
5. Undertake monitoring of the ecological impact of weed control operations on non-target native species and to review accordingly.
6. Undertake monitoring of the ecological impact of fuel reduction works to minimise adverse impacts on any one native flora and fauna species.

4.3.3 Post Construction Phase Validation and Verification Tasks

1. Monitor and report on the condition and use of artificial nest boxes.
2. Monitor the level of weed regeneration within the retained bushland areas.
3. Monitor and report on the recruitment and establishment of native vegetation within the revegetated areas.

4. Monitor and report on the occurrence of threatened flora and fauna species in comparison with threatened species records as identified on site prior to commencement of subdivision works.
5. Report on all other actions implemented as part of the Management Plan.
6. Issue compliance certificates for the implementation of key actions.

4.4 PERFORMANCE CRITERIA

All works on site are required to adhere to the following performance criteria to minimise impacts on threatened species habitat and the protection of any ecologically sensitive vegetation.

4.4.1 Pre-Construction Performance Criteria

1. No trees, vegetation or habitat is to be modified, disturbed or removed without the approval of the Project Ecologist.
2. All tree, waterway and habitat protection measures are to be installed and audited by the Project Ecologist. No works are to occur within conservation zones unless in accordance with this ESMP (eg. bush regeneration works).
3. No on-ground refugia (logs, rocks, and dense understorey) is to be destroyed, moved, stockpiled, burnt or modified without approval of the Project Ecologist.
4. All trees are to be dismantled under the supervision of a Project Ecologist.
5. No wildlife is to be handled by contract personnel unless approved by the appointed Project Ecologist.
6. No mulch is to be stockpiled or spread within conservation zones.
7. Conservation areas are to be managed to facilitate natural regeneration and protected from slashing.
8. Seed resources are to be retained, collected, stored and direct seeded for regeneration purposes.
9. Any top-soil to be translocated is to be relocated under the direction of the Project Ecologist to ensure optimal regeneration of native understorey.
10. Drainage or associated works are not to be undertaken without approval of the Project Ecologist other than approved under the Stormwater Management Plan.
11. Exclusion zones are to be established, maintained and any damage rectified if exclusion fences are breached.

4.4.2 Construction Performance Criteria

Bulk Earthworks

1. Tree protection measures are to be in place prior to commencement of earthworks and maintained for the duration of earthworks.

2. There is to be no disturbance to the root zones of any trees to be retained. Any necessary root exposure is to be undertaken under the direction of the Project Ecologist.
3. In areas disturbed by cut and fill works, the A and B horizon is to be stripped in areas nominated by the Project Ecologist prior to cut and fill works. Each horizon is to be placed in separate stock piles and respread over nominated areas to the required ground levels.
4. After spreading, A and B horizons are to be ripped to a maximum depth of 100mm such that the top soil is loose and friable.
5. Completed earthworks are to be fenced off and reseeded with locally occurring grass species. Rates of reseeding are to be as follows:

   - Cool season mix
     - Rye corn at 20kg/ha,
     - Native grasses at 60kg/ha.

   - Warm season mix
     - Japanese Millet at 20kg/ha,
     - Native grasses at 80kg/ha.

   Rye Corn and Japanese Millet can be excluded from the mix where erosion control is not a priority.

6. Filling around tree trunks is to be avoided unless approved by the Project Ecologist using a course gravel backfill surrounding the trunks of retained trees. Trees that are negatively impacted by cut and fill works to the extent that the tree is likely to die, are to be replaced at a ratio of 2:1 in the same location at the new soil surface.
7. Exclusion zones are to be established, maintained and any damage rectified if exclusion fences are breached.

Civil and Building Works Performance Criteria

1. All sediment measures and protective fences are to be maintained in good condition for the duration of the building works.
2. No soil, waste or building works are to occur beyond the construction site, nominated environmental protection, tree protection or exclusion zones.
3. There is to be no damage to retained trees.
4. There is to be no compaction around the base of trees or damage to the root zones.
5. No pH altering chemicals of an acid or alkaline nature are to be used without approval from the Project Ecologist.
6. Exclusion zones are to be established, maintained and any damage rectified if exclusion zone fences are breached.

Landscaping Works Criteria

1. No mulch is to be spread or stockpiled within asset protection zones, conservation zones, tree protection or exclusion zones. Mulch is to be placed in accordance with landscape plans approved by the Project Ecologist.
2. Only locally occurring native plant species are to be used in landscape works unless approved by the Project Ecologist.
3. Tree removal is to be undertaken under direction of the Project Ecologist. There is to be no physical or chemical damage to retained trees.
4. Soil improvements are not to include pH adjusting additives.
5. Only low impact weed control methods are to be used in landscaping with a preference given to a regeneration approach.
6. Exclusion zones are to be established, maintained and any damage rectified if exclusion zone fences are breached.

4.4.3 Post Construction Performance Criteria

1. All areas are to be maintained free of all noxious and invasive environmental weeds and continually suppressed.
2. Environmental and tree protection fences are to remain in place until completion of the post construction phase.
3. Any trees removed or damaged within development area are to be replaced at a ratio of 2:1.
4. Mulching is only to be used in nominated landscape beds as approved by the Project Ecologist.
5. Exclusion zones are to be established, maintained and any damage rectified if exclusion zone fences are breached.

To ensure all these performance criteria are effectively achieved, a Project Ecologist is to be present on site during all critical phases of works and to monitor the activities of all works on site. A series of contractual penalties have been identified for any serious breaches in the above performance criteria. All critical contractual payments are to be certified by the Project Ecologist on-site to ensure compliance with the performance criteria.

4.5 APPOINTMENT OF A PROJECT ECOLOGIST

The appointment of a Project Ecologist is crucial to ensure sound implementation of the ESMP. One of the most important roles of the Project Ecologist is involvement in the sign-off of all works to ensure that they have met with the relevant environmental performance criteria.

A Project Ecologist is to be appointed by the Proponent until such time all works in accordance with the ESMP have been completed up to a period of 5 years post construction. The appointed Project Ecologist is to be qualified and experienced in overseeing ecological site management works. The Project Ecologist is to be appointed prior to construction and will oversee all works on site prior, during and post construction.

SECTION 5 PROTECTION, RESTORATION AND VEGETATION WORKS SPECIFICATIONS

5.1 ECOLOGICAL SITE MANAGEMENT PROGRAM

A 5 year ecological site management program (Appendix 2) has been prepared which is inclusive of all mitigative measures, protection and restoration works within and adjacent to the development areas.

In scheduling protection, restoration and vegetation works with the development timeline, there are a number of tasks that need to be implemented prior to commencement of construction works. These tasks, typically termed "Pre-construction" tasks, are related to setting up the contractual arrangements between companies, establishing contract briefs, preparing and undertaking ecological inductions, gaining of licenses for seed collection, threatened species monitoring for auditing purposes, establishment of tree and environmental protection measures and initial vegetation removal. These tasks typically take 1 to 6 months to complete.

The second grouping of tasks, termed "Construction" tasks, is undertaken in conjunction with all construction works. These ecological site management works mitigate adverse impacts of construction works, and include works such as installing secondary protection fences, primary weed control, relocation of wildlife, top-soil stripping and translocation, asset protection works, hollow dismantling, tree removal, revegetation and biological monitoring. These tasks typically have a total duration of approximately 3-18 months.

A third grouping of tasks, typically termed "Post Construction" tasks, are undertaken on an ongoing basis for the duration of the maintenance period. In this case the maintenance period is up to 5 years involving tasks such as weed control, bush regeneration, enrichment planting, stabilisation, biological monitoring, and decommissioning of temporary tree and vegetation protection measures.

There are cross-over tasks contained within the ESMP that are normally undertaken as part of the civil, bulk earthworks, landscaping and building works but require the input, or compliance certification from the Project Ecologist. It is critical that the Project Ecologist is involved in the sign-off of all works to ensure that they have met with the relevant environmental performance criteria.

The environmental performance criteria and method as stipulated in the ESMP and must be re-stipulated in contract briefs for all works onsite. Please note that as most contractors are unfamiliar with the environmental performance criteria and methods an induction process needs to be undertaken and the implementation of works need to be closely monitored by the Project Ecologist.

Induction manuals are to be prepared and presented to each individual contractor intending to undertake works on the site. The induction manual is to outline the ecological value of the site and the penalties imposed for negligence resulting in the damage to, or destruction of, protected vegetation and/or fauna on site.

5.2 SITE MANAGEMENT

5.2.1 Contractor Environmental Induction

All contractors on site must be made fully aware of the site's significant ecological features, locations of sensitive vegetation and to be fully aware of the environmental protection measures. To facilitate compliance with the ESMP, the site manager is to ensure all contractors undertake an environmental induction based on a prepared induction manual. The induction manual is to include as a minimum:

- Identification of the type and location of exclusion zones
- Cut and fill procedures – stripping and stockpiling
- Sediment and pollution control procedures
- Tree protection/hollow and wildlife relocation procedures
- Integration of all contract management works with Project Ecologist monitoring and auditing process
- Contractor penalties for damage to exclusion zones
- Certification of critical contractors invoicing for compliance with the performance criteria

Contractor penalties are aimed at discouraging the occurrence of incidents that significantly affect any significant ecological feature such as regenerating areas. Penalties will be subject to NSW law.

Penalties generally are incurred for:

- Minor infringements e.g. breach in exclusion fencing - $5,000 per incident
- Damage to significant trees – up to $50,000 per incident
- Waste dumping including the cost of removal and rehabilitation
- Inadequate sediment control including the cost of sediment removal and rectification
- Pollution (sediment and chemical) within the site

In addition, contractors may be required to lodge a bond for rectification of any potential damage.

Performance criteria identified with **Section 4.4** need to be complied with for all contract works on site. These performance criteria set quality targets for contractors undertaking site preparation, primary weed control and restoration, tree removal, bulk earthworks, civil and building works, landscaping and maintenance works.

5.2.2 Project Ecologist Auditing Role

A Project Ecologist is to be available on site during periods of major construction/building works to assist in the early identification of adverse environmental incidents, to arrange appropriate rectification works, and to ensure on-site procedures are being closely followed.

In addition, the Project Ecologist is to undertake inspections to monitor the progress of works and issue compliance certification at critical phases. Inspections of the site by the Project Ecologist should be undertaken prior to, during and post-construction operations to ensure that vegetated areas designated for protection and restoration zones are adequately marked and that other appropriate protection procedures are being maintained. The Project Ecologist is to be present during any soil translocation works and a suitably qualified bush regeneration contractor is to be appointed to supervise restoration works under the direction of the Project Ecologist.

The Project Ecologist also has a role in certifying critical payments of contractors subject to an inspection of the contract works for compliance with the ESMP, stipulated site management procedures and performance criteria.

5.2.3 Site Construction Plans

To aid compliance with the ESMP, site construction plans are to be produced covering all aspects of cut and fill, road construction, service installation, vegetation removal, hazard reduction, fencing, landscaping and building works. All site construction plans must identify key environmental protection measures and state the penalties for breaching exclusion zones and procedural protocols. The site construction plans are to be approved by the Project Ecologist prior to commencement of contract works. Site Construction Plans for any future development applications must also be submitted for Council approval in accordance with this ESMP.

5.2.4 Exclusion Zones

A major objective of site management within construction areas is to minimise the area of disturbance during construction operations and to manage the stripping, stockpiling and replacement of topsoil to encourage regeneration of native plants. Consequently, all areas of translocated soil are to be protected to allow regeneration of native understorey species.

Exclusion fences will be installed to control the movement of vehicles and construction equipment. In addition, exclusion zones will be established within the disturbed areas immediately after cut and fill works to encourage the regeneration of native species.

The following exclusion areas are to be established on site.

- Conservation areas, drainage or ecological corridors
- Tree protection zones

Where an exclusion fence coincides with sediment control fencing, the silt fence will be deemed as a protective fence delineating the exclusion zone.

Consequently, all landscaping works need to be controlled in a similar manner to minimise disturbance and encourage regeneration.

The exclusion fences will be installed in accordance with the tree protection guidelines (refer to **Section 5.1.3**) using star pickets and suitable high visibility marking tape or orange plastic net fencing or temporary chain-link fencing panels.

5.2.5 Silt Fencing

Erosion and sediment control fences are to be implemented to minimise adverse effects of increased erosion and sediment loading. Erosion and sediment control measures are detailed within civil sediment and erosion control plans.

5.2.6 Instream Sedimentation Control

The minimisation of soil erosion will be achieved through soil stabilisation measures and water control techniques. Suitable soil stabilisation measures to be implemented include the immediate revegetation of cleared surfaces via seeding, planting of native species, mulching and the installation of biodegradable blankets. Suitable water control measures include construction of earth banks, catch drains, detention and sediment ponds (including gross pollutant traps), grassed or armoured waterways, rock, earth and sand-bag dams and outlet protection systems to prevent scouring.

As a minimum, cross channel silt fences and hay bales are to be installed within overland flow patterns and maintained during the establishment period of native grasses and groundcovers (up to 9 months). In small disturbed areas, jute mesh or jute matting or brush matting is to be laid in areas likely to be affected by surface erosion.

5.2.7 Mulching

Whilst, mulching is an efficient method to impede the establishment of weed species, soil erosion, compaction and desiccation, it is undesirable to place mulch within regeneration areas as it impedes the germination of opportunistic native species. Areas surrounding the stems/trunks of plants are to be kept free from mulch, thereby reducing the incidence of collar rot on retained or planted flora.

Except within landscape beds, mulching is to be avoided to minimise suppression of native plant regeneration and to avoid creating a fire risk within asset protection zones. If mulching is undertaken then the thickness of mulch should be spread thinly (less than 30mm)

5.3 TREE PROTECTION GUIDELINES

The following guidelines are proposed for the retention of trees or vegetation within the site and measures that may be implemented for the management of this vegetation:

1. Implementation of an adequate **Tree Protection Zone (TPZ)** will be required surrounding any retained tree or group of trees. This tree protection zone can generally be provided by preserving an area around the tree/s outside of the dripline.
2. Tree protection zones should be adequately marked using star pickets and high visibility tape or plastic net fencing.
3. Approved tree removal operations in the vicinity of retained trees are to be undertaken in a manner that avoids canopy damage and soil compaction. Such works are to be supervised by a qualified Arborist.
4. Stumps are to be ground - not dozed or dug out.
5. All trenches footings and major earth movement should avoid TPZ's.
6. Stockpiling materials and soils within tree protection zones is to be avoided.
7. Machinery is to avoid tree protection zones during all operations.
8. Any trenching or construction works undertaken within tree protection zones should be witnessed, supervised and recorded (photographed and documented) by a qualified Arborist.

5.4 REMOVAL OF HOLLOW BEARING TREES

If required, guidelines for ameliorating the loss of nesting hollows are as follows:

1. Where possible and practical, hollow bearing trees identified for removal should have the hollow sections collected and re-erected. Where this is not feasible (due to unstable decaying timber) artificial nest boxes providing accommodation of similar size to the removed hollows are to be erected in suitable locations.
2. Glider and bat nest and roost boxes will be of the same dimensions, 50 cm wide, 50 cm long with a depth of 20 cm but the entrance spacing on the underside of the box shall be sized according to the species requirements. An internal roosting support made of pegboard or shade cloth is to be fixed inside the box.
3. All replacement nest boxes are to be secured to trees at a minimum height of four metres above ground level facing the east to north east direction. An experienced arborist is required to install the nest boxes. Nest boxes and re-erected limbs are not to be placed near locations where public access is planned along reserve areas. All nest boxes and re-erected limbs will be inspected annually and any damaged, or in danger of falling, are to be repaired or replaced.

The following guidelines are provided in the event of a hollow bearing tree requiring removal.

5.4.1 Pre Clearing

At least one weeks notice will be needed prior to the planned date for clearing of any trees. This is required so as to allow for suitable time for inspections of trees by a suitably qualified and licensed ecologist for use by fauna and to plan for the safe felling of the tree/removal of fauna if present.

After notice is given of the planned removal of trees a fauna ecologist will inspect the trees for use by fauna. This may include inspection of trees at sunset (stag watching) which allows for the detection of diurnal fauna returning to hollows or nocturnal fauna leaving for the night.

In some cases physical inspections of hollows by climbing trees may be required. This will be carried out by suitably qualified arborists under the direction and supervision of the fauna ecologist.

5.4.2 During Clearing

Where fauna is identified within a hollow and the risk of death or injury as a result of machine felling of the tree is high, the tree may need to be dismantled in sections. This will involve the removal of hollow limbs or

sections by chainsaw with the hollow limb lowered to the ground for removal/relocation of fauna and the relocation of the hollow sections to suitable nearby trees. These works are to be carried out by a suitably qualified arborist under the direction of the fauna ecologist.

In those trees that contain hollows and no fauna has been observed, the tree will be machine felled. Where machinery is required to fell hollow trees, the blade or bucket of the machinery will be tapped against the base of the tree to disturb any fauna present and provide time to leave the hollow. The tree will then be felled as gently as possible. All hollow limbs will be inspected after felling for occupation by fauna. Any fauna will be removed and relocated to adjoining bushland.

Where young fauna are identified within a hollow whose survival will be at risk as a result of the removal of the hollow or the felling of the tree, then clearing will not be carried out until those young are old enough to leave the hollow and the care of the parents. It is suggested therefore that clearing is not carried out during breeding times when young are likely to be present within hollows (Spring-early summer).

Where possible, hollow limbs removed from trees will be collected by the fauna ecologist for relocation at a later date. Any fauna injured during clearing will be handed to WIRES for care and rehabilitation.

5.5 FUEL REDUCTION WORKS

Initially, the majority of the vegetation within the APZ will need to be under-scrubbed in accordance with the relevant bushfire protection measures. To meet the general requirements of the Rural Fire Service the following proportions of clearing need to be applied within the proposed asset protection zones (Inner and Outer Protection Areas).

Inner Protection Area (IPA) (Recommended Fuel load 0-3t/ha)

- Retain 25-30% of the understorey and shrub layers in discontinuous clumps
- Ensure discontinuous canopy by creating clumps of trees, each clump separated by 2-10m canopy separation
- Remove excessive ground layer litter on an annual basis

Outer Protection Area (OPA) (Recommended Fuel load 4-6t/ha)

- Retain the understorey
- No canopy removal required
- Remove excessive ground layer litter on an annual basis

As a general rule differing vegetation types have different natural fuel loads in different strata. Thus, hazard reduction within IPAs and OPAs will be dependent on vegetation type and spatial arrangement and will require specialist onsite advice at the appropriate time to determine the maximum permissible foliage cover and tree placement/retention.

5.6 PROPOSED WEEDING ACTIVITIES

Weed control works on site will be achieved by the following actions:

- Fuel reduction works that target major weed infestations as a means of reducing fuel loads (mechanical and hand removal methods).
- Target weed control works focusing on key invasive weed species.
- Suppression of weed regrowth by competitive planting and use of weed suppressants such as mulch in areas not being actively regenerated.
- Bush regeneration and revegetation.

Bushland regeneration techniques are described in Appendix 7.

Adopting the Bradley Method of regeneration requires the removal of weeds in three phases:

- Primary weeding – the initial weeding removing the majority of dominant weeds, usually for a period of 3-6 months. Typically initiates new growth of both weeds and natives.
- Secondary weeding – carried out in primary weed areas where regrowth has occurred. Usually 6-12 months post primary weeding.
- Maintenance weeding – undertaken on a monthly basis, until the resilience of the bushland to weeds increases.

Regeneration of dominant native plant species is expected to occur over a 2-10 year period provided ongoing management works are maintained. Following initial weed control and regeneration works, follow up maintenance weeding and bush regeneration is required on a needs basis for a minimum of 5 years.

As the development site is a mix of development areas, conservation areas and drainage corridors, the method of weed control needs to be carefully selected to avoid ‘overkill’ of any native species and impacting on sensitive habitats.

The area of disturbance for all construction works also needs to be carefully managed to minimise damage to any flora and to strip and replace the existing top soil to encourage regeneration of native species.

5.7 MAINTENANCE

Maintenance activities will continue to operate for a period of up to five (5) years after the completion of civil works.

Maintenance activities include:

- Target noxious and environmental weed control
- Waste removal
- Watering and revegetation maintenance
- Repairs to protection and sedimentation fencing and
- Cleaning of any permanent sediment control structures or traps.

Maintenance activities will occur on a monthly basis during the construction phase and on a quarterly basis during the post-construction phase.

5.8 MONITORING AND REVIEW

It is recommended that regular monitoring inspections be undertaken at 6 months, 1 year and annually for up to 10 years post construction. This will allow the determination of the condition of the vegetation and may include identification of any areas suffering from disturbance or in need of the following:

- further rehabilitation
- weed control
- sediment or storm water control
- bank and soil stabilisation
- maintenance of rehabilitated or regenerating areas

Monitoring will occur on a monthly basis during the construction phase, with the submission of a report by the Project Ecologist to Council detailing the performance of restoration works upon completion of the Construction Phase Threatened flora and fauna monitoring will be undertaken in accordance with Schedule 6.

A range of monitoring items have been identified in the Ecological Site Management Program as a result of detailed ecological and engineering assessments undertaken during the development planning process. These monitoring items have been designed to support the ecological strategies identified within this ESMP.

A monitoring program is to be implemented which ensures that each of the monitoring items (Schedule 6 – Ecological Monitoring Schedule), are undertaken and completed to the satisfaction of the Project Ecologist.

Appendix 5 identifies the auditing and monitoring parameters to be undertaken across the site.

5.9 WORKS PROGRAM

Table 5.1 identifies a typical works program for a 5-10 year ecological program. All contract works are to be undertaken in accordance with the appropriate contract brief.

Table 5.1 - Proposed works program

Action	Responsibility
Pre-construction	
• Erection of erosion control and protective fencing	• Project Manager
• Issue compliance certificate for erosion control and protective fencing	• Project Manager
• Installation of bollards, signs, fencing around Development Exclusion Areas and Tree Protection Zones	• Project Manager
• Collection of local provenance seed	• Project Ecologist
• Commencement of weed control and regeneration	• Project Ecologist
• Commence APZ clearing	• Project Ecologist
• Induct all construction staff on environmental protection measures	• Project Ecologist
• Issue of compliance certificate to Eurobodalla Council	• Project Ecologist
Construction	
• Stripping and stockpile topsoil	• Project Manager
• Monitor erosion control fencing (monthly – especially after heavy rain) and replace if required	• Project Ecologist
• Monitor vegetation, protection fencing and signs, replace if required	• Project Ecologist
• Install Construction Site barrier fencing covering the 'construction zone'	• Project Manager
• Respread Topsoil	• Project Manager
• Undertake native grass seeding	• Project Ecologist
• Install temporary protection fencing for seeded areas	• Project Ecologist
• Issue compliance certificate for handling of topsoil and native grass seeding and installation of all protective fencing	• Project Ecologist
• Continuation of Regeneration and Weed Control	• Project Ecologist

Table 5.1 - Proposed works program (Cont.)

Action	Responsibility
Post-construction	
• Removal of the vegetation protection fencing and installation of permanent fencing	• Project Ecologist
• Continuation of Regeneration and Weed Control within the Conservation Areas	• Project Ecologist
• Removal of the vegetation protection fencing and installation of permanent fencing	• Project Ecologist
• Monitoring of retained vegetation at 6 months, 12 months and two years post construction	• Project Ecologist
• Maintenance of seeded areas until 90% cover established	• Project Ecologist
• Conduct maintenance beyond 2 years as required	• Landowner / Lot purchaser under direction of Project Ecologist as required in accordance with generic guidelines
• Post construction compliance certificate for achievement of regeneration, protection targets and removal of protective fencing (if required)	• Project Ecologist

This program demonstrates the division of tasks which determine the release of construction and occupation certificates. This ensures that the primary protection and restoration works are completed prior to occupation. The occupation certificate is issued after satisfactory completion of the construction tasks.

The timetable of works (Section 5.12) will need to be implemented cognisant of the construction program. This will be resolved with the finalisation of the Civil Works Plans

5.10 ENVIRONMENTAL AUDIT AND COMPLIANCE CERTIFICATION

The environmental audit and compliance certification is the responsibility of the Project Ecologist. The Environmental Audit Checklist (Appendix 5) identifies key tasks and the frequency of which they are to be undertaken, to ensure the long term ecological management goals are reached throughout the monitoring period.

Typical audits include:

1. Receipt of seed collection licence.
2. Certification of provenance for all seed stocks used in the project.
3. Certification of correct installation of protective and erosion control fencing.
4. Issue of compliance certificates.
5. Auditing plant survival, species diversity, plant cover and weed control.
6. Audit the impact of animal grazing on restoration areas and recommend appropriate protection and control measures.
7. To certify landscape plans / construction plans are consistent with the approved vegetation management plans.
8. Auditing impact of works on threatened species.

The auditing and certification has implications for the timing, completion and rectification of contractor works on site. All contractors must prepare quotations cognisant of delays that may be required to rectify works as required by the Project Ecologist.

5.11 TIMETABLE OF WORKS

The attached Site Management Program, Ecological Site Management Program and Operational Works Program (**Appendices 1-3**) provide parallel timetables for completion of ecological site management works. At this stage, critical dates for timing of works and assessment reports have been based on typical construction timelines.

Whilst a framework for the effective project planning and budget control has been prepared for each of the works tasks, it is not possible to be definitive and provide a predictable process that is responsive to restoration conditions and changes in the construction program. Critical program reviews are scheduled to occur at critical points to enable a review of the requirements and allocation of costs.

5.12 CONSERVATION AND RESTORATION WORKS

The conservation and restoration works are a series of rehabilitation actions to maintain and improve the quality of habitat for flora and fauna species. Of key importance is the protection of the Conservation Areas and ecological corridors for fauna movement, the maintenance of foraging resources, protection of hollows for breeding, the maintenance of canopy resources and retention of ground refugia.

5.12.1 Protection and Restoration Works within the Conservation Areas and Ecological Corridors

The following works are required within the conservation areas and ecological corridors:

1. Protection of all vegetation and the installation of protective fencing in accordance with **Schedule 5.**
2. Collection and propagation of species collected from local occurring native species **(Appendix 6)**.
3. Adopting a low-impact approach to weed control to promote the revegetation of opportunistic native species **(Appendix 9)**.
4. Enrichment planting utilising locally occurring native plant species where works or weed control have resulted in the loss of native plant ground covers in accordance with **Appendices 6, 7 and 8**.
5. To eradicate all weeds in accordance with the weed control and bush revegetation methodology **(Appendix 7 and 9)**.
6. Controlling public access to minimise soil compaction and plant losses.
7. Disposal of all rubbish such as vegetative waste at authorised waster transfer stations or tip.
8. Site maintenance in accordance with **Section 5.8**.
9. Monitoring and review in accordance with **Section 5.9**.
10. Site management will be undertaken in accordance with **Section 5.2**.
11. Tree protection in accordance with **Section 5.3.**

5.12.2 Protection and Restoration Works within the Asset Protection Zones

The following works are required within the asset protection zones of the residential allotments:

1. Protection of all trees to be retained onsite and the installation of all protective and erosion control fencing in accordance with **Schedule 5**.
2. Collection and propagation of species collected from local occurring native species utilising species from **Appendix 6**.
3. Adopting a low-impact approach to weed control to promote the revegetation of opportunistic native species **(Appendix 9)**.
4. E nrichment planting, regeneration and seeding utilising locally occurring native plant species in accordance with **Schedule 2** (Fuel Management Schedule).
5. To eradicate all weeds in accordance with the weed control and bush revegetation methodology **(Appendix 7 and 9)**.
6. Slashing of the ground layer for fuel reduction in accordance with **Section 5.5 and Schedule 2.**

7. Controlling public access to minimise soil compaction and plant losses.
8. Disposal of all rubbish such as vegetative waste at authorised waster transfer stations or tip.
9. Site maintenance in accordance with **Section 5.7**.
10. Monitoring and review in accordance with **Section 5.8**.
11. Site management will be undertaken in accordance with **Section 5.2**.
12. Tree protection in accordance with **Section 5.3.**

SECTION 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The implementation of the ESMP depends on the effective integration of ecological and hazard reduction works into the sub-division works.

Critical is the establishment of an effective communication protocol between the Site Manager, Project Ecologist and contractors. In particular the Project Ecologist will need to be present and actively instructing on appropriate management techniques, identifying where contract works need rectification and certifying the completion of critical contract works.

A series of method trials will need to be undertaken with contractors to ensure the identified techniques achieve the desired environmental outcomes. Once the best practice method is confirmed, the remainder of works can continue with minimal supervision.

Running parallel to construction works will be restoration activities within the conservation area, ecological corridors and APZ's. As bush regeneration contractors will need free access to restoration areas, the coordination of access during construction will be critical for timely implementation of restoration works.

The implementation of the operational works program will be staggered in accordance with the completion of subdivision works. Consequently a staggered handover of operational works will need to be undertaken.

The following recommendations have arisen as a result of outstanding matters that need to be resolved prior to commencement of works onsite.

6.2 RECOMMENDATIONS

1. Establish a communication protocol between the site manager, Project Ecologist and contractors to ensure compliance with the ESMP and successful implementation of ecological and environmental protection measures;
2. Install environmental protection fences/sediment control fences prior to the commencement of any works;
3. Commence any seed collection contracts at an early stage to ensure a supply of locally sourced native plant stock;
4. Trial all procedures such as tree removal/dismantling, soil translocation, hazard reduction with contractors; and
5. Delineate areas within asset protection zones that are to be protected from slashing in accordance with the fuel reduction guidelines of asset protection zones.

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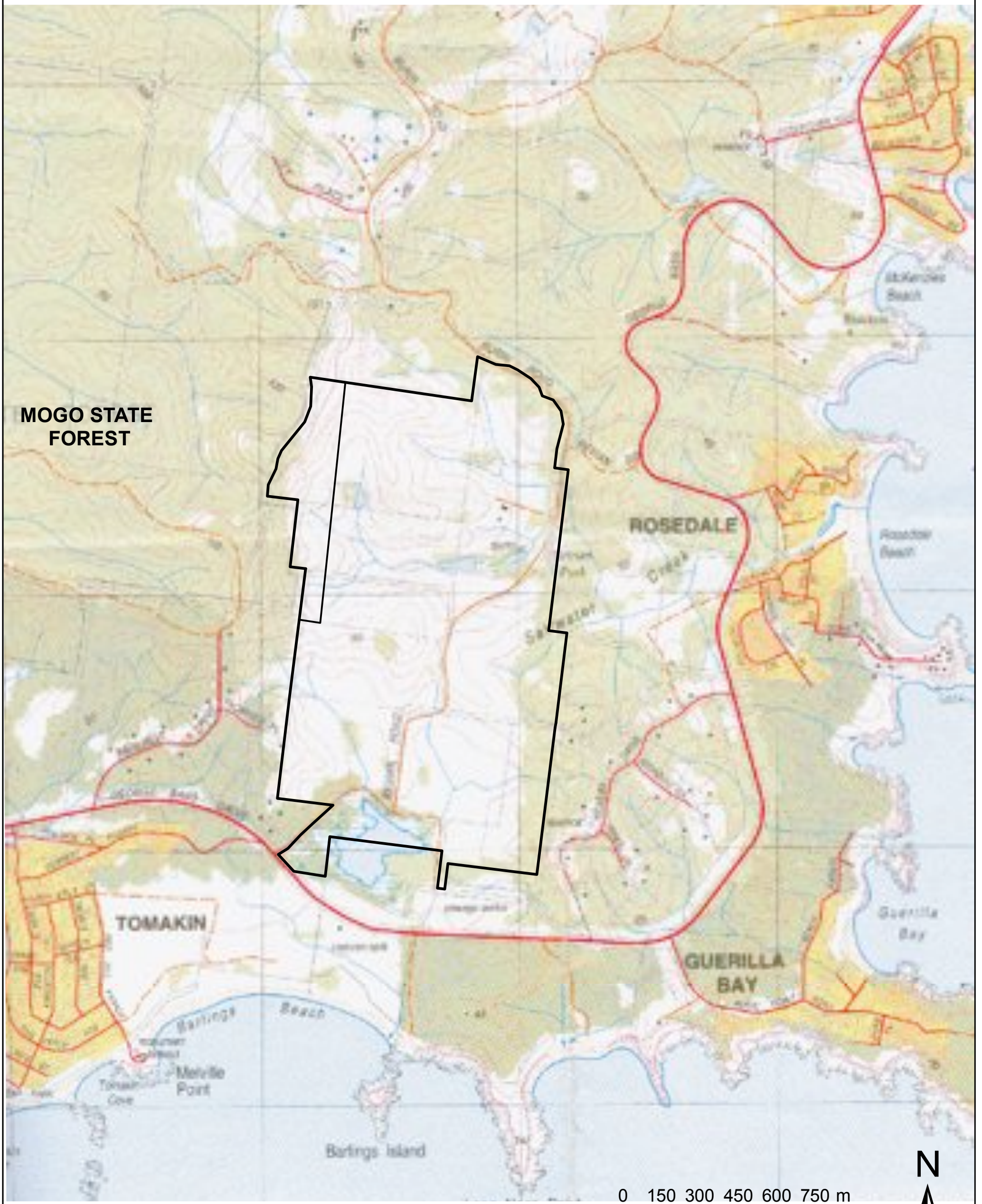
FIGURES



Original plan produced in A3 colour

*Subject Site boundary subject to final survey

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Figure 1 -
Property Location
Bevian Road, Rosedale

Ver.F1 By.TM 17/10/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

0 200 400 600 800 1,000 m

1:14,000

Original plan produced in A3 colour

N

Legend

Property Boundary

**Subject Site boundary subject to final survey*

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Figure 2 -

Aerial Appraisal

Bevian Road, Rosedale

Ver.F2 By.TM 17/10/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

Trees Retained as Part of Development Area

Category 3 Watercourse No. 2

Category 3 Watercourse No. 1

Cheese Factory

Remainder of the vegetation within the site and outside of those vegetation communities indentified in the legend forms Vegetation Community 7 - Grassland with Scattered trees

Trees Retained as Part of Development Area

'The Knoll'

Category 3 Watercourse No. 3

Category 3 Watercourse No. 4

Wetland Buffer 50m

Category 3 Watercourse No. 5

Freshwater Wetland Vegetation is not representative of the SEPP 14 Bevian Wetland

Legend

- Property Boundary
- Wetland Buffer (50m)
- Category 3 Water Courses
- Drainage Lines *Overland Flow Zones*
- 1 Spotted Gum/Ironbark Open Forest
- 2 Blackbutt Woodland
- 3 Banksia Scrub
- 4 Dry Gully Rainforest (Preliminary EEC - EPBC Act)
- 5 Swamp Oak Open Forest (Core Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- 5a Disturbed Swamp Oak Open Heath (Low Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- 6 Aquatic Herbfield
- 5a Freshwater Wetland Vegetation (Core Quality Freshwater Wetlands on Coastal Floodplains - EEC - TSC Act)
- 8 Disturbed Redgum Open Woodland (Low Quality Riverflat Eucalypt Forest on Coastal Floodplains - EEC - TSC Act)
- 9 Disturbed Swamp Paperbark Open Heath (Low Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- 9a Swamp Paperbark Closed Scrub (Core Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- Bangalay Sand Forest
- Perimeter Asset Protection Zone

0 100 200 300 400 500 m

1:10,000

Original plan produced in A3 colour

N

*Subject Site boundary subject to final survey

All mapped features are approximate and require land survey to confirm the location of Asset Protection Zones relative to developement footprint

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Figure 3 -

The Constraints Map - Ecological and Bushfire Constraints

Bevian Road, Rosedale

Ver.F3 By.TM 17/10/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

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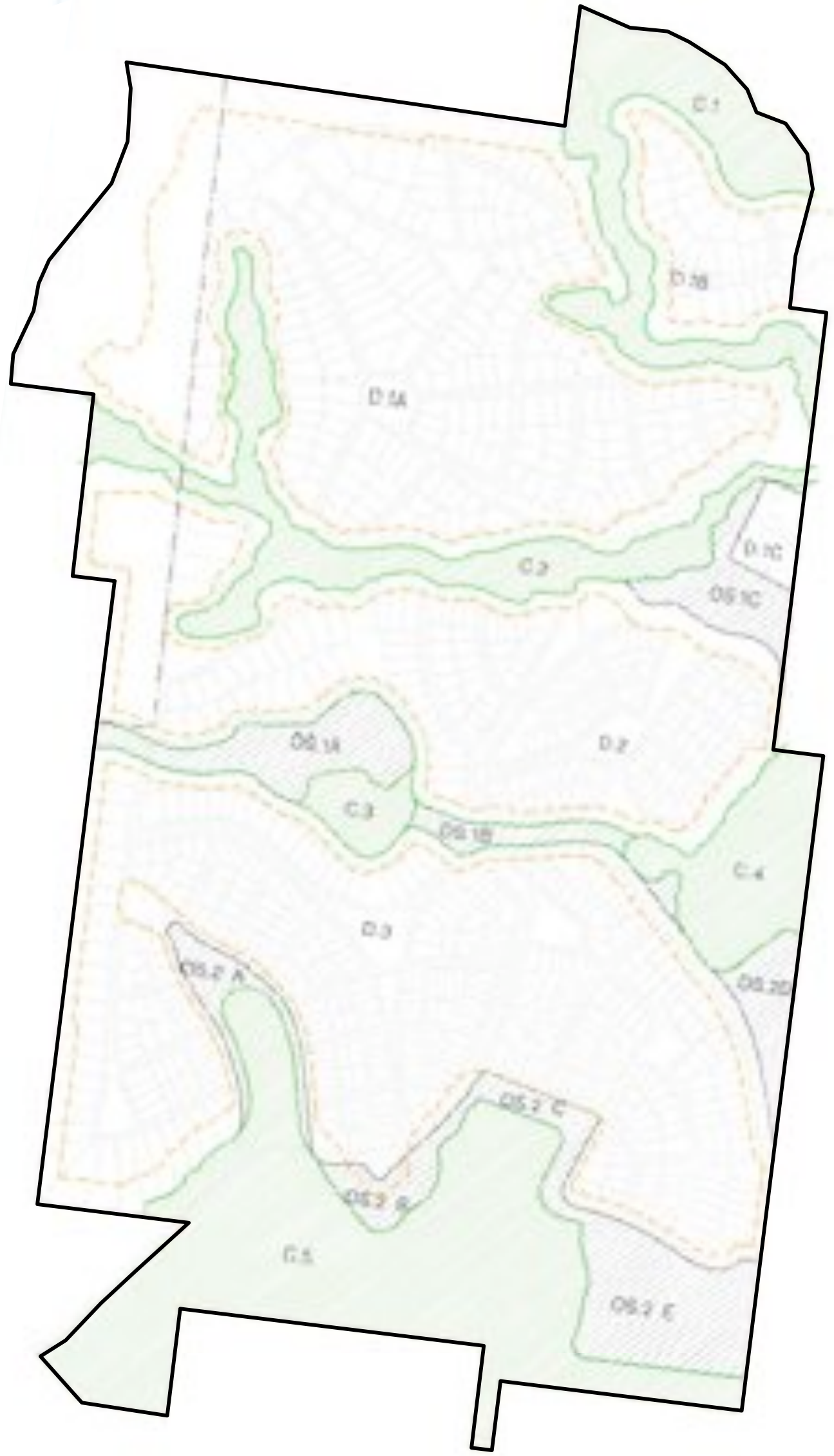
Figure 4 -
The Plan of Subdivision
Bevian Road, Rosedale

Ver.F4 By.TM
17/10/07
Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,



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Original plan produced in A3 colour

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Legend

Property Boundary

*Subject Site boundary subject to final survey

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Figure 5 -

Precinct Plan

Bevian Road, Rosedale

Ver.F5
17/10/07
Ref.No.6052

Source: Dept. of Lands 1:25,000, Aerial Photograph

SCHEDULES

SCHEDULE 1	Bushfire Protection Measures
SCHEDULE 2	Fuel Management Zones
SCHEDULE 3	Restoration Management
SCHEDULE 4	Tree Management
SCHEDULE 5	Works Environment Protection
SCHEDULE 6	Ecological Monitoring

All mapped features are approximate and require land survey to confirm the location of Asset Protection Zones relative to developement footprint

*Subject Site boundary subject to final survey

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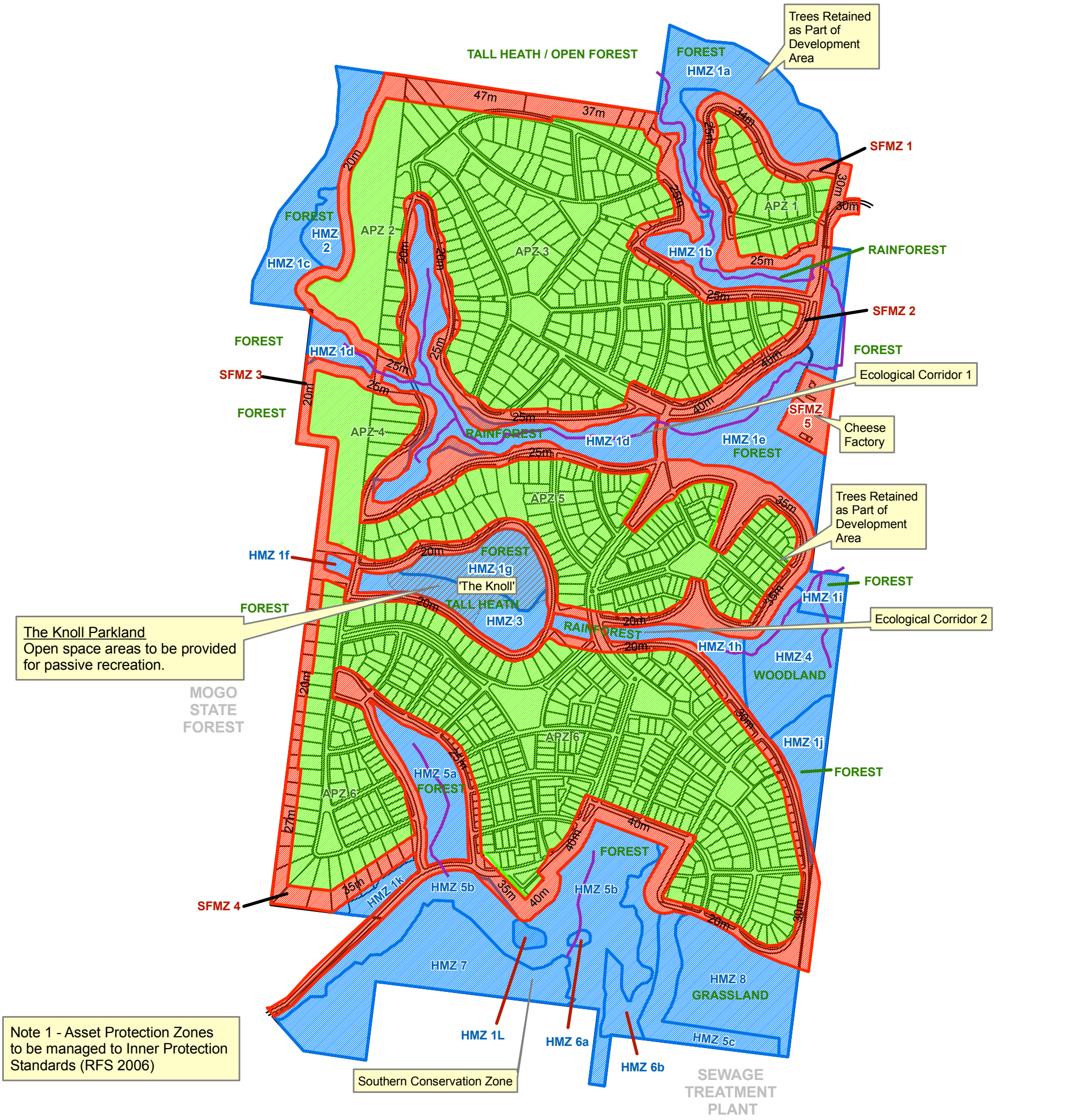
Schedule 1 -
Bushfire Protection Measures
Bevian Rd, Rosedale

Ver.S1 By.TM 22/11/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,



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Schedule 2 -
Fuel Management Zones
Bevian Rd, Rosedale

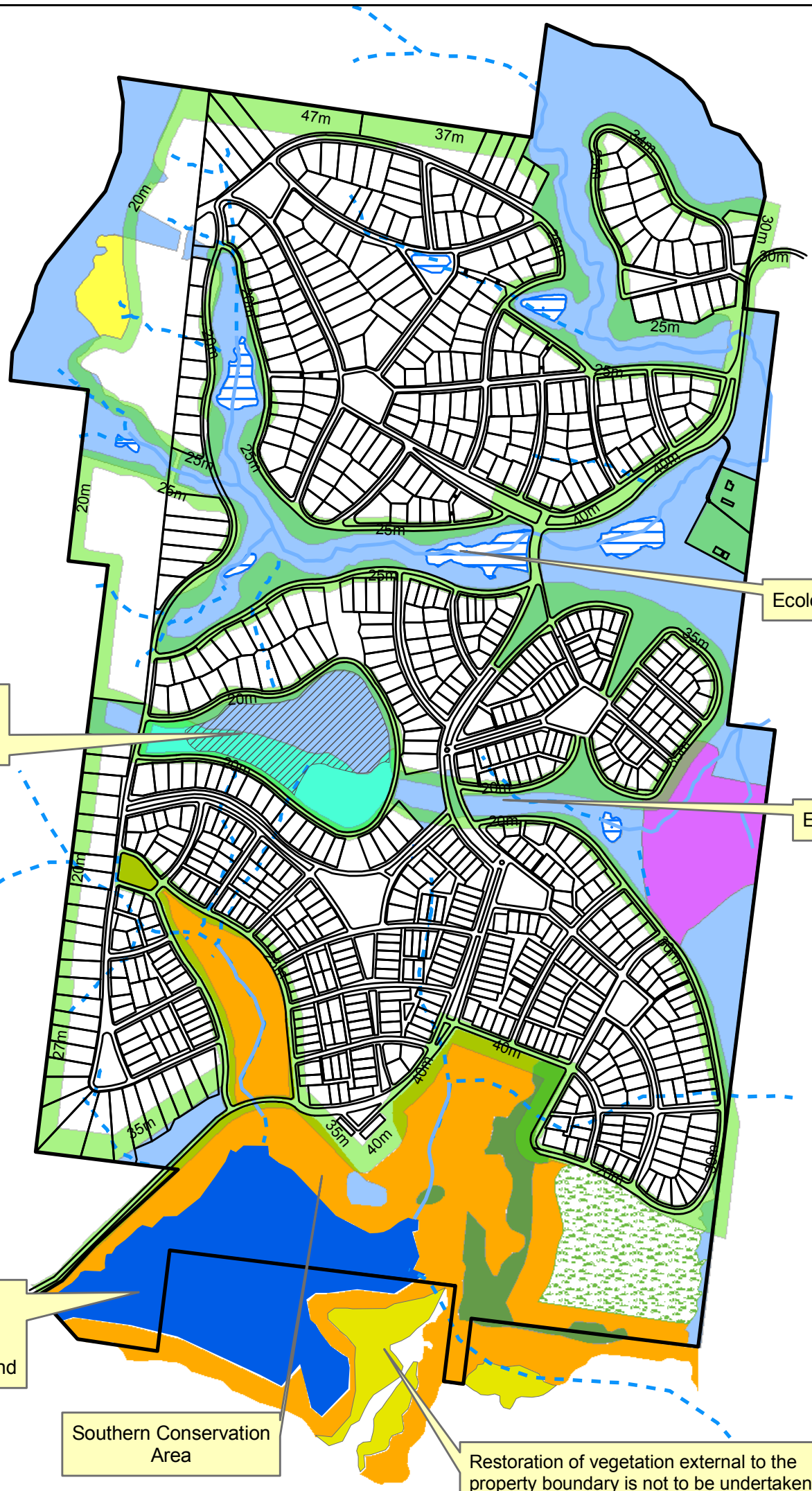
Ver.S2 By.TM 17/10/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

Restoration Specifications

Restoration is to be achieved through a combination of regeneration, revegetation and formal landscaping. The following specifications apply to the restoration of the target communities.

1. Open space areas within ecological corridors are to planted with locally occuring native plant species.
2. Revegetation within the riparian zones are to be in accordance with the General Terms of Approval to be issued by DWE.
3. Rehabilitation of EEC vegetation is to be fully structured vegetation endemic to that EEC.



Legend

Target Regeneration / Restoration Communities

- Bangalay Sand Forest
- Freshwater Wetland Vegetation (TSC Act EEC)
- Asset Protection Zone
- Grassland
- Swamp Oak Open Forest
- Spotted Gum / Ironbark Open Forest
- Banksia Scrub
- Blackbutt Woodland
- Dry Gully Rainforest (Preliminary EEC)
- Disturbed Redgum Open Woodland (TSC Act EEC)
- Aquatic Herbs/Macrophytes
- Passive Recreation Area
- Category 3 Water Courses
- Drainage Lines
- Property Boundary

Note: Open space areas are to be provided within ecological corridors in accordance with the Landscape Concept Plan.

0 100 200 300 400 500 m

1:8,000

Original plan produced in A3 colour

N

All features located by Trimble GPS have been modified
All mapped features are approximate and require land survey to confirm the location of Asset Protection Zones relative to developement footprint
Property boundary subject to final survey

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Schedule 3 -
Restoration Management
Bevian Road, Rosedale

Ver.S3 By.TM 11/02/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

Tree Protection Specification

1. Tree Protection Zone (TPZ) will be required surrounding any retained tree or group of trees. This tree protection zone can generally be provided by preserving an area around the tree or trees outside of the canopy dripline. Unless identified on a tree to be removed, a TPZ will automatically apply to all trees within the subdivision.

2. Tree protection zones in close proximity to earth works or construction are to be marked using star pickets and high visibility tape or plastic net fencing.

3. Approved tree removal in the vicinity of retained trees are to be undertaken in a manner that avoids canopy damage and soil compaction to adjacent trees.

4. Stumps are to be dugout along roads and within building footprints, elsewhere stumps are to be cut flush to the ground to avoid soil disturbance.

5. All trenches footings and major earth movement and to avoid TPZ's.

6. Stockpiling materials and soils within tree protection zones is not permitted.

7. Machinery is to avoid tree protection zones during all operations.

8. Any trenching or construction works undertaken within tree protection zones should be witnessed, supervised and recorded (photographed and documented) by a qualified Arborist.

9. Habitat Trees to be surveyed and categorised to CMA standard (Biometric Test Survey Guildlines)

Vegetation Removal

1. Canopy trees generally to be retained except where impacted by roads and building footprints.

2. Existing managed understorey to be maintained in asset protection zones, subject to fuel load analysis.

3. Existing sparse canopy to be retained in asset protection zones.

Notes:
1.Tree removal due to building footprints, cut & fill and services i.e. water, gas and power has not been assessed.
2.All works to be undertaken in accordance with the Ecological Site Management Plan (Conacher Travers 2007).
3.All hollow relocation to be undertaken under direction of Project Ecologist.
4.Revegetation Areas to be finalised subject to final understorey retention pattern.

Accompanying Schedules:
Schedule 1 - Bushfire Protection Measures
Schedule 2 - Fuel Management Zones
Schedule 3 - Restoration Management
Schedule 4 - Tree Management Plan
Schedule 5 - Works Environmental Protection Plan
Schedule 6 - Ecological Monitoring

Note: Trees not surveyed within areas of vegetation to be retained.

Legend

- Trees to be Removed
- Trees to be Retained
- Category 3 Water Courses
- Drainage Lines
- Asset Protection Zone
- Blackbutt Woodland
- Dry Gully Rainforest (Preliminary EEC - EPBC Act)
- Freshwater Wetland Vegetation (Core Quality Freshwater Wetlands on Coastal Floodplains - EEC - TSC Act)
- Spotted Gum/Ironbark Open Forest
- Banksia Scrub
- Aquatic Herbfield
- Swamp Oak Open Forest (Core Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- Disturbed Swamp Oak Open Heath (Low Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- Disturbed Redgum Open Woodland (Low Quality Riverflat Eucalypt Forest on Coastal Floodplains - EEC - TSC Act)
- Disturbed Swamp Paperbark Open Heath (Low Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- Bangalay Sand Forest
- Swamp Paperbark Closed Scrub (Core Quality Swamp Oak Floodplain Forest - EEC - TSC Act)

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Original plan produced in A3 colour

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*Subject Site boundary subject to final survey

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Schedule 4 -
Tree Management Schedule
Bevian Road, Rosedale

Ver.S4
20/10/07
Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

Works Environment Protection Specifications

The mitigation of potential adverse impacts of construction works will be implemented through the following procedures:
1. Implementation of erosion and sediment control measures during construction including installation of filter fences adjacent to conservation areas, overland flows, drainage lines and creeks.
2. Identification and fencing of areas to be protected (Exclusion fences).
3. All trees will be automatically subject to a Tree Protection Zone (TPZ) unless nominated for removal.
4. Avoidance of soil compaction of tree root zones situated within TPZ's.
5. Bush regeneration within conservation areas, riparian zones and creeks

Notes:
1.Tree removal due to services i.e. water, gas and power has not been assessed.
2.All works to be undertaken in accordance with the Environmental Site Management Plan (Conacher Travers 2006).
3.All hollow relocation to be undertaken under direction of Project Ecologist.
4.Effluent Trench locations subject to final Civil Development Plan.
5.Revegetation Areas to be finalized subject to final undustorey retention pattern.

Legend

- Drainage Lines
- Bangalay Sand Forest
- Dams
- Freshwater Wetland Vegetation (EEC)
- Grassland
- Swamp Oak Open Forest
- new apz *Asset Protection Zone*
- Spotted Gum / Ironbark Open Forest
- Banksia Scrub
- Blackbutt Woodland
- Dry Gully Rainforest (Preliminary EEC)
- Riverflat Eucalypt Forest on Coastal Floodplains (EEC)
- Property Boundary

0 100 200 300 400 500 m

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Original plan produced in A3 colour

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All mapped features are approximate and require land survey to confirm the location of Asset Protection Zones relative to developement footprint

**Subject Site boundary subject to final survey*

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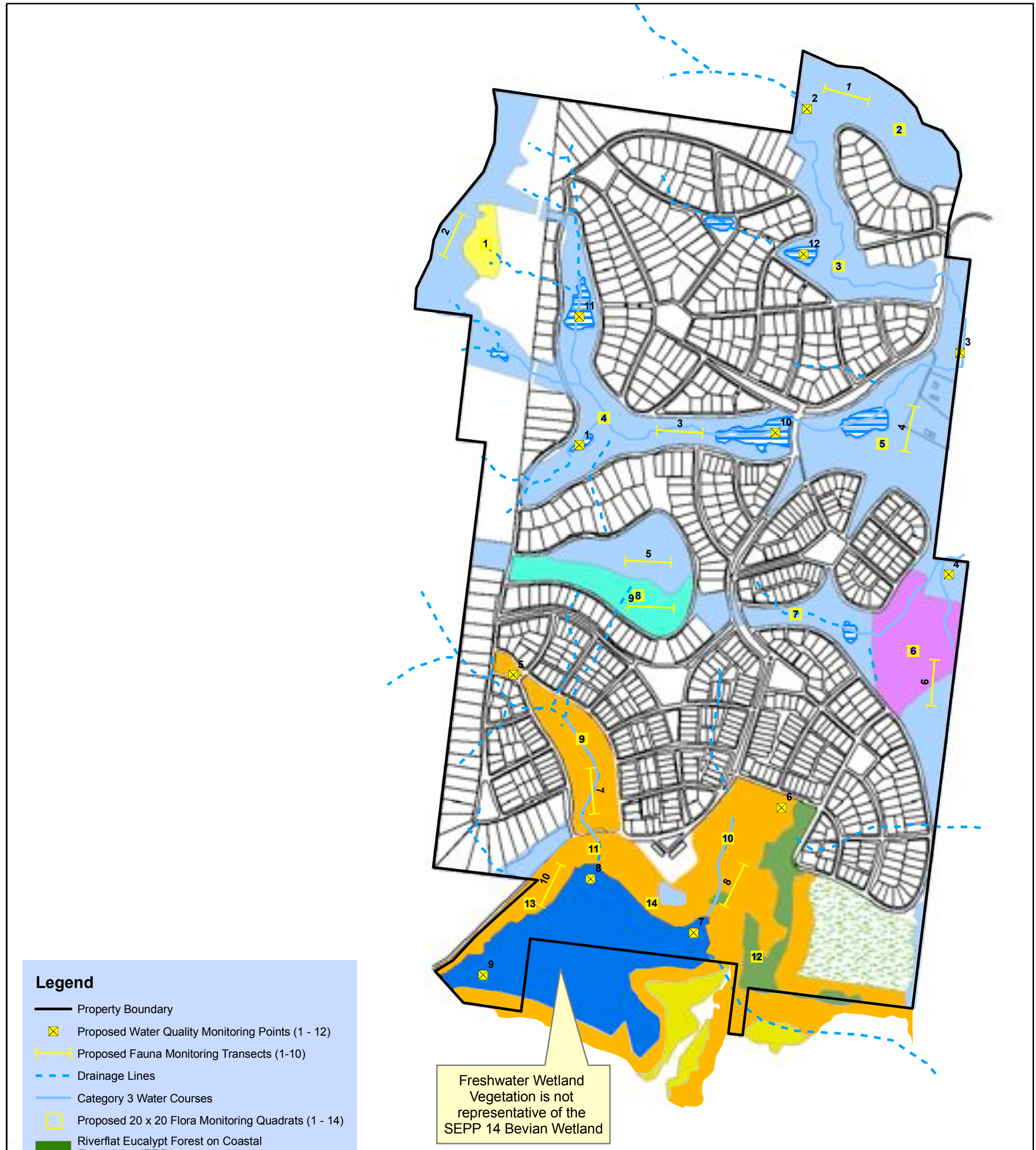
Schedule 5 -
Works Environment Protection
Bevian Road, Rosedale

Ver.S5 By.TM 22/11/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,



*Subject Site boundary subject to final survey

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Schedule 6 -
Monitoring Schedule
Bevian Road, Rosedale

Ver.S6 By.TM 17/10/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

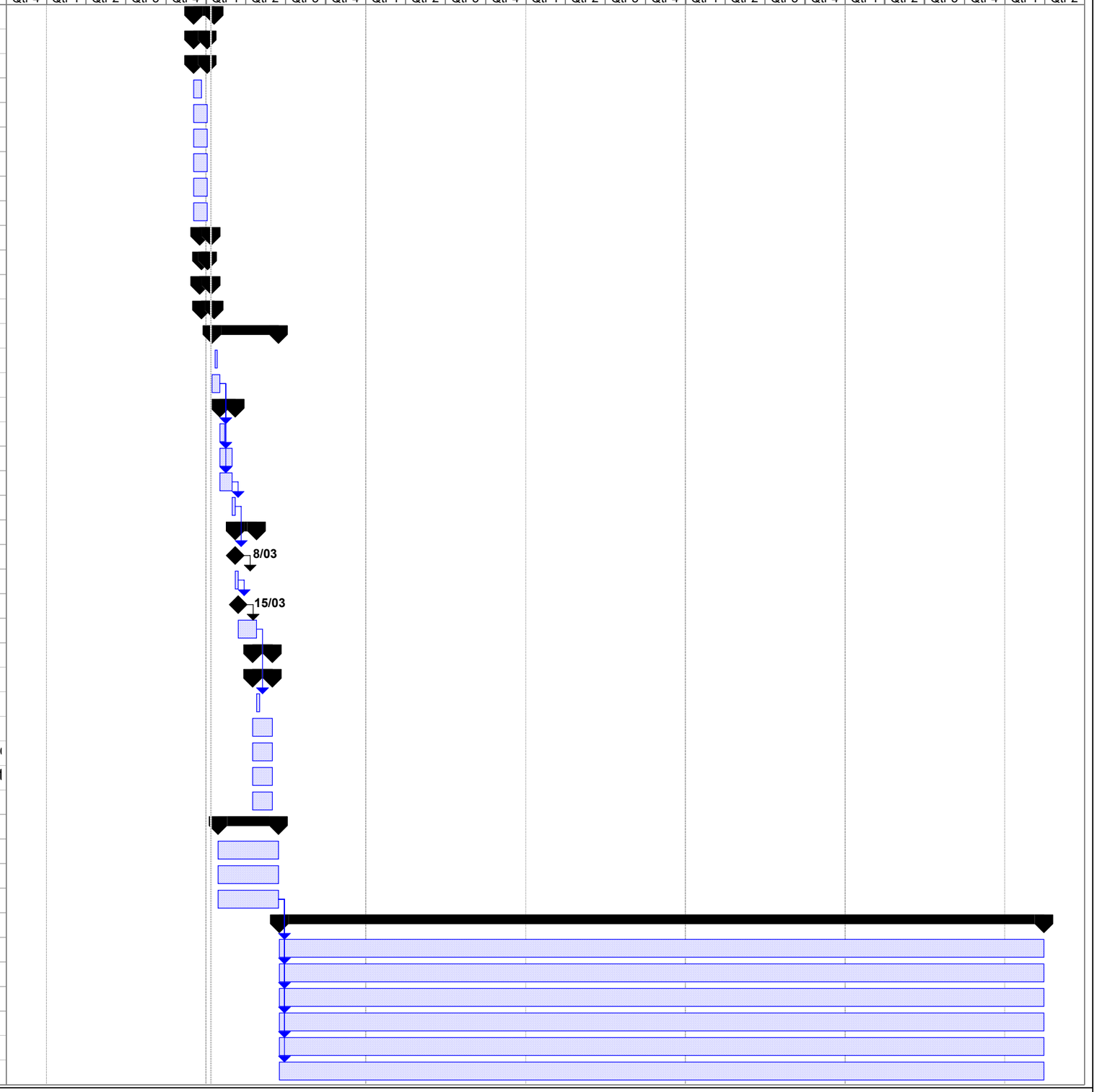
APPENDICES

APPENDIX 1	Site Management Program
APPENDIX 2	Ecological Site Management Program
APPENDIX 3	Operational Works Program
APPENDIX 4	Site Construction Plans (to be inserted when prepared)
APPENDIX 5	Environmental Audit Checklist
APPENDIX 6	Locally Occurring Native Flora
APPENDIX 7	Weed Management Techniques
APPENDIX 8	Revegetation Methods
APPENDIX 9	Bush Regeneration Methods
APPENDIX 10	How to Collect Native Seeds
APPENDIX 11	Hollow Bearing Tree Removal Guidelines

APPENDIX 1

SITE MANAGEMENT PROGRAM
(To be prepared and submitted to Project Ecologist prior to commencement of construction works)

ID	Task Name
1	**PRECONSTRUCTION**
2	**Project Initiation**
3	**Preparation of Project Management Plans**
5	Ecological Site Management Schedule
6	Restoration Management Schedule
7	Civil Works Schedule
8	Bulk Earthworks Schedule
9	Landscaping Schedule
10	Building Schedules
11	**Preparation of Project Briefs**
12	**Project Ecologist Brief**
24	**Site Management Briefs**
32	**Engagement of Critical Contractors**
46	**CONSTRUCTION**
47	Establishment of Communication Protocols
48	Preparation of Environmental Induction Manual
49	**TREE REMOVAL WORKS**
50	Commence removal of trees on access roads
51	Commence fuel reduction in understorey
52	Commence removal of trees in each lot
53	Tidy up all areas based on PE inspection
54	**BULK EARTHWORKS**
55	Commence bulk Earthworks
56	Install gravel protection in fill zones around affected trees
57	Project ecologist signoff on installation of gravel treatment.
58	Progressive Cut & Fill as per bulk earthworks program
59	**CIVIL WORKS**
60	**Construction**
61	Signoff on Environmental Controls by Project Ecologist
62	Monitor erosion control fencing (monthly - especially after heavy rain)
63	Inspect habitat trees during clearing and relocate fauna if required, prior to (
64	Mulching and shredding of removed vegetation in developed and rehabilitat
65	Monitor tree protection fencing and signs and replace if required.
66	**RESTORATION WORKS**
67	Continuation of weed control and regeneration
68	Continuation of revegetation works within restoration zones
69	Continuation of biological and water quality monitoring
70	**POSTCONSTRUCTION**
71	Continuation of weed control and regeneration
72	Plant new trees recognised within Landscape Master Plan
73	Remove tree protection fencing and signs
74	Enrichment planting and ongoing regeneration works
75	Enrichment planting and monitoring of revegetation of restoration zones
76	Monitoring of retained trees - conduct maintenance if required



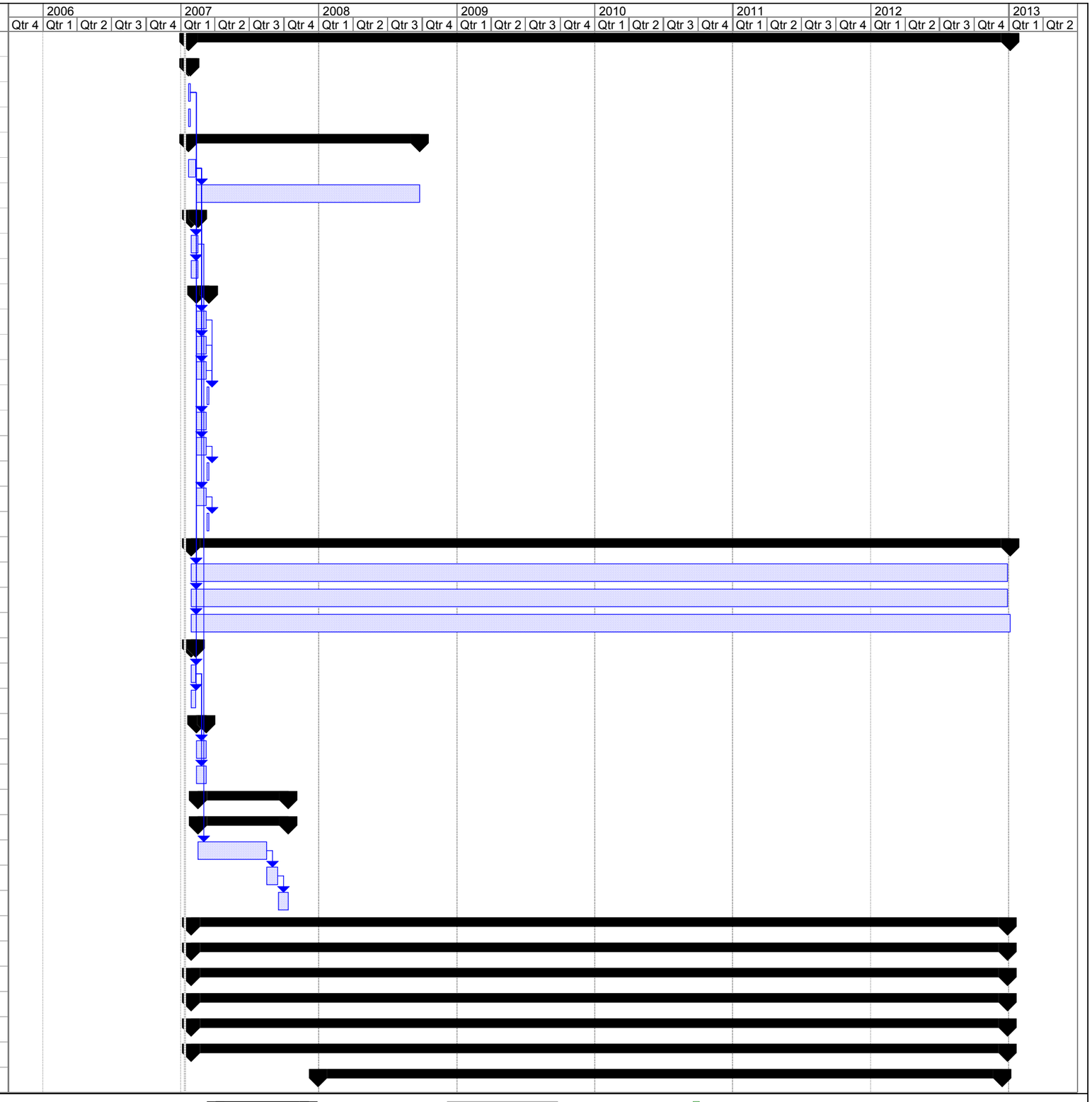
Project: SITE MANAGEMENT SCHED
Date: Thu 11/01/07

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

APPENDIX 2

ECOLOGICAL SITE MANAGEMENT PROGRAM

ID	Task Name
1	**ECOLOGICAL SITE MANAGEMENT**
2	**Licence Applications**
3	Application for S132 seed collection licence from DEC
4	Off Label Permit Application for specific noxious weed control works
5	**Environmental Inductions**
6	Main Project Team Induction
7	Subcontractor inductions (as required)
8	**Subcontract Management**
9	Engagement of seed collectors
10	Engagement of Wholesale Plant Suppliers
11	**Environmental Protection Works**
12	Install Exclusion fencing
13	Install Tree Protection Zones
14	Install Habitat Tree Protection
15	Project Ecologist Signoff on Environmental and tree protection
16	Install Sediment/ Erosion Control Fencing
17	Install Riparian Zone Protection
18	Project Ecologist Signoff of sediment control and drainage protection works
19	Install nest boxes and identify hollow relocation sites
20	Project Ecologist Signoff of nest boxes
21	**Implement Weed Control Program**
22	Within Development Area
23	Within Conservation Area
24	Asset Protection Zones
25	**Implement Asset Protection Works**
26	Install Access Routes
27	Install Asset Protection Zones
28	**Tree Dismantling Works**
29	Hollow Inspection, dismantle and relocation
30	Tree Removal and Mulching of waste
31	**Implement Revegetation Works**
32	**Riparian and Conservation Zone**
33	Seed Collection & Propagation of Plants
34	Site preparation
35	Planting and ongoing maintenance
36	**Implement Monitoring, auditing and Compliance Certification**
37	**Year 1-5**
38	**Benchmark Biological Monitoring program**
50	**Annual Biological Monitoring**
62	**Auditing program**
64	**Compliance Certification (as required)**
71	**Ongoing Regeneration Works within Conservation Area**



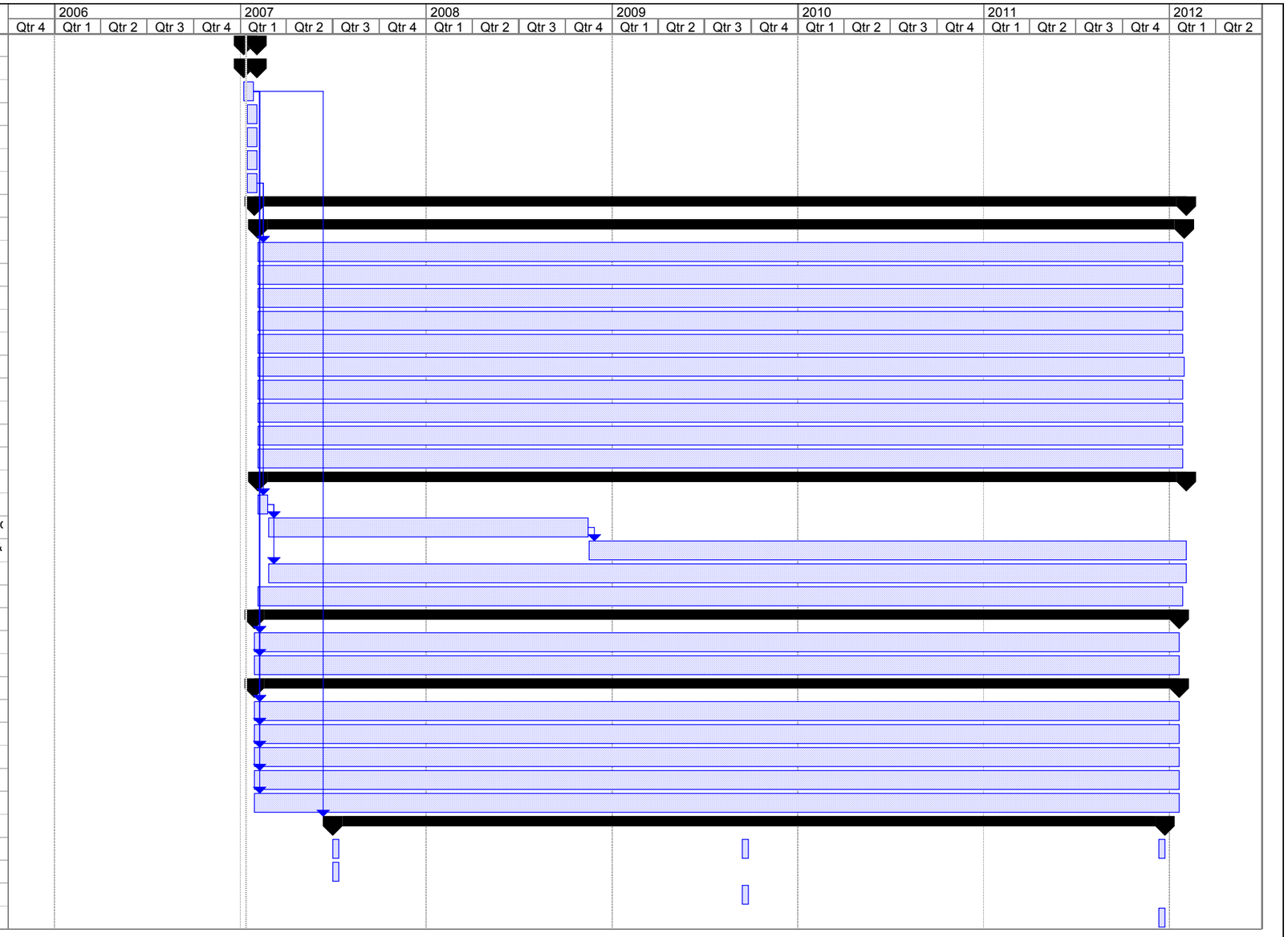
Project: ESMP WORKS SCHEDULE -
Date: Thu 11/01/07

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

APPENDIX 3

OPERATIONAL WORKS PROGRAM

ID	Task Name
1	**Initiation of Operation Works Program**
2	**Engage contractors**
3	Engage Project Ecologist (on contract)
4	Engage Bush Regeneration Company (On contract)
5	Engage Hazard Reduction Contractors (On Contract)
6	Engage Arborist (as required)
7	Engage Pest Control Contractor (as required)
8	**Implement Operational Works**
9	**Riparian and Conservation Management Program (Community Lot)**
10	Noxious & environmental weed control
11	Mulching
12	Erosion control
13	Enrichment Planting, seeding & brushmatting
14	Revegetation Maintenance (guarding, weeding, stabilisation)
15	Litter collection
16	Lawn Mowing
17	Slashing
18	Maintenance of protective fencing
19	Vegetation Condition Assessment (every 6 months until established)
20	**Biological Monitoring Program**
21	Permit application for threatened species monitoring.
22	Annual Biological Monitoring (first 2 years) - waterbodies, habitat corridors & conservation prec
23	Bienniel "Biotrack" Biological Monitoring (third and fifth year) - waterbodies, habitat corridors &
24	Ecological Monitoring - flora, fauna
25	Pest species Monitoring (Mosquito, fox, cat, rabbit, pigs, etc)
26	**Hazard Reduction Program**
27	Asset Protection Zones (annually)
28	Fuel Sampling (annually)
29	**Tree management**
30	Protection, dismantling & relocation of hollows
31	Protection of Habitat Trees
32	Opportunistic inspections
33	Management of damaged trees
34	Replacement planting of dead or diseased trees
35	**Environmental Auditing, Reporting and Compliance Certification**
36	**Annual Audit & Report submitted to Council**
37	Annual Audit & Report submitted to Council 3
38	Annual Audit & Report submitted to Council 4
39	Annual Audit & Report submitted to Council 5



Project: OPERATIONAL WORKS SCH
Date: Thu 11/01/07

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

APPENDIX 4

SITE CONSTRUCTION PLANS
(To be prepared and submitted to Project Ecologist prior to commencement of construction works)

APPENDIX 5

ENVIRONMENTAL AUDIT CHECKLIST

MANAGEMENT ISSUE	MANAGEMENT ACTIONS	WHEN	RESPONSIBILITY
Induction Manuals	Prepare Induction manuals and present to each individual intending to undertake works on-site.	Prior to any individual commencing work on-site	Project Ecologist
Approvals and Licences	Seek approval from DEC to undertake pest species control within the immediate area.	Prior to any individual commencing work on-site	Project Ecologist
	Apply for a seed collection licence from DEC.		
Contract Management	Prepare a project plan.	Prior to each contract company commencing works	Project Ecologist
	Prepare and submit restoration works briefs.		
	Prepare and submit tender documentation to prospective contractors.		
Tree Protection	Mark areas to be cleared and areas to be protected.	Prior to commencement of any earthworks	Project Ecologist
	Retain canopy vegetation not impacted by building envelopes or asset protection zones.		
	Implement Tree Protection Zones (TPZ) for all retained trees within the developable portions of the site.		
	Install vegetation (individual trees and remnant vegetation) protection measures.		

MANAGEMENT ISSUE	MANAGEMENT ACTIONS	WHEN	RESPONSIBILITY
Tree Protection (Cont.)	Monitor Tree Protection Zones for any damage.	All Phases	Project Ecologist
Fencing	Install protective fencing and signage.	Pre-construction	Construction
	Install exclusion fencing.		
	Access gates are to be provided to each management area enclosed by fencing to allow vehicle access to land management personnel.		
Weed Control	Noxious weed control is to be undertaken across the whole development area in accordance with the Ecological Site Management Plan (*Conacher Travers* 2007).	Pre-construction	Project Ecologist
	Targeted weed control is to be undertaken throughout the retained bushland areas.		
Pests	A program using cage traps for trapping of foxes and stray cats set by licensed feral pest control contractors is to be implemented in accordance with approvals from the Department of Agriculture and Pastures Protection Board.	Pre-construction	Project Ecologist

MANAGEMENT ISSUE	MANAGEMENT ACTIONS	WHEN	RESPONSIBILITY
Pests (Cont.)	Pest species monitoring and control program are to be undertaken annually for the first 3 years, then every 5 years in perpetuity or more frequently if required. Monitoring is to include detection of the use of the nest boxes by hollow dependant exotic species such as feral bees. Any exotic species are to be removed as part of ongoing management.	All Phases	Project Ecologist
	A qualified tree climber skilled in dealing with feral honey bees is to remove said bees occupying naturally occurring hollows within all hollow bearing trees.	Pre-Construction	Project Ecologist
	Ongoing liaison is to be undertaken with local Rangers, other control authorities, community groups and adjacent landholders for advice, coordination and educational purposes relating to pest fauna management	All Phases	Project Ecologist

MANAGEMENT ISSUE	MANAGEMENT ACTIONS	WHEN	RESPONSIBILITY
Strategic Hazard Reduction	Bushfire APZ's are to be provided as per Schedule 1 of Bushfire Protection Assessment.	Construction phase and ongoing management in perpetuity	Site Manager
	In order to reduce the incidence of wildfire, fuel levels are to be maintained within asset protection zones as outlined in the Bushfire Protection Assessment.		
	Bushfire activity is to be recorded by mapping the extent, intensity and dates of any bushfires within the areas covered by the Bushfire Protection Assessment		
Regeneration	A suitably qualified bush regenerator is to be engaged to supervise all regeneration works.	Pre-construction with ongoing management in perpetuity	Project Ecologist
	Suitable nursery grown tubestock is to be replanted into designated restoration areas and implement appropriate ongoing management to ensure continued growth, vitality and replacement of these plantings.		
	Only locally procured native seeds are to be used as a seed source for propagating replacement plants.		
	Locally endemic native species are to be used in all landscaping.		
	Recruitment / augmentation of plantings are not to occur within areas to be slashed for bushfire hazard management unless dieback occurs.		
	The condition and health of trees within the restoration and conservation areas is to be monitored and all necessary steps are to be taken to restore and replace any large trees that are lost since the previous monitoring period.		

MANAGEMENT ISSUE	MANAGEMENT ACTIONS	WHEN	RESPONSIBILITY
Pets	The ownership of cats and dogs by residents is to be prohibited, with the exception of 'assistance animals' as defined under Section 9 of the *Disability Discrimination Act* 1992, as part of a development approval requirement and included in the Community management Statement.	Pre-construction with ongoing management in perpetuity	Community Association
	'Assistance animal' control / restraint signage is to be erected and maintained.		
	'Assistance animal' restraints are to be inspected regularly.		
Erosion and Sediment Control	Erosion and sediment control measures are to be installed.	Prior to initiation of any earthworks	Site Manager
Stormwater and Nutrient Control	Nutrient control devices (e.g. wetland basins and bio-swales) are to be installed.	Prior to initiation of any earthworks	Site Manager
	Stormwater flows are to be diverted through gross pollutant control and nutrient filter devices.		
	A restriction is to be placed on the use of high phosphate household chemicals.		
	Gross Pollutant Traps are to be installed.		
Cut and Fill Management	All cut and fill works are to be carried out in accordance with the ESMP (*Conacher Travers* 2007).	Prior to initiation of any earthworks	Site Manager
Monitoring / Auditing & Reporting	Each monitoring report shall include a cumulative analysis of the results and data recorded in previous annual monitoring reports.	All Phases	Project Ecologist
	The site manager is to maintain a daily logbook of all activities undertaken		
	A logbook of all works undertaken is to be maintained which is to be made available to the Community Association upon request, with a summary of the logbook included in the annual report to Council.		

APPENDIX 6

LOCALLY OCCURRING NATIVE FLORA
(Vegetation Community Descriptions – *Conacher Travers* Flora and Fauna Assessment 2007)

LOCALLY OCCURRING NATIVE FLORA

The following nine (9) vegetation communities and three (3) variations were identified within the subject site using aerial photographic interpretation and extensive ground truthing.

Vegetation community No.	Vegetation Community Title	Existing extent (ha)
1	Spotted Gum/Ironbark Open Forest	15.76
2	Blackbutt Woodland	2.92
3	Dry Gully Rainforest (Preliminary EEC under the *EPBC Act* 1999)	0.52
4	Banksia Scrub	1.28
5	Swamp Oak Open Forest (Core Quality Swamp Oak Floodplain Forest EEC - *TSC Act* 1995)	4.48
*5a	Disturbed Swamp Oak Open Heath (Low Quality Swamp Oak Floodplain Forest EEC - *TSC Act* 1995)	1.62
6	Aquatic Herbfield	1.24
*6a	Natural Freshwater Wetland (Core Quality Freshwater Wetlands on Coastal Floodplains EEC - *TSC Act* 1995)	5.94
7	Grassland with Scattered Trees	146.68
8	Disturbed Redgum Open Woodland (Low Quality Riverflat Eucalypt Forest on Coastal Floodplains EEC - *TSC Act* 1995)	2.05
9	Closed Swamp Paperbark Scrub (Core Quality Swamp Oak Floodplain Forest EEC - *TSC Act* 1995)	0.09
*9a	Disturbed Swamp Paperbark Open Heath (Low Quality Swamp Oak Floodplain Forest EEC - *TSC Act* 1995)	5.04
* Denotes vegetation community variation		

These vegetation communities are described in the following tables.

Vegetation Community 1 – Spotted Gum/Ironbark Open Forest/Woodland	
Description	This vegetation community within the study area corresponds to Map Unit - 9 Coastal Lowlands Cycad Dry Shrub Forest – *Corymbia maculata / Macrozamia communis* as described and mapped by NPWS (2000). Variations from the NPWS (2000) description include *Eucalyptus fibrosa* occurred as the dominant ironbark along the eastern boundary of the study area and *Eucalyptus muelleriana* occurred throughout the vegetation community.
Occurrence	This vegetation community occurs in the northern-eastern corner, along the eastern boundary and within the north-western sections of the study area and covers approximately 10 % of the study area.
Structure	Open Forest to Woodland with a canopy cover ranging from 20% to 40% and height of approximately 15-20 metres. The understorey consists of a sparse, to moderate, to dense shrublayer to 3 metres high and sparse, to moderate, to dense groundcover of herbs and grasses.
Disturbances	This vegetation community has been disturbed by partial clearing, underscrubbing and incursions of weeds.
Common Species	
Trees	*Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *Eucalyptus muelleriana* (Yellow Stringybark), *Eucalyptus globoidea* (White Stringybark), *Eucalyptus paniculata* subsp. *paniculata* (Grey Ironbark) and *Allocasuarina littoralis* (Black She-oak).
Shrubs	*Acacia irrorata* subsp. *irrorata* (Blueskin), *Acacia floribunda* (Sally Wattle), *Acacia longifolia* (Sydney Golden Wattle), *Acacia longissima, Acacia melanoxylon* (Blackwood), *Acacia paradoxa* (Kangaroo Thorn), *Breynia oblongifolia* (Coffee Bush), *Bursaria spinosa* (Blackthorn), *Exocarpos cupressiformis* (Native Cherry), *Goodenia ovata, Indigophora australis, Ozothamnus diosmifolius* (Ball Everlasting), *Pultenaea villosa* and *Phyllanthus hirtellus* (Thyme Spurge).
Groundcovers	*Aristida vagans* (Wire Grass), *Dianella caerulea* (Flax Lily), *Dichondra repens* (Kidney Weed), *Entolasia stricta* (Wiry Panic), *Glycine tabacina* (Variable Glycine), *Gonocarpus teucroides, Hardenbergia violacea* (False Sarsparilla), *Imperata cylindrica* (Blady Grass), *Lepidosperma laterale* (Variable Sword-sedge), *Lepidosperma urophorum, Lomandra longifolia* (Spiky-headed Mat-rush), *Macrozamia communis* (Burrawang), *Poa labillardieri, Pratia purpurascens* (Whiteroot), *Pteridium esculentum* (Bracken Fern), *Themeda australis* (Kangaroo Grass) and *Veronica plebeia* (Creeping Speedwell).
Weeds	*Centaurium erythraea* (Pink Stars), *Chrysanthemoides monilifera* (Bitou Bush), *Cirsium vulgare* (Spear Thistle), *Conyza albida* (Tall Fleabane), *Conyza bonariensis* (Flaxleaf Fleabane), *Pennisetum clandestinum* (Kikuyu), *Plantago lanceolata* (Ribwort) and *Rubus anglocandicans* (Blackberries).

Vegetation Community 2 – Blackbutt Woodland	
Description	This vegetation community is a variation on Map Unit 9 – Coastal Lowlands Cycad Dry Shrub Dry Forest mapped by NPWS (2000). The shrub layer and understorey are similar to the Spotted Gum/Ironbark Open Forest. However, the dominant canopy species was *Eucalyptus pilularis* rather than *Corymbia maculata* in comparison to the Spotted Gum/Ironbark Open Forest.
Occurrence	This vegetation community occurs in the eastern section of the study area and covers <5% of the study area.
Structure	Woodland with a canopy cover of approximately 20-25% and height of approximately 18-20 metres. The understorey consists of a sparse shrublayer to 2 metres high and moderate to dense groundcover of herbs and grasses.
Disturbances	This vegetation community has been disturbed by underscrubbing and cattle grazing.
Common Species	
Trees	*Eucalyptus pilularis* (Blackbutt), *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *Eucalyptus muelleriana* (Yellow Stringybark) and *Eucalyptus globoidea* (White Stringybark).
Shrubs	*Acacia longifolia* (Sydney Golden Wattle), *Acacia terminalis* (Sunshine Wattle), *Acacia ulicifolia* (Prickly Moses), *Allocasuarina littoralis* (Black She-oak), *Daviesia ulicifolia* (Gorse Bitter-pea), *Hibbertia aspera*, *Persoonia linearis* (Narrow-leaved Geebung), and *Pultenaea villosa*.
Groundcovers	*Cassytha glabella* (Devil's Twine), *Centella asiatica, Cynodon dactylon* (Common Couch), *Entolasia stricta* (Wiry Panic), *Glycine tabacina* (Variable Glycine), *Gonocarpus teucroides*, *Hardenbergia violacea*, *Imperata cylindrica* (Blady Grass), *Joycea pallida* (Silvertop Wallaby Grass), *Lepidosperma laterale* (Variable Sword-sedge), *Lomandra longifolia* (Spiky-headed Mat-rush), *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat Rush), *Panicum simile* (Two Colour Panic), *Poa labillardieri* (Tussock Grass), *Themeda australis* (Kangaroo Grass).
Weeds	*Anagallis arvensis* (Pimpernel), *Ehrharta erecta* (Panic Veldtgrass), *Hypochaeris radicata* (Flatweed), *Plantago lanceolata* (Ribwort), *Rubus ulmifolius* (Blackberries), *Paspalum dilatatum* (Paspalum), and *Pennisetum clandestinum* (Kikuyu).

Vegetation Community 3 – Dry Rainforest Gully Open Forest	
Description	These two areas of rainforest gully forest were mapped as Map Unit 9 – Coastal Lowlands Cycad Dry Shrub Dry Forest by NPWS (2000). The gullies within Mogo State Forest to the west of the study area have been mapped as Map Unit 2c Moist Eucalypt Forest which includes Map Unit 20 – Coastal Hinterland Ecotonal Gully Rainforest. This vegetation community is most similar to Map Unit 20 – Coastal Hinterland Ecotonal Gully Forest as described by NPWS (2000).
Occurrence	This vegetation community occurs within two gullies in the north western section of the study area and covers approximately 1% of the study area.
Structure	Open Forest with a canopy cover of approximately 50% and height of approximately 10-12 metres. The understorey consists of a sparse to moderate shrublayer to 3 metres high and sparse groundcover of herbs, vines and grasses.
Disturbances	This vegetation community is generally undisturbed apart from small weed incursions.
Common Species	
Trees	*Alphitonia excelsa* (Red Ash), *Claoxylon australe* (Brittlewood), *Cassine australis, Acmena smithii* (Lilly Pilly) and *Glochidion ferdinandi* (Cheese Tree).
Shrubs	*Elaeocarpus reticulatus* (Blueberry Ash), *Ficus coronata* (Sandpaper Fig), *Pomaderris aspera* (Hazel Pomaderris), *Breynia oblongifolia*, *Melicope micrococca* (White Euodia), *Notelaea longifolia* (Mock Olive) and *Synoum glandulosum* (Scentless Rosewood).
Groundcovers	*Adiantum aethiopicum* (Common Maidenhair), *Blechnum cartilagineum* (Gristle Fern), *Carex appressa* (Tussock Sedge), *Centella asiatica* (Swamp Pennywort), *Cissus hypoglauca* (Water Vine), *Dichondra repens* (Kidney Weed), *Doodia aspera* (Rasp Fern), *Entolasia marginata* (Bordered Panic), *Eustrephus latifolius* (Wombat Berry), *Gahnia melanocarpa* (Black-fruit Saw-sedge), *Geitonoplesium cymosum* (Scrambling Lily), *Hydrocotyle peduncularis* (Pennywort), *Oplismenus aemulus* (Basket Grass), and *Pellaea falcata* (Sickle Fern), *Smilax australis* (Lawyer Vine) and *Veronica plebeia*.
Weeds	*Cirsium vulgare* (Spear Thistle), *Hypochaeris radicata* (Flatweed), *Pennisetum clandestinum* (Kikuyu), *Plantago lanceolata* (Ribwort) and *Trifolium repens* (White Clover).

Vegetation Community 4 – Banksia Scrub	
Description	This area known locally as "The Knoll" was mapped as cleared land by NPWS (2000). This vegetation community is most similar to Map Unit – 28 Coastal Sands Blackbutt – Old Man Banksia Scrub Fern Forest. Variations to the Map Unit – 28 (NPWS 2000) description included; the absence of eucalypt species and *Banksia serrata*, whilst the dominant banksia was *Banksia integrifolia*. The understorey has a similar species composition to that described by NPWS (2000).
Occurrence	This vegetation community occurs on the top of a hill located in the Central section of the study area and covers <5 % of the study area.
Structure	Open forest with a canopy cover of approximately 40-45% and height of approximately 10-15 metres. The understorey consists of a sparse to moderate shrublayer to 1-3 metres high and moderate to dense groundcover of herbs, ferns and grasses.
Disturbances	This vegetation community has been disturbed by the construction of an informal vehicular track through its centre. This track is currently unused and regrowth of the vegetation is occurring.
Common Species	
Trees	*Acacia irrorata* subsp. *irrorata* (Blueskin), *Acacia longifolia* (Sydney Golden Wattle), *Acacia melanoxylon* (Blackwood), *Allocasuarina littoralis* (Black She-oak) and *Banksia integrifolia* (Coast Banksia).
Shrubs	*Breynia oblongifolia* (Coffee Bush), *Exocarpos cupressiformis* (Native Cherry), *Hibbertia aspera*, *Leucopogon lanceolatus* (Lance-leaf Beard-heath), *Notelaea longifolia* (Mock Olive), *Ozothamnus diosmifolius* (Ball Everlasting), *Persoonia linearis* (Narrow-leaved Geebung), *Phyllanthus hirtellus* (Thyme Spurge), *Pittosporum undulatum* (Sweet Pittosporum) and *Platysace lanceolata* (Lance-leaved Platysace).
Groundcovers	*Adiantum aethiopicum* (Common Maidenhair), *Aristida vagans* (Wire Grass), *Cassytha pubescens* (Devil's Twine), *Centella asiatica* (Swamp Pennywort), *Dianella caerulea* (Flax Lily), *Dichondra repens* (Kidney Weed), *Doodia aspera* (Rasp Fern), *Entolasia marginata* (Bordered Panic), *Geitonoplesium cymosum* (Scrambling Lily), *Glycine tabacina* (Variable Glycine), *Gonocarpus teucroides*, *Goodenia hederaceaHibbertia scandens* (Climbing Guinea Flower), *Lomandra longifolia* (Spiky-headed Mat-rush), *Macrozamia communis* (Burrawang), *Pratia purpurascens* (Whiteroot), *Pteridium esculentum* (Bracken Fern), *Smilax australis* (Lawyer Vine), and *Solanum pungetium* (Forest Nightshade).
Weeds	*Cerastium glomeratum* (Mouse-ear Chickweed), *Chrysanthemoides monilifera* (Bitou Bush), *Cirsium vulgare* (Spear Thistle), *Conyza albida* (Tall Fleabane), *Conyza bonariensis* (Flaxleaf Fleabane), *Hypochaeris radicata* (Flatweed), *Modiola caroliniana* (Red-flowered Mallow), *Myrsiphyllum asparagoides* (Bridal Creeper), *Oxalis corniculata* (Creeping Oxalis) and *Plantago lanceolata* (Ribwort).

Vegetation Community 5 – Swamp Oak Open Forest (Swamp Oak Floodplain Forest)	
Description	This vegetation community was mapped as Map Unit – 25 South Coast Swamp Forest Complex however, it is most similar to Map Unit 27 – Ecotonal Coastal Swamp Forest as described by NPWS (2000). Variations of this community to the community described by NPWS (2000) include; only a small percentage (<5%) of *Eucalyptus botryoides* surrounding the wetland and the dominance of *Casuarina glauca.* Two areas of this vegetation community within the floodplain have a high level of disturbance due to cattle grazing hence the dominance of the coloniser species, *Casuarina glauca.* In contrast, the area surrounding the Bevian Swamp has a moderate level of disturbance with a diverse composition of species in both the shrublayer and groundlayer, more representative of Map Unit 27 – Ecotonal Coastal Swamp Forest as described by NPWS (2000).
Occurrence	This vegetation community occurs within the floodplains and along the edge of the Bevian Swamp in the south eastern section of the study area and covers approximately 15 % of the study area. Two fragmented areas of this community exist within the floodplain of the Bevian Swamp.
Structure	Open Forest with a canopy cover of approximately 40% and height of approximately 15-20 metres. The understorey consists of a sparse to dense groundcover of herbs and grasses.
Disturbances	Two areas of this community within the floodplain are highly disturbed with no shrub layer and a sparse groundcover due to cattle grazing. Vegetation surrounding the Bevian Swamp has been disturbed by the construction of Bevian Road along its western and part of its northern boundaries. Along the edges of Bevian Road a moderate incursion of pasture weeds exists. Regrowth of this community is occurring within a disused road along the northern boundary of the study area.
Common Species	
Trees	*Casuarina glauca* (Swamp Oak), and *Eucalyptus botryoides* (Bangalay).
Shrubs	*Acacia longifolia* (Sydney Golden Wattle), *Acacia maidenii* (Maidens Wattle), *Banksia integrifolia* (Coast Banksia), *Leptospermum polygalifolium* (Yellow Tea Tree), and *Melaleuca ericifolia*.
Groundcovers	*Dichondra repens* (Kidney Weed), *Entolasia marginata* (Panic), *Gahnia aspera* (Rough Saw-sedge), *Gahnia clarkei* (Tall Saw-sedge), *Gahnia melanocarpa* (Black-fruit Saw-sedge), *Goodenia hederacea* var. *hederacea* (Violet-leaved Goodenia), *Glycine tabacina* (Variable Glycine), *Hydrocotyle peduncularis* (Pennywort), *Juncus continuous, Oplismenus imbecillis* (Basket Grass), *Parsonsia straminea, Persicaria decipiens*, *Persicaria lapathifolia*, and *Viola hederacea*.
Weeds	*Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Juncus acutus, Modiola caroliniana* (Red-flowered Mallow), *Oxalis corniculata* (Creeping Oxalis), *Paspalum dilatatum* (Paspalum), *Pennisetum clandestinum* (Kikuyu), *Phalaris aquatica* (Phalaris), *Plantago lanceolata* (Ribwort) and *Trifolium repens* (White Clover).

Vegetation Community Variation 5a Disturbed Swamp Oak Open Scrub	
Description	A highly disturbed regrowth variation associated with previously cleared and heavily grazed areas of the floodplain. This community generally consists of no canopy, scattered samplings of *Casuarina glauca* <1m in height and an understorey generally dominated by a mixture of exotic herbs and pasture grasses with minor patches of native understorey. Detailed sampling identified this community as being of 'low condition' in accordance with the criteria set out in the Biometric operation manual version 1.8 (Gibbons *etal.* 2005). This community has been mapped separately within the Figure 1.
Common Species	
Trees	*Casuarina glauca* (Swamp Oak), and *Eucalyptus botryoides* (Bangalay).
Shrubs	*Acacia longifolia* (Sydney Golden Wattle), *Acacia maidenii* (Maidens Wattle), *Banksia integrifolia* (Coast Banksia), *Leptospermum polygalifolium* (Yellow Tea Tree), and *Melaleuca ericifolia*.
Groundcovers	*Dichondra repens* (Kidney Weed), *Entolasia marginata* (Panic), *Gahnia aspera* (Rough Saw-sedge), *Gahnia clarkei* (Tall Saw-sedge), *Gahnia melanocarpa* (Black-fruit Saw-sedge), *Goodenia hederacea* var. *hederacea* (Violet-leaved Goodenia), *Glycine tabacina* (Variable Glycine), *Hydrocotyle peduncularis* (Pennywort), *Juncus continuous, Oplismenus imbecillis* (Basket Grass), *Parsonsia straminea, Persicaria decipiens*, *Persicaria lapathifolia*, and *Viola hederacea*.
Weeds	*Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Juncus acutus, Modiola caroliniana* (Red-flowered Mallow), *Oxalis corniculata* (Creeping Oxalis), *Paspalum dilatatum* (Paspalum), *Pennisetum clandestinum* (Kikuyu), *Phalaris aquatica* (Phalaris), *Plantago lanceolata* (Ribwort) and *Trifolium repens* (White Clover).

Vegetation Community 6 – Aquatic Herbfield	
Description	This vegetation community has been mapped as cleared land by NPWS (2000) and consists of farm dams and does not correspond to any of the map units described by NPWS (2000).
Occurrence	This vegetation community occurs in eight (8) farm dams located throughout the study area and covers approximately 5% of the study area.
Structure	Sparse to dense herbfield to a height of approximately 1-2 metres.
Disturbances	Cattle are currently trampling the edge of these dams and weed incursions of Kikuyu are extensive along the edges of all farm dams.
Common Species	
Groundcovers	*Blechnum cartilagineum* (Gristle Fern), *Centella asiatica* (Swamp Pennywort), *Eleocharis sphacelata,* (Tall-spike Rush) *Juncus usitatus* (Common Rush), *Ottelia ovalifolia* (Swamp Lily), *Paspalum distichum* (Water Couch), *Persicaria decipiens*, *Persicaria lapathifolia*, *Philydrum lanuginosum* (Woolly Frogmouth), *Schoenoplectus validus* (River Club-rush), *Sparganium subglobosum* (Floating Burr Weed), *Typha domingensis* (Cumbungi) and *Typha orientalis* (Cumbungi).
Weeds	*Cyperus eragrostis* (Umbrella Sedge), *Hydrocotyle bonariensis* (Pennywort) and *Juncus acutus* subsp. *acutus* (Sharp Rush).

Vegetation Community Variation 6a Natural Freshwater Wetland	
Description	A native Aquatic Herbfield variation to this community associated with the open water of Bevian Swamp is located in the south of the subject site. This largely natural community variation contains the floristic and geomorphological characteristics of the EEC, Freshwater Wetlands on Coastal Floodplains and as such has been mapped separately within the Figure 1.
Common Species	
Groundcovers	*Blechnum cartilagineum* (Gristle Fern), *Centella asiatica* (Swamp Pennywort), *Eleocharis sphacelata,* (Tall-spike Rush) *Juncus usitatus* (Common Rush)*, Ottelia ovalifolia* (Swamp Lily), *Paspalum distichum* (Water Couch), *Persicaria decipiens*, *Persicaria lapathifolia*, *Philydrum lanuginosum* (Woolly Frogmouth), *Schoenoplectus validus* (River Club-rush), *Sparganium subglobosum* (Floating Burr Weed), *Typha domingensis* (Cumbungi) and *Typha orientalis* (Cumbungi).
Weeds	*Cyperus eragrostis* (Umbrella Sedge), *Hydrocotyle bonariensis* (Pennywort) and *Juncus acutus* subsp. *acutus* (Sharp Rush).

Vegetation Community 7 – Grassland with Scattered Trees	
Occurrence	This vegetation community occurs in the majority of the study area and covers approximately 70% of the study area.
Structure	Moderate to dense groundcover of herbs, ferns and grasses with scattered trees and shrubs.
Disturbances	This vegetation community is the result of clearing and agricultural activities.
Common Species	
Trees	*Corymbia maculata* (Spotted Gum), *Eucalyptus globoidea* (White Stringybark), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *Eucalyptus longifolia* (Wollybutt), and *Eucalyptus tereticornis* (Forest Red Gum).
Shrubs	*Acacia floribunda* (Sally Wattle), *Acacia longifolia* (Sydney Golden Wattle), *Bursaria spinosa* (Blackthorn), and *Melaleuca ericifolia*.
Groundcovers	*Aristida vagans* (Wire Grass), *Austrodanthonia ramosissima* (Stout Bamboo Grass), *Centella asiatica* (Swamp Pennywort), *Cheilanthes sieberi* (Mulga Fern), *Cynodon dactylon* (Common Couch), *Dichelachne micrantha* (Short-hair Plume Grass), *Dichondra repens* (Kidney Weed), *Glycine tabacina* (Variable Glycine), *Goodenia hederacea*, *Hydrocotyle peduncularis* (Pennywort), *Imperata cylindrica* (Blady Grass), *Joycea pallida* (Silvertop Wallaby Grass), *Microlaena stipoides* (Weeping Grass), *Panicum simile* (Two Colour Panic), *Pratia purpurascens* (Whiteroot), *Pteridium esculentum* (Bracken Fern), *Themeda australis* (Kangaroo Grass) and *Veronica plebia* (Creeping Speedwell).
Weeds	*Avena fatua* (Wild Oats), *Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Bidens pilosa* (Cobblers Pegs), *Briza maxima* (Quaking Grass), *Briza minor* (Shivery Grass), *Briza subaristata*, *Bromus cartharticus* (Prairie Grass), *Centaurium erythraea* (Pink Stars), *Cirsium vulgare* (Spear Thistle), *Conyza albida* (Tall Fleabane), *Conyza bonariensis* (Flaxleaf Fleabane), *Ehrharta erecta* (Panic Veldtgrass), *Gamochaeta spicata* (Cudweed), *Hypericum perforatum* (St John's Wort), *Hypochaeris radicata* (Flatweed), *Medicago sp.* (Medic), *Modiola caroliniana* (Red-flowered Mallow), *Oxalis corniculata* (Creeping Oxalis), *Paspalum dilatatum* (Paspalum), *Pennisetum clandestinum* (Kikuyu), *Plantago lanceolata* (Ribwort), *Protasparagus aetheopicus* (Asparagus Fern), *Rubus ulmifolius* (Blackberries), *Setaria gracilis* (Slender Pigeon Grass), *Sida rhombifolia* (Paddy's Lucerne), *Sporobolus africanus* (Parramatta Grass), *Trifolium repens* (White Clover), *Verbena bonariensis* (Purple Top) and *Verbena rigida* (Veined Verbena).

Vegetation Community 8 – Disturbed Redgum Open Woodland	
Occurrence	This vegetation community occurs as a number of isolated patches in the southeast porion of the subject site associated with the alluvial floodplain soils. This vegetation community occurs as a number of isolated patches in the southeast porion of the subject site associated with the alluvial floodplain soils.
Structure	Isolated paddock trees to Open Woodland with a canopy cover of approximately <5% and height of approximately 20 metres. The understorey consists of a generally absent to sparse shrublayer 1 metres high and a moderate to dense groundcover of herbs, sedges and grasses.
Disturbances	This vegetation community is the result of extensive clearing and agricultural activities including grazing. Detailed sampling identified this community as being of 'low condition' in accordance with the criteria set out in the Biometric operation manual version 1.8 (Gibbons *etal.* 2005).
Common Species	
Trees	*Eucalyptus tereticornis* (Forest Red Gum).
Shrubs	*Melaleuca ericifolia* and *Eucalyptus tereticornis* (Forest Red Gum) saplings.
Groundcovers	*Cynodon dactylon* (Common Couch), *Dichelachne micrantha* (Short-hair Plume Grass), *Eragrostis leptostachya* (Paddock Lovegrass), *Hemarthria uncinata* (Matgrass), *Hydrocotyle peduncularis* (Pennywort), *Lomandra longifolia* (Spiky Headed Mat Grass) *Microlaena stipoides* (Weeping Grass), *Ranunculus plebeius* and *Themeda australis* (Kangaroo Grass).
Weeds	*Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Bidens pilosa* (Cobblers Pegs), *Cirsium vulgare* (Spear Thistle), *Gamochaeta spicata* (Cudweed), *Hypericum perforatum* (St John's Wort), *Hypochaeris radicata* (Flatweed), *Medicago sp.* (Medic), *Modiola caroliniana* (Red-flowered Mallow), *Paspalum dilatatum* (Paspalum), *Pennisetum clandestinum* (Kikuyu), *Plantago lanceolata* (Ribwort), *Rubus ulmifolius* (Blackberries), *Setaria gracilis* (Slender Pigeon Grass), *Sida rhombifolia* (Paddy's Lucerne), *Sporobolus africanus* (Parramatta Grass), *Trifolium repens* (White Clover), *Verbena rigida* (Veined Verbena).

Vegetation Community 9 – Closed Swamp Paperbark Scrub	
Occurrence	This vegetation community occurs as a small isolated patch in the southern most portion of the subject site associated with the alluvial floodplain soils.
Structure	Closed Scrub with a canopy cover of approximately 70-90% and height of approximately 2 to 4 metres. The understorey consists of a sparse s groundcover of herbs, sedges and grasses.
Disturbances	There is very little disturbance within this community.
Common Species	
Emergent Trees	*Casuarina glauca (*Swamp Oak*).*
Shrubs	*Melaleuca ericifolia.*
Groundcovers	*Carex fascicularis* (Tassel Sedge), *Cynodon dactylon* (Common Couch), *Dichondra repens* (Kidney Weed), *Echinopogon caespitosus var. caespitosus* (Tufted Hedgehog Grass), *Entolasia marginata* (Bordered Panic), *Hemarthria uncinata* (Matgrass), *Gonocarpus tetragynus, Hydrocotyle peduncularis* (Pennywort), *Juncus usitatus* (Common Rush), *Lomandra longifolia* (Spiky Headed Mat Grass) *Microlaena stipoides* (Weeping Grass), *Parsonsia straminea* (Common Silkpod), *Ranunculus plebeius* and *Themeda australis* (Kangaroo Grass) *Viola hederacea* (Ivy-leaved Violet).
Weeds	*Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Paspalum dilatatum* (Paspalum), *Plantago lanceolata* (Ribwort), *Rubus ulmifolius* (Blackberries), *Setaria gracilis* (Slender Pigeon Grass) and *Verbena rigida* (Veined Verbena).

Vegetation Community Variation 9a – Disturbed Swamp Paperbark Open Heath	
Description	A highly disturbed regrowth variation associated with previously cleared and heavily grazed areas of the floodplain. This community generally consists of no canopy, scattered regrowth samplings of *Melaleuca ericifolia* <1m in height and an understorey generally dominated by a mixture of exotic herbs and pasture grasses with minor patches of native species. Detailed sampling identified this community as being of 'low condition' in accordance with the criteria set out in the Biometric operation manual version 1.8 (Gibbons *etal.* 2005). This community has been mapped separately within the Figure 1.
Common Species	
Emergent Trees	*Casuarina glauca (*Swamp Oak*).*
Shrubs	*Melaleuca ericifolia.*
Groundcovers	*Carex fascicularis* (Tassel Sedge), *Cynodon dactylon* (Common Couch), *Dichondra repens* (Kidney Weed), *Echinopogon caespitosus var. caespitosus* (Tufted Hedgehog Grass), *Entolasia marginata* (Bordered Panic), *Hemarthria uncinata* (Matgrass), *Gonocarpus tetragynus, Hydrocotyle peduncularis* (Pennywort), *Juncus usitatus* (Common Rush), *Lomandra longifolia* (Spiky Headed Mat Grass) *Microlaena stipoides* (Weeping Grass), *Parsonsia straminea* (Common Silkpod), *Ranunculus plebeius* and *Themeda australis* (Kangaroo Grass) *Viola hederacea* (Ivy-leaved Violet).
Weeds	*Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Paspalum dilatatum* (Paspalum), *Plantago lanceolata* (Ribwort), *Rubus ulmifolius* (Blackberries), *Setaria gracilis* (Slender Pigeon Grass) and *Verbena rigida* (Veined Verbena).

APPENDIX 7

WEED MANAGEMENT TECHNIQUES

WEED MANAGEMENT TECHNIQUES FOR USE IN AREAS OF NATIVE VEGETATION RETENTION

It is recommended that natural recruitment of the tree, shrub and groundcover layers be allowed within areas presently occupied by, or adjacent to, native vegetation. This is achieved by utilising low impact (bush regeneration) methods within the restoration areas.

There are currently a number of bush regeneration techniques used in bushland management for the removal of weeds. These include (Buchanan, 1989):

- The Bradley Method of minimal soil disturbance during weed removal;
- Clearing and stabilising techniques;
- The use of herbicides;
- The use of fire; and
- Biological controls.

The Bradley Method incorporates three basic philosophies:

- Work from areas containing less disturbed native vegetation towards more weed infested areas;
- Minimal disturbance to the soil and surrounding native plants. This is an important aspect especially in this situation as the topography of the site makes it susceptible to erosion once plant cover has been removed; and
- Allow natural native plant regeneration to occur throughout the native plant community. In some cases it may be necessary to assist regeneration by replanting areas where weeds have been removed with locally occurring native (endemic) species.

Employing the Bradley Method for regeneration requires the removal of weeds in phases. Stages of weed removal can be broken into three components:

Primary Weeding
Primary weeding is the initial weeding. It is recommended that primary weeding should be carried out on the subject land to remove the majority of dominant weeds. This involves removal of weeds through herbicide use and hand removal. It is important to note primary weeding usually initiates new growth of both weeds and native species. Primary weeding of the site may take up to four weeks and it is recommended that this work either be carried out by a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Secondary or Follow-up Weeding
Secondary or follow-up weeding involves intensive weeding in areas that have already received primary work to remove weed regrowth or overlooked weeds. It is recommended that secondary weeding be conducted 3-6 months after primary weeding. Secondary weeding of the site may take up to two weeks and should be carried out by either a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Maintenance Weeding

After primary and secondary weeding and natural regeneration of the bushland, the area should be able to resist most weeds. However, weeds will re-establish on the site from bird, wind, water transport and other seed or propagule dispersal mechanisms within the site. Maintenance weeding should be undertaken once or twice a year until such time as the resistance of the bushland to weeds increases, then only requiring hand-weeding every two to three years. Maintenance weeding of the site may take up to one week and should be carried out by either a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

If required, regeneration of dominant natural plant species is expected to occur over a 2 year period, provided ongoing management works are maintained. To allow regeneration to occur, the majority of weed infestations need to be controlled within 2 years of commencing weed control works. Follow-up maintenance weeding is required on a needs basis from 2 to 10 years.

The use of herbicides is needed where hand removal of weeds is impractical. The use of Glyphosate based herbicides is recommended in accordance with the manufacturers labels. Within 5m of a drainage line only Roundup, Bi-active or equivalent formulations can be used.

There are various categories of herbicides currently used (Buchanan, 1989), specifically those that kill on contact (contact herbicides), and those that must move through the tissue of the plant (systematic herbicides). Other herbicides include those that are non-selective and those that are selective. There are also those herbicides that kill all existing plants and those that prevent germination (Buchanan, 1989). The most commonly used herbicides by bush regenerators are Glyphosate 360 ®, Roundup ®, Bi-active ® and Weed Master ®.

Other regularly used herbicides include, Grazon DS ®, Brushoff ®, Brush Killer ® and Starane 200 ®. These non-glyphosate based herbicides are not to be used adjacent to water bodies subject to site conditions and the herbicide label.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds. The disadvantage is that no single herbicide is effective on all weed species, thus the herbicide used needs to be carefully selected to achieve an effective kill.

In general, *Conacher Travers Pty Ltd* recommends that the use of herbicides should be considered when:

- There are small areas of dense weeds with few or no native plants to protect;
- There are large areas of weeds; and
- Weeds are growing too rapidly for physical removal.

The potential for destabilising and causing erosion as a result of spraying vegetation needs to be considered prior to commencement of weed control works.

Only operators with Chemcert or equivalent training must undertake the spraying of weeds. The operator must evaluate the success of each treatment after a set period of time according to the labelled effectiveness for each herbicide. Care must be taken when applying herbicides near water bodies due to the sensitivity of the waterways, and flora and fauna, to runoff containing these herbicides.

All herbicides must be applied according to the herbicide label and provisions of the *Protection of the Environmental Operations Act 1997* and the *Pesticides Act 1999*.

Exotic species targeted for removal throughout the duration of the management plan are listed in Table A2.1. These species are exotic species that have either been observed on site or are known in the local area.

Weeds are to be progressively removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service and Australian Association of Bush Regenerators.

Woody Weeds Removal Techniques:

Cut and Paint (Woody weeds to 10 cm basal diameter)

- Make a horizontal cut close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:

- Cuts should be horizontal to prevent herbicide from running off the stump, sharp angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases;
- If plants re-sprout cut and paint the shoots after sufficient regrowth has occurred; and
- Stem scraping can be more effective on some woody weeds.

Stem Injection

- At the base of the tree drill holes at a 45 degree angle into the sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Frilling or Chipping

- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Considerations:

- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually; and
- Herbicides must be injected immediately before plant cells close (within 30 seconds) and translocation of herbicide ceases.

Small Hand-Pullable Plants Removal Techniques:

Hand Removal

- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:

- Leave weeds so roots are not in contact with the soil eg. hang in a tree, remove from site or leave on a rock.

Vines and Scramblers Removal Techniques:

Hand Removal

- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed manually or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

Stem Scraping

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

Weeds with Underground Reproductive Structures Removal Techniques:

Hand Removal of Plants with a Taproot

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

Crowning

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide Treatment – Stem Swiping

- Remove any seed or fruit and bag; and
- Using a herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

Exotic vegetation should be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of the exotic plant species should be removed and disposed of appropriately.

Table 1 (Appendix 7) – Exotic Species Targeted For Removal

Botanical Name	Common Name	Pest Plants in Eurobodalla Shire	NSW Noxious Weeds Listed
TREES			
*Erythrina X sykesii**	Coral Tree		Yes
Olea europaea subsp. *africana**	African Olive		Yes
*Citrus limon**	Lemon Tree		
*Salix babylonica**	Weeping Willow		Yes
*Taxodium distichum**	Bald Cypress		
SHRUBS			
Chrysanthemoides monilifera subsp. *monilifera**	Bitou Bush	Yes	Yes
Senna pendula var. *glabrata**	Cassia		Yes
*Ochna serrulata**	Mickey Mouse Plant		Yes
*Rubus anglocandicans**	Blackberry	Yes	Yes
*Lycium ferocissimum**	African Boxthorn		Yes
*Solanum mauritianum**	Wild Tobacco		
*Lantana camara**	Lantana	Yes	Yes
GROUNDCOVERS			
*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort		
*Protasparagus aethiopicus**	Asparagus Fern		Yes
*Aster subulatus**	Wild Aster		
*Bidens pilosa**	Cobbler's Pegs		
*Cirsium vulgare**	Spear Thistle		
*Conyza albida**	Fleabane		
*Conyza bonariensis**	Flax-leaf Fleabane		
*Gamochaeta spicata**	Cudweed		
*Hypochaeris radicata**	Flatweed		
Onopordum acanthium subsp. *acanthium*	Scotch Thistle	Yes	Yes
Pseudognaphalium luteo-album	Cudweed		
*Senecio madagascariensis**	Fireweed	Yes	Yes
*Sonchus oleraceus**	Common Sow-thistle		
*Taraxacum officinale**	Dandelion		
*Capsella bursa-pastoris**	Shepherds purse		
*Cerastium glomeratum**	Mouse-ear Chickweed		
*Stellaria media**	Common Chickweed		
*Tradescantia fluminensis**	Wandering Jew		Yes
*Cyperus eragrostis**	Umbrella Sedge		
*Euphorbia peplus**	Spurge		
*Medicago polymorpha**	Burr Medic		
*Trifolium repens**	White Clover		
*Centaurium erythraea**	Pink Stars		
Romulea rosea var. *australis**	Onion Grass		
*Juncus acutus**	-		
*Juncus cognatus**	-		
*Modiola caroliniana**	Red-flowered Mallow		
*Sida rhombifolia**	Paddy's Lucerne		
*Oxalis corniculata**	Yellow Wood Sorrel		

Table 1 (Appendix 7) – Exotic Species Targeted For Removal (Cont.)

Botanical Name	Common Name	Pest Plants in Eurobodalla Shire	NSW Noxious Weeds Listed
GROUNDCOVERS (Cont.)			
*Plantago lanceolata**	Ribwort		
*Plantago major**	Large Plantain		
*Avena fatua**	Wild Oats		
*Axonopus affinis**	Narrow-leaved Carpet Grass		
*Briza maxima**	Quaking Grass		
*Briza minor**	Shivery Grass		
*Bromus cartharticus**	Prairie Grass		
*Chloris gayana**	Rhodes Grass		
*Ehrharta erecta**	Panic Veldtgrass		
*Paspalum dilatatum**	Paspalum		
*Paspalum urvillei**	Vasey Grass		
*Pennisetum clandestinum**	Kikuyu		
*Setaria gracilis**	Slender Pigeon Grass		
*Sporobolus africanus**	Parramatta Grass		
*Acetosella vulgaris**	Sheep Sorrel		
*Rumex crispus**	Curled Dock		
*Anagallis arvensis**	Scarlet Pimpernel		
*Ranunculus repens**	Creeping Buttercup		
*Richardia stellaris**	-		
*Verbascum virgatum**	Twiggy Mullein		
*Solanum pseudocapsicum**	-		
*Verbena bonariensis**	Purpletop		
*Verbena rigida**	Veined Verbena		
VINES			
*Myrsiphyllum asparagoides**	Bridal Creeper	Yes	Yes
*Ipomoea indica**	Morning Glory	Yes	Yes
*Vicia hirsuta**	Hairy Vetch		
WATERPLANTS			
*Juncus cognatus**	-		

The primary stages of the weeding phase of this plan are estimated to take approximately 6 months, while the secondary and ongoing maintenance stage for the restoration process should continue for at least 2 years in order to achieve effective control. Maintenance and regeneration should continue after 2 years on a needs basis.

APPENDIX 8

REVEGETATION METHODS

REVEGETATION METHODS

1 Timetable of Work

The Contractor shall provide a preliminary planting schedule which incorporates a draft timetable of works for the planting activities. This shall be submitted at the time of tendering. A final planting schedule shall be prepared in consultation with the Project Manager, and approved by the Project Manager within 14 days of award of Contract. This schedule should be designed to minimise the time the sites are exposed and take into account seasonal factors, availability of tubestock plants, and timing of construction works.

2 Site Preparation

Site preparation activities for all planting sites will include preliminary weed control, rubbish removal and (where necessary) minor earthworks (levelling, ripping). It is expected that any bare soil areas will be sown with a nurse crop to provide temporary soil stabilisation, and (where applicable) soil erosion control measures installed.

3 Plant Material

Plant material used for revegetation within the project area shall be sourced only from local bushland areas. Contractors are responsible for obtaining all necessary permits and licenses.

All plants are to be provided in a healthy condition. They must have good root development and a sturdy shoot system. Plant with an elongated or yellowed shoot system shall not be accepted.

Planting shall be undertaken immediately after delivery. If this is not possible, the Contractor shall be required to provide appropriate storage to keep the plants in good condition on the site, adequately protected from frost, wind, sun and vermin, and secured from vandals.

4 Planting Guidelines

Planting Densities and Niche species

The Contractor shall be responsible for planting according to the Site Planting Plan prepared by the client. This Plan will detail the required species and their distribution across the bushland reconstruction and landscaping sites and will be supplied to the successful Contractor. The Contractor shall be responsible for ensuring planting densities and appropriate niche species.

Only locally indigenous plants will be used. Niche preferences shall be considered in planting, with plants being placed in the correct position with regard to soil type, moisture, aspect and slope.

Plantings should be at a density which will result in a near natural canopy density at all structural levels (strata). Plant will be placed at average 2-3 units/m^2 in order to achieve the following densities.

- Canopy Trees @ 1 unit / 5m^2
- Sub-canopy (small trees / large shrubs) @ 1 unit / 2 m^2
- Shrubs @ 1 unit / 1.5 m^2
- Grasses and Ground Covers @ 2-3 unit / m^2

Within riparian zones the planting density of 5 plants/m^2 should be achieved by increasing the grass and ground cover to 4 units per m^2.

Planting Methods

Planting holes shall be excavated to a depth of 150 mm and a diameter of 200 mm. Slow-release native plant fertiliser (low phosphorous formulated native plant fertiliser tablet/granules) shall be placed into the planting hole. In poorly structured soils, approximately 200 cubic centimetres of native plant soil mix is to be placed and incorporated into the planting hole with fertiliser and water storing granules.

Plants must be placed into moistened soil preferably by soaking 1-2 litres of water into each hole. After planting the soil shall be replaced and carefully firmed, leaving a slight depression around each plant to allow for water collection. Soil is to be replaced in the hole so that the base of the stem is level with the soil surface, not set below the soil, or sitting above.

All plants are to be thoroughly watered before planting and again after planting. If the weather is hot, a third watering shall be carried out within two (2) days or a t-tape or drip irrigation system set up to water plants on a weekly basis.

Plant Protection

The Contractor shall be responsible for adequately protecting plant material from frost, wind, sun, vermin and animals. Two (2) Litre cardboard guards (including 2 stakes) shall be around each plant and maintained throughout the maintenance period of up to 3 years. The use of Jute mats (mulch mats) is recommended where annual or grass regrowth is expected.

Mulching

After planting, the exposed ground should be thickly mulched with low-nutrient mulch such as chipped eucalyptus. A depth of approximately 75 mm and a diameter of 400 mm around each plant are recommended. No exotic plant material is to be used. Pine bark is not considered to be a suitable mulch material. The provenance of all mulch material must be known and approved by the Project Manager.

Mulch is not to be used in sand dunes ecosystems as the mulch inhibits plant establishment and provides a nutrient source for the growth of weeds in dune ecosystems.

Care should be taken to keep mulch material away from the stems of the newly planted tubestock. Alternately, a light sowing of a suitable nurse crop (Rye Corn or Japanese Millet) can be made between plantings to provide a protective microclimate. Sowing rates to be used are those recommended by the supplier and agreed with the Project Manager.

Maintenance and Weed Control

Tube stock must be suitably maintained (watering and weeding) are to be maintained over a 3 year period on the following basis:-

- 1-3 months post planting – weekly watering and maintenance.
- 4-12 months post planting – monthly watering and maintenance.
- 13-36 months post planting – quarterly watering and maintenance.

During the maintenance phase any plant losses in excess of 15% of the total number planted must be replaced at the expense of the Contractor.
Site maintenance shall consist of the following tasks:

- Weeding throughout the planting area;
- Watering tubestock;
- Replacing lost plants (as required); and
- Removing wind-blown or other rubbish from the planting area.

The Contractor shall provide a preliminary maintenance schedule which incorporates a timetable of works for each of the activities listed above.

APPENDIX 9

BUSH REGENERATION METHODS

BUSH REGENERATION METHODS

General Description of Work

This document outlines the general principles to be used in a bush regeneration and rehabilitation program. The term bush regeneration includes both weed control and re-vegetation (planting) in bushland and semi-bushland areas.

Definitions

Bush regeneration is defined as "the practice of restoring bushland by focusing on reinforcing and reinstating the ecosystem's on-going natural regenerative processes" (Australian Association of Bush Regenerators).

Aims of Bush Regeneration

- To create an environment where native plants are able to re-colonise degraded/cleared areas.
- To restore degraded areas far as possible, to viable, manageable ecosystems.
- To protect the bushland from further external disturbance events.
- To preserve and enhance local and regional biodiversity.
- To enhance and extend habitat for native fauna.
- To protect the site's special features (natural, geological, landscape and cultural)

Process

The Bush Regeneration process involves:

- *Primary Weeding* - initial weed clearance, through hand weeding and/or the use of herbicides.
- *Secondary or Follow-up Weeding* - maintenance of sites which have already received primary weeding.
- *Maintenance weeding* - monitoring/removal of weed re-growth and care of native plant seedlings (naturally occurring and planted).
- *Re-vegetation* - the use of locally indigenous species to restore an area via tubestock planting, direct seeding, transplanting and/or brush matting.

In areas where degradation has been serious enough to severely deplete or extinguish native regenerative capacity, it may be necessary to reconstruct or fabricate a plant community as close as possible to the original. This will involve a variety of techniques, including weeding, soil remediation, planting and on-going site maintenance. Small-scale soil stabilisation, earthworks, and remedial drainage works are often required.

Weed Control

Weed removal shall include any species likely to significantly invade bushland, prevent natural regeneration, or impede native seedling growth. Priority shall be given to species listed as 'noxious plants' in the Eurobodalla LGA in the Schedules of the *NSW Noxious Weeds Act 1993*. A list of target weed species has been included in Table 1 of Appendix 7.

Weeding Techniques

See Appendix 7 for detailed weed control techniques. Within the bush regeneration context weed control is described as the removal or control of weeds using hand removal and/or the application of selected herbicides. In specific circumstances, the use of machinery is used when the extent of the infestation is very large and will not cause significant erosion or destabilisation. Weeding techniques should be appropriate to the weed type, growth form and to the existing site conditions.

Wherever possible, weed removal should be carried out prior to annual seed set. Herbicide application via stem injection or foliar spray must not be applied to plants bearing ripe or semi-ripe fruit. It is important to plan herbicide control of target species according to a weeding calendar that recognises the weed's life form and seasonality (i.e. flowering, fruiting and seed set).

The techniques and methodologies used for bush regeneration shall conform to those identified in the National Trust Bush Regenerators Handbook (1991) and currently taught through the NSW TAFE Bushland Regeneration Certificate Course.

Labour

Bush regeneration work shall be carried out in a competent manner by experienced and qualified bush regenerators. A minimum 50% of the workforce must have completed a TAFE Bushland Regeneration Certificate Course or equivalent, and have suitable field experience (e.g. Minimum 200 hour's prior employment as a bush regenerator).

In assessing tenders, preference will be given to bush regeneration contractors with prior experience in the rehabilitation of bushland in the Western Sydney Region.

Use of Herbicides

The herbicide of choice for bush regeneration work is Glyphosate (Roundup). Roundup Biactive shall be used in wet areas (e.g. drainage lines, sediment basin). The Contractor shall not use any other herbicide or chemical contrary to herbicide label.

Herbicide application shall be limited to the following techniques:

- Cut-stump and poison (cut and dab)
- Stem injection
- Stem-scrape and poison
- Basal bark painting
- Selective spot-spraying

Mulch and Cut Brush

Any mulch imported onto the site shall be weed-free eucalyptus leaf mulch or woodchip. Mulch from Privet, Camphor laurel, Coral Tree, Poplar, Willow, aquatic or declared noxious weeds are not to be used. The Contractor shall ensure that any mulch used is properly composted before use.

Brush cut for erosion control and/or re-vegetation purposes shall be used only when cut branches are seed-laden. Branches shall be spread as quickly as possible to reduce seed loss during stockpiling. The collection of cut brush shall be limited to species occurring naturally in the bushland area. If seed and or brush are required to be collected from nearby Reserves, written permission must be obtained from the Bushland Management Officer, Great Lakes City Council. Collection sites are to be agreed between the Contractor and the Project Superintendent prior to any collection of brush.

Weed Debris and Rubbish

Disposal of weed debris and other rubbish generated as a result of the work shall be the responsibility of the Contractor. Costs for disposal of rubbish (collection and tipping fees) shall be clearly stated in the tender proposal.

Disposal of weed material via burns piles is permitted only after approval has been obtained from the Project Superintendent. Any burning must be carried out as advised by the Environment Protection Authority and NSW Fire Brigade.

Soil Erosion

Where bush regeneration works have the potential to destabilise slopes or embankments, action such as the use of fibre matting and/or the placing of logs across the slope and fixing in place shall be employed to minimise the problem. Erosion matting and/or silt fencing may be required in a number of sites. These sites are to be identified in the tender document and allowance made for the purchase and placement of erosion control matting.

Reconstruction of Bushland (planting)

The Contractor is required to supply a set number of locally indigenous plants to be used in the bushland reconstruction areas. All plant material used on-site shall be grown from seed or cuttings collected in local bushland.

Plant material may be supplied as tubestock or as hikos. Virocells are not considered to be suitable for this site. The method of delivery (as above) should be clearly stated in the tender documents.

Planting methods are to conform to the *Revegetation Specifications.*

APPENDIX 10

HOW TO COLLECT NATIVE SEEDS

HOW TO COLLECT NATIVE PLANT SEED RESPONSIBLY

To select seeds that will grow into plants that are best adapted to local conditions, collect seed from near the area where it is proposed to do the planting. If there are no suitable native species immediately nearby, then collect seed from as close as possible and from the same general habitat (same soil type, distance from watercourse, exposure etc.). The more similar the habitat, the greater the likelihood of the propagated seedlings being suitable for the planting site. As a guide, plants within about a 3 km radius can be considered satisfactory.

Seed collected from too far away may not be adapted to the local conditions and may introduce new genes to the site, thereby altering local genetic integrity.

There is one exception to the "local" rule. If the population of any of the native species has fallen to a very low level (eg. less than ten individuals of any species), then *for those species* it is advisable to supplement that seed with collections from elsewhere (but as close as possible) to ensure that there is sufficient genetic diversity to minimise the potential for inbreeding.

Where there are no native species left in the area, and no reasonable stands of native species within 3 km, then the site will probably be better treated as a garden and plants could be obtained from commercial sources. Even so, seed derived from closer to the site is preferred over seed collected further away.

Principles to follow when collecting native plant seed:

(a) Before collecting, obtain any necessary permit from the Department of Environment and Conservation and seek permission from the land owner (private, council, Crown Lands, etc.).

(b) Collect seed from as many different plants of the same species as possible (minimum of 5).

(c) Collect seed from plants of varying vigour, but not individuals with obvious disease symptoms.

(d) Collect seed from plants with different growth forms (straight, branching, straggly etc.).

(e) Try to maintain at least 100 m between each parent of the same species, but do not collect only from the edges of a population and always include the central areas in the collection.

(f) Do not strip plants of seed - collect no more than about 20 % of seed from any one tree.

(g) Collect from various parts of each plant and collect equal amounts of seed from each plant.

(h) If possible, avoid collecting from solitary plants and concentrate on stands or groups of plants (this is to minimise the risk of collecting self-pollinated seed).

(i) Label seed containers: *species name, location, date collected, collector's name, how many plants collected from* - and preferably: *position in the landscape (e.g. water's edge), % of ripe seed, soil/geology, plant associations, aspect/altitude/slope, weeds present.*

(j) Dry out seed and store in a cool and dry place (a refrigerator is ideal) in air-tight containers.

Source: Royal Botanic Gardens Sydney, Greening Australia (NSW) & "Seed Collection of Australian Native Plants" (Ralph, M., 1994).

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APPENDIX 11

HOLLOW BEARING TREE REMOVAL GUIDELINES

REMOVAL OF HOLLOW BEARING TREES

Removal of hollow-bearing trees may be required within the subject site. Subject to council approval the following guidelines are provided in the event of a hollow bearing tree requiring removal.

Pre Clearing

At least one weeks notice will be needed prior to the planned date for clearing of any trees. This is required so as to allow for suitable time for inspections of trees by a suitably qualified and licensed ecologist for use by fauna and to plan for the safe felling of the tree/removal of fauna if present.

After notice is given of the planned removal of trees a fauna ecologist will inspect the trees for use by fauna. This may include inspection of trees at sunset (stag watching) which allows for the detection of diurnal fauna returning to hollows or nocturnal fauna leaving for the night.

In some cases physical inspections of hollows by climbing trees may be required. This will be carried out by suitably qualified arborists under the direction and supervision of the fauna ecologist.

During Clearing

Where fauna is identified within a hollow and the risk of death or injury as a result of machine felling of the tree is high, the tree may need to be felled in sections. This will involve the removal of hollow limbs or sections by chainsaw with the hollow limb lowered to the ground for removal/relocation of fauna and the relocation of the hollow sections to suitable nearby trees. These works are to be carried out by a suitably qualified arborist under the direction of the fauna ecologist.

In those trees that contain hollows and no fauna has been observed, the tree will be machine felled. Where machinery is required to fell hollow trees, the blade or bucket of the machinery will be tapped against the base of the tree to disturb any fauna present and provide time to leave the hollow. The tree will then be felled as gently as possible. All hollow limbs will be inspected after felling for occupation by fauna. Any fauna will be removed and relocated to adjoining bushland.

Where young fauna are identified within a hollow whose survival will be at risk as a result of the removal of the hollow or the felling of the tree, then clearing will not be carried out until those young are old enough to leave the hollow and the care of the parents. It is suggested therefore that clearing is not carried out during breeding times when young are likely to be present within hollows (spring to early summer). Alternatively the fauna are to be removed by a fauna ecologist, allowed to recover from shock and relocated into adjacent protected bushland areas.

Where possible, hollow limbs removed from trees will be collected by the fauna ecologist for re-erection. Any fauna injured during clearing will be handed to WIRES for care and rehabilitation. Council's flora and fauna development planner is to be notified of any threatened fauna species listed in the TSC Act (1995) found to inhabit hollows.