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Vegetation Management Plan

Warriewood STP Buffer Area 3

Proposed Residential Development

Total Earth Care Pty Ltd
February 2010

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1 INTRODUCTION

Meriton Apartments is proposing the development of 14-18 Boondah Rd, Warriewood Valley (subject site). The proposed development includes the construction of 16 residential buildings, providing approximately 600 apartments. The development also includes internal roadways, landscaped areas, asset protection zones, core riparian zone and riparian buffer zones and retention of significant native vegetation where possible. This project has been declared a Major Project under Part 3A of the NSW Environmental Planning & Assessment Act 1979 (EP&A Act) and the applicant will be submitting a Concept Application together with detailed Stage 1 Project Application for 313 apartments to the Department of Planning. Approval of work conducted within 40 metres (m) of a water body by the NSW Office of Water (OW) under Part 3 Section 91 of the *Water Management Act 2000* (WMA) is not required, with assessment for this aspect of the project integrated into the approval process under Part 3A of the EP&A Act.

The Stage 2 Project Application will be submitted later in the year for the remaining apartments. Total Earth Care has been engaged to address the Director General's Requirements (DGRs) for the application, in regard to the Vegetation Management Plan, specifically to detail the criteria for the establishment and management of the Fern Creek riparian corridor and the adjacent Warriewood Wetlands riparian zones.

The Vegetation Management Plan (VMP) will be in operation during, and for a maintenance period after the proposed construction works. This VMP is prepared according to the most recent Department of Water and Energy (DWE) publication 'Guidelines for Controlled Activities - Vegetation Management Plans – February 2008'.

Total Earth Care Pty Ltd (TEC) was engaged to conduct a flora and fauna assessment on several land parcels at the corner of MacPherson St and Boondah Road, Warriewood Valley. The resulting document, Flora and Fauna Assessment Warriewood STP Buffer Sector 3, Proposed Residential Subdivision Master Plan report, was issued in January 2004 (TEC, 2004). In conjunction with Pittwater Council, the boundary of Warriewood Wetlands was established. The report included this agreed wetland boundary and mapping of riparian buffer zones of Warriewood Wetlands, and these controls and safeguards have been maintained throughout subsequent development proposals for the site. Additional flora and fauna assessments in 2006 and 2008 detail the flora and fauna species occurring on the subject site, as well as habitat for threatened or vulnerable species listed under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that may potentially utilise the site from time to time. A final conclusive Flora and Fauna assessment for the most recent Part 3A development proposal for the subject site (TEC 2010) is to be referenced for the compilation of this VMP.

1.1 Proposed Development Description

The proposal comprises a residential development as described above. The proposed building footprint can be seen in Map 1 (Appendix A). The current development plan includes the following key design measures relevant to the riparian zones and the vegetation management plan for the site (also shown in Map 2 Appendix B):

Public Riparian Zone: Creation of a 50 metre-wide Public Riparian Zone associated with Fern Creek along the western boundary. This buffer is in accordance with the Pittwater Council Development Control Plan Section C6.7 (P21 DCP);

Private Buffer Strip: Creation of a 25 metre-wide Private Buffer Strip to directly adjoin the Public Riparian Zone to the east. This buffer strip is in accordance with the P21 DCP Section C6.7;

Core Riparian Zone (CRZ): retention of a 20 metre-wide vegetated buffer (referred to as the CRZ) along the southern boundary of the site (as requested by Pittwater Council in the pre Development Application meeting for the previous proposal held on the 17th March 2008);

10m Buffer Strip: Retention of a 10 metre-wide buffer along the southern boundary of the site, to directly adjoin the CRZ to the north. This buffer is to protect the boundary of Warriewood Wetland and is in accordance with P21 DCP Section B4.14. This buffer was negotiated between Council and the former DIPNR (now OW) in 2003 and has been retained as part of the current proposal (as requested by Pittwater Council in the pre Development Application meeting for the previous proposal held on the 17th March 2008);

Asset Protection Zone (APZ): Retention of a 25 metre-wide APZ along the southern boundary of the site which comprises the 10m Buffer Strip and an additional 15m Inner Protection Area (IPA). The IPA will directly adjoin the 10m Buffer Strip to the north. This is a requirement of the Rural Fire Service (RFS) as the site has been identified as bushfire prone land;

Retention of an area of 'Swamp Oak Forest': An area of Swamp Oak Forest identified as core bushland under DCP No.25, in the south-eastern part of the site adjacent to Boondah Road will be retained. This area will be subject to some clearing and development under the current proposal, however, the retained portion will be either contiguous or adjacent to the Wetland buffer strip and will form a partial vegetated link in the form of 'stepping stone' habitat to the same vegetation community located across Boondah Road within the Sydney Water site and within Warriewood Wetlands.

1.2 Scope

The VMP applies to the Meriton Apartments Concept Plan and the actions contained within the VMP should be implemented as part of the Stage 1 development. The scope for the preparation of the VMP is based on the DGRs for the project, and has been prepared in accordance with the DWE guidelines for the preparation of VMP's (February 2008). The VMP has been prepared by qualified bushland and vegetation management consultants Total Earth Care (TEC) and the majority of VMP vegetation management measures are to be implemented by a qualified bushland regeneration contractor ('BR Contractor').

1.3 Aims & Objectives

The general aim of the VMP is to provide a working document for the protection and rehabilitation of native vegetation and habitats within the subject site, particularly those associated with the zones as set out in Section 1.1 above. More specifically, the objectives of the VMP are to:

- review previous studies and surveys for the study area;
- address the current status of the vegetation to be retained and habitats, based on the subject site including weed densities, physical disturbance, native plant diversity and resilience;
- assess the current status of the riparian vegetation adjacent to the subject site and review potential impacts and provide appropriate management practices;
- develop an appropriate management regime for the vegetation and habitats of the subject site, based primarily on natural resilience and the proposed future land uses of the subject site;
- determine appropriate vegetation management measures including bush regeneration and revegetation methods for the subject site and which are consistent with the scale of the development, objectives of the zoning, and adjacent areas; and
- recommend the appropriate sequence of vegetation management measures and assign responsibilities for work tasks.

2 METHODS

2.1 Desktop Research

A review of all updated design plans and reports relating to the site and adjacent area was conducted, as well as relevant legislation, recent vegetation mapping and other documentation relevant to the current project, including;

- *Site Staging Plan* (Meriton Apartments Pty Ltd 2010);
- *Landscape Plans* (Landscape Direct 2008);
- *Arboricultural Assessment/Vegetation Management Report* (TALC 2008);
- *Guidelines for Controlled Activities: Riparian Corridors* (DWE 2008);
- *NSW State Rivers and Estuaries Policy* (NSW WRC 1993);
- *NSW Wetlands Management Policy* (DL & WC 2000);
- Warriewood Valley Urban Release Area, Landscape Masterplan and Design Guidelines (Pittwater Council 2004);
- *The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area* (Draft) (DECCW 2009a); and
- Broad-scale mapping of the Sydney 1:100,000 map sheet by Benson and Howell (1994).

2.2 Flora and Fauna

A recent flora and fauna survey was conducted over the study area on March 17, 2008 involving:

- the identification of native and exotic plant species according to *Field Guide to the Native Plants of Sydney* (Robinson 2003) and the *Flora of NSW* (Harden 1992, 1993, 2000, 2002), with reference to recent taxonomic changes;
- the identification and mapping of plant communities based on the structural definitions of Specht & Specht (1999), and to previous broad-scale mapping of the Cumberland Plain by NPWS (2003);
- weed density mapping and bushland resilience assessment; and
- targeted searches for plant species of conservation significance using the “random meander” method of Cropper (1993).

The conservation significance of plant species and plant communities was determined according to:

- *Threatened Species Conservation Act 1995* (TSC Act) for significance within NSW; and
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for significance within Australia.

4 SITE DESCRIPTION

4.1 General

Warriewood STP Buffer Sector 3 is zoned 2 (f) Urban Purposes – Mixed Residential under the *Pittwater Local Environmental Plan 1997*. The subject site is within Warriewood STP Buffer Sector 3, and located at the junction of Macpherson Street and Boondah Road, Warriewood. It is bounded by Boondah Road to the east, Warriewood Wetlands to the south, Sector 11 to the west and Macpherson Street to the north. The current land use is rural residential, with horse paddocks located at the rear of residential properties fronting Macpherson Street, as well as disused agricultural land, plantation, and light industrial premises on Boondah Road.

Surrounding land uses include low density residential to the north, vacant land to the west (Sector 11), and conservation to the south (Warriewood Wetlands). Warriewood Sewage Treatment Plant and a Sydney Water Maintenance Depot lie to the east, opposite the site across Boondah Road.

4.2 Soils

The site lies within land mapped on the Sydney 1:100,000 soil landscape sheet as “disturbed terrain” (Chapman *et al*., 1989), which is described as “level to plain hummocky terrain, extensively disturbed by human activity” (Chapman & Murphy 1989). The site inspection verified the level of disturbance to the soils through levelling of the site and removal of vegetation. It is presumed that the original soils have been subject to complete burial or removal.

The surrounding land throughout the Warriewood Valley is mapped as the Warriewood Soil Landscape Group (Chapman *et al*., 1989) which occurs on “level to gently undulating swales, depressions and infilled lagoons on Quaternary sands”. The Warriewood landscape group contains soils described as “deep, well sorted, sandy humus podzols and dark, mottled siliceous sands, overlying acid peats in depressions, and deep podzols and pale siliceous sands on sandy rises”. Soils within the Warriewood landscape are highly permeable and subject to localised flooding, waterlogging, and high water tables. These soils are possibly still present at the surface on some parts of the site, and most likely occur at subsoil levels beneath fill and exotic vegetation.

The Hydrogeological Report compiled by Jeffery and Katauskas Pty Ltd for the Stage 1 proposal details soil types and groundwater flows from a series of boreholes. The subject site was found to be underlain by a superficial topsoil/fill over natural clayey soils on Sandstone bedrock at relatively shallow depth and a shallow ground water table.

4.3 Topography and Aspect

The site is located within the Warriewood Valley, and on the margins of the Fern Creek floodplain. The site is characterised by gently sloping topography, bordered by moderately inclined slopes to the north and the flat low-lying terrain of the Warriewood Wetlands to the south. The site has low relief, with a south-westerly aspect.

The water table is located close to the surface across most of the site and some areas, particularly in the south, are subject to waterlogging and periodic inundation. Surface runoff drains mainly into low-lying areas in the southern and western parts of the site, as well into artificial drainage channels constructed in various locations (apparently as irrigation channels for previous agricultural activities). The site drains into Fern Creek, which then discharges into Warriewood Wetlands.

4.4 Vegetation

A high percentage of the site is covered by exotic species with few examples of regenerating native species located along the south junction of Fern Creek and at the south-eastern corner. Exotic species include pasture grasses, herbaceous and woody weeds, the White Poplar plantation and garden plantings. Natural resilience appears to be very low and weed infestation of common

herbaceous, woody and vine weeds dominating disturbed locations. A full list of floristic assemblage for the site is available for review within the updated Flora and Fauna Assessment by Total Earth Care (2010).

A detailed floristic survey has not been carried out within the current VMP. A total of 87 species were recorded on the site during the flora field survey in March 2008, including 43 native species and 44 exotic species. Of the exotic species eight were noxious weeds as listed under the *NSW Noxious Weeds Act 1993* for the Pittwater LGA (Table 1). No endangered native species were recorded within the subject site.

Three plant communities were identified within the study site during the most recent survey, consistent with the plant communities previously recorded from the site (TEC, 2004 and TEC, 2006), and they are as follows:

- Swamp Oak Forest / Swamp Sclerophyll Forest;
- Poplar Forest; and
- Cleared and Disturbed.

The distribution of plant communities identified in the current survey within the study site is shown in Map 3 (Appendix A) and are briefly described below. The remnant native vegetation community recorded on site is considered to be an intergrade between Swamp Oak Forest and Swamp Sclerophyll, and these communities have been mapped together and named as 'Swamp Oak Forest' for the purposes of this report. A detailed description of the plant communities and their outlying distribution is available within the Flora and Fauna Assessment (TEC 2010).

An arboriculture report (TALC 2008) assessed the health of 749 trees present within the subject site and provides guidelines for the removal and protection of tree species. The Poplar species dominate the site with remnants of the old plantation still standing.

A selected grove of 43 Casuarinas located within the south east of the subject site is also proposed for removal for the construction footprint. A Tree Protection Zone (TPZ) has been established to protect the remaining Casuarinas outside the construction footprint to be implemented into the VMP recommendations. In relation to the proposed boardwalk construction within the Private Buffer Strip the report details protection of the Casuarina roots within the Swamp Oak Forest. All pier footings are to be dug using hand excavating methods to reduce disturbances to tree roots.

Warriewood Wetlands is the largest remaining sandplain wetland in northern Sydney. Three endangered vegetation communities are mapped within the wetlands providing optimal foraging and sheltering opportunities for fauna species. The current health of the wetlands is relatively poor although resilience is high. Aquatic weeds such as *Ludwigia peruviana* and *Salvinia molesta* are currently a priority for management efforts. Fern Creek is one of three major tributaries that drain directly into the wetlands.

Swamp Oak Forest

A riparian corridor at the south east of the subject site is mapped as Swamp Oak Forest (SOF). The area is dominated by *Casuarina glauca* Swamp Oak at 15 – 20m with a Foliage Projective Cover (FPC) of approximately 50-60%. Resilience of the Swamp Oak Forest of the subject site varies from moderate to low. Vegetation within the eastern end of the SOF is dominated by an understorey of weed species, Lantana *Lantana camara* and invasive grasses.

The SOF vegetation community contains diagnostic species of a coastal floodplain endangered ecological community (EEC), Swamp Oak Floodplain Forest, which are listed under the TSC Act 1995. The vegetation at the eastern boundary of the subject site represents an intergrade between Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest on Coastal Floodplains, both of which are listed as EEC's under the TSC Act.

Swamp Sclerophyll Forest

A small extent of Swamp Sclerophyll Forest is located within the south eastern corner of the subject site. The Swamp Sclerophyll Forest is also listed as an endangered ecological community. Typically represented as an open woodland subject to periodic inundation. Vegetation is dominated by a canopy layer *Eucalyptus botryoides* Bangalay and *Melaleuca quinquenervia* Paperbark and ferns, reeds and sedges.

Poplar Forest

The clearing of a large plantation of White Poplars *Populus alba* within the subject site is proposed for development. Canopy heights in the two stands of Poplar Forest are approximately 20 metres and FPC is 10%. There is a very sparse understorey from 2 to 4 metres with FPC approximately 5%. The vegetation within the plantation is limited to an understorey of exotic species *Lantana camara*, *Senna pendula* var. *glabrata* Senna*, Rubus fruticosus complex* Blackberry and *Ligustrum sinense* Small Leaved Privet.

Resilience of the Poplar Forest of the subject site is generally low grading to moderate along the boundary with 'Swamp Oak Forest' and other vegetation communities at the Warriewood Wetlands interface. Trees hollows identified within the site are mapped by the Arboricultural Assessment as potential habitat for arboreal species.

Cleared and Disturbed

Mapping of the plant community by Benson and Howell 1994 identified the subject site and its surrounding developed zones as cleared and degraded. A high percentage of weeds are present within the subject site including Noxious Weeds Lantana and Privets *Ligustrum* spp listed under the *Noxious Weed Act 1993*

Previous land use practices within the site include a Poplar tree plantation, which remains intact and provides some foraging and nesting habitat. Several other planted or garden escapee species are present Crepe Myrtle *Lagerstroemia indica* and Crimson Bottlebrush *Callistemon citrinus*. Resilience of the Cleared and Disturbed plant community is very low.

4.5 Fauna

A total of 13 vertebrate fauna species were recorded during field survey, including 12 bird species and one reptile. Two of the 12 bird species recorded in the study area are introduced. The full fauna description is available within the Flora and Fauna Assessment (TEC 2010). The endangered Powerful Owl was observed within the subject site during nocturnal studies by TEC (2004).

The study area forms part of an extensive local and regional riparian corridor with and is assessed as having an overall medium habitat value. An extensive list of habitat attributes can be sourced within the Flora and Fauna Assessment (TEC 2010). Of the Poplar trees assessed by TALC as part of the arborist assessment, some had declined in health due to age and 40 trees had sizable hollows, some of these trees also displayed arboreal scratch marks. Under the recommendations by the Arborist these trees are to be marked with fluro-tape prior to removal to identify inspection by a fully qualified wildlife handler is required.

Warriewood Wetlands in the adjacent site is considered a regionally significant habitat for nationally threatened and migratory species, over 80 bird species have been identified (Pittwater Council, 2008).

4.6 Habitat Corridors

The riparian vegetation bordering Fern Creek and Warriewood Wetlands have been mapped by Council as a 'major habitat area'. A Category 2 area has been mapped in the western corner of the subject site, along Fern Creek. Category 2 is defined as 'mostly cleared non-residential areas with

good potential for improvement of habitat'. This classification is accurate and is reflected in the management proposed for this area under the current proposal. The remainder of the subject site is classified as 'developed area' in the habitat corridor mapping, which is correct given the disturbed nature of the site. The buffer areas described briefly in Section 1.1 provide for the protection of flora and fauna habitat and habitat corridor values, as required under the P21 DCP Section B4.4.

5 VEGETATION MANAGEMENT MEASURES

The general aim of vegetation management for the proposed development is to provide guidelines and suitable management practices including but not limited to the; establishment of riparian buffer zones, protection of remnant vegetation and the protection of the adjacent Warriewood Wetlands. Whilst efforts to retain suitable habitat and indigenous vegetation communities have been made, the level of disturbance from construction and development has potential impacts on the adjacent riparian zone. These impacts will be managed through the implementation of the VMP to ensure that;

- there is limited disturbance to the remnant and regrowth native vegetation of the study area during construction works on the subject site;
- restores or replicates native plant communities that are similar in structure and floristics to Swamp Oak/Swamp Schlerophyll Forest and considers future uses of the subject site (e.g. fauna habitat, passive recreation);
- improves the habitat value for existing fauna of the site and habitat potential for threatened fauna recorded from the locality; and
- secures natural and cultural heritage for the local community in the long term.

The program of vegetation management measures will include:

- establishment of Core Riparian Zone;
- implement Asset Protection Zone;
- weed removal and control;
- erosion control; and
- revegetation in accordance with APZ

The proposed management strategy for this VMP has been divided into four components.

- **Construction Activities** – incorporating construction of the proposed Stage 1 development and groundwater control and erosion control;
- **Weed Control and Revegetation** - incorporating weed removal control and installation of native species;
- **Monitoring** – actions required to ensure the vegetation management measures of this VMP are being met and remain appropriate; and
- **Roles, Responsibilities and Timing** – recommending the staging of vegetation management works and assigning responsibilities.

Reference has been made to the Pittwater Council's Warriewood Valley Urban Land Release Draft Planning Framework (Pittwater Council 2008) where relevant. Cost estimates for the implementation each major vegetation management measure are included as a guide for budgeting.

5.1 Construction Activities

5.1.1 Overview

The current proposal for the development of 16 residential buildings providing approximately 600 apartments includes the construction of internal roadways, landscaped areas, asset and riparian protection zones. The vegetation management recommendations contained within this Plan should be implemented as part of the Stage 1 development, with a review of the VMP conducted prior to the Stage 2 proposed works. The major construction within the Stage 1 proposal includes significant ground water and surface water alteration and rehabilitation during the construction of the proposed basement layer. Completion of the proposed works includes the landscape revegetation and Fern Creek restoration. The proposal has endeavoured to protect native vegetation where possible; however, this report does recognise the removal of a portion of the Swamp Oak Forest for the construction footprint, and this has been assessed as part of the Flora and fauna Assessment (TEC 2010). Removal of vegetation is to be off set by revegetation of suitable provenance species.

5.1.2 Pre-construction Activities

Site Inductions

In compliance with Federal and State OH&S regulations all construction personnel are inducted into the site prior to commencement of works. Supervisors are required to identify all potential environmental impacts and implement and maintain control measures, procedures and constraints accordingly, and these should be documented as part of a Construction Environmental Management Plan (CEMP) or similar. Site specifics include the presence of threatened species, threatened species habitat, endangered vegetation communities, Warriewood Wetlands, Tree Protection Zones and Riparian Zone protection. General site inductions must also include strict hygiene protocols to reduce the potential the introduction of invasive flora and fauna species or disease into the subject area.

Identification of habitat trees and EEC protection

Prior to the commencement of works all habitat trees and vegetation communities to be retained and protected must be identified. The installation of exclusion fencing is required around the perimeter of the subject site, and as required for the tree protection zones and to define the riparian zone boundaries.

Poplar trees identified within the Arboriculture report as potential fauna habitat must be marked with fluro-tape around the trunk at breast height. A qualified wildlife handler is required to investigate the hollows and relocate fauna species before tree removal. The wildlife handler is also required to be on stand-by during the removal of the trees for any unforseen wildlife injured or stressed during the tree removal process. Works must cease if an endangered species has been identified within the subject area, until further notice from the environmental consultant.

Tree Protection Zones

A Tree Protection Zone (TPZ) is a safeguard for the protection of trees to be retained the level of impact and set backs required. The establishment of a TPZ is to be in accordance with the Arborist technical report. Exclusion fencing is to be installed around retained trees during the construction phase. Fencing of 1.8m high steel chain link with galvanised steel pipes is required within the primary construction and works zone. A minimal distance of 6m is measured from the centre of the tree to the fencing has been calculated according to the British Standard BS 5837: 1991 in the absence to an Australian standards. Signage of Tree Protection Zone in 10m intervals along the stretch of the exclusion fencing is a high priority.

The TPZ is required within areas where construction or removal of trees may possibly impact on trees to be retained. Areas include the removal of Casuarinas for the construction of internal road structures and flood storage area in the northern section of the grove off Boondah Road. Other direct impacts may result from the construction of pier footing for the pedestrian boardwalk through the Casuarina grove and the riparian corridor to the south west of the boundary.

Excavation of works within the TPZ, such as the pedestrian/cycle path is to be dug by hand. Construction work outside the TPZ must also be excavated by hand if woody roots greater than 40mm are located. No storage of materials, machinery or temporary sheds are to be constructed within the TPZ, no preparation of chemicals or concrete to be mixed in the TPZ and care to avoid the compaction of soils to be observed. More specifications on the TPZ are available within the Arborists technical report.

Define extent of Riparian Zones

The proposal comprises a residential development as described above. The proposed building footprint can be seen in Map 1 (Appendix A). The width of the Riparian corridor has been determined previously in conjunction with Pittwater Council, and is generally consistent with the *Guidelines for Controlled Activities in Riparian Corridors* (DWE 2008). The current development plan includes the following key design measures (also shown in Map 2 Appendix A), and the location and extent of these zones should be established on site prior to construction works commencing:

Public Riparian Zone: Creation of a 50 metre-wide Public Riparian Zone associated with Fern Creek along the western boundary.

Private Buffer Strip: Creation of a 25 metre-wide Private Buffer Strip to directly adjoin the Public Riparian Zone to the east.

Core Riparian Zone (CRZ): retention of a 20 metre-wide vegetated buffer

10m Buffer Strip: Retention of a 10 metre-wide buffer along the southern boundary of the site, to directly adjoin the CRZ to the north. This buffer is to protect the boundary of Warriewood Wetland

Asset Protection Zone (APZ): Retention of a 25 metre-wide APZ along the southern boundary of the site which comprises the 10m Buffer Strip and an additional 15m Inner Protection Zone (IPZ). The IPZ will directly adjoin the 10m Buffer Strip to the north. This is a requirement of the Rural Fire Service (RFS) as the site has been identified as bushfire prone land.

Retention of an area of 'Swamp Oak Forest': An area of Swamp Oak Forest identified as core bushland under DCP No.25, in the south-eastern part of the site adjacent to Boondah Road will be retained. This area will be subject to some clearing and development under the current proposal, however, the retained portion will be either contiguous or adjacent to the Wetland buffer strip and will form a partial vegetated link in the form of 'stepping stone' habitat to the same community located across Boondah Road within the Sydney Water site and within the Warriewood Wetlands;

Erosion and Sediment Controls

Earthworks are not to commence until sediment and erosion controls have been installed as per the *Sediment and Erosion Management Option* under *Pittwater Stormwater Management Plan* (PSMP) for Pittwater Council (21 DCP). Erosion and Sediment Control is to be observed and monitored for the entire proposed development phase. Erosion and sediment control measures are to be implemented for the reconstruction of Fern Creek and the riparian zones. All objectives and measures outlined within Landcom *Managing Urban Stormwater: Soils and Construction,* VMP and Sediment and Erosion Control Plan by Meriton Apartments are to be enforced.

Sediment fencing installation the western boundary towards the eastern corner and excavation of two bio-retention basin in the south are to be installed prior to construction. Site access through established RTA roads at MacPherson St and Boondah Rd, are to be stabilised for the period of construction and monitored regularly for soil disturbance and erosion. Rock check dams are required in identified area of high erosion and surface water flow according to prediction modelling of water flow in the initial stage of development and further more if required during routine monitoring.

The proposed car park excavation will cut into bedrock and will require the collection, redirection and sub-surface dispersal of ground water in order to reduce potential impacts to the ground water

dependent ecosystem of Warriewood Wetlands adjoining the site. The natural water flow traverse the subject site from the north east down a 1^{o} slope toward the south western corner at the Warriewood Wetlands boundary (Jeffery and Katauskas, 2010).

Installation of temporary wells for the dewatering of ground water is required during the construction of the underground carpark. Prior to the installation of the foundations a Geotechnical consultant must inspect the excavation and ground water. The underfloor drainage system is to be installed upon their approval.

Earthworks

Clearing and grubbing will be carried out according to Councils Clearing and Grubbing Specification; including disposal of all vegetation scalped prior to levelling earthworks. Noxious weeds located within the excavation area must be treated prior to the commencement of earthworks to prevent the spread of propagules or reproductive vegetative matter to other parts of the construction site. Treatment of noxious weeds will be as per the control category for each species under the *Noxious Weeds Act* (1993) or LGA specific management plans.

All Construction Activities

According to the *Water Management Act 2000* vehicles and heavy machinery entry is prohibited within the riparian zone or 40m from Fern Creek and the adjacent Wetlands. This includes turning bays, vehicle parking and equipment storage. The Sediment and Erosion Control Plan should identify the entry and exit points at Macpherson St and Boondah Road, and appropriate stabilisation at this point over the construction period. Vehicles passage must not divert into vegetated areas or fenced TPZ's.

5.2 Weed Control and Revegetation

5.2.1 Overview

As described in earlier sections of this VMP the Poplar plantation is dominated by exotic grasslands and thickets of the woody weed species; *Ligustrum sinense* Small Leaved Privet and *Lantana camara* Lantana noxious weeds. As part of the *Noxious Weeds Act* removal of these weeds and regular monitoring is the highest priority for weed control. A significant reduction in the percentage of woody weeds within the subject site is recommended, controls are described in the further sections below. Commencement of weed control will concentrated on areas of high weed densities as the first priority.

Although endangered ecological plant communities are identified in the current survey in the study area the subject site does not support a highly diverse native plant community. The implementation of a restoration project focusing on the endangered ecological communities of the study area would assist in addressing key threatening processes identified as affecting Swamp Oak Forest. However, the preparation of a complete and detailed restoration programme and implementation of a fully resourced restoration project for the endangered ecological communities of the study area are beyond the scope of this VMP. The main vegetation management measures to be carried out for the subject site are weed control and revegetation. The main vegetative and reconstructive processes for the project will concentrate on the Core Riparian Zone, adjacent zones and the restoration of Fern Creek establishing a buffer between construction activities and Fern Creek and Warriewood Wetlands.

5.2.2 Project Planning

Weed Control and Revegetation Project Planning

The period of operation of this VMP will be from the date of publication of the VMP or commencement of the proposed construction project and for a minimum period of two years from the date of final plantings of the initial planting works, although the proposed staging of the overall project may extend this time. It is noted here that a two year maintenance period from the dated of final plantings is commonly specified for the operation of a VMP in the conditions accompanying the issue of a Part 3A permit. Regular maintenance and weed control at 3 month intervals is required for the 2 year period.

Invitation to Tender for Weed Control and Revegetation Works

Meriton Apartments will need to prepare a scope of works for the weed control and revegetation project and invite bush regeneration contractors to tender, or put out to open tender, a contract for the project. Alternatively a suitably qualified bush regeneration or similar person is employed to carry out the works. The scope of works will consider this VMP. Additionally the document, *Bush Regeneration A Practical Guide to Contract Management* (Blue Mountains Urban Runoff Control Program, 2003) may assist Meriton Apartment in preparing a scope of works and tender documents for the proposed project.

Invitation to Tender for VMP Monitoring

Meriton Apartments will need to engage a vegetation management or ecological consultant to carry out the VMP works. The scope of works for VMP monitoring will consider this VMP and items discussed above for the planning phase. Generally the aim of the VMP monitoring will be to assess the progress and success of the restoration and revegetation project and recommend alterations to or further vegetation actions and prepare and submit the monitoring reports. The VMP consultant is contracted from the commencement of the restoration project, throughout the revegetation works until the desired outcomes are achieved. The VMP consultant has regular updates and contact with the bush regenerators.

5.2.3 Vegetation Management Measures

Restoration activities will concentrate on native vegetation within the Riparian corridors and Fern Creek rehabilitation. Weed control will occur in three stages: primary, secondary and maintenance, and weed control works will aim to treat noxious weeds throughout the retained vegetation and Riparian Zones. The final maintenance weed control works is to achieve less than 5% weed coverage as per the performance criteria.

Removal of Noxious weeds is required under the *Noxious Weeds Act* for several species. Weed control is required through out the riparian buffer zones and target noxious woody weeds, canopy vines and exotic grasslands. The use of herbicide spraying within the riparian zone is not an acceptable practice although small spot spraying is allowed as per specification within the table below.

The aim of the revegetation project is to establish native canopy cover that enhances the riparian corridor values and habitat potential of the adjacent Warriewood Wetlands whilst providing discontinuous canopy within the Asset Protection Zone. MacPherson Street plantings of *Eucalyptus robusta* Swamp Mahogany and *Angophora costata* Sydney Red Gum are preferred feed trees for fauna species and assists in the connectivity of adjacent vegetation. The selection of vegetation types, plant densities and fuel reduction for the asset protection zone will conform to the NSW Rural Fire Services *Guidelines for Asset Protection Zones.*

Site Establishment and Preparation

Once Meriton Apartments has awarded a contract to a BR contractor the site establishment and preparation works will involve:

- project initiation meeting between the BR Contractor and Council to ensure coordination of site activities;
- Council site inductions for BR Contractor staff;
- addressing occupational health and safety (OH&S) issues, including preparation of a site hazard assessments and safe work method statements; and
- preparation of a time line showing the order of the main vegetation management works with start and finish times and milestones.

The appointed BR Contractor will have formal Occupational Health and Safety Programs (OH&S Program), set up in accordance with the *NSW Occupational Health & Safety Act 2000* (OH&S Act) and the *NSW Occupational Health & Safety Regulation 2001*, incorporating:

- workplace principles and policies relating to QA;
- reporting systems;
- project management system;
- training and education;
- workplace inspections, evaluations and audits; and
- staff manuals.

The appointed BR Contractor and Vegetation Management Consultant will ensure that the following OH&S issues are addressed:

- a hazard assessment is conducted for the site prior to commencement of works;
- preparation of a safe work method statement covering all vegetation management actions for the contract and all areas of the site;
- site induction for bush regeneration crews, identifying all relevant safety issues and environmental risks;
- ongoing reviews of safe work methods and hazards; and
- self-auditing of OH&S procedures.

Noxious Weed Control

Weeds that are listed as 'noxious' for Pittwater LGA are to be removed from the site or controlled, depending on the category of weed and according to the provisions of the NW Act or LGA specific management plan for a species. The most abundant Noxious weeds identified listed below;

- *Lantana camara* Lantana
- *Asparagus aethiopicus* Asparagus fern
- *Ligustrum sinense* Narrow-leaf privet & large
- *Ipomoea indica* Morning glory
- *Ochna serrulata* Ochna
- *Rubus fruticosus agg sp* Blackberry

Removal of noxious weeds is according to the Guidelines for APZ by the NSW Rural Fire Services (RFS). These weeds are extremely flammable and rapidly colonise large areas. Under this VMP the control of noxious weeds will be removed according to the best practices under Pittwater Councils noxious weeds list and best management practices within the LGA Class 4 weed management plans.

Primary Weeding

It is essential that all weeds are treated prior to removal of Poplar trees. Weeds should be spot sprayed and removal by hand for large strands. In areas within the riparian zone and within the retained Swamp Oak Forest community weed control is conducted by hand (i.e cut and paint). Stem injection of herbicide is used for large canopy trees *Cinnamomum camphora* Camphor Laurel. Herbicide application in accordance with the standard bush regeneration practice and secondary weeding includes the removal of dead biomass from the site as fuel accumulation is high during this phase.

Revegetation Preparation Weeding

Disturbed areas after the initial clearing phase within the riparian corridor are to be planted as soon as possible. Any filled areas are to be planted within 2 days of laying the topsoil at a density of 150 to 300mm deep. Vegetated buffers are established in the initial sediment prevention phase at the commencement of construction. Vegetated buffers are maintained by the contractors for the life of the Plan.

Areas cleared of noxious and woody weed infestations within the subject site will be revegetated with native species within the APZ selected according to the RFS guidelines on the most appropriate species. Regrowth of and establishment of exotic grasses and herbs is expected in these areas and this will be partly controlled by slashing. Prior to planting works spray application of herbicide is required in location excluding the Riparian vegetation. An area of approximately $2m^2$ is to be sprayed out and the number of locations that this occurs in the revegetation area will be equivalent to the number of plants to be installed.

Secondary Weeding

Secondary weeding is expected one to three months from the conclusion of the primary weeding to be determined during the initial weeding stage on the presence and densities of weeds. The site will be inspected at regular monthly intervals by the BR Contractor/suitably qualified individual(s) to determine the need and appropriate timing of secondary weeding. This will vary according to the timing of the primary weeding, insofar as regrowth will be stronger if primary weeding occurs during spring and summer, and slower during autumn and winter.

Secondary weeding is to continue until the date of final plantings and this is only likely only to require a minor amount of spot spraying or handweeding.

Maintenance Weeding

Maintenance weeding will be required to ensure that weed growth following noxious and woody weed control and revegetation works is monitored. Maintenance weeding will be carried out in all zones for a minimum period of two years from the date of final plantings of the revegetation works. Areas within the subject site previously treated for noxious and woody weed will be either open space or revegetation areas post construction. Woody weed regrowth will partly be controlled by slashing as part of open space management. Follow up spot spraying targeting woody weed regrowth is required throughout the construction site including open space and revegetation areas. Handweeding is required around individual plantings and close to remanent or regenerating native species throughout the riparian area and 'Swamp Oak Forest' to control weed growth.

Open Space Maintenance

The use of silviculture to prune Eucalyptus canopy trees within the subject site including street trees is not permitted. The practice of silviculture is listed as a threatening process in the decline of the Regent Honeyeater. The pruning of top flowering branches available for the Regent Honeyeater, listed as Endangered under the EP&BC and TSC Act is attributed to the removal of foraging opportunities. Hazard reduction practices for canopy trees within the Asset Protection Zone are restricted to thinning of secondary branches and removal of lower branches.

Open space design includes grasslands and pathways within the Inner Protection Zone at the conclusion of the proposed development. These areas must be free of noxious flammable species for the entire VMP management period and for the life of the development. Landscaped areas will also be maintained in part as open space (ie grass is to mown between plantings, weed control etc).

Herbicide Application

Weed control by spray application, cut and paint, frill and fill, long stem scrape will use a chemical that is recommended for the species targeted and reference can be made to *Noxious and Environmental Weed Control Handbook. A guide to weed control in non-crop, Aquatic and Bushland Situations* (NSW DPI, 2007) to ensure that and appropriate pesticide is used for the situation and weed. The use of herbicides on the subject site must be in accordance with labelling instructions, MSDS's and comply with the NSW *Pesticides Act 1999*. Herbicide application is in accordance with the site specifications and the target weed. Herbicide application is not permitted in areas of high biodiversity sensitivity, such as the Core Riparian Zone and within the endangered ecological communities 'Swamp Oak Forest'. Herbicide use is permitted for the preparation of topsoil reused on site and within the APZ and 10m Buffer Zone and open area maintenance.

Revegetation Strategy

The aim of the Fern Creek restoration project is the restoration of previously degraded isolated habitat to a healthy system intergraded into existing vegetation in the adjacent site. Sufficient time is required to achieve this aim and accurately measure the effectiveness of the project. Therefore, the revegetation works will outlive the existence of the current VMP. As stated by the *Blue Mountains Urban Runoff Control Program* (BMURCP, 2003) an ecological restoration project such as a bush regeneration project can take up to 10 years to complete.

In view of the above revegetation works recommended in this VMP will aim to;

- improve vegetative connectivity in the existing native plant communities of the study area by focusing on establishing connectivity of the vegetation with adjacent subject areas;
- improve the wildlife habitat values and provide the platform for the long term restoration of native plant communities of the study area; and
- establish a healthy and established riparian corridor along Fern Creek that maintains ecological function and aesthetics.

Revegetation works are to be carried out in the area includes the restoration of the riparian vegetation at the south and south eastern boundary of the site and introduction of limited fauna feed trees within the Asset Protection Area and street trees. Recommended species planting list have been compiled from suitable provenance species for the area and selected according to the Guidelines for Asset Protection Zones (NSW RFS, 2003). The majority of the species included in the list are readily propagated from seed or cutting and are commercially available.

Planting works are to be carried out post construction and should not commence until woody weeds are controlled in the revegetation area following the rehabilitation of Fern Creek. Planting is to be scheduled within 2 days of topsoil addition following any changes in levels that may be required

Ideally revegetation works commence no later than six months after construction and woody weed removal is complete. Additionally revegetation works should be planned for autumn where possible and avoid installation in late spring through to summer.

Plants are to be propagated and supplied by a commercial or community nursery that is a member of a recognised industry association. Supplied trees, shrubs and scramblers will be 'forestry tubes' grasses and herbs as 'Hyco cells' or 'Viro cells' for groundcover species.. Shrubs, scramblers or groundcover species are to be installed as part of the revegetation works outside the Asset Protection Zone.

Revegetation Areas

The revegetation works proposed in this VMP occurs in three distinct zonings;

- plantings within the overland flowpath & bio-retention basins;
- garden and open space planting in the Inner Protection Area; &
- riparian corridor plantings.

The riparian corridor restoration aims to increase the biodiversity and connectivity of the vegetation and filter nutrient flow. Vegetation within the overland flowpath and bio-retention basin are to reduce velocity of stormwater and settle surface water sediments out of the hydrological flow. Open space planting act as an aesthetics mosaic garden, flood storage area and provide limited canopy and shrub vegetation composition.

The street trees along the two boundary roads offer greater connectivity to adjacent subject sites and increase the availability of foraging fauna species particular threatened native avian species. These will be installed according to the landscape Plans, however recommendations regarding suitable species is made below

Other relevant benefits from the establishment of revegetated areas include and are not limited to;

- reduce erosion along Fern Creek;
- filter nutrient and sediments from surface water runoff
- improve surface water quality and the velocity into Warriewood Wetlands
- increases native flora species within the site
- reduces the spread of exotic species and their associated impacts

Proposed plantings programs within the construction zones should commence immediately after construction works have concluded. Planting within the riparian corridor is not restricted to the completion of the construction works and should follow the secondary weeding works and be maintained throughout the project. Planting works is ideally accomplished within autumn utilising natural depressions and dips in the soil profile to establish species.

A regular watering schedule is required and is dependant on weather patterns. A preferred watering regime would schedule a weekly routine for the first month and then every second week thereon for 6 months. Water retaining crystal should be used for new planting within a distance of 40m from the waterway.

Seed Collection and Cuttings

Limited potential is available for the collection of provenance species within the subject site. Collection of seeds is available from the adjacent site within Warriewood Wetlands with approval from Council. A definition of local provenance for plant propagation is given by DEC (2005a) as material for propagation found on-site or close to it and states that 'That use of site-adapted local seed for propagation is best for restoring pre-existing plant communities and conserving local biodiversity. It is also more likely to lead to a successful self-perpetuating plant community, as local provenant seed is adapted to local soils, climatic conditions and ecological processes.' Table 5 of *Cumberland Plain: Best practice guidelines for the management and restoration of bushland* (DEC 2005a) provides guidelines on seed collection ranges based on estimated dispersal distances for plant categories. The collection of seeds should be first approved by Pittwater Council and the species sources from known indigenous communities and not planted species. Alternative plant stock may be sourced from existing supplies of seed or stock from a contracting nursery but proof of the origin of the material, that identifies it as local and provenance, must be forwarded to the Vegetation Management Consultant.

Seed collection by the contracting nursery or a qualified bush regenerator is to commence 12 months prior to the commencement of revegetation works. The BR contractor or nursery must possess the required license of seed collection issued by DECCW under the *National Parks and Wildlife Act 1974* and obtain permission for land holders. Seed collected should be used for direct seeding and for propagation.

Planting Densities

Planting densities are based on consideration of the aims of the revegetation for the subject site and this includes ecological restoration and open space function. Planting densities for species within the riparian corridor will by at 1 tree or shrub per m^2 alternately planted in approximately equal numbers and in addition groundcover plants at 4 per m^2 (DW&E, 2007).

The Asset Protection Zone (APZ) bordering the Warriewood Wetlands and Fern Creek serves to reduce bushfire fuel loads and continuous vegetation hazards from residential developments. The general criteria for the IPA (25m) are a mark reduction in the level of combustible vegetation and greater distance from dwellings. Plant densities within this zone should in accordance with the recommendations of the bush fire assessment and RFS guidelines for asset protection zones. The revegetation within the south and south western corners of the subject site boundaries will require careful selection of the species fuel contribution and spread.

The 10m Buffer Zone is located adjacent to the IPA and includes a higher vegetation composition of discontinuous trees and shrubs. The 10m Buffer Zone assists in the transition between the Core Riparian Zone and Inner Protection Zone. A tree canopy layer of 30% is an acceptable level accompanied by low growing shrubs and maintained ground covers.

Plant Installation

Installation of 'forestry tubes' will be as per bush regeneration industry standards. As specified in sections above planting works should not commence until woody weeds are under control in the revegetation area. Ideally revegetation works commence no later than six months after construction and woody weed removal is complete. Additionally revegetation works should be planned for autumn where possible and avoid installation in late spring through to summer.

Planting Maintenance

Planting maintenance will commence from the date of final plantings in the initial revegetation works. All revegetation works must be maintained and key elements will be water, prevention of predation and suppression of smothering weeds.

To prevent damage or loss of plantings by rabbits and open space maintenance activities all installed plants stakes and biodegradable containers are to be maintained until plants are established.

Weeding of plantings throughout the site is to be carried out and will be included as part of the maintenance weeding programme. Maintenance weeding will require hand weeding and spot spraying with topping up of mulch throughout the two year maintenance period to suppress weed regrowth around the plantings. As a general rule it is expected that there will be a loss of approximately 20% of the original planting numbers. Replacement plantings are required to maintain the original planting numbers at 80%. Replacement planting is to be carried out throughout the two year maintenance period to sustain the 80% of original number specification.

Pruning

Pruning conducted in accordance with the Australian Standard AS4373 'Pruning of amenity trees' and conducted in accordance with the NSW Work Cover Authority Code of Practice AS 4373-2007 for the Amenity Tree Industry 1998. Thinning of dead or diseased overhanging branches is a high priority along pathways and driveways to be undertaken by a qualified Arborist.

Irrigation

Water Wise Rules replace Sydney Waters Level 3 water restrictions in June 2009. Water rules have relaxed with recent rainfalls over the Warragamba catchment area. Watering of planted species by

commercial contractors allows the use of automatic and manually operated watering systems and hand held hoses in the initial eight weeks of plant establishment. Conditions apply for the use of watering devices beyond this period. It is recommended that hand held watering is used to maintain planting survivorship. Sensible water regime is still expected out of the hottest parts of the day from 10am to 4pm.

Mulching

Mulching within the Tree Protection Zone at a depth of 100mm is to be conducted one prior to planting. A composition of 75% lead litter and 25% wood is obtained ideal from site, however, give the request for species specific mulch the majority of species for removal on site could not be used as mulch. If mulching is to be on a slope, sediment fencing and erosion control measures are to be installed to prevent mulch transportation into Fern Creek or Warriewood Wetlands.

5.3 Monitoring

A program of monitoring and inspection will be carried out either by a qualified vegetation management consultant (or qualified botanist) for the full period of the restoration and revegetation project. The consultant will be responsible for ensuring the measures specified or recommended in this VMP are implemented and that performance criteria are met. The monitoring programme will commence at the establishment of weed control works and continue for the minimum two year maintenance period.

General observations will be made of the nature and condition of the plant communities of the restoration and revegetation areas during monitoring surveys including;

- certifying that the planting stock (including initial and replacement plantings) are of local provenance as evidenced by the supplying nursery or bush regeneration contractor;
- assessment of weed control works including noxious and woody weed control, control of herbaceous weeds around the plantings and maintaining mulch;
- estimates of the success rate of plantings and assessment of plant replacement requirements;
- identification and assessment of any natural regeneration of native plant species;
- evidence of erosion and sedimentation and the correct function of erosion control devices; and
- recommendations for corrective measures and/or vegetation management.

A weed density map will also be prepared at commencement of the restoration and revegetation project and it will be updated on a biannual basis. The vegetation management consultant will ensure that the map is prepared on a suitable base plan, which will remain as the base plan for the duration of the monitoring period.

5.4 Roles, Responsibilities and Timing

The roles and responsibilities of all project staff of relevance to the VMP are listed in Table 1. The proponent will be primarily responsible for the implementation of this VMP and will engage a qualified vegetation management consultant with experience in bush regeneration and ecological assessment for monitoring and auditing. The consultant will monitor the vegetation management works and ensure that the BR Contractor/ suitably qualified individual has complied with the requirements of this VMP. The consultant will act as a communication link between the BR Contractor/suitably qualified individual(s) or employer and consent authorities.

Table 1 Project Staff Roles and Responsibilities

Role	Responsibilities
Project Manager	▪ Project management of entire site including planning, contracting and coordination of all construction works, landscaping, Riparian Zone restoration and bush regeneration, compliance with development consent conditions, liaison with stakeholders and consent authorities and OH&S.
Construction Contractor	▪ Construction and maintenance of Bio-retention basins, sediment fences and all Sediment and Erosion Control measures prior to construction works. ▪ Exclusion fencing along native plant community and construction/excavation/riparian zone boundaries and Tree Protection Zones ▪ Earthworks including cut and fill operations ▪ Monitor erosion and vehicle access, ▪ Establish stockpiles and sediment controls, keep moist and rotate monthly,
Geological Consultant	▪ Inspection of excavation at contact with groundwater table ▪ Inspection of installation of subsoil drains
Arborist	▪ Pruning of overhanging dead or diseased branches along paths and driveways ▪ Inspection of Tree Protection Zone fencing and signage ▪ Removal of Poplar and other trees from subject site
Wildlife Handler	▪ Removal of fauna species from 40 Poplar trees identified with significant hollows. ▪ Monitoring of fauna species during the removal of Poplar trees.
Landscape Contractor (or other)	▪ Planted species in accordance with VMP species list and densities according to NSW Rural Fire Services guidelines for Asset Protection Zones. ▪ Maintain regular watering within Sydney Water *Water Wise Rules* ▪ Maintain a 80% survivorship for the life of the VMP
BR Contractor	▪ Vegetation management measures within areas designated for weed control and revegetation ▪ Implementation of VMP actions. ▪ Weed control, seed collection, planting, erosion control within riparian corridor ▪ Mulching, planting and watering
Commercial or community plant nursery	▪ Necessary license for seed collection under the *National Parks and Wildlife Act* and permission from land holder. ▪ Collection of local provenance native seed and cuttings. ▪ Supply of local provenance native plant stock and letter of authenticity and origin of plant stock.
Vegetation Management Consultant	▪ Monitoring and provision of advice of restoration and revegetation project in Riparian Zones and revegetated areas. ▪ Monitoring of weed control and revegetation works, plant survivorship, weed densities and correct installation of erosion control measures. ▪ Ensuring compliance with VMP ▪ Certification that restoration and revegetation works have met the assessment criteria at completion of the 2 year maintenance project.
Department of Planning	▪ Certification of commencement of maintenance period ▪ Inspection of restoration and revegetation works during maintenance period. ▪ Certification that restoration and revegetation works have met the assessment criteria at completion of the minimum 2 year maintenance project.

Timing

The entire restoration and revegetation project including on ground works and VMP monitoring will extend for a minimum of 30 months, allowing 6 months for site preparation, primary and secondary weeding and planting and a further 24 months for maintenance. Table 2 details the vegetation management actions to be carried out for the site and identified responsibilities, performance criteria and timing for each recommended action. Table 2 also lists the general order in which the vegetation management actions should occur. The construction staging of the overall development and influence the overall timing of the recommended vegetation management measures.

Table 2 Vegetation Management Actions for Proposed Meriton Apartments 14-18 Boondah Road, Warriewood.

Action	Responsibility	Performance Criteria	Timing
Contract			
Issue of Tender and selection of contractors for Weed Control and Revegetation contract and VMP Monitoring contract	Meriton Apartments	Preparation of Tender Scope of Works that references this VMP. Submission of Tenders that are consistent with this VMP	Prior to commencement of construction.
Preparation of a proposed timelines for the weed control, revegetation and VMP monitoring program showing the order of works and completion, dependencies and milestones.	BR Contractor and Vegetation Management Consultant	Submit Gannt charts or similar to Meriton showing start and finish times of major tasks and milestones	Prior to commencement of construction and vegetation management contracts.
OH&S. Hazard & risk assessment for bush regeneration crews. Prepare Safe Work Method Statement. Conduct internal safety and environmental induction.	BR Contractor and Vegetation Management Consultant	Safe Work Method Statement completed and submitted to Meriton.	Prior to commencement of all works.
Construction			
Definition and agreement of expected outcomes for Core Riparian Zone & Fern Creek restoration and revegetation project.	Construction Project Manager, BR Contractor/suitably qualified individual(s), Vegetation Management Consultant, Construction Contractor(s) and representative from a consent authority (eg Council, DNR, DEC)..	VMP actions roles and responsibilities clearly identified and defined	Prior to commencement of any construction works in Riparian Zones or Fern Creek.
Delineate Tree Protection Zone fencing and signage and no go vehicle access in vegetated zones or for construction activities.	Construction Project Manager, BR Contractor/suitably qualified individual(s), Vegetation Management Consultant, Construction Contractor(s) and representative from a consent authority (eg Council, DNR, DEC).	Tree Protection Zones, VMP areas and objectives clearly defined and no unauthorised encroachments or disturbance during construction.	Prior to commencement of any construction works.

Table 2 cont' Vegetation Management Actions for Proposed Meriton Apartments 14-18 Boondah Road, Warriewood.

Action	Responsibility	Performance Criteria	Timing
Install erosion and sediment control fences and devices; sediment & Barrier fences, bio-retention basins, rock check dam, diversion bank. Maintain erosion and sediment control fences and devices.	Construction Contractor	Temporary sediment control fences and devices installed and maintained according to CEMP and SWMP	Prior to any construction and throughout construction as required
Felling of trees scheduled for removal.	Arborist	No damage to trees not scheduled for removal. Tree limbs and foliage chipped and mulch reused on site. Tree trunks retained for habitat logs in restoration areas.	After fauna clearance surveys and prior to any construction earthworks.
Remove wildlife from 40 Poplar tree hollows prior to felling. Safety of wildlife during tree felling and release or monitoring.	Qualified Wildlife Handler	Fauna removed prior to tree felling.	Prior to tree felling
Noxious weed control in VMP areas.	BR Contractor/suitably qualified individual(s)	Control and disposal of noxious weeds	Ongoing for the life of the development.
Soil stabilisation works at vehicle access points at MacPherson St & Boondah Rd. Soil stabilisation works at temporary stockpiles (jute meshing, sediment fencing & other).	Construction Contractor or BR Contractor/suitably qualified individual(s).	Exposed soil stabilised	During the initial construction stage for vehicle access and as appropriate for stockpile. Regular monitoring of soil moisture.
Stabilisation of Fern Creek banks temporary silt fence on banks, sand bags	Construction Contractor or BR Contractor/suitably qualified individual(s)	Stabilisation of Fern Creek banks	Prior to creek bed restoration
Restoration of Fern Creek creek bed riffles, rock armouring & edge treatment	Construction Contractor Engineer	Stabilisation of Fern Creek bed	After erosion control measures installed.

Table 2 cont' Vegetation Management Actions for Proposed Meriton Apartments 14-18 Boondah Road, Warriewood.

Action	Responsibility	Performance Criteria	Timing
Installation of Pedestrian boardwalk within 25m Buffer Stripe	Construction Contractor Engineer	Installation of pedestrian bridge	After the installation of the creek stabilisation
Soil stabilisation works at disturbed sites at completion of construction.	Construction Contractor or BR Contractor/suitably qualified individual(s).	Exposed soil stabilised	At completion of construction works.
Collection of seed from native felled trees, *Angophora costata* & *Eucalyptus botryoides*	Contracting Nursery or BR Contractor/suitably qualified individual(s)	All seed collected and used in revegetation works on site. Surplus seed stored in a seedbank for future revegetation works at the site	Immediately after felling
Restoration and Revegetation Project			
Native seed and cuttings collection for propagation	BR Contractor or Nursery Contractor	Collection of native plants and cuttings from the site or locality of recommended planting species (Appendix C)	Commencing twelve months prior to revegetation works.
Project establishment meeting and planning of Restoration and Revegetation Project for Riparian corridor.	Construction Project Manager, BR Contractor/suitably qualified individual(s), Vegetation Management Consultant.	Formulation of a strategic approach and coordination of activities.	Before commencing the major works of the Restoration and Revegetation Project.
Finalisation of a timeline for the Restoration and Revegetation Project VMP monitoring program showing the order of start and completion, dependencies and milestones.	BR Contractor/suitably qualified individual(s) and Vegetation Management Consultant	Submit Gannt charts or similar to Construction Project Manger that shows start and finish times of major tasks and milestones	Prior to commencement of works and VMP monitoring and updated as required throughout the project
OH&S. Hazard & risk assessment for bush regeneration crews. Prepare Safe Work Method Statement. Conduct internal safety and environmental induction.	BR Contractor/suitably qualified individual(s) and Vegetation Management Consultant	Safe Work Method Statement completed and submitted to Construction Project Manager	Prior to commencement of all works

Table 2 cont' Vegetation Management Actions for Proposed Meriton Apartments 14-18 Boondah Road, Warriewood.

Action	Responsibility	Performance Criteria	Timing
Carry out noxious weed control in construction zone	BR Contractor/suitably qualified individual(s).	Noxious weeds controlled as per *Noxious Weeds Act 1993* provisions.	Prior to development construction and Poplar tree removal.
Carry out noxious weed control in riparian zones	BR Contractor/suitably qualified individual(s).	Noxious weeds controlled as per *Noxious Weeds Act 1993* provisions.	Prior to revegetation works and for the duration of the life of the development.
Carry out primary weeding in all zones	BR Contractor/suitably qualified individual(s).	Weeds treated.	Prior to revegetation works.
Install and maintain sediment and erosion control devices directly related to restoration and revegetation works	BR Contractor/suitably qualified individual(s)	Sediment and erosion control fences and devices installed and maintained according to CEMP and SWMP	Prior to any works that may result in soil erosion and for duration of project as required.
Carry out secondary weeding	BR Contractor /suitably qualified individual(s)	Weed regrowth following primary weeding treated.	Commencing within one month of primary weeding. Secondary weed control to continue until plantings commence.
Install mulch (to facilitate weed control and moisture retention)	BR Contractor/suitably qualified individual(s)	Mulch spread in revegetation areas to a depth of 100mm	One month prior to planting after secondary weed control.

Table 2 cont' Vegetation Management Actions for Proposed Meriton Apartments 14-18 Boondah Road, Warriewood.

Action	Responsibility	Performance Criteria	Timing
Certify plant stock is of local provenance	Vegetation Management Consultant.	Certification forwarded by BR Contractors	Prior to planting.
Planting of areas identified for revegetation and following the aims of revegetation. Phase 1 – plantings within riparian zone Phase 2 – planting within bio-retention basin Phase 3 – plantings within Asset Protection Zone & open space Phase 4 – street tree planting Phase 5 - Overland Flowpath plantings	BR Contractor/suitably qualified individual(s)	Revegetation to follow as close as possible the recommendations of this VMP. Watering by on site water extraction from the reservoir and/or current Sydney Water exemption permit. Plants installed as per densities and species specified in this VMP. Only local provenance plant stock of those species recommended in Appendix A to be planted throughout the site All plantings staked and bagged where predation by rabbits exceeds 5% of original numbers	On completion of primary and secondary weeding, mulching and completion of creek construction and development works.

Table 2 cont' Vegetation Management Actions for Proposed Meriton Apartments 14-18 Boondah Road, Warriewood.

Action	Responsibility	Performance Criteria	Timing
Carry out planting maintenance	BR Contractor /suitably qualified individual(s)	Weed regrowth following planting carried out to prevent reinvasion and smothering growth of weeds throughout Riparian Zones and other areas. DNR have specified not more than 5-10% weed cover in VMP planting areas. Exclusion fencing maintained. Top of mulch to maintain a depth of 75mm. where mulching has been carried out. Replacement planting to maintain native plant species cover that is a minimum of 80% of the original planting numbers.	Commencing from the date of final plantings and continuing for four years. From the date of final planting in either Riparian Zone (ie whichever is the last area to be planted). Maintenance period will only commence once DNR has certified that the conditions of consent and amendments regarding planting areas and plant densities have been met.
Monitoring			
Update project timelines.	BR Contractor/suitably qualified individual(s)	Updated Gannt charts submitted to Vegetation Management Consultant and Construction Project Manager	As required
Verify and update weed density map of the site.	Vegetation Management Consultant	Weed map prepared	Quarterly for the duration of the project

Table 2 cont' Vegetation Management Actions for Proposed Meriton Apartments 14-18 Boondah Road, Warriewood.

Action	Responsibility	Performance Criteria	Timing
Regular inspections of restoration and revegetation areas to check levels of weed regrowth following primary weeding.	BR Contractor/suitably qualified individual(s)	Levels of weed regrowth reported to Vegetation Management Consultant.	Monthly following completion of primary weeding.
6 monthly inspection and reporting	Vegetation Management Consultant	Reporting of weed densities and planting survivorship	Baseline surveys prior to restoration construction then at 6 monthly intervals until completion of VMP project.
Sediment and Erosion Control Monitoring Desilt control structures prior to 30% reduction in capacity	Construction Contractor	Sediment and Erosion control structures at full working capacity	Monthly and additionally after rainfall events
Certify plant stock is locally indigenous and planting densities if required.	Vegetation Management Consultant.	Certification forwarded to DNR.	Date of final planting.
Certify plant stock has been maintained at minimum 80% of original quantity of plantings.	DNR and Vegetation Management Consultant.	80% success rate for tubestock plantings four years from date of final plantings. Certification forwarded to DNR or other consent authority.	Two years from date of final planting.
Site inspections.	DNR and Vegetation Management Consultant.	Inspection checklist completed.	At Site Establishment, then quarterly for duration of contract.
Final Inspection of Works.	DNR and Vegetation Management Consultant.	Final Inspection carried out at completion of maintenance period.	Two years from date of final planting.

6 COST ESTIMATES

No cost estimates for the implementation of the vegetation management actions within the riparian zones, buffers or asset protection zones have been provided within this Plan. If cost estimates are required by the Department, these can be submitted as an addendum to the VMP once the final designs for the project have been approved, and with reference to the project timing and project staging.

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Appendix A

Maps and Figures

Vegetation Management Plan

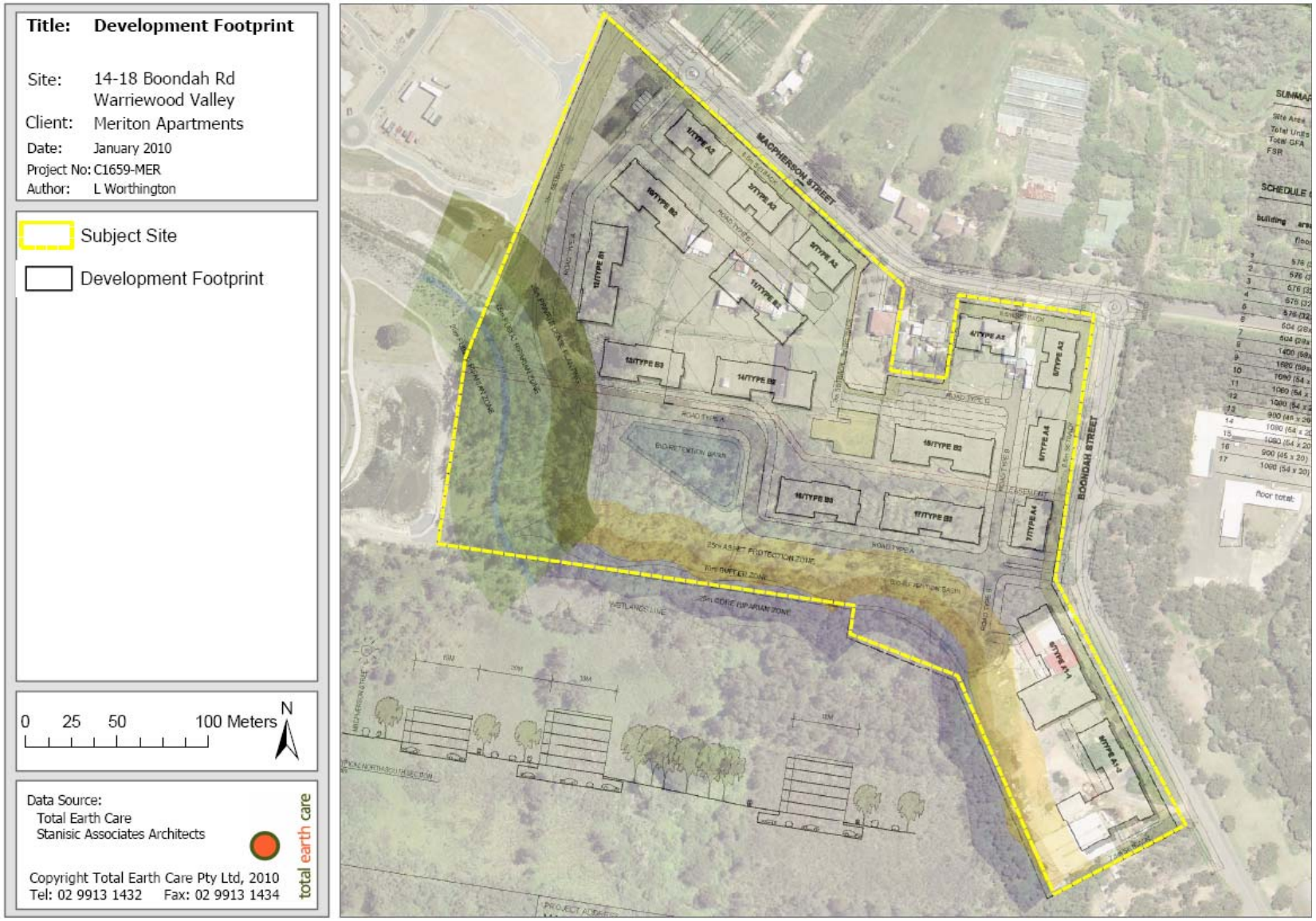
Warriewood STP Buffer Area 3
Proposed Residential Development

Meriton Pty Ltd

Map 1 Proposed building footprint

Map 2 Riparian zoning

Map 3 Vegetation Communities



Map 1: Proposed development footprint

Map 2: Buffer zones proposed for the protection of Fern Creek, the Riparian Corridor and Warriewood Wetlands

Map 3: Vegetation communities identified from the subject site

Appendix B

Photo Plates

Vegetation Management Plan

Warriewood STP Buffer Area 3
Proposed Residential Development

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Photo Plate 1: Weed infestation within the riparian corridor backing on to Fern Creek

Photo Plate 2: Looking towards the Poplar plantation

Appendix C

Recommended planting species

Vegetation Management Plan

Warriewood STP Buffer Area 3
Proposed Residential Development

Meriton Pty Ltd

Table C1 Recommended Plant Species for Revegetation at proposed Meriton Appartments 14-18 Boondah Rd, Warriewood.

Planting densities and locations are in accordance to the Landscape Design and APZ Requirements

Scientific Name	Common Name	Location
Acmena smithii	Lilly Pilly	Fern Creek, bio-retention basin, Overland Flowpath
Alternanthera denticulata	Lesser joyweed	Fern Creek
Backhousia myrtifolia	Grey Myrtle	APZ, bio-retention basin
Bauera rubiodes	River Rose	Fern Creek
Brachychiton populneus	Kurrajong	Street planting
Callistemon citrinus	Crimson Bottlebrush	APZ & Street planting
Carex appressa	Tall Sedge	APZ, bio-retention basin
Casuarina glauca	Swamp Oak	Street planting
Cyathea australis	Tree fern	APZ
Dianella caerulea	Blue-flax lily	APZ, bio-retention basin, Overland Flowpath, Street planting
Doryanthes excelsa	Gymea lily	Street planting
Eucalyptus robusta	Swamp Mahogany	Street planting
Ficus rubiginosa	Port Jackson Fig	APZ, bio-retention basin
Gahnia sieberana		APZ, bio-retention basin
Grevillea speciosa	Red Spider Flower	Street planting
Isolepsis nodosa	Clubrush	APZ, bio-retention basin
Juncus usitatus	Common Rush	APZ, bio-retention basin
Leptospermum juniperinum		APZ
Livistona australis	Cabbage Tree Palm	APZ
Lomandra longifolia	Mat Rush	APZ, bio-retention basin, Overland Flowpath, Street planting
Melaleuca linarifolia	Snow in summer	APZ
Pennisetum alopecuroides	*Nafray*	Street planting
Poa poiformis	Kingsdale	Street planting
Themeda australis	Kangaroo Grass	bio-retention basin, Overland Flowpath

Table C2 Suggested Planting for Core Riparian and 10m Buffer Zone.

Planting densities are in accordance to the required 1 tree or shrub per m^2 alternately planted in approximately equal numbers, and in addition groundcover plants at 4 per m^2 (DW&E, 2007).

Scientific Name	Common Name	Type
Acacia longifolia	Sydney Golden Wattle	Shrub
Acmena smithii	Lilly Pilly	Large Shrub
Casuarina glauca	Swamp She-oak	Tree
Commelina cyanea	Scurvy Weed	Scrambler
Dodonaea triquetra	Common Hop Bush	Shrub
Eleocharis sphacelata	Giant Spike Rush	Sedge
Entolasia marginata	Australian panic grass	Grass
Eucalyptus robusta	Swamp Mahogany	Tree
Eucalyptus botryoides	Bangalay	Tree
Ficus coronata	Sandpaper Fig	Tree
Gahnia clarkei		Sedge
Geitonoplesium cymosum	Scrambling lily	Vine
Glochidion ferdinandi	Cheese Tree	Shrub
Iscahne globosa		Grass
Imperata cylindrica	Blady Grass	Grass
Livistona australis	Cabbage Tree Palm	Palm
Melaleuca ericifolia	Swamp Paperbark	Shrub
Melaleuca quinquenervia	Broad-leafed Paperbark	Shrub
Oplismenus imbecillis	Basket Grass	Grass
Pittosperum revolutum		shrub
Philydrum languinosum		Sedge
Themada australis	Kangaroo Grass	Grass
Viola hederacea	Native Violet	Scrambler

Appendix D

Bush Regeneration General Methodologies

Vegetation Management Plan

Warriewood STP Buffer Area 3
Proposed Residential Development

Meriton Pty Ltd

Some or all of the following Bush regeneration / rehabilitation techniques may be used in the completion of the works. A flexible and adaptable approach to bushland regeneration / rehabilitation is required to respond to dynamic ecosystems.

Weeding Techniques

Type	Definition
Primary weeding	Weeding in bushland that has not been treated in the recent past and which requires the eradication of mature plants of deleterious weed species. All weeds of all age classes will be treated.
Secondary weeding	Weeding in bushland that has been primary treated and requires the eradication of the new seasons growth of weed propagules. Secondary weeding removes the largest flush of second generation weeds from soil stored propagules.
Follow up weeding	The eradication of ongoing weed flushes/germination until the soil stored bank of weed propagules has been substantially exhausted.
Maintenance weeding	Weeding in bushland that has a received secondary weeding and that has high to moderate resilience and which has no mature deleterious weed species.
Target weeding	The removal of a single species or class of weeds. The purpose of target weeding is to stop the lifecycle of the nominated species.
Assisted seedling recruitment:	The weeding and baring of soil adjacent to a mature native species to create the conditions which are conducive to the seed germination of that native species.
Age class weeding	The removal of an age class of a weed species. By removing the largest seeding plants the lifecycle of a weed monoculture can be interrupted and the seedlings progressively eradicated as they come to maturity.
Access weeding	The removal of a size class of weed to improve, humidity levels, access for fire management, chainsaw use or spot spraying. Removal of a size class can also remove weeds that compete with native plants.
Deseeding	The removal of seed from a plant prior to it reaching maturity and prior to its ultimate eradication.
Composting	The composting of weed refuse that is unlikely to re-grow by raising the pile on a raft of woody material to keep stems off the ground and striking / layering.
Propagule composting	The wrapping of weed propagules in a black plastic bundle to create heat and kill the propagules. These bundles also contain the spread of the propagules.

Rehabilitation Techniques

Type	Definition
Sandstone / clay capping	The installation of a clean soil medium over a degraded / weed infested soil. This process requires the following steps: A. The removal of the weed biomass and grading/smoothing of the surface to be capped. B. The eradication, usually through herbicide application, of the next generation of weed propagules. C: The selection of weed free, medium with varying particle sizes up to 400mm. (Sufficient percentage composition of fines is required to provide adequate plant growing media. The material must also have adequate sand/silt/clay composition to provide free drainage Water Holding capacity (WHC), and nutrient availability. D: The sand /silt clay composition must also provide adequate soil binding characteristics to allow it to gain an adequate angle of repose on the batters to which it is applied. The depth of the capping required depends on the following parameters. i. The contour and surface shape of the ground to be covered. Rough uneven surfaces require deeper capping. ii. Steeper slopes require deep capping at their toe and reduced depths at the top of the slope. iii. The working tolerances of the machinery / labour used to install the capping. (200mm is the minimum suggested capping depth if it is spread by hand and the weed species being suppressed are not intractable stoloniferous or root spreading species.) In general 400mm depth of capping allows for adequate weed suppression contour/reshaping and is also spreadable by excavator (without the teeth of the excavator digging and mixing weedy soil into the clean capping material.) E. Mulch, which decomposes to sugars, is required to initiate the establishment of Mycorrhizal fungi. Light mulching (25mm) Native tree wood fibre is suggested in conditions where there is a source of adjacent weed. (Clean crushed sandstone is not conducive to weed growth but decomposing mulch is. Light mulching provides some sugars but not a phosphorous rich and high pH medium that occurs in deeply mulched areas. Light mulching is also suitable to direct seeding applications especially of native tree species. Heavy mulching is suggested where there is not a source of adjacent weed seeds and native canopy species recruitment is not required. F: Installation A track mounted excavator should only be used to spread the medium. The excavators tracks exert less force on the ground per square meter than a tyred vehicle. Their slewing ability and boom reach enable them to spread material without compacting it which is very important for the air filled porosity of the soil and plant growth.
Direct seeding	The broadcasting of native seed, which has been prepared / treated, into a bushland area that is depauperate of native plants.
Sterile grasses	The broadcasting of sterile seed to either stabilize unstable ground of to out compete weed species in heavily weed infested soil.

Herbicide Use

- All spraying should be completed by trained and licensed staff in accordance with the NSW Pesticides Act.
- All spray equipment is well maintained so that it can safely and accurately complete very careful spray works.
- All herbicides are used in accordance with their labels or NRA approved off label permits.
- All rinse water is reused in broad spraying programs on highly disturbed sites.
- All spraying is completed in suitable climatic conditions ie not during droughts, high winds or preceding rains. Every effort is made to improve the effectiveness of the herbicides that are applied.
- Herbicides are not applied in the immediate proximity of creek lines or permanent water bodies.

Type	Definition
Spot spraying	The precision application of sprayed herbicide to weed species that are growing in close proximity to native plants. The spraying occurs after the target weeds have been eradicated by hand from around native plants.
Broad spraying:	The application of herbicides in broad areas of weeds. Care is taken to ensure that spray drift does not effect native plants near by. This type of spraying is usually preceded by spot spraying along the native weed interface.
Vine curtain spraying	The spraying of vine weeds that have formed a dense curtain of foliage over trees and shrubs. These curtains are carefully sprayed and the herbicide translocated into the roots of the plants killing them some distance from the point of herbicide application.
Motorised spraying	The application of herbicide with a motorised pump and large volume reservoir. This means of herbicide application is restricted to large weed polycultures and disturbed sites. Two operators work in tandom with two spray guns or with a single machine mounted boom.
Cut and Painting	The cutting, as close to ground level as possible, of woody weeds and the application of herbicide, within 30 seconds to the phloem ring of the cut stump.
Scrape and painting	The scraping of a stem or root of a weed, close to its roots, to expose the phloem and then painting that stem with Herbicide.
Long stemmed scraping	The scraping of a stem of a weed at a long distance from the roots when the root and stem base are inaccessible.
Bagging and spraying	Bundling of a grass or vine weed and while bagging the bundle while still connected to its roots so that the contents of the bag can be sprayed without fear of applying herbicide to the surrounding bushland.
Chiseling and poisoning	The ringed chiseling of a woody weed close to the ground to apply herbicide to the phloem via an applicator bottle.
Wiping	The application of herbicide by use of a sponge, wick or cloth to the leaves of bulbs or grass weeds.

Other Specific Herbicide Uses

Trounce for *Protastaragus Aethiopicus.*	The use of Trounce mixed with Roundup Biactive to form a slurry for the treatment of *Protasparagus aethiopicus* has been found to achieve good kill rates. The sprouts are cut and the herbicide slurry applies close to or directly to the crown. This treatment method greatly reduced the strenuous manual handling aspect of *Protasparagus aethiopicus* treatment. In addition it reduce soil disturbance. This use is covered by the minor use Permit Number 4793.
Dicot Selective	For spraying Dicot weeds among native moncots.
Monocot Selective	For spraying monocot weeds from among native dicots.
Garlon for Blackberry	We recommend the control of *Rubus fruticosus* with Garlon 600. We have achieved better kill rates with Garlon 600 than Glyphosate based herbicides that burn the foliage, however fail to kill the plant. The use of Garlon 600 for the control of *Rubus fruticosus* is a registered use under the controlled droplet application table of on the product label.

Phytophthora Prevention

The principals of the Royal Botanic Gardens protocols for bush regeneration contractors should be adopted to prevent the spread of Phytophthora root rot. The protocols are currently being implemented on numerous sites including all Department of Defence lands, and Lion Island for the NPWS.

Fire

Type	Definition
Broad area burns	The burning of bushland in a mosaic pattern between established control lines / mineral earth trails.
Mineral earth Trails	Paths and fire fuel free tracks that are created to back burn from or created to contain a fire within.
Pile burns	Piles of vegetation constructed in clearings and canopy free areas. These piles are made in linear shapes that do not exceed 1600mm in height. They are constructed in areas where weed seedlings are likely to eradicated and where native seedlings are likely to be stimulated into germinating.
Fire frequency	The frequency with which fires occur in discreet area within a bushland reserve. The frequency is a recommendation based on the sites known fire history and the vegetation community type.
Fire intensity	The heat with which a fire is deliberately burnt. Low intensity burns can be used to stimulate grass germination and remove grass and herbaceous weeds.
Post Fire regeneration	The health of post fire regeneration is of paramount importance to the well being of a plant community. If the community has suffered dense weed invasion that has killed native canopy and created high humidity and wet soils native seeds stored in the soil seed bank may have rotted and species are at risk of being lost from the community if the post fire regeneration is not nurtured through to maturity and new propagules grown for successive generations.