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Vegetation Management Plan

Lipman Properties Pty Ltd

Proposed Residential Development
128 Herring Road Macquarie Park

Total Earth Care Pty Ltd
September 2010

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ADDUNDUM

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1 INTRODUCTION

Lipman Properties Pty Ltd are currently proposing the redevelopment of a section of the Morling College site located at 128 Herring Road, Macquarie Park. This includes the subdivision of the site and construction of a staged development, including the construction of five mixed use (predominately residential) multi-level buildings with associated parking and public domain works.

In liaison with the NSW Department of Planning (DoP) the proponent has been issued with Director Generals Requirements (DGR's). The DGR's provide a preliminary scope for the preparation of an Environmental Assessment to accompany a Part 3A project application to the NSW Minister for Planning. An assessment of the environmental impacts of the proposed project has been specified in the DGR's. Additionally several key issues are identified from the DGR's for the investigation and management of biodiversity on the subject site and study area. In summary these are to:

- address impacts on flora (including trees to be retained) and fauna, including threatened species, populations and Endangered Ecological Communities (EEC) and their habitats and steps taken to mitigate any identified impacts to protect the environment and land in accordance with DECCW *Draft Guidelines for Threatened Species Assessment under Part 3A of the Environmental Planning Act 1979*.(DEC/DPI 2005) and;
- detail actions that will be taken to avoid or mitigate impacts or compensate for unavoidable impacts of the project on threatened species, populations, Endangered Ecological Communities and their habitats. Any proposed offsetting measures should be developed in accordance with the *Principles for the Use of Biodiversity Offsets in NSW* (DECCW 2008) and;
- demonstrate the implementation of measures to protect and rehabilitate the adjoining University Creek and Riparian Corridor in accordance with the *Guidelines for Controlled Activities in Riparian Corridors* (DWE 2008).

This Vegetation Management Plan addresses the key biodiversity issues highlighted above, and provides detail related to the management of vegetation within the Riparian Corridor proposed as part of the development. Together with the Flora and Fauna Assessment, this will be used to inform the overall Environmental Assessment to accompany the Part 3A project application.

1.1 Scope

The VMP applies to the parcel of land known as the subject site and shown in the figures located in Appendix B of this Plan. The scope for the preparation of the VMP has been based on the DWE guidelines for the preparation of VMP's (DWE, 2007).

The VMP has been prepared by qualified bushland and vegetation management consultants (TEC) and the majority of VMP vegetation management measures are to be implemented by a qualified bushland regeneration contractor ('BR Contractor').

1.2 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. More specifically, the objectives of the VMP are to:

- Describe the site, including geology, soil and topography and flora and fauna;

- Describe the proposed works and mitigation areas;
- Map the vegetation communities and weed distribution;
- Provide management prescriptions of threatened flora and fauna;
- Identification of different methods for rehabilitation, native tree management and weed management;
- List appropriate species for use in revegetation in any rehabilitation areas;
- Outline management issues and proposed actions, their timing and parties for pre-construction, construction and post-construction; and
- Outline the initial rehabilitation and revegetation programs and the maintenance and monitoring program.

2 METHODS

2.1 Desktop Research

Prior to field surveys, records of all threatened species, populations and endangered ecological communities (EEC) previously recorded within a 5km radius of the subject site were obtained from the Department of Environment, Climate Change and Water (DECCW) Wildlife Atlas database. An EPBC Act Protected Matters Report was generated using the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Search Tool for a 5km radius of the subject site. The report identifies matters of national environmental significance in the study area including threatened biodiversity and other matters protected by the EPBC Act.

Threatened species, threatened populations, threatened communities, or their habitats, were targeted during the field survey. Recent existing reports of the biodiversity of the study area and locality were also reviewed prior to field surveys and these are briefly summarised in following sections of this report.

2.2 Flora and Fauna

General botanical surveys were conducted on the subject site and adjoining area to the north of the subject site (together termed the 'study area') on 18th December 2009 and 12th January 2010. The results of this survey are presented in the Flora and Fauna Assessment for Lipman Properties Pty Ltd, 128 Herring Rd, Macquarie Park. (Total Earth Care, 2010)

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.

General fauna surveys, involving diurnal and nocturnal techniques, were conducted on the subject site during the afternoon and evenings of 4th and 6th January 2010. . The results of this survey are presented in the Flora and Fauna Assessment for Lipman Properties, 128 Herring Rd, Macquarie Park. (Total Earth Care, 2010)

3 PREVIOUS REPORTS AND STUDIES

3.1 Native Vegetation of the Cumberland Plain

Previous mapping of the native vegetation of the Cumberland Plain (NPWS, 2002) has not identified any of the subject site as representative native overstorey vegetation. The nearest area to the subject site that is

mapped as having native overstorey is approximately 1km north of the subject site in Macquarie University. This is mapped as Turpentine Ironbark Forest and Turpentine Ironbark Margin Forest.

3.2 Urban Bushland in the Ryde LGA

Ryde City Council has undertaken surveys to map the extent and classify the remnant native vegetation of the local government area (Oculus, 2001). The survey involved reference to existing vegetation mapping schemes of the Sydney region and interpretation of aerial images. Some ground truthing was carried out and limited to a few sites focusing on predicted or known areas supporting EECs. The survey identified six native plant communities, three of which are identified as having national and state conservation significance. The report lists the largest and/or most significant bushland reserves in the local government area and this includes an area referred to as Macquarie University Nature Reserve.

The report suggests that the EEC Sydney Turpentine-Ironbark Forest (STIF) was probably the most common native plant community in the Ryde LGA prior to European settlement. The report identifies a small and degraded remnant of STIF at Macquarie University amongst other areas.

3.3 Ryde Flora and Fauna Study 2006

The *Ryde Flora and Fauna Study 2006* (Biosphere Environmental Consultants, 2006) was commissioned by Ryde City Council to identify base-line biodiversity in four key reserves of the LGA. The survey focused on vertebrate and invertebrate fauna and native and exotic plant species assessing both species richness and relative abundance with surveys carried out in autumn and spring.

Although none of the reserves were free of urban impacts the report identified that several bushland reserves in the LGA retained representative native flora and fauna. Several rare and two threatened plant species were located during the survey effort as were threatened ecological communities. One threatened owl and one threatened microchiropteran bat species were detected during the surveys and the report suggests that both species were foraging preferentially along the Lane Cove River corridor (Biosphere Environmental Consultants, 2006).

In assessment of the fauna survey results, the report suggests that terrestrial mammals, large reptiles and frogs have been significantly affected by development in the Ryde LGA. Predation by foxes, dogs and cats and clearing of native vegetation are identified as resulting in the widespread loss of terrestrial mammals and larger reptiles. The significant decline of frog species in the LGA is attributed to substantial loss of foraging and breeding habitat, impacts on water quality and predation by introduced fish species (Biosphere Environmental Consultants, 2006).

The report states that forest and woodland birds are still well represented in the LGA due to the habitat provided by tree canopy including that of surveyed reserves. However due to an absence of mid-storey vegetation cover, the smaller passerines (perching birds) had declined markedly (Biosphere Environmental Consultants, 2006).

The major impacts that are affecting the biodiversity of the LGA are summarised in the report and these include but are not limited to:

- weed invasion;
- contamination of creeks and ground water;
- changes in flow patterns of creeks through storm water control;
- increased erosion of creek banks;
- loss of ephemeral freshwater habitat;
- penetration of bushland by walking tracks, roads and easements;
- feral animals, such as foxes, cats, dogs, rats and mice;
- high density of native, predatory birds;
- night-light pollution from street lights and house lights;

- noise and movement disturbance; and
- edge effects

3.2 Ryde Flora and Fauna Study 2008

In 2008 Ryde City Council commissioned Biosphere Environmental Consultants to produce *The Ryde Flora and Fauna Study 2008* (Biosphere Environmental Consultants, 2008). This study focused more on the flora and fauna species found in the smaller reserves not surveyed in the 2006 study. The study echoed the previous report's findings (Biosphere Environmental Consultants, 2006) and found poorer species diversity in these smaller reserves with increased impacts such as weeds, predatory birds and edge effects. There were little additional management recommendations.

4 LEGISLATION AND POLICY

4.1 Environmental Planning and Assessment Act 1979

As the current project is to be assessed under Part 3A of the EP&A Act, the terms of reference for the environmental assessment have been set out in the Director-General's Requirements (DGRs), including reference to the Draft Guidelines for *Threatened species assessment under Part 3A of the EP&A Act* (DECCW 2005). As such the requirement for any integrated approvals from other authorities is not required, however the information below is included for reference.

The remnant vegetation in the adjacent area is representative of the STIF EEC vegetation assemblage and the potential impacts of the proposal on this community have been assessed in accordance with the guidelines referred to above, and the flora and fauna assessment has included an assessment of significance (7-part test) for the STIF vegetation community of the study area which was completed in accordance with Section 5A of the EP&A Act.

4.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation and protection of threatened species, populations and ecological communities of animals and plants through specific objectives relating to the conservation of biodiversity and promoting ecologically sustainable development. The Schedules of the TSC Act identify endangered or vulnerable species, populations, ecological communities, critically endangered species or ecological communities and key threatening processes affecting the listed species, populations and ecological communities. Provision is made for the preparation of recovery plans for listed threatened species, populations and ecological communities and threat abatement plans to manage key threatening processes.

The TSC Act provides for the declaration and mapping of habitats that are critical to the survival of those identified threatened species, populations and ecological communities that are classified as endangered (critical habitats). Further, the TSC Act also sets out the methods of assessment, management and regulation of actions that may damage critical or other habitat or otherwise significantly affect threatened species, populations and ecological communities.

4.3 Water Management Act 2000 (WMA)

The *Water Management Act 2000* (WMA) controls, amongst other things the carrying out of activities on or near water sources, to limit potential impacts of activities on the terrestrial and aquatic transitional zone. It ensures that approval for controlled works within the riparian zone, defined as 40m from a river, lake or estuary, is obtained and includes conditions to meet the aims and objectives of the Act. The DGRs required reference to the *Guidelines for Controlled Activities – Riparian Corridors* (DWE, 2008), and this sets out the establishment of two riparian corridor zones, and an associated Asset Protection Zone if required, that are used to protect or restore the vegetated riparian zones. These zones outlines in the Guideline are:

- Core Riparian Zone (CRZ) – must be retained or revegetated with native species as a fully structured vegetation community. No infrastructure, stormwater or vehicles are to be located within this zone.

- Vegetative Buffer (VB) – filters surface water runoff, litter, weed intrusion and nutrients from entering CRZ. A vegetative zone should be retained or restored to protect the CRZ, and the final width is based on a merit assessment of site conditions.

- Asset Protection Zone (APZ) – is not a requirement in this case as this site is not mapped as Bush Fire Prone Land.

A Controlled Activity Approval from the DWE under the *Water Management Act 2000* is not required as the project is being assessed under Part 3A of the EP&A Act. The NSW Office of Water provided additional detail regarding the key issues and assessment requirements in a letter to the Department of Planning dated 10 February 2010. They supported the proposed 20m setback from the centreline of the creek, confirmed that University Creek is classified as a Category 3 stream from a strategic perspective, and indicated that a minimum 10m CRZ is required. The current proposal does include the retention and restoration of a CRZ and VB to form the riparian zone associated with University Creek.

5 SITE DESCRIPTION

5.1 General

The subject site is located at Macquarie Park, and will be subdivided from the larger property known as the Morling College Site. A large extent of the subject site lacks vegetation due to existing buildings including houses, a larger multi-storey accommodation block, chapel, day care facility, shed and carports, with associated roads and driveways. The remainder of the site is regularly mown largely exotic grassland, with some remnant canopy trees and planted native and exotic trees. There is a playing field in the north-western part of the mown area. Immediately bounding the chapel, day care facility and dwellings are small cultivated gardens. Along the north-western boundary adjoining the Cochlear development within Macquarie University is a creekline with a more intact assemblage of remnant trees and some naturalised indigenous species (but not remnant from the original vegetation). The understorey of this strip of vegetation along the creekline is largely weedy trees and shrubs.

Current land uses adjacent to the site are urban residential development, passive recreational parkland associated with the Morling College and educational facilities within Macquarie University, and a multi-level development currently being constructed. There is a small but floristically and structurally intact remnant of Sydney Turpentine Ironbark Forest occupying approximately 0.01 of a hectare on Macquarie University's land directly adjacent to the northern tip of the subject site. The approved Concept Plan for the re-development of the university site has identified that this remnant of STIF may be modified and/or removed, however the University Creek riparian corridor will be protected and restored.

5.2 Soils

Two soil landscapes are mapped by Chapman *et al* (1989) in the study area as both Glenorie Soil and Lucas Heights Soil Landscapes. Soils of these landscapes are typically clay loams as is confirmed by ground-truthing of the study site (Total Earth Care, 2010). These soil landscapes have potential moderate to high erodibility (Chapman and Murphy 1989).

There is evidence that some parts of the site have had the parent soils modified. Widespread alteration of natural soil levels has occurred along the central and northern boundary where the soil level has been built up and leveled. Again, around the playing field, there has been leveling of soils. There is a low but distinct batter running parallel to the creekline between the creek and the playing field. This batter contains some large pieces of concrete building rubble. Despite these changes in levels, most of the subject site's surface soil appears to be composed of parent soil representative of the subject site's original soil. With the exception of visible pieces of exposed fill in the aforementioned small area between the creek and the playing field, any filled areas appear to be commensurate with soil sourced from on-site and of the upper

horizons of the subject site's soil profile. The creekline is severely eroded in places due to stormwater runoff.

5.3 Topography

The topography of the study area is relatively flat with a gentle slopes falling in the direction of University Creek. Local relief is approximately between 55m and 65m above sea level (asl). The general locality can be described as broad low hills with gentle slopes draining to the north east towards the Lane Cove River.

5.4 Drainage

The study area and subject site are adjacent to University Creek which is a tributary of Shrimpton's Creek which in turn joins the Lane Cove River, and the creekline crosses through the north of the subject site. Shrimpton's Creek is one of many medium tributaries of the Lane Cove River, located in the Central North of the Sydney Metropolitan region. University Creek is a first order stream, and piped stormwater flows from a small urbanised catchment enter the creekline a small distance upstream of the subject site. An additional stormwater pipe enters the creekline from the Macquairie University site to the west. The creekline would receive high flows during storm events, and stream bed erosion and widening of the channel of University Creek is evident.

5.5 Flora

5.5.1 Plant Species

A total of 76 plant species were recorded within the study area during the flora field survey, including 56 native species and 20 introduced species. There were 18 native species recorded in the subject site that are not indigenous to the area. Of the 20 introduced species, 8 are recorded as noxious, as listed under the *NSW Noxious Weeds Act 1993* for the Ryde City LGA (Table 3). These species were restricted to the Riparian Vegetation.

Two threatened plant species as listed under the TSC Act or EPBC Act were recorded on the subject site or in the study area during the current survey; *Eucalyptus scoparia* Wallangara White Gum, and *Syzygium paniculatum* Magenta Lilly Pilly. Both these species were represented by single specimens and were planted individuals growing outside of their natural ranges or habitats. As such, the management for conservation of these specimens is not appropriate. Indeed, *Syzygium paniculatum* Magenta Lilly Pilly has naturalized along creek lines in the northern part of Sydney and has the potential to disturb the natural genetic integrity of the populations to the north and south of the Sydney Metropolitan area through the 'founder effect' (Botanic Gardens Trust 2007) as well being a weed and shading out natural vegetation. There is a large mature specimen of this species just outside the subject site planted 30m west of the proposed stage 5 building.

5.5.2 Plant Communities

Two plant communities were identified within the study site:

- Cleared and Disturbed Woodland / Grassland; and
- Riparian Vegetation

A third plant community was assessed for the purposes of this report due to its presence within the study area, its connectivity to the subject site and its conservation value:

- Sydney Turpentine Ironbark Forest (STIF) adjoining the site in Macquarie University.

The distribution of plant communities identified in the current survey within the study site is shown in Figure 1, Appendix A.

These three communities are summarised below. For more detail refer to the Total Earth Care Flora and Fauna Report (TEC 2010).

Cleared and Disturbed Woodland / Grassland

The Cleared and Disturbed Woodland / Grassland plant community occurs over the majority of the subject site (Figure 1 Appendix A) in the open parkland, around the dwellings, chapel, day care centre and sheds. The canopy of the Cleared and Disturbed community consists of scattered native and exotic trees throughout the parkland. At the time of assessment, this community is regularly mown with a resultant absence of observed native species and low diversity of weed species.

The Cleared and Disturbed community has a very low resilience and would require significant restoration works to return it to a fully structured native community. The resilience is noted as being higher below the larger remnant tree canopies compared to the more open areas. This slightly higher, but still very low resilience, seems to be a response to lower weed competition in turn influenced by canopies and roots of the remnant trees to those weed species. There is no measurable resilience in the area of the playing field with no native species encountered.

All areas of the property appear to be mown and grazed by rabbits quite heavily - this not only making survey accuracy difficult but also may be giving a false impression of the recoverability (positive or negative) of many of the forb species, which for many STIF species have underground storage parts and dormancy buds. Some seeds, particularly leguminous species, have long term dormancy as underground stored seed. It is relevant to note the effect at several similar sites where mowing of *Pennisetum clandestinum* Kikuyu and *Cynodon dactylon* Couch stopped under remnant and planted trees and recovery of STIF species occurred.

In the Cleared and Disturbed community understory, there was only one qualified naturally occurring shrub representative of the original community – a single specimen of *Acacia stricta* Straight Wattle. The only non-shrub species in the understory that was naturally occurring and representative of the original community was a single specimen of the twining plant *Hardenbergia violacea* Purple Coral Pea.

The ground layer below 50cm tall was composed of 14 species as remnants of the original community, with many represented by only be a few specimens. The average Foliage Protective Cover (FPC) of native species was very low and measured at <5%. It was composed of scattered forb and graminoid species.

Riparian Vegetation

Riparian Vegetation occurs along University Creek near the northwest boundary of the site. The creek flows northeast through this section of the site. It is connected to a small patch of a floristically more diverse remnant of vegetation downstream on the adjoining Macquarie University land (subsection of the area marked as remnant 3 in the EDAW, 2006, mapping) which is discussed below *(STIF adjoining the site in Macquarie University*). STIF is listed as an Endangered Ecological Community (EEC) under Schedule 1 of the *Threatened Species Conservation Act 1995* (TSC Act) and as Critically Endangered under the EPBC Act 1999.

The Riparian Vegetation community, as mapped for the purposes of this report and the Flora and Fauna Assessment (Total Earth Care 2010), is very narrow and is subject to edge effects including weeds and disturbance. It has a low to moderate resilience. Note that the term “Riparian Corridor” referred to below is a management term describing the area required by the DGRs to be protected and rehabilitated as per *The Water Management Act 2000* Guidelines*.* In this instance it incorporates a Core Riparian Zone and a Vegetated Buffer. The Riparian Vegetation community falls within the Riparian corridor.

Sydney Turpentine Ironbark Forest (STIF) adjoining the site in Macquarie University.

Near the Northern corner of the site on Macquarie University land where the Riparian Vegetation zone drains into, is a remnant of STIF occupying approximately 30m x 50m. Although outside the subject site, the area was targeted during field surveys based on the assessments of previous studies (EDAW, 2006) and to assess the potential impacts of the current development to this vegetation. In determining the classification of the community the flora and fauna report (TEC 2010) applied the diagnostic tests described for the community by Tozer (2003).

This plant community has a moderate resilience with the lower stratums regenerating over the majority of the area most likely as a result of stop mow practices. Weed control works have also most likely been carried out in the past however woody and vine weeds are re-establishing.

5.6 Fauna

A total of 21 vertebrate fauna species were identified during previous survey (TEC 2010), including 1 frog species, 13 bird species, 6 mammal species and 1 species of eel. Upon analysis of the Anabat data, a probable recording of *Chalinolobus gouldii* Gould's Wattle Bat was made. *Chalinolobus gouldii* has been noted for its highly adaptive nature and its ability to utilise residential dwellings for roosting sites (Churchill, 1998).

Several *Pteropus poliocephalus* Grey-headed Flying Foxes were observed flying over the site during nocturnal survey. No individuals were observed foraging within the subject site during the current survey. *Pteropus poliocephalus* Grey-Headed Flying-Fox is listed as a Vulnerable species under Part 1 of Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act).

5.7 Fauna Habitat

The subject site supports a variety of habitat resources that may be utilised by common protected or threatened fauna occurring in the locality. The main habitat types occurring in the study area occur within the Riparian Vegetation and Cleared and Disturbed areas.

The study area forms part of a disturbed and fragmented local and regional network of landscapes with STIF values of varying qualities. The riparian area specifically is likewise part of a wider, very fragmented and disjointed network of remnant vegetation leading downstream to Lane Cove National Park.

Overall the subject site is a highly modified landscape that lacks many of the natural habitat features and resources that are important in the maintenance of native fauna diversity and life cycles. In addition to the altered nature of fauna habitats, intense human activities within the subject site and surrounding area, including high levels of night light, noise and vehicle or human traffic, are likely to reduce fauna habitat potential. Relative to the condition of native vegetation on the subject site, limited connectivity to bushland and the absence of many habitat features and resources as described above, the subject site has a low to moderate level of fauna habitat value. For more details refer to *Total Earth Care* (2010).

5.8 Weeds and Resilience

Weed growth recorded within the study area generally comprises:

- opportunistic, annual or perennial species (eg *Sida rhombifolia* Paddy's Lucerne, *Modiola caroliniana* Red Flowered mallow and *Plantago lanceolata*) that have colonised disturbed ground;
- exotic grasses (eg *Pennisetum clandestinum* Kikuyu Grass, *Ehrharta erecta* Panic Veldtgrass, *Stenotaphrum secundatum* Buffalo Grass and *Sporobolus africanus* Parramatta Grass);
- woody weeds (eg *Ligustrum sinense* Small Leaved Privet, *Ligustrum lucidum* Large Leaf Privet and *Genista monspessulana* Montpellier Broom and *Lantana camara* Lantana); and
- climbing weeds (*Ipomoea indica* Morning Glory)

Weed species richness is low - moderate throughout the study area, present in varying densities. Bushland resilience of the native plant communities is variable across the study site. In the Cleared and Disturbed community the bushland resilience is low with resilience in the Riparian community being low-moderate. Bushland resilience in the STIF adjoining the subject site is moderate-high. Bushland resilience and weed densities and described in more detail below. Weed densities are mapped on Figure 3, Appendix A.

Cleared and Disturbed

The Cleared and Disturbed plant community has a low resilience with weed densities estimated at 80% and mapped in the >80% class. The Cleared and Disturbed community has been subject to a high level of disturbance including the substantial loss of native vegetation cover and modification of levels of surface soils from previous land management practices. The Cleared and Disturbed community of the subject site has very little to no potential to naturally recover to a fully structured native plant community. Significant financial and time resources are required to reconstruct a native plant community that replicates the native plant community that would have occurred over this mapping unit.

Riparian Community

The Riparian plant community has a low to moderate bushland resilience and weed densities are estimated at between 60 to 80% with a slight increase in percentage cover along University Creek from the south-western to the north-eastern end. Weed densities correlate to a converse native species percentage cover with a gradation from moderate resilience at the western end of the community to low resilience at the eastern end. Restoration of this native plant community to a fully structured status is possible with the sustained commitment of financial resources over the medium term and on-going maintenance.

Noxious Weeds

Eight noxious weed species listed under the *NSW Noxious Weeds Act 1993* (NW Act) for the Ryde City LGA were recorded in the current survey (Table 1). All noxious weed species present on the site must be either controlled or removed (and disposed of appropriately) by the landowner, according to the requirements of the Act. Additionally Council has prepared LGA specific management plans for several of the noxious weed species listed in Table 1, and these plans state the control measures and methods to be implemented for each species.

Table 1 Plant species recorded within the study site listed under the *NSW Noxious Weeds Act 1993* for Ryde City LGA (Order No.20).

***Control Class*[1]**	**Common name**	***Scientific name***
4	Camphor Laurel	*Cinnamomum camphora*
4	Large Leaf Privet	*Ligustrum lucidum*
4	Small Leaf Privet	*Ligustrum sinense*
4	Asparagus Fern	*Asparagus aethiopicus*
4	Morning Glory	*Ipomoea indica*
4 & 5	Lantana	*Lantana camara*
4	Camphor Laurel	*Cinnamomum camphora*
4	Senna	*Senna pendula var glabrata*

[1] Noxious weed control categories (pursuant to the *NSW Noxious Weeds Act 1993*):

Class 1 State Prohibited Weeds. The plant must be eradicated from the land and the land must be kept free of the plant.

Class 2 Regionally Prohibited Weeds. The plant must be eradicated from the land and the land must be kept free of the plant.

Class 3 Regionally Controlled Weeds. The plant must be fully and continuously suppressed and destroyed.

Class 4 Locally Controlled Weeds. The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

Class 5 Restricted Plants. The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

6 VEGETATION MANAGEMENT MEASURES

The general aim of vegetation management for the proposed residential development will be to create open space that serves the recreational and amenity needs of the community and to retain and enhance adjacent native plant communities. The specific objective for native vegetation will be to protect and enhance the condition of the Riparian vegetation community described in other sections of this document and reconstruct a native plant community similar to that which would have occurred naturally along University Creek. The retention and enhancement of the Riparian community of the study area is the priority and will be met by implementing a program of vegetation management measures that:

- ensure no disturbances occurs to the remnant and regrowth native vegetation of the Riparian community area during construction works on the subject site;
- reconstruction of the riparian zone vegetation within the CRZ and VB areas;
- improve the wildlife habitat values and provide the platform for the long term restoration and net improvement of the native plant communities of the study area;
- ensure that no disturbance occurs to remnant trees that are retained as a result of the development and as part of the mitigation precautions, to assist regeneration of native vegetation growing within the trees' primary root zone.

The program of vegetation management measures will include:

- weed removal and control;
- bush regeneration techniques in the Riparian community;
- erosion control; and
- revegetation.

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

- **Construction Activities** – incorporating the construction of permanent and temporary flood mitigation, stormwater control infrastructure, sediment and erosion control devices;
- **Restoration and Revegetation** - incorporating weed control, bush regeneration techniques, revegetation and erosion control;
- **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 *Bringing Back the Bush to Western Sydney: Best Practice Guidelines for Bush Regeneration on the Cumberland Plain* (DIPNR, 2003) and *Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland.* (DEC, 2005) in the preparation of the strategy and it is recommended that these documents be used for the refinement of this VMP to a scope of works for carrying out on ground works.

6.1 Construction Activities

6.1.1 Overview

The current development proposal will require major earthworks for the construction of the underground parking and road works. Requirements to minimise the impacts on the riparian zones for the life of the development are specified in the DGRs and include the preparation of a Landscape Plan (LP), a Stormwater Concept Plan (SWCP), and an Erosion and Sediment Control Plan (ESCP).

The rehabilitation of the Riparian Corridor vegetation will involve minimum earthworks. The boundaries for the Riparian Corridor and its component Core Riparian Zone and Vegetated Buffer should be established prior to construction. The Riparian Corridor will have two zones as determined under the *Guidelines for Controlled Activities in Riparian Corridors* (DWE 2008) (Figure 2, Appendix A):

- **Core Riparian Zone (CRZ)** - this is the land found within and adjacent to the watercourse and will be 10 metres wide from the top of the creek bank on either side of the creek. Reconstruction of this zone will be through naturally assisted regeneration (bush regeneration) and revegetation. No construction or infrastructure shall be carried out in the CRZ, including paths, drainage services, fencing etc.
- **Vegetated Buffer (VB)** - this is the land found on either side of the CRZ and will protect the CRZ from weed invasion and other environmental impacts. It is to be up to 10 metres wide but may vary slightly on merit issues such as the available space within the lot, proximity of the proposed development building line and the resilience of the area within the VB. No roads or infrastructure should occur in the VB, however a shared pedestrian/bicycle path and a bio-swale are proposed. Suggested materials for the construction of the low-impact path include asphalt with a hardwood timber edge, or crushed sandstone.

6.1.2 Vegetation Management Measures

Erosion and Sediment Control

As would be part of a comprehensive ESCP, site inductions for all construction personnel are to identify environmental impact control measures, procedures and constraints. General site inductions must include specific reference to work activity constraints for the Riparian Corridor. General site inductions must also include presentation of an image or example of the signage to be installed that defines the Riparian Corridor. It is recommended that a Riparian Zone induction be developed in the ESCP for any earthworks or construction works to be carried out in this zone and which identifies site environmental constraints.

Earthworks should not commence until any sediment and erosion controls have been installed as per the ESCP. At a minimum sediment and erosion controls are to be maintained throughout the duration of construction. Sediment and erosion controls are to remain in place until the construction footprint and other disturbed areas are sufficiently stabilised with vegetation cover before decommissioning.

Earthworks

Clearing and grubbing should include the disposal of all non-locally indigenous vegetation prior to levelling earthworks. Any 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 NW Act (1993) or LGA specific management plans.

As far as practicable trees scheduled for removal are to be retained on site for chipping or mulching. Any seed that can be collected from trees scheduled for removal is to be used for propagation for site specific plantings. Excess seed is to be stored by a nursery or recognised seed bank for use in on-going revegetation of the site.

A Tree Protection Zone (TPZ) is to be established for any native trees that are to be retained but which may be affected by earthworks. Distances for TPZ for trees will preferably be a minimum distance of five times the tree diameter measured at 1.4 m (Diameter at Breast height, DBH) above ground level raised to the next 0.5m. Additionally excavation must not disturb the main feeder roots of any retained native trees. Any batters adjacent to native trees must be at low angles to ensure slope stability and reduce the potential for tree root damage. TPZ's are to be determined by a qualified and experienced arborist, defined by temporary exclusion fencing and installed prior to the commencement of earthworks or construction works. TPZ's are to be maintained for the duration of earthworks and construction.

All Construction Activities

No vehicles, machinery, heavy plant, site sheds, stockpiling or materials storage are to use any area mapped as Riparian Zone (Core Riparian Zone or Vegetated Buffer) (Figure 2) and this includes access/egress or parking. Parking of vehicles and machinery or heavy plant or stockpiling and materials storage is to be restricted to areas mapped as Cleared and Disturbed (Figure 1) and outside any TPZs.

6.2 Weed Control and Revegetation

6.2.1 Overview

The current proposal for the site incorporates the restoration of the Riparian Community and broader Riparian Corridor to a Riparian STIF community representative of that which would have originally occurred at this site. This restoration, through assisted regeneration and revegetation, aims to enhance existing habitat of the EEC in both quality and area as per the *Principles for the use of Biodiversity Offsets in NSW* (DECCW 2008). The implementation of a restoration project for the Riparian Corridor will require noxious weed control, bush regeneration, revegetation (using appropriate native plant species) and erosion control and this will be consistent with the aims and objectives described above for vegetation management of the site. Several of the guiding principles for the following information have been drawn from *Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland.* (DEC, 2005a).

All proposed construction development occurs within the Cleared or Disturbed community. This vegetation community, while showing some elements of the Endangered Ecological Community STIF, exhibits poor overall structural and floristic quality with a very sparse tree cover, negligible midstorey and understory, and poor ground layer (Total Earth Care, 2010). The total area of the Cleared and Disturbed community, including built areas, occupies approximately 1.3 ha with 23 remnant tress in this community, giving a remnant tree cover of approximately 18 trees per hectare.

Although endangered ecological plant communities are identified in the current survey in the study area the subject site does not support any native plant community apart from the Riparian Community. The implementation of a restoration project will focus on the Riparian Corridor to protect remnant vegetation, create a habitat corridor for both fauna and flora, provide bank stabilisation and compliment adjoining STIF. Works outside the Riparian Corridor will be governed by the landscape plan along with relevant recommendations of this VMP.

6.2.2 Project Planning

Weed Control and Revegetation Project Planning

Adequate funding for the implementation of restoration and revegetation project is critical for its success along with timely planning and carrying out of activities such as seed collection. One of the key points of the DGRs requires that the Riparian Corridor is rehabilitated. This document, along with the *Principles for Biodiversity Offsets in NSW* (DECCW 2008), requires a net improvement of biodiversity values over time. 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 within the riparian corridor. It is noted here that a minimum two year maintenance period from the date of final plantings is commonly specified for the operation of a VMP in the conditions accompanying the issue of a Controlled Activity permit. In accordance with the *Principles for the Use of Biodiversity Offsets in NSW* (DECCW 2008), any compensatory actions for unavoidable impacts of the project on threatened species and EECs and their habitats must be enduring and result in a net improvement of biodiversity over time. As such, ongoing vegetation management on this site must be enduring, including weed eradication, erosion control, mitigation against vegetation clearance and the removal of dead wood, dead trees and loss of hollow bearing trees and any other relevant or future Key Threatening Processes as defined in the *Threatened Species Conservation Act, 1995.*

A long term management plan is recommended to maintain the riparian vegetation community and landscaped areas as part of the future operation of the development, after the completion of the maintenance period associated with this VMP.

6.2.3 Vegetation Management Measures

Weed control and revegetation is recommended and will generally be confined to the area mapped as Riparian Corridor within the subject site (Figure 2). Weed control works may be extended into areas within the Cleared and Disturbed community not impacted on by the development footprint, particularly areas underneath retained trees. Weed control works will aim to treat noxious weeds and woody weeds

throughout the subject site and control herbaceous weeds around plantings. Revegetation works described by this VMP will be concentrated in the Riparian Corridor (Figure 2) and aim to establish all layers of native vegetation to enhance the corridor values and habitat potential of the subject site and adjacent site's plant communities.

Site Establishment and Preparation

Once a contract has been awarded to a Bush Regeneration (BR) contractor the site establishment and preparation works will involve:

- project initiation meeting between the Construction Contractor, Bush Regeneration Contractor (BR Contractor) or suitably qualified individual(s) and Vegetation Management Consultant to ensure coordination of site activities;
- General and Site specific inductions for BR Contractor staff and VMP monitoring 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.
- advise the DECCW of the person responsible for any seed or vegetative propagation prior to the commencement of the plant propagation. As this area is an EEC under the TSC Act, a permit to collect propagules form this EEC should be sought from DECCW as part of a *Scientific Licence for the Purpose of Science, Education or Conservation (Section 132 C of the National Parks and Wildlife Act 1974).* Likewise any plant listed as a Protected Plant (*Schedule 13 of the National Parks and Wildlife Act 1974*) should be collected under licence.
- Because much of the VMP proposal determines work to occur in an EEC, a permit for any revegetation and BR works may be required as part of a *Scientific Licence for the Purpose of Science, Education or Conservation (Section 132 C of the National Parks and Wildlife Act 1974).*
- addressing occupational health and safety (OH&S) issues, including preparation of a site hazard assessments and safe work method statements.

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.

Standard Bush Regeneration techniques are provided in Appendix C.

Restoration and Regeneration Project Area Establishment

Riparian Corridor
As described in Section 6.1 above the boundaries of Riparian Corridor will have been established prior to commencement of restoration and revegetation works. A physical barrier should be erected, such as temporary exclusion fencing during the construction period that is replaced by a permanent fence or bollard system on completion of the development to prevent access and inadvertent damage to the Riparian Corridor. This should be placed at its landward extent in all locations and must not form part of the Riparian Corridor. Any constructed path must not impede water flow and be constructed so as to not increase water runoff into the Riparian Corridor and be chemically stable so as not to influence soil nutrient levels. A suitable path may be of use as a physical barrier to creeping plants such as turf grasses outside the Riparian Corridor impacting this zone.

Lost Biodiversity Offset
The loss, due to the proposed development, of remnant trees and their rhizospheres will be compensated for by the planting of native trees in an assemblage that replicates Sydney Turpentine Iron Bark Forest. The deep soil planting areas that have been described in the TURF Design Tree Management Drawing L5 attached will be revegetated as described in the Addendum "Offset Strategy" of this report.

In summary of this strategy 805m^2 of ground growing beneath native remnant trees is proposed to be destroyed. These trees will be felled and their parts relocated as nesting hollows and habitat logs or mulch and the soil beneath them will be translocated to 1510m^2 of the site to assist in recreating native soil profiles. These areas will be planted out with 45 super advanced native trees, 1,100 shrubs and 4000 native groundcovers and vine species. The areas will be mulched and maintained and the process will be monitored to prove that over time the program has successfully "maintained and improved" upon the existing biodiversity values of the site.

Noxious Weed Control

Weeds that are listed as 'noxious' for Ryde City 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.

Earthworks within the Riparian Corridor

The soil within the Vegetated Buffer may require treatment such as soil scalping or shallow ripping to a depth of 20 cm prior to planting as an aid in the control of Kikuyu and to help the establishment of plantings. Any machinery should be outside the area where natural regeneration of the vegetation community is proposed.

Primary Weeding

Primary weeding is the first round of weeding activity and involves the removal of most of the weed biomass present, incorporating:

- 'cut-and-paint', 'frill and fill', long stem scrape or target spraying of woody weeds (eg *Genista monspessulana* Montpellier Broom, *Ligustrum sinense* Small leaved Privet, *Ligustrum lucidum* Large leaved Privet, *Senna pendula var glabrata S*enna, and *Lantana camara* Lantana);
- hand-removal and spot spraying of smaller woody herbaceous weeds (eg. *Sida rhombifolia* Paddy's Lucerne, and *Conyza canadensis* Canadian Fleabane);
- spot-spraying and hand-weeding of exotic grasses (eg. *Pennisetum clandestinum* Kikuyu and *Sporobolus africanus* Parramatta Grass).
- 'scrape, paint and dig' of twining weeds (eg. *Ipomoea indica* Morning Glory)
- Crown removal of non-suckering rosettes (eg. *Asparagus aethiopicus* Asparagus Fern)

Previous land uses has resulted in the disturbed nature of the vegetation in the Riparian Corridor. Exotic grasses are to remain on the steeper banks and main channels of the Riparian Zone to maintain soil and slope stability. Weeding of the banks will focus on woody, perennial and herbaceous annuals (other than grasses) and use a combination of hand-weeding and spot spraying.

Revegetation Preparation Weeding and Secondary Weeding

Primary weeding in preparation for revegetation works will require broad spraying with non selective herbicide carried out during late Autumn to early Spring.

One month after initial broad spraying (primary weeding) the revegetation areas are resprayed. Secondary weeding of the steeper banks and main channels of the Riparian community is also to occur and follow the same methodology as described above for primary weeding. 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. However secondary weeding is to be carried out within a minimum of three months from completion of primary weeding of the banks and channels of the Riparian Zone.

Secondary weeding is to continue until the date of final plantings in the Riparian Corridor and this is likely only to require a minor amount of spot spraying or hand-weeding.

Maintenance Weeding

Maintenance weeding will be required to ensure that weed growth following noxious and woody weed control and revegetation works is controlled. Maintenance weeding will be carried out 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. Follow up spot spraying targeting woody weed regrowth is required throughout the whole subject site including open space and revegetation areas. Spot spraying is required around individual plantings throughout the revegetation area to control herbaceous weed regrowth.

The strategy for woody weed control carried out in the native plant communities will be to focus on areas of highest resilience first and create buffers between native plant communities and exotic plant communities.

Open Space Maintenance

Areas mapped as Cleared and Disturbed which are cleared of noxious and woody weeds are to be incorporated as part of open space management and maintenance, post construction. Revegetation areas will also be maintained in part as open space. The Flora and Fauna Assessment (Total Earth Care 2010) identified within the Cleared and Disturbed community the greatest STIF understory species diversity below the protective cover of the remnant trees, particularly *Syncarpia glomulifera* Turpentine and *Eucalyptus pilularis* Blackbutt. Where possible, as part of the Landscape Plan, remnant tress retained post construction should have the local indigenous remnant species that are extant below them regenerated to form a higher quality representation of the remnant STIF. Currently, much of this resilience is stifled by regular mowing and rabbit grazing and as such resilience assessment of these areas is difficult and may be underestimated.

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 or in the study area must be in accordance with labelling instructions, MSDS's and comply with the NSW *Pesticides Act 1999*.

Revegetation Strategy

Revegetation of the subject site with the aim to reconstruct a fully structured native plant community would require significant and sustained resources over a period of time that well exceeds the operation period of this VMP. The Blue Mountains Urban Runoff Control Program (BMURCP, 2003) states that an ecological restoration project, such as a primary bush regeneration project, can take up to 10 years to complete. Accordingly, in some cases it is better not to start such projects unless there is guaranteed funding for at least five years. 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 a fully structured native plant community in the Riparian Community through reconstruction and assisted regeneration;
- improve the wildlife habitat values and provide the platform for the long term restoration of the native plant community in the Riparian Corridor; and
- establish a landscaped environment outside the Riparian Corridor that provides some ecological function and maintains an open space aesthetic.

Riparian revegetation works are to be carried out in the area identified in Figure 2, namely the CRZ and VB. Reconstruction of a native plant community is defined by DEC (2005a) as 'active intervention to facilitate the restoration of an ecosystem. It generally involves the reintroduction/augmentation of plant species to a site in a process known as revegetation.' Recommended species are listed in Appendix C and this has been compiled from locally indigenous species recorded in the current survey of the study area (Total Earth Care, 2010) and diagnostic species listed in the Final Determination for STIF (NSW Scientific Committee, 1998). 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 either once the riparian zone has been excluded from the construction area or post construction, and should not commence until woody weeds are under control in the revegetation area and it is stabilised as maintained open space. Ideally revegetation works commence no later than six months after 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. Supply and installation of plants will be 'forestry tubes', or smaller tubes or cells for grass species. Enough lead time needs to given to plant suppliers to harvest propagules, propagate and grow on tubestock.

For the Riparian Corridor a planting scheme is to be developed in the preparation of a scope of works for the restoration and revegetation project that;

- improves vegetative connectivity between individual trees;
- creates a mosaic of habitat through clumping of groundcover, shrub and canopy species in the discrete planting areas in the Riparian Corridor
- reduces the potential for erosion;
- is consistent with the floristics of Sydney Turpentine Ironbark Forest;
- uses locally and commonly occurring aquatic and semi-aquatic plant species in the creekline of the Riparian Corridor;

The revegetation area proposed in this VMP is located through the western end of the subject site and shown in Figure 2, along the University Creek and extending out to the limits of the Riparian Corridor. Appendix B contains a list of recommended planting species for the Riparian zones.

Seed Collection and Cuttings

Production of plant stock will be, as far as possible, from seed or cuttings collected on-site or from nearby remnant bushland. The DEC (2005a) suggests that the use of site-adapted local seed for propagation is best for restoring pre-existing plant communities and conserving local biodiversity. Additionally local provenance seed is more likely to lead to a successful self-perpetuating plant community, as the seed and propagated plants are adapted to local soils, climatic conditions and ecological processes. The DEC (2005a) recommend that the collection of seed of Angophora, Casuarina and Eucalyptus species in Cumberland Plain native plant communities for revegetation projects seed should be done locally but can extend to nearby remnants that were formerly contiguous. Due to the heavily fragmented nature of STIF remnants in the locality, seed sources for STIF species may not be from formerly contiguous remnant vegetation. To maintain genetic integrity of seed sources, reliance purely on provenance as a determining factor on seed source must be avoided and minimising the number of propagated specimens from individual parent plants must be enforced, to guard against extrapolating any potential reduced genetic integrity from

selecting only local provenace seeds. As a guideline, commonly a maximum of 20 seeds are propagated from common species with a presumed wide genetic footprint, and fewer for rare or restricted species.

The BR Contractor (or appointed nursery sub-contractor) will possess the necessary licence for seed collection issued by DECCW under the *National Parks & Wildlife Act 1974* and will obtain permission from Councils for collection activities within any Council reserves (if necessary).

The BR Contractor or contracting nursery will commence seed and cutting collection from native plants within the site or nearby remnant bushland at least twelve months prior to the scheduled commencement of revegetation works. Approvals should be sought to collect seed from STIF on the adjoining Macquarie University Site, and from Council Reserves of STIF in the local area.

Some seed should be retained for propagation of replacement plantings during the maintenance period. Seed collection and propagation should be carried out in accordance to the Florabank Guidelines (CSIRO/Greening Australia, 2000)

Planting Densities

Planting densities are based on consideration of the aim of the revegetation for the subject site, namely ecological restoration. Planting of tree and shrub species must not be less than 1 tree or 1 shrub per square metre, alternately planted in approximately equal numbers, and in addition, groundcover plants at 4 per square metre, as per DWE (2007). The actual distribution of groundcover, shrub and tree species across the Riparian Corridor will be determined by some of the considerations in dot point from the *Revegetation* chapter above, specifically creating a mosaic of habitats and higher densities in areas of potential erosion.

Species Diversity of Plantings

The required mix of species is based on the area of the site to be revegetated and the number of species in the assemblage of the vegetation community to be emulated. STIF has a characteristic assemblage of 1 trees, 18 shrubs and 36 groundcovers. Using the guidelines for estimating species diversity in DWE (2007),the area to be revegetated has an area of approximately 2,000 square metres and so will need 50% of thetrees, 50% of the shrubs and 50% of the groundcovers. That is, 7 tree species , 9 shrub species and 18 groundcover species need to be planted.

Plant Installation

Installation of trees, shrubs, grasses and vines will be as per bush regeneration industry standards. As specified in sections above planting works are to be carried post construction and should not commence until woody weeds are under control in the revegetation area and it is stabilised as maintained open space. 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.

Prior to planting works, spray application of herbicide is required in preparation at each planting location in the VB. The VB may need to be shallow ripped to a depth of 200mm and have some organic material incorporated. Plants are to be installed once herbicide spray preparation has taken substantial effect. Each installed plant is to be bagged and the entire planting area is to be mulched to a depth of 100mm. Mulch is to be sterile, weed and contaminant free and not to be from material that is freshly mulched. Preferably mulch should be from native sources. Supplementary mulching is to be carried out for the duration of the maintenance period to maintain a mulch depth of 75mm.

Planting Maintenance

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 bags 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 maintenance period to suppress weed regrowth around the plantings.

As a general rule it is expected that there will be a maximum loss of 20% of the original planting numbers for an individual species. Replacement plantings are required to maintain the original planting numbers at a minimum of 80% survivorship for each species. Replacement planting is to be carried out throughout the maintenance period to sustain the 80% of original number specification at the end of the maintenance period. A maximum 5% weed cover for the total Riparian Corridor must be achieved by the end of the maintenance period.

Losses of greater than 20% or having unacceptable weed issues will have the maintenance period extended until survival rates and weed control have been achieved.

Maintenance replanting is to replace plants by the same species, or where that species is not available, with the same growth form (i.e. a shrub with a shrub etc). This must not decrease species diversity and any new species must be from STIF and of local provenance.

Feral Animal Control

The implementation of a rabbit control program must be considered in the planning of the restoration and revegetation project. A successful long term rabbit control program for the site will require incorporation of a site specific control program into an existing or proposed local or regional program. The landowner or project manager will need to coordinate and liaise with other government authorities such as Ryde City Council, the Rural Lands Protection Board, NSW Agriculture, DECCW, Macquarie University and adjacent private landholders. Any feral animal control on the subject site is to be carried out by a suitably qualified and experienced contractor or employee of a government local control authority.

6.3 Monitoring

A program of monitoring and inspection will be carried out either by a qualified vegetation management consultant (or qualified botanist). Monitoring of the weeding and revegetation works is required to ensure the measures outlined in this VMP are implemented and that performance criteria are satisfied. The monitoring programme will commence at the establishment of weed control works and continue for the duration of the maintenance period.

The monitoring programme will involve;

- 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 through monitoring techniques such as weed density mapping;
- identification and assessment of any natural regeneration of native plant species;
- estimates of the success rate of plantings and assessment of plant replacement requirements;
- evidence of erosion and sedimentation; and
- recommendations for corrective measures and/or vegetation management.

A weed density map has been prepared (Figure 3), and this will be updated at commencement of the restoration and revegetation project and then 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.

6.4 Roles, Responsibilities and Timing

The roles and responsibilities of all project staff of relevance to the VMP are listed in Table 3. Lipman Properties will be primarily responsible for the implementation of this VMP, and should 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 has complied with the requirements of this VMP. Where a consultant is engaged they will report to Lipman on the progress of the project and advise of any rectification where the vegetation management measures are not achieving the aims or specification of this VMP.

Table 3 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 Corridor restoration and revegetation project, compliance with development consent conditions, liaison with stakeholders and consent authorities and OH&S.
Construction Contractor(s)	▪ Install and maintain exclusion fencing along Riparian Corridor and around TPZ's during construction works. ▪ Install all erosion and sedimentation controls during construction works leading to the Riparian Corridor. Maintain any erosion and sedimentation controls in the Riparian Zones relating to construction works in the Riparian Zone for the duration of the restoration and revegetation project.
BR Contractor /suitably qualified individual(s)	▪ Vegetation management within Riparian Corridor. ▪ Implementation of VMP actions. ▪ Weed control, seed collection, planting, erosion control (only for works directly related to the restoration and revegetation project) and maintenance of plantings and mulch.
Commercial or community plant nursery	▪ Collection of local provenance native plant seed and cuttings. ▪ Supply of local provenance native plant stock.
Pest Species Contractor	▪ Rabbit control in coordination with adjoining landowners and government authorities.
Vegetation Management Consultant (or qualified botanist)	▪ Monitoring and provision of advice of for restoration and revegetation project in Riparian Corridor ▪ Ensuring compliance with VMP. ▪ Certification that restoration and revegetation works have met the assessment criteria at completion of the maintenance project.
Consent Authority (or representative)	▪ 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 maintenance project.

Timing

The vegetation management contracts (weed control, revegetation and bush regeneration and monitoring) will extend for approximately 30 months (2 years and six months), allowing six months for site preparation and a further 24 months for maintenance commencing from the date of final plantings. Table 4 details the vegetation management actions to be carried out for the site and identifies responsibilities, performance criteria and timing for each recommended action. Table 4 lists the general order in which the vegetation management actions should occur. A project staging timeline for the overall development is provided in Appendix D. This timeline will influence the implementation of the vegetation management plan measures, however the actions should be conducted in line with the table below.

Table 4 Vegetation Management Actions for 128 Herring Rd, Macquarie Park

Action	Responsibility	Performance Criteria	Timing
Issue of Tender and selection of contractors for Weed Control and Revegetation contract and VMP Monitoring contract	Applicant	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 start and completion, dependencies and milestones.	BR Contractor and Vegetation Management Consultant	Submit Gantt charts or similar showing start and finish times of major tasks and milestones	Prior to commencement of construction and vegetation management contracts.
Definition and agreement of expected outcomes for Riparian Corridor 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 DoP, DECCW)	VMP actions roles and responsibilities clearly identified and defined	Prior to commencement of any construction works in Riparian Corridor
Native seed and cuttings collection for propagation	BR Contractor or Nursery Contractor	Collect native plants and cuttings from site or locality of recommended species (Appendix C, Table 2)	Commencing twelve months prior to revegetation works.
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	Prior to commencement of all works

Table 4 cont' Vegetation Management Actions for 128 Herring Rd, Macquarie Park

Action	Responsibility	Performance Criteria	Timing
Install temporary exclusion, Riparian Corridor vegetation management areas and 'no go zones'.	Construction Contractor	Temporary exclusion fencing installed and maintained according to VMP boundary maps.	Prior to any construction and throughout construction as required
Identify native plant communities in the study area and specify them as 'no go zones' for construction contractors.	Vegetation Management Consultant, Construction Contractor.	VMP areas and objectives clearly defined and no encroachments into native plant communities during construction.	Prior to commencement of construction
Install and maintain sediment and erosion control devices directly related to restoration and revegetation works	Construction Contractor	Sediment control fences and devices installed and maintained according to ESCP and SWCP	Prior to commencement of construction and throughout construction as required
Primary weed control	BR Contractor	Noxious, environmental and woody weeds fully suppressed throughout the subject site	Prior to commencement revegetation works
Collection of seed from felled trees.	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
Rabbit control program	Pest species contractor	Eradication or significant reduction of rabbit population at the site	Prior to revegetation works and for the duration of restoration and revegetation project as required

Table 4 cont' Vegetation Management Actions for 128 Herring Rd, Macquarie Park

Action	Responsibility	Performance Criteria	Timing
Large infestations of noxious and woody weeds left in situ after control to be slashed/mulched to the ground	BR Contractor or subcontracting slashing/mulching contractor	No standing noxious or woody weed biomass remaining in subject site	Once standing noxious and woody biomass is substantially controlled with little to nil live stems
Revegetation preparation weeding	BR Contractor	Revegetation area to be sprayed shows complete dieback of established non-native species in response to herbicide application.	Approximately six months after the completion of construction and once standing biomass of noxious and woody weeds is cleared
Revegetation secondary weeding	BR Contractor	Revegetation area to be sprayed shows complete dieback of established non-native species in response to herbicide application.	One month after revegetation preparation weeding
Certify plant stock is of local provenance	Council or Vegetation Management Consultant.	Certification forwarded by BR Contractor.	Prior to planting.
Planting of revegetation area	BR Contractor	Revegetation to follow the recommendations of this VMP Plant tubestock of STIF species. Species and densities as per Appendix C, table 2. Only certified local provenance plant stock to be installed.	Once herbaceous weeds are suppressed at planting locations

Table 4 cont' Vegetation Management Actions for 128 Herring Rd, Macquarie Park

Action	Responsibility	Performance Criteria	Timing
Certify planting densities	Vegetation Management Consultant.	Densities as specified in this VMP.	One week after date of final planting.
Install mulch (to facilitate weed control and moisture retention) and bag plantings.	BR Contractor/suitably qualified individual(s)	Mulch spread in revegetation areas to a depth of 100mm	As required.
Planting maintenance	BR Contractor.	Minimum 80% original quantity of plant stock maintained No dead plant stock left in ground. Adequate mulch maintained at plant locations to suppress weed regrowth	Minimum four times per year, for two years from date of final plantings
Maintenance weeding	BR Contractor.	Regrowth of weeds controlled throughout subject site	Minimum four times per year, for two years from date of final plantings
Monitor plantings to ensure a minimum 80% of original quantity of plantings are maintained. Monitoring for adequate mulch levels. Monitoring of noxious and woody weed regrowth throughout subject site.	Vegetation Management Consultant.	80% success rate for tubestock plantings one year from date of final plantings. Certification forwarded to consent authority if required. Top of mulch to maintain a depth of 75mm. where mulching has been carried out. Not more than 5% weed cover in VMP planting areas.	Quarterly for two years from date of final plantings.

Table 4 cont' Vegetation Management Actions for 128 Herring Rd, Macquarie Park

Action	Responsibility	Performance Criteria	Timing
Update project timelines.	BR Contractor/suitably qualified individual(s)	Updated Gantt charts submitted to Vegetation Management Consultant and Construction Project Manager	As required
Certify plant stock has been maintained at minimum 80% of original quantity of plantings.	Consent Authority (if required) and Vegetation Management Consultant.	80% success rate for tubestock plantings four years from date of final plantings. Certification forwarded to Consent Authority.	Two years from date of final planting.
Site inspections.	Consent Authority (if required) Vegetation Management Consultant.	Inspection checklist completed.	At Site Establishment, then quarterly for duration of contract.
Final Inspection of Works.	Consent Authority (if required) and Vegetation Management Consultant.	Final Inspection carried out at completion of maintenance period.	Four years from date of final planting.

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Appendix A

Maps and Figures

Vegetation Management Plan

Lipman Properties Pty Ltd

Proposed Residential Development
128 Herring Road Macquarie Park

Title: **Vegetation Communities & Threatened Species**

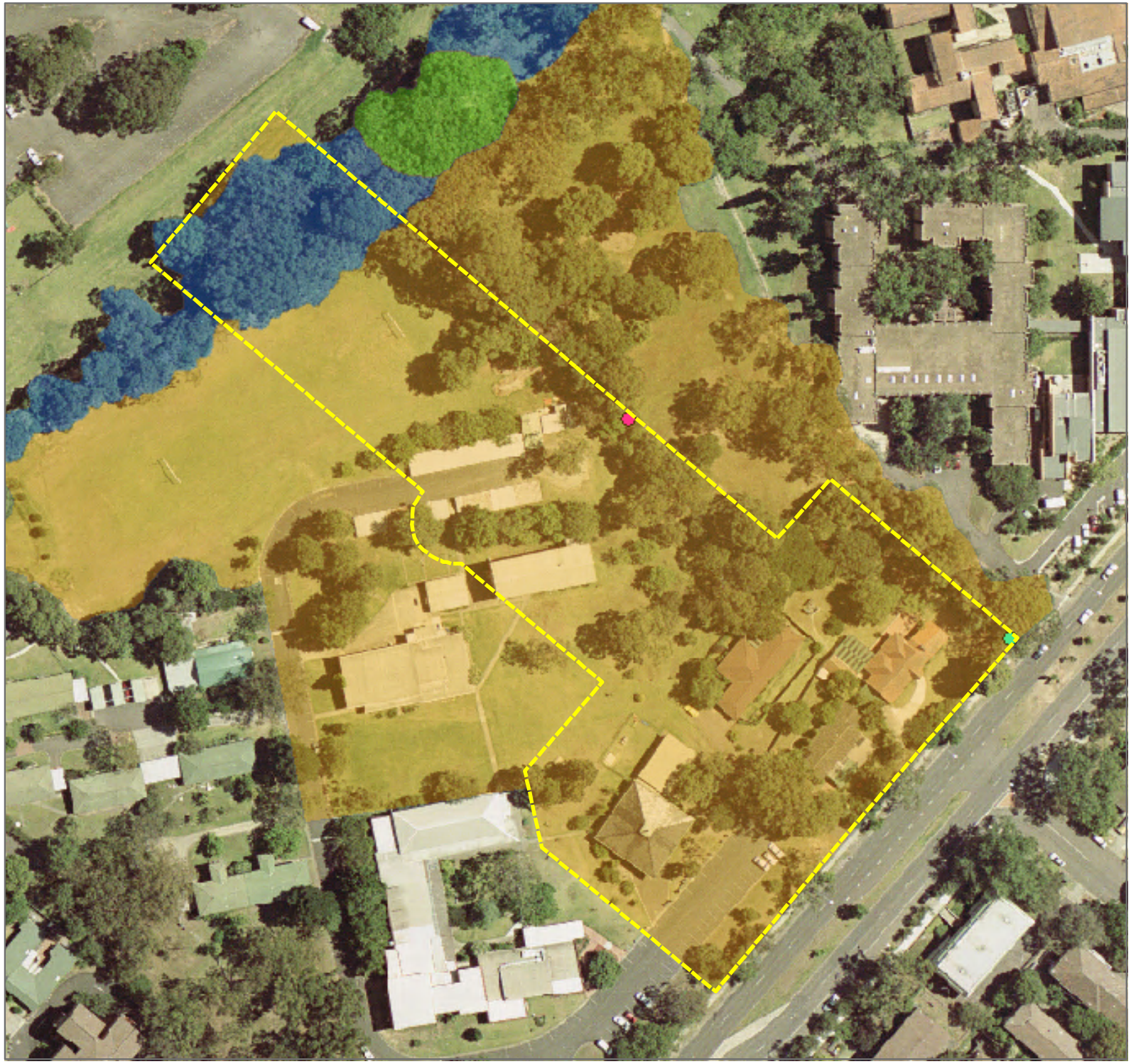
Site: 128 Herring Rd
Macquarie Park

Client: Lipman

Date: February 2010

Project No: C1771-LPM

Author: L Laurie, L Worthington



Subject Site (approximate)

Vegetation Communities

- Sydney Turpentine Ironbark Forest
- Cleared and Disturbed Woodland/Grassland
- Riparian Vegetation

Threatened Species

Species

- Eucalyptus scoparia
- Syzygium paniculatum

0 10 20 40 Meters

Data Source:
Total Earth Care

total earth care

Tel: 02 9913 1432 Fax: 02 9913 1434

Title: **Riparian Zones**
Figure 2

Site: 128 Herring Rd
Macquarie Park

Client: Lipman

Date: February 2010

Project No: C1771-LPM

Author: L Laurie, L Worthington

Legend

Subject Site (approximate)

Riparian Corridors

Core Riparian Zone

Vegetation Buffer

Metres
0 5 10 20

Data Source:

Total Earth Care
Turf Designs

total earth care

Tel: 02 9913 1432 Fax: 02 9913 1434

Title: **Weed Density (% Biomass)**

Figure: 3

Site: 128 Herring Rd
Macquarie Park

Client: Lipman

Date: February 2010

Project No: C1771-LPM

Author: L Laurie, L Worthington

Subject Site (approximate)

Weed Density

60-80%

>80%

0 10 20 40 Meters

Data Source:
Total Earth Care

Tel: 02 9913 1432 Fax: 02 9913 1434

total earth care

Appendix B

Recommended planting species for Riparian Corridor

Vegetation Management Plan

Lipman Properties Pty Ltd

Proposed Residential Development
128 Herring Road Macquarie Park

Table 2 Recommended Planting Species for Revegetation of Riparian Corridor, 128 Herring Rd, Macquarie Park

Scientific Name	Common Name
Trees	
Acacia decurrens	Sydney Green Wattle
Acacia parramattensis	Parramatta Green wattle
Allocasuarina torulosa	Forest Sheoak
Angophora costata	Sydney Red Gum
Angophora floruibunda	Rough Barked Apple
Corymbia gummifera	Red Bloodwood
Eucalyptus globoidea	White Stringybark
Eucalyptus paniculata	Grey Ironbark
Eucalyptus resinifera	Red Mahogany
Pittosporum undulatum	Sweet Pittosporum
Syncarpia glomulifera	Turpentine
Shrubs	
Acacia falcata	Sickle Wattle
Acacia implexa	Hickory Wattle
Acacia longifolia	Sydney Golden Wattle
Acacia mrytifolia	Myrtle Wattle
Acacia stricta	Straight Wattle
Breynia oblongifolia	Breynia
Bursaria spinosa	Blackthorn
Clerodendron tomentosum	Hairy Clerodendron
Dodonaea triquetra	Hop Bush
Eleocarpus reticulatus	Blueberry Ash
Indigofera australis	Native Indigo
Kunzea ambigua	Tick Bush
Leucopogon juniperinus	Beard heath
Notolaea longifolia	Native Olive
Ozothamnus diosmifolius	Paper Everlasting
Pittosporum revolutum	Rough Fruit Pittosporum
Platylobium formosum ssp. parviflorum	Handsome Flat Pea
Polyscias sambucifolius	Native Elderberry
Zieria smithii	Sandfly Zieria

Table 2 cont' Recommended Plant Species for Revegetation of Riparian Corridor, 128 Herring Rd, Macquarie Park

Scientific Name	Common Name
Groundcovers (Grasses, Herbs, Scramblers & Vines)	
Aristida vagans	Three awned Spear Grass
Billardiera scandens	Apple Dumplings
Centella asiatica	Centella
Clematis aristata	Old Man's Beard
Clematis glycinoides	Old Man's Beard
Commelina cyanea	Scurvy Weed
Dianella caerulea	Flax Lily
Dichelachne rara	Plume Grass
Dichondra repens	Kidney Weed
Echinopogon caespitosus	Hedgehog Grass
Entolasia marginata	Broad Panic
Entolasia stricta	Straight Panic
Glycine clandestina	Love Creeper
Goodenia heterophylla	Variable Leaved Goodenia
Hardenbergia violacea	Native Sarsparilla
Imperata cylindrica	Bladey Grass
Kennedia rubicunda	Dusky Coral Pea
Lepidosperma laterale	Sword Sedge
Lomandra longifolia	Mat Rush
Microlaena stipoides	Weeping Rice Grass
Oplismenus aemulus	Basket Grass
Pandorea pandorana	Bower of Beauty
Panicum simile	Two-colour Panic
Poa affinis	Tussock Grass
Pratia purpurascens	White Root
Pseuderanthemum variabile	Pastel Flower
Rubus parvifolius	Native Raspberry
Smilax glyciphylla	Sarsparilla
Stipa pubescens	Tall Speargrass
Themeda australis	Kangaroo Grass
Tylophora barbata	Milk Vine

Veronica plebeia	Native Hebe
Aquatic and Semi-Aquatic	
Gahnia aspera	Sword Grass
Juncus usitatus	Common Rush
Paspalum dischitum	Native Couch
Persicaria lapathifolium	Knotweed

Appendix C

Bush Regeneration General Methodologies

Vegetation Management Plan

Lipman Properties Pty Ltd

Proposed Residential Development
128 Herring Road Macquarie Park

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.

Appendix D

Project timing

Vegetation Management Plan

Lipman Properties Pty Ltd

Proposed Residential Development
128 Herring Road Macquarie Park

Project Phase	Dates *as per key milestones in Design Brief and subject to possible changes*
PHASE 1	
Lodgement of **draft** Environmental Assessment (draft EA) Package for Part 3A Submission to DoP– Draft Concept Plan and Project Applications	05/03/2010
Lodgement of amended Environmental Assessment (EA) and reports	30/04/2010
Lodgement of Preferred Project Report (PPR) Concept / Project Applications to DoP	20/08/2010
Anticipated Department of Planning Approval of Concept Plan + Project Applications	15/11/2010
SUBDIVISION	
Subdivision –Stage 1 Construction Documentation for 3 Lot Subdivision (create Lot1, Residual Development Site and College Site)	Nov 2010 - Jan 2011
Subdivision –Stage 1A Construction Documentation for Subdivision Lot 1 (Create Stratum Lots 10,11 and Roadlot 12) & Construct Road	April 2011 – June 2011
Subdivision –Stage 2 Construction Documentation for Subdivision Residual Development Lot (create Lots 20,21,22 and Roadlot 23) & Construct Road	March 2012 – June 2012
BUILDING A	
PHASE 3A Construction Certificate Documentation Building A on Lot1	August 2011 - Oct 2011
PHASE 4A Construction Documentation for Building A , Lot 1	Oct 2011 – March 2012
PHASE 5A Construction of Building A , Lot 1	Around 16 month Nov 2011 – March 2013
BUILDING B	
PHASE 2B Development Application Documentation for Building B, Lot 2	July 2011 –Nov 2011
PHASE 3B Construction Certificate Documentation Building B on Lot 2	June 2012 – Sep 2012
PHASE 4B	Sep 2012 - Dec 2012

Construction Documentation for Building B , Lot 2	
PHASE 5B Construction of Building B , Lot 2	Around 16 month Sep 2012- Dec 2013
BUILDING C	
PHASE 2C Development Application for Building C, Lot 3	March 2012 - July 2012
PHASE 3C Construction Certificate Documentation Building C, Lot 3	March 2013 – July 2013
PHASE 4C Construction Documentation for Building C , Lot 3	July 2013 - Oct 2013
PHASE 5C Construction of Building C , Lot 3	Around 16 month July 2013 - Oct 2014
BUILDING D	
PHASE 2D Development Application for Building D, Lot 4	Feb 2013 – June 2013
PHASE 3D Construction Certificate Documentation Building D, Lot 4	March 2014 –June 2014
PHASE 4D Construction Documentation for Building D , Lot 4	June 2014 – October 2014
PHASE 5D Construction of Building D , Lot 4	Around 16 month July 2014 –Oct 2015
BUILDING E	
PHASE 2E Development Application for Building E, Lot 3	Feb 2014 – June 2014
PHASE 3E Construction Certificate Documentation Building E, Lot 3	March 2015 – June 2015
PHASE 4E Construction Documentation for Building E , Lot 3	June 2015 – Sep 2015
PHASE 5E Construction of Building E , Lot 3	Around 16 month July 2015 –Oct 2016

LPPL (Lipman Properties Pty Ltd) reserves the right to modify the program.

Addendum 1

Offset Strategy

Vegetation Management Plan

Lipman Properties Pty Ltd

Proposed Residential Development
128 Herring Road Macquarie Park

Offset Strategy

Overview

Floral surveys conducted by TEC (December 2009, January 2010) and ACA (September 2010) and the soil analysis undertaken by Dr Pam Hazelton (August 2010) therein were submitted as supporting documents for Major Project Development Application MP09-0195, MP09-0217, and MP09-0218 at 120-128 Herring Rd Macquarie Park. These reports have established that the remnant native plants on site do not provide enough evidence of the existence of an Endangered Ecological Community as described by the Scientific Committee of NPWS. However the aerial photography (1930, 1943, 1951, 1970, 1986), included in the ACA report does prove the existence of trees that were remnant of a native plant assemblage and as such the flora surveys have been used as a basis to construct this offset strategy to replace the remnant biodiversity that will be lost as the result of the proposed development. The offset strategy has been included as an addendum to the revised Total Earth Care Vegetation Management Plan September 2010.

Soil Disturbance

The degree of soil disturbance and its impact on the native soil seed bank must be considered in assessing the biodiversity value of the remnant trees that are proposed for removal. Three distinct soil disturbance histories are present on site.

Creek banks

The banks of University creek have been substantially cleared of vegetation and have been disturbed by intermittent filling, excavation and inversion of the soil profiles. The seed bearing organic horizon has been substantially disturbed and the likelihood of any, as yet unrecorded species, of native seedling recruitment from the seed bank is low. The regrowth of unrecorded species of native plants that predominantly reproduce from vegetative propagules is even lower. Nearly all native species that have been recorded for the subject site have been recorded from within 5 metres of the centre line of the creek. This area is extremely depauperate of local native plant species but remains the best remnant on site upon which to base the parameters of a biodiversity offset revegetation program should be based.

Oval

Past filling of the land upslope of the immediate creek banks with material of unknown origin and to a depth of at least a metre, evidenced by the soil profile visible along the creek and the northern boundary, precludes the existence of a native plant community in this area. Several *Syncarpia glomulifera* have been filled around to a substantial depth, and these are the only remnant native trees found within the oval area that are proposed for removal.

Hillslope

The soils in the remainder of the site have been extensively disturbed and the original soil profiles have been either filled over, truncated or inverted. There are virtually no native species present as seedlings of the shrub or forb layer and outlying remnant trees are the only plants that are remnants of the original community. The organic soil horizon in between and beneath these isolated trees is very thin and has no mulch layer. The hillslope is unlikely to have been burned and has been subjected to a mowing regime for several decades. It is very unlikely that any native recruitment apart from a very narrow selection of native grasses might be recruited beneath the remnant trees and even less chance of recruitment in areas without native tree canopy.

Baseline Biodiversity Values

The scattered remnant trees that have been proposed for removal are growing on the Hillslope and as such are in an area depauperate of biodiversity value. The spatial arrangement, perching opportunities, tree hollows, biomass, and the organic horizon in the soil beneath the trees have been taken as the descriptors of the biodiversity. The non-native trees and planted gardens also contribute to the biodiversity on site and these too have been proposed for removal however they have not been included in the calculation of the proposed losses for they have replaced and excluded native species. The revegetation plan certainly aims to provide vastly improved habitat than what these non-native plants currently constitute. The biodiversity offset strategy aims to demonstrate that these biodiversity parameters (spatial arrangement, perching opportunities, tree hollows, biomass, organic soil horizon) have been; considered, replaced and improved upon over time.

The Floristic Composition of the Remnant Community

Historical aerial photography included in the ACA report clearly proves that scattered remnant native trees are currently growing on the upper slopes of the site and a more continuous grouping of trees is remnant along University creek. This offset strategy relates to the trees that are proposed for removal on the oval and the upper slopes of the site.

Two Ecological Communities (SSTF or STIF) were discussed in the Flora reports TEC (March 2010) and ACA (September 2010) as potentially existing on or near the site. These two communities were considered as a basis for a revegetation program and a comparative analysis of the Floristics of the two is undertaken below. The DECCW comments on the major projects application states that some tree species are **"component"** species of STIF. Component species is a term that has been interpreted as meaning that the species may occur within but may not be a characteristic species of an Ecological Community.

Sydney Sandstone Transition Forest (SSTF)

16 characteristic species or 15% of all the characteristic species listed in the determination for SSTF were found on or immediately adjacent to the Development Site. 10 species or 9% were recorded in the Development Site and 14 species (13%) were found in the adjoining land to the north.

SSTF "**component"** species growing on site include 8 species represented by 36 trees, i.e. 1-6, 11, 15, 16, 28, 30, 32, 35-41, 47, 53, 58, 59, 70, 77 & 79-83. Only one Component species was not characteristic, i.e. Eucalyptus racemosa tree # 28.

Sydney Turpentine Ironbark Forest (STIF)

27 characteristic species or 38% of all the characteristic species listed in the determination for STIF were found on or immediately adjacent to the Development site. 20 species or 28% were found in the Morling Property and 24 species or 34% were found in the adjoining Macquarie University remnant. TEC had determined the adjacent remnant to be STIF.

It is clear that from the past surveys of the Ryde LGA, and Macquarie University that Sydney Turpentine Ironbark Forest (STIF) is the endangered ecological community that was most likely to occur within close proximity to the site and given that **36** STIF "**component" (DECCW Comments)** trees 1-6, 11, 15, 16, 28, 30, 32, 35-41, 47, 53, 58, 59, 70, 77 & 79-83 are growing within the site. it is clear that there is a close correlation with the floristics between STIF and the remnant on site.

Characteristic trees on site include **22** trees of 4 species 2, 4, 10, 11, 15, 16, 25, 32, 35-41, 47, 58, 59, 70, 77, 82 & 83 are growing within the site.

The floristics are undoubtedly more alike to the STIF characteristic species in the Scientific Committee determination and the Tozer (TEC Flora and Fauna report March 2010) positive fidelity class species and are less representative of SSTF.

In brief:

The biodiversity losses that result from the proposed actions are minimal and the bio-diversity offsets detailed below and in the "TURF Design Tree Management Plan L5" are well in excess of what is required to meet the DECCW Offset guidelines. They provide a substantial biodiversity conservation benefit and are appropriate regardless of the Ecological Community found on site.

OFFSET EVALUATION - DECCW 2008 Principles for the use of biodiversity offsets in NSW.

In applying the biodiversity offset guidelines below it can be demonstrated that:

1: Impacts must be avoided first by using prevention and mitigation measures.

The development has been planned so that:

- The core remnant of the community, along the creek, will remain undisturbed by the proposal.
- The Master Plan for the site has avoided development in areas where moderate to higher quality native remnants exist.
- The isolated very low condition tree remnants alone are proposed for removal and reuse on site as replacement fauna habitat to mitigate the tree loss.
- The loss of these isolated trees and the corresponding biodiversity offset for them is the subject of this offset evaluation.
- A Construction Environmental Management Plan will govern the safe keeping of the remnant ecological community on site and in the adjacent property. The same plan will safe guard the creek and will be updated to accommodate any unforeseen ecological considerations that relate to the remnants.

Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

2: All regulatory requirements must be met.

- The development site includes Office of Water controlled land adjacent to University Creek. The creek beds, banks, core riparian and outer vegetated buffer zones will be rehabilitated in accordance with a plan that is compliant with and approved as a controlled activity.
- The development related offset areas will be established within the development site additionally to the Office of Water Controlled land.

Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

3: Offsets must never reward ongoing poor performance.

- The proposed development area and the offset areas on site will be governed during and post construction by a Construction and Environmental Management Plan, this Vegetation Management Plan and the appended Landscape Plan TURF September 2010. These plans will ensure that all approved target outcomes are clearly defined, achieveable, and that all hold points are met.

- These approved plans will ensure that the quality of the offset is clearly established, maintained and monitored so that the value of the offset cannot be manipulated to the advantage of the landholder in a manner that is contrary to the intention of the offset agreement.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

4: Offsets will complement other government programs.

- This is not deemed to be relevant to the circumstances unless the conservation and management of the riparian Office of Water controlled land on site is considered to be complementary.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.

5: Offsets must be underpinned by sound ecological principles.

Offsets must:

- include the consideration of structure, function and compositional elements of biodiversity, including threatened species
    - The Flora and Fauna report and the VMP provide ample description of the structure and compositional elements of the biodiversity of the Ecological Community.
    - The function of the elements of the biodiversity are considered at length in the VMP and make direct reference to them.
    - The mature trees that are proposed to be removed influence the edaphic and hydrological and biotic environment around them. These interrelationships can only be replicated by the growth of a tree of the same species, similar age and size, growing in soil with the same or better structure. Subsequently all trees that are planted to replace the trees lost must be:
        - planted at a density that exceeds the current density by a factor of two when they are mature which will require at nearly a 3/1 replacement ratio.
        - grown only in deep soil (i.e. have unimpeded depth to parent material) that is either undisturbed in it's basic stratigraphy, or
        - grown in soil sourced from on site in which case the soil from the Rhizosphere of the trees that are to be removed will be excavated and reused for the growth of these replacement trees, if the construction program creates impractical conditions for the direct translocation of the soil from the donor to recipient sites then the soil shall be relocated immediately into the riparian area and used to remediate a damaged soil profile or stockpiled and reused when the planting bed becomes available.
            - The Duffy's forest soil translocation protocols (NPWS TSU) will be used as a guide for the translocation measures.
            - The stockpiles must be managed in a manner that maintains the viability of soil flora and fauna; i.e. they are not to be treated as they were abiotic minerals.
        - grown in soil that has been ameliorated in a manner that ensures that the soil replicates the stratigraphy of a natural soil derived from the Mittagong Formation. The Douglas and Partners bore logs are to be used as a reference for this.

- planted into soil that has been be handled in a manner and in moisture conditions that do not compromise it's structure.
- cultured/maintained in adherence with and reference to a monitored maintenance program that dictates watering, pest management, mulching and fertiliser needs.
    - A full complement of floristic structural elements of STIF will also be planted and nurtured to maturity at densities that will provide for a fully structured plant community.
    - All plants must be grown from seed/propagules collected from within the provenance 5km radius and in the case of the trees will be of the same species that have been removed.

- enhance biodiversity at a range of scales.
    - The measures undertaken above will ensure that the floristic biodiversity of the trees (being removed) and their accompanying biota is significantly enhanced.
    - The main boughs of the trees that have been removed will be relocated and reinstalled in the offset zones, in an augered hole, as standing totems with nest boxes affixed. The nest boxes will be built from limbs of the same trees that have been hollowed and will be a mix of: sizes, entry hole dimensions and orientations that will provide refuge for microbats, avifauna and arboreal mammals.
    - The remaining tree limbs will be mulched and installed as a 100mm deep layer and will be allowed to lie fallow for 3 months prior to plant installation to ensure that nitrogen draw is not experienced by plantings and to ensure that bio-turbation soil particle sorting, Mychorrizal fungi and soil fauna have had time to re-establish prior to plants being installed.
- consider the conservation status of ecological communities
    - Although an exact determination of the community on site has not been determined the conservation status of the remnant community is considered to have the equivalent value of the two communities of which it is assumed to be an intergrade. The conservation status of both communities have concurrently been considered and the management actions would have been exactly the same regardless of which community it might have been described as. The conservation outcome of these management actions are of the highest possible order.
- ensure the long-term viability and functionality of biodiversity.
    - The management actions will result in the salvage of every possible biotic element that can feasibly be incorporated into the offset management strategy.
    - The VMP actions that relate to the riparian area will be greatly enhanced by the installation of contiguous bushland corridors that surround the building.
    - The islands of native bushland that will be created within the isolated garden beds within the properties hard space will provide refugia for animals and genetic passage ways for plants to spread outward from the core bushland in the riparian zone and will provide and improved ecological benefit to the isolated remnant trees that are providing this same function.
    - The bio-swale that is proposed along the southern side of Building D has been designed so that it imitates the cross section and stability of a natural creek.
    - Large sandstone boulders will be installed as bed control structures and drop structures that imitate stable creekline formations. The creek will have no artificial materials used in its construction but instead will be filled with graded sandstone gravel and sand particles and iron stone pisoliths in keeping with the geology of the Mittagong parent material. The large rocks will be arranged to create deep sand beds through which low-flow nutrient rich waters will infiltrate and remove sediment and pollutants creating clean water habitat for burrowing frogs, eels and native fish down stream. Minimal rock will be installed on the banks and bilateral water flow will be encouraged to enter the creek through sub-surface seams.

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

6: Offsets should aim to result in a net improvement in biodiversity over time.

- The site is currently depauperate of native flora and fauna and can only benefit by the offsets proposed above.
- The tree planting density far exceeds the current density of trees on site and will far exceed the number of trees required to replace the trees that are proposed to be removed.
- The offsets will be maintained under the amended Vegetation Management Plan TEC September 2010 that extends until the trees that are proposed to be planted and the ecological community that is to be reconstructed has reached at least five years of age. It is presumed that by this time all plants will be capable of reproduction and the trees will have reached a height that affords them further protection under the Ryde Tree preservation Order as well as the TSC Act.
- The riparian area remnant is protected by the Vegetation Management Plan.
- The uncertainties and risks associated with the failure of revegetation projects will be further reduced by ensuring that the contractor engaged to complete the program has 5 years demonstrable experience in soil translocation and creek line construction works and that all key staff are qualified and experienced bush regenerators.
- The bio-swale and the location of the offsets will provide substantial links between extant community components.
- The offsets will further buffer the core habitat in the riparian zones that are protected under the Water Management Act.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.

7: Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.

- The Vegetation Management Plan should be included as a controlled document in the operational plan for the building and should be revised at five year intervals or as legislation requires.
- Contracts to undertake the management actions arising from the VMP should be novated if the property changes hands to maintain continuity of care for the bushland. This legal mechanism and the conditions of consent for the development provide ample legal assurance that the offset agreement is honoured.

- The period of the impact is the time required to grow tree biomass and habitat elements that replace those that have been removed. The approximate size of the trees should be used as a determining factor in establishing when this impact has been resolved.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

8: Offsets should be agreed prior to the impact occurring.

- The scale, nature and intent of the Offset strategy being proposed would be included in and thereby constitute an in-principle agreement that would be validated and become legally binding under the development approval. Any unresolved details such as programming, holdpoints, monitoring, ecological inductions etc could be conditions of consent that are resolved during the construction period. Any such details should not confound the commencement of the construction program. The site is species depauperate and has very little biodiversity to lose and much to gain from the revegetation program. There are no ecological risks associated with time lags.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

9: Offsets must be quantifiable - the impacts and benefits must be reliably estimated.

- The impact of the proposed tree removal and the minimal loss of biota associated with each trees biosphere being translocated will be reliably estimated as the loss of the trees biomass. i.e. the volume of timber and soil that is transported and the volume of timber and soil that is established in the deep soil beds, or
- Still photographic points will be used to monitor the biomass of the trees to be removed and can provide evidence that the growth of an equivalent amount of biomass of the same species with similar relative location to each other has been grown.
- The number of trees that are proposed for removal is known and the replanting of just under three times that number of trees can be quantified.
- The area that tree canopies cover and the area the critical root zone occupies (which ever is larger) will be estimated and replicated.
- The number and size of hollows that the trees contain can be estimated and twice as many hollows can be installed to replace them.
- The overall structure and the relative location of the trees has been described and mapped and maximal distances between existing isolated trees will be measured, reduced and thereby improved upon.
- Aerial photography and the tree survey will be used to delineate the cover abundance of the trees.
- An invertebrate species survey will be used as an indicator of the relative health of the existing and future tree rhizosphere.

- Periodic surveying and/or incidental sightings of flora using the offset areas should be compared with the Fauna surveys records made to date.
- Daily work records of bush regeneration contractors should be collated and included in an annual monitoring report.
- Ecological/floristic monitoring using the Duffy's Forest EEC Soil Translocation Monitoring protocols developed by Mr Mark Walters will provide an empirical assessment of the community structure and the condition of habitat.
- A survey of litter depth, fallen timber frequency and surface rock will be undertaken and more than equivalent amount of each will be installed in all Offset areas.
- The conservation status of the adjacent ecological community and the two non local native species Scheduled under the TSC Act 1995 have been established and considered in the assessments of significance.
- The management actions are detailed above in the VMP and the reference documents cited above.
- The level of security afforded to the offset site was established in point 7 above.
- The recent surveys completed for the Development Application provide the best available data relating to the biota on site and these will be used along with additional surveys that will be completed prior to the biodiversity loss occurring.
- The offset areas will be prepared so that they are connected with larger and more structurally diverse land units that have greater conservation significance.
- It has been clearly demonstrated that the management actions will reap greater benefits for biodiversity than leaving the isolated trees to be mown beneath and compacted by foot and machine traffic.
- The majority of the offset areas will create continuous bushland however some offset areas are more distal and are separated by car parks and roads however all of the currently isolated trees are more distant from each other than the matrix of plantings in the offset proposal and so will provide a far better conservation outcome than the current distribution of the remnant trees.
- The development is not secured however the life span of the development is many decades long and the conservation benefits that this period will afford the biodiversity of the region is substantial.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- *the area of impact*
- *the types of ecological communities and habitat/species affected*
- *connectivity with other areas of habitat/corridors*
- *the condition of habitat*
- *the conservation status and/or scarcity/rarity of ecological communities*
- *management actions*
- *level of security afforded to the offset site.*

The best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- *they protect land with high conservation significance*
- *management actions have greater benefits for biodiversity*
- *the offset areas are not isolated or fragmented*
- *the management for biodiversity is in perpetuity (e.g. secured through a conservation* agreement).

Management actions must be deliverable and enforceable.

10: Offsets must be targeted.

- The number of trees proposed for removal is 17 and the number of proposed replacement trees is 50.
- The number of shrubs proposed is 1,303.
- The number of vines and ground covers proposed is 5,412.
- The total area within the rhizosphere/drip line of these trees is 805m^2 the proposed offset areas total 1,353m^2. Please refer to the Turf Design Tree Management Plan L5.
- The type of ecological community that is proposed to be reconstructed is as similar as can be determined from the recent investigations regarding its components.

They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

11: Offsets must be located appropriately.

- The offsets are located in the same site upon which the impact will occur.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

12: Offsets must be supplementary.

- The offsets are not already funded by another scheme, nor does the area receive any incentive funds nor is the offset area an existing protected area nor is it managed by a Government agency nor is it public open space.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.

13: Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

- The offsets and the management actions that relate to them will be included in an approved development proposal and/or development consent conditions if they are accepted as appropriate by the consent authority.
- The development approval would require that all required actions were programmed, constituted hold points and were audited to ensure their completion.
- Ecological monitoring and adaptive management must be undertaken as described earlier to demonstrate and ensure that positive bio-diversity outcomes were achieved.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.