



**Vegetation Management Plan
Crookwell II Wind farm**

November 2018

Vegetation Management Plan Crookwell II Wind farm

**Report for Crookwell
Development Pty Ltd.**

November 2018

Newcastle

Suite 8, 27 Annie Street, Wickham NSW 2293
Phone: (02) 4911 4040
Email: newcastle@biosis.com.au

Ballarat:

1/22 Skipton Street, Ballarat VIC 3350
Phone: (03) 5304 4250 Fax: (03) 9646 9242
Email: ballarat@biosis.com.au

Albury:

593a Macauley Street, Albury NSW 2640
Phone: (02) 6069 9200
Email: albury@biosis.com.au

Melbourne:

38 Bertie Street, Port Melbourne VIC 3207
Ph: (03) 9646 9499 Fax: (03) 9646 9242
email: melbourne@biosis.com.au

Sydney:

14/17-27 Power Ave, Alexandria NSW 2015
Ph: (02) 9101 8700 Fax: (02) 9646 9242
email: sydney@biosis.com.au

Wollongong:

8 Tate Street, Wollongong NSW 2500
Ph: (02) 4229 5222 Fax: (02) 4229 5500
email: Wollongong@biosis.com.au

**Gary Leonard
Josephine Dessmann
Alejandro Barreto**

Project no. 28994

ACKNOWLEDGMENTS

Biosis Pty. Ltd. wishes to acknowledge the contribution of the following people and organisations in the preparation of this document:

Shaq Mohajerani (Union Fenosa Wind Australia)

Robert Suansri (GIS Officer, Biosis Research)

Charlie Prell (Gundowringa)

David Prell (Ahgunyah)

Tim Smith (DWE, Queanbeyan)

Sydney CMA; Goulburn office

Hawkesbury – Nepean CMA – Goulburn office

CONTENTS

ACKNOWLEDGMENTS	III
1.0 INTRODUCTION	6
1.1 VMP Aims	6
2.0 RELEVANT LEGISLATIVE FRAMEWORK	8
2.1 <i>Biosecurity Act 2015</i>	8
2.2 <i>Pesticides Act 1999</i>	8
2.3 Pesticide Permits and Registration	9
2.4 Biodiversity Conservation Act 2016 (BC Act)	9
2.5 Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth)	10
2.6 Water Management Act 2000.....	10
3.0 SITE DESCRIPTION	12
3.1.1 Location	12
3.1.2 Land Use History	12
3.1.3 Soils and Geomorphology	13
3.1.4 Existing Vegetation	13
3.1.5 Priority Weeds	14
4.0 MANAGEMENT AREAS	16
4.1 Area 1 – Stony Creek Crossing, ‘Gundowringa’	16
4.2 Area 2 – Cable Crossing of Wollondilly River, ‘Gundowringa’	16
4.3 Area 3 – First Creek Crossing, ‘Ahgunyah’	16
4.4 Area 4 – Middle Creek Crossing, ‘Ahgunyah’	16
5.0 VEGETATION MANAGEMENT MEASURES	17
5.1 Weed Management Planning.....	17
5.1.1 Weed Species.....	18
5.2 Bush Regeneration Planning	18
5.2.1 Bush Regeneration	18
5.3 Revegetation Planning.....	19
5.3.1 Species Collection and Propagation	19
5.3.2 Revegetation	19
5.3.3 Direct Seeding.....	20
6.0 SCOPE OF WORKS	21
6.1 Area 1- Stony Creek Crossing ‘Gundowringa’; Area 2 – cable crossing of Wollondilly River, ‘Gundowringa’; Area 3 - First Creek Crossing; Area 4 – Middle creek Crossing ‘Ahgunyah’	22
6.2 Additional Site and Vegetation Maintenance Requirements	23
6.2.1 Soil Testing.....	23
6.2.2 Planting Scheme.....	24
6.2.3 Fencing	25
6.2.4 Outlet structures.....	25
6.2.5 Irrigation.....	27
6.2.6 Plant Replacements.....	27
6.2.7 Erosion and Sediment Control Measures.....	28
7.0 MONITORING, REPORTING AND PERFORMANCE EVALUATION PROGRAM	29
REFERENCES	32
FIGURES	33
PLATES	37
BIOSIS PTY. LTD.	

APPENDICES	40
APPENDIX 1	41
FLORA RESULTS	41
APPENDIX 2	47
MONITORING REPORT TEMPLATE	47

Tables

Table 1: Priority weed within the site	14
Table 2: Estimated number of tubestock plants required	26
Table 3: Performance indicators, targets and responsibilities.....	30

Figures

Figure 1. The locality.....	34
Figure 2. Vegetation type	35
Figure 3. Revegetation areas.....	36

Plates

Plate 1: Creek tributary on the ‘Ahgunyah’ property.....	38
Plate 2: Creek tributary on the ‘Ahgunyah’ property. <i>Eucalyptus dives</i> growing on bank.....	38
Plate 3: Exotic riparian vegetation – Wollondilly River on the ‘Gundowringa’ property	39
Plate 4: Stony Creek on the ‘Gundowringa’ property.....	39

1.0 INTRODUCTION

Biosis Pty. Ltd. was commissioned by Shaq Mohajerani, on behalf of Crookwell Development Pty Ltd to prepare a Vegetation Management Plan (VMP) for the revegetation and weed management of several sections of creekline and creek banks adjacent to crossing points on ‘Gundowringa’ and ‘Ahgunyah’, to the south of Crookwell. This VMP is required as a component of approval conditions for the development of Crookwell II Wind Farm.

This VMP is based on information collected during site visits by Biosis Research on 5 and 6 May 2009 and a review of relevant literature including:

- *How to prepare a Vegetation Management Plan Guideline* (NSW Government Dept. of Water and Energy, 2007)
- *Recovering Bushland on the Cumberland Plain: Best Practice Guidelines for the Management and Restoration of Bushland* (DEC 2005)
- State of the Environment report 2004 Upper Lachlan Riparian Condition and Ecological Communities
- *Soil and Land Assessment for Native Vegetation Rehabilitation, Technical Guidelines*, published by the NSW Government, Department of Natural Resources (DNR 2006).

1.1 VMP Aims

The aims of the VMP are to provide:

- guiding documentation toward revegetation and weed management in compliance with the relevant legislative framework (see Section 1.2)
- a rationale for the management actions recommended in the VMP
- management strategies for the regeneration and revegetation of native vegetation
- the protection and stabilisation of soils from erosion and sedimentation
- a working document for practical implementation by an appropriately qualified bush regeneration contractor
- an ecologically sustainable outcome for the site through the provision of reconstructed native flora and fauna habitats.

Revegetation of the site will seek to replicate original plant communities in order

to maintain ecosystem health (corridor and habitat).

2.0 RELEVANT LEGISLATIVE FRAMEWORK

Legislation that is relevant to the implementation of this VMP includes (but is not limited to) the following;

2.1 *Biosecurity Act 2015*

The *Biosecurity Act 2015* outlines biosecurity risks and impacts, which in relation to the current assessment includes those risks and impacts associated with weeds. A biosecurity risk is defined as the risk of a biosecurity impact occurring, which for weeds includes the introduction, presence, spread or increase of a pest into or within the State or any part of the State. A pest plant that has the potential to out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight and / or harm or reduce biodiversity.

Under the Biosecurity Act a priority weed is any weed identified in a local strategic plan, for a region that includes that land or area, as a weed that is or should be prevented, managed, controlled or eradicated in the region. A local strategic plan here refers to a local strategic plan approved by the Minister under Division 2 of Part 4 of the *Local Land Services Act 2013*.

The Biosecurity Act also introduces the General Biosecurity Duty, which states:

All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Priority Weeds are discussed further in Section 3.1.5.

2.2 *Pesticides Act 1999*

The *Pesticides Act 1999* regulates and provides for the control and use of pesticides. Relevant objectives of this legislation include the protection of human health and the environment, property. There are different requirements under the Pesticides Act for the use of registered pesticides and unregistered pesticides. Under this legislation the following controls may apply (EDO 2008):

- unregistered pesticides cannot be used except with a permit
- registered pesticides must only be kept in containers bearing an approved label and must be used in accordance with the instructions on the label

- all pesticide users needs to meet certain public health and environmental standards in order to avoid harm

It is recognised that the application of pesticides (specifically herbicides) may be required during implementation of this VMP. The use of pesticides should follow the requirements of the Pesticides Act. Records will be kept of any use of pesticides on the project.

2.3 Pesticide Permits and Registration

Before agricultural and veterinary chemical products can be sold, supplied, distributed or used in Australia, they must be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) in Canberra (APVMA 2008). The registration process is governed by Commonwealth legislation including (but not limited to) the *Agricultural and Veterinary Chemical Code Act 1994* and associated amendments.

Under this legislation, agricultural chemical products include substances used to:

- destroy, stupefy, repel, inhibit the feeding of, or prevent pests on plants or other things
- destroy a plant or to modify its physiology
- modify the effect of another agricultural chemical product
- attract a pest for the purpose of destroying it

This encompasses all herbicides, insecticides and fungicides (APVMA 2008). The used of herbicides during the implementation of this WMP will require registration permits which can be obtained online from the APVMA website - <http://www.apvma.gov.au/index.asp>. Weed control must only be undertaken with herbicides registered for treatment of each specific weed, and in accordance with manufacturer's directions.

2.4 Biodiversity Conservation Act 2016 (BC Act)

The BC Act is the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and communities, key threatening processes (KTPs) and critical habitat for threatened species, populations and communities. Impacts to threatened species, populations and communities are assessed under Section 1.7 of the *Environmental Planning and Assessment Act 1979* and Section 7.3 of the BC Act.

Under the BC Act, restoration works will require a license where:

- seed collection of threatened species activities are to be carried out
- where bush regeneration activities are within or in close proximity to an Endangered or Threatened Ecological Community (TEC) (DEC 2005). It should be noted that no TECs exist within or adjacent to the study area.

Three Key Threatening Processes (KTPs) as listed under Schedule 4 of the BC Act are also relevant to the implementation of this VMP. These include:

- *Clearing of native vegetation* – no clearing of native vegetation is proposed at any of the four crossing points.
- *Invasion of native plant communities by exotic perennial grasses* – exotic perennial grasses including *Phalaris* spp., *Sporobolus africanus* and *Nasella trichotoma* are present within the study area. Soil disturbance and the importation of topsoils and organic materials (e.g. including tubestock) have the potential to introduce weed grass species. Management actions specified in this VMP include measures to control and suppress exotic perennial grasses.
- *Infection of native plants by *Phytophthora cinnamomi** – soil disturbance and the importation of topsoils or infected propagules has the potential to introduce or spread *P. cinnamomi*. Management actions specified in this VMP include measures to prevent the introduction of *P. cinnamomi*.

2.5 Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth)

Impacts on nationally listed threatened species and ecological communities, as well as internationally listed migratory bird species are considered by URS (2004) and Biosis Research (2009). The conclusions in these reports indicate that revegetation work at four crossing points will not cause a significant impact on a matter of national environmental significance.

2.6 Water Management Act 2000

The object of this Act is to manage the State's water for present and future generations. The Act is based on the principles of ecologically sustainable development and is concerned with the protection of the health of rivers, groundwater systems and associated wetlands. Under this Act, there are

Guidelines for Controlled Activities in the following areas which are relevant to the Crookwell II Windfarm:

- in-stream works
- watercourse crossings
- outlet structures
- riparian corridors
- laying pipes and cables in watercourses.

3.0 SITE DESCRIPTION

3.1.1 Location

This VMP has been prepared to minimise the impact of increased traffic of heavy vehicles across creek access tracks during the construction of the proposed Crookwell II Wind Farm.

The site of the proposed Crookwell II Wind Farm comprises approximately 2,088 hectares on three properties (Ahgunyah, Gundowringa and another land parcel), located approximately 14 kilometres southeast of Crookwell and 30 kilometres northwest of Goulburn. The study area is located in the Upper Lachlan Shire Local Government Area (LGA), within the Lachlan Catchment Management Authority and the South-eastern Highlands Biogeographic Region. The climate of the Crookwell area is temperate, with summer temperatures of up to 38°C and winter temperatures to -9°C, occasionally accompanied by snow falls. Average annual rainfall is 860 millimetres, evenly distributed over the year. The Goulburn region has been experiencing drought conditions for the last seven to ten years (Charlie Prell pers. comm.).

There are four proposed crossings that will require revegetation work: Access track one is to cross Stony Creek on the ‘Gundowringa’ property on the eastern side of Crookwell Rd, Access 2 involves a cable crossing of the Wollondilly River on ‘Gundowringa’ while access track three and four respectively are to cross First Creek and a tributary of Middle Creek on the ‘Ahgunyah’ property to the west of Crookwell Rd.

3.1.2 Land Use History

The dominant feature of the local landscape is cleared grazing lands for cattle with a small number of isolated woodland remnants of varying size within the wind farm site. Bayley (1951) refers to “...the paddocks of Gundowringa (as) the cradle of pasture improvement experiments in Australia and the home of their author and pioneer, the late Charles Ernest Prell” Clearing for agriculture in the area which comprised Gundowringa and adjacent properties began sometime after 1830. Charles Prell purchased Gundowringa in 1904 and divided the properties into three parts: Gundowringa homestead and paddocks, No 1 Farm and No 2 farm (see Bayley 1951). Mature trees, after ring-barking were cleared with a steam traction engine and potatoes were raised, making use of a horse-drawn mechanical potato digger and a potato grader, invented by Charles Prell.

Pasture was improved by the introduction of clover and the application of Superphosphate. “The results appeared slowly but were entirely satisfactory;

gradually the clover took possession, gradually it ousted the tussocks, gradually it raised the fertility of the land until it was good enough to grow rye and other valuable grasses which need a fertile soil. On the very poor land that took at least ten years but eventually the whole property had been treated and finally introduced grasses, phalaris tuberosa, cocksfoot, sheep's burnet and perennial rye were sown with the clover" (Bayley 1951).

Gundowringa was divided into three properties in 1933, including Gundowringa, the home station, Ahgunyah and Wharekarori (see Bayley 1951).

3.1.3 Soils and Geomorphology

The soil landscape of the site where each of the creeks; Middle, First and Stony flow is mapped at a 1:250 000 scale by Hird (1990) as

- Taralga Soil Landscape Group (map unit ta) to the Northern extents of the Creeks.

Soils of the Taralga Group are formed on remnants of tertiary lava flows. The landscape is characterised by irregular valley fills which have formed around the basalt plateau. The crests, slide slopes and foot slopes are typically friable soils. These soils can be susceptible to sheet erosion along steep gradients where there is soil creep and occasional slumping. Alluvial soils are typically found in the drainage lines. A common tree species on this soil type is *Eucalyptus viminalis*.

- Garland Soil Landscape Group (map unit ga) to the Southern extents of the Creeks.

Soils of the Garland Group are derived from granitic parent material. The landscape is characterised by undulating rises and valleys marked by the occasional granite tor. Sandy textured top soils are found on the mid and lower slopes, with deep siliceous sands found in some drainage lines. These soils are susceptible to "significant erosion". Particularly in drainage depressions siliceous sands mean that the surface condition may be loose, and have a high potential for soil erosion. Provided appropriate soil conservation measures are adopted prior to and during land use developments, both short term and long-term erosion problems may be avoided. Common tree species on this soil type are *Eucalyptus melliodora* and *E. blakeleyi* (Hird 1990).

3.1.4 Existing Vegetation

Existing vegetation on the site has been described by Biosis Research 2009 and

URS 2004. Vegetation types which were recorded include:

- Exotic Grassland (Improved Pasture), occurring over a large proportion of the area
- Native Grassland (Secondary Grassland or Natural Temperate Grassland), recorded near the main entrance to ‘Ahgunyah’
- Broad-leaved Peppermint (*Eucalyptus dives*) – Red Stringybark (*E. macrorhyncha*) Grassy Woodland, described by URS (2004) as “...the dominant community recorded throughout the study area...”
- Yellow Box (*E. melliodora*) – Apple Box (*E. bridgesiana*) Grassy Woodland, recorded on lower, gentler slopes
- Manna Gum (*E. viminalis*) – Snow Gum (*E. pauciflora*) Grassy woodland, mainly recorded along gully lines of Middle Creek
- Gully Reedland/sedgeland, recorded along sections of the Wollondilly River, Stony, First, Middle and Grays Creeks.

3.1.5 Priority Weeds

Eight Priority Weeds for South East LLS region, which includes the Upper Lachlan LGA, that have been recorded in the study area are listed in Table 1, along with their associated Duty.

Under the National Weeds Strategy (CoA 2017), 32 introduced plants have been identified as Weeds of National Significance (WONS). A list of 20 was endorsed in 1999 and a further 12 were added in 2012. These weeds are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts. Six WoNS were recorded within the study area (Table 1).

A comprehensive list of native and exotic plant species recorded at the site is included in Appendix 1.

Table 1: Priority weed within the site

Species Name	Common Name	General Biodiversity Duty	WoNS
<i>Nasella trichotoma</i>	Serrated Tussock	Prohibition on dealings Must not be imported into the State or sold	Yes
<i>Salix alba</i>	Golden Willow	Prohibition on dealings Must not be imported into the State or sold	Yes
<i>Salix sepulcralis</i>	Weeping Willow		Yes
		All species in the <i>Salix</i> genus	

Species Name	Common Name	General Biodiversity Duty	WoNS
		have this requirement, except <i>Salix babylonica</i> (weeping willows), <i>Salix x calodendron</i> (pussy willow) and <i>Salix x reichardtii</i> (sterile pussy willow)	
<i>Rubus fruticosus</i>	Blackberry	Prohibition on dealings Must not be imported into the State or sold All species in the <i>Rubus fruticosus</i> species aggregate have this requirement, except for the varieties Black Satin, Chehalem, Chester Thornless, Dirksen, Thornless, Loch Ness, Murrindindi, Silvan, Smooth Stem, and Thornfree	Yes
<i>Lycium ferocissimum</i>	African Boxthorn	Prohibition on dealings Must not be imported into the State or sold	Yes
<i>Senecio madagascariensis</i>	Fireweed	Prohibition on dealings Must not be imported into the State or sold	Yes
<i>Eragrostis curvula</i>	African Love Grass	Regional Recommended Measure Land managers reduce impacts from the plant on priority assets.	No
<i>Hypericum gramineum</i>	Small St John's Wort	Regional Recommended Measure Core infestation area: whole region except the exclusion area of Bega, Eurobodalla, Shoalhaven, Wollongong, Shellharbour and Kiama Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.	No

As such to prevent the above listed biosecurity impacts from occurring as a result of the presence of the above listed Priority Weeds within the study area, all practical steps should be taken to control and eradicate the weeds from the study area prior to vegetation removal.

4.0 MANAGEMENT AREAS

The site has been divided into four vegetation management areas, allowing for the description and prioritisation of site specific management requirements (Figure 1).

4.1 Area 1 – Stony Creek Crossing, ‘Gundowringa’

An access track will cross the upper reaches of Stony Creek. This crossing was dry during the survey in May 2009. A culvert with a diameter of 800 millimetres will be installed beneath the crossing.

4.2 Area 2 – Cable Crossing of Wollondilly River, ‘Gundowringa’

A cable crossing will be installed to cross the Wollondilly River near the confluence of Stony Creek.

4.3 Area 3 – First Creek Crossing, ‘Ahgunyah’

An access track will cross First Creek. During the May 2009 survey, water was flowing along a narrow, deeply incised channel. A culvert with a diameter of 1200 millimetres will be installed beneath the crossing.

4.4 Area 4 – Middle Creek Crossing, ‘Ahgunyah’

An access track will cross Middle Creek. During the May 2009 survey, water was flowing along a narrow channel. A culvert with a diameter of 400 millimetres will be installed beneath the crossing.

5.0 VEGETATION MANAGEMENT MEASURES

The following section provides vegetation management measures which apply to the study area as detailed in the scope of works.

5.1 Weed Management Planning

A site can be particularly susceptible to weed invasion where the soil is disturbed or where introduced waste materials such as fill or topsoil are present (DNR 2006). The timing of weed management actions is critical to the successful control and suppression of weeds on a site. Weed management planning provides for the appropriate timing of weed control measures to be implemented during pre-construction, during development and during the post-construction and maintenance phases of the project.

The outcomes of appropriate weed management planning include:

- the provision of an initial inventory of weed species to be used as a guide for species to be targeted on site and for the long term monitoring of the site
- the minimisation of weed dispersal and colonisation as a consequence of the earthworks and disturbance during development activities
- minimising the impact of subsequent weed invasion in rehabilitated areas of the landscape
- outline a long term programme of maintenance for the site to enable the establishment of the plantings
- the identification of control measures that may be required for specific weed species
- the implementation of Integrated Pest Management (IPM) principles to achieve sustainable, long term weed management of the site.

Appropriate weed management should have its foundations in IPM, which is based on a sound knowledge of the life cycle (phenology), structure and function (physiology) and ecology of the pest species. A clear distinction is made between weed management and weed control. Weed control should not be considered in isolation and must be comprehensively integrated with regeneration, revegetation and ecological management.

Invasive species have the capacity to rapidly degrade the functioning of the ecological communities present by competing with regeneration and plantings. The control of both priority and environmental weeds is, therefore, an important

component of the weed management planning for the study area.

The early recognition and control of potentially problematic species can significantly reduce their ecological and economic cost (Lamp and Collet 1999). In this respect the implementation of a rigorous monitoring and performance evaluation program is of the utmost importance. The monitoring and performance evaluation measures to be adopted in respect to weed management at the site are outlined in Table 3. A monitoring report template is provided in Appendix 2.

5.1.1 Weed Species

A complete list of native and exotic plant species recorded at the site is included in Appendix 1. All four sites have a range of aquatic and pasture species which consist of a combination of exotic and native species.

Of the Priority weed species listed in Table 1, Willow species are the most commonly occurring in the creeklines. Small clumps of Blackberry occur, mainly on the Wollondilly River were recorded in Stony and Middle Creeks as well as in sections of the Wollondilly River. The most commonly occurring introduced species along the creekbanks include *Phalaris* spp., *Trifolium* spp., *Hordeum leporinum*, *Paspalum dilatatum*, *Lolium perenne* and *Polypogon monspeliensis*.

5.2 Bush Regeneration Planning

5.2.1 Bush Regeneration

Bush regeneration or assisted regeneration involves active intervention within bushland remnants through the treatment and removal of weed species. Bush regeneration is generally undertaken in areas where resilience is present. Although the aquatic vegetation at all crossing sites exhibit reasonable degrees of resilience, the creekbanks and uplands are generally devoid of native forb, shrub or tree species, therefore only the creeklines themselves allow for the implementation of bush regeneration management activities.

Bush regeneration is generally undertaken in three stages:

- **Primary weeding** is the first round of weeding activity and involves the removal of the majority of weed biomass present on the site.
- **Secondary weeding** generally occurs three to four months after the completion of primary weeding, depending on the seasonal response of weed regrowth. Secondary weeding often involves the treatment of annual and

herbaceous weeds depending on the degree of seed that is present in the soil.

- **Maintenance weeding** is then undertaken to ensure that any weed regeneration which occurs following secondary weeding is controlled over the long term. Maintenance is generally required over a long term period in order to ensure weed seed present on the site is exhausted. Without ongoing and long term maintenance including a sufficient allocation of resources, bush regeneration projects will almost certainly fail.

Before primary clearing is undertaken, consideration of management issues such as site stabilisation and likely annual weed infestations need to be considered. Adequate resources should be allocated to control erosion and potential annual weed flushes after primary clearing and disturbance. To ensure management issues such as these are adequately addressed, a suitably qualified and experienced contractor should be employed to undertake bush regeneration activities on the site.

5.3 Revegetation Planning

5.3.1 Species Collection and Propagation

In order to achieve optimal species richness, structural diversity and genetic integrity at the site, it is paramount that a provenance native plant nursery is engaged promptly upon project approval. This is to allow for any lag time (up to six to eight months) in the raising and hardening-off of stock and planting and to ensure the sourcing of locally indigenous tubestock.

Local provenance plants seed collection on-site and from adjacent bushland should be undertaken. Any seed collection will require the necessary licence for seed collection issued by the DECC under the National Parks & Wildlife Act (1974). For further information regarding the appropriate best practice protocols for provenance seed collection, handling, storage use in the landscape, see *Flora Bank Guidelines* at <http://www.florabank.org.au/Default.htm>.

5.3.2 Revegetation

Prior to the implementation of any revegetation efforts adequate soil testing and site preparation will be required (see Section 6.2.1 below). Revegetation involves the reconstruction of plant communities by planting out a site with locally indigenous plant species. Revegetation is generally considered necessary when:

- the resilience of a site has been severely depleted or is absent

- bush regeneration techniques fail to trigger natural regeneration
- where key species of a plant community are missing (DEC 2005).

Where revegetation is undertaken in areas that lack any native vegetation structure and have low resilience, the limitations of revegetation efforts need to be recognised. Based on current best practice techniques, the complete re-creation of biological complexity (such as that represented by an undisturbed plant community) is not possible (DEC 2005).

It is generally recommended that the minimum time frame required to restore a plant community is five years (DNR 2006). It is likely that ongoing, occasional maintenance after this period will be necessary, therefore it is recommended that the early involvement of a local bushcare group be actively encouraged. Specific details regarding revegetation of the study area are provided in Section 6.2.2, including provision for the required plant numbers, application of fertiliser, irrigation requirements and plant replacements.

5.3.3 Direct Seeding

The direct application of local native seed including pre-treated or cleaned seed and brush matting (using seed laden branches) can be an effective and cheap method of native vegetation establishment. Brush matting with species such as *Eucalyptus* spp., *Casuarina* spp., *Kunzea* spp. and *Leptospermum* spp. can be very effective.

The initial stages (first year) of revegetation and direct seeding should include the use of hardy, fast growing, pioneer species (DNR 2006) such as *Acacia* species and other legumes. Such species can be established via direct seeding following appropriate seed treatment such as boiling water or scarification. Care should be taken not to create a monoculture of *Acacia* species as they are generally short lived and may not provide a long term vegetative cover for the site.

6.0 SCOPE OF WORKS

The following scope of works is to be implemented within each area and provides a guide for works to be carried out by an appropriately qualified bush regeneration contractor. It should be noted that the provision of specific methods or techniques that are required is beyond the scope of this VMP and is considered assumed knowledge of the qualified bush regeneration contractor.

Departures from the following scope of works may be required during VMP implementation in response to changing site conditions (e.g. due to unforeseen weather conditions) and the degree of natural regeneration following the implementation of management actions. Any departures from the scope of works that are considered necessary or which provide for appropriate adaptive management should only be undertaken with prior consultation and approval from the land-owners and CMA officers.

Under the *Water Management Act 2000* Guidelines relating to Riparian Corridors are relevant to this study: “Riparian corridors form a transition zone between terrestrial and aquatic environments and perform a range of important environmental functions. Riparian corridors:

- provide bed and bank stability and reduce bank and channel erosion
- protect water quality by trapping sediment, nutrients and other contaminants
- provide a diversity of habitat for terrestrial, riparian and aquatic flora and fauna species
- provide connectivity between wildlife habitats
- allow for conveyance of flood flows and control the direction of flood flows
- provide an interface between developments and waterways.

Three Riparian Corridor Zones need to be identified:

The Core Riparian Zone (CRZ) is the land contained within and adjacent to the channel. In the case of Areas 1, 3 and 4, the channel width varies from 3 to 10 metres. In Area 2, the width is 25 metres. Recommended CRZ widths for Area 2, 3 and 4 are 20 metres and 20-40 metres for Area 2 (see NSW DWE 2008).

The Vegetated buffer, which is usually recommended to be 10 metres, although this width will be dictated by the topography of the uplands.

The Asset protection Zone, which is required by the NSW Rural Fire service and is not relevant to the four crossings as they are not located near any buildings and are not adjacent to any vegetation stands.

6.1 Area 1- Stony Creek Crossing ‘Gundowringa’; Area 2 – cable crossing of Wollondilly River, ‘Gundowringa’; Area 3 - First Creek Crossing; Area 4 – Middle creek Crossing ‘Ahgunyah’

Seed and Propagule Collection and Propagation

- Local provenance seed will be harvested from native vegetation for use in direct seeding activities and for propagation and revegetation activities in each area. All seed collection, handling and storage will follow current best practice techniques outlined in *Florabank Guidelines* (Mortlock 1999).
- Seed and propagules for aquatic planting should be collected from upstream and downstream of the crossing site. Recommended species include *Typha* spp., *Eleocharis* spp., *Juncus* spp., *Carex* spp. and *Phragmites australis*. Seed of appropriate tree, shrub and herb species should be collected from adjacent small stands, as well as the larger stands near Woodhouselee Road (for Areas 1 and 2) and stands in ‘Ahgunyah’ for Areas 3 and 4. Recommended species for Areas 1 and 2 include *Eucalyptus viminalis*, *E. pauciflora*, *E. dives*, *E. macrorhyncha*, *Acacia dealbata*, *A. melanoxylon*, *A. falciformis*, *Hardenbergia violacea*, *Glycine tabacina*, *Cassinia aculeata*, *Leptospermum obovatum*, *Kunzea parvifolia*, *Lomandra longifolia*, *Lomandra filiformis*, *Themeda triandra*, *Austrodanthonia* spp. and *Austrostipa* spp. Recommended species for Areas 3 and 4 include *Eucalyptus viminalis*, *E. blakelyi*, *E. stellulata*, *E. dives*, *E. macrorhyncha*, *Acacia dealbata*, *A. melanoxylon*, *A. falciformis*, *Hardenbergia violacea*, *Glycine tabacina*, *Cassinia aculeata*, *Hibbertia obtusifolia*, *Lomandra longifolia*, *Lomandra filiformis*, *Themeda australis*, *Austrodanthonia* spp. and *Austrostipa* spp.
- Seed that is not to be used in direct seeding operations will be supplied to an appropriate native plant nursery for propagation, growing on and hardening off before later planting on site (see below).

Sediment and Erosion Control

- Appropriate best practice sediment and erosion controls (see Section 6.2.7) will be installed along areas of creekbank which require intensive weed removal, prior to any works on site.

Weed Management and Hygiene

- Hand weeding, cut and paint and spot herbicide spraying will be undertaken, focussing on sections of the creekline where weedy forbs are well established. All weed waste will be bagged, removed and disposed of at an appropriate waste disposal depot.

- All vehicles and plant to be used on site are to be thoroughly cleaned prior to site access to ensure that no weed seed or pathogens are carried onto the site. Special attention should be paid to the removal of dirt from vehicles, machinery and equipment including mud guards, tyres and excavator tracks and buckets.

Revegetation

- Direct seeding and brush matting will be applied during spring, summer or autumn (dependant on seed availability) to all cleared and disturbed areas.
- Approximately six months following direct seeding and brush matting, areas with no seedling germination will be subject to supplementary direct seeding and brush matting.
- During the second year of the contract, tubestock will be installed in accordance with the prescribed planting scheme and planting densities (see Section 6.2.2).
- Depending on levels of herbivory (e.g. from wallabies, rabbits or hares) plant installation may require the use of tree guards.
- Following plant installation and the application of seed and brush matting, the upper banks will be watered using a utility mounted tank approximately once a week for four weeks and then as required dependant on climatic conditions.

Weed Management

- Quarterly inspections of the revegetation areas will be undertaken and appropriate weed management actions (e.g. hand weeding and spot spraying) implemented as required. Any necessary fencing repairs should be carried out at this time.

6.2 Additional Site and Vegetation Maintenance Requirements

6.2.1 Soil Testing

In order to determine the appropriate physical requirements for suitable plant growth, soil testing or materials characterisation is necessary where topsoil is disturbed or absent (DITR 2006; DNR 2006; NSW Minerals Council 2008). Soil testing, however, may not be necessary, as it is likely that the Prell family have historical records of soil tests and fertiliser application rates.

6.2.2 Planting Scheme

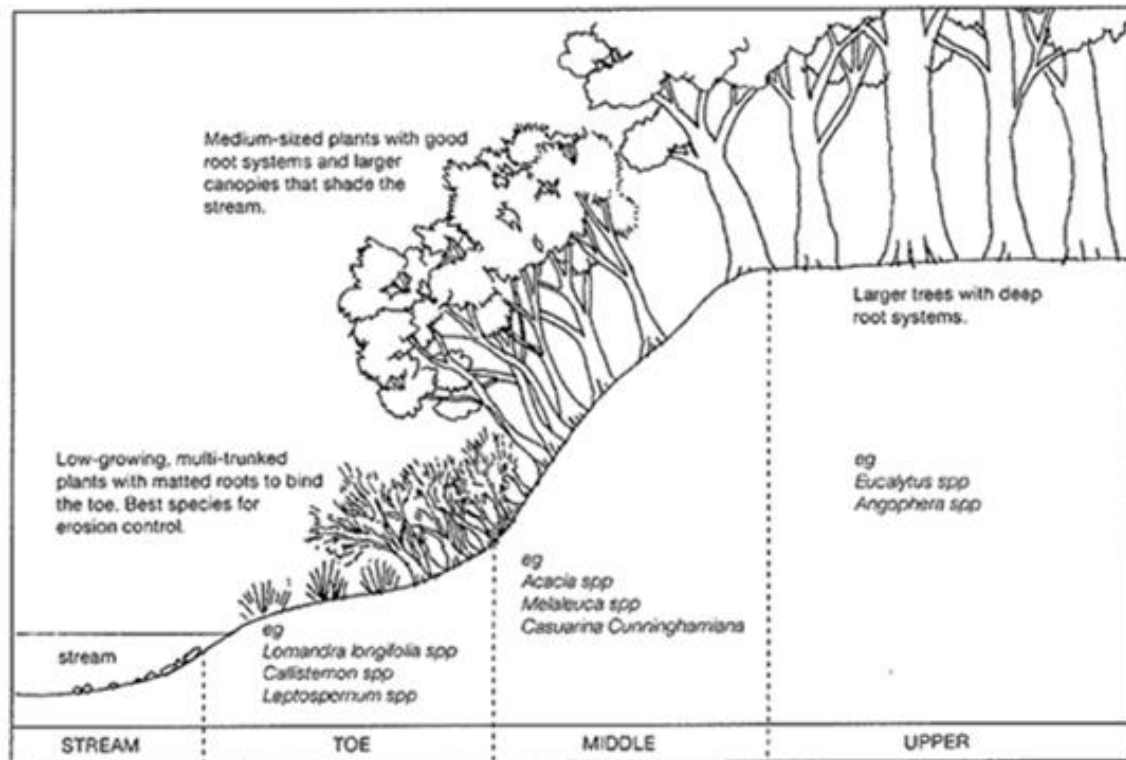
The proposed planting scheme contains species deemed appropriate for revegetation purposes, derived from those identified during the site survey (see Appendix 1) and those identified as common within the mapped vegetation types (see Fig. 2). Species selection is also based upon availability, which is influenced by ease of collection and propagation. Species numbers are based on an assumption of a 40 metre strip extending upstream and a 40 metre strip extending downstream of each crossing. The width of the strip will also be variable, depending on topography but ideally should average 20 metres on each side of the creekline.

The location of the proposed planting scheme may also be modified in situations that can be improved in order to prioritise:

- existing land use (livestock water points)
- revegetation establishment success rates (avoidance of dry and vegetated pasture areas)
- revegetation of low ecological values area (heavily eroded areas downstream).

The planting scheme should be used as a guide only and is based on a plant density of approximately three shrub or groundcover species per metre squared and one tree species per four metres squared. Table 1 provides a guide to the total number of plants required in each area. The estimated number of plants required does not account for losses (see section 6.2.6). It should also be noted that the estimated number of plants may also be reduced dependant on the success or failure of direct seeding and brush matting efforts.

The attached cross section indicates the projected structure of revegetated riparian vegetation adjacent to crossing areas. This cross section has been extracted from NSW DWE 2008 and Raine & Gardiner 1995.



6.2.3 Fencing

Each planting area should be protected by stock-proof fencing around the area perimeter. The fencing should be resistant to occasional flooding and should ideally be located at the toe of steep batters. Cattle grids on the approaches to the crossing could be incorporated to restrict access by stock to these revegetated sections of creekline, although gates would be a cheaper alternative.

6.2.4 Outlet structures

The bed of the watercourse below the outlet should be protected against scour. If necessary, rock rip-rap should be installed at the outlet. The rip-rap should be topsoiled and aquatic species planted within the topsoil.

Table 2: Estimated number of tubestock plants required

Management Area	Trees	Shrubs and Groundcovers
Area 1	400 <i>Eucalyptus dives</i> , <i>E. pauciflora</i> , <i>E. viminalis</i> , <i>E. macrorhyncha</i>	1600 <i>Acacia dealbata</i> , <i>A. melanoxylon</i> , <i>A. rubida</i> , <i>A. falciformis</i> , <i>Leptospermum obovatum</i> <i>Kunzea parvifolia</i> , <i>Glycine tabacina</i> , <i>Hardenbergia violacea</i> , <i>Lomandra</i> spp., <i>Themeda australis</i> , <i>Austrostipa</i> spp.. <i>Austrodanthonia</i> spp. <i>Carex</i> spp., <i>Juncus</i> spp., <i>Eleocharis</i> spp.
Area 2	600 <i>Eucalyptus dives</i> , <i>E. pauciflora</i> , <i>E. viminalis</i> , <i>E. macrorhyncha</i>	2000 <i>Acacia dealbata</i> , <i>A. melanoxylon</i> , <i>A. rubida</i> , <i>A. falciformis</i> , <i>Leptospermum obovatum</i> <i>Kunzea parvifolia</i> , <i>Glycine tabacina</i> , <i>Hardenbergia violacea</i> , <i>Lomandra</i> spp., <i>Themeda australis</i> , <i>Austrostipa</i> spp.. <i>Austrodanthonia</i> spp. <i>Carex</i> spp., <i>Juncus</i> spp., <i>Eleocharis</i> spp.
Area 3	400 <i>Eucalyptus dives</i> , <i>E. pauciflora</i> , <i>E. viminalis</i> , <i>E. macrorhyncha</i> , <i>E. stellulata</i>	1600 <i>Acacia dealbata</i> , <i>A. melanoxylon</i> , <i>A. rubida</i> , <i>A. falciformis</i> , <i>Leptospermum obovatum</i> <i>Kunzea parvifolia</i> , <i>Glycine tabacina</i> , <i>Hardenbergia violacea</i> , <i>Lomandra</i> spp., <i>Themeda australis</i> , <i>Austrostipa</i> spp.. <i>Austrodanthonia</i> spp. <i>Carex</i> spp., <i>Juncus</i> spp., <i>Eleocharis</i> spp.
Area 4	400 <i>Eucalyptus dives</i> , <i>E. pauciflora</i> , <i>E. viminalis</i> , <i>E. macrorhyncha</i>	1600 <i>Acacia dealbata</i> , <i>A. melanoxylon</i> , <i>A. rubida</i> , <i>A. falciformis</i> , <i>Leptospermum obovatum</i> <i>Kunzea parvifolia</i> , <i>Glycine tabacina</i> , <i>Hardenbergia violacea</i> , <i>Lomandra</i> spp., <i>Themeda australis</i> , <i>Austrostipa</i> spp.. <i>Austrodanthonia</i> spp. <i>Carex</i> spp., <i>Juncus</i> spp., <i>Eleocharis</i> spp.

The use of native tube stock (e.g. 75 millimetre Forestry Tubes) is likely to be the most successful mode of revegetating the site. Installation of tubestock will be undertaken as follows:

- The availability of appropriate stock will dictate the timing of the plantings, which should ideally be installed during spring or autumn and not during the extremes of summer or winter.
- Planting holes will be pre-watered before tube stock is installed and then again immediately following installation.
- Dependant on herbivorous animal populations (e.g. wallabies, wombats and rabbits) tree guards may need to be installed around each plant. An alternative option may be to install temporary rabbit-proof fencing of revegetation areas until plants are sufficiently established.

6.2.5 Irrigation

Under current (February 2009) water restrictions, Sydney Water requires the issue of permits in order to allow the establishment of vegetation by commercial contractors. Maximum establishment periods of eight weeks by automatic and manually operated watering systems currently apply. The status of water restrictions should be checked by the contractor prior to plant installation (see - <http://www.sydneywater.com.au/SavingWater/WaterRestrictions/>).

All revegetated areas should be watered on a weekly basis (dependant on prevailing climatic conditions) for approximately one month post-installation and then as required, dependant on weather conditions. Alternatively, non-potable water from the artificial wetland may be used to irrigate revegetation areas provided it is a suitable pH (5 – 8) and does not interfere with fauna habitats.

6.2.6 Plant Replacements

Up to 20% mortality can be expected within 12 months of planting. These plants should be replaced with appropriate stock. Where plant losses are greater than 30% additional methods may be required to ensure improved survival rates. These may include the use of tree guards, further soil remediation, native plant fertiliser, water crystals or improving irrigation requirements.

6.2.7 Erosion and Sediment Control Measures

Best practice sediment and erosion controls for the construction industry (Landcom 2004) will be implemented in Zone 3 prior to construction works. A self-auditing programme (e.g. log books) for sediment and erosion controls is to be implemented by the construction project manager. The timing of erosion and sediment control inspections should be on a fortnightly to monthly basis and at opportunistic times, such as during and immediately following rainfall events.

Sediment and erosion control practices to be implemented on-site include:

- Minimising unnecessary disturbance to retained native vegetation and the soil profile.
- Appropriate site management practices – including scheduling of construction, sequencing of erosion control measures and restriction of access to non-essential areas.
- Appropriate physical stabilisation techniques including the construction of mitre drains, silt fencing, contour banks and use of onsite logs and vegetative debris.
- Regular inspection of drainages and sediment and erosion controls to ensure their integrity, especially after heavy rainfall.

7.0 MONITORING, REPORTING AND PERFORMANCE EVALUATION PROGRAM

In order to undertake the prescribed scope of works a qualified and experienced bush regeneration contractor should be engaged. A list of appropriate contractors and industry rates is available from the Australian Association of Bush Regenerators (AABR), see – <http://www.aabr.org.au/aabr/>.

Monitoring and reporting is an important part of any management strategy. An iterative process of monitoring and feedback has the benefit of fine-tuning management strategies by allowing for adaptive management. All aspects of this VMP should be assessed and, where possible, quantitative data should be collected.

To monitor the success of establishment and bush regeneration on the site, visual assessments need to be formally recorded. At the onset of the bush regeneration contract, the successful contractor is to set up permanent photographic monitoring points. Photographs should be taken before any works are undertaken on-site, from the same point immediately following significant works, then at least every 6 months. Photographic records should be included as part of each monitoring report.

Monitoring reports are to be submitted to the principal contractor on an annual basis. A copy of each monitoring report is to be submitted to the relevant stakeholders as required by the principal contractor.

Monitoring reports should include:

- A summary of the works completed during to date.
- An evaluation of the success or failure of management actions.
- Before and after photographs of the site.
- Recommendations for future site management actions.

An example table of contents (which can be used as template for the monitoring reports) has been included in Appendix 2. Table 2 provides a list of the performance indicators, associated targets and responsibilities to be monitored by stakeholders.

Table 3: Performance indicators, targets and responsibilities

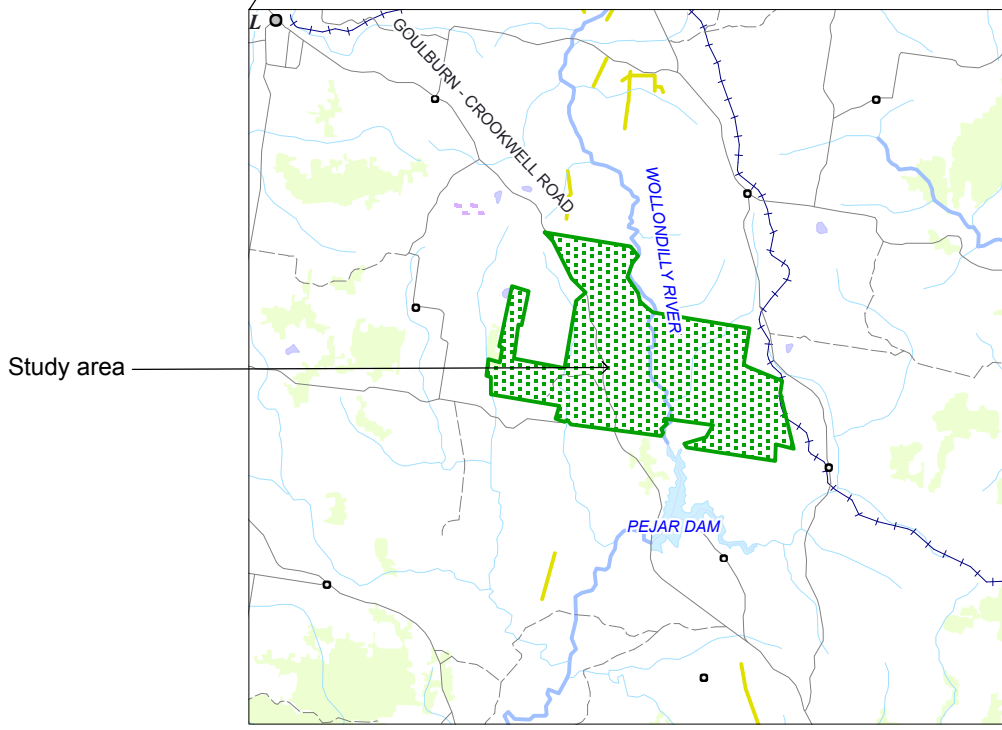
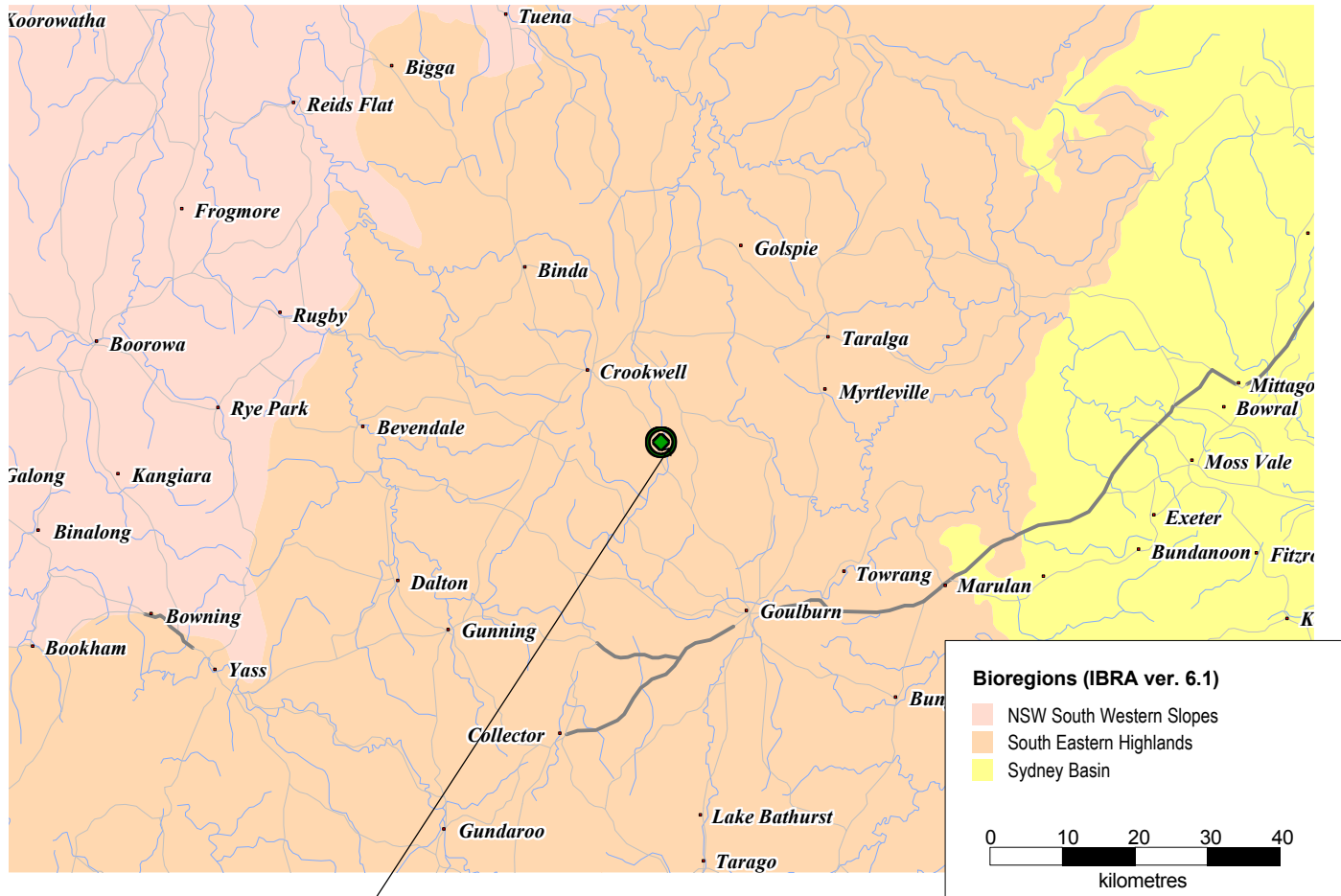
Performance Indicator	Performance Target	Responsibility
Establishment of exclusion zones	<ul style="list-style-type: none"> All remnant native vegetation and regenerating woodland clearly demarcated Disturbance, storage and parking of vehicles confined to cleared and disturbed areas Perimeter fences installed 	Civil works contractor
Site stabilisation and installation of barrier mesh and erosion controls.	<ul style="list-style-type: none"> All required sediment fencing and barrier mesh has been installed at the start of the contract. Evidence of self-auditing program (e.g. log books) for sediment and erosion controls All sediment and erosion controls operating properly A reduction in sediment or other pollutants (including weed waste) that is leaving the site or has the potential to do so 	Civil works contractor / Bush regeneration contractor
Soil testing and remediation* *Only if considered necessary	<ul style="list-style-type: none"> Soil samples sent to laboratory for testing Compacted areas ripped Additional soil remediation as required 	Civil works contractor / Bush regeneration contractor
Seed Collection, direct seeding and brush matting	<ul style="list-style-type: none"> Records kept of all seed collected including names, dates and estimated quantities Evidence of sufficient direct seeding and brush matting Evidence of seedling germination 	Bush regeneration contractor
Weed Management	<ul style="list-style-type: none"> 95% removal of weeds from all zones by the end of the first contract year 	Bush regeneration contractor
Mulching	<ul style="list-style-type: none"> Application to max. 75mm depth of weed-free, disease-free leaf and chip mulch 	Bush regeneration contractor
Local provenance plant supplier engaged	<ul style="list-style-type: none"> Nursery is to confirm contract growing of 1800 tree and 6800 shrub, sedge or herb tubestock species 	Bush regeneration contractor / provenance nursery
Native Vegetation Establishment	<ul style="list-style-type: none"> Bare areas revegetated Plantings monitored for herbivorous animal attack Plantings watered as required 20% accepted plant losses over one year. Additional losses to be replaced 50% vegetative cover of revegetated areas achieved after two years 75% vegetative cover after 4 years 	Bush regeneration contractor
Weed Management – Ongoing Site Maintenance	<ul style="list-style-type: none"> Continued site visits demonstrating follow-up weed treatment and control (e.g. annual weeds treated before seed set) Control methods, species targeted and rates of herbicide application to be included in six-monthly reports Weed species absent from the study area 	Bush regeneration contractor
Fences and signs	<ul style="list-style-type: none"> Installation of stock-proof (and possibly rabbit-proof) fencing around revegetation areas,. Installation of “Revegetation Area” signs 	Bush regeneration contractor

Performance Indicator	Performance Target	Responsibility
Reporting	<ul style="list-style-type: none">• Progress reporting provided to principal contractor on an annual basis	Bush regeneration contractor

REFERENCES

- APVMA (2008). Australian Pesticides and Veterinary Medicines Authority, <http://www.apvma.gov.au/index.asp>, Accessed 25-6-2008
- Bayley WA 1951 *Gundowringa The Life and Work of Charles Ernest Prell, OBE*. Gundowringa, Crookwell..
- Biosis Research 2009 Crookwell II Wind Farm - Modifications to DA 176 8 2004 i Ecological Assessment. Report prepared for Robert Luxmoore Project Management. Biosis Research , Alexandria
- DNR (2006) 'Soil and Land Assessment for native vegetation rehabilitation.' Department of Natural Resources, No. 1.
- EDO (2008). Environmental Defender's Office New South Wales, Fact Sheets, Topic 3, Pollution, http://www.edo.org.au/edonsw/site/factsheets/fs03_5.php, Accessed 25-5-0008
- Gray JM, Rawling JL & Chapman GA 2006 *Soil and land assessment for native vegetation rehabilitation. Technical Guidelines*. NSW Department of Natural Resources, Sydney.
- Hird C 1990 *Soil Landscapes of the Goulburn 1:100 000 sheet map*. Soil Conservation Service of NSW, Sydney
- Hird 1991 *Soil Landscapes of the Wollongong-Port Hacking 1:100 000 sheet report*. Soil Conservation Service of NSW, Sydney
- Lamp, C. & Collet, F. 1999, *Field Guide to Weeds in Australia*, Inkata Press, Melbourne.
- Landcom 2004, *Managing Urban Stormwater: Soils and Construction*, NSW Government
- Commonwealth of Australia (CoA) 2017. Australian Weeds Strategy 2017–2027. Invasive Plants and Animals Committee. Department of Agriculture and Water Resources
- NSW DWE 2008 Guidelines for controlled Activities: Riparian Corridors, Watercourse crossings, Outlet structures, Vegetation Management Plans and In-stream works. NSW Department of Water & Energy Water management Act 2000.
- Parsons WT and Cuthbertson EG (2001) 'Noxious Weeds of Australia.' (CSIRO Publishing, Collingwood, VIC).
- Raine AW & Gardiner JN 1995 *Rivercare: Guidelines for Ecological Sustainable Management of Rivers and Riparian Vegetation*. LWRRDC, Canberra
- URS 2004 A Survey and Impact Assessment of the Terrestrial Flora and Fauna of the Proposed Crookwell II Wind Farm Development. Report prepared for Wind Farm Joint Venture

FIGURES



This product incorporates data which is copyright to the Commonwealth of Australia (c.2003-)



BIOSIS RESEARCH Pty. Ltd.
18-20 Mandible Street
Alexandria
NEW SOUTH WALES 2015

Figure 1: Location of the Study Area in a regional context.

Date: 28 May 2009
Checked by: GGL File number: S5431
Location: P:\5000\5400s\5431\Mapping\S5431 F1 Region.WOR



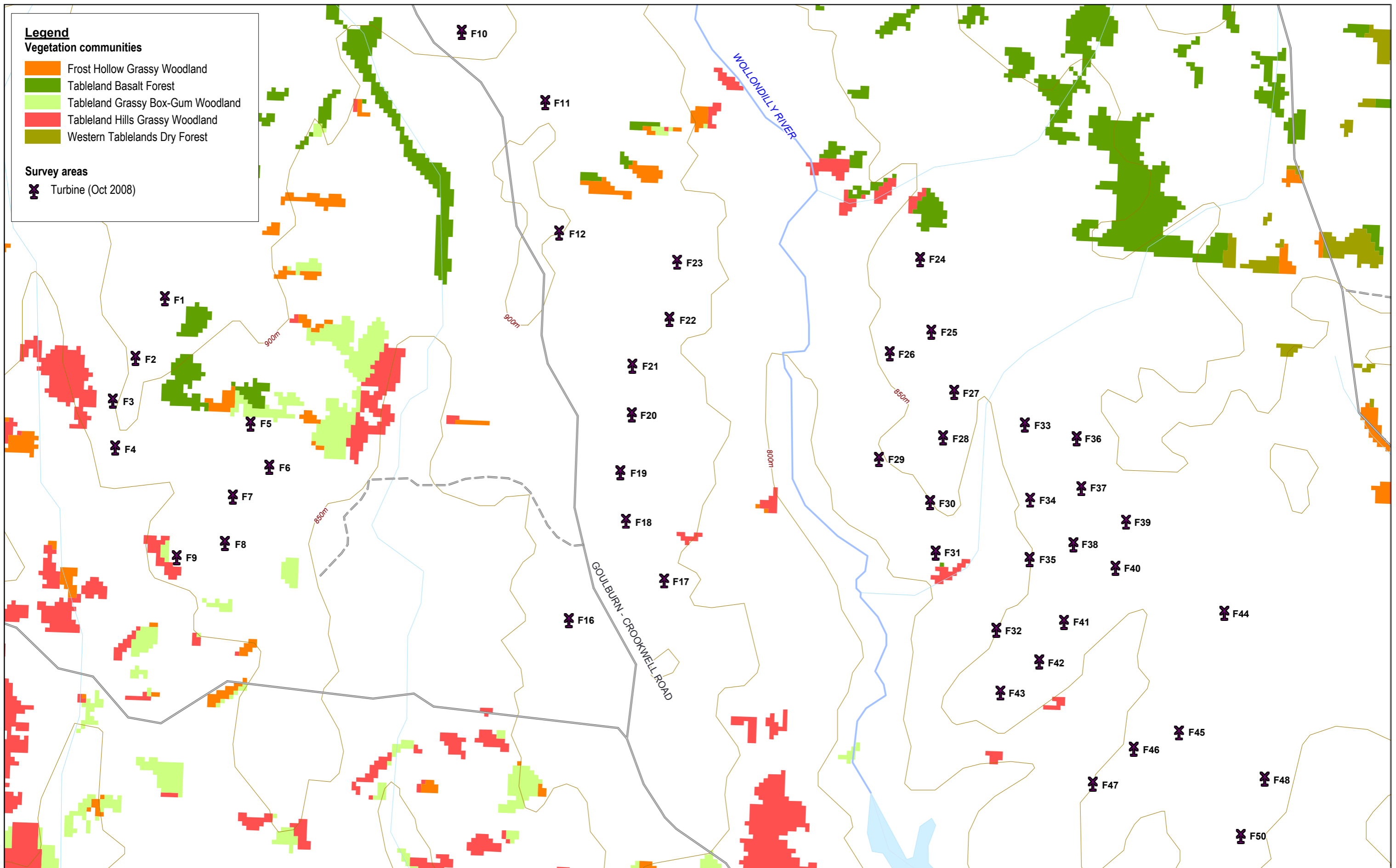


Figure 2: Vegetation communities according to survey conducted by Biosis Research.

Date: 28 May 2009
 Checked by: GGL
 Location: P:\5000\5400s\5431\Mapping\S5431 F2 vegcomm.WOR

Scale: 0 0.2 0.4 0.6 0.8 1
 kilometres

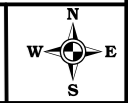
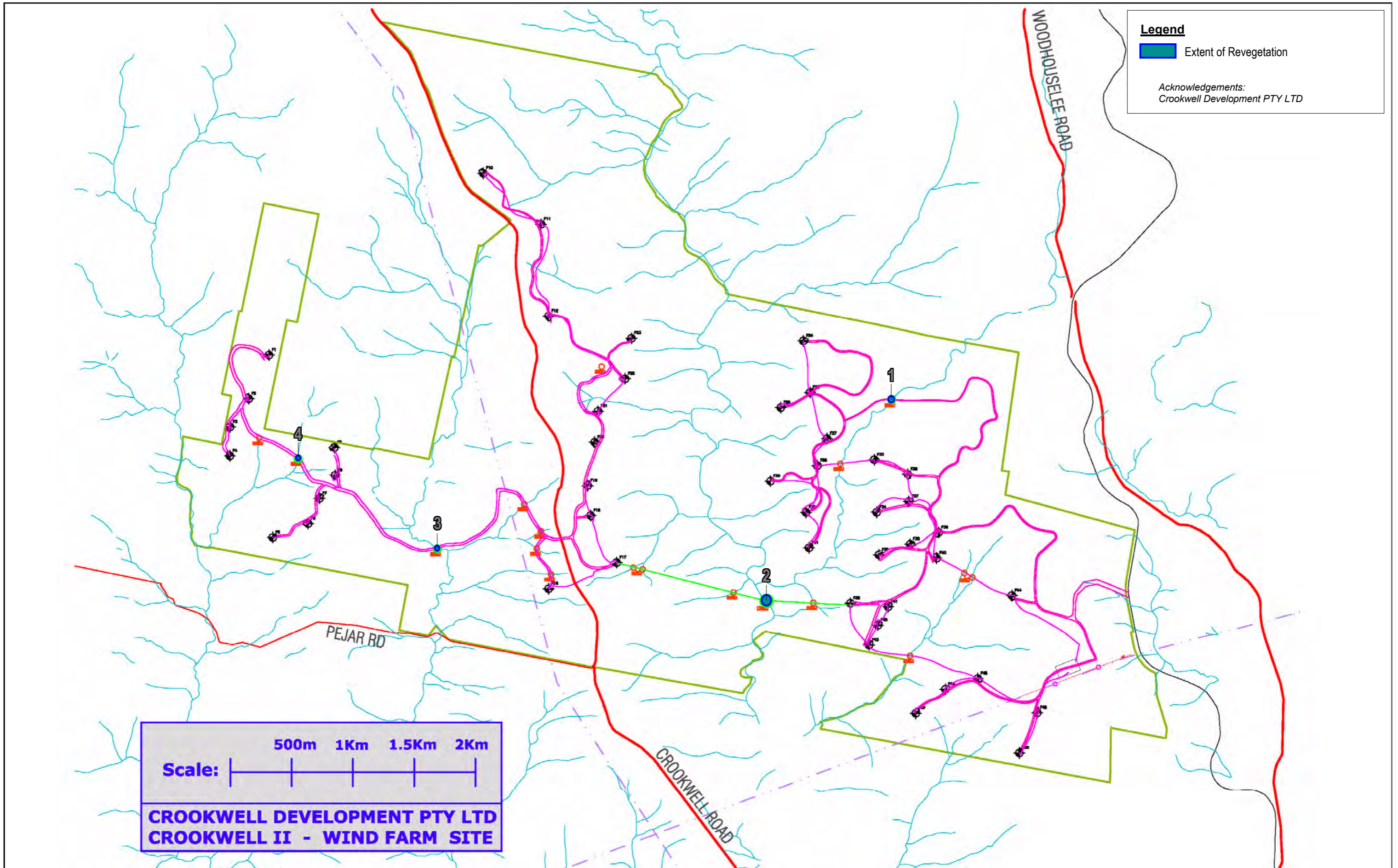


Figure 2: Vegetation communities according to survey conducted by Biosis Research.



Legend
 ■ Extent of Revegetation
 Acknowledgements:
 Crookwell Development PTY LTD

Scale: 500m 1Km 1.5Km 2Km
**CROOKWELL DEVELOPMENT PTY LTD
 CROOKWELL II - WIND FARM SITE**

PLATES



Plate 1: Creek tributary on the 'Ahgunyah' property



Plate 2: Creek tributary on the 'Ahgunyah' property. *Eucalyptus dives* growing on bank



Plate 3: Exotic riparian vegetation – Wollondilly River on the ‘Gundowringa’ property



Plate 4: Stony Creek on the ‘Gundowringa’ property

APPENDICES

APPENDIX 1

Flora Results

Plant species recorded at turbine sites by URS (2004) and Biosis Research (2008; 2009)

Family	Botanical name	Common name	Exotic Sp.	Riparian sp..
Sinopteridaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	Narrow Rock Fern		
Gymnosperms				
Cupressaceae	<i>Cupressus macrocarpa</i>	Monterey Cypress	*	
Pinaceae	<i>Pinus radiata</i> subsp. <i>radiata</i>	Monterey Pine	*	
Angiosperms				
(Monocotyledons)				
Colchicaceae	<i>Burchardia umbellata</i>	Milkmaids		
	<i>Wurmbea dioica</i>	Early Nancy		
Cyperaceae	<i>Bolboschoenus fluviatilis</i>	Marsh Club-rush		√
	<i>Cyperus eragrostis</i>	Umbrella Sedge	*	√
	<i>Carex appressa</i>	Tall Sedge		√
	<i>Eleocharis spacelata</i>	Tall Spike Rush		√
	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge		√
	<i>Isolepis inundata</i>	Club-rush		√
	<i>Schoenus apogon</i>	Fluke Bogrush		√
Hypoxidaceae	<i>Hypoxis hygrometrica</i>	Golden Weather-grass		
Iridaceae	<i>Romulea rosea</i>	Onion Grass	*	
Juncaceae	<i>Juncus articulatus</i>	Jointed Rush	*	√
	<i>Juncus australis</i>			√
	<i>Juncus subsecundus</i>	Finger Rush-		√
	<i>Juncus usitatus</i>			√
Lomandraceae	<i>Lomandra filiformis</i> subsp. <i>coreacea</i>	Wattle Mat-rush		
	<i>Lomandra longifolia</i>	Spiny-headed mat-rush		
	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many flowered Mat-rush		
Phormiaceae	<i>Dianella revoluta</i> var. <i>revoluta</i> -			
Poaceae	<i>Agrostis capillaris</i>	Browntop Bent	*	
	<i>Amphibromus pithogastrus</i>			
	<i>Aristida calycina</i> var. <i>calycina</i>			
	<i>Aristida ramosa</i>	Purple Wiregrass		
	<i>Aristida vagans</i>	Threeawn Speargrass		
	<i>Austrodanthonia duttoniana</i>	Brown-back Wallaby Grass		
	<i>Austrodanthonia pilosa</i>	Smooth-flowered Wallaby Grass		
	<i>Austrodanthonia racemosa</i>	Wallaby Grass		

Family	Botanical name	Common name	Exotic Sp.	Riparian sp..
	<i>Austrostipa scabra</i> subsp. <i>falcata</i>	Rough Speargrass		
	<i>Avena fatua</i>	Oats	*	
	<i>Avena sterilis</i>	Oats	*	
	<i>Bothriochloa macra</i>	Red Grass		
	<i>Briza maxima</i>	Quaking Grass	*	
	<i>Bromus catharticus</i>	Prairie Grass	*	
	<i>Bromus diandrus</i>	Great Brome	*	
	<i>Bromus hordeaceus</i> subsp. <i>molliformis</i>	Soft Brome	*	
	<i>Chloris truncata</i>	Windmill Grass		
	<i>Cynodon dactylon</i>	Couch		
	<i>Dactylis glomerata</i>	Cocksfoot	*	
	<i>Dichelachne micrantha</i>	Shorthair Plumegrass		
	<i>Eleusine tristachya</i>	Goose Grass	*	
	<i>Elymus scaber</i>	Common Wheatgrass		
	<i>Entolasia marginata</i>	Bordered Panic		
	<i>Eragrostis curvula</i>	African Love Grass	*	
	<i>Holcupanis lanatus</i>	Yorkshire Fog	*	
	<i>Hordeum leporinum</i>	Barley Grass	*	
	<i>Joycea pallida</i>	Silvertop Wallaby Grass		
	<i>Lolium perenne</i>	Perennial Rye Grass	*	
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass		
	<i>Nassella trichotoma</i>	Serrated Tussock	*	
	<i>Panicum effusum</i>	Hairy Panic		
	<i>Paspalum dilatatum</i>	Paspalum	*	
	<i>Themeda triandra</i>	Kangaroo Grass		
	<i>Lolium perenne</i>	Perennial Rye Grass	*	
	<i>Cynosurus echinatus</i>	Rough Dog's Tail	*	
	<i>Agrostis capillaris</i>	Browntop Bent	*	
	<i>Phalaris aquatica</i>	Phalaris	*	√
	<i>Phalaris minor</i>	Phalaris	*	
	<i>Phragmites australis</i>	Common Reed		√
	<i>Poa labillardieri</i> var. <i>labillardieri</i>	Poa Tussock		
	<i>Poa sieberiana</i>	Snowgrass		
	<i>Polypogon monspeliensis</i>	Annual Beardgrass	*	
	<i>Setaria verticillata</i>	Whorled Pigeon Grass	*	
	<i>Sporobolus creber</i>	Sporobolus	*	
	<i>Themeda australis</i>	Kangaroo Grass		
	<i>Vulpia bromoides</i>	Squirrel Tail Fescue	*	
Typhaceae	<i>Typha orientalis</i>	Broad leaved Cumbungi		√
(Dicotyledons)				
Amygdalaceae	<i>Prunus cerasifera</i>	Cherry Plum	*	
	<i>Prunus domestica</i> subsp. <i>insitita</i>	Damson Plum	*	

Family	Botanical name	Common name	Exotic Sp.	Riparian sp..
Apiaceae	<i>Centella asiatica</i>	Pennywort		
	<i>Hydrocotyle laxiflora.</i>	Stinking Pennywort		
Asteraceae	<i>Anthemis arvensis.</i>	Corn Chamomile	*	
	<i>Arctotheca calendula</i>	Capeweed	*	
	<i>Calotis anthemoides</i>	Cut-leaf Burr-daisy		
	<i>Carduus tenuiflorus</i>	Winged Slender thistle	*	
	<i>Carthamnus dentatus</i>	Toothed thistle	*	
	<i>Cassinia aculeata</i>	Dolly Bush		
	<i>Cassinia arcuata</i>	Sifton Bush		
	<i>Chrysocephalum apiculatum</i>	Common Everlasting		
	<i>Cirsium vulgare-</i>	Spear thistle	*	
	<i>Cymbonotus lawsonianus</i>	Bear's Ear		
	<i>Euchiton involucratus</i>	Star Cudweed		
	<i>Helichrysum scorpioides</i>	Button Everlasting		
	<i>Hypochoeris radicata</i>	Catsear	*	
	<i>Hypochoeris glabra</i>	Smooth Catsear	*	
	<i>Leptorhynchos squamatus</i> subsp. <i>squamatus</i>			
	<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>albicans</i>	Hoary Sunray		
	<i>Onopordum acanthium</i> subsp. <i>acanthium</i>	Scotch Thistle	*	
	<i>Scolymus hispanicus</i>	Golden Thistle	*	
	<i>Sonchus oleraceus</i>	Common Sowthistle	*	
	<i>Senecio madagascariensis</i>	Fireweed	*	
	<i>Triptilodiscus pygmaeus</i>	Common Sunray		
	<i>Vittadinia cuneata</i> var. <i>cuneata</i>	Fuzzweed		
Boraginaceae	<i>Echium plantagineum</i>	Paterson's Curse	*	
Brassicaceae	<i>Lepidium campestre</i>	Fieldcress	*	
	<i>Hirschfeldia incana</i>	Hairy Brassica	*	
	<i>Nasturtium officinale</i>	Watercress		√
Campanulaceae	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell		
	<i>Wahlenbergia multicaulis</i>	Tadgell's Bluebell		
Chenopodiaceae	<i>Einadia hastata</i> -	Berry Saltbush		
	<i>Einadia nutans</i>	Climbing saltbush		
	<i>Chenopodium album</i>	Fat hen	*	
Clusiaceae	<i>Hypericum gramineum</i>	Small St John's Wort		
	<i>Hypericum perforatum</i>	St John's Wort	*	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed		
	<i>Convolvulus arvensis</i>	Field Bindweed	*	
	<i>Convolvulus erubescens</i> -	Pink Bindweed		
Dilleniaceae	<i>Hibbertia obtusifolia</i>	Hoary Guinea-Flower		
Ericaceae (sensu. str.)	<i>Melichrus urceolatus</i>	Urn Heath		
	<i>Lissanthe strigosa</i> subsp.(?) <i>subulata</i>	Peach Heath		
	<i>Leucopogon virgatus</i> -	Whitebeard		

Family	Botanical name	Common name	Exotic Sp.	Riparian sp..
	<i>Brachyloma daphnoides</i> -	Daphne heath		
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed		
	<i>Euphorbia peplus</i>	Petty Spurge	*	
Fabaceae/Faboideae	<i>Trifolium campestre</i>	Hop Clover	*	
	<i>Trifolium arvense</i>	Haresfoot Clover	*	
	<i>Trifolium subterraneum</i> -	Subterranean Clover	*	
	<i>Indigofera australis</i>	Australian indigo		
	<i>Pultenaea subspicata</i>	Low Bush Pea		
	<i>Bossiaea buxifolia</i> -			
	<i>Desmodium varians</i>	Slender Tick-trefoil		
	<i>Glycine clandestina</i>	Twining Glycine		
	<i>Glycine tabacina</i>	Variable Glycine		
	<i>Hardenbergia violacea</i>	False Sarsparilla		
	<i>Hovea purpurea</i>			
	<i>Medicago polymorpha</i>	Burr Medic	*	
	<i>Platylobium formosum</i> subsp. <i>formosum</i>			
	<i>Vicia sativa</i>	Common vetch	*	
	<i>Zornia dyctiocarpa</i> var. <i>dyctiocarpa</i>	Zornia		
Fabaceae/Mimosoideae	<i>Acacia genistifolia</i>	Early Wattle		
	<i>Acacia dealbata</i> subsp. <i>dealbata</i>	Silver Wattle		
	<i>Acacia decurrens</i>	Black wattle		
	<i>Acacia falciformis</i>	Broad-leaved hickory		
	<i>Acacia melanoxylon</i>	Blackwood		√
	<i>Acacia rubida</i>	Red-stemmed wattle		
Geraniaceae	<i>Erodium cicutarium</i>	Common Crowfoot	*	
	<i>Geranium solanderi</i>	Native Geranium		
Gentianaceae	<i>Centaurium erythraea</i>	Common Centaury	*	
Geraniaceae	<i>Geranium solanderi</i>	Australian Cranesbill		
Goodeniaceae	<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	Ivy Goodenia		
Haloragaceae	<i>Gonocarpus tetragynus</i>	Common Raspwort		
	<i>Myriophyllum variifolium</i>			√
Lamiaceae	<i>Marrubium vulgare</i>	Horehound	*	
Loranthaceae	<i>Amyema miquelii</i>	Box Mistletoe		
Lythraceae	<i>Lythrum hyssopifolia</i>	Hyssop Loosestrife		
Malaceae	<i>Crataegus monogyna</i>	Hawthorn	*	
Menyanthaceae	<i>Nymphoides crenata</i>	Wavy Marshwort		√
Myrtaceae	<i>Eucalyptus melliodora</i>	Yellow Box		
	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum		
	<i>Eucalyptus bridgesiana</i>	Apple Box		
	<i>Eucalyptus mannifera</i> subsp. <i>mannifera</i>	Brittle Gum		
	<i>Eucalyptus dives</i>	Broad-leaved Peppermint		√
	<i>Eucalyptus macrorhyncha</i>	Red Stringybark		

Family	Botanical name	Common name	Exotic Sp.	Riparian sp..
	<i>Eucalyptus viminalis</i>	Ribbon Gum		√
	<i>Eucalyptus rubida</i>	Candlebark Gum		
	<i>Eucalyptus stellulata</i>	Black Sally		√
	<i>Eucalyptus pauciflora</i>	Snow Gum		√
	<i>Kunzea parvifolia</i>			√
	<i>Leptospermum obovatum</i>			√
Nymphaeaceae	<i>Nymphaea caerulea</i>	Cape Waterlily	*	√
Onagraceae	<i>Epilobium billardioreanum</i> subsp. <i>cinereum</i>	Willow Herb		
Oxalidaceae	<i>Oxalis articulata</i>		*	
	<i>Oxalis perennans</i>	Grassland Wood-sorrel		
Plantaginaceae	<i>Plantago debilis</i>	Shade Plantain		
	<i>Plantago lanceolata</i>	Plantain	*	
	<i>Plantago varia</i>	Variable Plantain		
Polygonaceae	<i>Acetosella vulgaris</i>	Sorrel	*	
	<i>Rumex brownii</i>	Swamp Dock		√
	<i>Rumex crispus</i>	Curled Dock	*	√
Primulaceae	<i>Anagallis arvensis</i>	Pimpernel	*	
	<i>Samolus valerandi</i>	Common Brookweed		√
Ranunculaceae	<i>Ranunculus lappaceus</i>	Common Buttercup		√
	<i>Ranunculus muricatus</i>	Sharp Buttercup	*	√
Rosaceae	<i>Geum urbanum</i>			
	<i>Rosa rubiginosa</i>	Briar Rose	*	
	<i>Rubus fruticosus</i>	Blackberry	*	
	<i>Acaena novae-zelandiae.</i>	Bidgee-widgee		
Rubiaceae	<i>Asperula conferta</i>	Common Woodruff		
	<i>Galium aparine</i>	Goosegrass	*	
	<i>Pomax umbellata</i>	Pomax		
Salicaceae	<i>Populus alba</i>	White Poplar	*	
	<i>Populus nigra</i> 'Italica'	Lombardy Poplar	*	
	<i>Salix babylonica.</i>	Weeping Willow	*	√
	<i>Salix caprea</i>	Goat Willow	*	√
	<i>Salix fragilis</i>	Crack Willow	*	√
	<i>Salix sepulcralis</i> var. <i>chrysoarpa</i>	Golden Willow	*	√
Scrophulariaceae	<i>Derwentia perfoliata</i>	Digger's Speedwell		
	<i>Verbascum thapsus</i>	Blanket Weed		
	<i>Veronica plebeia</i>	Trailing Speedwell		
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn	*	
	<i>Solanum brownii</i>	Violet Nightshade		
	<i>Solanum nigrum</i>	Blackberry Nightshade	*	
Verbenaceae	<i>Verbena officinalis</i>	Common Verbena	*	

Appendix 2

Monitoring Report Template

Creek Crossing Revegetation, Crookwell II

Revegetation and Bush Regeneration Works

2010 – 20XX

Prepared by XXX XXXX

By: XXXX

For: Crookwell Development Pty Ltd

Table of Contents

1.0 INTRODUCTION AND SUMMARY OF WORKS COMPLETED TO DATE

2.0 SITE DESCRIPTION

2.1 Location

2.2 Soils

2.3 Flora / Plant Communities

3.0 DESCRIPTION OF BUSH REGENERATION CONTRACT WORKS

3.1 Crossing 1

3.2 Crossing 2

3.3 Crossing 3

3.4 Crossing 4

3.4 Before / After Photographic Monitoring (every twelve months)

3.5 Compensatory Planting

4.0 CONCLUSIONS AND PERFORMANCE EVALUATION

5.0 RECOMMENDATIONS

5.0 APPENDICES

APPENDIX 1: Weed Density Map

APPENDIX 2: Contract Summary

APPENDIX 3: Planting Species List

APPENDIX 4: Native Species List

LIST OF PLATES

WORK SHEETS INDICATING ACTIVITIES UNDERTAKEN; TIME TAKEN; CHEMICALS USED AND DATE