

FINAL REPORT:

Ryan Corner Wind Farm Weed Management Plan

January 2010

Ecology Partners Pty Ltd

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Acknowledgments

Ecology Partners Pty. Ltd. thank the following people for their contribution in the project.

- Shaq Mohajerani (Union Fenosa) for project and study area information
-

The following Ecology Partners Pty. Ltd. employees either undertook the field assessments and/or contributed to the preparation of the final report:

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Project # 1610

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SUMMARY

Introduction

Ecology Partners Pty. Ltd. was commissioned by Ryan Corner Development Pty Ltd to undertake a Pre-Construction Weed survey and prepare a Weed Management Plan for the Ryan Corner Wind Farm.

This Weed Management Plan has been prepared in response to the requirements to the conditions of Planning Permit # 20060222 Section 13g, from the Victorian Minister for Planning.

Study Area

The Ryan Corner Wind Farm is located in south west Victoria, approximately 12 km northwest of Port Fairy. It covers an area of 3,600 ha and comprises 12 land holdings (ERM 2006). The study area is bound by private property to the north, Hamilton-Port Fairy Road to the east, Fingerboard Road to the south and Youls Road to the West, and is bisected by Riverside Road and Harris Road.

Methods

A weed survey was undertaken across the study area on 19, 20 and 21 October, 2009 to identify the type of weeds present; their current distribution, cover and abundance; and likelihood of threat to each property and surrounding areas.

The survey was primarily focused on the areas where wind turbines and access tracks are proposed for construction, as well as property access points. The majority of properties were traversed on foot, due to the nature of the terrain (i.e. rocky, inundated with water). Incidental records were also made where severe weed infestations were identified in other parts of the study area.

Results

In general, the study area has been subject to historical land uses (land clearing, grazing, cropping, fertilising) and consists of highly modified vegetation, dominated by exotic species either as improved pasture or agricultural crops. A total of 59 exotic weed species were recorded during the assessment, including 18 species listed as noxious under the *Catchment and Land Protection Act 1994*. The history of disturbance and surrounding agricultural land use, are key factors in facilitating weed invasion within the study area.

The survey identified eight key weed species with a high predicted threat level, based on the level of impact, invasiveness, distribution and rate of dispersal within the study area. The control and management of key weed species is considered a high priority.

Conclusion

Specific issues and mitigation measures relating to weed management have been detailed for each project phase (pre-construction, construction and post-construction).

A regular monitoring program will be undertaken for key weed species throughout the construction area for two years post-construction as part of an integrated pest management approach within the locality.

1 INTRODUCTION

1.1 Background

Ecology Partners Pty. Ltd. was commissioned by Ryan Corner Development Pty Ltd to undertake a pre-construction weed survey and prepare a Weed Management Plan (WMP) for the Ryan Corner Wind Farm.

This WMP has been prepared in response to the requirements to the conditions of Planning Permit # 20060222 Section 13g, from the Victorian Minister for Planning.

1.2 Study Area

The Ryan Corner Wind Farm (study area) is located in south west Victoria, approximately 12 km northwest of Port Fairy. It covers an area of 3,600 ha and comprises 12 land holdings (ERM 2006). The study area is bound by private property to the north, Hamilton-Port Fairy Road to the east, Fingerboard Road to the south and Youls Road to the West and is bisected by Riverside Road and Harris Road (Figure 1).

The majority of native vegetation throughout the study area has been cleared, with remnant vegetation generally restricted to roadside reserves. The main land use within the study area is agricultural (mostly grazing and cropping), and typically comprises areas of improved and unimproved pasture. The study area comprises mostly undulating topography with numerous stony rocky rises. A number of ephemeral creeklines and water-bodies are also present. The study area occurs within the Victorian Volcanic Plain Bioregion, the Glenelg Hopkins Catchment Management Authority and the Shire of Moyne.

1.3 Purpose

The purpose of this WMP is to:

- Identify environmental and noxious weeds within the study area and outline the relevant National and State legislative requirements for their control;
- Ensure that the activities of the project do not exacerbate existing weed impacts so as to cause economic or environmental impacts to landholders; and,
- Outline mitigation and monitoring measures to be implemented throughout each phase (pre-construction, construction and post-construction) of the project to prevent the increase of weed populations.

2 LEGISLATION AND GUIDELINES

2.1 Commonwealth and State Legislation

Relevant Commonwealth and State government legislation and policy regarding the control and spread of listed noxious weeds include:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- *Flora and Fauna Guarantee Act 1988* (FFG Act).
- *Catchment and Land Protection Act 1994* (CALP Act).
- Weeds of National Significance (WONS).

2.1.1 Environment Protection and Biodiversity Conservation Act

The Commonwealth EPBC Act deals with actions that have, or are likely to have, a significant impact on a matter of national environmental significance. There are currently no key threatening processes relevant to pest plants listed under the EPBC Act.

2.1.2 Flora and Fauna Guarantee Act

The FFG Act provides the listing of taxa and communities of flora and fauna which are threatened, and potentially threatening processes. The listed potentially threatening processes under the FFG Act that consider weed species and are relevant to the study area are:

- Invasion of native vegetation by Blackberry *Rubus fruticosus* L. agg.; and,
- Invasion of native vegetation by environmental weeds (DPI 2009).

2.1.3 Catchment and Land Protection Act 1994

The key legislation relating to the management of weeds in Victoria is the CALP Act which is administered by DSE. The CALP Act provides for the declaration of plants as noxious weeds if they have or have the potential to become a threat to primary production, the environment or community health in Victoria. This legislation places responsibility on land managers to control and prevent the spread of noxious weeds from their properties (DNRE 2002b).

Under the CALP Act, certain plants are declared as noxious weeds in Victoria. These are considered to either: cause environmental or economic harm; or have the potential to cause such harm. They can also present risks to human health. Current legislation requires that these species must be controlled or eradicated (DPI 2008).

There are four categories of noxious weeds defined under the Act, including:

- State Prohibited (S).
- Regionally Prohibited (P).
- Regionally Controlled (C).
- Restricted (R) (DPI, 2008).

State Prohibited Weeds: These weeds either do not occur in Victoria but pose a significant threat if they invade, or are present, pose a serious threat or can reasonably be expected to be eradicated. Under the CaLP Act landowners may be directed to prevent their growth and spread (DPI, 2008).

Regionally Prohibited Weeds: In general, Regionally Prohibited Weeds are not widely distributed in a region, but are capable of spreading further and they must be managed to eradicate them from the region. Land owners and managers, including public authorities responsible for the management of Crown lands, are responsible for control of these weeds on their lands (DPI 2008).

Regionally Controlled Weeds: These weeds are usually widespread and are considered critical in a particular region. Continuing control measures are required to prevent their spread. Land owners have the responsibility to take all reasonable steps to control and prevent the spread of these weeds on their land and the roadsides that adjoin their land (DPI 2008).

Restricted Weeds: This includes plants that pose an unacceptable risk of spreading in this State or to other parts of Australia, and are a serious threat to another State or Territory of Australia (DPI 2008).

It should be noted that all land managers/persons are required under the CALP Act to prevent the growth and spread of a Regionally Controlled weed for which they are responsible. Land managers that do not control Regionally Controlled weeds may be issued with a Land Management Notice or Directions Notice that requires specific control work to be undertaken. Failure to comply with the conditions of a notice may result in court action and fines or the issuing of an infringement notice and fine (DPI 2008).

There are no legal requirements to eradicate or control Restricted Weeds growing on land; however, Restricted Weeds cannot be traded, transported or spread in Victoria. Sections 70, 70A and 71 of the CALP Act for all declared noxious weeds, irrespective of category or Region, prohibits the:

- Movement from land on to a road of:
 - Vehicles and trailers used for carrying, moving or transporting hay, grain, fodder or livestock;
 - Vehicles used for carrying, moving or transporting machinery or equipment for road and utility building or maintenance;

- Machinery, implements or other equipment without first taking precautions to ensure the vehicle and equipment is free from noxious weed seeds and any other part of a noxious weed that is capable of growing (weed propagules).
- Removal or sale of soil, sand, gravel or stone which comes from land on which a noxious weed grows, or contains or is likely to contain any part of a noxious weed.
- Transport of a noxious weed or its propagules within Victoria.
- Deposition on land of a noxious weed or its seeds (DPI 2008).

2.1.4 Weeds of National Significance (WONS)

The National Weeds Strategy Executive Committee was established in 1997, which concluded that the greatest impact from weed problems within Australia was related to the effect and spread of specific individual species. On this basis, they developed a list of weeds of national significance (WONS). The determination of twenty Weeds of National Significance (WONS) is the first attempt to prioritise weeds over a range of land uses at the national level. WONS are those weeds, which have been identified as already causing significant environmental damage and must be eradicated (DPIF 2008; DEWHA 2009).

Four major criteria were used in determining WONS:

- the invasiveness of a weed species;
- a weed's impacts;
- the potential for spread of a weed; and
- socio-economic and environmental values (DEWHA 2009).

Individual landowners and managers are ultimately responsible for managing Weeds of National Significance (WONS), while the State government is responsible for overall legislation and administration (AWC 2008; DEWHA 2009).

2.2 Literature Review

The following documents have been reviewed in developing the WMP:

- Australian Weed Strategy – a national strategy for weed management in Australia. (DEWR 2007);
- Victorian Pest Management – A Framework for Action (DNRE 2002a);

- Victorian Pest Management – A Framework for Action: Weed Management Strategy (DNRE 2002b);
- Weed management in riparian zones: A guide for grazing properties in southwest Victoria (DPI 2004);
- Guidelines and Procedures for Managing the Environmental Impact of Weeds on Public Land in Victoria (DSE 2007); and,
- Advisory list of environmental weeds of coastal plains and heathy forests bioregions of Victoria (DSE 2008).

2.3 Definition of a Pest Plant

Under the CALP Act the definition of a pest plant or weed is:

“Pest” means exotic plants (excluding any that cannot be declared under the CALP Act) that threatens or has the potential to threaten the existence or well being of valued environmental, agricultural, social or personal resources or assets (DSE 2008).

For the purposes of this assessment weed species have been categorised in two broad classes: noxious weeds (regionally controlled and prohibited, and state prohibited weeds) and environmental weeds (overlap often occurs between these classes), which includes all other weeds and introduced pasture species. Note, during the assessment sown pasture species have not been referred to as environmental weeds.

Species listed as WONS or as defined under the CALP Act will be referred to throughout as ‘noxious’ weeds.

Environmental weeds are usually plants of garden, horticultural or agricultural origin and many are not recognised under environmental legislation. However, management of these species is still important, as they can out compete and displace indigenous plant species and alter fauna habitats. In some instances, plants that are of value in agricultural production systems can become major weed problems in native ecosystems. Environmental weeds may also represent a threat to agricultural production (also known as agricultural weeds). They can reduce the available area for agricultural use, interfere with agricultural practices and affect the quality of produce (NSW DPI 2005).

3 METHODS

3.1 Desktop Assessment

A desktop assessment of the Flora Information System database (FIS 2007) was undertaken to identify the weed species known to occur on and within 10 km of study area. The search identified 136 exotic species, including several species listed under the CALP Act (Appendix 1).

3.2 Survey Method

A weed survey was undertaken across the study area on 19, 20 and 21 October, 2009 to identify the type of weeds present; their current distribution, cover and abundance; and likelihood of threat to each property and surrounding areas.

The survey focused on the areas where wind turbines and access tracks are proposed for construction, as well as property access points. The majority of properties were traversed on foot, due to the nature of the terrain (i.e. rocky, inundated with water). Incidental records were also made where severe weed infestations were identified in other parts of the study area. Point locations of weed infestations were recorded using hand-held GPS (accuracy ± 5 m).

In order to identify the cover and abundance of each weed infestation, a visual assessment of density was undertaken. A visual assessment is the simplest way to determine weed density, and although this method can be subjective, it is considered appropriate for the requirements this report. Weed density, as a percentage of ground cover, is the proportion of the area covered by each weed species (Figure 1). This approach was applied to weeds found within study area.

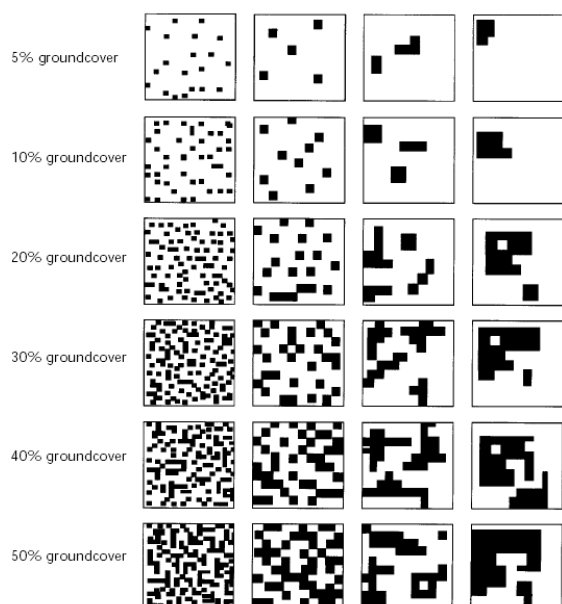


Figure 1: Weed Densities Expressed as a Percentage of Ground Cover (Source: Weeds CRC 2004).

4 WEED ASSESSMENT

4.1 Field Assessment

In general, the study area has been subject to historical land uses (land clearing, grazing, cropping, fertilising) and consists of predominantly introduced vegetation, dominated by exotic species as improved pasture or agricultural crops. The history of disturbance and surrounding agricultural land use, are key factors in facilitating weed invasion within the study area. The majority of native vegetation within the study area has been removed, and is restricted to roadside reserves.

The majority of sites within the study where wind turbines are proposed for construction occur in areas of improved pasture, which typically contain sown pasture species such as Perennial Ryegrass *Lolium perenne* and Sub Clover *Trifolium sp.* In general, fewer key weed species were recorded in areas of improved pasture, which may be due to constant grazing by livestock and weed control by landowners. Areas of unimproved pasture generally contained a sparse cover of Perennial Ryegrass and Sub Clover, with a high component of common environmental weeds such as Onion Grass *Romulea rosea*, Cape Weed *Arctotheca calendula* and Ribwort *Plantago lanceolata*.

Roadsides adjacent to each property and along Harris/Riverside road were found to contain an extensive number of environmental weed species, and some noxious weed species. This is not unexpected as many of these areas are prone to disturbance. Common species included environmental weeds such as Toowoomba Canary Grass *Phalaris aquatica*, Wild Oat *Avena fatua*, Panic Veldgrass *Ehrharta erecta*, Slender Pigeon Grass *Setaria parviflora*, Yorkshire Fog-grass *Holcus lanatus* and Harlequin Flower *Sparaxis sp.*

A total of 59 exotic species were recorded during the assessment, including 18 species listed as noxious under the CALP Act (Table 1 and Appendix 1). The predicted threat level in Table 1 is based on the level of impact, invasiveness, distribution and rate of dispersal within the study area (DSE 2008). The results of the assessment for individual properties are outlined in Table 2.

Table 1: Weed Species Recorded during the Field Assessment

Scientific Name	Common Name	Classification (GHCMA)	Predicted Threat Level
<i>Aira caryophyllea</i>	Silvery Hair-grass	E	L
<i>Agrostis capillaris</i>	Brown-top Bent	E	M
<i>Anagallis arvensis</i>	Pimpernel	E	L
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	E	M
<i>Arctotheca calendula</i>	Cape Weed	E	M
<i>Avena barbata</i>	Wild Oat	E	M
<i>Briza maxima</i>	Large Quaking-grass	E	M
<i>Briza minor</i>	Lesser Quaking-grass	E	L
<i>Bromus catharticus</i>	Prairie Grass	E	L
<i>Bromus diandrus</i>	Great Brome	E	L

Scientific Name	Common Name	Classification (GHCMA)	Predicted Threat Level
<i>Carduus tenuiflorus</i>	Winged Slender-thistle	R	H
<i>Carthamus lanatus</i>	Saffron Thistle	R	M
<i>Centaurea erythraea</i>	Common Centaury	E	L
<i>Chenopodium murale</i>	Sowbane	E	L
<i>Cirsium arvense</i>	Perennial Thistle	C	M
<i>Cirsium vulgare</i>	Spear Thistle	R	H
<i>Conium maculatum</i>	Hemlock	R	M
<i>Coprosma repens</i>	Mirror Bush	E	L
<i>Crataegus monogyna</i>	Hawthorn	R	L
<i>Cupressus macrocarpa</i>	Monterey Cypress	E	L
<i>Cynodon dactylon</i>	Couch	E	L
<i>Cynosurus echinatus</i>	Rough Dogtail	E	L
<i>Dactylis glomerata</i>	Cocksfoot	E	M
<i>Echium plantagineum</i>	Paterson's Curse	C	M
<i>Ehrharta erecta</i>	Panic Veldt-grass	E	L
<i>Ehrharta longifolia</i>	Annual Veldt-grass	E	L
<i>Foeniculum vulgare</i>	Fennel	R	L
<i>Genista monspessulana</i>	Montpellier Broom	R	M
<i>Holcus lanatus</i>	Yorkshire Fog-grass	E	L
<i>Hyperchoeris radicata</i>	Flatweed	E	L
<i>Lolium perenne</i>	Perennial Ryegrass	E	M
<i>Lycium ferocissimum</i>	African Boxthorn	C	H
<i>Malva nicaeensis</i>	Mallow of Nice	E	L
<i>Marrubium vulgare</i>	Horehound	C	L
<i>Medicago polymorpha</i>	Burr Medic	E	L
<i>Nasturtium officinale</i>	Watercress	E	L
<i>Onopordum acanthium</i>	Scotch Thistle	C	H
<i>Oxalis pes-caprae</i>	Soursob	R	L
<i>Paspalum dilatatum</i>	Paspalum	E	M
<i>Plantago lanceolata</i>	Ribwort	E	M
<i>Plantago major</i>	Greater Plantain	E	L
<i>Pennisetum clandestinum</i>	Kikuyu	E	L
<i>Poa annua</i>	Annual Meadow-grass	E	L
<i>Polypogon monspeliensis</i>	Annual Beard-grass	E	M
<i>Pinus radiata</i>	Radiata Pine	E	M
<i>Phalaris aquatica</i>	Toowoomba Canary Grass	E	M
<i>Romulea rosea</i>	Onion Grass	E	M
<i>Rosa rubiginosa</i>	Sweet Briar	C	H
<i>Rubus fruticosus</i> agg.	Blackberry	C #	M
<i>Rumex crispus</i>	Curled Dock	E	L
<i>Setaria parviflora</i>	Slender Pigeon Grass	E	L
<i>Silybum marianum</i>	Variegated Thistle	R	H
<i>Solanum linnaeanum</i>	Apple of Sodom	R	H
<i>Sonchus asper</i>	Rough Sow-thistle	E	L
<i>Sparaxis</i> sp.	Harlequin Flower	E	M
<i>Sporobolus africanus</i>	Rat-tail Grass	E	L
<i>Trifolium angustifolium</i>	Narrow-leaf Clover	E	L
<i>Ulex europaeus</i>	Gorse	C #	H
<i>Vulpia bromoides</i>	Squirrel-tail Fescue	E	M

Notes: Threat classification defined by DPI (2008). Predicted threat level determined by current abundance and distribution within the study area. Classification (S = State Prohibited, P = Regionally Prohibited, C = Regionally Controlled, R = Restricted, all Noxious Weeds) and E = Environmental Weed, # = Weed of National Significance. Predicted threat level; H = High, M = Moderate, L = Low.

Table 2: Survey Results at Individual Properties

Property	Property Description	Environmental Weeds Present	Noxious Weeds Present*
Dumseny	Mostly unimproved pasture. Large weed infestations towards Riverside road	Wild Oat, Toowoomba Canary-grass, Cape Weed, Onion Grass, Brown-top Bent, Annual Veldt-grass, Paspalum, Ribwort	Blackberry, Paterson's Curse, Winged Slender-thistle, Variegated Thistle, Spear Thistle, African Boxthorn
Dumseny (Harlock)	Mostly unimproved pasture. Several areas impacted by weeds	Wild Oat, Toowoomba Canary-grass, Cape Weed, Onion Grass, Brown-top Bent, Annual Veldt-grass, Paspalum, Ribwort	Winged Slender-thistle, Variegated Thistle, Blackberry,
McDonald (Hogan)	Mostly unimproved pasture. Several areas impacted by weeds	Sweet Vernal-grass, Wild Oat, Prairie Grass, Great Brome, Soft Brome, Yorkshire Fog, Cocksfoot, Toowoomba Canary-grass, Paspalum, Onion Grass	Scotch Thistle, Winged Slender-thistle, Spear Thistle, Variegated Thistle, Sweet Briar, African Boxthorn, Blackberry, Apple of Sodom
McNamara	Mostly unimproved pasture. Several areas impacted by weeds	Wild Oat, Prairie Grass, Great Brome, Annual Veldt-grass, Paspalum, Onion Grass, Squirrel-tail Fescue, Radiata Pine,	Winged Slender-thistle, Spear Thistle, Variegated Thistle, Sweet Briar
Moore	Mostly unimproved pasture. Several areas impacted by weeds	Wild Oat, Great Brome, Cocksfoot, Yorkshire Fog, Toowoomba Canary-grass, Cape Weed, Onion Grass	Winged Slender-thistle, Variegated Thistle, Spear Thistle, Blackberry, African Boxthorn, Sweet Briar, Apple of Sodom, Gorse
Homan	Mostly unimproved pasture. Several areas impacted by weeds	Wild Oat, Toowoomba Canary-grass, Cape Weed, Onion Grass, Brown-top Bent, Annual Veldt-grass, Paspalum, Ribwort	Winged Slender-thistle, Variegated Thistle, African Boxthorn, Apple of Sodom
Wright	Improved pasture towards Youls road	Wild Oat, Toowoomba Canary-grass, Cape Weed, Onion Grass, Brown-top Bent, Annual Veldt-grass, Paspalum, Ribwort	Winged Slender-thistle, Variegated Thistle, Spear Thistle, African Boxthorn, Gorse
Hocking	Improved pasture towards Youls road	Wild Oat, Great Brome, Cocksfoot, Yorkshire Fog, Toowoomba Canary-grass, Cape Weed, Onion Grass	Winged Slender-thistle, Variegated Thistle, Spear Thistle, African Boxthorn
Forest	Improved pasture	Wild Oat, Toowoomba Canary-grass, Cape	Winged Slender-thistle, Variegated Thistle,

Property	Property Description	Environmental Weeds Present	Noxious Weeds Present*
		Weed, Onion Grass, Brown-top Bent, Annual Veldt-grass, Paspalum, Ribwort	Spear Thistle
Winter	Improved pasture towards Youls road; unimproved pasture and rocky areas towards Riverside road	Wild Oat, Toowoomba Canary-grass, Cape Weed, Onion Grass, Brown-top Bent, Annual Veldt-grass, Paspalum, Ribwort	Winged Slender-thistle, Variegated Thistle, Spear Thistle, Blackberry, African Boxthorn, Sweet Briar
Youl	Improved pasture towards Youls road. Unimproved pasture and rocky areas towards Riverside road	Wild Oat, Great Brome, Cocksfoot, Yorkshire Fog, Toowoomba Canary-grass, Cape Weed, Onion Grass	Winged Slender-thistle, Variegated Thistle, Spear Thistle, African Boxthorn, Sweet Briar, Gorse
Porter	Improved pasture towards Youls road. Unimproved pasture and rocky areas towards Riverside road	Wild Oat, Toowoomba Canary-grass, Cape Weed, Onion Grass, Brown-top Bent, Annual Veldt-grass, Paspalum, Ribwort	Winged Slender-thistle, Variegated Thistle, Sweet Briar

*Includes roadsides adjacent to the property

4.2 Key Weed Species

The survey identified a number of key weed species with a high predicted threat level, based on the level of impact, invasiveness, distribution and rate of dispersal within the study area. The following key weed species is considered a high priority for control (see Table 4 for Action Plan for key weed species):

- Gorse *Ulex europaeus* (C; WONS);
- African Boxthorn *Lycium ferocissimum* (C);
- Sweet Briar *Rosa rubiginosa* (C);
- Apple of Sodom *Solanum linnaeanum* (R);
- Variegated Thistle *Silybum marianum* (R);
- Spear Thistle *Cirsium vulgare* (R);
- Winged Slender Thistle *Carduus tenuiflorus* (R); and,
- Blackberry *Rubus fruticosus* (C; WONS).

The approximate location of key weed species on each property is shown in Figure 2.

4.2.1 Environmental Weeds

A number of environmental weeds were recorded during the survey. Many of these species are common in unimproved pasture or degraded areas, such as: Sweet Vernal Grass *Anthoxanthum odoratum*, Great Brome *Bromus diandrus*, Rough Dogstail *Cynosurus echinatus*, Yorkshire Fog and Onion Grass. Cape Weed was found to be the most highly abundant environmental weed within unimproved pasture and was recorded at the majority of turbine locations (see Figure 3). However, Cape Weed is also widely distributed throughout the study area, and while it provides competition with common pasture species, control is usually not considered necessary.

The majority of landowners were contacted during the survey to discuss weed issues relevant to their property. Landowners reported many of the key weed species present on their property; and although the majority of these species were being managed, several species (particularly Variegated Thistle, Apple of Sodom and Winged Slender Thistle) remain highly abundant and problematic within parts of the study area. The surrounding agricultural landscape provides ideal conditions for key weeds to proliferate, therefore on-going control on and off the study area will be required for the foreseeable future. Complete eradication for many of these species (i.e. Variegated Thistle) is considered unlikely due the large area of suitable habitat and difficulty of control.

Although this WMP does not directly address the remaining weed species identified in Table 1, general mitigation measures are provided in Section 5 to avoid or reduce the likelihood of other weeds becoming a threat to study area values post construction.

4.3 Study Area Values

The study area contains a number of environmental and agricultural values that need to be protected from the direct (i.e. loss of productivity) or indirect impacts (i.e. loss of fauna habitat) of weeds.

4.3.1 Environmental Values

While the majority of the study area has been modified by agricultural landuse, several areas contain important environmental values. These values include stony rocky knolls, rocky ridges, ephemeral wetlands and creeklines, remnant grassland and grassy wetland, and scattered indigenous trees.

A desktop assessment undertaken by ERM (2006) found that nine flora species listed under the EPBC Act and seven flora species listed under the FFG Act may occur on, or within the vicinity of the study area. Also 21 bird species, six mammal species, two fish species, three reptile species and three frog species classified as rare or threatened may occur on, or within the vicinity of the study area. Of the 35 threatened species, 17 are listed on the EPBC Act and 20 are listed under the FFG Act (ERM 2006).

Two threatened species was recorded during the survey alongside Riverside Road (Figure 4):

- Clover Glycine *Glycine latrobeana* listed as Vulnerable under the EPBC Act and Threatened under the FFG Act; and,
- Golden Cowslips *Diuris behrii* listed as Vulnerable in Victoria (DSE 2005).

No threatened fauna species were recorded during the current survey.

The majority of native vegetation has been cleared from the study area and is restricted to roadside reserves adjacent to each property (Figure 3). Ecological Vegetation Class (EVC) communities previously identified on the study area include Stony Knoll Shrubland (EVC 649); Aquatic Herbland (EVC 653); and Plains Grassy Woodland (EVC 55_61) (ERM 2006).

Potential impacts from weeds to environmental values include:

- Alteration of ecological processes and prevention of regeneration of native species;
- Modification of native fauna habitat; and,
- Loss of threatened flora species through competition.

4.3.2 Agricultural Values

The main land use within the study area is agricultural, which includes livestock grazing, crops and improved and unimproved pasture. Areas of improved pasture mostly comprise Perennial Ryegrass *Lolium perenne* and Clover *Trifolium* sp., whereas unimproved pasture contains a higher component of common environmental weeds such as Sweet Vernal Grass and Cape Weed, as well as noxious weeds including Variegated Thistle, African Boxthorn, Gorse and Apple of Sodom.

Potential impacts from weeds to agricultural values include:

- Invasive noxious weeds (i.e. African Boxthorn) creating harbour for rabbits;
- Loss of productivity (i.e. Variegated Thistle) in improved pasture; and,
- Contamination of crops.

5 WEED MANAGEMENT AND MITIGATION MEASURES

5.1 Overview

Specific issues and mitigation measures relating to weed management have been detailed for each project phase (pre-construction, construction and post-construction). Mitigation measures should be incorporated into the site Construction Environment Management Plan.

Mitigation measures have been developed to comply with regulations outlined in the CALP Act for noxious weeds; and the FFG Act for environmental weeds (see Table 4 for Action Plan for key weed species). Proper implementation of mitigation measures for weed control will enable compliance with responsibilities under the CALP Act.

5.2 Pre-Construction

5.2.1 Threats

One of the main concerns associated with pre-construction activities is the further spread of existing weeds or the introduction of new weed species into the area. Weeds can potentially be spread between sites via contaminated machinery, vehicles, equipment, clothing, footwear and other sources. The implementation of personnel, vehicle and equipment hygiene procedures are critical to minimising the spread and/or introduction of noxious and environmental weeds onto the construction area.

Appropriate weed hygiene measures will need to be implemented to minimise the risk of the further spread and introduction of weeds. Where appropriate, weed hygiene measures must be followed by all construction personnel, vehicles and equipment entering the construction area during the pre-construction phase.

5.2.2 Mitigation Measures

Mitigation measures identified during the pre-construction phase include:

- Any noxious weeds within the construction area will be controlled by a licensed contractor, and as directed by a site environmental officer, any environmental weeds, within the construction area will also be controlled by a licensed contractor,
- Vehicle access points will be established at entry points to the construction zone, and all vehicles accessing the construction site will enter and exit only through the recognised access points,
- Prior to entering the construction area all personnel will complete weed management inductions and will check personnel clothing and footwear daily,

- A wash down area will be established on site for vehicles entering the site for the first time or that requires periodic cleaning, and will be maintained to prevent the further spread of noxious and environmental weeds.
- The cleaning process will include physical removal of soil and organic matter from underneath vehicles, in the cabin and/or load trays. Where required, removal of excess material by high pressure air or water spray jets may be necessary.

5.3 Construction

5.3.1 Threats

During construction weeds have the potential to germinate within the study area, such as around infrastructure, fencing, soil stockpiles, disturbed areas, etc. In order to minimise the germination of weeds (particularly noxious weeds) within the study area during construction, on-going weed control works will be maintained.

Further, any topsoil excavated during construction will be carefully managed and replaced after construction. Any topsoil stockpiled will be stored for the shortest possible time to minimise the risk of weed establishment. The movement of topsoil and machinery between different properties along the alignment will be avoided wherever possible. Any imported topsoil or bedding material should be certified free of weeds. .

Treatment options following the placement of stockpiled soil or any imported soil material should endeavour to re-establish pasture cover as soon as possible, where appropriate, which will minimise the potential for the establishment of weed species.

5.3.2 Mitigation Measures

Mitigation measures identified during the construction phase include:

- Disturbed areas will be sown as soon as practicable to minimise the area of exposed soil as potential for weed establishment and spread.
- Imported topsoil and bedding material will be certified free of weeds (where possible).
- Vehicles will enter and leave the site via defined entry points and use constructed roads to minimise on site damage and the potential for weed spread.
- Prior to entering the construction area all personnel will complete weed management inductions and will check personnel clothing and footwear daily.
- A wash down area will be established on site for vehicles entering the site for the first time or that requires periodic cleaning, and will be maintained to prevent the further spread of noxious and environmental weeds.

- The cleaning process will include physical removal of soil and organic matter from underneath vehicles, in the cabin and/or load trays. Where required, removal of excess material by high pressure air or water spray jets may be necessary.

5.4 Post Construction

5.4.1 Threats

The threat of weeds being introduced and/or spread within the construction area remains into the post-construction phase. This threat is particularly evident in the first year following reinstatement, when weeds have a greater likelihood of colonising or emerging from disturbed areas.

Actions will be undertaken after the construction phase to minimise the risk of noxious and environmental weeds spreading from an existing site or being introduced to the construction area.

5.4.2 Mitigation Measures

Mitigation measures identified during the post-construction phase include:

- The construction and adjacent areas (including access points) will be monitored four times in the first year (early spring, late spring, summer, autumn), and bi-annually (mid-late spring, mid-late summer) the following two years to identify any new outbreaks of noxious and environmental weeds.
- Monitoring will be undertaken by a licensed weed contractor, but during spring in the first and second years, the licensed weed contractor will be accompanied by an ecologist/botanist to assess the impact of weeds on environmental/agricultural values.
- A weed monitoring proforma will be completed following each monitoring assessment, and summarised at the end of each year in a progress report. The proforma will include categories such as weed species; location; weed distribution and cover; and recommended control measures).
- At the completion of the two year post-construction period, a weed audit will be undertaken comparing the results of the current assessment, with the results after the two year post-construction period, with references made to the weed control/eradication techniques employed during that period.

5.5 Summary of Mitigation Measures

Mitigation measures to be implemented throughout the site are summarised in Table 3.

Table 3: Summary of Mitigation Measures

Phase	Mitigation Measure	Action	Location	Responsibility
Pre-construction	Control of significant weed infestations	Any noxious weeds and at the direction of the site environmental officer, environmental weeds within the construction area will be controlled by a licensed contractor	Areas impacted by construction activities	Site/Project Environmental Officer
Pre-construction	Vehicle and equipment hygiene	Vehicle access points will be established at entry points to the construction zone, and all vehicles accessing the construction site will enter and exit only through the recognised access points	Vehicle access points	Site/Project Environmental Officer
Pre-construction	Personnel equipment hygiene	Prior to entering the construction area all personnel will complete weed management inductions and will check personnel clothing and footwear daily,	Access Points	Site/Project Environmental Officer
Pre-construction	Vehicle and equipment hygiene	A vehicle wash down area will be established on site for vehicles entering the site for the first time and for periodic cleaning, and will be maintained to prevent the further spread of noxious and environmental weeds	On site, away from water points	Site/Project Environmental Officer
Pre-Construction	Vehicle and equipment hygiene	The cleaning process will include physical removal of soil and organic matter from underneath vehicles, in the cabin and/or load trays. Where required, removal of excess material by high pressure air or water spray jets may be necessary	Designated vehicle wash down area	Site/Project Environmental Officer
Construction	Control of significant weed infestations	Any noxious weeds and at the direction of the site environmental officer, environmental weeds within the construction area will be controlled by a licensed contractor	Areas impacted by construction activities	Site/Project Environmental Officer
Construction	Topsoil management	Disturbed areas will be revegetated as soon as practicable to minimise the area of exposed soil as potential for weed establishment and spread	All areas directly impacted by construction activities	Site/Project Environmental Officer
Construction	Topsoil management	Imported topsoil and bedding material will be certified free of weeds (where possible)	All areas directly impacted by construction activities	Site/Project Environmental Officer
Construction	Weed management	Vehicles will enter and leave the site via defined entry points and use constructed roads to minimise on site damage and the potential for weed spread	Defined entry points	Site/Project Environmental Officer
Construction	Personnel equipment hygiene	Prior to entering the construction area all personnel will complete weed management inductions and will check personnel clothing and footwear daily,	Access Points	Site/Project Environmental Officer

Phase	Mitigation Measure	Action	Location	Responsibility
Construction	Vehicle and equipment hygiene	A vehicle wash down area will be established on site for vehicles entering the site for the first time and for periodic cleaning, and will be maintained to prevent the further spread of noxious and environmental weeds	On study area, away from water points	Site/Project Environmental Officer
Construction	Vehicle and equipment hygiene	The cleaning process will include physical removal of soil and organic matter from underneath vehicles, in the cabin and/or load trays. Where required, removal of excess material by high pressure air or water spray jets may be necessary	Designated vehicle wash down area	Site/Project Environmental Officer
Post-construction	Periodic weed monitoring	Construction areas and access points will be monitored four times annually (early spring, late spring, summer, autumn) for two years	Defined entry points and areas directly impacted by construction activities	Weed contractor
Post-construction	General weed management	Monitoring and control will be undertaken by a licensed weed contractor but during spring in the first and second years, the licensed weed contractor will be accompanied by an ecologist/botanist to assess the impact of weeds on environmental/agricultural values.	Defined entry points and areas directly impacted by construction activities	Botanist / Weed contractor
Post-construction	Weed monitoring	A weed monitoring proforma will be completed following each monitoring assessment	Defined entry points and areas directly impacted by construction activities	Weed contractor
Post-construction	Weed monitoring	At the completion of the two year post-construction period, a weed audit will be undertaken comparing the results of the current assessment, with the results after the two year post-construction period, with references made to the weed control/eradication techniques employed during that period.	Defined entry points and areas directly impacted by construction activities	Botanist

5.6 Performance Indicators

Key performance indicators for weed management include:

- Meeting the requirements of the CALP Act in relation to control of listed noxious weeds within the study area;
- Achieving control and eradication of key (noxious) weed species within the construction phases (for the duration of the project);
- No net increase in the cover of environmental weeds; and,
- Minimise impacts to native flora and fauna.

5.7 Monitoring and Reporting

A regular monitoring program will be undertaken for weeds throughout the construction area for two years post-construction, using the standard proforma. Monitoring of the area for the presence of existing key weeds as well as any new outbreaks of other weeds will be undertaken four times annually (early spring, late spring, summer, autumn) for two years, as part of an integrated weed management approach within the study area. During spring in the first and second years, the licensed weed contractor undertaking the monitoring will be accompanied by an ecologist/botanist to assess the impact of weeds on environmental/agricultural values.

Important stakeholders in managing weeds include: DPI, DSE, Parks Victoria, GHCMA, Landcare, local government and private landholders (DNRE 2002b), and these will be consulted where appropriate.

Monitoring across the study area should include:

- Photographs taken from the same place during each monitoring period;
- A record of the distribution and abundance of key weeds using GIS mapping; and,
- Details on the effectiveness of weed control.

Monitoring and reporting of weed management within the standard proformas will also follow established processes such as bioregional planning to ensure that relevant information is recorded on appropriate monitoring systems, including the Integrated Pest Management System and the Environmental Information System of Parks Victoria (DNRE 2002b).

The results of the weed monitoring proformas will be recorded in a progress report after the first and second years, in order to compare different approaches to weed management, increase efficiency and maximise the removal and control of infestations.

At the completion of the two year post-construction period, a weed audit will be undertaken by an ecologist/botanist, comparing the results of the current assessment, with the results after the two year post-construction period, with references made to the weed control/eradication techniques employed during that period.

6 ACTION PLAN

6.1 Objectives

The WMP is designed to:

- Prevent the spread of noxious weeds and environmental weeds;
- Eradicate or control any noxious weeds and environmental weeds that may establish during or after the soil disturbance associated with construction activities; and,
- To ensure that the study area is returned to a similar or better state in regards to weeds, after the two year post construction period.

6.2 Action Plan for Weed Control

6.2.1 Pre Construction

Any noxious weeds within the construction area will be controlled by a licensed contractor, and as directed by a site environmental officer, any environmental weeds, within the construction area will also be controlled by a licensed contractor,

6.2.2 Construction

During construction weeds have the potential to germinate within the study area, such as around infrastructure, fencing, soil stockpiles, open areas, disturbed areas, etc. In order to minimise the germination of weeds, particularly noxious weeds, within the study area during construction, on-going weed control works will be maintained. Weed control works will be undertaken four times annually (early spring, late spring, summer, autumn).

6.2.3 Post Construction

Weed control works will be undertaken four times annually (early spring, late spring, summer, autumn) for two years at the same time as the weed monitoring to identify any additional outbreaks of weeds.

6.3 Management Approaches

Depending on the type of weed being controlled on the site, the main approach to management will either be eradication or containment (Weeds CRC 2004).

Eradication of certain weeds may not be realistic due to the nature of the weed itself (i.e. highly dispersive) or the level of infestation (predominant throughout the landscape). Eradication may be achieved where:

- the weed occupies only a small area and will not reinvade from adjoining areas;
- the infested area is known and at low density;
- the control method used kills all plants before maturity; and
- the weed seed does not remain dormant on the soil, or the infestation is detected before seeds are released (Weeds CRC 2004).

Containment of weed species is likely to be a more realistic management approach when dealing with widespread, well established species (such as the key weed species identified on the study area). Containment is aimed at reducing new weed infestations and the need for future control by limiting the extent and intensity of infestations. The key to containment is to focus on treating isolated infestations, rather than core infestations, with the objective of preventing weed populations extending beyond the perimeter of the core infestation (Weeds CRC 2004).

6.4 General Weed Control Information

Weed control will primarily target key noxious weeds and focus on areas of high weed abundance by commencing weed control from the edge of the population, converging towards the centre of the population. Spring and summer are appropriate seasons to target many weeds as they are actively growing in this period and herbicide application is more effective, but autumn is also considered an appropriate time to control some weeds (Muyt 2001).

It is important that realistic timeframes for weed control works are implemented in order to apply a definite structure to weed management within the study area. It is advised that timeframes are set on a property-by-property basis, based on the priority for management. An action plan for control of key weed species is shown in Table 4.

Weed control contractors will make appropriate decisions on which technique to use based on individual situations. Contractors will also need to be aware of the potential for new outbreaks of weed species not recorded in this survey and implement necessary weed control techniques. It is likely that several control methods will need to be employed, including: spraying, physical removal, hand pulling, and cutting and painting. Different weed control techniques are outlined in Appendix 2 and pictures of the key weeds are presented in Appendix 3.

Table 4: Action Plan for Key Weed Species

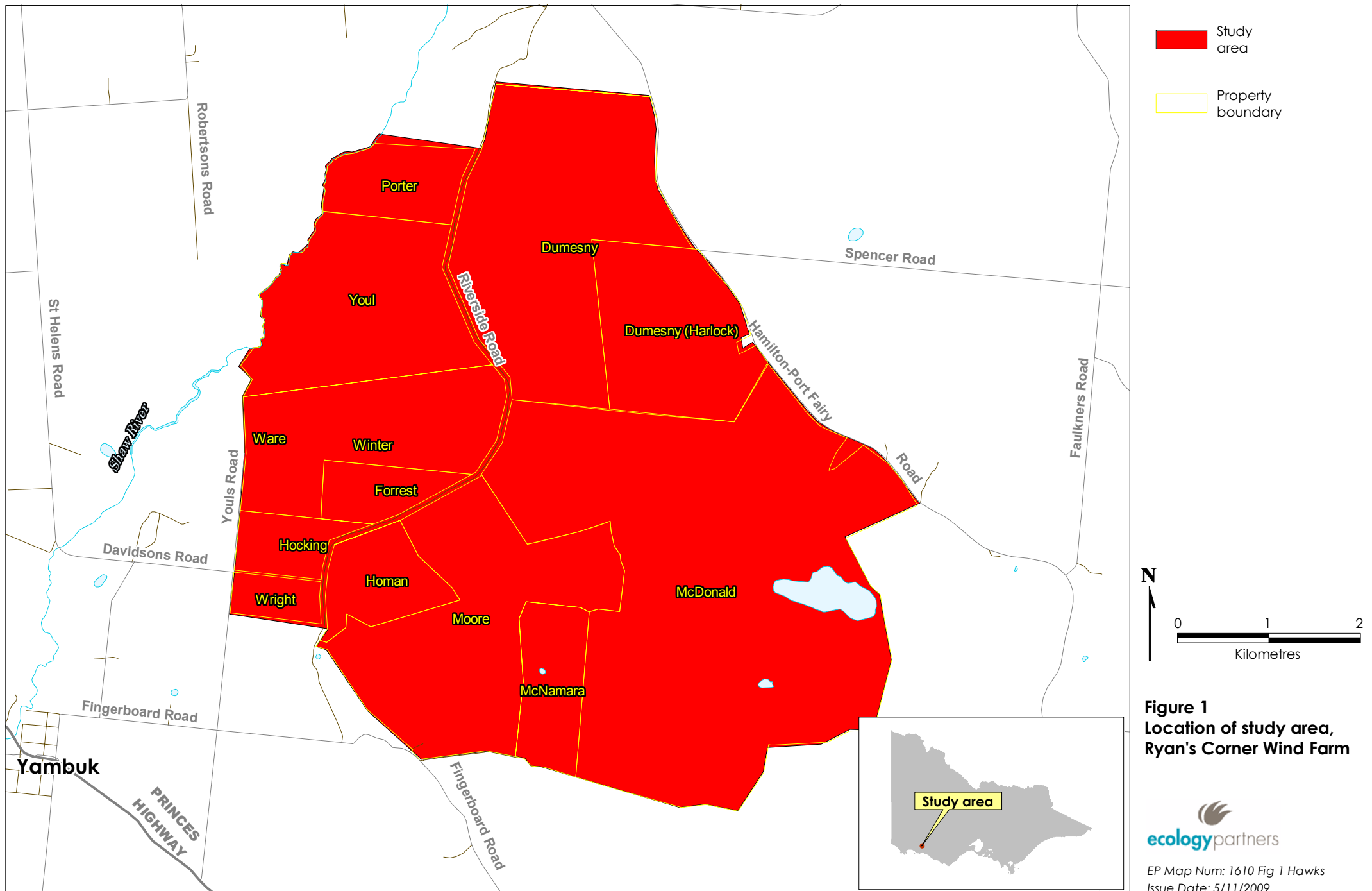
Common Name	Aim	Work Plan	Property*	Timing	Control Method	Comments
African Boxthorn	Eradicate from construction area within 2 years	Remove small and scattered plants first and then target outer edges of larger infestations. Mulch sites, where feasible, to reduce seedling regrowth. Monitor sites regularly for regrowth or new seedlings	Youl, Winter, Dumesny (Harlock), Wright, Hocking, Homan, Moore, McDonald	Best removed before main fruiting time (March-May)	MR, CP & SS	Dig out whole crown of small plants. Large plants by cut-stump herbicide. Larger-scale: basal bark or foliar herbicide treatment. Boxthorn has a deep extensive root system. Burn dead Boxthorn as it takes a long time to break down and continues to provide safe harbour for rabbits
Sweet Briar	Eradicate from construction area within 2 years	Lightly infested areas should be treated as a priority to minimise further spread and heavily infested areas should be tackled progressively	Moore, McDonald, Youl, Dumesny (Harlock), Winter	Late Spring – Early Autumn	CP & SS	Dig out whole crown of small plants. Large plants by cut-stump herbicide. Larger-scale: basal bark or foliar herbicide treatment
Apple of Sodom	Contain by removing all new plants within 2 years	Remove small and scattered plants first and then target outer edges of larger infestations	Homan, Moore, McDonald, Dumesny (Harlock)	Flowering to fruiting spring to summer	CP	Dig out whole crown of small plants. Large plants by cut-stump herbicide. Larger-scale: basal bark or foliar herbicide treatment
Gorse	Contain by removing all new plants within 2 years	Tackle the small, outlying infestations first. This allows a bigger area of land to be cleaned up first and there will be less	Youl, Winter, Wright, Moore, McDonald	All Year	MR, CP & SS	Do not apply sprays when plants are in full flower or when bees are active. Small-scale: dig out plants or slash frequently to weaken them. Larger scale: slash or burn then use grazing or herbicide

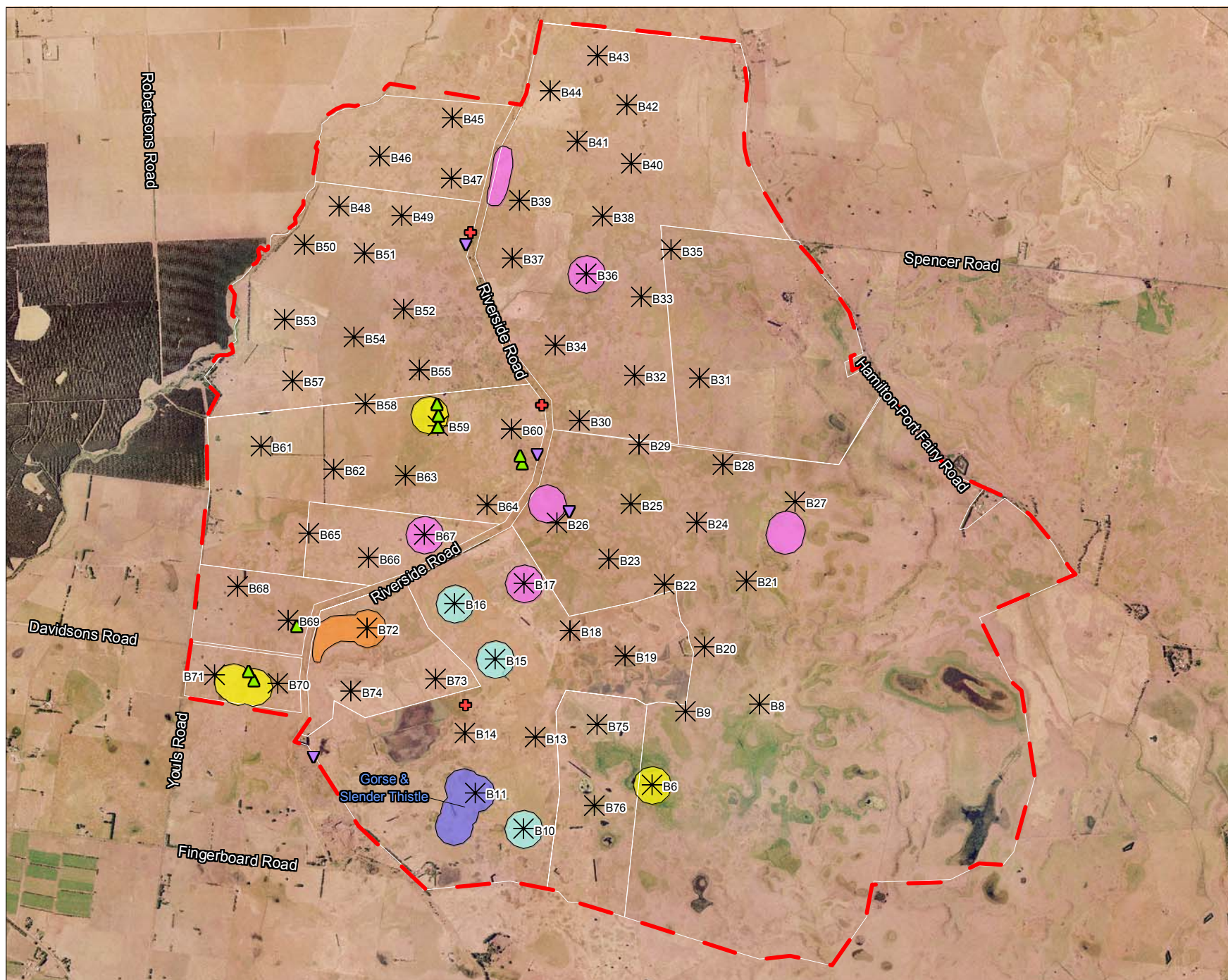
		follow-up maintenance Where possible prevent flowering or at least reduce the ability to set seed				spray as a follow-up. Cut-paint herbicide treatment is an alternative for larger plants
Slender Winged Thistle	Contain by removing all new plants within 2 years	Maintain healthy perennial pasture with good ground cover at all times, especially in summer going into autumn to prevent seedling establishment	All properties	Early Spring	CH & SS	Hand-hoeing is effective for individual plants and small patches. Ensure that the growing point and the top 20-40mm of the taproot are removed
Variegated Thistle	Contain by removing all new plants within 2 years	Most effective herbicide control is at seedling and rosette stage. Maintain healthy perennial pasture with good ground cover at all times, especially in summer going into autumn to prevent seedling establishment	All properties	Early Spring	CH & SS	Hand-hoeing is effective for individual plants and small patches. Ensure that the growing point and the top 20-40mm of the taproot are removed
Spear Thistle	Contain by removing all new plants within 2 years	Maintain healthy perennial pasture with good ground cover at all times, especially in summer going into autumn to prevent seedling establishment	All properties	Early Spring	CH & SS	Hand-hoeing is effective for individual plants and small patches. Ensure that the growing point and the top 20-40mm of the taproot are removed. When there is an early autumn break and large numbers of thistles germinate before the temperature falls, autumn spraying can be very effective

Blackberry	Contain by removing all new plants within 2 years	Spray from November to February; cut and paint during April and May	Moore, McDonald, Dumesny (Harlock), Winter	Summer	SS & CP	Small-scale: dig out or slash several times per year. Large-scale: herbicide spray
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Notes: CP = Cut and Paint; RB = Ringbark; WB = Weed Burner; SS = Spot-spray; M = Frequent Mowing; DF = Drill and Fill; MR = Mechanical Removal and CH = Chip Out or Hand Pull; * Includes adjacent roadside to the property.

FIGURES





Noxious Weeds

- Apple of Sodom
- Gorse
- Slender Thistle
- Variegated Thistle
- Mixed - as labelled

- Blackberry
- Boxthorn
- Sweet Briar
- Proposed turbine

Study area

Note: An area of 25 x 40 metres was surveyed around each turbine.

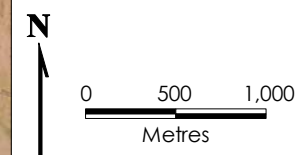
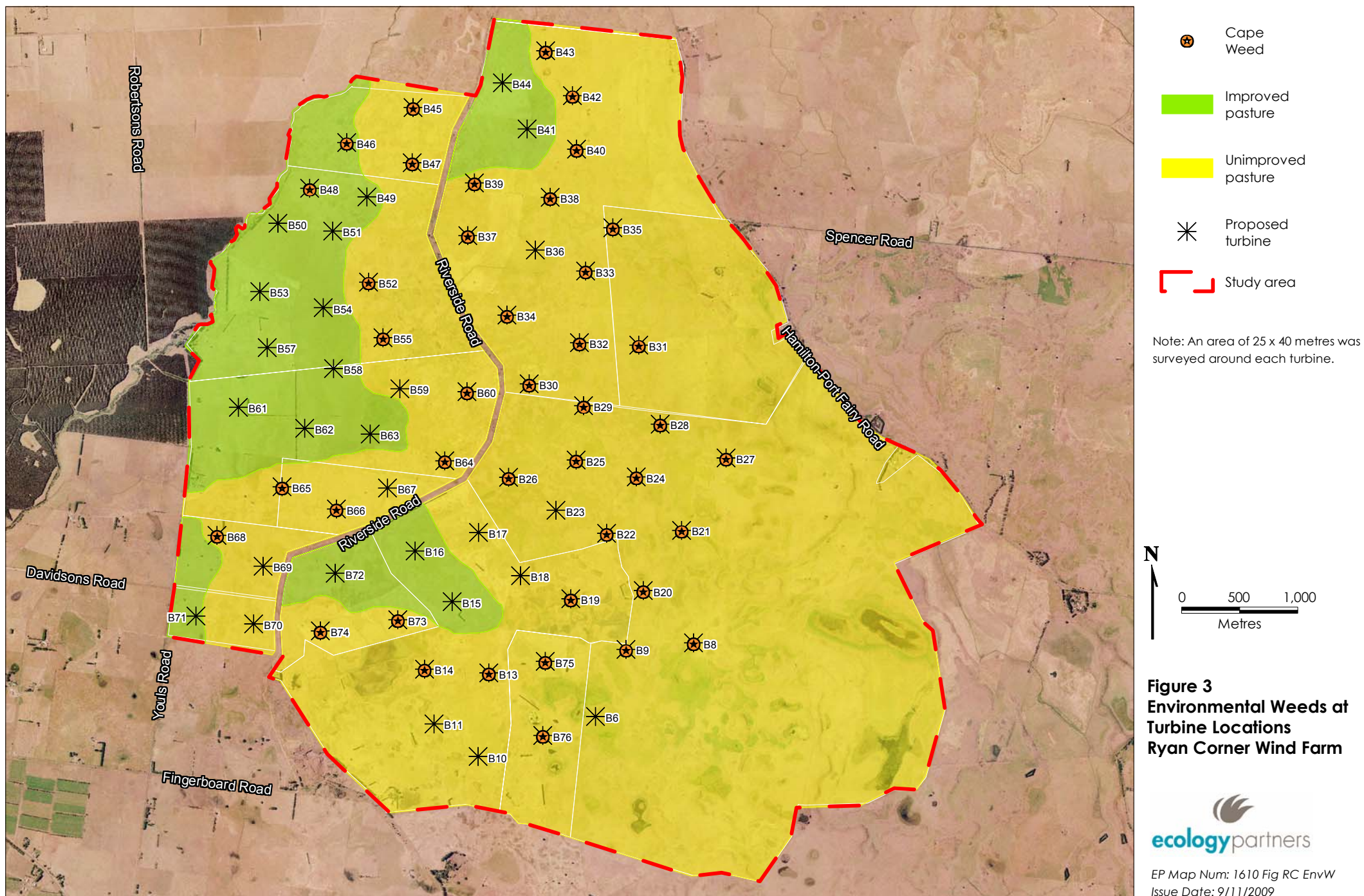
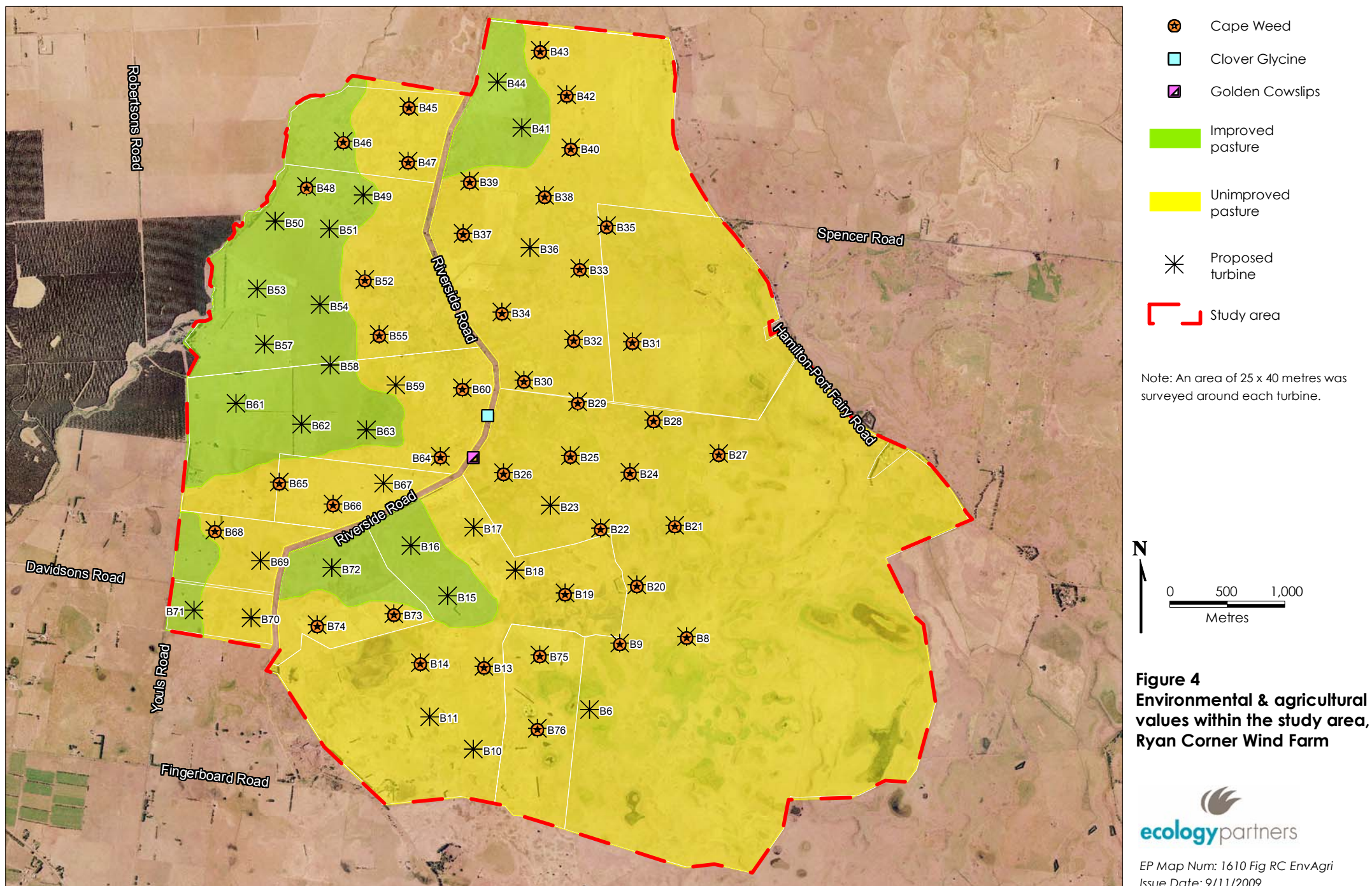


Figure 2
Noxious Weeds within
the Study Area,
Ryan Corner Wind Farm





APPENDICIES

Appendix 1 – Database Searches and Current Results

Table A1: Exotic species recorded during database searches and the current weed survey.

Scientific Name	Common Name	2009 Survey
<i>Agrostis capillaris</i>	Brown-top Bent	✓
<i>Aira caryophyllea</i>	Silvery Hair-grass	✓
<i>Aira cupaniana</i>	Quicksilver Grass	
<i>Aira elegantissima</i>	Delicate Hair-grass	
<i>Aira spp.</i>	Hair Grass	
<i>Allium triquetrum</i>	Angled Onion	
<i>Alopecurus pratensis</i>	Meadow Fox-tail	
<i>Amaranthus retroflexus</i>	Red-root Amaranth	
<i>Ammophila arenaria</i>	Marram Grass	
<i>Anagallis arvensis</i>	Pimpernel	✓
<i>Anchusa capensis</i>	Cape Forget-me-not	
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	✓
<i>Arctotheca calendula</i>	Cape Weed	✓
<i>Asparagus asparagoides</i>	Bridal Creeper	
<i>Atriplex prostrata</i>	Hastate Orache	
<i>Avena fatua</i>	Wild Oat	✓
<i>Avena spp.</i>	Oat	
<i>Bellis perennis</i>	English Daisy	
<i>Briza maxima</i>	Large Quaking-grass	✓
<i>Briza minor</i>	Lesser Quaking-grass	✓
<i>Bromus catharticus</i>	Prairie Grass	✓
<i>Bromus diandrus</i>	Great Brome	✓
<i>Carduus tenuiflorus</i>	Winged Slender-thistle	✓
<i>Carthamus lanatus</i>	Saffron Thistle	✓
<i>Catapodium rigidum</i>	Fern Grass	
<i>Centaurea calcitrapa</i>	Star Thistle	
<i>Centaurea melitensis</i>	Malta Thistle	
<i>Centaureum erythraea</i>	Common Centaury	✓
<i>Cerastium semidecandrum s.s.</i>	Little Mouse-ear Chickweed	
<i>Chenopodium album</i>	Fat Hen	
<i>Chenopodium murale</i>	Sowbane	✓
<i>Cicendia filiformis</i>	Slender Cicendia	
<i>Cirsium arvense</i>	Perennial Thistle	✓
<i>Cirsium spp.</i>	Thistle	
<i>Cirsium vulgare</i>	Spear Thistle	✓
<i>Conium maculatum</i>	Hemlock	✓
<i>Coprosma repens</i>	Mirror Bush	✓

Scientific Name	Common Name	2009 Survey
<i>Crataegus monogyna</i>	Hawthorn	✓
<i>Crepis vesicaria</i> subsp. <i>taraxacifolia</i>	Bladder Hawksbeard	
<i>Cupressus macrocarpa</i>	Monterey Cypress	✓
<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch	✓
<i>Cynosurus echinatus</i>	Rough Dog's-tail	✓
<i>Dactylis glomerata</i>	Cocksfoot	✓
<i>Delairea odorata</i>	Cape Ivy	
<i>Diplotaxis muralis</i>	Wall Rocket	
<i>Diplotaxis tenuifolia</i>	Sand Rocket	
<i>Dipogon lignosus</i>	Common Dipogon	
<i>Dipsacus fullonum</i> subsp. <i>fullonum</i>	Wild Teasel	
<i>Disa bracteata</i>	South African Orchid	
<i>Echium plantagineum</i>	Paterson's Curse	✓
<i>Eleusine indica</i>	Goose-grass	
<i>Euphorbia paralias</i>	Sea Spurge	
<i>Ehrharta erecta</i>	Panic Veldt-grass	✓
<i>Ehrharta longifolia</i>	Annual Veldt-grass	✓
<i>Fallopia convolvulus</i>	Black Bindweed	
<i>Foeniculum vulgare</i>	Fennel	✓
<i>Freesia</i> spp.	Freesia	
<i>Fumaria muralis</i> subsp. <i>muralis</i>	Wall Fumitory	
<i>Galium murale</i>	Small Goosegrass	
<i>Glaucium flavum</i>	Yellow Horned-poppy	
<i>Genista monspessulana</i>	Montpellier Broom	✓
<i>Hedypnois cretica</i>	Cretan Hedypnois	
<i>Helminthotheca echioides</i>	Ox-tongue	
<i>Holcus lanatus</i>	Yorkshire Fog	✓
<i>Hordeum marinum</i>	Sea Barley-grass	
<i>Hypochoeris radicata</i>	Flatweed	✓
<i>Isolepis levynsiana</i>	Tiny Flat-sedge	
<i>Juncus microcephalus</i>	Tiny-headed Rush	
<i>Lactuca saligna</i>	Willow-leaf Lettuce	
<i>Lagurus ovatus</i>	Hare's-tail Grass	
<i>Leontodon taraxacoides</i> subsp. <i>taraxacoides</i>	Hairy Hawkbit	
<i>Limonium hyblaenum</i>	Sicilian Sea-lavender	
<i>Lolium perenne</i>	Perennial Ryegrass	✓
<i>Lycium ferocissimum</i>	African Box-thorn	✓
<i>Malva nicaeensis</i>	Mallow of Nice	✓
<i>Marrubium vulgare</i>	Horehound	✓
<i>Medicago lupulina</i>	Black Medic	
<i>Medicago polymorpha</i>	Burr Medic	✓
<i>Melilotus indicus</i>	Sweet Melilot	
<i>Mentha pulegium</i>	Pennyroyal	

Scientific Name	Common Name	2009 Survey
<i>Mesembryanthemum crystallinum</i>	Common Ice-plant	
<i>Moraea flaccida</i>	One-leaf Cape-tulip	
<i>Nasturtium officinale</i>	Watercress	✓
<i>Nepeta cataria</i>	Catmint	
<i>Oenothera stricta</i> subsp. <i>stricta</i>	Common Evening-primrose	
<i>Onopordum acanthium</i>	Scotch Thistle	✓
<i>Osteospermum fruticosum</i>	Dimorphotheca	
<i>Oxalis pes-caprae</i>	Soursob	✓
<i>Paspalum dilatatum</i>	Paspalum	✓
<i>Parapholis incurva</i>	Coast Barb-grass	
<i>Parapholis strigosa</i>	Slender Barb-grass	
<i>Pennisetum clandestinum</i>	Kikuyu	✓
<i>Petrorhagia dubia</i>	Velvety Pink	
<i>Phalaris aquatica</i>	Toowoomba Canary-grass	✓
<i>Pinus radiata</i>	Radiata Pine	✓
<i>Plantago lanceolata</i>	Ribwort	✓
<i>Plantago major</i>	Greater Plantain	✓
<i>Poa annua</i>	Annual Meadow-grass	✓
<i>Polypogon monspeliensis</i>	Annual Beard-grass	✓
<i>Rhamnus alaternus</i>	Italian Buckthorn	
<i>Romulea rosea</i>	Onion Grass	✓
<i>Rosa rubiginosa</i>	Sweet Briar	✓
<i>Rubus fruticosus</i> spp. <i>agg.</i>	Blackberry	✓
<i>Rumex conglomeratus</i>	Clustered Dock	
<i>Rumex crispus</i>	Curled Dock	✓
<i>Rumex pulcher</i> subsp. <i>pulcher</i>	Fiddle Dock	
<i>Salix</i> spp.	Willow	
<i>Salvia aurea</i>	Golden Salvia	
<i>Scabiosa atropurpurea</i>	Pincushion	
<i>Schinus molle</i>	Pepper Tree	
<i>Scolymus hispanicus</i>	Golden Thistle	
<i>Senecio elegans</i>	Purple Groundsel	
<i>Setaria parviflora</i>	Slender Pigeon Grass	✓
<i>Silene gallica</i>	French Catchfly	
<i>Silene pendula</i>	Nodding Catchfly	
<i>Silybum marianum</i>	Variegated Thistle	✓
<i>Sisyrinchium iridifolium</i>	Striped Rush-leaf	
<i>Solanum linnaeanum</i>	Apple of Sodom	
<i>Sonchus asper</i> s.l.	Rough Sow-thistle	✓
<i>Sonchus oleraceus</i>	Common Sow-thistle	
<i>Sparaxis</i> sp.	Harlequin Flower	✓
<i>Sporobolus africanus</i>	Rat-tail Grass	✓
<i>Stenotaphrum secundatum</i>	Buffalo Grass	✓
<i>Taraxacum officinale</i> spp. <i>agg.</i>	Garden Dandelion	

Scientific Name	Common Name	2009 Survey
<i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Narrow-leaf Clover	✓
<i>Trifolium campestre</i> var. <i>campestre</i>	Hop Clover	
<i>Trifolium dubium</i>	Suckling Clover	
<i>Trifolium pratense</i>	Red Clover	
<i>Trifolium</i> spp.	Clover	
<i>Trifolium striatum</i>	Knotted Clover	
<i>Ulex europaeus</i>	Gorse	✓
<i>Valerianella eriocarpa</i>	Italian Corn-salad	
<i>Vicia</i> spp.	Vetch	
<i>Vulpia bromoides</i>	Squirrel-tail Fescue	✓
<i>Vulpia myuros</i>	Rat's-tail Fescue	
<i>Vulpia</i> spp.	Fescue	

Source: Flora Information System (2007).

Appendix 2 – Weed Control Methods

Herbicides

Spot spraying and Rig-spraying

The application of herbicides is an effective and efficient control technique for a range of woody, herbaceous and grass weeds. The correct use and application of herbicides can provide targeted control of a range of species, however it must be stressed all use of herbicides must be used in accordance with the manufacturer's specifications and occupational health and safety policies.

Application methods for herbicides include spot spraying with a knapsack for small or sensitive areas, or for targeted species. Rig spraying is best used in larger areas which are not sensitive to high volume application of herbicide and there is limited potential for off-target damage. Dabbing of species with foam tipped application device, with the herbicide applied from an attached bottle, should be used in sensitive areas or in areas where weed control is targeted to a small number of plants, especially bulbs or tuberous plants.

Timing of intervals, plant age and growth seasons, plant stress levels and climatic factors all need to be considered when develop methodologies for the application of herbicides to ensure successful outcomes. Problems exist with ongoing unsuccessful herbicide treatments, which may result in weeds developing herbicide resistance, or the build up of chemicals in the soil. Surrounding plants' susceptibility to herbicides and ongoing uses of the treated areas should also be considered when choosing the right herbicide to be used in a weed control program, as some herbicides are residual and may persist within the soil for varying durations.

Drill and Fill

Drill and fill, also known as direct injection, is a method where the selected herbicide (usually Glyphosate) is injected through a device into a hole that has been made into the targeted plant (i.e. woody species). The hole is usually made through the use of a drill but sometimes a tomahawk or saw may be used to put small nicks into the targeted plant. It is essential that the hole or nick must always be lower than the first branch containing foliage (i.e. ideally, the lowest possible point on the plant) and also the herbicide is applied into the hole as quick as possible. The general rule of thumb is that the herbicide must be applied within 30 seconds. Holes are scattered around the main trunk at 50 millimetre intervals, depending on the diameter of the trunk and also branches or angle of the trunk. It is essential that a complete ring around the trunk of the plant be made of this herbicide filled holes to ensure plant death, as large gaps may allow sections of the target tree to survive. Generally, the holes or nicks do not need to be deeper than 20 millimetres, but do need to be deep enough to penetrate the outer cambium layer of the tree. This allows the phloem to carry the herbicide into the roots, which will kill the plant over a number of weeks, depending on conditions.

The benefits of this method include: the retention of standing material for habitat, no costs for the removal of the plant from the site; no dragging of material across sensitive areas; and, speed, as the method is fast to execute (i.e. drill and fill, and move on).

The drawbacks of this method are that if it is not executed correctly, trees may re-grow, particularly as accessing the base of the trunk of spiny plants such as Hawthorn and African Box-thorn can be difficult. However if the application is successful, dead standing vegetation can become a fire hazard and look aesthetically displeasing to the community.

Cut and Paint

The cut and paint method of control requires the cutting of the target species at the very base, under any foliage, and the immediate application of herbicide (usually a glyphosate, dependent on the target species). The application can be done through a ‘dabber’ bottle or paint brush. Care should be undertaken during application, to avoid splash of herbicide causing non-target damage. Once cut down, the biomass of the target species may sometimes be left on the ground, but usually requires removal. This is particularly necessary if it bears fertile seeds or has the potential to re-shoot from contact with moist ground (i.e. *Salix* sp.), or covers native vegetation.

Many herbicides are available that are very effective in the control of woody weed species. Typically these herbicides are applied to the stem, trunk or roots of the target plant by ‘drill and fill’, ‘cut and paint’ or ‘frilling’ methods of application. These herbicides can be more effective than manual removal alone, as the chance of the plant re-sprouting is significantly reduced.

Mechanical Removal

Mechanical removal by machine may include grooming of woody weed infestations by a tractor-mounted groomer (slasher/mulcher), which is quite effective on Gorse, African Box-thorn and Hawthorn infestations. The excavation of Spiny Rush has been used in areas of dense infestations where other means of eradication may be a slow process due to difficult access.

Manual Removal

Some weed species are resilient against other methods of eradication, such as herbicides, and should be targeted by manual removal. Infestations of species such as African Box-thorn, Fennel, Serrated Tussock and Toowoomba Canary-grass should be combated by manual removal techniques.

Additionally, manual removal is a crucial technique when used in conjunction with herbicides for the control of both woody and herbaceous weed species. This combination of weed eradication is advised for almost all weed species.

Ring-barking

Ring-barking is a viable technique for use when eradicating large woody shrubs and trees. The technique involves the use of a large knife, tomahawk or axe to make a continuous cut around the trunk of the plant. The cut should be 5-10 centimetres wide and deep enough to penetrate the heart-wood (Muyt 2001). This technique should not be used when removing species which can reproduce by suckering.

Mowing

While it has been found that mowing may enhance the survival of many weed species, in some instances mowing can be used to control their spread. Areas located in close proximity (500 metres – 1 kilometre) to sites of ecological significance that are currently mown, should undergo an intensive mowing regime (every week), particularly in spring. This method of weed control is only effective against species which are prevalent within mown areas. It will prove most effective in controlling the spread of grass species such as Chilean Needle-grass, Serrated Tussock and Toowoomba Canary-grass.

Mulching

It is advised that mulching be used in areas of revegetation which were previously dominated by exotic vegetation. Mulching can be a very effective technique in suppressing species which may invade, particularly from mown areas.

In areas of remnant vegetation, mulch should be used very carefully. Only people who have an in-depth knowledge and long history of the specific site should advise the use of mulch in these areas to ensure native species (particularly rare and threatened species) are not affected by the use of mulch.

Soil Scalping

Soil scalping involves the removal of a thin layer of topsoil in areas of extremely high weed cover abundance. Care must be taken in order to ensure that enough soil is removed to eliminate the possibility of re-colonisation from the soil seedbank. It is important that this process is directly followed by high density revegetation and mulching in order to reduce the migration of other weeds into these areas. This process is only favoured in areas that are considered a major source population for weed species of high threat to agriculture, heritage or areas of conservational significance.

Appendix 3 – Noxious Weed Species Identification



African Boxthorn *Lycium ferocissimum*



Sweet Briar *Rosa rubiginosa*



Apple of Sodom *Solanum linnaeanum*



Spear Thistle *Cirsium vulgare*



Blackberry *Rubus fruticosus* sp. agg.



Gorse *Ulex europaeus*



Slender Winged Thistle *Carduus tenuiflorus*



Variegated Thistle *Silybum marianum*

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