

Weed and Dieback Management Plan

Keysbrook Mineral Sand Project Keysbrook, Western Australia

Prepared for:

Matilda Zircon Limited



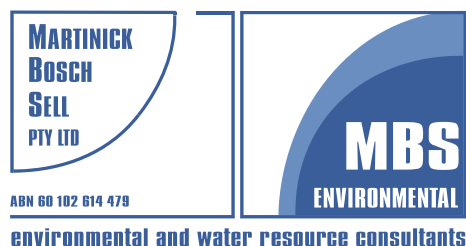
January 2011

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MBS
ENVIRONMENTAL



WEED AND DIEBACK MANAGEMENT PLAN
KEYSBROOK MINERAL SAND PROJECT
KEYSBROOK, WESTERN AUSTRALIA
JANUARY 2011

PREPARED FOR

MATILDA ZIRCON LIMITED

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Document History

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2	January 2011	Changes in relation to comments received from Shire of Serpentine – Jarrahdale and Shire of Murray	LMB (MBS)	KLS (MBS)

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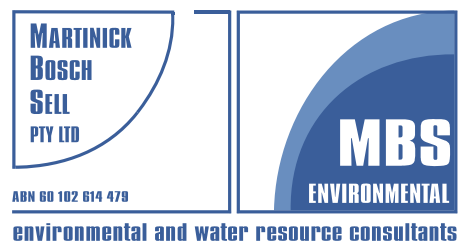


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1. INTRODUCTION

Matilda Zircon Limited (Matilda Zircon) are planning to develop a mineral sand mine and primary processing plant within an area of rural land near the small townships of Keysbrook and North Dandalup (Figure 1).

The mining area of 1,354 hectares is located on privately owned land actively used for grazing. Of this, 1,174 hectares (87%) is open pasture with scattered trees and 180 hectares (13%) is remnant vegetation in good to a degraded condition of which 105 hectares will be cleared. Figure 2 shows the proposed mining area.

Patches of remnant native vegetation occur on upland sandy Bassendean dunes. Most of these patches are completely degraded by grazing activity with little, if any native understorey remaining. The vegetation comprises both of *Phytophthora cinnamomi* (Dieback) resistant species, such as *Corymbia calophylla* and Dieback susceptible species, such as *Banksia attenuata*, *Banksia menziesii* and *Eucalyptus marginata* subsp. *marginata*.

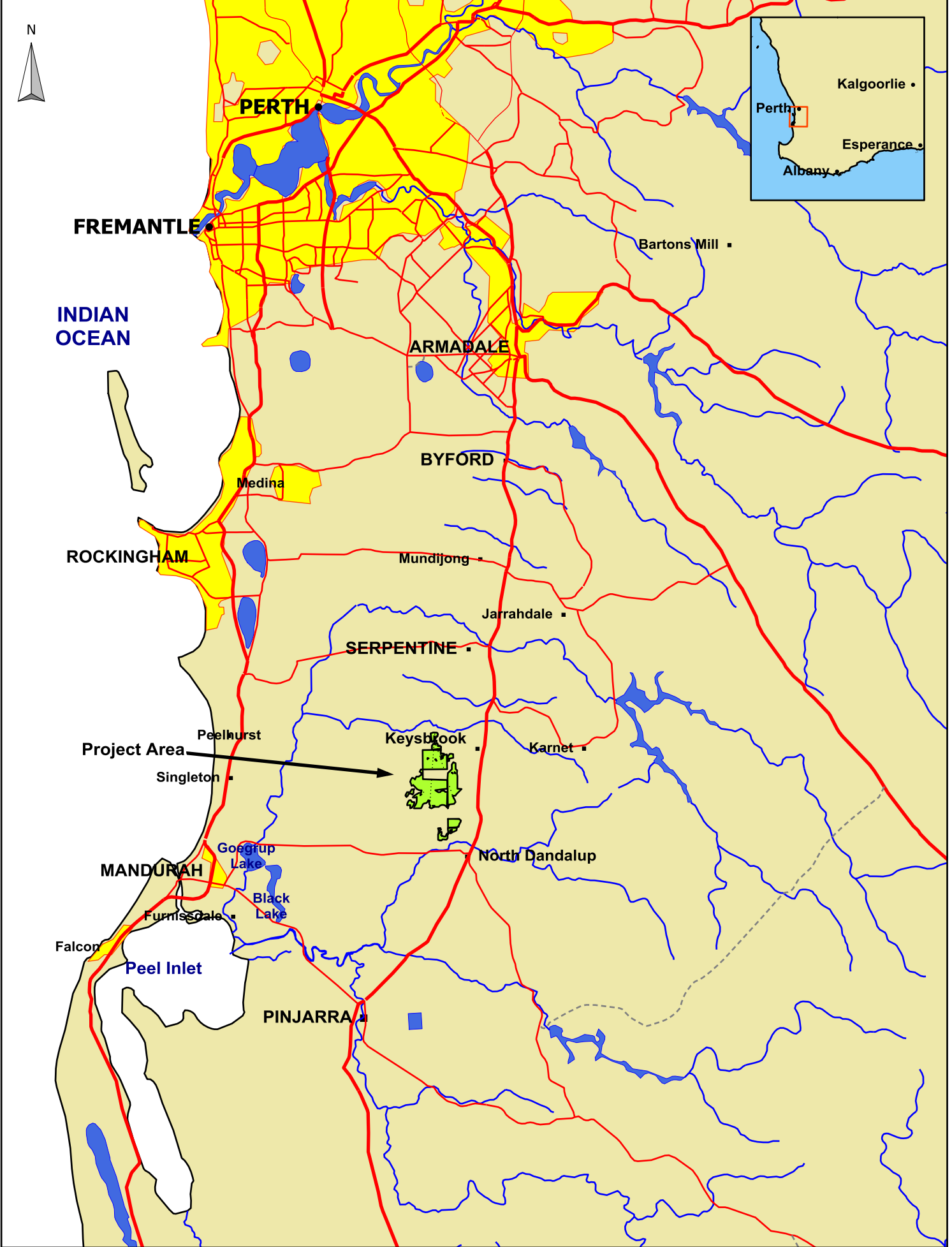
Drainage lines from the Darling Scarp flow through the mine area. These drain catchments are infected by Dieback, however as the low-lying land within the mine area is almost exclusively cleared and developed as pasture, no visible effect of Dieback is present in these areas. Any native vegetation in these low lying areas are species resistant to the disease.


The ore is hosted totally within the superficial (Bassendean sand) profile. The depth of the open pit will range from one to two metres in the flat sandplain locations and up to six metres in the undulating dunes.

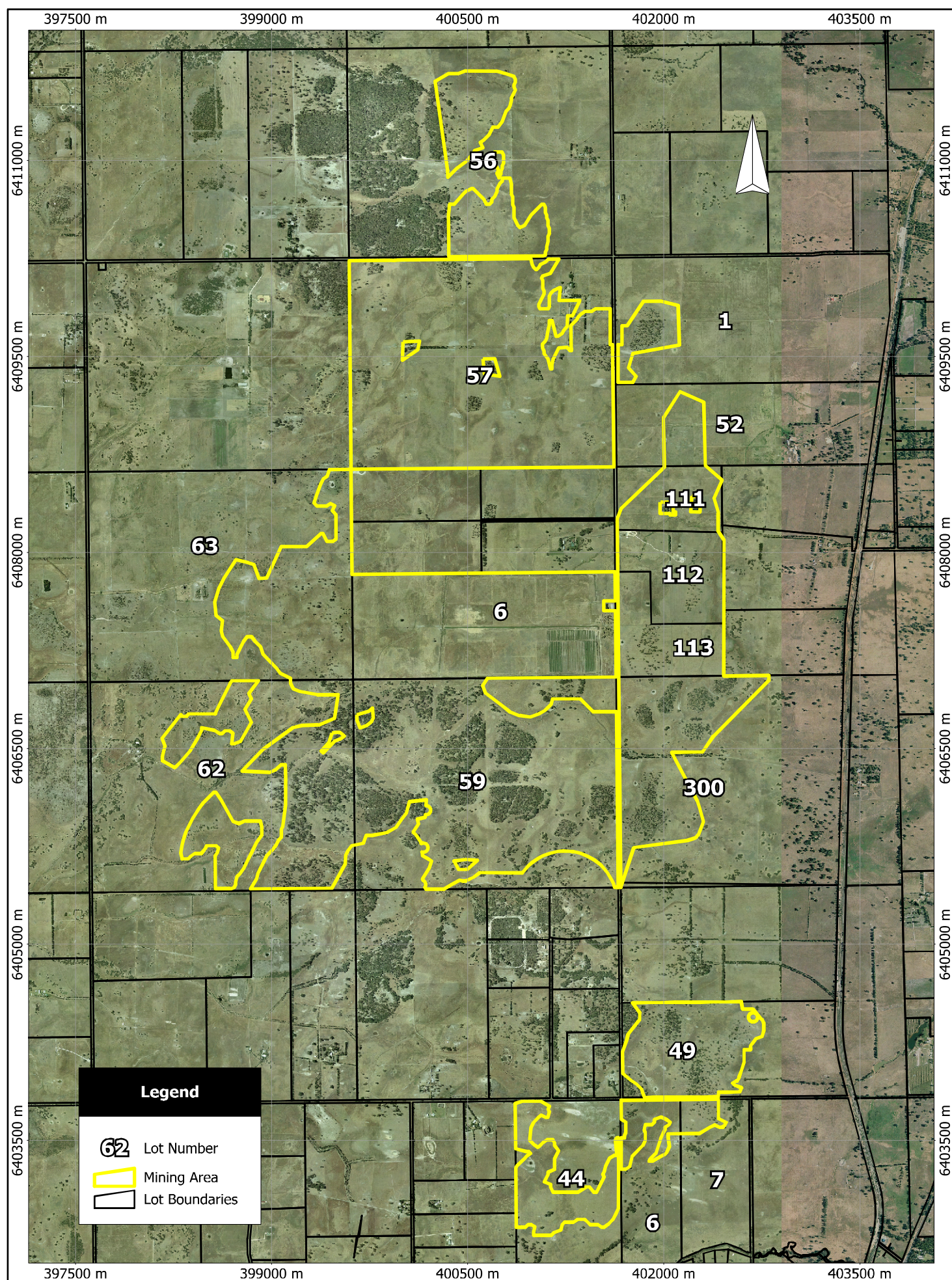
The proposed mine has an expected operational life of up to eight years. The mineral sand resource will be progressively mined through a series of stages with no more than 30 hectares being actively mined at any one time. Each stage will be progressively rehabilitated once mining of that block is completed.

1.1 PURPOSE

This Weed and Dieback Management Plan (WDMP) has been prepared to comply with Ministerial Statement 810, Condition 9. It also addresses requirements relating to Conditions 6, 7 and 8. This Plan is applicable to all phases of the project, including planning, construction, operation and closure.



 MBS ENVIRONMENTAL	Environmental + Water Resource Consultants 4 Cook St West Perth WA 6005 Telephone: + 618 9226 3166 Facsimile: + 618 9226 3177 info@mbsenvironmental.com.au	Scale 1:400000 Original Size: A4 0 10 km	Matilda Zircon Limited Keysbrook Mineral Sands Project	Location Plan
				Figure 1



1.2 OBJECTIVES AND TARGETS

The objectives and targets of this WDMP are outlined in Table 1.

Table 1: Weed and Dieback Management Objectives and Targets

Objectives	Target
Weed Management	
Prevent introduction of new weed species and/or spread of existing weed species as a result of mining.	No new weeds species or infestations as a result of mining practices.
Control of weeds to ensure the protection of remnant vegetation and vegetation within twenty metres of the banks of watercourses or within 100 meters of the boundary of the conservation category wetland.	No new weeds species or infestations in remnant vegetation or watercourse/wetland vegetation as a result of mining practices.
Weeds in newly disturbed areas will be controlled as rehabilitation behind mining progresses.	6 months after rehabilitation, less than 10% weed species in rehabilitated areas.
Dieback Management	
Prevent spread of Dieback from Dieback Infected areas to Dieback Free Areas as a result of mining activities.	No spread of Dieback within the mine areas as a result of mining.
Identify and implement measures to limit Dieback through the movement of topsoil.	Topsoil from Dieback infected areas not utilised in rehabilitation of Dieback free areas.
Identify and implement measures to protect Dieback free topsoil from contamination.	All topsoil from Dieback free areas stockpiled separately to topsoil from Dieback infected areas. All topsoil stockpiles signposted correctly.
Include awareness training into site induction and training programs.	100% inclusion of all site personnel in induction programs.

1.3 RELATIONSHIP TO OTHER MANAGEMENT PLANS

This WDMP has elements in common with the Rehabilitation Management Plan and Water Management Plan. Weed management is a crucial factor in the success or otherwise of rehabilitation while movement of topsoil, translocation of flora and species selection for rehabilitation must be undertaken with Dieback management in mind. The potential for Dieback to be spread through water movement also needs to be addressed as part of landform design and site water management.

2. LEGISLATIVE AND POLICY CONTEXT

2.1 LEGISLATIVE AND REGULATORY REQUIREMENTS

The Keysbrook Mineral Sand Projects is subject to the following legislation and regulations relating to weeds and Dieback:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- *Environmental Protection Act 1986 Western Australia* (EPA Act).
- *Agriculture and Related Resources Protection (ARRP) Act 1976* (Part V _Control of Declared plants. Division 4 49 refers to occupiers of private land and control of declared plants and animals) (ARRP Act).
- *Local Government Act 1996*.

The relevance of legislation and regulations in the context of this management plan are briefly described.

2.1.1 *Environment Protection and Biodiversity Conservation Act 1999*

Under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), any activity that may have a significant impact on matters of national environmental significance must be approved by the Department of the Environment, Water, Heritage and the Arts (DEWHA). Controlling provisions for the Keysbrook Mineral Sand Project were deemed to be wetlands of international importance (Section 16 and 17B) and listed threatened species and communities (Section 18 & 18A).

On 16 February 2010, DEWHA granted conditional approval of the Keysbrook Mineral Sand Mine.

2.1.2 *Environmental Protection Act 1986 Western Australia* (EP Act)

Under the *Environmental Protection Act 1986 Western Australia* (EP Act), the Department of Environmental and Conservation (DEC) can give notice, orders and or directions in respect to protection of the environment and native vegetation.

Section 38(1) of the *EP Act* provides that where a development proposal could have a significant effect on the environment, a proponent may refer the proposal to the Environmental Protection Authority (EPA) for a decision on whether or not it requires assessment under the Act.

Conditional approval for the project was given by the Minister on 19 October 2009 under Ministerial Statement 810. Conditions in the statement relevant to this plan include Conditions 6, 7, 8 and 9.

2.1.3 *Agriculture and Related Resources Protection Act 1976 (ARRP Act)*

The Department of Agriculture and Food is responsible for overseeing the *ARRP Act* requiring management of Declared Plants in Western Australia. The *ARRP Act* lists gazetted Declared Plants that require control in Western Australia.

No Declared Plant species listed under the *ARRP Act* were identified during the flora survey conducted by Bennett Consulting in 2004 and updated in 2006.

2.1.4 *Local Government Act 1996*

The *Local Government Act 1996* allows a local authority to declare plants as “pest plants” which requiring control on all lands within the local authority boundary. This legislation is used for environmental weeds.

There are no weeds declared under this Act for the Shire of Murray. A number of weed species have been declared under this Act by the Shire of Serpentine Jarrahdale as detailed in Council Policy E204 – Control of Weeds.

2.2 ENVIRONMENTAL POLICY AND MANAGEMENT STRATEGY

The following publications provide additional information on weed and Dieback management:

- Commonwealth National Weeds Strategy.
- Weed Plan for Western Australia prepared by the State Weed Plan Steering Group 2001.
- Western Australia Environmental Weed Strategy 1999 (WAWS).
- Dieback Working Group Guidelines for Local Government.

3. EXISTING ENVIRONMENT

3.1 REGIONAL SETTING

The project is situated along the eastern edge of the Swan Coastal Plain approximately 70 kilometres south of Perth and four kilometres west of the small township of Keysbrook. The mining area of 1,354 hectares is located on privately owned land.

A large portion of the mine area has been cleared for grazing activities. Patches of remnant native vegetation also remain. The remnant vegetation ranges from stands of trees over pasture grass with little to no understorey to areas of trees with a partially intact understorey.

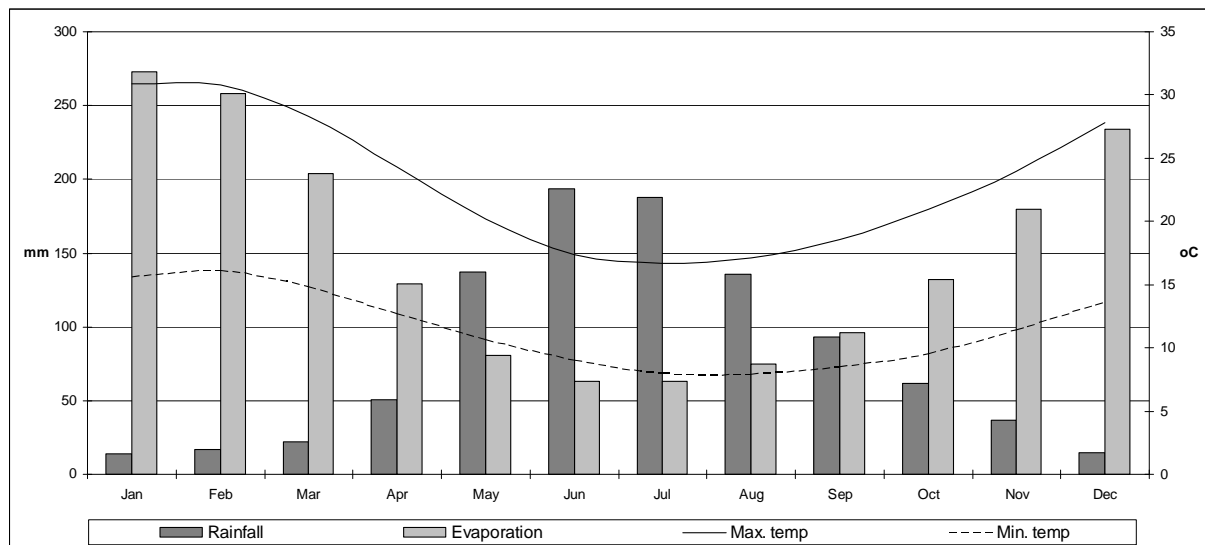
The topography of the mine area is flat to very gently undulating plain. The lowest elevations are in the south-west of the mine area at approximately 22 metres AHD, gradually sloping to approximately 48 metres AHD in the north-east.

3.2 CLIMATE

The area experiences a mediterranean climate characterised by cool wet winters and warm to hot dry summers. The mine area lies between the 1,000 and 1,100 millimetres rainfall isohyets (Heddle *et al.*, 1980).

Average maximum and minimum temperatures at Keysbrook range from 30.6 degrees Celsius to 15.2 degrees Celsius (Australian Meteorology, 2010). The warmest months are December to February with rainfall peaking during the winter months of June to August.

The nearest meteorological monitoring station is located at Karnet, approximately nine kilometres to the east. This weather station is located in the Darling Scarp and experiences a slightly different climate to the mine area, with an annual average rainfall of 1,200 millimetres. The nearest meteorological monitoring station on the Swan Coastal Plain is located at the Medina Research Centre, about 28 kilometres north-west of the mine area, which has a 800 millimetre annual rainfall. Wokalup, although a further 80 kilometres south of Keysbrook, has an annual rainfall of 964 millimetres as shown in Chart 1. This is closer to Keysbrook's total than either Karnet or Medina. The average annual evaporation rate of approximately 1,800 millimetres exceeds the precipitation rate of 960 millimetres by a factor of about two to one.

Chart 1: Wokalup Climate Data

3.3 LAND SYSTEMS

The Keysbrook project area is situated across three Land Systems. The Bassendean Land System consists of low dunes of leached siliceous sand interspersed with sand flats and seasonal swamps. This Land System is the main source of the heavy mineral sands. The majority of the project area lies within this Land System and all remnant vegetation related to the project occurs within the Bassendean Land System.

The Southern River Land System consists of sand plain with low dunes and many intervening wetlands. The soils of this Land System are similar to those of the Bassendean Land System. In the vicinity of swamps the soils of the Southern River Land System has iron and humus podzols, peats and clays deposited.

The Guildford Land System (also referred to as the Pinjarra Plain) is characterised by flat plains with medium textured deposits and yellow duplex soils.

3.4 SOILS

The heavy mineral resource is hosted within the dunes of the Bassendean Sand, which partly covers mottled clayey sand or a pisolitic ironstone-clay unit of the Guildford Formation, also referred to as the Pinjarra Plain.

3.4.1 Bassendean Dunes

The dominant soil parent materials within the Bassendean system are highly leached quartzose sands containing potentially economic heavy mineral mineralisation. The most easterly dunes are well defined in the landscape, are higher, up to six metres above the plain level. The Bassendean Dunes form a series of subdued low relief dunes, sandplains and intervening swamps adjacent to and partly overlying the finer textured soils of the Pinjarra Plain (Guildford Unit). Some inland movement by wind action has also occurred. The majority of the soils are podzols. Soils in the eastern part of the area are more severely leached than those to the west. The mine is within the eastern part of the unit.

The topsoil in the Bassendean Dunes contains organic matter to a depth of about 15 centimetres and is noticeably lower in heavy mineral grade than in the underlying sand (MBS, 2006).

3.4.2 Pinjarra Plain

The soils of the Pinjarra Plain have largely formed from unconsolidated alluvial material of Tertiary and Quaternary age. The depositional systems can be grouped into three main types based on soil parent material.

- The older alluvium occurring in extensive flat plains and forming imperfect to poorly drained soils - mottled yellow duplex soils and mottled yellow or greyish brown gradational earths.
- Fine textured alluvium of generally intermediate age, in areas of lowest relief and forming very poorly drained soils - uniform cracking black grey or yellow-grey clays.
- The youngest alluvium occurring along the major present river systems and forming well to moderately well-drained soils - red duplex or gradational soils and uniform reddish brown loams or earthy sands.

3.5 VEGETATION OF THE PROJECT AREA

Some 1,174 hectares (87.0%) of the mine area is open pasture with scattered trees and 180 hectares (13%) is remnant vegetation in varying condition. In accordance with Ministerial Statement 810, 75 hectares of remnant native vegetation within the project area will be retained and protected in perpetuity. A total of 105 hectares of native vegetation in varying condition will be cleared.

Nine vegetation units have been mapped across the project area. One vegetation unit within the project area was inferred to be a potential Threatened Ecological Community (TEC), correlating to Swan Coastal Plain Floristic Community Types (FCT)3a. The area FCT3a is less than 0.25 hectares in size and although there were several *Corymbia calophylla* plants, there were very few *Kingia australis*. The vegetation condition of FCT3a is completely degraded and is therefore not considered worthy of conservation (Bennett Environmental Consulting Pty Ltd 2006).

4. WEED MANAGEMENT

4.1 DEFINITIONS OF WEEDS

An **Environmental Weed** is an introduced plant that is established in a natural ecosystem and adversely modifies natural processes, resulting in decline of invaded communities (EPA, 2009).

A **Declared Plant** is a plant that impacts on individual people, agricultural production and the community. These are plants declared under *ARRP Act* and all landholders are obliged to control these on their properties according to the rankings and information provided by the Department of Agriculture and Food. No declared Plants have been recorded from the project area.

4.2 MANAGEMENT CLASSIFICATION OF WEEDS SPECIES

A total of 34 weeds species were recorded from the site by Bennett Consulting (2004, revised 2006). Weeds recorded were rated according to three criteria defined in the Environmental Weed Strategy for Western Australia (1999) and are shown in Table 2.

Weed species rated High will be prioritised for control. In addition, *Rumex crispus* (Curled Dock) will also be prioritised. The 29 species rated Moderate or Low will be included into the general rehabilitation monitoring program.

Table 2: Weeds Recorded in the Project Area and Classification According to the Environmental Weed Strategy for Western Australia (1999) (DEC)

Scientific Name	Common Name	DEC Rating	Invasiveness	Impacts
Environmental Weeds				
<i>Bromus diandrus</i>	Great brome	High	✓	✓
<i>Ehrharta calycina</i>	Perennial veldt grass	High	✓	✓
<i>Leptospermum laevigatum</i>	Victorian teatree	High	✓	✓
<i>Romulea rosea</i>	Guildford grass	High	✓	✓
Weeds				
<i>Aira carophyllea</i>	Silvery hairgrass	Moderate	✓	
<i>Aira cupaniana</i>	Hairgrass	Moderate	✓	
<i>Artotheca calendula</i>	Cape weed	Moderate	✓	
<i>Avena barbata</i>	Bearded oat	Moderate	✓	
<i>Briza maxima</i>	Blowfly grass	Moderate	✓	
<i>Briza minor</i>	Shivery grass	Moderate	✓	
<i>Callitriche stagnalis</i>	Common starwort	Moderate	✓	
<i>Carduus pycnocephalus</i>	Slender thistle	Moderate	✓	
<i>Cynodon dactylon</i>	Slender thistle	Moderate	✓	
<i>Cyperus tenellus</i>	Tiny flat sedge	Moderate	✓	

Scientific Name	Common Name	DEC Rating	Invasiveness	Impacts
<i>Disa bracteata</i>	South African orchid	Moderate	✓	
<i>Ehrharta longiflora</i>	Annual veldt grass	Moderate	✓	
<i>Hordeum leporinum</i>	Barley grass	Moderate	✓	
<i>Hypochaeris glabra</i>	Flat weed	Moderate	✓	
<i>Juncus bufonius</i>	Toad Rush	Moderate	✓	
<i>Juncus capitatus</i>		Moderate	✓	
<i>Lolium rigidum</i>	Annual ryegrass	Moderate	✓	
<i>Orobanche minor</i>	Lesser broom rape	Moderate	✓	
<i>Parentucellia latifolia</i>	Red Bartsia	Moderate	✓	
<i>Solanum nigrum</i>	Black berry nightshade	Moderate	✓	
<i>Trifolium campestre</i>	Hop clover	Moderate	✓	
<i>Ursinia anthemoides</i>	Ursinia	Moderate	✓	
<i>Vulpia bromoides</i>	Squirrels tail fescue	Moderate	✓	
<i>Vulpia myuros</i>	Silvery grass	Moderate	✓	
<i>Rumex crispus</i>	Curled dock	Mild		
<i>Aira praecox</i>	Early hairgrass	Low		
<i>Bromus hordeaceus</i>	Soft brome	Low		
<i>Lotus suaveolens</i>	Hairy birdsfoot trefoil	Low		
<i>Ornithopus pinnatus</i>	Slender seradella	Low		
<i>Trifolium hirtum</i>	Rose clover	Low		

Sourced: Bennett Consulting (2004).

4.3 POTENTIAL ENVIRONMENTAL IMPACTS

The following issues could potentially arise from mining and processing operations in the absence of mitigation and management measures:

- Introduction of new weed species to the project area.
- Spread of weeds via heavy plant, vehicles and equipment within and between properties.
- Increase in existing weed infestations through disturbance caused by clearing of native vegetation and soil disturbance.
- Compromised resilience of natural revegetation processes after mining due to weed infestation.
- Limiting of topsoil resources due to proliferation of weed species in topsoil seed banks.

4.4 MANAGEMENT MITIGATION MEASURES

During the life of the project all plant, heavy machinery and vehicles arriving on site will be required to be certified clean and free of soil and vegetative matter (Appendix 1). The Environmental Officer is responsible for ensuring all plant, heavy machinery and vehicles arriving on site are inspected and issued with a sticker to certify the item is clean. The sticker

is to have the date of inspection written on it, be signed by the Environmental Officer and placed in a prominent position on the item.

4.4.1 Prior to Topsoil Stripping Activities

Weed management will be required ahead of mining. The purpose of weed management in the pre-mining phase is to limit the volume of weed seeds present in topsoil. The Environmental Officer will liaise with the Site Manager during spring (in conjunction with requirements in the Rehabilitation Management Plan) to determine areas that will be mined in the coming 12 month period. It is then the responsibility of the Environmental Officer to schedule weed surveys of these areas at least three months prior to ground disturbing activities commencing.

In areas where weeds have been identified, the Environmental Officer will ensure the following is undertaken:

- Pre-clearing treatment with “knockdown” herbicide 6 to 12 weeks prior to clearing. The Environmental Officer is responsible for determining whether large scale application of herbicides is appropriate or targeted treatment should be undertaken.
- Post treatment visual inspections to evaluate results and ensure success of herbicide treatment(s).
- Follow up treatments where initial treatment has not been at least 90% successful.
- Completing records detailing the area treated, date of treatment, type of treatment and results.

4.4.2 During Topsoil Stripping

During topsoil stripping activities, plant, machinery and vehicles travelling from weed infested areas will be required to clean down before entering weed free areas. The Environmental Officer will ensure Clean on Entry (CoE) points are established as required and are equipped with log books and the appropriate cleaning equipment. Detailed information on CoE points is provided in Section 4.5.

Where topsoil stockpiles are created, the Site Manager will ensure their height is limited to two metres. The Environmental Officer will inspect topsoil stockpiles as part of regular site inspections to determine if weeds are germinating from the soil seed bank. Where weeds are growing, the Environmental Officer will ensure spot treatment of the topsoil stockpiles is undertaken with an appropriate herbicide.

4.4.3 During Mining

Weed management during mining will focus on weed hygiene procedures and the localised treatment of weeds in operational areas as required.

The Environmental Officer will undertake inspections if the Primary Processing site, production and monitoring bore locations on a monthly basis. Topsoil stockpiles will be inspected on a quarterly basis.

Clean on Entry points will be inspected on a weekly basis when they are in operation to ensure:

- Employees and contractors are using these facilities correctly.
- Adequate numbers of log sheets are available to be completed and collect completed log sheets.
- Assess the effectiveness of CoE points.

If weeds are evident in any inspected areas, the Environmental Officer is responsible for ensuring that these areas are treated with an appropriate herbicide and follow-up monitoring is implemented.

4.4.4 Rehabilitation

Monitoring of weeds in rehabilitation areas is incorporated into the general rehabilitation monitoring program conducted according to the rehabilitation monitoring procedure. Where weeds are identified, the Environmental Officer is responsible for ensuring occurrences are treated with an appropriate herbicide and implementing follow up monitoring.

Weed management post mining will continue until rehabilitated areas are resilient to weed infestation. This is expected to occur with 18 to 24 months after rehabilitation.

4.5 CLEAN ON ENTRY POINTS

CoE points will be established where vehicles and equipment moves from areas known to contain weeds to weed free areas. Where CoE points are required for weed management and hygiene only these points can be removed once topsoil removal activities have been completed. As discussed in Section 5.3.2, CoE points for dieback management and hygiene are required to be in operation for all phases of mining.

The Environmental Officer is responsible for establishing CoE points and ensuring the appropriate equipment is provided. Clean down will involve one of the three following methods depending upon site conditions:

- Washdown – during wet soil conditions only. Inspection of each vehicle/machine traversing the CoE point. Wash to ensure vehicles are free of vegetative matter and mud.
- Blowdown – during dry soil conditions. Inspection of each vehicle/machine traversing the CoE point. Blow off dust, soil and vegetative matter.
- Manual removal – during dry soil conditions. Brushes and buckets for manual removal of dust on vehicles machinery at CoE point.

The Environmental Officer will ensure CoE points are established such that washdown water, mud, soil and vegetative mater is not allowed to travel into weed free areas. Criteria necessary for effective CoE points include:

- A well drained surface to enable effluent / waste material from the clean down process to remain separate from the object being cleaned.

- Easy disposal of water or waste to prevent spread of the disease. This may include construction of bunds and/or a sump and placement of bins to contain vegetative material and soil/mud for later disposal into suitable landfill facility.
- Clear signage to identify the purpose of the CoE point:
 - CoE – WEEDS.
 - CoE – DIEBACK.
 - CoE – WEEDS & DIEBACK.

4.6 HERBICIDES

Weed eradication and control procedures can be obtained from the Department of Agriculture and Food (DAFWA), Western Australia. Contact details are available in Appendix 2.

Where herbicide application is undertaken by contractors, the Environmental Officer will ensure contractors are appropriately licensed and accredited.

A general guide to weed management for weed species rated as High has been included in Appendix 2. Management trends and herbicide use change over time and require continual updating. The Environmental Officer is responsible for remaining up to date with current best practice herbicide applications methods.

In areas where run-off from rain events is likely to enter watercourses or wetlands, the Environmental Officer will ensure that the appropriate herbicides are used to avoid adverse impacts on these areas.

The Environmental Officer will ensure appropriate safety measures are undertaken when handling herbicides including:

- Read and adhere to instructions on the product label.
- Wear appropriate personal protective equipment as detailed on the product label.
- Ensure rates of application and rates of concentration are applied. Do not dilute or over concentrate.
- Avoid spraying with herbicides during conditions of extreme heat, high winds, before or immediately after rainfall.
- Adhere to the recommended methods of application for herbicides. A guide to techniques used for different methods of application of herbicides is provided in Appendix 3.
- Limit any drifting of herbicides onto adjacent areas.

4.7 WEED MONITORING

Table 3 outlines the monitoring schedule and actions required in relation to weed management within the project area.

Table 3: Weed Monitoring Requirements

Description	Responsibility
Pre-mining	
Pre-mining site assessment, three months ahead of mining to identify target weeds species present and the extent of these.	Environmental Officer
Post treatment follow-up within 6-12 weeks of initial treatment during the pre-mining phase.	Environmental Officer
Records of treatment in weed management register, photographic records.	Environmental Officer
Hygiene	
Weekly inspections of all CoE points.	Environmental Officer
Monthly inspections of operational areas, bores, roads, wash down bays.	Environmental Officer
All vehicles, heavy machinery and equipment entering site must be inspected and issued with a Hygiene Certification Sticker.	Environmental Officer
Rehabilitation	
Quarterly inspection of topsoil stockpiles.	Environmental Officer
Assessment of weed presence in line with the Rehabilitation Monitoring Procedure.	Environmental Officer
Treatment of weed occurrences.	Environmental Officer
Post-treatment follow up inspections 6 weeks after herbicide treatment.	Environmental Officer

Monitoring will focus on the general area and the end land use objectives.

General monitoring criteria for weed management will include:

- Absence of Declared Plants and environmental weeds on rehabilitated sites or within operational areas.
- Species present in pre-mining phase.
- Species in rehabilitation areas.
- Weeds around CoE points and mining area.

Where weeds are present, the Weed Management Register (Appendix 4) will be completed by the Environmental Officer. A copy of the form to be completed during site inspections for weeds can be found in Appendix 5.

Monitoring and review of weed management strategies will be ongoing to ensure the Weed Management Plan is effective and progressively developed through the pre-mining, operational and post mining phases.

5. DIEBACK MANAGEMENT

Dieback is a plant pathogen that attacks the root system causing root rot. Spread of the pathogen occurs through movement of the pathogen along root systems and in water via microscopic fungal spores in surface and subsurface flows, by animals and any activity that transfers soil or plant material from one location is also a potential vector. Humans are the most effective vectors, responsible for the fastest and most widespread infestations (Commonwealth, 2009).

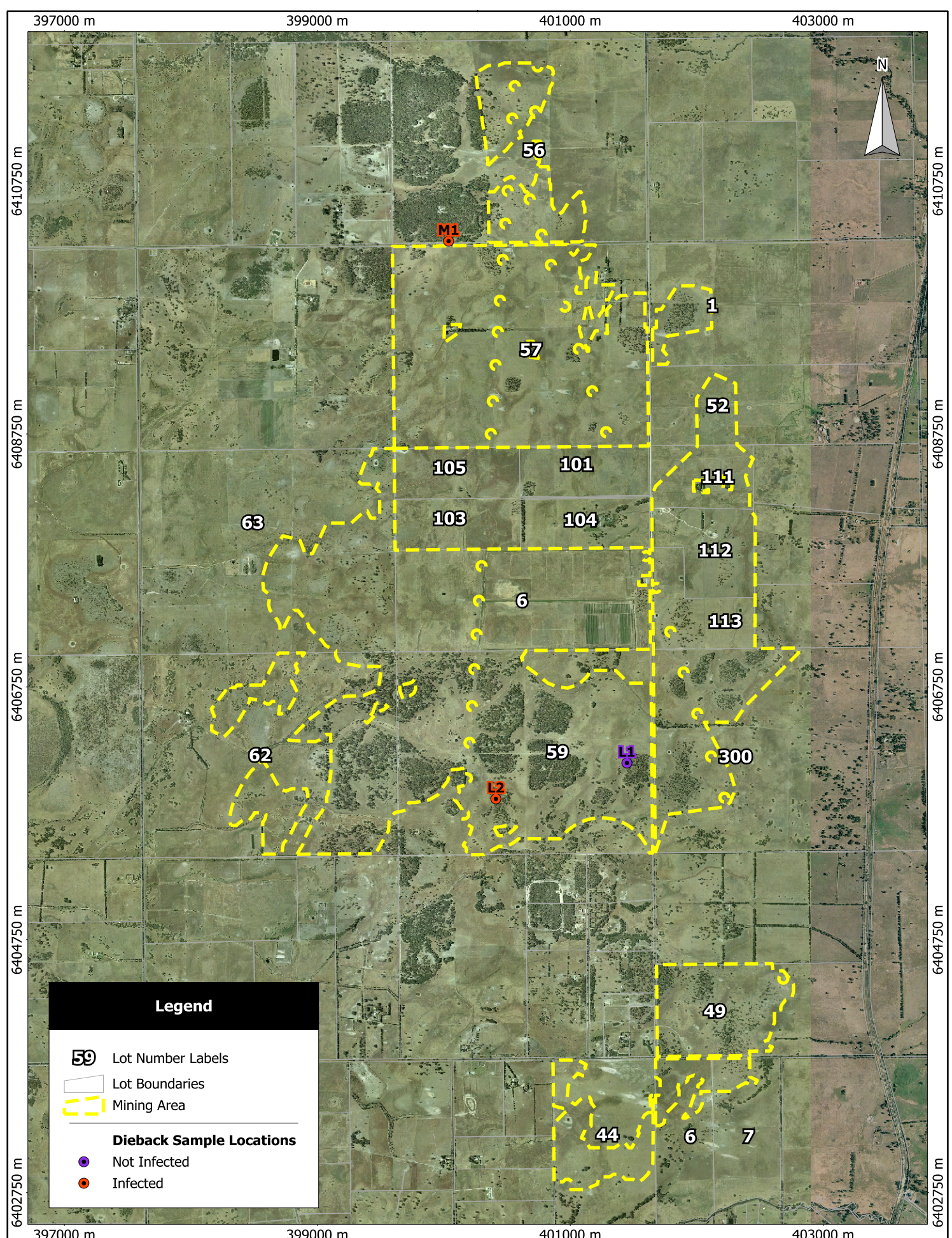
The presence of Dieback is deduced from the death of susceptible plants. Commonly used indicator plants include Jarrah, *Banksia*, Grassrees (*Xanthorrhoea*), *Zamia* Palm, *Hibbertia*, and *Hakea*. Other factors that could have caused plant death (e.g. fire, insects, flooding, drought, chemicals, other pathogens etc) must also be discounted.

5.1 CURRENT STATUS OF DIEBACK IN THE PROJECT AREA

A preliminary survey and sampling program was undertaken on 30 January 2006 investigating native remnant vegetation fragments that exhibited symptoms of Dieback. Soil and root samples were taken in the vicinity of the root zone of deceased *Banksia*. The samples were analysed for the presence of Dieback by DEC's Vegetation Health Services. Results confirmed that Dieback is present in some upland sites. Locations of the sample sites confirming the presence of Dieback in the Project area is presented in Figure 3.

Dieback risk areas are:

- Areas around sampling sites on Lots 57 and 59 identified during preliminary investigations (Section 5.1) as Dieback infected (Figure 3).
- Seventy-five hectares of remnant vegetation identified for conservation in perpetuity.
- Defined buffer areas along watercourses and adjacent wetlands.
- Drainages associated with roads and surface water runoff from mine site infrastructure.
- Un-interpretable areas. Those areas that are sufficiently disturbed so that Dieback mapping can not be undertaken due to the lack of indicator species. Pasture areas, which occur across most of the project area, are un-interpretable. Presence of Dieback in these areas is possible and as such, these areas should be treated as if they are Dieback infected.



Legend

59

Lot Number Labels

Lot Boundaries

Mining Area

Dieback Sample Locations

Not Infected

Infected

5.2 POTENTIAL ENVIRONMENTAL IMPACTS

Mining of mineral sands at Keysbrook has the potential to spread Dieback via:

- Clearing of vegetation and subsequent movement of soil and vegetation.
- Transplanting of vegetation for rehabilitation.
- Movement of soil on equipment and vehicles.
- Movement of infected soils via water erosion to Dieback Free areas.

5.3 MANAGEMENT MITIGATION MEASURES

5.3.1 Site Assessment and Area Categories for Dieback Management

Due to natural processes the extent of Dieback across the project area will have increased since samples were taken in 2006. Further investigation is required for each mining cell prior to ground disturbing activities.

The presence and extent of Dieback requires assessment of the mining area and influencing adjacent areas by an Accredited Dieback Assessor. The Environmental Officer is responsible for ensuring an Accredited Dieback Assessor is engaged to survey mining cells prior to ground disturbing activities occurring. Areas will be mapped according to the following categories:

- Dieback Infected Areas – areas that have been determined to have Dieback.
- Dieback Free Areas – areas that have been confirmed not to have Dieback.
- Un-interpretable Areas – degraded areas where a lack of indicator species presence makes it impossible to determine presence or absence of the disease.

Areas will be signposted by the Environmental Officer using Western Australian Standard Dieback Signage System. A copy of the Standard Dieback Signage Protocol is provided in Appendix 6. Maps of the project area will be maintained by the Environmental Officer to show the results of Dieback assessments, locations and categories of topsoil and vegetation and the Dieback status of each mining cell.

5.3.2 Access Management

Only mining equipment and authorised vehicles will be permitted to travel beyond the primary processing area. All other vehicles including delivery trucks and private vehicles will be required to report directly to the site office at the primary processing area. A single access road will link this area with the South Western Highway.

All vehicles and equipment that are authorised to proceed beyond the primary processing area are required to be inspected by the Environmental Officer and issued with a sticker to certify the item is clean of soil and vegetative matter. The sticker is to have the date of inspection written on it, be signed by the Environmental Officer and placed in a prominent position on the item.

Access roads in Dieback infected or uninterpretable areas will include a layer of limestone to limit the risk of spread of Dieback along these roads. The Site Manager will liaise with the Environmental Officer to determine where limestone is required. All materials for road construction will be sourced from Dieback free areas.

Outside of the site access roads, mining equipment and vehicles will be required to pass through Clean on Entry (CoE) points and be free of vegetative matter and soil when leaving areas identified as being Dieback infected or uninterpretable. CoE points will be required during all phases of mining. The Environmental Officer is responsible for ensuring CoE points are established and stocked with the appropriate cleaning equipment and log books. The Environmental Officer will also ensure all Dieback CoE points are sign posted correctly (e.g. CoE – DIEBACK).

The Environmental Officer will prepare materials for and attend Toolbox and pre-start meetings to ensure employees and contractors are aware of CoE requirements and the need for Dieback hygiene.

5.3.3 Topsoil Management

Topsoil salvage requires planning ahead of mining to ensure that the spread of Dieback in topsoil is limited. The Site Manager will ensure:

- Topsoil from Dieback Infected areas is stockpiled separately, away from topsoil from Dieback Free areas.
- Topsoil from Dieback Free areas will not come into contact with surface water runoff from Dieback Infected materials.
- Topsoil is respread during rehabilitation according to its Dieback status. Topsoil potentially infected with the disease will not be used in Dieback Free areas.
- Where practicable, topsoil is respread at the same location from which it was removed.

The Environmental Officer shall ensure topsoil stockpiles are signposted as described in Section 5.3.1.

5.4 DIEBACK ASSESSMENT

The Environmental Officer will ensure that annual assessments are undertaken to confirm the Dieback status of each mining and rehabilitation area.

Areas requiring annual assessment outside of staged mining areas include:

- Seventy-five hectares of remnant vegetation identified for conservation in perpetuity.
- Defined buffer areas along watercourses and adjacent to wetlands.
- The edges of known or suspected Dieback infected areas to determine the extent of spread (if any).

6. RESPONSIBILITIES

6.1 GENERAL MANAGER

The General Manager is responsible for ensuring any non-compliance are reported to the CEO of the Office of the Environmental Protection Authority (OEPA) within two business days of the non-compliance being known.

6.2 SITE MANAGER

The Site Manager is responsible for:

- Liaising with the Environmental Officer every Spring to determine areas to be mined in the coming 12 month period such that weed and Dieback assessments can be completed.
- Limiting the height of topsoil stockpiles to two metres or less.
- Liaising with the Environmental Officer to determine where limestone is required in road construction to limit the risk of Dieback spread along site access roads.
- Ensuring topsoil from Dieback infected areas is stockpiled separately, away from topsoil from Dieback Free areas.
- Topsoil is respread during rehabilitation according to its Dieback status. Topsoil potentially infected with the disease will not be used in Dieback Free areas.
- Where practicable, topsoil is respread at the same location from which it was removed.

6.3 ENVIRONMENTAL OFFICER

The Environmental Officer is responsible for:

- Ensure all plant, heavy machinery and vehicles arriving on site are inspected and issued with a sticker to certify the item is clean. The sticker is to have the date of inspection written on it, be signed by the Environmental Officer and placed in a prominent position on the item.
- Liaising with the Site Manager during Spring (in conjunction with requirements in the Rehabilitation Management Plan) to determine areas that will be mined in the coming 12 month period such that weed and Dieback assessments can be completed.
- Scheduling weed surveys of areas at least three months prior to ground disturbing activities commencing.
- Scheduling Dieback Assessments prior to ground disturbing activities.
- Establish CoE points and ensure they are appropriately equipped and maintained.
- Conducting quarterly assessments of topsoil stockpiles to assess/treat weed growth.
- Conduct monthly weed inspections of operational areas and treat any identified problem areas.
- Remaining up to date with current herbicide regulations and best practice.

- Identifying appropriate herbicides for use dependant upon specific conditions at each treatment location.
- Ensuring appropriate safety measures are undertaken when handling herbicides including:
 - Read and adhere to instructions on the product label.
 - Wear appropriate personal protective equipment as detailed on the product label.
 - Ensure rates of application and rates of concentration are applied. Do not dilute or over concentrate.
 - Avoid spraying with herbicides during conditions of extreme heat, high winds, before or immediately after rainfall.
 - Limit any drifting of herbicides onto adjacent areas.
- Ensuring topsoil stockpiles, CoE points and Dieback areas are appropriately signed.
- Ensuring accurate maps are maintained of Dieback occurrence across the project area.
- Liaising with the Site Manager to advise where limestone is required in road construction to limit the risk of Dieback spread along site access roads
- Attend Toolbox and pre-start meetings to ensure employees and contractors are aware of CoE requirements and the need for dieback hygiene.

7. AUDITING, REPORTING AND REVIEW

This WDMP will undergo an internal audit to ensure compliance with this plan and assess the effectiveness of management measures contained within the plan. The Environmental Officer is responsible for ensuring this audit is undertaken on an annual basis.

The Environmental Officer is responsible for internal monthly reporting of results of all monitoring and assessments under this Plan. This information will also be included in the Annual Environmental Report submitted to DEC.

The Environmental Officer is responsible for reporting any non-compliance with this Plan to the General Manager. The General Manager is responsible for ensuring any non-compliance are reported to the CEO of the Office of the Environmental Protection Authority (OEPA) within two business days of the non-compliance being known.

This WDMP will be reviewed on an annual basis and as directed by the CEO of OEPA to ensure it remains current. Results of monitoring and internal audits will be taken into account during the review process.

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KEYSBROOK MINERAL SANDS PROJECT
KEYSBROOK, WESTERN AUSTRALIA
JANUARY 2011

PROJECT CODE: MATWEE

NAME/TITLE	COMPANY	COPY NO.	DATE	AUTHORISED BY
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APPENDICES

APPENDIX 1:
KEYSBROOK MINERAL SANDS PROJECT MACHINERY AND
VEHICLE INSPECTION HYGIENE CERTIFICATE

MATILDA ZIRCON MACHINERY AND VEHICLE HYGIENE CERTIFICATE CHECKLIST

It is important that all earthmoving machinery, vehicles and equipment are in an acceptable condition before entering the Keysbrook Mineral Sands Project area in relation to weeds and Dieback..

This inspection must be completed upon entry to the site and submitted to the Environmental Officer. A sticker confirming this inspection has been passed will be issued.

Date of inspection:

Company requesting equipment import to Frances Creek:

Name of person conducting inspection:

What kind of vehicle / machine /equipment is it?

Serial or registration No of equipment/machine:

Was the vehicle / machine cleaned before it left the last site?

Yes ☐ No ☐

Are buckets, tracks, blades, grills, utility tray-back free of soil and vegetation?

Yes ☐ No ☐

Are the tyres free of vegetation and soil?

Yes ☐ No ☐

Work required/comments:

If you have answered **NO** to any of these questions, please carry out the required cleaning and/or maintenance before the machine is transported onto Keysbrook Mineral Sand Project. Entry of the machinery will not be permitted until evidence of cleaning can be provided. No machines may enter site until authorised by the Environmental Officer.

Based on inspection of the specified equipment/machinery, I confirm the item is free of vegetative and soil material and is suitable for entry into the Keysbrook Project area.

Signed:

Name:

Position:

Date:

KEYSBROOK MINERAL SANDS PROJECT USE ONLY

Evidence of cleaning provided is satisfactory and the equipment is suitable for entry to Frances Creek.

Signed:

Position:

Date:

APPENDIX 2:

WEED INFORMATION AND ERADICATION PROCEDURES

Weed information and eradication procedures can be gained from consultation with:

Department of Food and Agriculture (DAFWA), Western Australia

Senior Research Officer: John Moore

Phone: (08) 989 28 444 or E mail: jmoore@agric.wa.gov.au

Weed Control Procedures for Targeted Environmental Weeds

Weed Species	Description	Eradication
<i>Bromus diandrus</i>	Not a Declared Weed A tufted annual grass to 90 cm tall with soft, hairy, flat, loosely folded. The inflorescence is an erect or drooping panicle to 15 to 25 cm long. Flowers in spring leaves with branched inflorescences that are 2-12 centimetres long and usually prominently long awned spikelets.	500 ml glyphosate (450g/l) applied when grass in very young or flowering is fairly selective amongst native vegetation, cheap and effective (DAFWA Bulletin 4744)
<i>Ehrharta calycina</i> Perennial Veldt Grass	Not a Declared Weed Serpentine – Jarrahdale Pest Plant Check periodically with shires for changes to weeds declared under the Local Government Act. A tufted annual grass up to 80 cm high. Inflorescence is an erect panicle of drooping reddish purple flowers 7 – 22 cm long. Flowers in spring.	Spray topping with 1200 ml/ha glyphosate (1350g/l) when flowering. Contact DAFWA for suitable control methods for use during rehabilitation.
<i>Romulea rosea</i> Guilford Grass/Onion Grass	Not a Declared Weed A small herb with long slender, very tough, cylindrical basal leaves produced annually from a small corm. Star flowers pink to purple. Flowers winter and spring.	20g/ha chlorsulfuron (750g/kg) plus 25 ml Pulse® suitable for use in bushland (DAFWA Bulletin 4744).
<i>Leptospermum laevigatum</i> Victorian teatree	Not a Declared Weed Serpentine – Jarrahdale Declared Pest Plant Check periodically with shires for changes to weeds declared under the Local Government Act. Large shrub to 5 m high with greyish green foliage, leathery leaves, 15-30 mm long and 4-9mm wide. Single white flowers have 5 small but broad petals spreading above cup-shaped leathery base. Domed woody fruit opens by 7 – 10 valves to release tiny seeds.	Slash, burn, bulldoze or mulch thickets then burn dry. Spray re-growth until just wet with 100ml Grazon® plus 25ml Pulse® n 10l water. Seedlings can be manually removed the first year or two seedlings (DAFWA Bulletin 4744).

Weed Species	Description	Eradication
<i>Rumex crispus</i> Curled Dock	<p>Not a Declared Weed</p> <p>Serpentine – Jarrahdale Pest Plant</p> <p>Check periodically with shires for changes to weeds declared under the Local Government Act.</p> <p>A robust, tap-rooted perennial 50-150 cm high, with numerous stiff branches held more or less upright. Basal rosette of big leaves at ground-level. The leaf blade is puckered or wavy especially near the margins (crisped), narrowly egg-shaped (ovate) to more or less oblong, to 30 cm long and to 6 cm wide, with a pointed tip and a tapered to blunt base. The numerous flowers are in dense clusters close together along the branches. Flowers have 6 greenish to white perianth segments (commonly called 'valves' in the docks). The fruiting heads become rusty-brown and conspicuous.</p>	<p>5ml per litre Asulox® (Asulam) Apply in spring when leaves fully expanded but before the flowering shoot begins elongation. May also be applied by wiper applicator.</p>

Pictures of each weed species are provided to assist with identification (see Plates 1 to 5).



Plate 1: **Flowers of *Bromus diandrus* (Great Brome) (Florabase 2010)**



Plate 2: *Ehrharta calycina* (Perennial Veldt Grass) (Florabase 2010)



Plate 3: *Romulea rosea* (Guilford Grass/Onion Grass) (Florabase 2010)



Plate 4: *Leptospermum laevigatum* (Victorian teatree) (Florabase 2010)



Plate 5: *Rumex crispus* (Curled Dock) (Florabase 2010)

APPENDIX 3:
WEED CONTROL TECHNIQUES FOR EFFECTIVE USE OF
HERBICIDES

Weed Control Techniques for Effective Use of Herbicides

Different techniques for the application of herbicides include:

- **Foliar Sprays** – usually most effective during phases of active plant growth. Concentration and rates of application vary between products and manufacturers (read product label), consider use of dyes to identify sprayed areas, use of wetters/surfactants to improve results.
- **Cut Stump/Cut and Paint** – suitable for woody species. Involves cutting the plant off close to the ground and immediately applying herbicide to the cut surface whilst the stem is still wet to maximise uptake by translocation of sap. Large trees can be ring barked and treated via the same method.
- **Scrape and Paint** – Useful on scrambling vines and shrubs with a woody stem. Scrape a section of stem with a knife to expose sapwood just below the bark, apply herbicide with a paint brush immediately to the exposed stem. Avoid scraping the width of the whole stem, consider scraping thicker stems on two sides, and follow directions on the product label.
- **Stem Injection** – useful to kill trees in situ without chopping. Apply concentrated herbicide to an angled cut or drill hole made into the xylem/ woody part of the stem.
- **Basal Bark Treatment** – useful on young woody species and suckers. Spray herbicide onto bark at the base of the plant from ground level to about 30 centimetres above the ground.

APPENDIX 4: WEED MANAGEMENT REGISTER

APPENDIX 4: WEED MANAGEMENT REGISTER

Details of Personnel	
Name	
Position	
Date	
Specifics	Details
Weed species	
Common name	
Cause of weed occurrence (e.g. vehicle)	
Photo of weed attached	
Approximate area for control (m2)	
GPS location	
Before photo date and number at GPS location	
After photo date and number at GPS location	
Fixed Point Photography site:	YES/NO
Site description	
Aspect.	
Control method including herbicide name with/without wetter/surfactant	
Post Treatment	Follow up Actions
No further treatment required:	YES/NO
Date:	
Description of growth, e.g. seedlings and height, coppicing, length of shoots, , flowers, seeds, fruit, coloration, etc	
Herbicide	
Date of treatment	
Concentration and rate	
Surfactant/wetter	

APPENDIX 5: WEED MONITORING FORM

KEYSBROOK MINERAL SAND PROJECT WEED MONITORING FORM

Name of Inspector (Print): _____

Date: _____

Weather Conditions Prior to Inspection: _____

Weed Inspection Areas	Date Completed	Weeds Present (Yes/No)	Actions to be Taken
Primary Processing Area			
Wash down bay			
Office and Car Park area			
Access Roads			
Monitoring/Production Bores			
CoE Points			
Other			

APPENDIX 6: STANDARD DIEBACK SIGNAGE PROTOCOL

Standard Dieback Signage Protocol

For the use of Standard Phytophthora Dieback Signage on all land tenures in Western Australia.

10 March 2009



Project Dieback is delivered by South Coast Region NRM Inc., funded by the Australian Government and Government of Western Australia.



Australian Government



Department of Environment and Conservation

Our environment, our future



Summary

Any person or organisation responsible for the management of lands either with or neighbouring native vegetation in the South West of Western Australia should consider the threat that *Phytophthora Dieback* presents to the maintenance of biodiversity. This is important particularly for areas receiving more than an average annual rainfall of 400mm.

A professional assessment should first be made to determine the disease status of an area. Standard signage is then available which can be used to insure protection of disease free areas.

A range of signs are available depending on the management objectives for an area or works and activities planned.

The signage system is based on the following status symbols:



Soil, gravel, sand and plant material should never be moved from areas that are known to be infested to areas known to be disease free. It is important to get the message across “Be Clean in the Green” and “Don’t Spread the Red”.

Interpreting the disease status of areas can be difficult especially as many area of the South West have been affected for many decades. Signage should only be used if qualified environmental consultants have sampled and verified the disease situation in an area.

There are many reasons for the cause of plant deaths so it is important to confirm presence of *Phytophthora cinnamomi* in any candidate areas for signage. However, if field interpretation is not available in the short term for a potentially threatened area, non-mapped “Dieback Protection Area” signs are available until a *Phytophthora Dieback* assessment can be made.

Project Dieback NRM, in conjunction with the State Dieback Consultative Council (DCC), Dieback Working Group (DWG) and Department of Environment & Conservation (DEC), have developed this standard dieback signage system to assist in the management of *Phytophthora Dieback*. Project Dieback is a Natural Resource Management (NRM) initiative to protect environmental, social and economic values from the dieback threat in Western Australia. The Australian Government and Western Australian Government fund the project through the joint National Action Plan for Salinity and Water Quality programme and the Natural Heritage Trust.

Introduction

The south west of Australia is extensively invaded by the introduced soil borne water mould *Phytophthora cinnamomi* known as Phytophthora Dieback. The pathogen is recognised as one of the key threatening processes to Australian biodiversity.

Humans are the greatest vectors in spreading Phytophthora Dieback. People can carry the plant pathogen from infested areas in many ways. Often by mud on footwear or vehicles, shifting infested soil or gravel, grading roads or moving infected plant material.

The aim of the signage is to raise dieback awareness and to assist land managers, operations staff and contractors involved in any earthworks to minimise the risk of spreading existing infestations and protecting areas still free from this invasive species.

The Western Australian Standard Dieback Signage System has been developed for use across all land tenures, including areas managed by local and state government, private property and mining areas. Land managers, government agencies, extractive industries and developers should use the signage system as part of an overall disease risk management plan to minimise the risks of establishing new infestations as a result of human activity.

The signage system is designed particularly to protect valued areas threatened by dieback following the field interpretation and mapping of *Phytophthora cinnamomi*. These areas may be identified as Dieback Protection Areas and dieback infestations can be delineated from dieback free areas using the signs.

The signage has a standardised series of designs to ensure consistency across land tenures and therefore higher recognition and understanding of the threat. Consequently, the signage will be the same format in national parks and reserves, mine sites, along road sides and in local government parks.

To be effective, signs must be considered an integral part of an area's overall management. Use of signage to guide public staff and contractors should be one component of management. Managers, government agencies and developers are advised to also adopt best practise disease management to minimise the risks of establishing new infestations as a result of soil movements.

This protocol describes the signage system, sets out a flow chart to graphically represent the sequencing of steps required to use the signs and provides information required for signage application, installation and management.

Standard Dieback Signage System

The signage system was designed as part of a state communication plan that aims to have consistent relevant themes and messages for stakeholder groups to use in Western Australia in regard to Phytophthora Dieback management.

The signs aim to enable people to gain the right message, do the right actions and be aware of Phytophthora Dieback in the environment.

The signage system is based on the following status symbols:



A range of signs and markers are available depending on an area's requirements including for roadsides, walk tracks and Dieback Protection Areas. (Section 1: Dieback Signs and markers.)



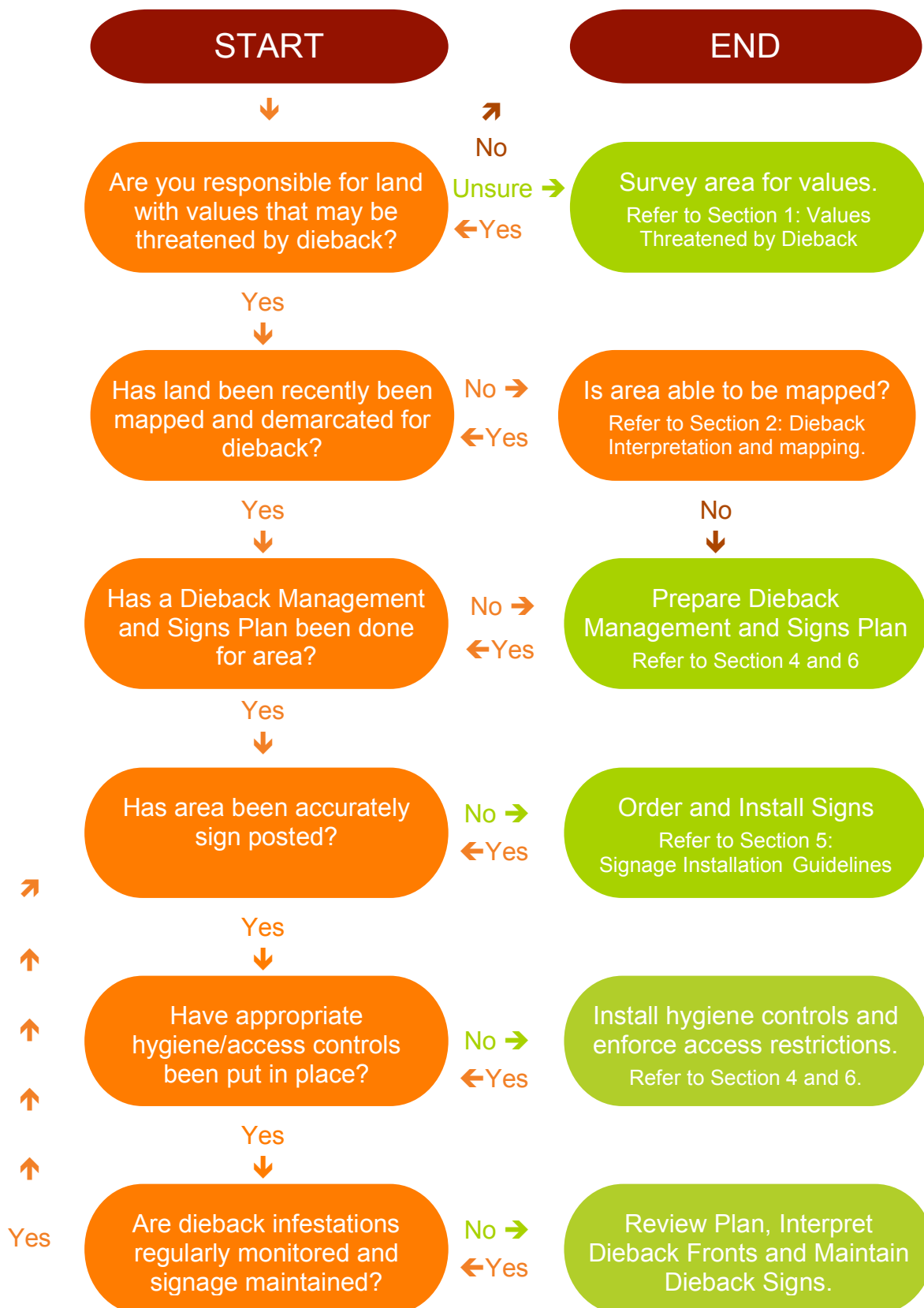
Picture 1: Example of Dieback Protection Area sign.

There is an option to have management logos integrated into Dieback Protection Area signs and changes to wording for specific area requirements. These wording changes however still need to be approved to ensure messages and themes are accurate and consistent with Phytophthora Dieback management.

The Dieback Signage flow chart sets of the procedure to follow in regard to using the signs.

Protocol Flowchart

The following flowchart provides guidance for incorporating the Standard Dieback Signage System into an area.



Section 1: Values Threatened by Dieback

Phytophthora Dieback impacts over 40% of the plant species in Southwest Australia, which consequently threatens many environmental values including changes to ecosystems and destruction of habitats. Dieback threatens social and economic values impacting natural resources and horticultural industry.

When assessing the risks from Phytophthora Dieback, values should to be prioritised to ensure management resources are designated effectively.

Area may have access roads, tracks or drainage lines into other areas with values that are threatened by Phytophthora dieback and therefore neighbouring areas should to be taken into consideration in surveying values and Dieback Management planning. Hygiene control is advised during any ground survey.

An overall strategic risk assessment has been carried out for the south west of WA and is also a resource that can assist in value assessment. Details can be accessed through the www.dieback.net.au website as well as a list of the most susceptible species threatened by Phytophthora Dieback. The following lists some of the values that may be impacted.

Environmental Values

Environmental Values may include:

- healthy bushlands with susceptible plant communities,
- endangered plants,
- rare animal habitats.

A susceptible plant species list is available on www.dieback.net.au. Technical advice is available through your NRM Dieback officer, DEC or local environmental officer.

Social Values

Social Values may include:

- wildflower viewing areas,
- cultural places,
- bush products.
-

Economic Values

Economic Values may include:

- tourist areas,
- timber resources,
- nurseries,
- susceptible horticultural plantations
- honey production.

Section 2: Dieback Interpretation and Mapping

Dieback Interpreters carry out a detailed procedure to determine the presence of Phytophthora Dieback (*Phytophthora cinnamomi*) in bushland and forest areas.

The presence of this soil borne pathogen is typically undertaken using a combination of aerial photography interpretation (API), assessment of existing vegetation using certain susceptible species as indicators and sampling soil and plants to confirm infestation through laboratory testing.

The determination of the presence of Phytophthora dieback requires significant technical knowledge and it is recommended that suitably qualified and experienced professionals undertake this assessment.

Consultants provide a dieback report, management recommendations, detailed maps of dieback status/protectable areas and ground demarcation usually with coloured tape. Old mapping and demarcation may need to be refreshed as dieback has been known to move downhill over ten metres a year and even uphill one metre a year through root to root contact. Dieback status signage should only be used in areas where the dieback has been recently verified.

Phytophthora Dieback indicator plants include members of the Proteaceae, (*Banksia*, *Grevillea*, *Hakea* etc), Myrtaceae (*Eucalyptus*, *Verticordia*, *Calothamnus* etc), as well as species such as grasstrees (*Xanthorrhoea* sp.), and zamia palms (*Macrozamia* sp.). More details of susceptible can be found at www.dieback.org.au.

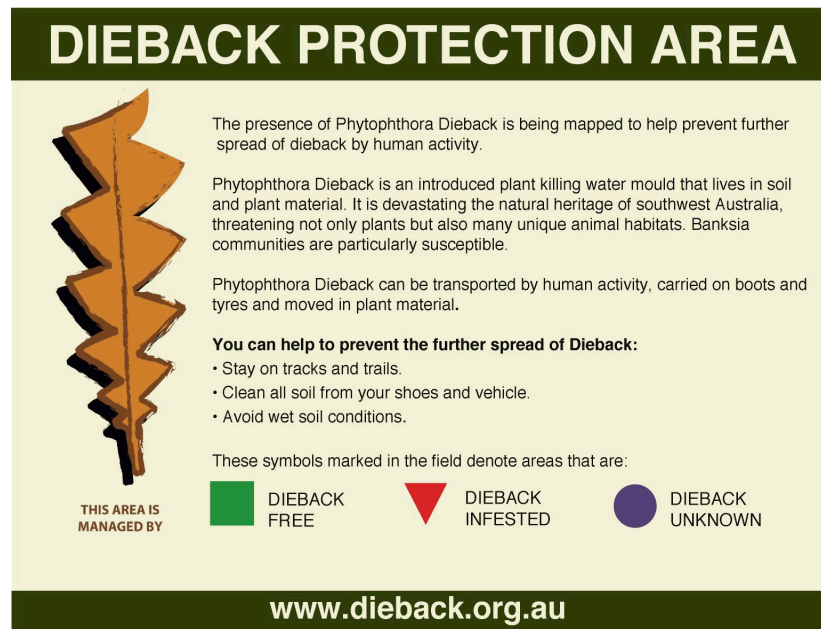
Consultants that can provide assessment of lands and arrange analysis of soil samples for dieback can be found in Section 9: Contacts.

Section 3: Dieback Signs and Markers

1. Dieback Protection Area (DPA) Signs

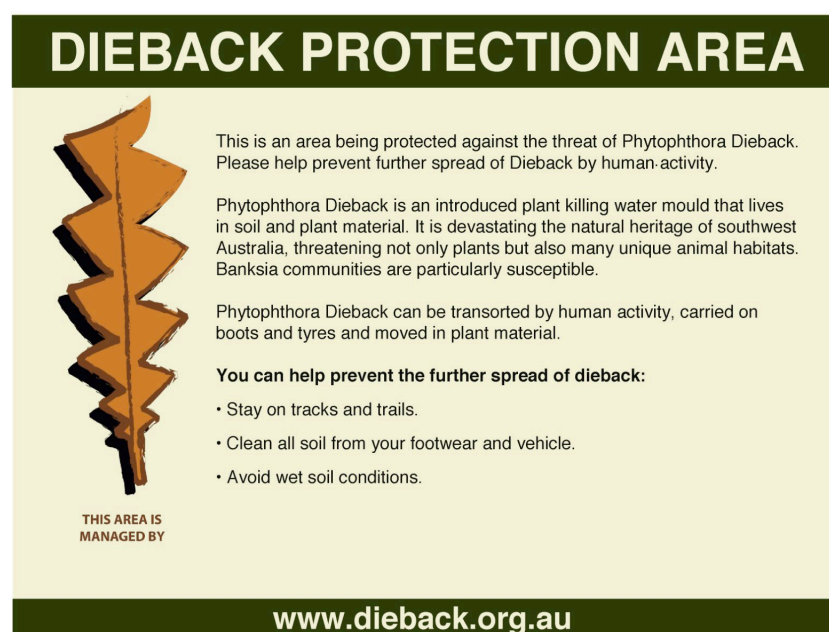
DPA Signs are digitally printed on 600 x 450 aluminium panels.

1.1 DPA Boundary Entry Signs for dieback mapped areas:



Item Code: DPA07-1

1.2 DPA Boundary Entry sign for non-mapped areas



Item Code: DPA07-2

1.3 DPA Boundary Entry Signs for Access By Permit Only Areas:



Item Code: DPA07-3

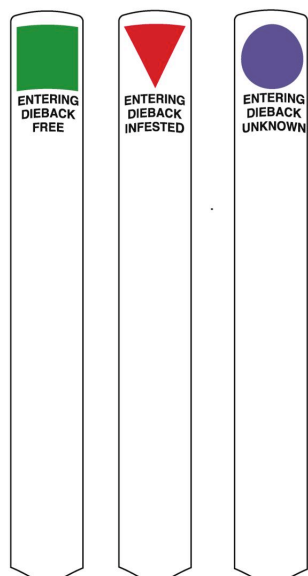
1.4 DPA Boundary Entry Signs for Hygiene Stations - Footwear:



Item Code: BCS-1

2. Dieback Status Markers and Symbols

2.1 Dieback status boundary markers for roads and walk tracks are indicated using status stickers on white steelflex guideposts.



Item Codes:

Steelflex Posts - EDSF1300-WHT

Vinyl Stickers -

- *Entering Dieback Free – EDF-TV*
- *Entering Dieback Infested – EDI-TV*
- *Entering Dieback Unknown – EDU-TV*

2.2 Dieback status symbol alternative for roads and walktracks are on 95 x 140mm aluminium panels.



Item Codes:

Aluminium Panels -

- *Entering Dieback Free – EDF-TA*
- *Entering Dieback Infested – EDI-TA*
- *Entering Dieback Unknown – EDU-TA*

2.3 Dieback status symbol indicators used within dieback status areas on 95 x 140mm aluminium panels or vinyl stickers.



Item Codes:

Aluminium Symbol Panels -

- *Dieback Free Symbol – DF-SA*
- *Dieback Infested Symbol – DI-SA*
- *Dieback Unknown Symbol – DU-SA*

Vinyl Symbol Stickers

- *Dieback Free Symbol – DF-SV*
- *Dieback Infested Symbol – DI-SV*
- *Dieback Unknown Symbol – DU-SV*

See Appendix 1 for current Signs ordering form.

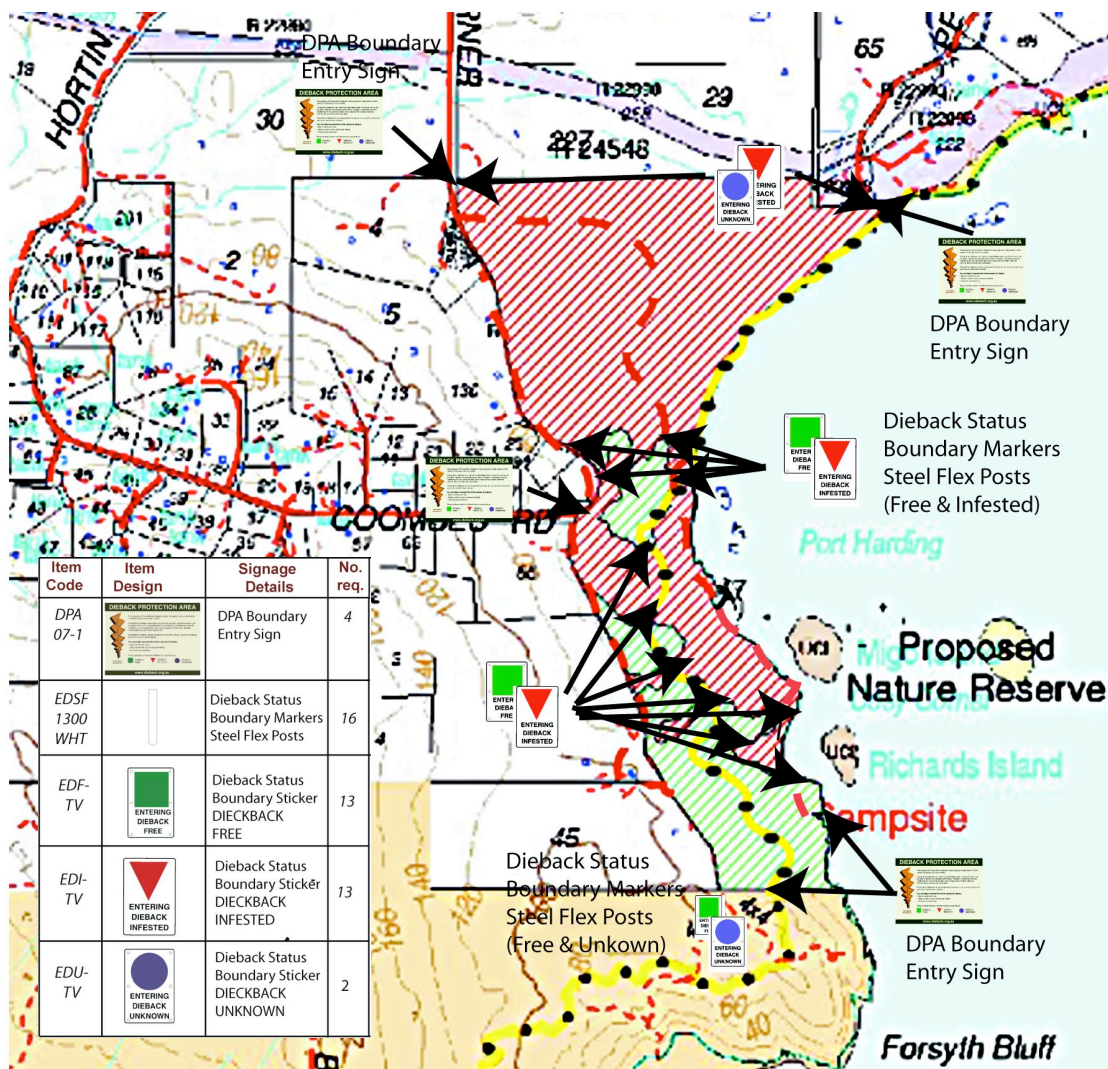
Section 4: Dieback Management and Signs Plan

A signs plan is done in conjunction with the area's overall management plan. The Signs plan records required signs in regard to access points, awareness objectives, restrictions, hygiene stations and future predicted autonomous spread.

The Area Signage Plan should also designate hygiene requirements for installation and future dieback monitoring and signs review. It is essential that signs are maintained in good condition and a register of installations be made. All Dieback Signage used in any area is to be documented as part of the signs plan and a summary is requested to be sent to the DCC State Register (Appendix 1).

Example of a Signs Plan Map

Phytophthora Dieback Signs Plan Map Cosy Corner Reserve, Albany



Section 5: Signage Installation Guidelines

The correct placement of signs along the dieback boundary and at entrances to areas affected by Dieback is important assist in reducing the spread of Phytophthora Dieback.

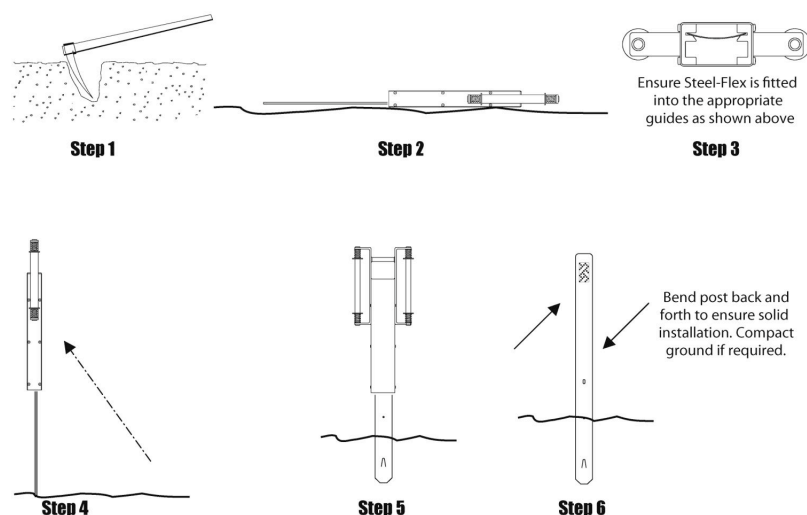
Dieback Protection Area Entry signs (DPA-071, DPA-072;) should be placed at road and walking trail entrances. This should be at a location where vehicle speeds are at a minimum such as a gate, or walking trail entrance. These signs should be installed on posts of sufficient length to enable them to be visible over any vegetation. 4x4 wooden posts are acceptable or the 2250 mm steel posts (code Calm2250-csa) which can be driven directly into the ground.

Posts for the delineation of the dieback front are to be Ezydrive Steel Flex posts. (Code EDSF1300-WHT) with self adhesive symbols (code DF-SA, DI-SA, and DU-SA) to be applied to the posts. These should be installed so that the posts are aligned with the axis of the dieback front as demarcated by the Dieback Interpreters.

Installation of the Posts

The easy drive steel flex posts from Rondo Building services are easy to install using a hand driver. It is critical that care is taken to ensure all equipment is clean before use in installation of posts. Signage should be installed under dry soil conditions and no soil should be moved on vehicles or equipment away from infested areas. Always install signs into disease free areas prior to any with in infested areas. Advice on hygiene and sterilants is provided in Section 7.

It is preferable to locate the correct location for the sign by GPS and ground demarcation. This information is to be provided by the mapping consultants. Be sure to place signs at the correct buffer width from the visible disease front (15m up slope or cross slope, and 25m + down slope depending on rate of spread.) This allows for cryptic disease which will be present but not showing symptoms. Buffers also allow for some movement of the disease as it grows.



Section 6: Standard Hygiene and Management

To manage Phytophthora Dieback in any area, there is a need to plan ahead. The introduction or human-assisted spread of the pathogen can be avoided if activities are well planned and management procedures are in place.

Phytophthora Dieback management procedures must be integrated into all land management activities if the spread and impact of this organism is to be minimised.

Organisations such as the Department of Environment and Conservation (DEC), Alcoa World Alumina Australia and Main Roads WA follow procedures to minimise the risk of their activities spreading the pathogen. Many local governments are also adopting Phytophthora Dieback management policies and implementing management procedures. Anyone who owns, manages or uses a bushland area can also take steps to ensure that their activities don't introduce or spread the pathogen. Any operations which involve soil movement can put disease free areas at risk.

Standard hygiene and management may vary for each status area.

DIEBACK FREE	DIEBACK INFESTED	DIEBACK UNKNOWN
Cleandown stations should be used to remove or sterilize mud and soil from footwear, equipment and vehicles when entering Dieback Free. Avoid moist soil conditions. Access may be restricted.	An effective hygiene cleandown must be carried out when leaving a Dieback Infected area into Dieback Free. Ensure no infested soil, gravel or plant material crosses the dieback boundary.	Areas are unknown if they have not been mapped or do not have indicators that identify the presence of Phytophthora Dieback. Areas may still have hygiene and access restrictions.

Hygiene is essential to any operation or activity aiming to minimise the spread of Phytophthora Dieback. Next section details some guidelines applicable to the cleaning of vehicles, equipment and footwear. Also included are some points about sterilisation of water, equipment and footwear. Where practical it is preferable to use the dry cleaning methods (air compressor, brushes) rather than cleaning with water as it has a significantly lower chance of accidentally spreading the pathogen.

It should be noted that dust and grime on vehicles or equipment is not a threat in terms of spreading Phytophthora Dieback.

Section 7: Guidelines for cleaning vehicles/equipment

- Cleaning will be easier and more effective if completed at a depot or designated cleaning area.
- Field-based cleaning requires:
 - A hard, well-drained surface (e.g. road) that is well away from native vegetation. Any washdown effluent should be collected on-site and must not be allowed to drain bushland.
- Minimise water use to remove soil and mud from equipment/vehicles. This can be achieved by preferentially dry cleaning techniques e.g. stiff brushes.
- Washdown on ramps if possible.
- Prevention of mud and slurry from entering into uninfested or uninterpretable bushland. Soil and waste can be collected for sterilisation (see guidelines for sterilising below).
- Pay particular attention to mudflaps and tyres.
- Do not drive through effluent generated from cleaning when exiting the washdown facility.

Guidelines for cleaning footwear

- Try to remove mud and soil when it is dry. Remove as much mud and soil as possible with a stiff brush or stick and minimise the amount of water used.
- Collect all mud and soil removed and place in a bucket or bag for later disposal at a site that is infested with *P. cinnamomi* or that contains no native vegetation.

Guidelines for sterilising

- Sterilisation of equipment, footwear and vehicle tyres can be used to take an extra precaution. Sterilisation of nursery equipment using steam is common practice, however the use of steam is not practical in the field. The following sterilisation methods can be used in the field.
- Spray methylated spirits on small hand tools and footwear covering all surfaces and allowing a few minutes for it to soak into all soil material.
- Spray diluted bleach (sodium hypochlorite) onto equipment and footwear allowing a few minutes before rinsing the bleach off using water. Dilute bleach so that solution contains 1% active ingredient sodium hypochlorite. Be sure to follow any of the manufacturer's safety instructions provided on the bleach container.
- Spray Phytoclean® can be used in footbaths, washdown facilities and during the cleaning of equipment. See the manufacturer's details for directions.

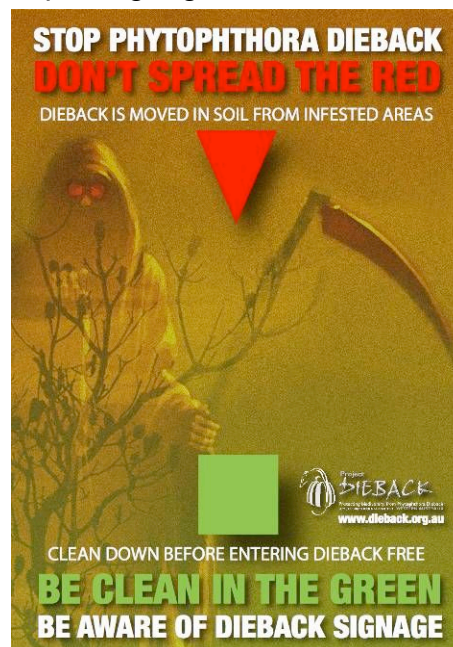
Section 8: Publications and resources

- “Signage For All” DL Pamphlet



Produced by Project Dieback April 2008

- “Botanical Grim Reaper Signage Awareness” A3 Posters



- Project dieback website www.dieback.net.au

Pamphlets and posters are free on request from South Coast NRM Inc. on Mercer Rd., Albany or Cranmill Environmental Services.

Section 9: Contacts

Dieback Consultants

Coffey Environments

Jeremy Spencer

61 Duke Street,
Albany 6330

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E-mail: mail@glevan.com.au

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Ian Moore

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Mob: 0418612815

Email: itemoore@primus.com.au

Woodman Environmental Consulting Pty Ltd

Greg Woodman

Ph: (08) 9315 4688

Fax: (08) 9315 4699

Mobile: 0408 940 589

email: office@woodmanenv.com.au

Ordering Signs

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Rick and Simone Miller

PO Box 500 Mundijong WA 6123,

Phone: (08) 9525 9643

Mob: 0407 758 799

Mob: 0409 290 944

Email: cranmill@iinet.net.au

Jason Signs

54 Kurnall Road,
WELSHPOOL WA 6106





Ph: 08 9458 7033

Fax: 08 9458 8552

Web: jsm.net.au

State Dieback Signs Register

The following Signage Summary Sheet should be completed and copied for each area where signage is installed. A copy should be sent to Cranmill Environmental Services (PO Box 500 Mundijong WA 6123 or cranmill@iinet.net.au;) who are coordinating the state register funded by Project Dieback on behalf of the Dieback Consultative Council.

Reserve or Location:	
Central GPS Reading:	
Closest road name:	
Contact person/position:	
Organisation:	
Phone:	
Email:	
Values at risk:	
 DPA Entry with Status Symbols	Total Number Used: <input type="text"/>
 DPA Entry without Status symbols	Total Number Used: <input type="text"/>
 Boot Cleaning Station	Total Number Used: <input type="text"/>
 Road/Track Posts	Total Number Used: <input type="text"/>
 Track Markers Panels 95 x 140 (Aluminium)	Total Number used: <input type="text"/>
 Track Markers 95 x 95 (Aluminium)	Total Number Used: <input type="text"/>
Dieback interpretation done by:	
Date of installation:	
Monitoring of disease fronts in vicinity of signs.	Dates to be visited by officer responsible.
Comments/Requests:	

Acknowledgements



Great Southern TAFE

Students assisted in developing this system and have also developed icons representing values and threats which could be made available if any land managers felt they would assist them in communicating with the public.