

# Appendix F

**Dieback Assessment (Gleven, 2013)**



**Woodman  
Environmental  
Consulting Pty Ltd**

Warrego Energy

*Phytophthora* Dieback  
Occurrence Assessment



**GLEVAN  
CONSULTING**

## Disclaimer

This report has been compiled by Evan Brown from Glevan Consulting and is prepared in accordance with the scope of work agreed between Woodman Environmental Consulting Pty Ltd and Glevan Consulting. The report may contain results and recommendations specific to the agreement. Results and recommendations in this report should not be referenced for other projects without the written consent of Glevan Consulting.

Procedures and guidelines stipulated in various Department of Environment and Conservation and Dieback Working Group manuals are applied as the base methodology used by Glevan Consulting in the delivery of the services and products required by this scope of work. These guidelines, along with overarching peer review and quality standards ensure that all results are presented to the highest standard.

Glevan Consulting has assessed areas based on existing evidence presented at the time of assessment. The *Phytophthora* pathogen may exist in the soil as incipient disease. Methods have been devised and utilised that compensate for this phenomenon; however, very new centres of infestation, that do not present any visible evidence, may remain undetected by dieback assessors.

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# Table of Contents

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<b>Introduction</b>	<b>4</b>
Study team	5
Background	6
<b>Methods</b>	<b>9</b>
Pre survey desktop study	10
Field survey	11
Demarcation of hygiene boundaries	11
Factors indicating the presence of Phytophthora Dieback	11
Limitations of disease mapping	14
<b>Results and Discussion</b>	<b>15</b>
<b>Recommendations</b>	<b>17</b>
<b>Bibliography</b>	<b>18</b>
<b>Maps</b>	<b>19</b>

# List of Figures

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Figure 1 - Project Area .....	5
Figure 2 - Disease Triangle .....	7
Figure 3 - Disease pyramid .....	7

# List of Tables

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Table 1 - Dieback Occurrence Categories .....	10
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## INTRODUCTION

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Glevan Consulting was commissioned by Woodman Environmental Consulting Pty Ltd to conduct an assessment for the presence of *Phytophthora* Dieback in the Warrego Energy West Erregulla Exploration area (Project Area) as shown below in Figure 1. The project area covers approximately 9,400 hectares, of which 6,000 hectares is remnant vegetation on crown land and is located forty kilometres south-east of Dongara.

The greater majority of remnant vegetation occurs on Uninvested Crown Land (UCL) with small pockets of vegetation appearing on road reserves and private property. The remainder of the private property has been cleared.

The dominant indicator species used during this survey and that were expected to be reliable indicators to the presence of Dieback included *Banksia* and *Xanthorrhoea* species. A recent survey conducted by Glevan Consulting in similar vegetation communities and environmental conditions ten kilometres west of this project area used these same families of species to determine the presence of *Phytophthora* species.

The project area is expected to receive between 400mm to 500mm of annual rainfall based on rainfall maps and Bureau of Meteorology data (Bureau of Meteorology). The Department of Environment and Conservation Management Guidelines manual states that “there is no record of *Phytophthora cinnamomi* in regions receiving <400mm” and that “in areas receiving <600mm dieback due to *Phytophthora cinnamomi* is restricted to circumstances where localised hydrological effects, such as the shed from granite bosses or rising ground water tables associated with upslope land clearance in the catchment, cause effective rainfall to substantially exceed the regional patterns” (CALM, 2003). This is supported by previous surveys conducted in the greater area, with *Phytophthora cinnamomi* not recorded or observed within the general area, but other species of *Phytophthora* (*P. arenaria* and *P. constricta*) have been proven from soil and tissue samples.

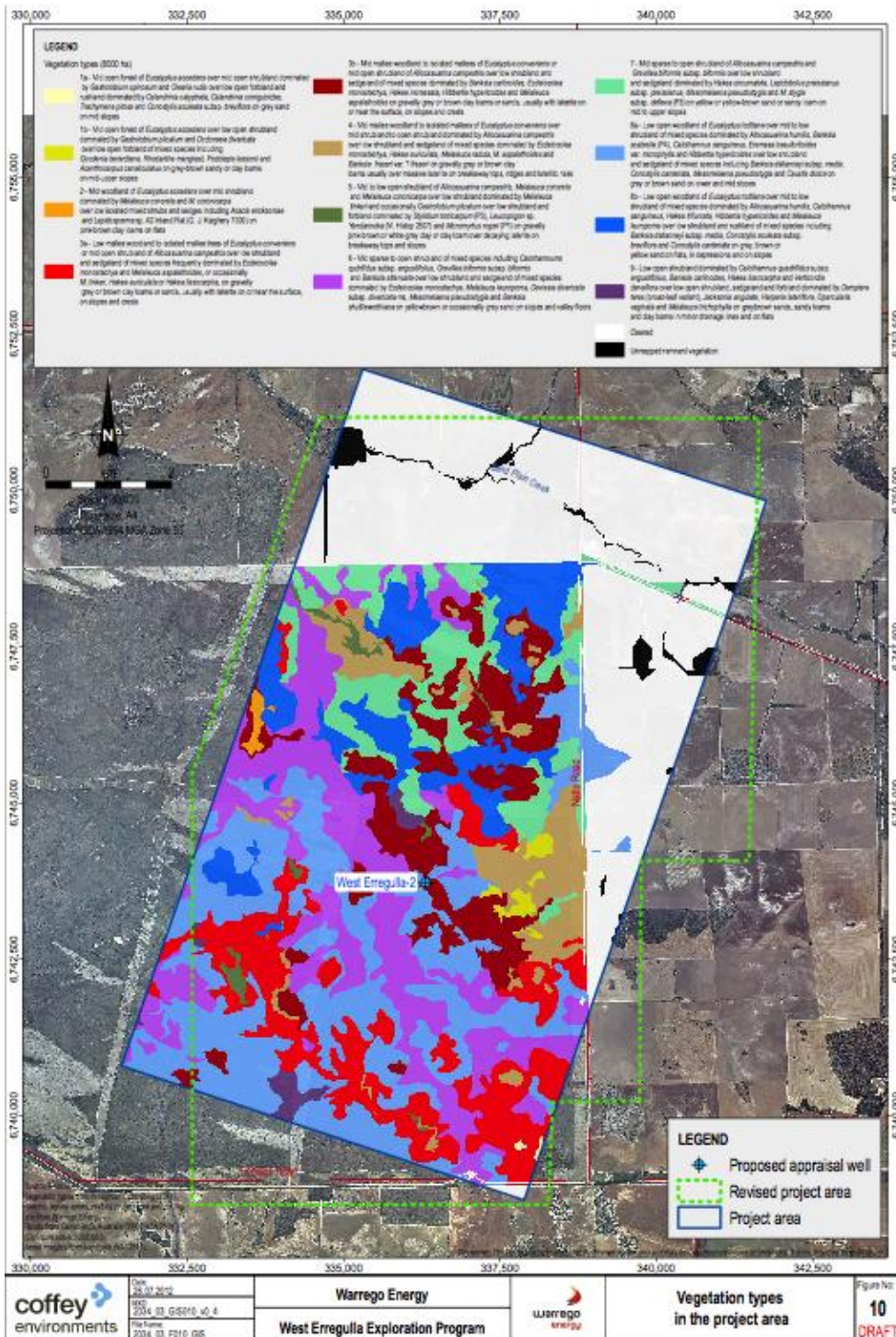


Figure 1 - Project Area

### Study team

The assessment was conducted by Evan Brown and Liam Brown of Glevan Consulting in November 2012. Both members of the study team are accredited by the Department of

Environment and Conservation in the detection, diagnosis and mapping of the Dieback disease. This accreditation recognises the skills and experience of the study team. Both members have also conducted many previous surveys within the general proximity of the project area.

## ***Background***

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Phytophthora Dieback is the name generally used in Western Australia to describe the disease symptoms of, and the causal agent, *Phytophthora cinnamomi*. This introduced soil-borne pathogen is a major threat to Australian vegetation, and in particular, the vegetation and dependent biota within the south west botanical province. This disease is listed as a key threatening process under the Environment Protection and Biodiversity Conservation Act 1999, with a subsequent threat abatement plan introduced in 2001 (Environment Australia, 2001).

It is generally believed that Phytophthora Dieback was introduced to Australia during the early European settlement. From 1921, patches of healthy jarrah forest were observed to be dying, with Frank Podger and George Zentmyer establishing in 1964 that *Phytophthora cinnamomi* was the causal agent for the forest decline (DWG, 2011).

The impact of the disease on the vegetation is dependent on climatic conditions along with host plant species and suitable soils (Keane & Kerr, 1997). This relationship, shown in Figure 1, describes all aspects required to create the disease.



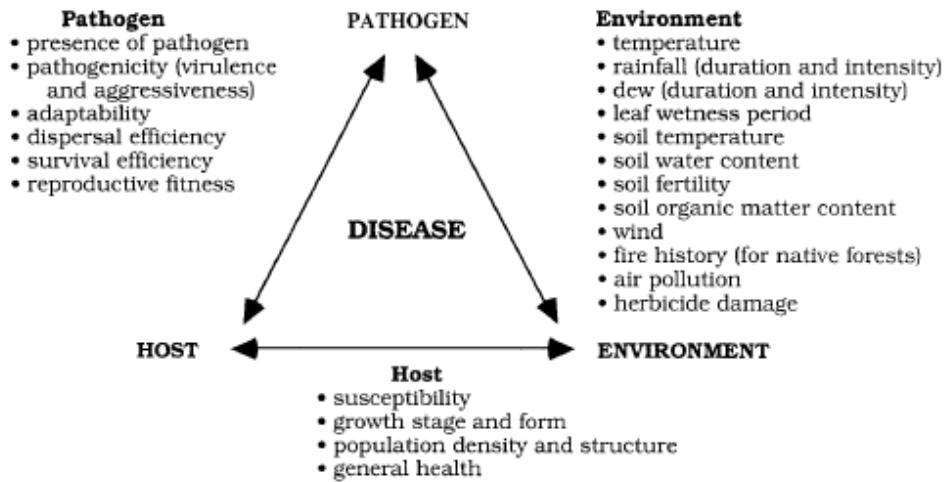


Figure 2 - Disease Triangle

This relationship is also described in Management of *Phytophthora cinnamomi* for Biodiversity Conservation in Australia Part 2 - National Best Practice Guidelines / Appendix 3 as the disease pyramid (O'Gara, Howard, Wilson, & Hardy, 2005). This figure includes the additional element of time to demonstrate the progressive impact of the disease on susceptible vegetation.

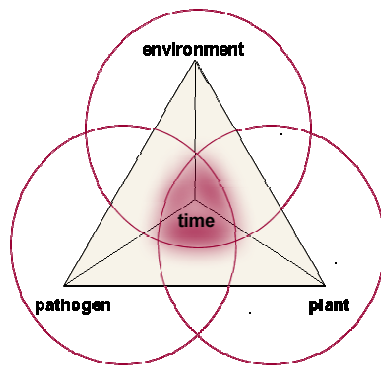


Figure 3 - Disease pyramid

It is recognised that *Phytophthora Dieback* has a greater and more widespread impact in areas of Western Australia where the average annual rainfall exceeds 600mm and the soil structure has a more acidic composition (Hardy, Colquhoun, Shearer, & Tommerup, 2001). The impact of the disease can be significant (but less widespread) in areas of lower rainfall if there are extra-ordinary rainfall events, or the pathogen is situated in a rainfall aggregating site, e.g. creek lines, water shedding from granite outcrops.

The impact of the pathogen on the Australian economy is significant, and is estimated to cost between \$160 million (Carter, 2004) and \$200 million annually (EPA, 2011).

The impact of the disease on animals is less understood, however the greatest impact is likely to be on those species that require relatively dense species-rich shrub lands or have restricted diets. There is a growing body of evidence that the dramatic impact of Phytophthora Dieback infestations on plant communities can result in major declines in some animal species due to the loss of shelter or food sources.

## METHODS

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During the assessment for the presence of Dieback caused by *P. cinnamomi*, the interpreter is specifically looking for those areas that are:

- Possibly infested with *Phytophthora* Dieback;
- Possibly infested by other *Phytophthora* species;
- Uninfested – free of plant disease caused by *Phytophthora* Dieback;
- Uninterpretable – those areas where presence or absence of *Phytophthora* Dieback cannot be determined because the vegetation is naturally void of sufficient numbers of disease indicating species, and;
- Unmappable – those areas where presence or absence of *Phytophthora* Dieback cannot be determined at the time of the assessment, due to disturbance factors i.e. fire disturbance or forestry activity.

Detection of the plant pathogen *Phytophthora* Dieback involves the observation and interpretation of plant deaths (or reduction of biomass or perceived temporal change in vegetation structure) using a logical assessment of factors that imply pathogen presence above other possible causes of plant deaths or vegetation change.

The following table describes *Phytophthora Dieback* occurrence categories as defined by the Department of Environment and Conservation in the manual “*Phytophthora cinnamomi*. and disease caused by it, volume 1, Management Guidelines, 2003”. The superior categories “Mappable” and “Unmappable” definitions are not yet published by the department, but are in general use at this time.

**Table 1 - Dieback Occurrence Categories**

<p><b>Unmappable</b></p> <p>Areas that are sufficiently disturbed so that <i>Phytophthora</i> Dieback occurrence mapping is not possible at the time of inspection.</p>	<p>Further categorisation may be possible after variable regeneration periods for different types of disturbance.</p>	
<p><b>Mappable</b></p> <p>Natural undisturbed vegetation. <i>Phytophthora</i> Dieback occurrence mapping is possible. Three categories may result.</p>	<p><b>Infested</b></p>	<p>Areas that a qualified person has determined to have plant disease symptoms consistent with the presence of the pathogen <i>Phytophthora</i> Dieback.</p>
	<p><b>Uninfested</b></p>	<p>Areas that a qualified person has determined to be free of plant disease symptoms that indicate the presence of the pathogen <i>Phytophthora</i> Dieback.</p>
	<p><b>Uninterpretable</b></p>	<p>Areas where indicator plants are absent or too few to determine the presence or absence of disease caused by <i>Phytophthora</i> Dieback.</p>

***Pre survey desktop study***

Known databases of *Phytophthora* locations retained by Vegetation Health Services (DEC) were searched to determine previous recoveries of *Phytophthora* within and adjacent to the project area.

Previous *Phytophthora* Dieback Occurrence reports and maps relating to areas within a reasonable proximity to the study area were also studied prior to undertaking the field work.

## ***Field survey***

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Due to the large area involved, the marginal environmental conditions and the limited known infestations of *Phytophthora* in the greater area, a strategic assessment targeting higher risk sites was conducted in the study area. Those areas targeted included all navigable tracks and firebreaks and water-gaining sites.

Aerial photographs were utilised to determine tracks and particular water-gaining sites that could be field checked

## ***Demarcation of hygiene boundaries***

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No demarcation was performed in the project area.

## ***Factors indicating the presence of *Phytophthora Dieback****

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In determining the possible presence of *Phytophthora Dieback*, the interpretation will consider the varied affects the pathogen may be having on the vegetation. This variation will be due to the considerable variability which exists within and between native plant species in their responses to the presence of *Phytophthora cinnamomi*, and the differential influence of temporal and spatial variation in environmental forces.

These possible degrees of impact of the disease range from no apparent disease, to post infection endemism and can be described as:

i) No apparent disease at all:

This can apply to areas of vegetation which are considered not susceptible to the pathogen, or those areas of the landscape in which the soil is calcareous or the mean rainfall of the site places it outside the recognised vulnerable zone.

ii) An extremely destructive epidemic of root rot:

This can apply within the highly susceptible elements of the vegetation. It is characterised by:

- a) devastation soon after the first arrival of the wave front of infestation,
- b) steady extension of epidemic disease soon after arrival of the pathogen,
- c) complete or near complete elimination of important structural elements of the plant community.
- d) a relative insensitivity of the degree of damage to variation in soil characteristics.

iii) An 'endemic' pathogen

Where *Phytophthora cinnamomi* has been long established in sites and the pre-existing vegetation has been very heavily impacted, *Phytophthora cinnamomi* behaves in a manner characteristic of endemic pathogen. The susceptible vegetation can over time be replaced by non-susceptible species. Periodic outbreaks of mortality in existing susceptible species may still occur.

The interpretation process is therefore determining areas where:

Susceptible species are absent, inhibiting the opportunity for the disease to express if present; or,

There are areas of deaths in multiple susceptible species with a pattern and perceptible temporal movement in the progression of the disease; or,

Areas exist where it is perceived that the natural vegetation structure has been altered with the density of susceptible species reduced.

A combination of the following factors may indicate the presence of disease caused by *Phytophthora Dieback* or other *Phytophthora* species.

Deaths of disease indicating species:

An indicator species is a plant species, which is reliably susceptible to *Phytophthora Dieback* (i.e. will die). Common indicators include several species of *Banksia* and *Xanthorrhoea*. The distribution and composition of indicator species will vary from place to place according to vegetation types.

### Chronology of deaths:

As the pathogen spreads through an area, some or all susceptible plants become infected and die. Consequently there will be an age range from more recent deaths with yellowing or brown leaves through to older leafless stags to remnant stumps in the ground.

### Pattern of deaths:

The topography, soil type, vegetation type and drainage characteristics of an area together with the influence of climatic patterns and disturbances will influence the shape or pattern of an infested area over time. A typical recent infestation may show a small cluster of dead indicator species which, in time, will spread to become a small circular shape 'the ulcer effect' and then begin lengthening towards natural drainage channels. A fringe of recent deaths is often seen around the edge of the infested area. Patterns may be further highlighted by a paucity of ground cover within the infested area.

### Environmental factors:

Sites will vary in the way that disease is expressed both spatially and temporally. Environmental conditions can either favour or disfavour the growth and spread of the pathogen. Sites that are moist but not saturated are most favourable, sites that are well drained and mostly dry are least favourable.

### Other causes of indicator species death:

*Phytophthora cinnamomi* is not the only agent to cause death of native vegetation. Other agents include, but are not limited to:

- other *Phytophthora* spp, *Armillaria luteobubalina*, various cankers, insects;
- drought, wind scorch, frost, salinity, water logging, fire and lightning;
- senescence, competition, physical damage;
- herbicides, chemical spills (for example fuel).

### *Limitations of disease mapping*

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The assessment for the disease caused by *Phytophthora* Dieback is based on interpreting the vegetation for symptoms which can be ascribed to the disease presence. These observable factors must be present during the assessment period. Management recommendations may be included if it is considered that the disease may be cryptic, or the project area displays evidence of activities that are considered a high risk of introducing the disease.



## RESULTS AND DISCUSSION

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For the assessment, over ninety-four kilometres of tracks and roads were driven, and all creek crossings and other water-gaining sites were scrutinised for observable symptoms of the presence of *Phytophthora* Dieback.

As discussed in the methodology, the assessment process involved determining those areas where:

The disease wouldn't express, if present;

The Dieback is showing disease symptoms; or

The disease may have been present for a considerable period and has altered the vegetation structure.

The vegetation has been disturbed to a point where a confident assessment of the disease presence is not possible, or the vegetation is not currently being managed and protected against *Phytophthora* Dieback.

The project area is discussed as being that area situated on private property , and generally farmland, and the greater area (UCL area) which is contained on the Uninvested Crown Land, north of Tomkins Road and west of Natta Road.

Some sections of the UCL project area contain fewer species that would be considered reliable in determining the presence of Dieback, in particular *Banksia* and *Xanthorrhoea* species. These sections are dominated by *Allocasuarina campestris* and *Eucalyptus* species over mixed shrublands and sedgelands. Due to the low likelihood of *Phytophthora* Dieback being present in these areas, it was not considered necessary to demarcate these sites in the field, nor recommend specific hygiene procedures for the sites.

No areas on UCL were observed to be currently impacted and infested with *Phytophthora* Dieback.

No areas of vegetation on UCL were considered to be altered by the previous introduction of *Phytophthora* Dieback.

Areas of remnant vegetation on private property are not considered to be currently hygienically managed and are classified as Unmappable.

The vegetation throughout the UCL site appeared in good condition, and very few areas of plant stress were noted. Occasional deaths in *Banksia* and other proteaceous species were observed but these deaths were not considered to be caused by *Phytophthora* Dieback, with the absence of likely vectors of disease introduction or pattern associated with disease presence noted. The entire UCL site should be considered as being protectable from the *Phytophthora* Dieback disease and should be managed accordingly.

## RECOMMENDATIONS

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Below are several management recommendations that are applicable to the West Erregulla 2 project area.

- Soil and plant material of infested or unknown dieback status should not be introduced to uninfested or unmappable sections of the study area.
- Soil and plant material should not be transported from the unmappable sections of the study area for use at any other protectable area site.
- Soil movement within each category is permissible, but should not occur across category boundaries, except where the source is uninfested.
- Vehicles and machinery should be clean upon entry into any of the site categories and when moving across category boundaries. Moving from uninfested areas into other categories does not require clean down measures.
- Restrict access, where possible, to dry soil conditions only. Where vehicles or machinery are required to access the area during, or shortly after rainfall, they must carry clean down equipment, and remove any soil or plant material at designated hygiene points.

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# MAPS

