

# **Norwest Energy**

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## ***Midwest Project EP413***

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Phytophthora Dieback occurrence assessment



## **Disclaimer**

*This report has been prepared in accordance with the scope of work agreed between the Client and Glevan Consulting and contains 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 during the assessment.*

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# 1 Summary

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Glevan Consulting conducted an assessment of approximately 111 square kilometres of the EP413 Norwest Energy exploration area (the Project Area) for the presence of the disease caused by *Phytophthora cinnamomi* (*Phytophthora Dieback*).

The assessment was conducted in November 2013 by Evan Brown, Senior Disease Interpreter with Glevan Consulting.

No known *Phytophthora Dieback* assessments have been conducted in the Project Area and some sections have suffered varying levels of disturbance, including fire, clearing and establishment of roads and infrastructure sites.

No *Phytophthora Dieback* infestations were found in the Project Area which was expected, and is consistent with adjoining vegetation throughout the region. The nearest infestation of *Phytophthora Dieback* is located in Eneabba Creek, approximately 30 kilometres southeast of the Project Area.

It is considered that all vegetation within the Project Area is Protectable and hygiene principles should be applied across the Project Area.

## 2 Introduction

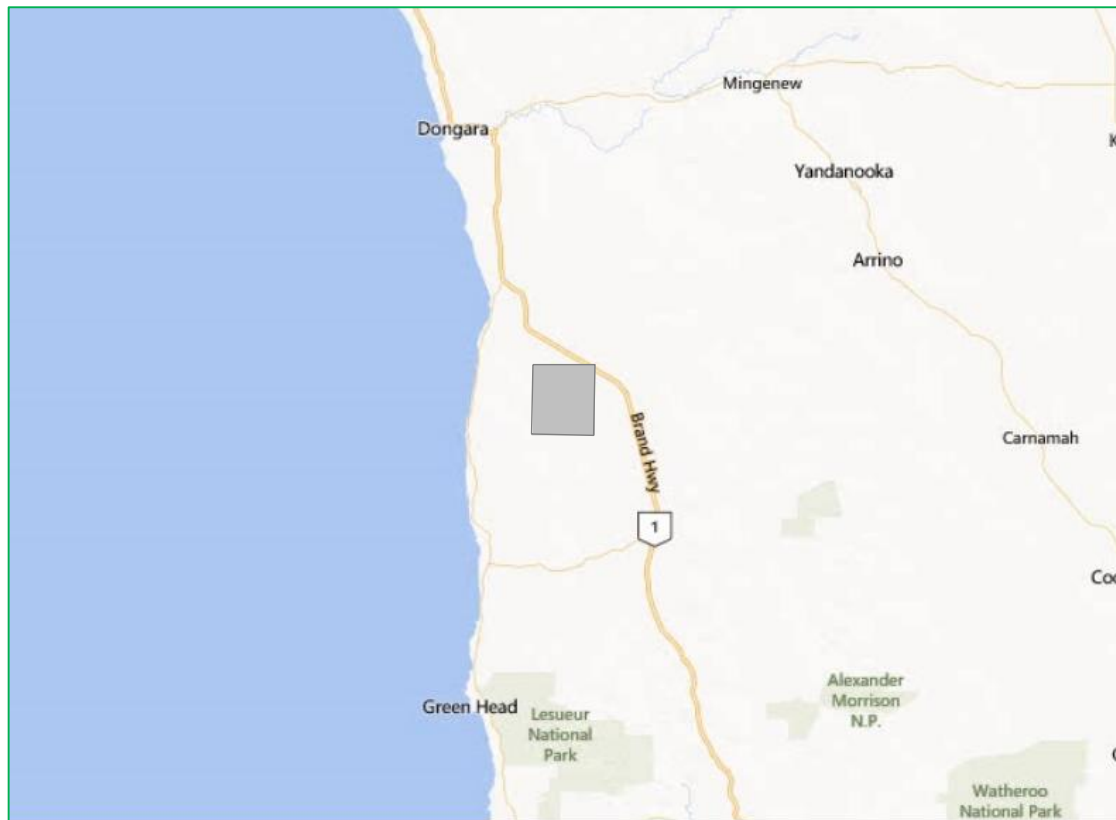
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### 2.1 Background

Glevan Consulting was commissioned by Norwest Energy to conduct an assessment of the vegetation within sections of the EP413 exploration area (Project Area) located in the Northern Perth Basin for the presence of *Phytophthora Dieback*.

The Project Area covers various soil profiles, with sandy plains with occasional pockets of sand dunes, small swamps and stream courses in the east of the Project Area. To the west of this soil type is an undulating dune landscape underlain by aeolianite and further west is undulating dunes with exposed aeolianite.

The vegetation had been mapped at Level 1 in 2012 and shows Acacia dominated shrublands, Banksia dominated shrublands, Eucalyptus dominated woodlands and Melaleuca dominated shrublands. Each vegetation community has varying levels of interpretability for the disease caused by *Phytophthora cinnamomi* (*Phytophthora Dieback*). The impact of the disease on the vegetation can also be determined by the underlying soil, generally the disease will not flourish on the calcareous soils that are found in the west of the Project Area.



**Figure 1 - Project Area**

## 2.2 Location of Project Area.

The Project Area covers approximately 111 square kilometres and is situated 30 kilometres northwest of Eneabba. The Project Area covers sections of Beekeepers Natures Reserve, various other Reserves, Crown Land and private property.

## 2.3 Historical land use and previous disturbances.

The Project Area has suffered varying levels of previous disturbance, with sections of private property being cleared, tracks and railway lines being developed in the area, and other infrastructure developments.

Sections of the Project Area have also been burnt within the previous three years.

## 2.4 Study team

The assessment was conducted by Evan Brown of Glevan Consulting in November of 2013. Mr Brown is accredited by the Department of Parks and Wildlife (DPaW) in the detection, diagnosis and mapping of the Dieback disease. This accreditation recognises the skills and experience of Mr Brown in the bioregion covered by the Project Area.



## 3 Methods

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### 3.1 Pre survey desktop study

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

No previous *Phytophthora* Dieback Occurrence reports and maps pertaining to the Project Area were found, and all samples taken in nearby areas all returned negative results. These samples were taken adjacent to the Brand Highway, Western Flora Caravan Park and on the fibre optic backbone cable that was constructed near the Brand Highway.

The nearest known infestation of *Phytophthora* Dieback is located in Eneabba Creek, just north of the Eneabba townsite.

### 3.2 Interpretation

Due to the significant size of the Project Area, the less than favourable environmental conditions and the lack of *Phytophthora* Dieback close to the Project Area, a strategic survey of the area was implemented. All possible vectors of *Phytophthora* Dieback introduction were identified during the desktop assessment, and then assessed in the field. These vectors included the rail line and associated tracks, internal sand tracks and firebreaks, creek lines and the gravel access tracks to the existing infrastructure.

During the assessment, Mr Brown determined the possible presence of *Phytophthora* Dieback based on symptoms and disease signatures displayed in susceptible vegetation.

The 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. 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*, *Patersonia*, *Persoonia*, 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 *Phytophthora cinnamomi* 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).

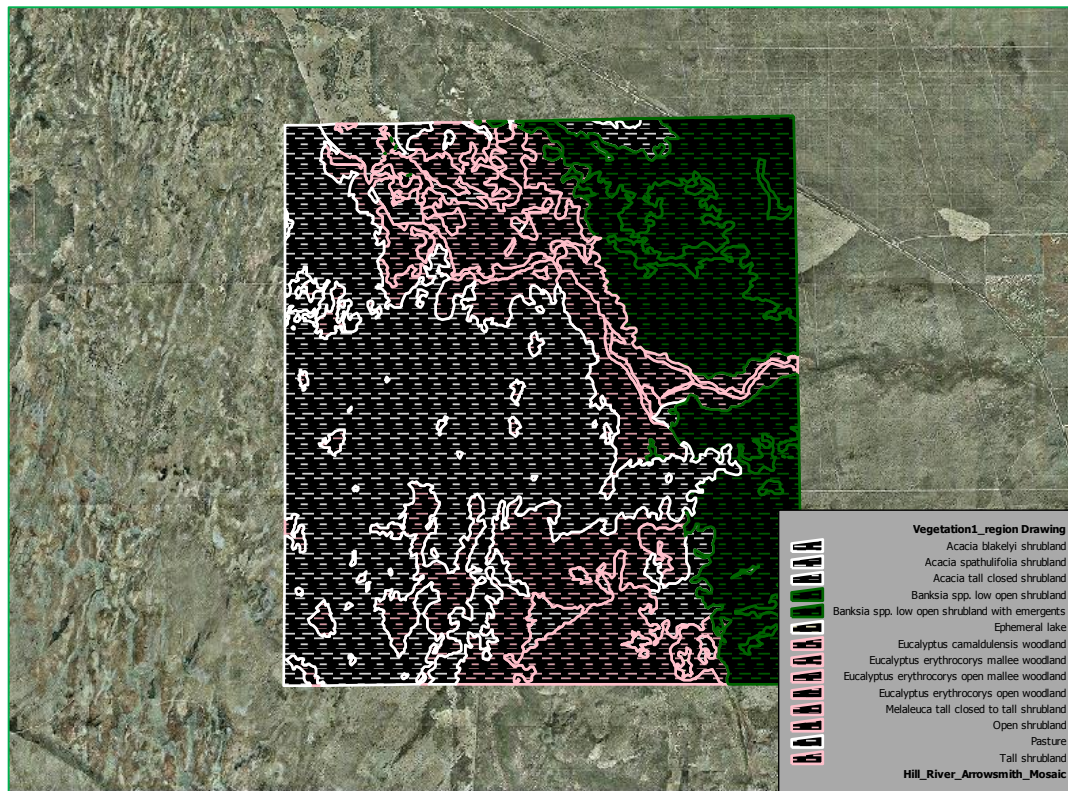
Based on the field assessment, the Project Area can be distributed to the following occurrence categories.

**Table 1 - Phytophthora Dieback occurrence categories**

Vegetated area	Infested	Areas that have plant disease symptoms consistent with the presence of Phytophthora Dieback
	Uninfested	Areas free of plant disease symptoms that indicate the presence of Phytophthora Dieback.
	Uninterpretable	Areas where indicator plants are absent or too few to determine the presence or absence of Phytophthora Dieback.
	Unmappable	Areas that are sufficiently disturbed so that Phytophthora Dieback occurrence mapping is not possible at the time of inspection.
	Not yet resolved	Areas where the interpretation process has not confidently determined the status of the vegetation.
Non-vegetated area	Excluded	Areas devoid of vegetation are excluded from the assessment area.

### 3.3 Landform and vegetation complexes.

The Project Area is situated on the Lesueur Sandplain sub-region of the Geraldton Sandplain IBRA. The vegetation mapping conducted by Strategen identified areas that contain Phytophthora Dieback indicating species which are contained within the Banksia shrubland areas identified in Figure 2.



**Figure 2 - Vegetation communities in Project Area**

### 3.4 Mapping

Evidence collected during the assessment to support the field diagnosis was recorded using a hand-held GPS / PDA, with line and point data transferred to a desktop GIS.

### 3.5 Limitations of disease mapping

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.

The validity of the *Phytophthora Dieback* occurrence statement is twelve months from the completion of this project. All boundaries should be reassessed by 11/2014 if activities are still occurring beyond this time.

## 4 Results

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### 4.1 Phytophthora Dieback occurrence distribution

The vegetation within the Project Area has been classified (using the definitions in Table 1) as following in Table 2

**Table 2 - Area Summary**

Category	Area (ha)	% of total area
Uninterpretable	8099 ha	72.8 %
Unmappable	143 ha	1.3 %
Uninfested	2878 ha	25.9 %
TOTAL AREA	11120 ha	

During the assessment, 83 kilometres of tracks were interpreted for the presence of Phytophthora Dieback. Creek lines and other water gaining sites were also inspected.

### 4.2 Disease expression

No Phytophthora Dieback infestations were observed in the Project Area.

## 5 Discussion

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The vegetation within the Project Area was assessed strategically to determine the presence of Phytophthora Dieback. It was determined that, due to the size of the area, and the environmental conditions over the Project Area, any Phytophthora Dieback infestations would be associated with possible vectors of introduction. These vectors being any method of transporting the *Phytophthora cinnamomi* spores into the Project Area from infested areas. The pathogen can be transported in soil and plant material, and through water movement in water courses.

A desktop assessment of the Project Area was performed to identify those areas and vectors that could be considered an introduction of the Phytophthora Dieback disease. All tracks, fire-breaks are considered a risk, with the pathogen possibly being transported on vehicles using the tracks. Water courses were identified and also areas where soil has been introduced to the Project Area from external donor sites, mainly with the development of the rail track and the gravelling of access roads to existing infrastructure sites. It is not expected that any Phytophthora Dieback infestations would occur unless immediately adjacent to a possible vector of disease introduction. The current DPaW manual (Department of Parks and Wildlife, 2013) states that 'assessment areas situated in the 400 to 600-millimetre rainfall zone are very unlikely to have upland infestation. If upland infestations have initially established it may be possible for symptoms to dissipate or vanish altogether depending on rainfall received at a particular site' The average annualised rainfall at the Project Area is 497.9mm, based on the Green Grove recording station (Bureau of Meteorology, n.d.), ten kilometres northwest of the Project Area.

An unused airplane landing ground is also situated in the east of the Project Area containing a large gravelled area and access track..

The eighty-three kilometres of tracks within the Project Area were assessed by observing any suspicious sites within 25 metres each side of the track. Using this method, any Phytophthora Dieback infestations that may occur would be seen progressing from the track with deaths in Phytophthora Dieback indicating species, particularly various Banksia species and Xanthorrhoea species. Particular attention was also paid to areas where water aggregation may occur, including creek lines and vegetation adjacent to water runoff from cleared areas. It is assumed that all gravel used in the construction of roads and hardstands in the Project

Area has been sourced from external locations. It is also assumed (and hoped) that the source location is likewise free of *Phytophthora Dieback*. The edges of the gravelled areas are considered at a higher risk of being infested by *Phytophthora Dieback*, both through the possible presence of the pathogen in the imported material, and the rainfall aggregating nature of the road, relative to the vegetation on the edge of the roads and hardstands.

A large proportion of the Project Area has been burnt within the previous four years. The vegetation is recovering from this burn and in most places has a healthy vigour. Some scattered deaths were seen throughout this vegetation, but deaths seen did not appear to have any cause except the burn. This burn however may mask any reduction in biomass that may be caused by pathogen activity.

Creek lines were considered a high risk of introducing the *Phytophthora* pathogen into the Project Area. The creeks that were assessed had no *Phytophthora Dieback* indicating species along the water line, suggesting that if the pathogen was introduced, it would not encounter any host plant to survive and therefore cause disease. The exception may be though at times of extraordinarily high rainfall periods where the water would extend from the creek line and flow into adjoining susceptible vegetation.

The vegetation in the west of the Project Area, (in general all areas west of the rail line), is uninterpretable due to the calcareous nature of the soils, even though some areas had a dense covering of some *Phytophthora Dieback* indicating species, particularly *Banksia sessilis*. Although *B. sessilis* is highly susceptible to *Phytophthora cinnamomi* in acidic soils, the calcareous soils are antagonistic to the pathogen.

All sections dominated by *Eucalyptus* species contained very few (if any) *Phytophthora Dieback* indicating species, indeed some areas appeared a pure mono-culture.

The Department of Parks and Wildlife has a dam and water tank installed fire-fighting purposes just on the western side of the rail line. This area would be considered a higher risk of being infested with *Phytophthora Dieback* due to the access of vehicles, possibly in unhygienic circumstances. It is assumed that access to the site is along the rail line from Beekeepers Road. All vegetation surrounding the water-site is uninterpretable, with no *Phytophthora Dieback* indicating species present.

During the assessment, no suspicious sites were observed adjacent or within any of the assessed vectors. Due to the environmental conditions at the site, it is therefore considered that no Phytophthora Dieback infestations will occur at any distance from the assessed vectors.

No soil and tissue samples were taken in the area as no suspicious sites were encountered. It is recommended that the vegetation within the entire Project Area be considered protectable from Phytophthora Dieback, and hygiene measures be implemented for the site.

Any site that has been cleared of vegetation, particularly those areas on private property, have been categorised as Unmappable.



## 6 Recommendations

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Below are several 'generic' management recommendations that are applicable to most operational areas. It is recommended that a specific Phytophthora Dieback Hygiene Management Plan be developed prior to significant vehicle access to the Project Area. This HMP may contain additional recommendations to the following;

- All access to the site should be from the existing gravel track entering the Project Area from the Brand Highway in the northeast of the area, or along the rail line from Beekeepers Road.
- All vehicles should be certified as clean on entry to the project area from these access points.
- 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 infested or 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 (except infested), 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.
- The Project Area can be segmented to all areas west of the rail line, and all areas east of the rail line (Figure 3 - Management Areas Map). Vehicles and equipment should be cleaned of soil and plant material when traversing easterly over the rail line from Area 2 to Area 1.

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8 Appendix – Phytophthora management areas map

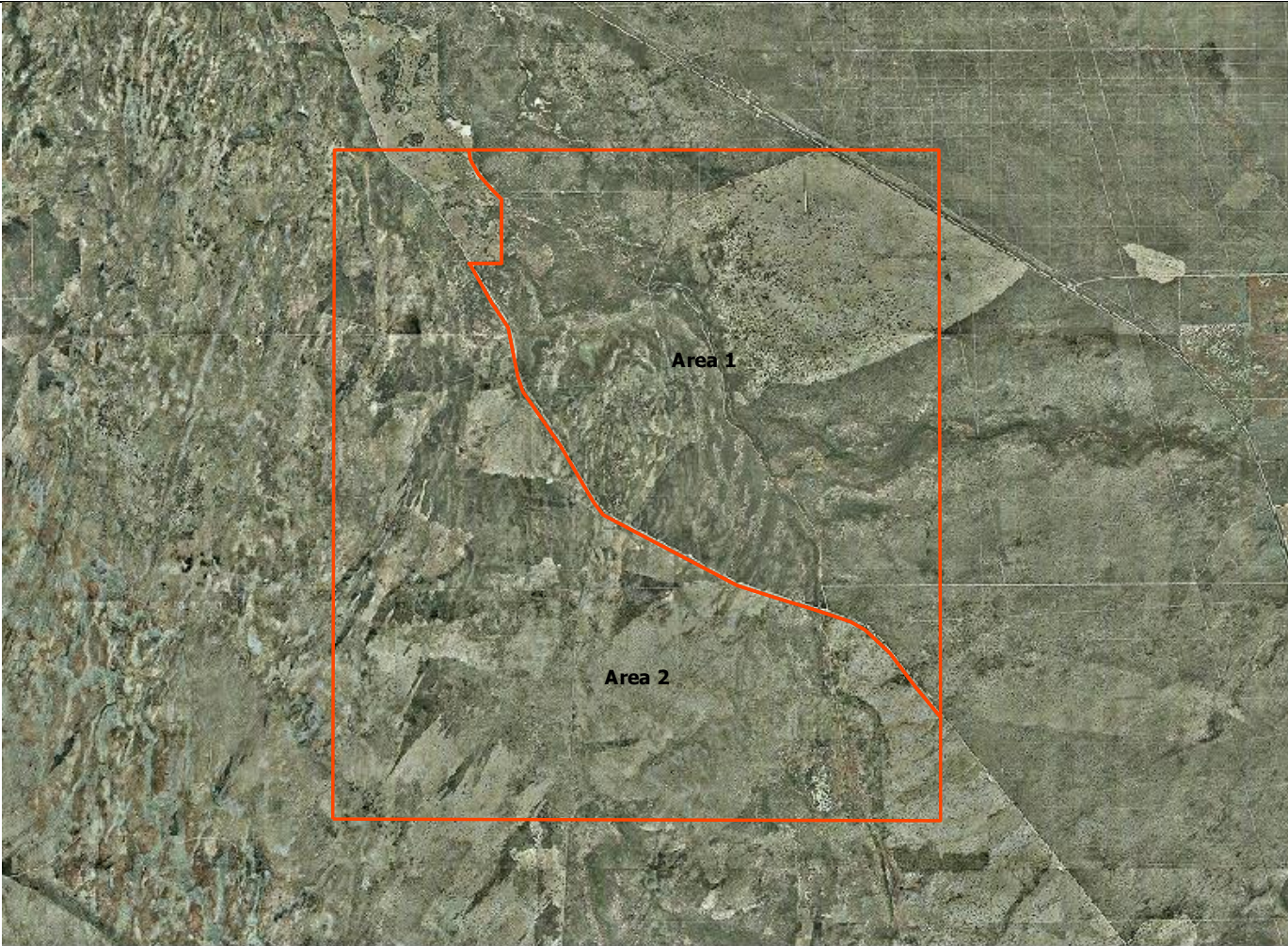


Figure 3 - Management Areas Map

## 9 Appendix – Introduction to Phytophthora

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.

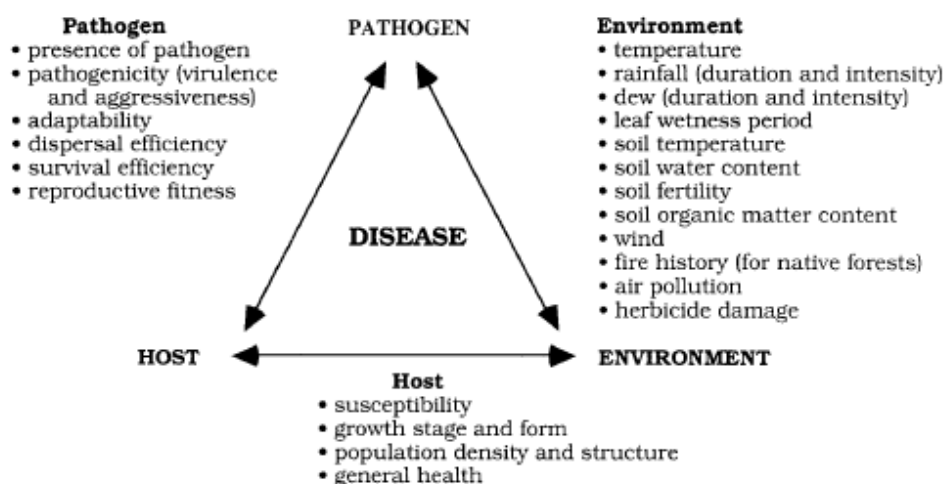
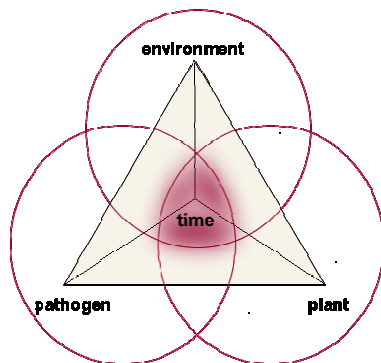


Figure 4 - Disease Triangle

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 5 - 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.