Appendix C Dieback assessment report

Annual Compliance Report

Lot 131 Jandakot Road, Treeby WA EPBC Approval No. 2018/8025

SLR Project No.: 675.073237.00001

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Terratree

Phytophthora Dieback Assessment of Lots 131 and 705, Treeby

Prepared for SLR Consulting Australia Pty Ltd

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ecological assessment
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Abbreviations and Acronyms

BoM	Bureau of Meteorology
CALM	former Department of Conservation and Land Management (now DBCA)
CPSM	Centre for Phytophthora Science & Management
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DBCA	Department of Biodiversity, Conservation and Attractions, WA Government
DIDMS	Dieback Information Data Management System
Dieback Interpreter's Manual	FEM047 Phytophthora Dieback Interpreter's Manual for lands managed by the Department
Dieback Management Manual	FEM049 Phytophthora Dieback Management Manual
DMIRS	Department of Mines, Industry Regulation and Safety
DPIRD	Department of Primary Industries and Regional Development, WA Government
EPA	Environmental Protection Authority
FEMD	Forest and Ecosystem Management Division of DBCA, WA Government
GPS	Global Positioning System
VHS	Vegetation Health Services

Executive Summary

SLR Consulting Australia Pty Ltd (SLR) commissioned Terratree Pty Ltd (Terratree) to complete a comprehensive Phytophthora Dieback (Dieback) assessment of two Lots in Treeby, WA.

The assessment area is located within a Development and Resource zone within the City of Cockburn WA, and totals approximately 36.8 ha in size. The objective of the Dieback assessment was to determine if Dieback is present within areas mapped as 'Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region', a Threatened Ecological Community (TEC) that is highly susceptible to Phytophthora.

The comprehensive Dieback field assessment was conducted on April 17th of and May 7th of 2025, followed by two additional site visits on May 29th and June 4th of 2025, and was completed by DBCA-registered Dieback Interpreter's Joseph Grehan and Norman Lai, along with Trainee Interpreter Elisa Brendel.

The desktop analysis of the assessment area through the Dieback Information Delivery Management System and Vegetation Health Services database search identified no previous positive Phytophthora samples within the assessment area. Additionally, no previous Dieback occurrence information was available over the assessment area.

Fourteen soil and tissue samples were taken during the Dieback assessment, of which four returned a positive result for *P. cinnamomi* and one sample returned a positive result for *P. arenaria* through diagnostic baiting. The location of the four positive *P. cinnamomi* samples represent a range extension to previously identified Infested areas adjacent to the assessment area.

In total, 38.13 ha of vegetation were assessed comprehensively, of which 8.57 ha (22.5 %) over five discrete Infested areas was mapped as Infested with *P. cinnamomi*. A further 28.64 ha (75.1 %) was mapped as Uninfested, an area of 0.58 ha (1.5%) mapped as Uninterpretable, and the remaining 0.34 ha (0.9 %) mapped as Excluded from assessment.

The assessment area has been fenced to deter 4WD and motorbike access.

Terratree makes the following recommendations:

- All earthworks and ground disturbance activities should be conducted in dry soil conditions.
- Ensure uncontrolled access to the assessment area is limited.
- Follow-up Dieback assessment should be considered after ground disturbance activities near the reserve have taken place.
- Ensure any rehabilitation of the site does not introduce Dieback by utilising only Nursery Industry Accreditation Scheme Australia (NIASA) accredited nurseries and appropriate hygiene measures.

- All personnel, including management, on-ground personnel and sub-contractors undertake Green Card biosecurity training, to ensure compliance with Dieback management. https://www.dwg.org.au/green-card-training/.

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) commissioned Terratree Pty Ltd (Terratree) to undertake a comprehensive Phytophthora Dieback (Dieback) assessment of Lots 131 and 705, Treeby. The objective of the Dieback assessment was to determine if Dieback is present within areas mapped as 'Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region' (DCCEW, 2016), a Threatened Ecological Community (TEC) that is highly susceptible to Phytophthora.

1.1 Project Location and Size

The project area (hereafter referred to as 'the assessment area') is 38.13 ha and is located within a Development and Resource zone in Treeby, City of Cockburn, WA, north of Armadale Road and south of Jandakot Road **Figure 1**. The area is classified as a Bush Forever Site and is mainly comprised of Banksia Woodland of the Swan Coastal Plain Ecological Community (TEC), of which the dominant genus, Banksias, are highly susceptible to Dieback.

Phytophthora Dieback (or Dieback) is a disease caused by the introduced soil-borne pathogen *Phytophthora cinnamomi*. While some plant species are resistant, others are susceptible to the disease caused by the pathogen, which can result in chlorosis, dieback and usually death (Wills and Keighery 1994). The pathogen has a range of hosts in Southwest WA, predominantly from the *Ericaceae*, *Fabaceae*, *Myrtaceae*, *Proteaceae*, and *Xanthorrhoeaceae* plant families.

Although several Phytophthora species occur in Western Australia (WA), the most virulent and pathogenic is *P. cinnamomi*. References to Phytophthora Dieback refer to the disease caused by this species unless otherwise specified.

The most recent Western Australian State of the Environment Report lists Dieback as a Priority 1 threat to biodiversity (EPA 2007). A recent review of threats to species listed as threatened under the Federal *Environment Protection and Biodiversity Conservation Act 1999* shows that *P. cinnamomi* is the second greatest invasive species threat in Australia after rabbits (Kearney *et al*. 2018).

Dieback has a significant effect in WA for the following reasons:

- 40 % of native plant species in Southwest WA (over 2,200 species), including almost half the endangered species, are susceptible to the pathogen (Shearer *et al*. 2004). This includes 49 % of WA's threatened flora (EPA 2007).
- Changes in the composition and structure of floral communities resulting from the spread of Dieback have flow-on impacts throughout the ecosystem, including habitat alteration negatively affecting indigenous fauna populations.

- Dieback can lead to significant soil erosion through the loss of susceptible vegetation.

Disease expression caused by Phytophthora species occurs in native vegetation when the following variables and environmental conditions are present:

- **Host** - plant species are present that are susceptible to *Phytophthora* spp.
- **Pathogen** - a *Phytophthora* spp. pathogen must be present, either residing in susceptible or resistant species.
- **Environment** - soil temperatures of 15-30 °C and pH 5-6 (acidic) are required for *P. cinnamomi* survival and activity. Some Phytophthora species, including *P. multivora*, can survive in alkaline soils (pH 7+).

Dieback is widespread in areas with greater than 800 mm of annual rainfall, less extensive in areas that receive between 600 and 800 mm, and mainly restricted to water-gaining sites in areas that receive between 400 and 600 mm. The pathogen rarely occurs in areas receiving less than 400 mm annual rainfall. In WA, Dieback is a significant environmental issue for projects between Geraldton in the Midwest and Esperance on the South Coast, and it is widespread in the Southwest region.

Dieback is spread through the movement of water and soil within the landscape. Major vectors of Dieback include, but are not limited to, wet soil adhering to vehicle tyres/tracks and earthmoving equipment. Therefore, quarantine management procedures are an effective tool in reducing the spread of Dieback associated with any earthmoving activity.

1.2 Regulatory Context

Phytophthora Dieback management is required under several regulatory mechanisms including:

- The Federal *Environment Protection and Biodiversity Conservation Act 1999*, which lists Phytophthora Dieback as a key threatening process.
- Projects being assessed under the Western Australian *Environmental Protection Act 1986*, which requires the Department of Biodiversity, Conservation and Attractions (DBCA) and/or Department of Mines, Industry Regulation and Safety (DMIRS) to comment on Dieback management and provides these agencies with the right to impose conditions on new approvals.
- The *Environmental Protection Act 1986* Part V S.50A "Serious Environmental Harm" provisions.
- A National Threat Abatement Plan (DCCEEW 2018) has been developed to abate the threat of Phytophthora Dieback caused by *P. cinnamomi*, to Australia's biodiversity. On state level DBCA is responsible for its implementation on *Conservation and Land Management Act 1984* (CALM Act).

The Forest Products Commission is required to manage the risks to biodiversity posed by spreading Dieback during harvesting operations under the following regulatory mechanisms:

- Conservation and Land Management Act 1984.
- Forest Management Plan 2024-2033 (Conservation and Parks Commission 2023).

2 Existing Environment

2.1 Biogeography

The Interim Biogeographic Regionalisation for Australia (IBRA) has defined 89 bioregions and 419 subregions across Australia, based on climate, geology, landforms, native vegetation and species (Environmental Australia 2000). These provide a useful method for reporting biodiversity patterns and categorising assessment areas. The assessment area falls within the Swan Coastal Plain (SWA2) IBRA subregion.

The Swan Coastal Plain is primarily covered with woodlands. Sandy soils are dominated by Banksia or Tuart trees, while *Casuarina obesa* is found on outwash plains, and Paperbarks in swampy areas. In the eastern part, the plain rises to duricrusted Mesozoic sediments, dominated by Jarrah woodlands. The climate is characterized as Warm Mediterranean. Relief is provided by three phases of marine sand dune development. Outwash plains, once largely covered by *C. obesa* - Marri woodlands and Melaleuca shrublands, are now mainly found in the southern region (Mitchell *et al*. 2002).

The Perth subregion (SWA2) consists of colluvial and aeolian sands, alluvial river flats, and coastal limestone. It features heath and/or Tuart woodlands on limestone, as well as Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of different ages. Marri trees are found on colluvial and alluvial soils. The area also includes a complex series of seasonal wetlands (Mitchell *et al*. 2002).

Dominant land uses in the area include dry land agriculture, conservation, UCL and Crown reserves, Urban and rural residential areas and infrastructure, irrigated horticulture, Forestry-plantations, and grazing. There are smaller areas of mining, and defence lands (Mitchell *et al*. 2002).

2.2 Regional Vegetation

The assessment area lies in the Drummond Botanical Subdistrict within the Swan Coastal Plain Subregion (SWA2) and is described as 'Mainly *Banksia* low woodland on leached sands with melaleuca swamps where ill-drained; woodland of tuart (*Eucalyptus gomphocephala*), jarrah (*E. marginata*) and marri (*E. calophylla*) on less leached soils.' (Beard 1990).

2.3 Vegetation Complexes

Vegetation complexes are a broad level of vegetation description which is based on the underlying geomorphology and rainfall (Heddle *et al*. 1980). The site intersects with the Swan Coastal Plain 'Bassendean complex – Central and South' as described in **Table 1.**

Table 1: Vegetation complexes within the assessment area.

Vegetation Complex	Description (DBCA 2018)
Bassendean complex – Central and South'	Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Allocasuarina fraseriana* (Sheoak) - Banksia species to low woodland of Melaleuca species, and sedgelands on the moister sites. This area includes the transition of *Eucalyptus marginata* (Jarrah) to *Eucalyptus todtiana* (Pricklybark) in the vicinity of Perth.

2.4 Soils

The Department of Primary Industries and Regional Development soil mapping for Western Australia (DPIRD 2017) shows that the assessment area lies within the Bassendean zone (212) of the Swan Province (21).

The Swan Province is characterised by 'pale and yellow deep sands, semi-wet and wet soil, sandy and loamy gravel, calcareous deep sands, and grey deep dandy duplex' (Purdie *et al.* 2004). The Bassendean zone is described by 'Mid-Pleistocene Bassendean sand. Fixed dunes inland from coastal dune zone. Non-calcareous sands, podsolised soils with low-lying wet areas' (Purdie *et al.* 2004).

The characteristics of the soil systems within the project area are listed in **Table 2**.

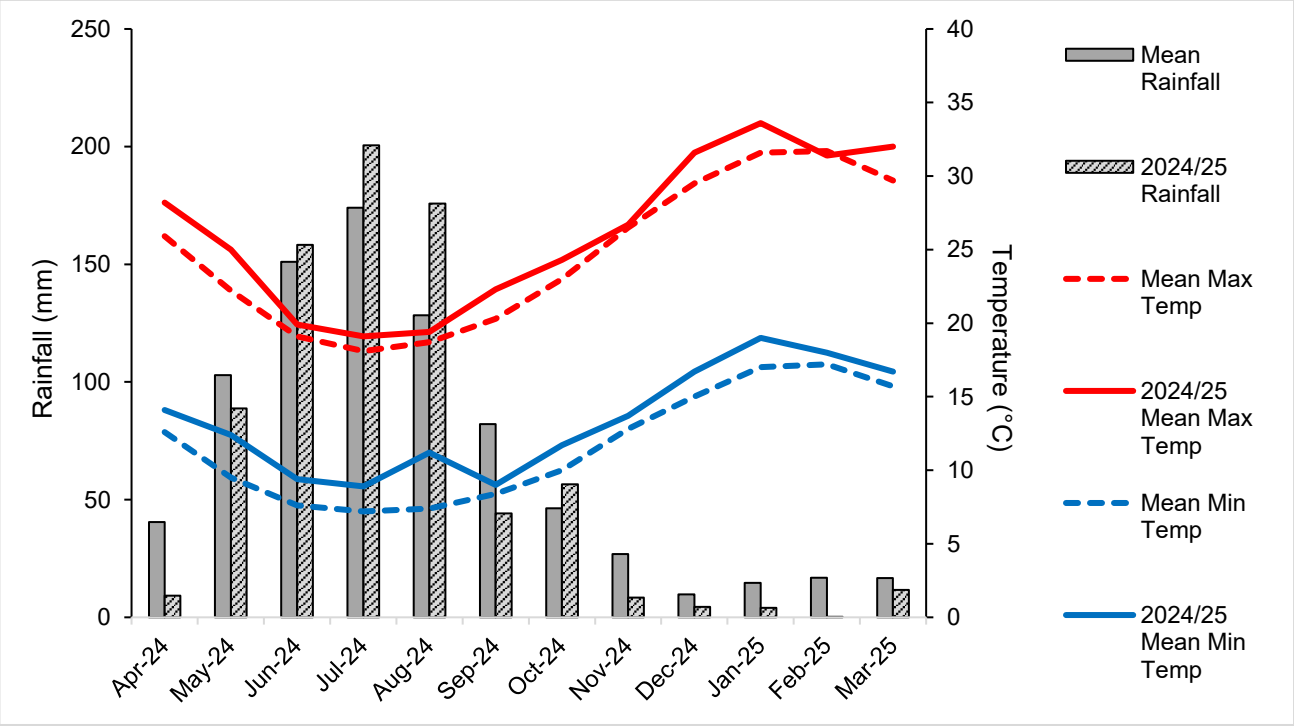
Table 2: Soil systems within the assessment area (DPIRD 2017).

Subsystem Name (and symbol) (DPIRD 2018)	Bassendean B1 Phase (212Bs_B1)
Phase Description	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a week iron-organic hardpan at depths generally greater than 2 m; banksia dominant.
Subsystem Name (and symbol) (DPIRD 2018)	**Bassendean B2 Phase (2012Bs_B2)**
Phase Description	Flat to very gentle undulating sandplain with well to moderate well drained deep bleached grey sands with pale yellow B horizon or a week iron-organic hardpan 1-2 m
Subsystem Name (and symbol) (DPIRD 2018)	**Bassendean B4 Phase (2012Bs_B4)**
Phase Description	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.

2.5 Climate

The Swan Coastal Plain Subregion is characterised by a warm Mediterranean climate with winter precipitation 600-1200 mm and 5-6 dry months per year (Beard 1990). Data was taken from Jandakot Airport station (009172) **Graph 1**. The average annual rainfall is 810.2 mm, with the majority of the rainfall occurring between

May to October. The rainfall recorded for the 12 months prior to and including the Dieback assessment accounted for 762 mm, 48.2 mm below the mean annual rainfall for the area. The average maximum temperature of the last 12 months amounts to 26.1 °C, 1.4 °C above the long-term mean (24.7 °C). The average minimum temperature in the last 12 months accounts to 13.4 °C, 1.7 °C above the long-term mean (11.7 °C). In the last year at the assessment area the monthly mean temperatures were warmer compared to the long-term mean, and the monthly mean rainfall was less than then the long-term mean, this fits with the long-term trend of a warming and drying climate being currently experienced in Southwestern Australia and is not considered a limiting factor on this dieback assessment.



Graph 1: Rainfall and temperature data from Jandakot Airport weather station #009172 (BoM 2025).

2.6 Historical Land Use and Disturbance

The assessment area is classified as a Bush Forever Site and is mainly comprised of EPBC Act-listed Endangered *Banksia Woodlands of the Swan Coastal Plain Ecological Community*. The assessment area lies within the Jandakot Airport Protected Airspace and is partly surrounded by residential housing subdivisions and development sites, recreational parks, and conservation reserves (Clementine Park, Cilantro Park, Rose Shanks Reserve), as well as two water catchment zones (City of Cockburn Mapping Hub 2025).

There was no evidence of recent bushfires within the assessment area, however, the site is located within a designated bushfire-prone area (City of Cockburn Mapping Hub 2025). A powerline utility corridor intersects

Lot 131, and occasional rubbish dumping has been observed throughout the assessment area. The south side of the eastern portion of Lot 705 is partly affected by soil extractions from the bordering development area.

The central portion of Lot 131 is also affected by historical limestone quarrying and soil extractions in that area.

Lots 131 and 705 are not within a Disease Risk Area (DBCA 2017).

The assessment area is planned to be retained in its natural state.

3 Methods

3.1 Comprehensive Dieback Assessment

The Comprehensive Dieback assessment was conducted in a two-stage process:

- A desktop review of relevant, available information regarding site characteristics plus previous Dieback mapping and sample results.
- A field assessment to observe disease symptoms, record Dieback occurrence category data and collect soil and tissue samples for diagnostic testing.

The Dieback Interpreter's Manual requires a comprehensive Dieback assessment every three years where ground disturbance activities are planned (FEMD 2015). Recheck assessments can be completed annually for up to three years to update Dieback occurrence maps. While this only applies to DBCA-managed lands, it is recommended that all land managers follow this guidance where ground disturbance activities are planned in areas of native vegetation.

3.2 Desktop Assessment

A desktop assessment has been conducted to collect information about the project area, landscape features, relevant disturbances and previous history of Phytophthora Dieback surveying.

Terratree obtained previous mapping and sample data from the following sources:

1. Dieback Information Delivery and Management System (DIDMS).
2. Vegetation Health Services (VHS) laboratory on Dieback sample results from previous assessments in the area.

The desktop assessment also aimed to:

- Identify access to the assessment area and internal tracks,
- Examine topography and drainage of the assessment area and broader landscape,
- Identify possible disease vectors (e.g. tracks, utility corridors and ground disturbance),
- Determine the location of high-risk areas (e.g. areas of high disturbance and water-gaining sites) and
- Review relevant literature and maps.

Results of the desktop study are listed under **Section 2.6** and **4.1**.

3.3 Field Assessment

3.3.1 Survey Strategy

The field assessment requires visually assessing native vegetation within the assessment area, recording Dieback occurrence category data, and collecting soil and tissue samples from recently dead Disease Indicator Species for diagnostic testing.

The comprehensive Dieback field assessment was conducted on 17th of April and the 7th of May 2025, followed by two additional site visits on 29th of May and the 4th of June 2025 and was completed by DBCA-registered Dieback Interpreter's Joseph Grehan and Norman Lai, along with Trainee Interpreters Elisa Brendel and Kyren Cleave.

The assessment was conducted according to the Dieback Interpreter's Manual (FEMD 2015). Particular attention was applied in areas where high risk vectors (roads, low-lying areas, human activity) are intersecting or adjacent to the assessment area.

Spatial data, including disease evidence points, sample locations and photographs, were recorded using handheld Global Positioning System (GPS) units.

3.3.2 Assessability

The Keighery vegetation disturbance scale in the Dieback Interpreter's Manual **Table 3** was used to determine the assessability of vegetated areas within the assessment area.

Areas with a vegetation condition rating of 1-3 (Pristine - Very Good) and enough Disease Indicator Species present to enable a diagnosis of the disease status are considered assessable.

Other areas of vegetation may be categorised as possibly assessable based on a condition rating of 4 (Good). In these areas, significant impacts to vegetation, including grazing, forestry harvesting, weed incursion and frequent fire events, have altered vegetation composition and structure so that it is unlikely to recover in the medium to long-term. Assessability of these areas is at the discretion of the Interpreter.

Areas where native vegetation is significantly degraded or cleared are given a condition rating of 5 (Degraded) or 6 (Completely Degraded) and classified as Excluded from assessment. Non-vegetated areas are also excluded from assessment, including pasture, pits (including gravel pits), large roads (sealed and unsealed), permanently flooded areas and parkland tree stands.

Table 3: Keighery vegetation disturbance scale and assessability (Keighery 1994, as defined in FEMD 2015).

Assessability	Scale		Condition
Assessable	1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
	2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
	3	Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, Dieback, logging and grazing.
Possibly assessable, discretion required	4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, Dieback and grazing.
Not assessable or Excluded from assessment	5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, Dieback and grazing.
	6	Completely Degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees or shrubs.

3.3.3 Dieback Occurrence Categories

The assessability of vegetated and non-vegetated areas and associated Phytophthora Dieback occurrence categories can be determined using **Table 4**.

Uninfested vegetation exhibits the following characteristics:

- No positive sample results received for *P. cinnamomi.*
- An acceptable diversity of healthy Disease Indicator Species is present
- Vegetation condition is in Pristine - Very Good (1-3) condition according to the Keighery scale (Keighery 1994) with a good density of vegetation cover and no obvious reduction in biomass or masking by resistant species.
- No evidence found of disease pattern or chronology.

Infested vegetation is identified and characterised by the following features:

- Positive sample results for *P. cinnamomi* are found either in the immediate area, upslope or upstream of the infested area.
- Multiple disease indicator species deaths are occurring.
- Disease pattern and chronology are visible.
- Vegetation structure and composition are obviously altered.

Uninterpretable vegetation is identified and characterised the following features:

- Insufficient amounts of Disease Indicator Species are present.
- Vegetation condition is in Pristine - Very Good (1-3) condition according to the Keighery scale (Keighery 1994) with a good density of vegetation cover, possible masking by resistant species and no obvious reduction in biomass.
- Environmental conditions occur that discourage the pathogen, such as highly fertile soils, fewer host species or a dominating resistant host.

Uninterpretable areas may contain Dieback (e.g. in very low levels as an endemic or incipient disease) without showing signs of its presence and determining the presence of the pathogen is not possible using interpretation methods (FEMD 2015). Uninterpretable areas that meet the protocols for identifying Protectable areas are managed as being both Infested and Uninfested so that the pathogen is neither imported into, nor exported from, these areas.

The Temporarily Uninterpretable category is allocated to areas of native vegetation that have been disturbed but will recover over time and become interpretable and mappable in the future (i.e. within five years).

Examples of Temporarily Uninterpretable areas include vegetation that has been impacted by fire, timber harvesting, grazing, flooding or mining with subsequent rehabilitation (FEMD 2015).

Excluded areas are distinguished from Temporarily Uninterpretable areas in that they cannot normally regenerate naturally and become mappable for Dieback occurrence in the future. Excluded areas are mapped from both field data and, where applicable, aerial imagery.

Table 4: Assessability of vegetated and non-vegetated areas (adapted from FEMD 2015).

Description	Phytophthora occurrence category	Typically present	May be present
Naturally vegetated areas Keighery disturbance rating (Keighery 1994) of 3 or less. Phytophthora occurrence categorisation is possible. Small unvegetated areas can exist and may be included in the assessment area, considering total environmental context.	**INFESTED**	Dead and dying reliable indicator species	Healthy reliable indicator species Indicator species deaths that have been killed by other agents
	UNINFESTED	Healthy reliable indicator species	Indicator species deaths that have been killed by other agents
	UNINTERPRETABLE	Very few reliable indicator species	Occasional reliable indicators, but too few for Phytophthora Dieback interpretation
	NOT YET RESOLVED	Usually, reliable indicator species in an environment not favourable to disease development	Negative sample results for all Phytophthora species
Vegetation structure temporarily altered Phytophthora occurrence assessment will be possible when vegetation structure recovers. Recovery times will be variable depending on severity and type of disturbance.	**TEMPORARILY UNINTERPRETABLE**	Indicator species masked by disturbance typically from fire, harvesting, temporary flooding, poisoning	Occasional reliable indicator species, but disturbance prevents accurate placement of Phytophthora occurrence
Road disturbance area	**DISEASE RISK ROAD (DRR)**	Unformed track with shoulders of interpretable vegetation	Shoulders and batters with regenerated vegetation, incipient infestation
Vegetation structure severely altered Keighery disturbance rating (Keighery 1994) 5 or greater. Phytophthora occurrence assessment is not possible. Can be determined by desktop assessment (aerial photo). Small-vegetated areas can exist and may be excluded from the assessment area considering total environmental context.	**EXCLUDED**	Pasture, pits, easements, infrastructure, large roads (sealed and unsealed) permanent flooding, plantations, parkland tree stands	Sporadic reliable indicator species

3.3.4 Sampling Strategy and Methods

Potential sample locations were selected throughout the assessment area. Sampling strategies for the assessment of Dieback aim to resolve the following scenarios:

- Sampling to support an infested diagnosis - recently dead and dying indicator species are sampled to support an Interpreter's diagnosis of an area as Infested.
- Sampling to support an uninfested diagnosis - recently dead and dying indicator species are sampled to support an Interpreter's diagnosis of an area as Uninfested.

Samples must be collected of soil and tissue from recently dead or dying disease indicator species to confirm the presence, or indicate the possible absence, of Dieback and to inform interpretation of the assessment area. Caution must be applied to interpreting the results of sampling and claiming that an area is Uninfested. False negative results can be obtained for several reasons, including when inoculum levels are depleted due to prolonged unfavourable environmental conditions for the pathogen (FEMD 2015). Therefore, sample results should be considered within the context of other field evidence, including disease vectors, pattern, chronology, biomass reduction and changes in vegetation structure.

All sampling strictly adhered to the following procedures:

- All tools used in sampling are thoroughly sterilised with a 70:30 mixture of methylated spirits and water before samples are taken. Tools are dry prior to sampling so that the results are not compromised.
- The plant sampled are excavated to a depth that ensure adequate plant tissue material can be obtained from the roots and cambium layer around the collar of the plant being sampled (not more than 150 mm depth).
- Material from all around the plant is taken in addition to any obvious lesions to avoid missing any infected material. Plant tissue material plus soil from around the roots and other places in the soil profile are placed in a polythene bag.
- All relevant information pertaining to the plant sampled and sample location are recorded on the Sample Information Sheet.
- Two aluminium tags that provided the date, company name, sample number and species sampled are prepared. One tag is to be placed in the sample bag and the other is tied near the sample site, which is also demarcated with fluorescent pink flagging tape.
- The sample hole is backfilled to prevent fauna from becoming trapped.
- All tools are brushed off to remove excess soil and sterilised to prevent contamination of the next sample site and sample.

All soil and tissue samples are lodged with the VHS laboratory, where diagnostic baiting is conducted. All sample point locations are recorded using a hand-held GPS unit.

Dieback assessment is conducted in a manner to ensure it does not spread Dieback within the assessment area. The following procedures are followed:

- Start all field assessments with a clean vehicle and footwear free of soil and vegetative material.
- Only work in dry conditions (i.e., when soil is not adhering) to reduce the spread of soil from footwear and vehicle movement.
- In wet conditions on more exposed soils, carry a small cleaning brush and spray bottle with a 70:30 solution methylated spirits/water to remove soil and mud from footwear when moving from Infested to Uninfested areas.
- In wet conditions:
    - Aim to work from Uninfested into Infested or Uninterpretable or Excluded areas.
    - Drive vehicles only on well-formed tracks avoiding muddy and wet areas.
    - If Uninfested areas need to be entered, complete an in-field vehicle inspection, and clean down if required.
- If a water-crossing or muddy area must be driven through, drive through slowly to reduce mud-spraying and complete an in-field vehicle inspection and clean down if required.
- An in-field vehicle inspection and clean down involves the following process:
- Before entering an Uninfested area or after completing a water/mud-crossing, stop at an appropriate site as soon as possible. This should be a dry and sandy or hard-pan location in the Infested area, draining onto or into the Infested area.
- Remove soil and mud from tyres, bumper, wheel arches, steps and under vehicle.
- Spray down the undercarriage and wheels of vehicle with 70:30 solution methylated spirits/water.
- Spray all equipment used to clean the vehicle and footwear with 70:30 solution methylated spirits/water.

3.4 Demarcation

Infested and Uninterpretable areas are demarcated in accordance with the guidelines in the Dieback Interpreter's Manual for linear Dieback assessments. Infested areas are demarcated using 25 mm fluorescent pink flagging tape. Uninterpretable areas are demarcated using 25 mm pink-and-black tiger-stripe flagging tape applying a 15 m buffer.

Discontinued sections of demarcation will be annotated on a map as 'Not Demarcated'.

Demarcation tapes are placed at sufficient frequency so that an installed tape can be clearly seen from adjacent forward and backward tape positions. For all Phytophthora demarcation scenarios, the tape will indicate which side of the line the category is on by the position of the knot and tape tail that will face the category being demarcated. A double tape will indicate the start and end of a demarcation line.

Demarcated sections are tracked using a GPS to digitise the location of all demarcation associated with disease mapping. The recorded line is not the disease edge but covers Infested area plus variable buffer. Buffers are applied to Phytophthora boundaries to counteract incipient disease.

The following buffers are applied during assessments in accordance with the Dieback Interpreter's Manual:

- Minimum upslope buffer of 15m depending on complexity of disease expression.
- Minimum downslope buffer of 25m depending on degree of slope, drainage patterns, soil type and geology.

3.5 Mapping

Spatial data, including tracks and waypoints recorded on hand-held GPS units, were downloaded into a Geographic Information System (GIS) program. The GIS software used for the project was QGIS 3.34.11 (QGIS Development Team 2025).

Field evidence and observations plus spatial data were used to prepare a Dieback occurrence map for the assessment area. Phytophthora occurrence categories were mapped using the categories defined in **Table 4.**

For operational purposes, Dieback occurrence mapping is only valid for 12 months after the assessment is completed to counter for autonomous spread of the pathogen (FEMD 2015).

4 Results

4.1 Desktop Review

The desktop review using the DIDMS database identified four previous positive *Phytophthora cinnamomi* samples from 2010 in the vicinity of the assessment area. One of these samples was located approximately 10 meters west, outside the project boundary of Lot 705. Another positive sample for *P. cinnamomi* was recorded within the construction work southward, adjacent to Lot 705.

The VHS database search revealed no historical positive samples for *P. cinnamomi* within the assessment area. However, one positive sample from 2015 was recorded in the neighbouring Clementine Park, and another positive *P. cinnamomi* sample from 2020 was found approximately 100 meters up an unnamed road heading towards the eastern end of the project boundary of Lot 705.

No previous Dieback occurrence information was available over the assessment area.

4.2 Disease Indicator Species

Disease Indicator Species observed within the project boundary include, but are not limited to representatives of the *Casuarinaceae*, *Iridaceae*, *Fabaceae*, *Proteaceae* and *Xanthorrhoeaceae* families. Disease indicator species observed during the field survey are listed in **Table 5.**

Table 5: Disease Indicator Species within the Project Boundary.

Family	Species
Casuarinaceae	*Allocasuarina fraseriana*
	Allocasuarina humilis
Fabaceae	*Daviesia sp.*
Iridaceae	*Patersonia sp.*
Myrtaceae	*Eucalyptus marginata*
Proteaceae	*Adenanthos cygnorum*
	Banksia attenuata
	Banksia dallanneyi
	Banksia ilicifolia
	Banksia menziesii
	Stirlingia latifolia
Xanthorrhoeaceae	*Xanthorrhoea preissii*
Zamiaceae	*Macrozamia fraseri*

4.3 Sample Results

Fourteen soil and tissue samples were taken during the Dieback assessment, of which four returned a positive result for *P. cinnamomi* through diagnostic baiting. With one sample returning a positive result for *Phytophthora arenaria*. The CPSM laboratory Phytophthora testing results are provided in

. A summary of all sample results is presented in **Table 6.**

Table 6: Sample results comprehensive Dieback assessment

Sample Label	Plant Species Sampled	Northing	Easting	Result
SLR01	*Banksia menziesii*	6444822	394818	Negative
SLR02	*Banksia menziesii*	6444805	394659	Negative
SLR03	*Banksia menziesii*	6445140	395252	Negative
SLR04	*Banksia menziesii*	6444684	394766	Negative
SLR05	*Banksia attenuata*	6445498	395370	*Phytophthora cinnamomi*
SLR06	*Banksia attenuata*	6444627	394689	*Phytophthora cinnamomi*
SLR07	*Banksia attenuata*	6445256	394835	Negative
SLR08	*Banksia menziesii*	6444834	395397	*Phytophthora cinnamomi*
SLR09	*Banksia menziesii*	6445580	394812	*Phytophthora arenaria*
SLR10	*Banksia attenuata*	6445663	394884	Negative
SLR11	*Banksia attenuata*	6445668	394970	Negative
SLR12	*Banksia attenuata*	6445620	395070	Negative
SLR13	*Banksia attenuata*	6445335	395332	Negative
SLR14	*Banksia attenuata*	6445249	395387	*Phytophthora cinnamomi*

4.5 Dieback Occurrence

Figure 2 presents a Dieback occurrence map for Lots 131 and 705. **Table 7** provides a breakdown of the Dieback Occurrence Categories and the area calculations.

In total, 38.13 ha of vegetation was assessed comprehensively for the presence of Dieback, of which 8.57 ha (22.5 %) has been mapped as Infested with *P. cinnamomi*. A further 28.64 ha (75.1 %) was mapped as Uninfested, an area of 0.58 ha (1.5%) was mapped as Uninterpretable, and the remaining 0.34 ha (0.9 %) mapped as Excluded due to the Degraded vegetation condition in these areas.

Table 7: Dieback occurrence area statement for the assessment area

Occurrence Category	Area (ha)	% of Assessment Area
Infested	8.57	22.5%
Uninfested	28.64	75.1%
Uninterpretable	0.58	1.5%
Excluded	0.34	0.9%
Total	**38.13 ha**	**100 %**

5 Discussion

5.1 Dieback Occurrence within the Treeby Assessment Area

There is evidence of historical off roading activities across the assessment area, the boundary has now been fenced to deter 4WD and motorbike access, these fences should be maintained to help prevent the spread of Dieback into Uninfested areas.

The comprehensive Dieback survey mapped 28.64 ha (75.1%) of the assessment area as Uninfested. These areas were characterised by healthy, intact Banksia woodland with an abundance of healthy disease indicator species present **(Photo 1)**. This was corroborated by a previous flora and vegetation assessment of the area finding all the native vegetation within the assessment area ranging from Good to Excellent condition (SLR 2024; SLR 2023).

There is a long history of disturbance in the vicinity of the site, with some Completely Degraded areas adjacent to the assessment area, and one identified within the assessment area totalling 0.34 ha (0.9%) that was subsequently mapped as Excluded.

There were five discrete Infested areas mapped within the assessment area, totalling 8.57 ha (22.5%). These five individual areas all had active disease expression with positive *P. cinnamomi* samples in three of these areas, all five discrete areas are as described in detail below.

The area adjacent to Solitare Road mapped Infested as shown below in **Figure 2 Extract A**. This area appears to have had a long history of public access and disturbance including some basic raw material extraction. There was an obvious disease front with a clear pattern and chronology of Banksia deaths surrounding the disturbed area

There was a positive sample for another species of Phytophthora (**SLRS09**) and is part of landscape unit of the larger Uninfested vegetation to the south of the Infested area.

Figure 2 Extract A: The area adjacent to Solitare Rd

Although a positive sample for *P. arenaria* was recovered within an otherwise large Uninfested area, *P. arenaria* is considered native to Western Australia and the disease was observed to be inactive with minimal impact to the surrounding vegetation (Jung *et al.* 2011; Rea *et al.* 2011; Terratree 2023). Therefore, the vegetation has been determined to be Uninfested surrounding the (**SLRS09**) sample point.

An area adjacent to Lycaste Pde was mapped Infested as shown in **Figure 2 Extract B** below and displayed active disease expression surrounding sample point **(SLR06) (Photo 2).** The area to the east of this mapped Infested area was found to have multiple disease indicator species deaths in the vicinity of sample (**SLR04**), however this area was ultimately determined to be Uninfested. The impacts on the Banksia species in this area likely the result of an altered groundwater table in the localised area, associated with the recently constructed drainage soak installed immediately adjacent to this part of the assessment area.

Figure 2 Extract B: The area adjacent to Lycaste Pde

The area adjacent to Jandakot Rd, in the Northeast corner of the assessment area contains a large wetland area that is Infested, this has resulted in some narrow areas of banksia woodland adjacent to this wetland also being Infested as mapped below in **Figure 2 Extract C**. There is a small raised area forming an island of Uninfested vegetation near sample (**SLR13**).

There are also two areas of Uninterpretable vegetation mapped in the vicinity of (**SLR13**) that were categorised by an absence of Banksia and other indicator species. The Uninterpretable areas are dominated by resistant species such as *Kunzea glabrescens*, *Regelia inops* and Melaleuca species, this Uninterpretable section of the assessment area was quantified and mapped as a closed heath community of *Regelia inops* over riparian species in a recently conducted flora and vegetation survey in the area (SLR 2024). There is a likelihood that these low-lying areas could be Infested, however there is no observable evidence for this.

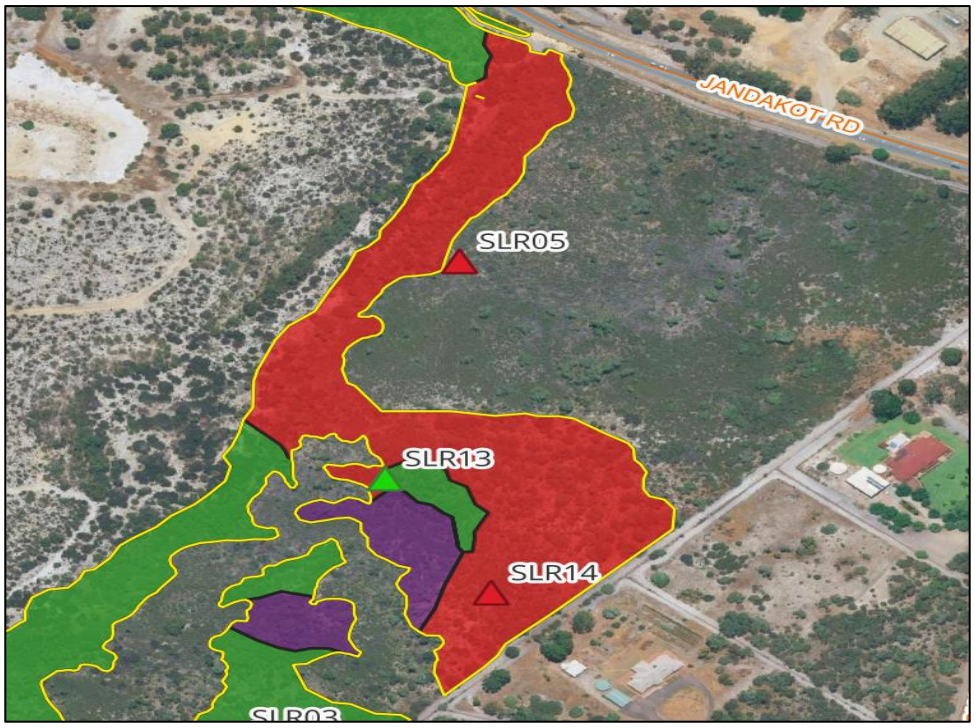


Figure 2 Extract C: The area adjacent to Jandakot Rd

The area adjacent to the end of Skotsch Rd is a high impact Infested area around the positive sample (**SLRS08**) for *P. cinnamomi* as mapped below in **Figure Extract D**, there is an adjacent heavily disturbed area just outside this section of the assessment area to the southwest, with a historical positive sample for *P. cinnamomi* located approximately 150m from the edge of the assessment area.

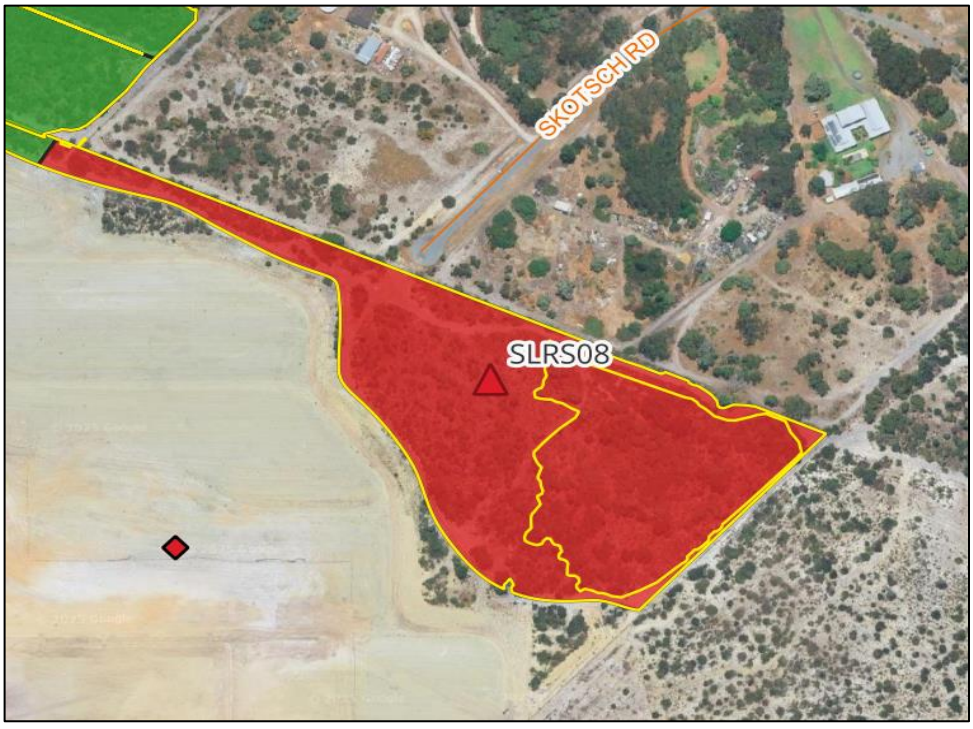


Figure 2 Extract D: The area adjacent to the end of Skotsch Rd

The area adjacent to Maxillaria Vista contained two historical positive sample points for *P. cinnamomi*, with one directly adjacent and within 20m of the edge of this section of the assessment area. Two areas were mapped Infested as shown below in **Figure 2 Extract E**, there is also a possibility that these Infested areas are potentially connected outside of the assessment area.

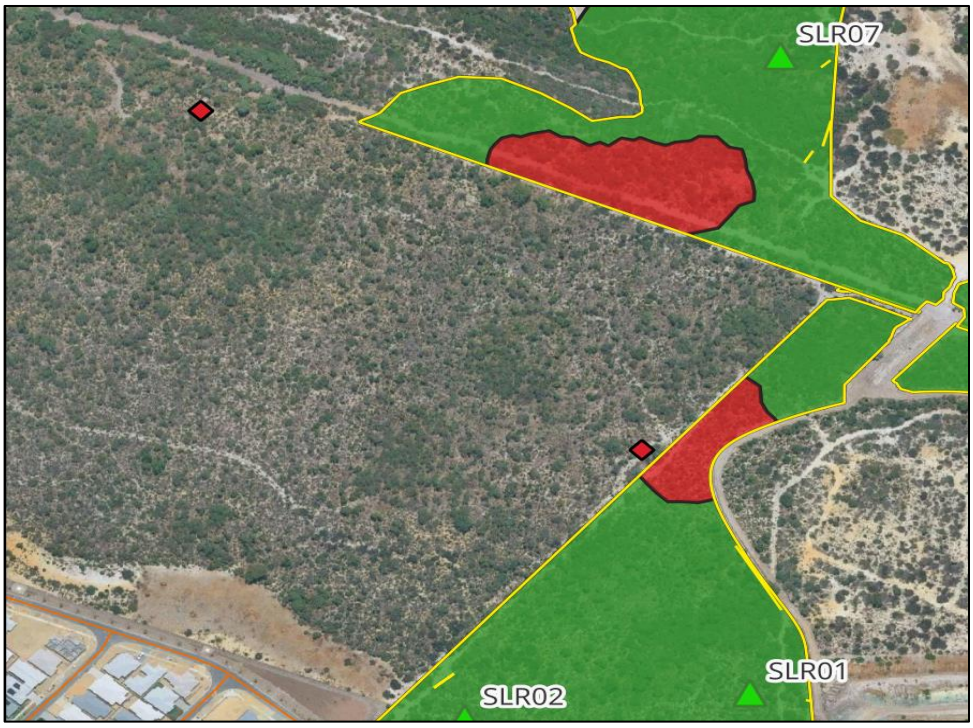


Figure 2 Extract E: The area adjacent to Maxillaria Vista

Only 0.56 ha (1.5%) of the assessment area was mapped as Uninterpretable where the vegetation is dominated by resistant species from Melaleuca, Kunzea and Regelia genera **(Photo 3)**.

A small area of 0.34 ha (0.9%) was mapped as Excluded because the vegetation condition in this area is Degraded and could not be assessed for the presence of Dieback **(Photo 4)**.

5.2 Limitations

The following limitations were encountered during the Phytophthora Dieback assessment:

- The long history of disturbance in the surrounding area has undoubtedly had a negative impact on some sections of vegetation adjacent to the disturbance within the assessment area.
- The lack of previous Dieback assessments within parts of the project boundary was a limiting factor for the desktop assessment.
- The impact of drought on susceptible vegetation and partly shallow soil conditions made interpretation and disease mapping more difficult.

- The absence of disease indicator species in some areas, along with heavily disturbed areas meant that the vegetation in those areas was mapped as Excluded and was consequently not assessable for Dieback.

6 Conclusion and Recommendations

The comprehensive Dieback field assessment was conducted on April 17th and the May 7th, of 2025, followed by two additional site visits on May 29th and June 4th 2025, and was completed by DBCA-registered Dieback Interpreter's Joseph Grehan and Norman Lai, along with Trainee Interpreter Elisa Brendel. The assessment was conducted according to the Dieback Interpreters Manual (FEMD 2015).

In total, 38.13 ha of vegetation was evaluated for Dieback. 8.57 ha (22.5 %) of assessment area has been mapped as Infested with *P. cinnamomi*. A further 28.64 ha (75.1 %) was mapped as Uninfested, an area of 0.58 ha (1.5%) was mapped as Uninterpretable, and the remaining 0.34 ha (0.9 %) mapped as Excluded due to the Degraded the vegetation condition in that area.

Fourteen soil and tissue samples were taken during the Dieback assessment, of which four returned positive results for *P. cinnamomi* and one sample returning a positive result for *P. arenaria* through diagnostic baiting. The location of the four positive *P. cinnamomi* samples represent a range extension to previously identified Infested areas adjacent to the assessment area.

Terratree makes the following recommendations:

- All earthworks and ground disturbance activities should be conducted in dry soil conditions.
- Ensure uncontrolled access to the assessment area is limited.
- Follow-up Dieback assessment should be considered after ground disturbance activities near the reserve have taken place.
- Ensure any rehabilitation of the site does not introduce Dieback by utilising only Nursery Industry Accreditation Scheme Australia (NIASA) accredited nurseries and appropriate hygiene measures.
- All personnel, including management, on-ground personnel and sub-contractors undertake Green Card biosecurity training, to ensure compliance with Dieback management. https://www.dwg.org.au/green-card-training/.

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Glossary of Terms (adapted from FEMD 2015)

Assessment - (*Phytophthora* occurrence) any combination of activities including detection, diagnosis (interpretation), mapping and demarcation of Phytophthora Dieback disease in natural ecosystems.

Assessment Area - an area where Phytophthora occurrence assessment is possible or will be possible in the short to medium term. This area may be larger or smaller than the proponent's project area. Synonyms used in this report include “track alignment” and “corridor”,

Diagnosis - a determining or analysis of the cause or nature of a problem or situation.

Dieback (*Phytophthora*) - in the south-west of Western Australia, a disease of plants caused by infection by the soil-borne organisms of the genus Phytophthora, of which *P. cinnamomi* is the most widespread.

Dieback (*Phytophthora*) Interpreter - a registered person who conducts Phytophthora Dieback interpretation.

Dieback (Phytophthora) Interpretation - the method of determining Phytophthora Dieback infestation using procedures in the Dieback Interpreter’s Manual (Forest and Ecosystem Management Division (2015). FEM047 Phytophthora Dieback Interpreter’s manual for lands managed by the department. Version 1.0. Department of Parks and Wildlife, Perth, Western Australia).

Disease - the combination of a pathogen, host and correct environmental conditions, which results in disease symptoms or death of a host.

Environment - the sum of all external factors that act on an individual organism during its lifetime.

Excluded Area - an area that has been disturbed to an extent that it is not assessable and therefore Excluded from Dieback interpretation.

Host - the plant that is invaded by a pathogen and from which the pathogen derives its energy.

Indicator species – a plant species that is more susceptible to Phytophthora disease and reliably shows symptoms earlier than other species.

Infection - the invasion of a host organism's bodily tissue by disease-causing organisms. In relation to Dieback, this refers to an individual plant and not the population.

Infested Area - an area that an accredited Dieback Interpreter has determined has plant disease symptoms consistent with the presence of the pathogen Phytophthora *cinnamomi.*

Inoculum - cells, tissue, or viruses that are used to inoculate a new culture.

Not Yet Resolved - an area that is interpretable for Dieback but where a determination regarding the disease status cannot be made due to a lack of evidence in the form of positive sample results.

Pathogen - any organism or factor causing disease within a host.

Phytophthora Dieback - a term referring to the disease symptoms caused by Phytophthora species in susceptible vegetation.

Project area - The proponent's project area, demarcated by the "**Project boundary"**. This area includes the "assessment area" of the survey.

Protectable Area - an area of land managed by the landowner where hygiene management rules for the plant pathogen Phytophthora, including clean on entry, will apply. These areas are generally free of disease.

Susceptible - influenced or able to be harmed by Phytophthora Dieback.

Uninfested Area - an area that an accredited Dieback Interpreter has determined to be free of plant disease symptoms that indicate the presence of Phytophthora Dieback.

Uninterpretable Area - an area situated in locations receiving >600 mm rainfall per year or are water-gaining sites (e.g. granite outcrops, impeded drainage or engineering works that aggregate rainfall) in the 400-600 mm per year rainfall zone where indicator plants are absent or too few to determine the presence or absence of disease caused by Phytophthora Dieback.

Unprotectable Area - a disease-free area that is likely to become Infested within a given time.

Vector - any agent that acts as a carrier or transporter.

Photos

Photo 1: Uninfested vegetation dominated by healthy disease indicator species including *Banksia attenuata* and *B. menziesii.*

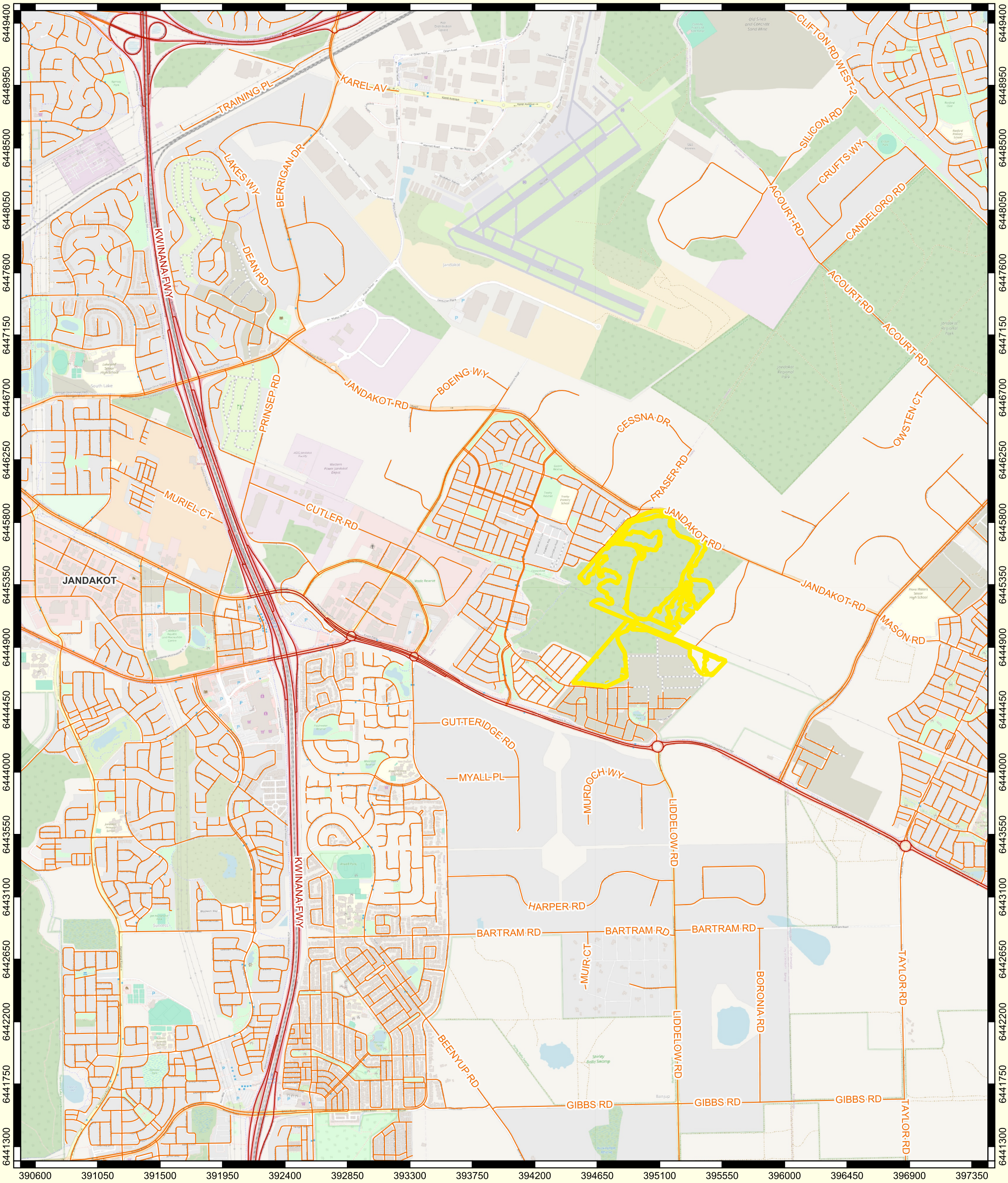
Photo 2: Infested area with multiple disease indicator species deaths including *Banksia attenuata* and *B. menziesii*.

Photo 3: Uninterpretable vegetation dominated by resistant species.

Photo 4: Excluded area with Degraded vegetation condition.

Figures

Figure 1: Project Location

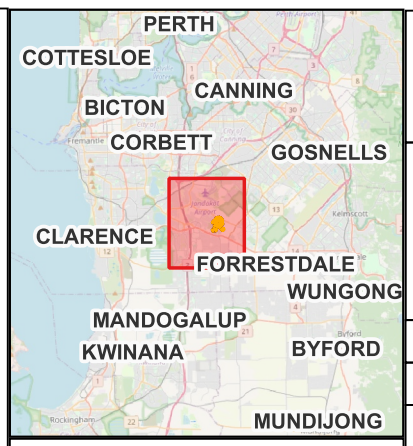


Legend

- Treeby Assesment Area
- Contour (10 m)

Road Network

- Local Road
- State Road



Project Location

Project Location Map

2025 Comprehensive Dieback Assessment - Treeby

0 0.75 1.5 km

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:2500 at A3

Date: 4/06/2025	Interpreter: JG	Project #: T25004
Expiry: N/A	Prepared: JB	
Figure 1	Review: JG	
	Revision:	

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Figure 2: Dieback Occurrence

Note: Terratree Pty Ltd does not guarantee that this figure is without any mistakes and disclaims all liability for any error, loss or other consequences that may arise from any of the spatial information illustrated.
Spatial information in this figure is based on observable disease symptoms made during the field survey component of the assessment and does not take into account recent or incipient disease symptoms.

MAP LIMITATIONS
The information represented on this map is digitised relative to mapped features and may not be accurate. Consequently, the field demarcation should be followed.

394500 394600 394700 394800 394900 395000 395100 395200 395300 395400 395500 395600

6446000 6445900 6445800 6445700 6445600 6445500 6445400 6445300 6445200 6445100 6445000 6444900 6444800 6444700 6444600

JANDAKOT RD
FRASER RD
SAPPHIRE DR
HYDRANGEA RD
FUCHSIA RD
KAMALA ST
ALATA WY
SOLITAIRE RD
MANGROVE ST
TORWOOD AV
ABELIA RD
TAMARIND RD
BOAB WY
SLR10
SLR11
SLR12
SLRS09
SLR05
SLR13
SLR14
SLR07
SLR03
SKOTSCH RD
SLR02
SLR01
SLRS08
ANTILLA WY
MAXILLARIA VSTA
SLR04
SLR06

Legend

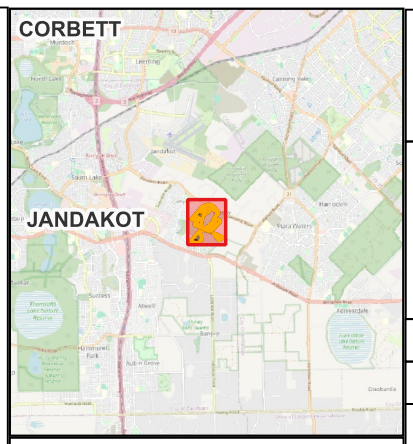
- Treeby Assesment Area
- Contour (10 m)

Sample Location and Result

- Negative Sample Result
- P. cinnamomi
- P. arenaria
- P. cinnamomi (Historical)

Phytophthora Occurrence

- Uninfested
- Infested
- Uninterpretable
- Excluded



Project Location

Phytophthora Occurrence Map

2025 Comprehensive Dieback Assessment - Treeby

0 50 100 150 200 250 300 m

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:4500 at A3

Date: 4/06/2025	Interpreter: JG	Project #: T25004
Expiry: 4/06/2026	Prepared: JB	
Figure 2	Review: JG	
	Revision:	

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Appendix

Appendix A: CPSM Laboratory Sample Result Sheets

Batch Details
Analysis Fee
Delivery date
Registered by Joe Grehan
Organisation Terratree Pty Ltd

Address :3/42 Victoria Street, Midland
Phone Number: 08 92501163/0400 003 688
Email Address: joeg@terratree.com.au

Sample Information

Sample	Sample Label	Date Collected	**Plant Species Sampled**	Species of Interest	Sample Type	Species Isolated
1	SLR01	20/02/2025	*Banksia menzesii*	Phytophthora sp	Soil & Root	NEGATIVE
2	SLR02	20/02/2025	*Banksia menzesii*	Phytophthora sp	Soil & Root	NEGATIVE
3	SLR03	21/02/2025	*Banksia menzesii*	Phytophthora sp	Soil & Root	NEGATIVE
4	SLR04	21/02/2025	*Banksia menzesii*	Phytophthora sp	Soil & Root	NEGATIVE
5	SLR05	21/02/2025	*Banksia attenuata*	Phytophthora sp	Soil & Root	Phytophthora cinnamomi
6	SLR06	21/02/2025	*Banksia attenuata*	Phytophthora sp	Soil & Root	Phytophthora cinnamomi
7	SLR07	21/02/2025	*Banksia attenuata*	Phytophthora sp	Soil & Root	NEGATIVE
8	SLR08	21/02/2025	*Banksia manzesii*	Phytophthora sp	Soil & Root	Phytophthora cinnamomi

Plant Health Laboratories
Biological Science and Biotechnology
Contact: Diane White 0419943382
E-mail d.white@murdoch.edu.au
Web www.cpsm-phytophthora.org

9	SLR09	21/02/2025	*Banksia manzesii*	Phytophthora sp	Soil & Root	Phytophthora arenaria
10	SLR10	24/04/2025	*Banksia attenuata*	Phytophthora sp	Phytophthora sp	NEGATIVE
11	SLR11	24/04/2025	*Banksia attenuata*	Phytophthora sp	Phytophthora sp	NEGATIVE
12	SLR12	24/04/2025	*Banksia attenuata*	Phytophthora sp	Phytophthora sp	NEGATIVE
13	SLR13	24/04/2025	*Banksia attenuata*	Phytophthora sp	Phytophthora sp	NEGATIVE
14	SLR14	24/04/2025	*Banksia attenuata*	Phytophthora sp	Phytophthora sp	Phytophthora cinnamomi

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