

Main Roads Western Australia

Great Eastern Highway Bypass Interchanges Project

Phytophthora Dieback occurrence assessment – Revision 0



<i>Client</i>	<i>Main Roads Western Australia</i>
<i>Report name</i>	<i>Great Eastern Highway Bypass Interchanges Project</i>

This report has been prepared in accordance with the scope of work agreed between Main Roads 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 manuals, particularly Phytophthora Dieback Interpreters Manual for lands managed by the Department (DBCA), 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.

Executive Summary

Glevan Consulting conducted an assessment of the development envelope associated with the Great Eastern Highway Bypass Interchanges project for the presence of *Phytophthora Dieback*. The development envelope covers 158.9 hectares and includes sections of Great Eastern Highway, Tonkin Highway, Abernethy Road, Kalamunda Road and Brinsmead Road.

Three protectable uninfested areas, comprising a total of 5.7 ha were identified during the assessment. Three *Phytophthora Dieback* infestations, covering 13.2 ha were observed during the assessment (Map 1). An area covering 0.6 ha was mapped as temporarily uninterpretable due to fire disturbance. An additional 4.1 ha of unprotectable uninfested vegetation was also identified. The remaining 135.3 ha of development envelope was excluded from the assessment due to being degraded or void of vegetation.

Three soil and tissue samples were taken during the assessment, two of which tested positive for the presence of *Phytophthora cinnamomi*. A desktop assessment of previous *Phytophthora* spp. recoveries for the area indicates that *Phytophthora cinnamomi* was previously recovered at three locations within the development envelope.

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1 Introduction

Glevan Consulting was commissioned by Focused Vision Consulting Pty Ltd (FVC) on behalf of Main Roads Western Australia (Main Roads) to conduct an assessment of the development envelope associated with the proposed Great Eastern Highway Bypass Interchange project. A dieback survey is required as part of the baseline surveys for the project to inform the environmental management requirements.

The development envelope covers 158.9 hectares and includes sections of Great Eastern Highway, Tonkin Highway, Abernethy Road, Kalamunda Road and Brinsmead Road. (Figure 1).



Figure 1 - Assessment area location

2 Background

Thousands of Australian native plant species are susceptible to Phytophthora dieback—a destructive disease caused by the pathogen *Phytophthora cinnamomi* and other *Phytophthora* species. This disease is a major threat to Australia’s biodiversity, placing important plant species at risk of death, local extirpation or even extinction. Its dramatic impact on plant communities can also result in major declines in some insect, bird and animal species due to the loss of shelter, nesting sites and food sources. *Phytophthora* dieback can cause permanent damage to ecosystems. Once an area is infested with the pathogen, eradication is usually impossible. Awareness that human activity can easily spread the pathogen will help prevent an increase in the extent of this disease (Commonwealth of Australia, 2018)

Phytophthora spp. are a group of microscopic water moulds that belongs to the class Oomycetes. Oomycetes organisms are filamentous and absorptive and reproduce both sexually and asexually. *Phytophthora* spp. are considered parasitic. The species behave largely as a necrotrophic pathogen causing damage to the host plant’s root tissues because of infection and invasion. (Department of Parks and Wildlife, 2015) The pathogen infects a host when it enters at a cellular level and damages the cell structure.

Phytophthora Dieback is the result of interaction between three physical components forming a ‘disease triangle’: the pathogen (*Phytophthora* spp.), the environment and the host. All three components are needed for the disease to develop over time. The relationship between the presence of *Phytophthora* spp. and the development of *Phytophthora* Dieback disease is variable and based on the susceptibility of native plant species and the different environmental characteristics, landform types and rainfall zones across bioregions.

Armillaria Rot Disease (ARD) is a pathogen frequently encountered during *Phytophthora* Dieback assessments. It is caused by an indigenous fungus which is endemic to the south-west of Western Australia, occasionally presenting symptoms consistent with *Phytophthora* Dieback presence. The impact of the fungus on the vegetation may range from single dead plants to complete devastation of understorey and overstorey species.

3 Materials and methods

3.1 The assessment area

As per Department of Parks and Wildlife (DPAW) (2015), areas within the development envelope are excluded from assessment if the vegetation is suffering from significant disturbance. This disturbance (Table 1) is based on Vegetation Condition Scales (Keighery, 1994). The remaining area, including the area outside of the development envelope if necessary, will be categorised post-assessment into Phytophthora Dieback occurrence categories (Table 2, Map 1).

Table 1 - Keighery Vegetation Condition Scale

Scale		Vegetation condition
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.
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.
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 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.

Table 2 - Phytophthora Dieback assessment for vegetation condition

Vegetation Condition	Phytophthora occurrence category
Naturally vegetated areas. Keighery disturbance rating of 3 or less Phytophthora occurrence categorisation is possible.	Infested - Determined to have plant disease symptoms consistent with the presence of <i>Phytophthora cinnamomi</i> .
	Uninfested - Determined to be free of plant disease symptoms that indicate the presence of <i>P. cinnamomi</i>
	Uninterpretable - Undisturbed areas where susceptible plants are absent, or too few to make a determination of the presence or absence of <i>P. cinnamomi</i> .
	Not yet resolved.
Vegetation structure temporarily altered.	Temporarily Uninterpretable - Areas of disturbance where natural vegetation is likely to recover.
Vegetation structure severely altered. Keighery disturbance rating 4 or greater. Phytophthora occurrence assessment is not possible	Excluded.

3.2 The assessment method

All *Phytophthora* Dieback detection, diagnosis and mapping was performed to standards and procedures defined in FEM047 Chapter 6 (DPAW 2015). These procedures are grounded on the presence in the vegetation of Indicator Species, and the observance of deaths in these plants. An indicator species is a plant species that is reliably susceptible to *Phytophthora cinnamomi*. Indicator species deaths (ISDs) alone do not necessarily indicate disease presence and it is necessary to consider all environmental and ecological factors that may be present. These other factors (as listed in FEM047) include:

- Chronology of deaths;
- Pattern of deaths;
- Topographical position;
- Vectoring – causal agencies, and;
- Biomass and biological diversity reduction.

Other causes of plant deaths need to be considered when determining the presence of *Phytophthora* Dieback, including (from FEM047):

- *Armillaria luteobubalina*;
- various cankers;
- insects;
- drought, wind scorch and frost;
- salinity and waterlogging;
- fire and lightning;
- senescence and competition;
- physical damage; and
- herbicides and chemical spills.

Both the linear and comprehensive (featuring transect lines) assessment types were used during the survey and performed to standards defined by Chapter 8, FEM047. Prior to assessment, all information relevant to the project was assembled to assist the interpretation process (as defined in Chapter 7, FEM047). This information included previous assessments of the area, history of burning and possible other disturbances.

3.3 Other *Phytophthora* species

Phytophthora species other than *P. cinnamomi* are identified using DNA analysis by the Centre for *Phytophthora* Science and Management (CPSM) at Murdoch University following the identification of the presence of a *Phytophthora* species in baiting analysis performed by Vegetation Health Service (VHS) at the Department of Biodiversity, Conservation and Attractions (DBCA).

3.4 Collection of evidence of *Phytophthora* Dieback

During the assessment process, the collection of evidence to support the field diagnosis is recorded using a tablet running the ESRI Collector application. Waypoints are recorded at locations to show evidence of:

- where field diagnosis is certain or almost certain of *Phytophthora* Dieback infestation;

- healthy indicator species where field diagnosis is almost certain of the site being uninfested;
- sites with too few or devoid of indicator species, thus supporting uninterpretable classification, or
- areas of disturbance, which are temporarily uninterpretable or excluded from assessment.

Additional waypoints recorded include:

- points requiring soil and tissue sampling;
- points located where samples have been taken;
- points located at ISDs; and
- points that need to be revisited for further examination.

3.5 Soil and Tissue Samples

Soil and tissue samples taken during the assessment were to standards and prescriptions defined in Chapter 11 of FEM047. All samples were analysed in the Vegetation Health Services (DBCA) laboratory using best-practice techniques.

Taking a soil and tissue sample from dead and dying plants is an integral part of assessment – although in some cases sampling is not essential. Sample results provide evidence to support field diagnostic decisions. The following table (**Table 3**) shows the need for sampling to assist the disease diagnosis process (Department of Parks and Wildlife, 2015).

Table 3 - Determination of requirement for sampling

Observable factors indicating likelihood of <i>Phytophthora cinnamomi</i> presence				
ISD type	Multiple	Cluster	Scattered	Isolated
Species	Some or most indicator species	Any indicator plant	Any indicator plant	Any indicator plant
Pattern development	Obvious			Not obvious
Chronology	Obvious			Not obvious
Topographic situation	Gully/flat	Lower to mid slope	Mid slope to upper slope	Ridge
Causal agent	Obvious			Not obvious
Requirement for soil and tissue sample	Low	High	High	Low

4 Results

4.1 *Phytophthora* Dieback Occurrence

Three protectable uninfested areas, comprising a total of 5.7 ha were identified during the assessment. Three *Phytophthora* Dieback infestations, covering 13.2 ha were observed during the assessment (Map 1). An area covering 0.6 ha was mapped as temporarily uninterpretable due to fire disturbance. An additional 4.1 ha of unprotectable uninfested vegetation was also identified. The remaining 135.3 ha of development envelope was excluded from the assessment due to being degraded or void of vegetation (as per DPAW 2015).

A desktop assessment of previous *Phytophthora* spp. recoveries for the area indicates that *Phytophthora cinnamomi* was previously recovered from three locations within the development envelope (Map 1).

Table 4 - Area Summary

Category	Area (ha)	% of total area
Infested (with <i>Phytophthora</i>)	13.2	8.5
Uninfested	5.7	3.5
Uninfested (unprotectable)	4.1	2.5
Temporarily uninterpretable	0.6	0.5
Excluded	135.3	85
TOTAL AREA	158.9	100.0

4.2 Disease symptoms and expression

Disease expression was highly variable across the development envelope. The infested area located immediately south of the GEH Bypass exhibited obvious signs of disease presence, including significantly reduced biomass, multiple indicator species deaths (ISD's), good chronology and an obvious disease front. The other infested sections exhibited more subtle disease symptoms, including reduced biomass, scattered ISD's, slight chronology and no obvious disease front.

4.3 Other *Phytophthora* species

No other *Phytophthora* spp. were identified during the assessment.

4.4 *Armillaria luteobubalina*

No infestations associated with ARD were observed during the assessment.

4.5 Sample results

Three soil and tissue samples were taken during the assessment. The results are presented in section 7.1.

5 Discussion

The majority (85%) of the development envelope is either degraded or completely degraded and largely void of understorey vegetation. As such, these areas could not be assessed for the presence of Phytophthora Dieback and were excluded from assessment. Due to the presence of several water-gaining sites it is likely that the pathogen is present at some sites within the excluded area.

Three protectable areas are located within the development envelope. A section of one of the protectable areas has been recently burnt and is temporarily uninterpretable (Map 1). The burnt section is surrounded by uninfested vegetation and did not exhibit any evidence of disease presence. When the size of the burnt area is added to the surrounding uninfested area, the total size meets the minimum requirements for protectable areas. One of the protectable areas mapped is relatively narrow (Map 1), however it is contiguous with a larger area of uninfested vegetation outside the development envelope.

Two uninfested areas were classified as unprotectable due to their size. The area immediately north west of the GEHB Bypass / Tonkin Hwy intersection is less than 1 ha and therefore does not meet the minimum size requirements (1 ha minimum recommended by Glevan). The other unprotectable area is on the eastern side of the Roe Hwy (Map 1) and is considered to be too narrow in some areas. In addition, there are several small degraded areas associated with disturbance activity in this narrow section.

It appears likely that a significant portion of the protectable vegetation will be cleared during construction, leaving sections of vegetation that are too small to be considered protectable. Should the final design of the development envelope result in the majority of the protectable uninfested areas being cleared, then the remaining vegetation will be too small to be considered protectable and no hygiene points will be required. It is recommended that once a design has been developed, this conclusion be reconsidered.

Despite a negative sample result (Sample 3) being recorded, a section at the southern end of the development envelope (Map 1) has been mapped as infested. The area exhibited several symptoms consistent with the presence of Phytophthora Dieback and cannot be mapped as

uninfested. It is also immediately adjacent to Hawkesvale Reserve, which appeared to be uninfested and protectable. As such, movement between the infested area and Hawkesvale Reserve should be avoided. Pushing soil and plant material towards the reserve during clearing operations should also be avoided. The infested section is bordered to the south and north by degraded, excluded areas and no hygiene points are required when moving north or south.

As a general hygiene measure, vehicles and machinery should be clean when arriving on site. After completion of work in the development envelope, vehicles and machinery should also be cleaned prior to use in any other project areas that may contain protectable vegetation.

6 Bibliography

Commonwealth of Australia. (2018). *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi*.

Department of Parks and Wildlife. (2015). *FEM047 Phytophthora Dieback Interpreter's Manual for lands managed by the department*. Unpublished.

Keighery, B. (1994). *Bushland Plant Survey: a Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc.).

7 Appendices

7.1 Sample Summary

Three soil and tissue samples were taken during the assessment, two of which returned a positive result for the presence of *P. cinnamomi* (Table 5).

Table 5 - Sample Results

Sample no	Plant Sampled	Easting	Northing	Result
01	<i>Banksia attenuata</i>	406891	6468325	<i>P. cinnamomi</i>
02	<i>Banksia attenuata</i>	407043	6468543	<i>P. cinnamomi</i>
03	<i>Xanthorrhoea preissii</i>	407154	6466638	Negative

7.2 Phytophthora Dieback Occurrence map

The provided map is the Phytophthora Dieback occurrence map. The project area is displayed as a blue boundary line. The following categories are also shown (if present in the project area):

- Excluded (shown as uncoloured). Areas of high disturbance where natural vegetation has been cleared and is unlikely to recover to a level that is interpretable.
- Infested (shown as red). Determined from the assessment to have the plant disease caused by *Phytophthora cinnamomi*. Phytophthora Dieback caused by other *Phytophthora* species will be displayed as other colours, typically shades of orange and yellow.
- Uninfested (shown as green). Determined from the assessment to be free of plant disease Phytophthora Dieback.
- Uninterpretable (shown as purple). Undisturbed areas where susceptible plants are absent, or too few to decide the presence or absence of Phytophthora Dieback.
- Temporarily Uninterpretable (shown as grey). Areas of disturbance where natural vegetation is likely to recover.

Additional spatial data that may be shown include:

- Sample location

7.3 Mapping Metadata

DATASET DESCRIPTION	
Title	GEHB Interchange
Data Created	16-08-2020
Date Last Updated	07-09-2020
Abstract	Phytophthora Dieback Occurrence and sample location shapefiles for the GEHB Interchange development envelope.
Purpose	Dieback category boundary mapping
Document Number	20-1036
Contact Organisation	Glevan Consulting
Contact Name	Simon Robinson
Contact Position	Phytophthora Dieback Interpreter
Contact Phone	0427 113 336
Contact Email	simon.robinson@glevan.com.au
Lineage	All field data recorded using ESRI Collector on a GPS enabled tablet.
Datum / Coordinate System	GDA94 Zone 50
Geographic Description	Great Eastern Highway, Tonkin Highway, Abernethy Road, Kalamunda Road and Brinsmead Road.
Restrictions	None

7.4 Shapefile spatial data

Spatial data is contained in the attached file named GEHB_Interchange_Shapefiles.zip.



Map 1
Phytophthora Dieback
Occurrence Map

Great Eaastern Highway
Bypass Interchange
Main Roads W.A

Occurrence

- Excluded
- Infested
- Uninfested Protectable
- Uninfested Unprotectable
- TUI

Samples

- Positive
- Negative
- P. cinamomi all years
- Development Envelope

Author: Simon Robinson
Date: 01-09-2020

Datum: GDA94 Zone 50
Mapping expiry: 16-08-2021

250 0 250 500 m

