

Appendix G Phytophthora Dieback Occurrence Assessment

METRONET

Malaga to Ellenbrook Rail Works

Phytophthora Dieback occurrence assessment – Version 1.1



<i>Client</i>	<i>METRONET</i>
<i>Report name</i>	<i>Malaga to Ellenbrook Rail Works</i>

This report has been prepared in accordance with the scope of work agreed between METRONET 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 was commissioned by METRONET to conduct an assessment of the development envelope associated with the Malaga to Ellenbrook Rail Works project for the presence of *Phytophthora Dieback*. The development envelope is located between the Reid Highway/Marshall Road intersection and The Promenade, Ellenbrook and is approximately 13 kilometres in length and comprises 464 ha.

Four *Phytophthora cinnamomi* (*Phytophthora Dieback*) infestations, comprising a total of 24.02 ha were observed within the development envelope (Table 4). A further 3.1 ha of unprotectable, uninterpretable vegetation was also observed. Four sections of protectable uninfested vegetation, comprising a total of 6.2 ha were also identified. The remaining 430.68 ha of the survey area was excluded from assessment due to being assessed as degraded or cleared (Maps 1 & 2).

A desktop assessment of the project area indicates that *Phytophthora Dieback* has previously been recovered (through soil and tissue sampling) at one location within the development envelope. No other *Phytophthora* species have been previously identified within the development envelope.

Three soil and tissue samples were taken during the assessment, all of which tested negative for the presence of *Phytophthora Dieback*.

Table of Contents

1	<i>Introduction</i>	1
1.1	Location	1
2	<i>Background</i>	3
3	<i>Materials and methods</i>	4
3.1	The assessment area	4
3.2	The assessment method	5
3.3	Other <i>Phytophthora</i> species	6
3.4	Collection of evidence of <i>Phytophthora</i> Dieback	7
3.5	Soil and tissue samples	7
4	<i>Results</i>	9
4.1	<i>Phytophthora</i> dieback occurrence	9
4.2	Disease symptoms and expression	9
4.3	Other <i>Phytophthora</i> species	10
4.4	<i>Armillaria luteobubalina</i>	10
4.5	Sample results	10
5	<i>Discussion</i>	11
6	<i>Recommendations</i>	12
7	<i>Bibliography</i>	13
8	<i>Appendices</i>	14
8.1	Sample summary	14
8.2	Mapping metadata	14
8.3	Shapefile spatial data	14

List of Figures

Figure 1 - Assessment area location	2
Figure 2 Occurrence Map 1.....	15
Figure 3 Occurrence Map 2.....	16

List of Tables

Table 1 - Keighery Vegetation Condition Scale	4
Table 2 - Vegetation condition and Occurrence Categories	5
Table 3 - Determination of requirement for sampling	8
Table 4 - Area Summary	Error! Bookmark not defined.

1 Introduction

Glevan Consulting was commissioned by METRONET to conduct an assessment of the development envelope associated with the Malaga to Ellenbrook Rail Works project for the presence of Phytophthora Dieback. The planned works will involve clearing and disturbance to native vegetation. The assessment is required to determine the Dieback status of the vegetation within development envelope prior to the commencement of construction activities.

1.1 Location

The project area is located between the Reid Highway/Marshall Road intersection and The Promenade, Ellenbrook. The development envelope associated with the project is approximately 13 kilometres in length and comprises 464 ha (Figure 1).

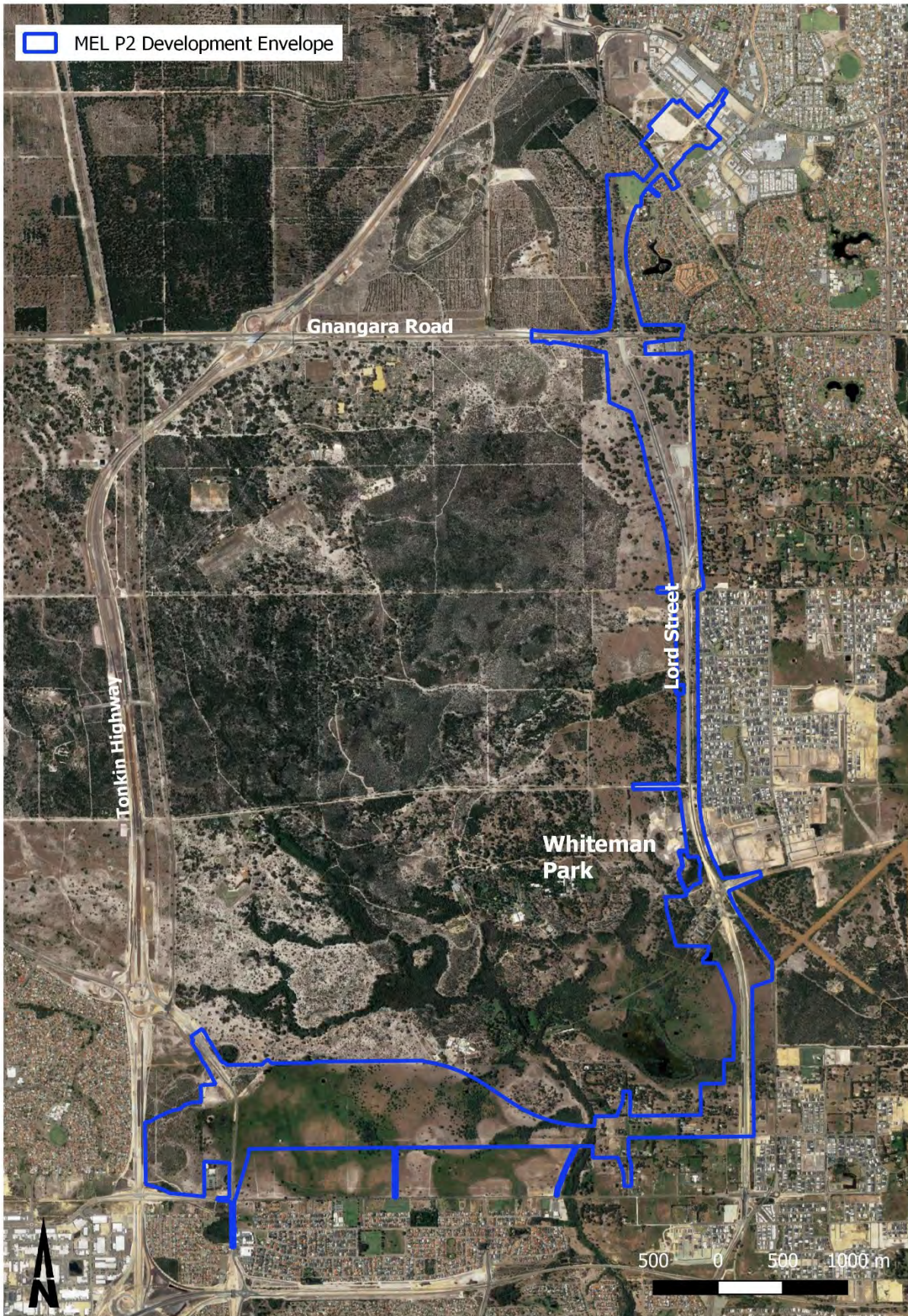


Figure 1 - Assessment area location

2 Background

Thousands of Australian native plant species are susceptible to Phytophthora dieback—a destructive disease caused by the pathogen *Phytophthora Dieback* 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

Areas within the Project Area that are in poor condition will be excluded from the dieback assessment as stipulated in DPAW (2015). Vegetation condition will be assessed using the Keighery (1994) vegetation condition scale (Table 1). All areas that are considered suitable for inclusion will be categorised and mapped using the categories defined in Table 2.

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 - Vegetation condition and Occurrence Categories

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>P. 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 (not related to Keighery scale)	Temporarily Uninterpretable - Areas of disturbance where natural vegetation is likely to recover e.g. fire disturbance.
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 will be performed to standards and procedures defined in Chapter 6 of FEM047 *Phytophthora Dieback Interpreter's Manual for lands managed by the department* (DPAW, 2015). These procedures are grounded on the presence of Indicator Species, and the observance of deaths in these plants. An indicator species is a plant species that is reliably susceptible to Phytophthora Dieback. 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.

Prior to assessment, all information relevant to the project will be assembled to assist the interpretation process (as defined in Chapter 7, FEM047). Spatial data sets and maps containing previous sample sites and occurrence mapping are studied prior to undertaking the field work. The maps and data are available through the Dieback Information Delivery Management System (DIDMS, 2020). The assessment was largely conducted using the linear assessment method (used when a proposed activity is linear in nature, such as along a utility easement or road) using standards defined in Chapter 8, FEM047. Larger areas were assessed using transect lines, traversed on a 50m grid.

3.3 Other *Phytophthora* species

Phytophthora Dieback refers to the disease caused by *P. cinnamomi* and other *Phytophthora* species. *Phytophthora* species other than *P. cinnamomi* will generally be detected in the field using the same methods used to detect *P. cinnamomi*. These other *Phytophthora spp.* are detected during the baiting process, performed by Vegetation Health Service (VHS) at the Department of Biodiversity, Conservation and Attractions (DBCA). They are then submitted for DNA analysis by the Centre for Phytophthora Science and Management (CPSM) at Murdoch University.

3.4 Collection of evidence of Phytophthora Dieback

During the assessment process, the collection of evidence to support the field diagnosis were recorded using a tablet running the ESRI Collector application (GPS accuracy +/- 5m).

Waypoints were 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 located at soil and tissue sample sites with *Phytophthora cinnamomi* result;
- points located at sites known to be infested by *Phytophthora* species other than *Phytophthora cinnamomi*;
- points located where field diagnosis is certain or almost certain of *Armillaria*;
- points requiring soil and tissue sampling;
- points located where samples have been taken, results pending;
- points located at ISDs, and
- points that need to be revisited for further examination.

3.5 Soil and tissue samples

Any soil and tissue samples taken during the assessment were taken to standards and prescriptions defined in Chapter 11 of FEM047. All samples are analysed in the Vegetation Health Services (DBCA) laboratory using best-practice techniques. *P. cinnamomi* is easily identifiable under a microscope and therefore DNA analysis is not required.

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

Samples may also be taken for the following strategic reasons:

- Supporting infested field diagnosis;
- Incipient, subtle or cryptic disease in apparent uninfested sites, or
- Altering mapped infested area boundaries.

4 Results

4.1 Phytophthora dieback occurrence

Four *Phytophthora* Dieback infestations, comprising a total of 24.02 ha were observed within the development envelope (Table 4). A further 3.1 ha of unprotectable, uninterpretable vegetation was also observed. Four sections of protectable uninfested vegetation, comprising a total of 6.2 ha were also identified. The remaining 430.68 ha of the survey area was excluded from assessment due to being assessed as degraded or cleared (Appendices, Maps 1 & 2).

A desktop assessment of the survey area indicates that *Phytophthora cinnamomi* has previously been recovered (through soil and tissue sampling) at one location within the development envelope (Appendices, Map 1). The historical sample data available through DIDMS(2020) also indicates that *P. cinnamomi* has been recovered in a significant number of samples taken in the area surrounding the development envelope. No other *Phytophthora* species have been previously identified within the development envelope.

Table 4 Survey Area Summary

Category	Area (ha)	Protectable area (ha)	% of assessed area
Infested	24.02	0.00	72.10
Uninfested	6.20	6.20	18.60
Uninterpretable	3.10	0.00	9.30
Assessed Area	33.32	6.20	
Excluded	430.68		
Total Area	464.00	6.20	

4.2 Disease symptoms and expression

Disease expression was largely subtle or average throughout most of the infested area. This is partly due to the infested areas being largely associated with low-lying, water-gaining sites where the coverage of reliable indicator species was often low. There were some small sections with obvious disease expression, featuring multiple indicator species deaths (ISD's) present, including *Banksia* and *Xanthorrhoea* species. A reduction in vegetation biomass and notable chronology were also observed in some of infested areas.

4.3 Other *Phytophthora* species

No other *Phytophthora* species 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 within the development envelope, all of which tested negative for the presence of *Phytophthora*. The location and results are presented in Section 7.1.

5 Discussion

All of the infestations mapped during the assessment are associated with low-lying, water-gaining (historically at least) parts of the landscape. Disease expression was more subtle in these areas as much of the vegetation associated with these high-moisture sites has limited or no susceptibility to the pathogen. Disease expression was typically limited to scattered *Xanthorrhoea* deaths in these areas.

Much of the development envelope has been subjected to significant disturbance activities, including grazing, clearing and construction associated with the installation of services. These areas (90.5% of the development envelope) are in a degraded or completely degraded state and were excluded from assessment. While the presence and distribution of *Phytophthora* dieback could not be mapped in these areas, it is likely that a considerable portion of the excluded area is infested. Much of the area is water-gaining, contains (where vegetated) vegetation decline and is bordered by areas known to be infested.

The uninterpretable areas mapped in the development envelope have been mapped as unprotectable. These areas were too small to be considered protectable. Moreover, they are water-gaining sites that are most likely infested anyway.

The four protectable, uninfested areas identified during the assessment contain *Banksia* woodland in very good or excellent condition. These protectable areas are all 'upland' sections of the development envelope, that are surrounded by infested areas or excluded areas. Vehicles and machinery will need to be inspected and cleaned where necessary, prior to entering the mapped uninfested areas.

While the sample results (negative) do not support the view that the low-lying sections surrounding the upland protectable areas are infested, the combination of the high-risk

landscape (water-gaining site), obvious vectors and a significant number of ISD's means that the vegetation cannot be classified as uninfested. There may be some uninfested sections present in these low-lying areas, however the combination of factors mentioned above, means they are considered unprotectable anyway.

6 Recommendations

- Soil and plant material of infested or unknown Dieback status should not be introduced to the uninfested sections of the study area.
- Soil and plant material should not be taken from the infested, uninterpretable or excluded sections of the development envelope for use at any sites containing protectable vegetation.
- Vehicles and machinery should be clean upon entry into uninfested areas. Moving from uninfested areas into other categories does not require clean down measures.
- Restrict access/activity, 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 COE points.

- Construction should be undertaken under a Hygiene Management Plan (HMP). The HMP should include the provision of dieback occurrence mapping, location of CoE points and management of vehicles and other machinery both entering the site and moving within the project area.

7 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.

Dieback Information Delivery Management and System. Available from: <https://www.didms.gaiaresources.com.au/> [May 2020].

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

8 Appendices

8.1 Sample summary

Sample	Plant Sampled	Easting	Northing	Result
2	<i>Xanthorrhoea preissii</i>	397875	6475940	Negative
3	<i>Xanthorrhoea preissii</i>	397717	6475274	Negative
6	<i>Xanthorrhoea preissii</i>	401858	6479448	Negative

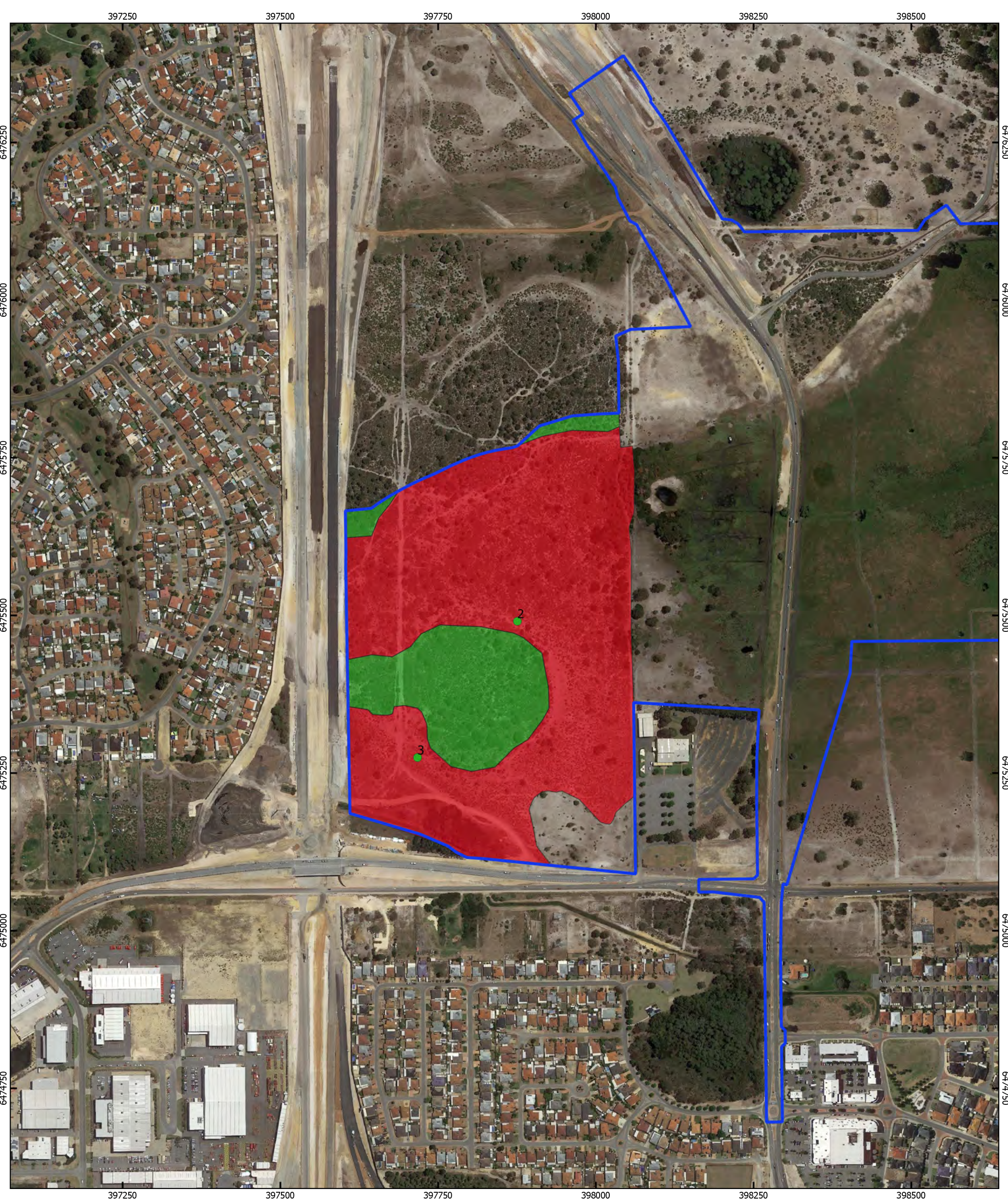
Note: Other samples were taken outside the development envelope that are not shown above, hence sample numbers are not sequential.

8.2 Mapping metadata

DATASET DESCRIPTION	
Title	Malaga to Ellenbrook Rail Works
Data Created	08-05-2020
Date Last Updated	18-05-2020
Abstract	Phytophthora Dieback Occurrence and sample location shapefiles for Malaga to Ellenbrook Rail Works development envelope.
Purpose	Dieback category boundary mapping
Document Number	20-0927
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	Between the Reid Highway/Marshall Road intersection and The Promenade, Ellenbrook.
Restrictions	None

8.3 Shapefile spatial data





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







Map 1
Phytophthora Dieback
Occurrence

Malaga Ellenbrook
Railworks

METRONET

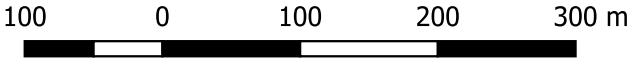
-  MEL P2 Development Envelope
-  Occurrence
-  Infested
-  Uninfested

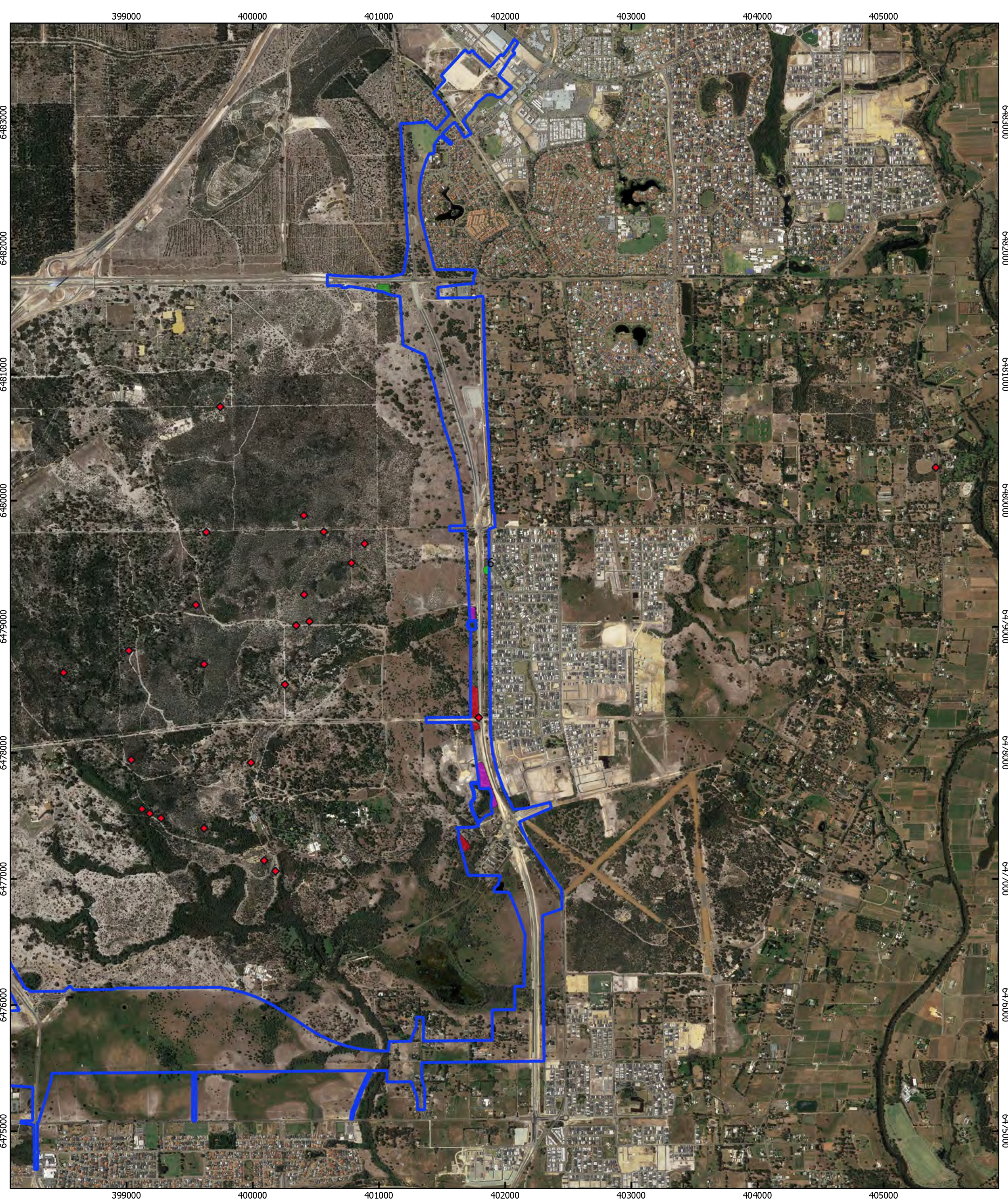
-  Uninterpretable
-  Excluded
-  Sample sites
-  Negative



Author: Simon Robinson
Date: 12-05-2020

Datum: GDA94 Zone 50
Mapping expiry: 08-05-2021





Map 2
Phytophthora Dieback
Occurrence

Malaga Ellenbrook
Railworks

METRONET

- | | |
|-----------------------------|-------------------------------|
| MEL P2 Development Envelope | Excluded |
| Occurrence | Sample sites |
| Infested | Negative |
| Uninfested | <i>P. cinnamomi</i> all years |
| Uninterpretable | |



Author: Simon Robinson
Date: 12-05-2020

Datum: GDA94 Zone 50
Mapping expiry: 08-05-2021

