Public Transport Authority

Yanchep Rail Extension

Phytophthora Dieback occurrence assessment – Version 2.0

GLEVAN
CONSULTING

Disclaimer

This report has been prepared in accordance with the scope of work agreed between the Client and Glevan Consulting and contains results and recommendations specific to the agreement. Results and recommendations in this report should not be referenced for other projects without the written consent of Glevan Consulting.

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

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

Author Simon Robinson

Note on version numbering:

0.1 – 0.∞	*Internal documents*
1.0 – 1.∞	*First draft and iterations to Client.*
2.0	*Final document.*

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1 Summary

Glevan Consulting conducted an assessment of the project corridor associated with the proposed Yanchep Rail Extension for the presence of Phytophthora Dieback. The project corridor is approximately 16 kilometres in length, averages around 60 metres in width and comprises a total of 92 hectares in area. A total of 82.5 hectares was assessed, with the remaining 9.5 ha being excluded from the assessment due to being void of vegetation.

The assessment was conducted from the 09-08-2017 to the 18-08-2017 by Simon Robinson and is the first assessment of the area conducted since the initial 2011 assessment. The proposed alignment has been modified in several areas since the 2011 assessment, therefore several areas had not previously been assessed for the presence of Phytophthora Dieback.

No Phytophthora Dieback infestations were observed during the assessment and all 30 ha (33% of the project area) of interpretable vegetation that was observed during the assessment was found to be uninfested. Three soil and tissue samples were taken during the assessment, all of which returned a negative result for the presence of *Phytophthora cinnamomi*.

More than half (57%) of the project area was observed to be uninterpretable due to an insufficient coverage of reliable indicator species. The absence of sufficient indicator species was due primarily to the presence of vegetation types that are largely void of the species used to detect the presence of Phytophthora Dieback. All uninfested and uninterpretable areas are considered to be protectable.

The Phytophthora Dieback mapping contained in this report is valid for three years and will expire in August 2020. However, where construction works are to occur, the validity is 12 months and will expire in August 2018.

2 Introduction

2.1 Background

Glevan Consulting was commissioned by the Public Transport Authority to conduct an assessment of the project footprint associated with the proposed Yanchep Rail Extension for the presence of Phytophthora Dieback. The assessment is required to provide mapping of the Phytophthora Dieback occurrence categories present within the project footprint, which will determine the locations of any hygiene points required and facilitate the development of a hygiene management plan if necessary.

2.2 Location of Project Area.

The project area extends from Alkimos in the south in a north north-westerly direction for approximately 16 kilometres, terminating around 3 kilometres north of Yanchep. The width of the project footprint varies considerably, however the average width in most sections is between 40 and 60 metres.

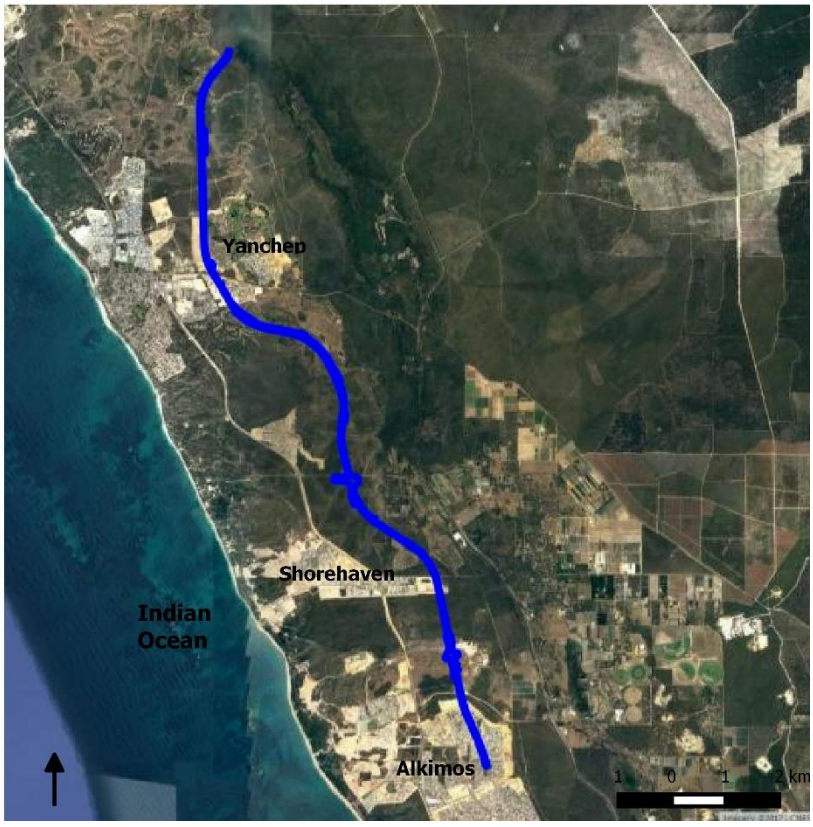

Figure 1 - Project Area

2.3 Historical land use and previous disturbances.

There is evidence of significant clearing, revegetation, grazing and off road vehicle movement throughout much of the project area.

2.4 Study team

The assessment was conducted by Simon Robinson of Glevan Consulting in August of 2017. Mr Robinson is accredited by the Department of Parks and Wildlife (DPaW) in the detection, diagnosis and mapping of the Dieback disease. This accreditation recognises the skills and experience of Mr Robinson.

3 Phytophthora Dieback

The pathogen *Phytophthora cinnamomi* is an agent of environmental disease found in vulnerable areas of Western Australia. Phytophthora Dieback is the common name for the observable disease result of interaction between the pathogen (*P. cinnamomi*) and the vegetation hosts (susceptible plant species within vulnerable areas).

The environmental conditions of the site significantly affect the pathogens ability to survive or flourish and spread over time. All land with an annual average rainfall of more than 400 millimetres and suitable soil composition is considered vulnerable to Phytophthora Dieback. This large area stretches approximately from Perth, Bunbury and Augusta in the west to Narrogin, Ravensthorpe and Esperance in the east, and as far north as Kalbarri.

This vulnerable area has many different bioregions, having specific characteristics formed by climate and geology. These two factors are highly significant in determining the pathogen's effectiveness and resulting disease impact levels.

3.1 The Pathogen

Phytophthora cinnamomi is a microscopic water mould. It belongs to the class Oomycetes and belongs in the Kingdom Stramenopila. It is more closely related to brown algae than to true fungi. Oomycetes organisms occupy both saprophytic and pathogenic lifestyles however *P. cinnamomi* is considered parasitic. It behaves largely as a necrotrophic pathogen causing damage to the host plant's root tissues because of infection and invasion.

The life cycle of *Phytophthora cinnamomi* is a continuous circle of infection, sporulation and further infection and is readily vectored by animals and human activity allowing for rapid invasion into new areas.

3.2 Host

A population of hosts is made up of susceptible, infected and immune or resistant individuals. The infection of host plants is an unseen activity happening constantly beneath the soil at an infested site.

The environmental conditions favouring or disfavouring the pathogen may change at a critical point during disease development, temporarily changing the rates of infection and

invasion. This can be observed symptomatically after soil temperature change through winter months.

The plant host is a highly variable component of the disease development. Sites may range from having no susceptible host, to containing vegetation that is almost entirely susceptible. Within vulnerable areas, three main family groups are regarded as highly susceptible to Phytophthora Dieback disease, being:

- Proteaceae
- Ericaceae
- Xanthorrhoeaceae.

3.3 Environment

Two fundamental environmental characteristics influencing Phytophthora Dieback disease are rainfall and soil. Areas vulnerable to Phytophthora Dieback are defined as native vegetation which occur west of the 400 millimetre rainfall isohyet. The correlation of increased Phytophthora Dieback impact with increased annual rainfall is generally applicable.

Certain soil properties influence Phytophthora Dieback disease development within the vulnerable areas:

1. Moisture is critical for *Phytophthora cinnamomi* to survive in the soil and for sporangia production.
2. Soil pH affects the growth and reproduction of the pathogen. The calcareous sands closest to the coast are alkaline and hostile to *Phytophthora cinnamomi,* but are favourable to *P. multivora.*
3. Fertile soils are less favourable to Phytophthora Dieback because the richness of nutrients aids strong host resistance, good soil structure allows water movement and drainage, and high organic matter provides antagonistic microflora.
4. Coarse-textured soils have larger pore spaces which favour dispersal of spores.
5. The optimum temperature for *Phytophthora cinnamomi* sporulation is 21 to 30°C, peaking at 25°C., but some sporangia can still be produced at temperatures as low as 12°C. The optimum growth range is 15 to 30°C and temperatures lower than 5°C or greater than 35°C are unfavourable for the persistence of survival of spores and the vegetative mycelia of *P. cinnamomi.*

4 Methods

4.1 Pre survey desktop study

Known databases of *Phytophthora* locations retained by Glevan Consulting and Vegetation Health Services (DPaW) were searched to determine previous recoveries of *Phytophthora* within the project area. Previous Phytophthora Dieback Occurrence reports (Glevan, 2011) and maps pertaining to the study area were also studied prior to undertaking the field work.

4.2 Interpretation

Based on the considerations of Section 3 'Phytophthora Dieback', the personnel involved in the field work determined the presence of Phytophthora Dieback based on symptoms and disease signatures displayed in susceptible vegetation. These symptoms are supported through the strategic sampling and subsequent recovery of Phytophthora from soil and tissue samples taken during the assessment.

The detection of the plant pathogen Phytophthora Dieback involves the observation and interpretation of plant deaths (or reduction of biomass or perceived temporal change in vegetation structure) using a logical assessment of factors that imply pathogen presence above other possible causes of plant deaths or vegetation change. A combination of the following factors may indicate the presence of disease caused by *Phytophthora* Dieback or other *Phytophthora* species.

Deaths of disease indicating species:

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

Chronology of deaths:

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

Pattern of deaths:

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

Other causes of indicator species death:

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

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

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

Table 1 - Phytophthora Dieback occurrence categories

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

4.3 Demarcation of hygiene boundaries

The uninterpretable boundaries were denoted with black and pink tiger tape, with the knots facing towards the uninterpretable area. The tapes were placed approximately 10m apart across the width of the proposed project footprint.

4.4 Soil and tissue sampling

Suspicious sites can have a representative soil and tissue sample taken to assist with the interpretation process. The laboratory result can confirm the presence of the *P. cinnamomi* pathogen. A negative result does not necessarily prove that the pathogen isn't present at the site, and should be supported by the field interpretation.

Sampling was conducted using the following procedure:

- All digging implements used were thoroughly sterilised prior to use with methylated spirits. The implements were then allowed to dry so that the integrity of the sample was not compromised.
- The area around the base of the plant/s to be sampled was cleared of vegetative matter to aid the digging process.
- The plant was dug to a satisfactory depth so that the tissue with the highest moisture content was obtained.
- Sections of the roots and stem base from all sides of the plant were taken and placed in a plastic bag. If any lesion was noticed on the tissue, it was also placed in the bag. A few handfuls of sand from various depths were also deposited in the plastic bag.
- The sample bags were irrigated with distilled water to try and simulate the optimum conditions for the *Phytophthora* to survive.
- Details, such as the date, sample number and interpreters were written on an aluminium tag, which was left at the site. The tag was demarcated with a strip of day-glow orange flagging tape.
- All digging implements used were again sterilised after each sample was taken to ensure that infected soil was not transported to the next sample site.

4.5 Mapping

Subsequent to hygiene boundary demarcation, the boundaries were again walked and recorded utilising a handheld GPS. The recorded data was then transferred to a desktop computer and used to produce the relevant maps.

4.6 Limitations of disease mapping

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

The validity of the hygiene boundaries mapped for this project is twelve months from the completion of this survey. All boundaries should be reassessed by 08/2018 if construction activities are still occurring beyond this time.

5 Project area environmental data

5.1 Rainfall

Climate statistics retained by the Bureau of Meteorology (BOM, 2017) since 1905 for the nearby Wanneroo weather station, indicate an average annual rainfall of 797mm. In terms of rainfall, the study area is in the highly vulnerable zone. Average soil temperatures above 20 degrees Celsius for several months of the year, are also favourable for sporulation.

5.2 Soil types

The study area is underlain by the Spearwood dunes, and Tamala limestone. Chief soils are shallow calcareous loams with stony calcrete rises. Such soils have a relatively high pH, which is known to be hostile to the pathogen (DPaW, 2015), and therefore the risk of disease occurrence on these soil types is considered very low.

5.3 Vegetation structure

The vegetation within the project area is a mixture of Banksia woodland and coastal shrubland. Both vegetation types are generally very dense with occasional impenetrable thickets of *Banksia sessilis* and *Acacia* species.

While the study area has sufficient rainfall, suitable soil temperatures, and contains areas with susceptible vegetation (Banksia woodland), the soil type means that disease occurrence is highly unlikely. The pathogen may exist in the soil, but it will subsist as an organism, rather than manifest and proliferate as visible disease symptoms.

6 Results

6.1 Phytophthora Dieback occurrence distribution

No Phytophthora Dieback infestations were observed during the assessment. A total of 30 ha of vegetation was mapped as uninfested. More than half (57%) of the project area was observed to be uninterpretable due to an insufficient coverage of reliable indicator species. A total of 9.5 ha of the project area was excluded from the assessment due to being void of vegetation (Table 2).

Table 2 - Area Summary

Category	Area (ha)	% of total area
Infested (with *P. cinnamomi*)	0	
Uninterpretable	52.5	57
Uninfested	30	33
Excluded	9.5	10
TOTAL AREA	92	

6.2 Soil and tissue samples

A total of three soil and tissue samples were taken during the assessment, all of which returned negative results (Table 3). The number of samples required was relatively low, reflecting the lack of sites exhibiting suspicious decline. Only sites where decline was associated with high-risk vectors, or where a pattern exhibiting some consistency with Phytophthora Dieback infestation was observed, were sampled.

Table 3 – Project Area Sample Summary

Sample	Plant sampled	Easting	Northing	Result
1	***Banksia sessilis***	**376110**	**6500972**	***Negative***
2	***Xanthorrhoea preissii***	**375830**	**6502012**	***Negative***
3	***Xanthorrhoea preissii***	**373082**	**6507769**	***Negative***

7 Discussion

7.1 Phytophthora Dieback occurrence distribution

The presence of calcareous soils and limestone throughout most of the project area means that there is a very low likelihood of the disease being present. The pH of such soils is hostile to the pathogen and its ability to manifest as visible disease symptoms is known to be significantly reduced. So, despite the significant amounts of disturbance and unhygienic vehicle/machinery movement that has occurred throughout the project area, it is not considered unusual that the entire interpretable area appears to be Dieback-free.

Areas exhibiting decline were observed within the project area, and while the deaths were suspicious, the pattern of decline was not entirely consistent with that typically associated with Phytophthora Dieback infestation. The suspicious areas were sampled to further assist in determining the disease status of these areas.

The absence of sufficient indicator species encountered throughout much of the assessment was due primarily to the presence of vegetation types that are naturally void of the species used to detect the presence of Phytophthora Dieback. The sections of coastal shrubland vegetation were almost entirely void of reliable indicator species with only small, scattered areas containing *Banksia sessilis* being interpretable. Other uninterpretable areas were observed where significant levels of disturbance have occurred, where there is a very low chance of the required levels of recovery occurring in the foreseeable future.

7.2 Soil and tissue sampling strategies

Three soil and tissue samples were taken in areas exhibiting suspicious indicator species deaths (ISD's). Sample one was taken in a roadside depression where rubbish dumping has occurred. Several ISD's, including multiple different species were observed to have died in this area and there was notable chronology amongst the deaths. The pattern of decline was not convincing however, and a sample was taken to help support the view that the decline is related to factors other than Phytophthora Dieback.

Sample two was taken immediately adjacent to a well-used track. It was an isolated death surrounded by healthy vegetation, however its proximity to such a high-risk vector meant that it could not be dismissed as a simple background death and a sample was required to eliminate Phytophthora Dieback as the cause.

Sample three was taken on the interface between a plantation area and native vegetation. Several scattered, deceased *Xanthorrhoea preissii* specimens were observed along the edge of the native vegetation where it borders the highly disturbed plantation. Again, the pattern of decline was not convincing, however the proximity of the deaths to high-risk disturbance activities meant that a sample was required to eliminate Phytophthora Dieback as the cause.

8 Recommendations

- Phytophthora management tactics should be devised with consideration to protectable areas. Tactics should be formulated in consultation with the Department of Parks and Wildlife, Swan Coastal District. The Department's Phytophthora management pro- forma will identify necessary steps in prescribing effective Phytophthora management strategies and tactics.

- Ensure all vehicles and machinery are clean upon arrival to site.

- Soil movement from uninterpretable areas into uninfested areas is to be prevented. In conditions where soil adheres to vehicles and machinery, cleandown will be required when entering uninfested areas from an uninterpretable area.

- Conduct operations under dry soil conditions where possible. Where activities occur under dry soil conditions, vehicles and machinery may move from uninterpretable areas into uninfested areas without performing a cleandown.

9 Bibliography

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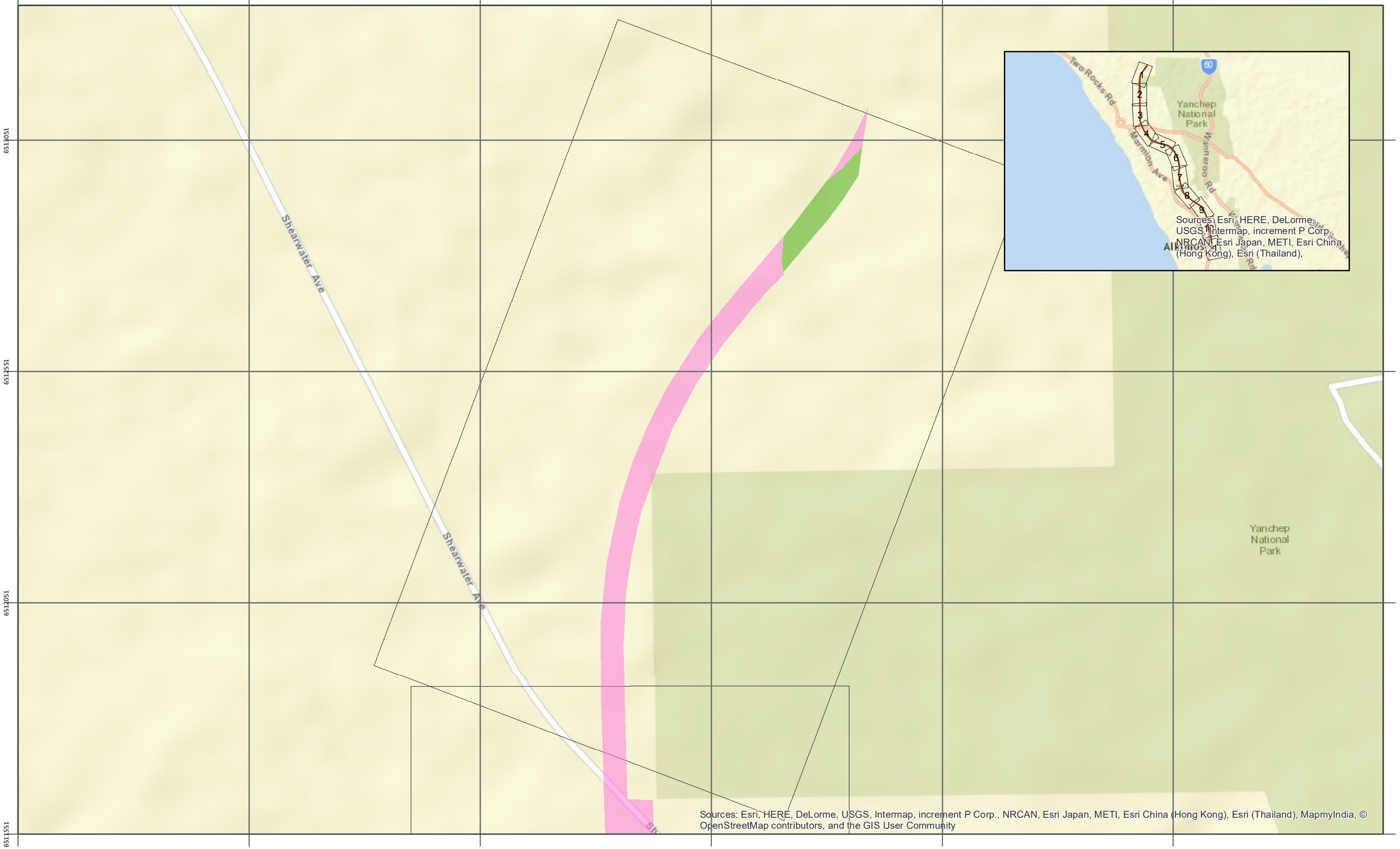

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Area Statement		Overlays		
Primary Categories	Area (Ha)	Unprotectable	High Impact	Very High Impact
INFESTED				
UNINFESTED	30.0			
UNINTERPRETABLE	52.5			
NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Map No.1

Dieback_Occurrence_Polygons

- EXCLUDED
- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
- NOT YET RESOLVED, UNPROTECTABLE
- TEMPORARILY UNINTERPRETABLE
- TEMPORARILY UNINTERPRETABLE, UNPROTECTABLE

PTA - Northern Rail Extension
Phytophthora *cinnamomi* Occurrence Map

1:7,500

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Product	Code	Assessment completion	Interpreters	Map produced by		Expires
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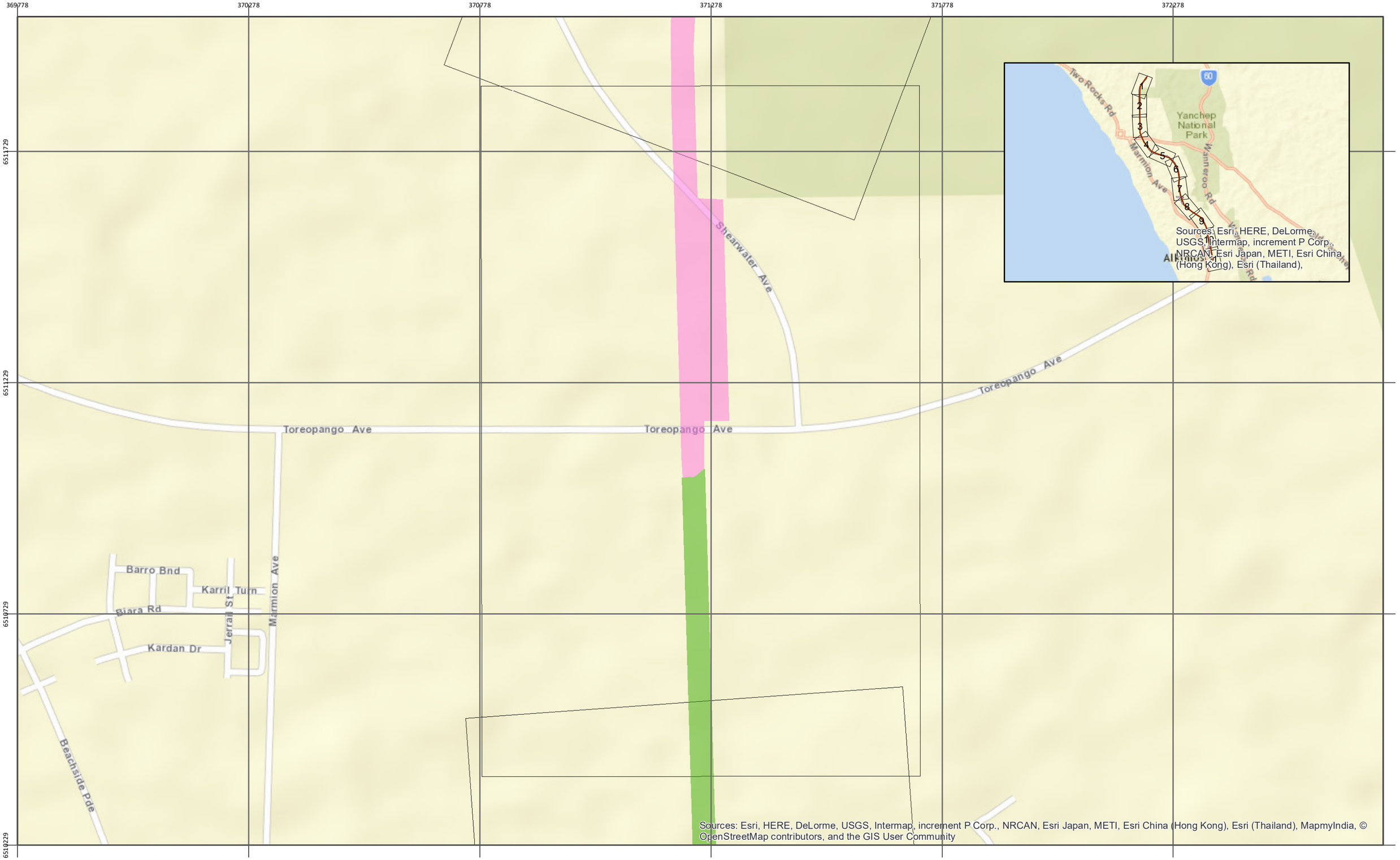

GLEVAN CONSULTING

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INFESTED				
UNINFESTED	30.0			
UNINTERPRETABLE	52.5			
NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Map No.2

Dieback_Occurrence_Polygons

- EXCLUDED
- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
- NOT YET RESOLVED, UNPROTECTABLE
- TEMPORARILY UNINTERPRETABLE
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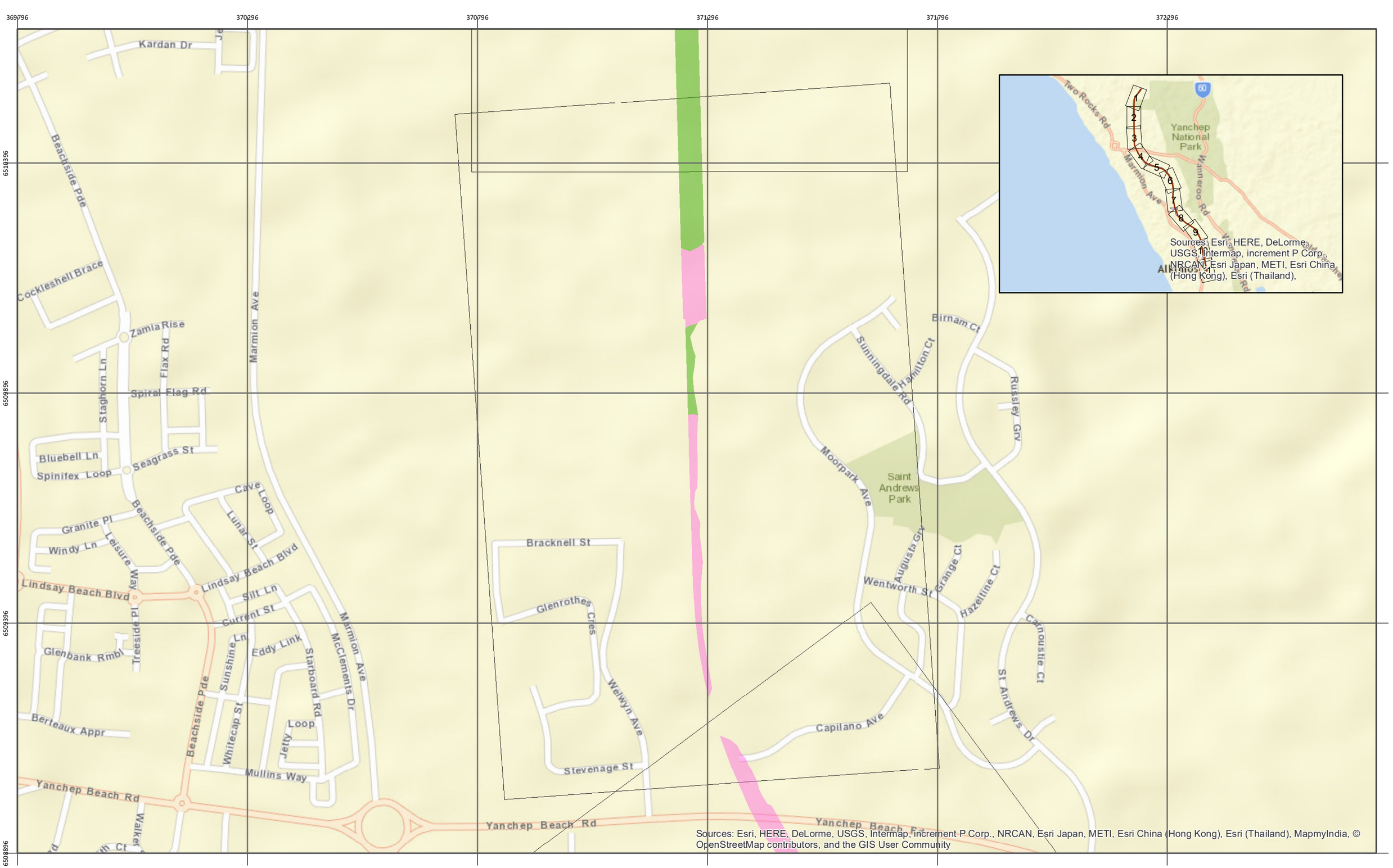

GLEVAN CONSULTING

Area Statement		Overlays		
Primary Categories	Area (Ha)	Unprotectable	High Impact	Very High Impact
INFESTED				
UNINFESTED	30.0			
UNINTERPRETABLE	52.5			
NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Map No.3

Dieback_Occurrence_Polygons

- EXCLUDED
- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
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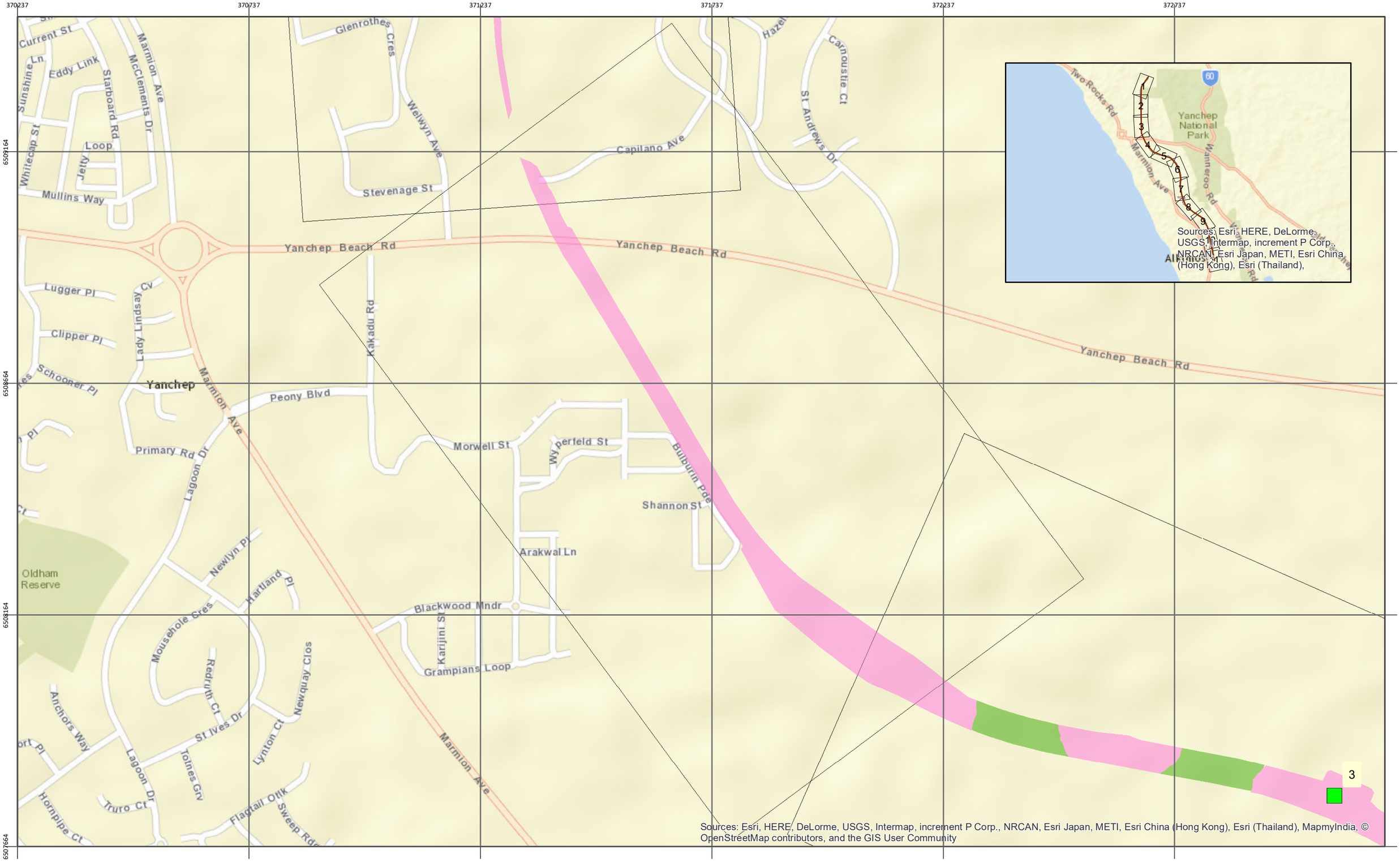

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NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Map No.4

Dieback_Occurrence_Polygons

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- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
- NOT YET RESOLVED, UNPROTECTABLE
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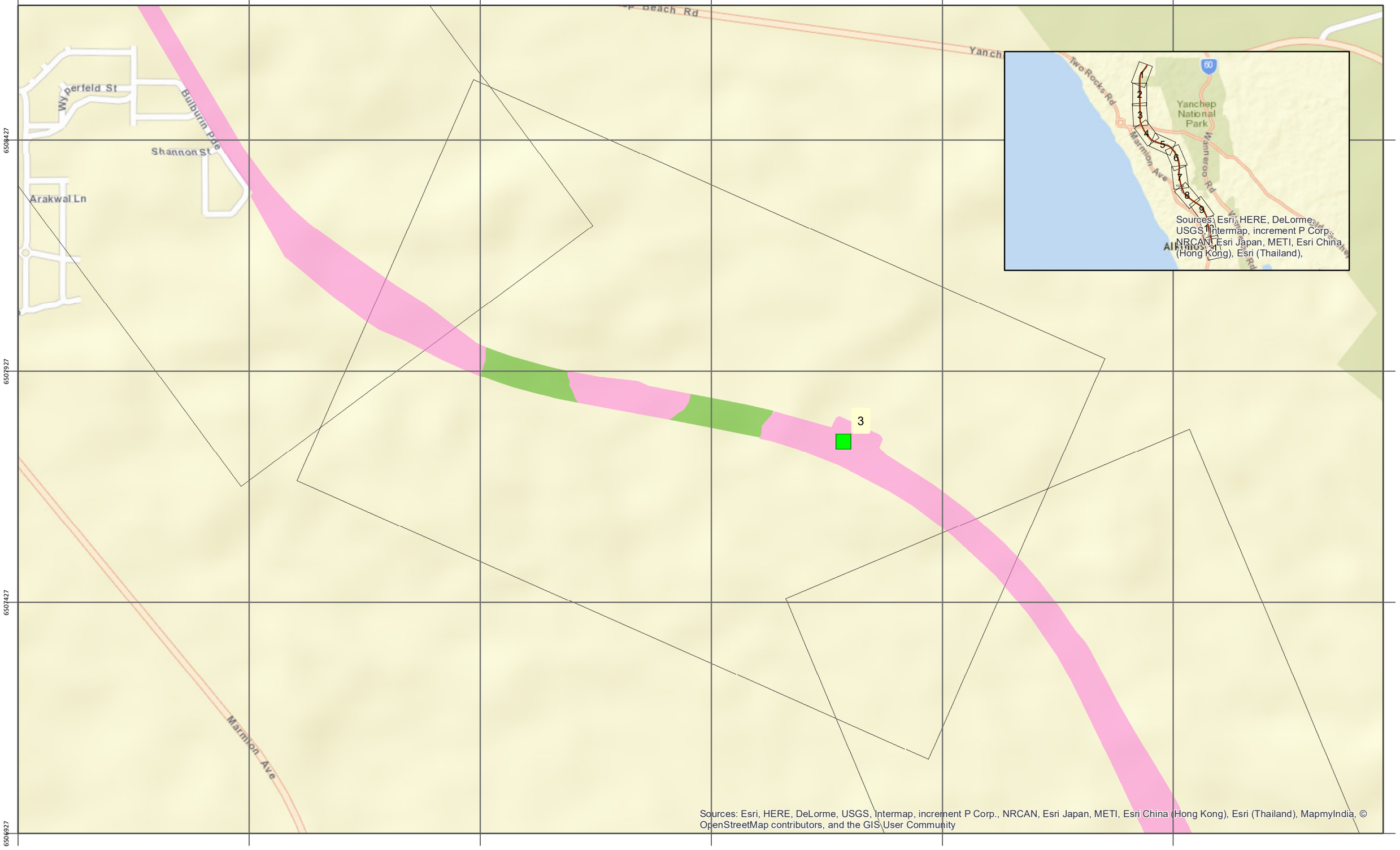

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Map No.5

Dieback_Occurrence_Polygons

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- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
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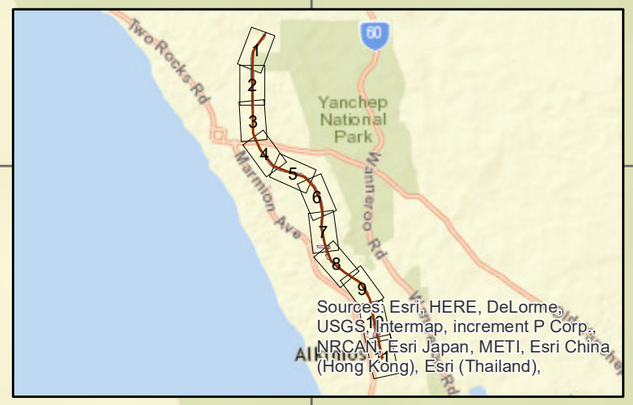

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Map No.6

Dieback_Occurrence_Polygons

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- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
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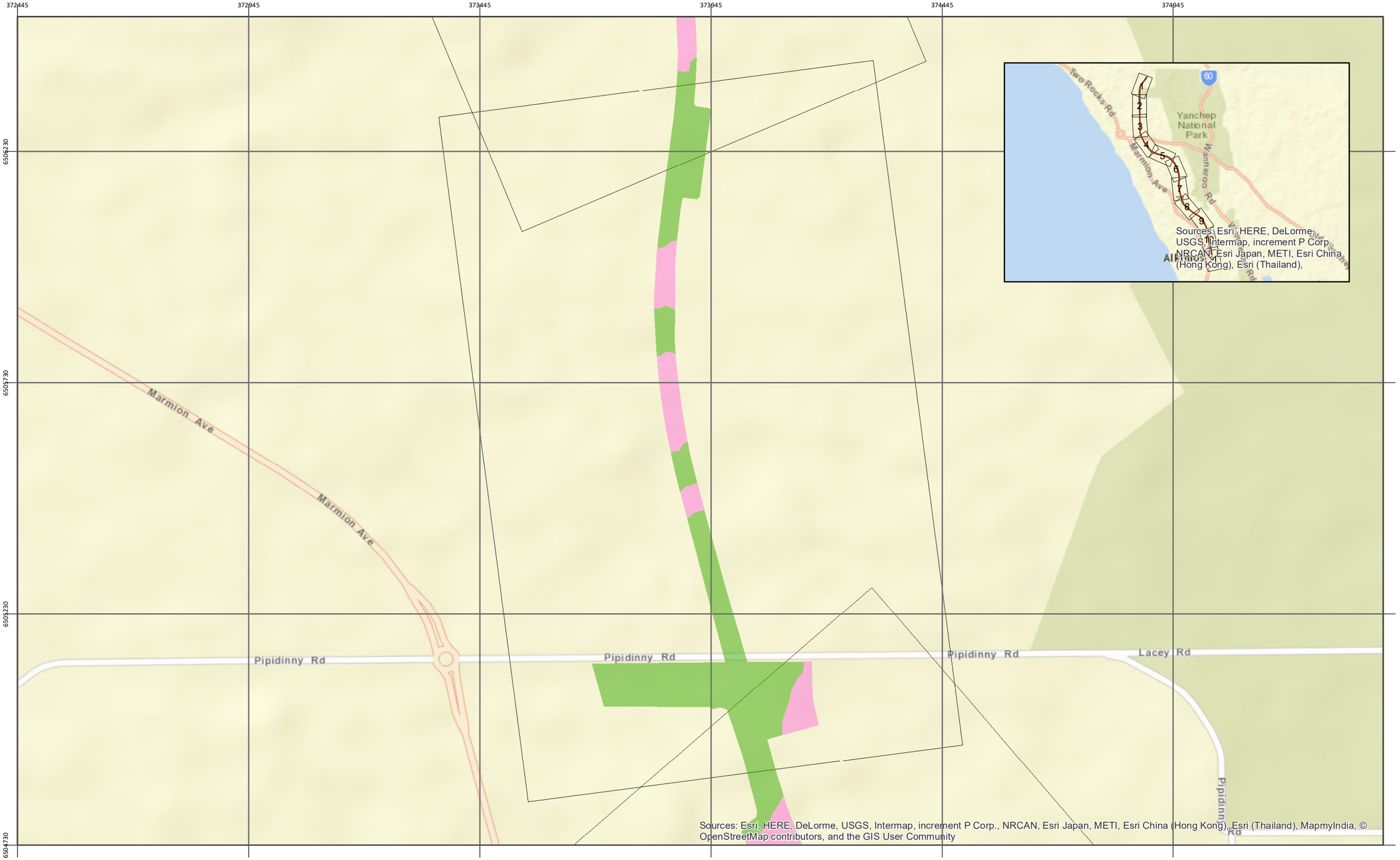
Product	Code	Assessment completion	Interpreters	Map produced by		Expires
OCCURRENCE	UCL	JULY 2017	SR	EB	JULY 2017	JUNE 2018



GLEVAN CONSULTING

Area Statement		Overlays		
Primary Categories	Area (Ha)	Unprotectable	High Impact	Very High Impact
INFESTED				
UNINFESTED	30.0			
UNINTERPRETABLE	52.5			
NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Map No.7

Dieback_Occurrence_Polygons

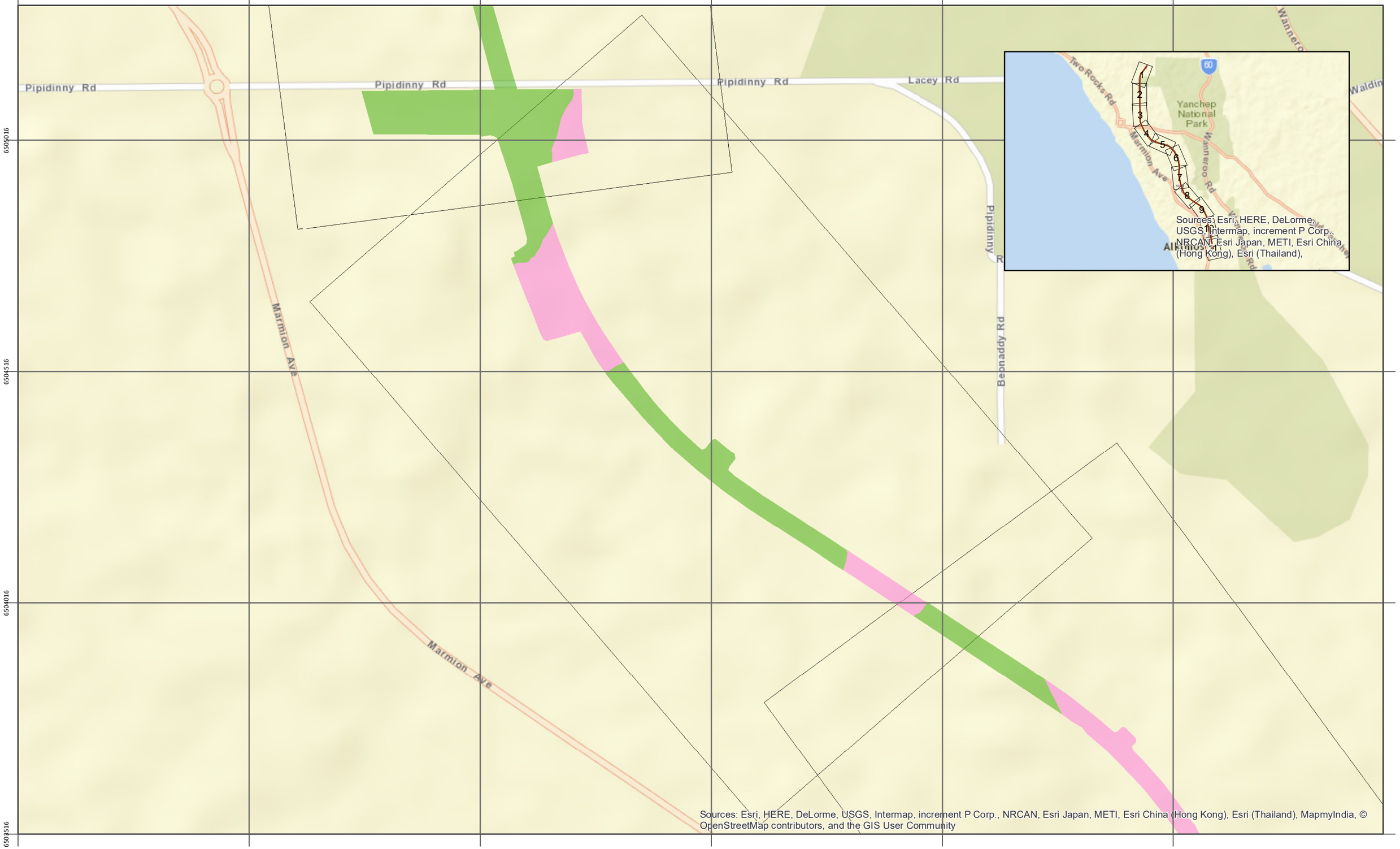
- EXCLUDED
- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
- NOT YET RESOLVED, UNPROTECTABLE
- TEMPORARILY UNINTERPRETABLE
- TEMPORARILY UNINTERPRETABLE, UNPROTECTABLE

PTA - Northern Rail Extension
Phytophthora *cinnamomi* Occurrence Map

1:7,500

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Product	Code	Assessment completion	Interpreters	Map produced by		Expires
OCCURRENCE	UCL	JULY 2017	SR	EB	JULY 2017	JUNE 2018



GLEVAN CONSULTING

Area Statement		Overlays		
Primary Categories	Area (Ha)	Unprotectable	High Impact	Very High Impact
INFESTED				
UNINFESTED	30.0			
UNINTERPRETABLE	52.5			
NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Map No.8

Dieback_Occurrence_Polygons

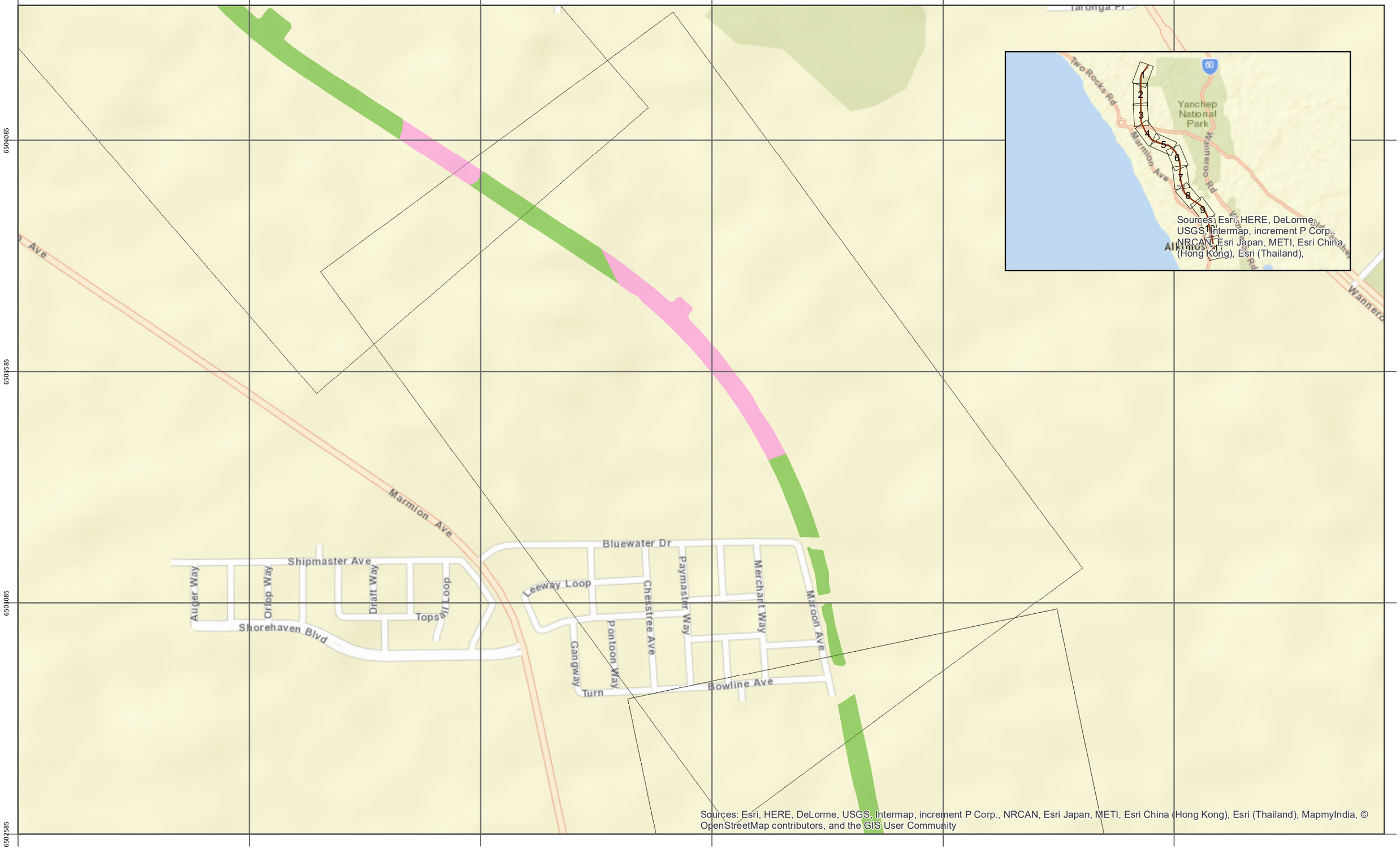
- EXCLUDED
- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
- NOT YET RESOLVED, UNPROTECTABLE
- TEMPORARILY UNINTERPRETABLE
- TEMPORARILY UNINTERPRETABLE, UNPROTECTABLE

PTA - Northern Rail Extension
Phytophthora *cinnamomi* Occurrence Map

1:7,500

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Product	Code	Assessment completion	Interpreters	Map produced by		Expires
OCCURRENCE	UCL	JULY 2017	SR	EB	JULY 2017	JUNE 2018



Area Statement		Overlays		
Primary Categories	Area (Ha)	Unprotectable	High Impact	Very High Impact
INFESTED				
UNINFESTED	30.0			
UNINTERPRETABLE	52.5			
NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Map No.9

Dieback_Occurrence_Polygons

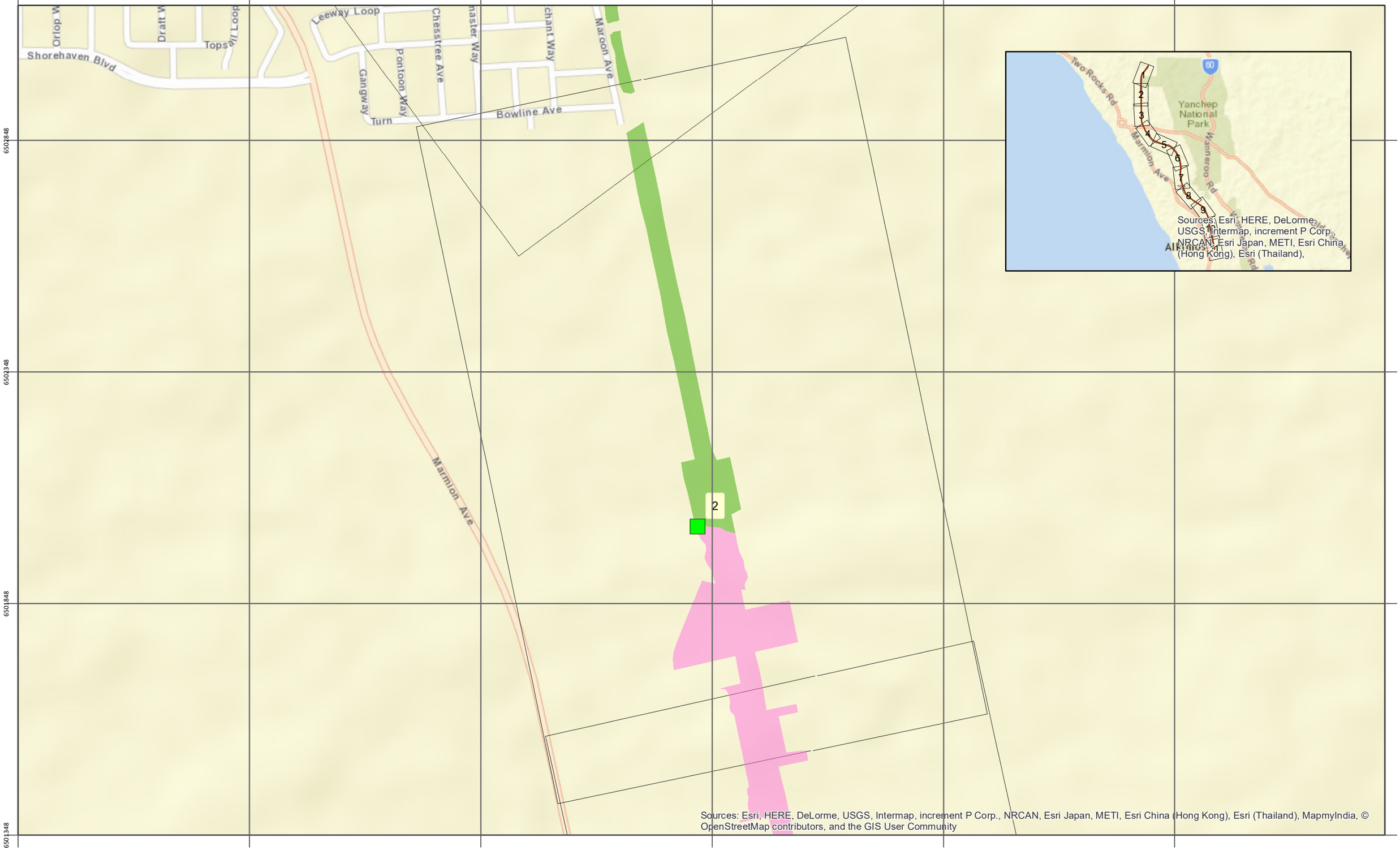
- EXCLUDED
- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
- NOT YET RESOLVED, UNPROTECTABLE
- TEMPORARILY UNINTERPRETABLE
- TEMPORARILY UNINTERPRETABLE, UNPROTECTABLE

PTA - Northern Rail Extension
Phytophthora *cinnamomi* Occurrence Map

1:7,500

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Product	Code	Assessment completion	Interpreters	Map produced by		Expires
OCCURRENCE	UCL	JULY 2017	SR	EB	JULY 2017	JUNE 2018



GLEVAN CONSULTING

Area Statement		Overlays		
Primary Categories	Area (Ha)	Unprotectable	High Impact	Very High Impact
INFESTED				
UNINFESTED	30.0			
UNINTERPRETABLE	52.5			
NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Map No.10

Dieback_Occurrence_Polygons

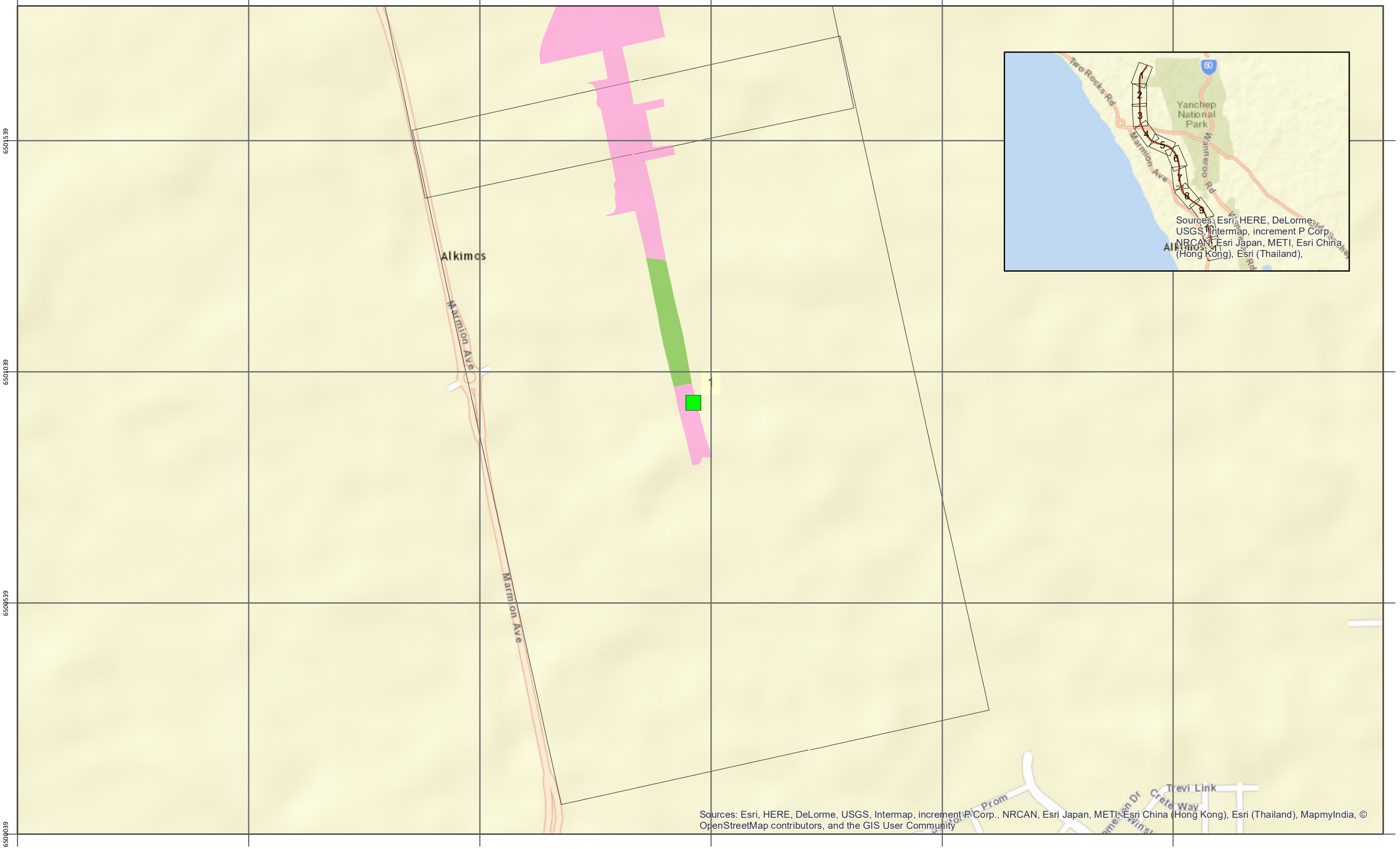
- EXCLUDED
- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
- NOT YET RESOLVED, UNPROTECTABLE
- TEMPORARILY UNINTERPRETABLE
- TEMPORARILY UNINTERPRETABLE, UNPROTECTABLE

PTA - Northern Rail Extension
Phytophthora *cinnamomi* Occurrence Map

1:7,500

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Product	Code	Assessment completion	Interpreters	Map produced by		Expires
OCCURRENCE	UCL	JULY 2017	SR	EB	JULY 2017	JUNE 2018



Area Statement		Overlays		
Primary Categories	Area (Ha)	Unprotectable	High Impact	Very High Impact
INFESTED				
UNINFESTED	30.0			
UNINTERPRETABLE	52.5			
NOT YET RESOLVED				
TEMPORARILY UNINTERPRETABLE				
ASSESSED AREA	82.5			
EXCLUDED AREA	9.5			
PROJECT AREA	92.0			

Dieback_Occurrence_Polygons

- EXCLUDED
- EXCLUDED, UNPROTECTABLE
- INFESTED
- UNINFESTED
- UNINFESTED, UNPROTECTABLE
- UNINTERPRETABLE
- UNINTERPRETABLE, UNPROTECTABLE
- NOT YET RESOLVED
- NOT YET RESOLVED, UNPROTECTABLE
- TEMPORARILY UNINTERPRETABLE
- TEMPORARILY UNINTERPRETABLE, UNPROTECTABLE

PTA - Northern Rail Extension
Phytophthora *cinnamomi* Occurrence Map

Map No.11

1:7,500

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Product	Code	Assessment completion	Interpreters	Map produced by		Expires
OCCURRENCE	UCL	JULY 2017	SR	EB	JULY 2017	JUNE 2018