Dieback Interpretation Report
Meelup Regional Park

Total area interpreted (ha)	572 ha
DRA	No
Method of interpretation	Recheck
Date commenced	30th of January 2017
Date completed	2nd of February 2017
Interpreters	Glenn Tuffnell and assisted by trainee Kris Griffin
Map expiry date (recheck date)	**2nd of February 2018** (for soil moving operations that occur in uninfested areas of the park)

LIST OF FIGURES AND PLATES

1 Introduction

1.1 Background

Dieback disease caused by the pathogen *Phytophthora cinnamomi* is a major threat to the biodiversity of south-western Australia. The spread of this water mould is facilitated by the movement of soil infested with spores, particularly under warm, moist conditions. Consequently, a major component of the strategy to constrain this disease involves managing access and soil-disturbance activities within native vegetation. Knowledge of the occurrence of the disease in the landscape is therefore an essential prerequisite to formulating suitable hygiene management practices.

Dieback Treatment Services was contracted to undertake the task of rechecking the existing demarcated disease boundaries and scrutinising all vectors for the physical presence of *Phytophthora* species at the request of the City of Busselton and the Meelup Regional Park Management Committee. Field interpretation followed the DPaW standard methods and operating procedures as stated in the document titled "Phytophthora Dieback Interpreters Manual for Lands Managed by the Department of Parks and Wildlife" Forest and Ecosystems Management (DPaW) March 2015 and has been facilitated by Glenn Tuffnell and assisted by Kris Griffin who is qualified to offer this service.

In addition, Phytophthora treatment utilizing the environmentally safe chemical Phosphite applied via stem injection and folia application has also been applied during this management cycle. This report will detail both actions.

1.2 Location and size of area

Meelup Regional Park covers an area of 572 hectares and is in the south-western corner of Western Australia; approximately 250 kilometers south of Perth within the Shire of Busselton. The Park extends along the coastline for 11.5 kilometres from Dunsborough to Bunker Bay, on the western side of Geographe Bay, and the eastern side of the Leeuwin-Naturaliste Ridge. It has an undulating surface rising to 100 metres above sea level, with steep seasonal water courses and pockets of varying vegetation types.

The total lineal distance of active *Phytophthora* disease edge that has been re-mapped and taped for the occurrence of *Phytophthora* during this mapping cycle is approximately 18 500 metres and is displayed on the Phytophthora Occurrence map product (Figure 2.1).

1.3 Historical land use, rainfall and past disturbances

The Park was initially surveyed for *Phytophthora* Dieback in 1994 (Helyar 1994), which showed that 28% of the Park was infected with *Phytophthora cinnamomi* and another 13% of the Park was at risk of infection. Since this initial survey other mapping work has been undertaken including two re-checks, one by DEC staff in 2007 and two by Dieback Treatment Services (DTS) in April/May 2009

and again in November 2013. In addition to this the Car Rally Track was checked in April 2012 by DTS and the small section of the Park that extends along the coastline between Bunker Bay and Eagle Bay was interpreted for the presence of *Phytophthora* in October 2012 also by DTS and included the access off Eagle Bay Road known as the Wildlife Corridor.

Historically, extensive gravel extraction has occurred between Cape Naturaliste Road and the golf course in the southern end of the Park and consequently this area was found to be infested with *Phytophthora*.

Evidence of low impact fuel reduction burning was seen in the western side of the Park but this did not hamper the re-mapping of the disease edges in this area.

The Park is in the 800-900 mm rainfall zone. The area does not occur within a Disease Risk Area (DRA), as determined by the old Forest Department and managed by the Department of Environment and Conservation (DEC), although just like DRA areas, access is restricted through locked gates for most the Park and therefore the possibility of unhygienic access by large off road vehicles is reduced.

2 Methods

2.1 Interpretation

Field interpretation followed the DPaW standard methods and operating procedures, in the field the area was interpreted in accordance with the rechecking guidelines set out in the above stated document.

Presence or absence was determined not only through observation but by sampling of recently-dead plant species. Non-differential, hand-held global positioning system (GPS) receivers were used for navigation and to record survey boundaries and waypoints within the areas.

2.2 Demarcation

The demarcated boundaries were identified, checked for accuracy (adjusted if required) and re-mapped during this project. The infested areas were demarcated with a single yellow painted blaze following the 2009 recheck and these blazed trees have been re-taped using pink tape with the knots facing the infestation and significant changes also re-blazed during this re-check. The condition of the blaze lines varied greatly across the site with many blazes being obscured through excessive sap flow in Marri and also through vegetation regeneration particularly in the demarcated deeper valley systems.
The image below is an example of the current state of the existing blaze condition now in its 8th year since installation.

Current Blaze condition along most of the demarcated disease edge

Uninterpretable areas have not been demarcated or re-checked during this survey as all are based on a rationalised edge (the coastal walk track or roads) and are due to vegetation communities devoid of suitable indicator species. Buffer widths vary throughout the Park depending on disease impact, interpreter confidence and slope and are generally between 5 and 10 metres from indicator species deaths which, in conjunction with strategic soil and plant tissue samples

are used as evidence of *Phytophthora* presence. Small buffers have been applied to simplify the application of phosphite.
Double tapes have been installed each side of all line terminations and track crossings as pictured below.

Double tapes signify track crossings and line terminations

2.3 Soil and tissue sampling

Four soil and tissue samples associated with dead or dying plants were taken to confirm the presence or absence of *Phytophthora sp.* These soil and plant samples were forwarded to the Vegetation Health Service laboratory at Kensington, where diagnostic baiting was conducted. These samples were used as supportive evidence for the field determination of *Phytophthora cinnamomi* distribution in the area. The sample point location was recorded with a handheld Global Positioning System unit (GPS) receiver. Appendix 7.I summarizes the laboratory results of the sampling and Appendix 7.2 illustrates the sample distribution.

2.4 Mapping

The field observations, boundaries, waypoints and survey data were downloaded into a Geographic Information System (G.I.S.) from a Global Positioning System unit (G.P.S.) to generate a map of *Phytophthora cinnamomi* occurrence for the area.

The following table lists the categories that have been used to define the Phytophthora Occurrence throughout the project area and the associated colours as defined in the document titled “Phytophthora Dieback Interpreters Manual for Lands Managed by the Department of Parks and Wildlife” Forest and Ecosystems Management (DPaW) March 2015.

Table 4 - Assessability of vegetated and non-vegetated areas

Vegetation condition	Phytophthora occurrence category (See section 13.4.2)	Typically present	May be present
Naturally vegetated areas. Keighery disturbance rating of 3 or less Phytophthora occurrence categorisation is possible. Small un-vegetated 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. ISDs that have been killed by other agents
	UNINFESTED	Healthy reliable indicator species	ISDs 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 severity and type of disturbance (see section 6.4.3.)	**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 boundaries.
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 5 or greater. Phytophthora occurrence assessment is not possible Can be identified and selected 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

Phytophthora category description and colour assignment

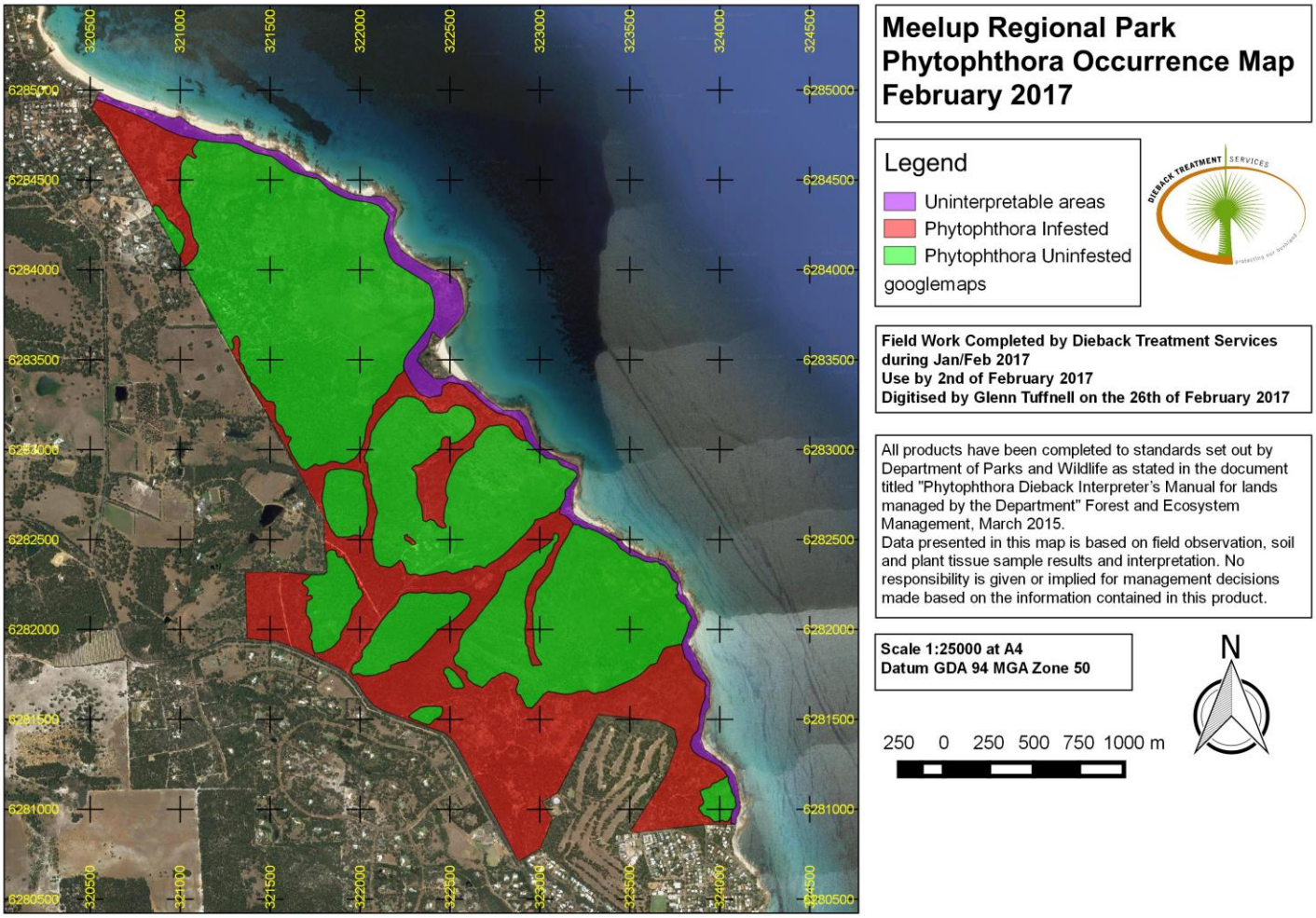

Figure 2.1 Meelup Regional Park Phytophthora Occurrence map

According to the document titled "Phytophthora Dieback Interpreters Manual for Lands Managed by the Department of Parks and Wildlife" Forest and Ecosystems Management (DPaW) March 2015, the following primary criteria are used to define 'Protectable Areas' as those that:

Are determined to be free of the pathogen *Phytophthora cinnamomi* by a certified disease interpreter (all susceptible indicator plant species are healthy; no plant disease symptoms normally attributed to *P. cinnamomi* are evident).

Situated in areas receiving more than 600 millimetres' rainfall a year or those that are water-gaining sites (for example, granite outcrops, impeded drainage or engineering works which aggregate rainfall) in the 400- to 600-millimetres a year rainfall range.

Both positioned in the landscape and of sufficient size such that an interpreter judges that the pathogen will not autonomously engulf them in the short term (greater than four hectares with an axis greater than 100 metres).

Includes areas of high conservation and/or socio-economic value (for

example, a small uninfested area with a known population of a susceptible species of threatened flora).

Consists of areas where human vectors are controllable.

The above parameters have been applied to the mapped areas resulting in the clear majority of the uninfested vegetation found to be positioned in the landscape as to be protectable in the short to medium term (30-50 years). The Protectable protocols do not consider changing climatic conditions, changes to land use that may increase potential vectoring or the application of disease mitigation actions such as phosphite.

The protectable areas map found in Figure 2.2 shows a reduced area of non-protectable vegetation when compared to the November 2013 recheck map product due to the reduced time scale applied to protectable areas. This protectable area map is a non-conforming map product (by DPaW standards), and should be considered to be inferred due to the lack of transect surveys during this interpretation (only the previously demarcated disease edges have been rechecked). However, it is considered unlikely that unmapped disease centres occur in the previously mapped uninfested areas due to a lack of vectoring possibilities both currently and historically.

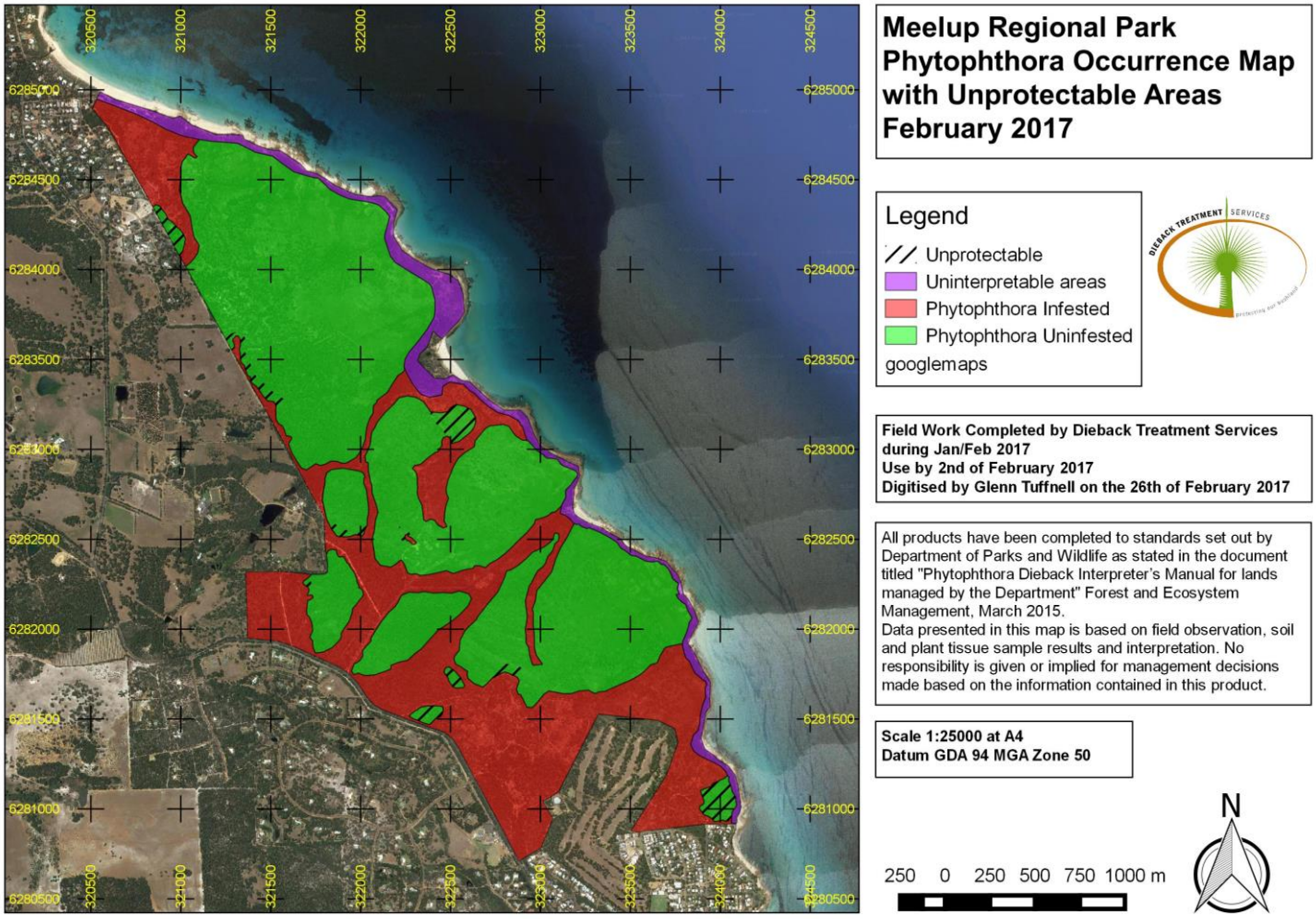

Figure 2.2 Phytophthora protectable areas map

3 Results

3.1 Disease Distribution

The presence of *Phytophthora* and its distribution was surveyed and mapped, with a total lineal distance of active *Phytophthora* disease edge of approximately 18,500 metres. All obvious disease vectors such as tracks and creeks were scrutinised for disease expression with most infestations associated with low lying moisture gaining sites.

3.2 Disease expression and impact

Plants used as *Phytophthora* indicator species during this survey included:

Allocasuarina humilis, Dasypogon bromeliifolius, Allocasuarina fraseriana, Lomandra nigricans, Hibbertia sp, Styphellia tenuiflora, Leucopogon sp, Pattersonia sp, Eucalyptus marginata, Daviesia sp, Grevillea trifida, Adenanthos meisneri, Banksia grandis, Banksia sessilis, Banksia attenuata, Petrophile linearis, Hakea trifurcata, Synaphea gracillima, Persoonia longifolia, Hakea ruscifolia, Hakea prostrata, Hakea lissocarpha, Grevillea quercifolia, Hakea amplexicaulis, Synaphea petiolaris, Xanthorrhoea preissii and *gracilis and Macrozamia riedlei.*

Once again, the disease expression throughout the Park was generally cryptic in nature with very low numbers of fresh indicator species deaths observed along most of the infested boundaries. The exceptions to this rule was in areas that had altered levels of moisture such as road side drainage systems, and the area on the western side of the Park that has been exposed to a low intensity fuel reduction burn. The increased Phytophthora impact in vegetation following fire is due to reduced biomass which in turn leads to greater soil moisture combined with increased soil temperature (due to reduced shading). All observed disease areas within the Park are expressing a low disease impact.

Phytophthora cinnamomi distribution was predominantly unchanged from the last interpretation in 2013 with minor adjustments made to the existing disease edge based on fresh indicator species deaths. In some instances, reclamation of small sections of previously classified infested areas was made possible due to increased interpreter confidence.

The three main areas of observed fresh Phytophthora spread are as follows;

- A small disease extension on the northern end of the coastal walk track with fresh expression seen in the *Macrozamia riedlei*
- A small disease extension mapped and sampled (sample site 4), on the western side of Sheens Road and a similar extension mapped on the eastern side of Sheens Road with fresh disease expression observed in numerous *Xanthorrhoea preissii* in both sites as pictured below.

Disease expression in Xanthorrhoea preissii located on active edges opposite Sheens Road

Small areas of obvious drought recovery as pictured below have also been seen throughout the park. These sites are generally seen with associated regrowth in indicator species such as *E. marginata* or Banksia species and were most prevalent on the upland sections of the Park with associated impeded drainage and exposed rock.

Drought affected sites associated with impeded drainage in upland sites

3.3 Sample results

A total of four soil and plant tissue samples were taken to aid the interpretation process during this project. The original sample sheets from VHS are found in Appendix 7.1. Of the four samples two returned a positive for *P. cinnamomi* result, one of which was below the Car Rally Track in an area that had not

previously returned positive results. The sample distribution is illustrated in Appendix 7.2. The two negative samples (samples 1 and 2), were both taken from the Whale Lookout track on a suspected drought affected site from a range of shallow rooted Phytophthora indicator species. This vector would appear to be experiencing little use however ongoing monitoring of this site is recommended to ensure fresh disease introduction is detected and controlled as soon as possible.

4 Recommendations

Phytophthora related management recommendations have been supplied in the following document previously supplied to the City of Busselton "Management Recommendations for activities around the Meelup Regional Park" DTS October 2016. Two additional recommendations are made based on observations made during this interpretation.

1. Reblaze or use another form of permanent demarcation along all taped boundaries remapped during this mapping cycle. This action is required due to the poor condition of the existing blaze. Blazing of the car Rally Track infestation which was applied directly to the bark of trees instead of on a fresh wound was found to be in good condition therefore this method of paint application may prove to be suitable throughout the park.
2. Continue to monitor all open walk tracks that pass through uninfested vegetation for fresh disease expression preferably on an annual basis. This action is required in order to identify fresh infestations before they become entrenched allowing for the application of phosphite to reduce impact.

4.1 Dieback treatment with phosphite

INFORMATION ABOUT THE PHOSPHITE TREATMENT PROCESS

(Reproduced from CALMS Nature Base website

http://www.calm.wa.gov.au/projects-phosphite.html)

What is it?

Phosphite is formulated from neutralized phosphonic acid and is a proven weapon in the battle to preserve susceptible Western Australian native plants which are under threat from root-rot disease caused by the introduced pathogen *Phytophthora cinnamomi*. Phosphite provides protection for vulnerable plant species against the killer disease for up to five years. Phosphite is an environmentally safe, inexpensive chemical that is systemically transmitted throughout treated plants and has a very low toxicity to animals.

How it works

The mode of action of phosphite is not fully understood, but it appears that the progress of infection by *Phytophthora cinnamomi* is halted when it comes into contact with phosphite in plant tissue. This may be because phosphite concentrations interfere with the internal phosphorus utilisation cycle essential for survival of the pathogen. The plant self-defence mechanism may also be triggered to wall-off and isolate the invaded root cells. Plants in poor health which are treated in time have been shown to fully recover and remain healthy for a number of years. Therefore, this treatment can be said to be a curative as well as a preventative measure against *Phytophthora* infestation.

History of Use

Previously called phosphonate, phosphite has been used to protect avocado, pineapple and cocoa crops and many others against *Phytophthora* disease since the 1970s. In the late 1980s research staff at the Department of Conservation and Land Management's Dwellingup office, led by Dr Bryan Shearer, decided to investigate whether the fungicide provided any additional protection to Western Australian native species. These treatments, where phosphite solution was injected into jarrah (Eucalyptus marginata) and several banksia species, showed considerable promise, slowing and stopping the growth of the pathogen within the plants under attack.

This early success sparked a research effort, partly funded by Environment Australia grants, which was to continue over the next decade and included field trials ranging from the northern sand plain near Eneabba to the Fitzgerald River National Park east of Albany. Aerial application of phosphite to native plant communities was tested for the first time in 1993 in several

Reserves near Albany and proved a success.

Aircraft allow for relatively cheap and rapid treatment of entire plant communities containing rare plant species, and are suitable for areas

where ruggedness of the terrain would make ground application prohibitively expensive. One drawback with aerially applied phosphite, however, is that

protection normally only lasts for one to two years and is not as effective as ground based spray application or stem injection which can potentially provide protection for up to 5 years.

Four sections of the Park have had phosphite application during this project. The first area targeted all host plants within the Wildlife Corridor via folia spray due to the identification of *P. cryptogea* made during the 2012 mapping and initially treated in November 2013. The second area targeted all vegetation in a 10-metre buffer on the eastern side of Sheens Road between the taped active disease edge near the water tank located to the south of the Wildlife Corridor through to the northern end of the small section of Unprotectable / Uninfested vegetation on the northern end of Sheens Road. This section of the Park was treated with phosphite via folia spray only.
The third section of treatment was in a 15 – 20 metre buffer along the fresh demarcated disease edge that runs parallel to Sheens Road between the water tanks and Meelup Beach walk track. A combination of stem injection and folia spray was applied in this area as a repeat of the March 2014 treatment.
The fourth and final section to be treated targeted a buffer 10 metres each side of the uninfested sections of the Car Rally Track via folia spray only and was also a repeat of the March 2014 treatment

The evidence files for this treatment are shown in Figures 4.1, 4.2 and 4.3

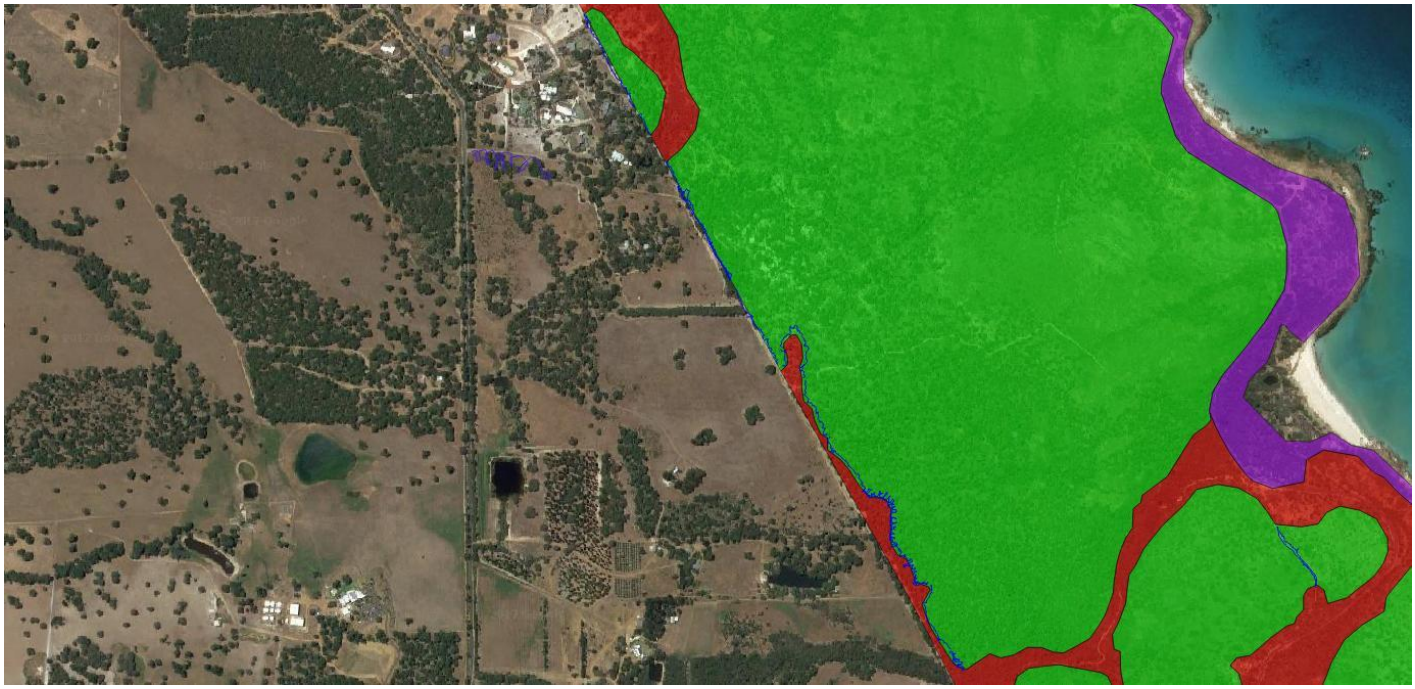

Figure 4.1: Dieback treatment with Phosphite evidence file (in blue) North Section including the Wildlife Corridor

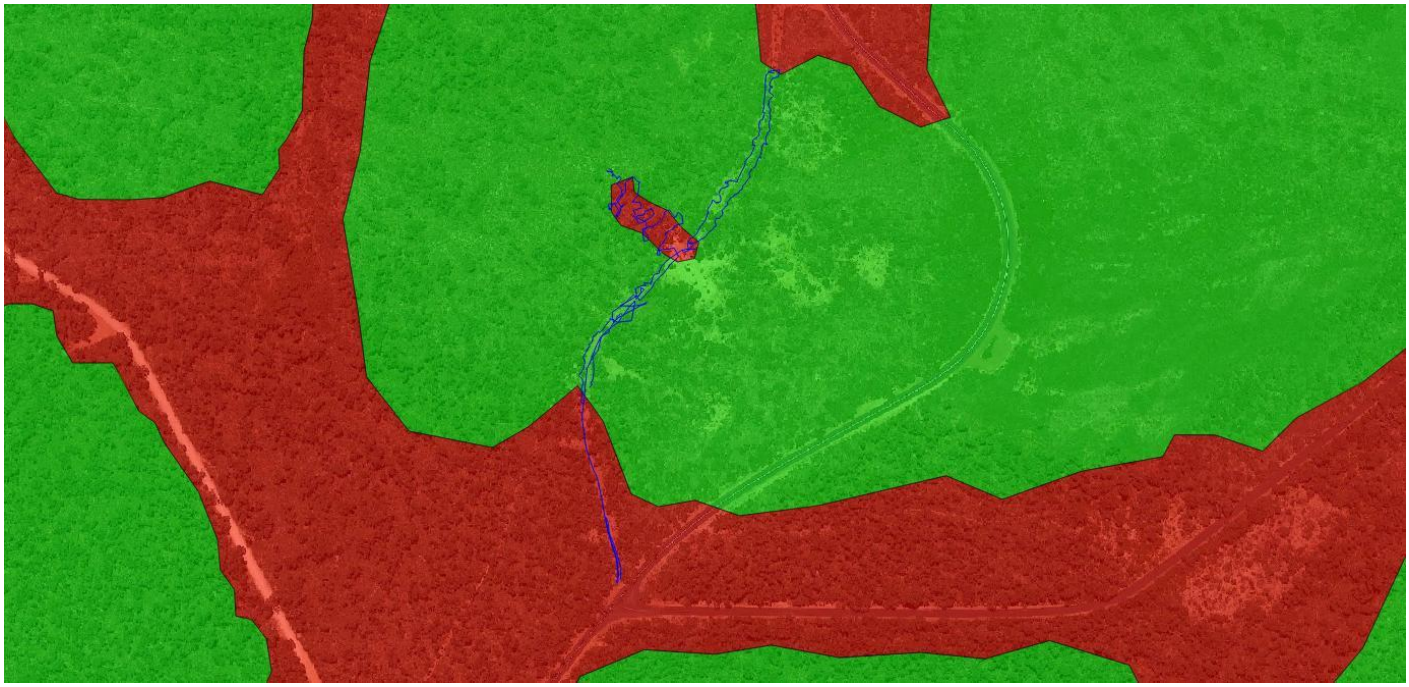

Figure 4.2: Dieback treatment with Phosphite evidence file (in blue) South end of Car Rally Track.

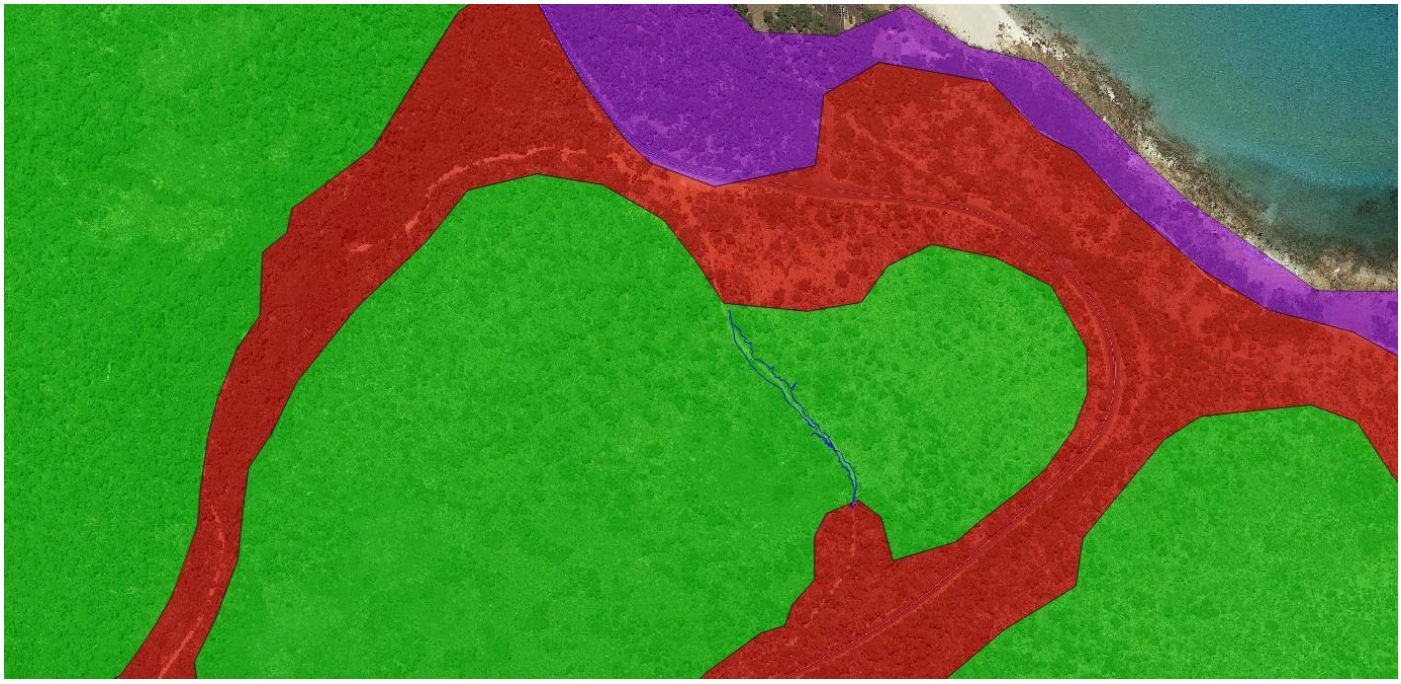

Figure 4.3: Dieback treatment with Phosphite evidence file (in blue) North end of Car Rally Track.

5 Conclusion

Meelup Regional Park was rechecked for the distribution and impact of *Phytophthora cinnamomi* along all previously mapped disease edges between January and February 2017.

The map indicating disease boundaries (Figure 2.1) is valid until February 2018. Because *Phytophthora cinnamomi* has the ability to spread autonomously and through vectors such as machinery, vehicles and animals, the map boundaries should be rechecked prior to, and in the vicinity of, any soil moving activities that occur in the uninfested sections of the Park after this date.

Phosphite has been applied in a buffer to susceptible vegetation in four areas within the Park to support previous applications of phosphite. These areas will be due for re-application of phosphite in February 2020 or earlier if fresh disease symptoms are observed.

6 References

Phytophthora Dieback Interpreters Manual for Lands Managed by the Department of Parks and Wildlife. Forest and Ecosystems Management (DPaW) March 2015.

Meelup Regional Park Management Committee (2008). Meelup Regional Park Management Plan (draft).

Havel, J.J. (1975). Site Vegetation Mapping in the Northern Jarrah Forest (Darling Range). 2. Location and Mapping of Site-Vegetation Types.

7 Appendices

7.1 Summary of soil and plant tissue sample results

VEGETATION HEALTH SERVICE - PHYTOPHTHORA SAMPLE INFORMATION SHEET

SEND TO: Vegetation Health Service, Science Division – D.E.C., 17 Dick Perry Ave KENSINGTON 6151 **Phone**: (08) 9334 0317 **Fax:** (08) 9334 0114

CONTACT DETAILS of sender
Name Glenn Tuffnell
e-mail preferred glenn@diebacktreatments.com
Phone No.1300785311
Company Name Dieback Treatment Services

GDA (1) GDA 94 [x]

Job Type (Please indicate)
D.E.C. (C) Alcoa (A)
Recoup (R) FPC
Private (P) Other_____

VHS USE ONLY
Date received 9/2/2017
Date faxed 16.2.17, 22.2.17

VHS Identification Number (VHS USE ONLY)	Sample Date	Sample label (Give location, eg. Forest Block or Shire, etc. and sample number)	Plant species sampled	Site Impact (2)	Zone 50 or 51	Map Reference (3)	Land Tenure (4)	RESULT s/s root (5)	RESULT bait (5)
VHS 35968	31/1/2017	MS1 (Meelup sample one, Dunsborough)	Syn pet Xan pre	L	50	321984 6283581	R		NEG
VHS 35969	31/1/2017	MS2 (Meelup sample two, Dunsborough)	Pat occ Xan pre Ade bar	L	50	321873 6283655	R		NEG
VHS 35970	1/2/2017	MS3 (Meelup sample three, Dunsborough)	Pat sp.. Xan pre	L	50	322500 6283039	R		CIN
VHS 35971	2/2/2017	MS4 (Meelup sample four, Dunsborough)	Xan pre	M	50	321723 6282185	R		CIN

NOTES:
1. Please tick this box if your map references are supplied in the **GDA 94** standard. If not, please specify the datum used.
2. Site impact - Low, Moderate, or High (as in the Dieback Interpreter's Manual).
3. An MGA map reference with prefixes **must** be supplied for all samples.
4. Land Tenure - State Forest (SF), National Park (NP), Reserve (R), Westrail (W), Private (P), Gravel Pit (GP), or other. (Other - describe in comments below).
5. Result codes used – CIN = *Phytophthora cinnamomi*, MUL = *P. multivora*, CRY = *P. cryptogea*, PI = *P. inundata*, ARE = *P. arenaria*, ELO = *P. elongata*, THE = *P. thermophila*, PM = *P. megasperma*, PN = *P. nicotianae*, CON = *P. constricta*, NEG = negative, SUB = subcultured for further tests

Please Note: a). NEG results cannot be used to represent a total absence of *Phytophthora* in the sampled area. b). Information from your samples will be incorporated into the VHS database.

COMMENTS:

Modified 22/9/2011

Figure 7.2 Sample distribution