APPENDIX 6: WEEDS AND DIEBACK

A. *Phytophthora* Dieback survey 2021a
B. *Phytophthora* Dieback survey 2021b
C. *Phytophthora* Dieback survey 2023
D. Weed and Dieback Management Plan (WDMP)

APPENDIX 6A: *PHYTOPHTHORA* DIEBACK SURVEY 2021A

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Phytophthora Dieback Occurrence Report

for

Lot #64 - Keysbrook

A report prepared for
DORAL

August 2021

What is Phytophthora Dieback?

Phytophthora Dieback is the disease caused by a group of microscopic soil-borne water moulds in the genus Phytophthora that means 'plant destroyer' in ancient Greek. Phytophthoras can infect and rot the roots of susceptible plants so they cannot effectively uptake water and nutrients. This contributes to them Dying-back that can significantly impact ecosystems and biodiversity! *Phytophthora cinnamomi* is one of the most common species and well-researched in south western Australia where it has had a major impact within forests and bushland.

The greatest plant disease threat to biodiversity conservation (DPaW, 2015)

Phytophthora Dieback threatens biodiversity, placing important flora and fauna species at risk of death or extinction. We are very concerned about how many plant species it can kill. Approximately 40% of the known flora in the South West Botanical Province (an International Biodiversity Hotspot!) are susceptible. This literally means thousands of plants are threatened and the flow-on negative impacts of this disease can be severe affecting ecosystem health, biodiversity, fauna habitat, amenity; and increased costs for government, industries and landholders to mitigate it.

Phytophthoras can spread easily when their spores in soil, water or organic material are carried on unclean vehicles, equipment and footwear and deposited elsewhere. They also spread between plants via root-root contact. Therefore, integrated management is considered best practice that involves actions to prevent its spread by assessing the risks of proposed disturbance activities, mapping disease distribution and quarantining areas of Uninfested vegetation, applying stringent biosecurity-hygiene protocols and raising stakeholder awareness.

Western Australia's biodiversity is unique and invaluable for current and future generations. Further research on the Phytophthora pathogen and efficacy of mitigation options is essential. To date there has been excellent collaboration between all tiers of the Australian government, not-for-profit associations, affected industries and communities. But more work is needed to integrate policies and innovative science into practical management that is made accessible to all land managers and public.

You can help STOP its spread by **Arriving Clean and Leaving Clean**

Thank you for your interest in Phytophthora Dieback!

Bruno Rikli
Director, BARK ENVIRONMENTAL PTY LTD

ARRIVE CLEAN – LEAVE CLEAN

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1. EXECUTIVE SUMMARY

BARK Environmental (BARK) was commissioned by DORAL to complete a comprehensive Dieback assessment, sampling and reporting for three areas of remnant bushland remaining within Lot #64 in Keysbrook.

The results of this 2021 comprehensive Dieback assessment mapped disease occurrence over a total area of 11.35 hectares (ha). No evidence of Phytophthora disease was detected and all three remnant areas were Excluded from assessment due to significant grazing and clearing disturbances. The vegetation condition within all three areas was Degraded to Completely Degraded where plants used to observe the disease symptoms were absent or too few to enable Dieback Interpretation. Two samples were collected within Lot 64 and both did not return a positive result for *Phytophthora*.

Dieback management within Lot 64's assessed areas should be kept simple due to their degraded condition. If any of the three area are retained for conservation/environmental offset purposes that may include revegetation with native plants, it is recommended that the following precautionary Dieback management measures be applied to minimise the risk of introducing Phytophthora within areas for retention of native vegetation:

- Clean-on-entry when operating within retained area/s;
- Purchase seedlings from a NIASA accredited nursery;
- For disturbance operations outside of any of the above areas within Lot 64 will only need to ensure Clean on Arrival to site and can them move freely across Lot 64.

One supporting GIS map has been prepared that shows *Phytophthora* Dieback Occurrence mapping for three areas within Lot 64. Please note these maps have an expiry date (see below).

Dieback Occurrence Map Validity:
All Dieback Occurrence Maps expire for use during proposed disturbance activities after 1 year (August 2022) due to *Phytophthora*s having the ability to spread autonomously and through vectors such as machinery, vehicles, animals, water and footwear. These maps can be re-checked annually for up to 3 years (August 2024) after which a Comprehensive Dieback Assessment should be undertaken to provide accurate and valid mapping to guide disturbance activities and formulation of Dieback Management Plans as required (DPaW, 2015).

This service was delivered by Bruno Rikli, a Department of Biodiversity, Conservation and Attractions (DBCA) Registered Dieback Interpreter with 30 years of professional experience in the Dieback and Biosecurity industry.

Thank you for caring for country, I hope this report helps.

Sincerely,

Bruno Rikli, B Sc.
DIRECTOR – BARK ENVIRONMENTAL
DIRECTOR, BARK ENVIRONMENTAL PTY LTD
Scientist, Trainer, Biosecurity & Dieback Specialist, Facilitator
T 0400 208 582 E barkenv@gmail.com W barkenviro.com
ARRIVE CLEAN - LEAVE CLEAN in all natural areas!

2. INTRODUCTION

2.1 Background

BARK Environmental (BARK) was commissioned by the DORAL to complete a Dieback assessment within three areas of native vegetation, within Lot #64, Keysbrook.

This 2021 report is the first comprehensive Dieback assessment with sampling within Lot 64, Keysbrook. It includes details of the methodology, results and conclusion. A supporting GIS map has been prepared that highlights three separate remnant areas of vegetation within Lot 64 (see attached, Figure 1).

This service was delivered by Bruno Rikli, a DBCA Registered Dieback Interpreter with 30 years of professional experience in the Dieback and Biosecurity industry.

2.2 Scope of Work

BARK Environmental was commissioned to undertake:

1. A comprehensive Dieback assessment to remap the entire area per current DBCA methodology.
2. Prepare a report, plus 1 x GIS map of 2021 Disease Occurrence within 3 areas of Lot 64.

2.3 Description of Assessment Area

A comprehensive Dieback assessment was undertaken over three separate areas that total 11.35 ha. Lot 64 is located in the suburb of Keysbrook, approximately 55km south of the Perth Central Business District, within the Shire of Serpentine-Jarrahdale. The general area is comprised of predominantly cleared agricultural that is grazed with small clusters of scattered trees and degraded to completely degraded remnant vegetation based on the rating scale of Keighery (1994). Understory vegetation was comprised of weed species and pastural grasses and often bare soil was present. The site sits on the deep, pale sands of the Bassendean Soil Complex (DPIRD 2018).

Table 1 describes the two vegetation complexes mapped over the area area by Web *et al* (2016) and identifies the Dieback assessment areas they extend over.

Table 1. Vegetation complexes and Dieack assessment areas (Web et al,2016, cited in Ecoedge,2021).

Vegetation Complex	Description	Extent of Vegetation Complex over Dieback Assessment Areas
Southern River Complex (42)	*Open woodland of Corymbia calophylla (Marri) – Eucalyptus marginata (Jarrah) - Banksia species with fringing woodland of Eucalyptus rudis (Flooded Gum) - Melaleuca rhaphiophylla (Swamp Paperbark) along creek beds.*	Area 1.
Bassendean Complex Central and South (44)	*Vegetation ranges from woodland of Eucalyptus marginata (Jarrah) - Allocasuarina fraseriana (Sheoak) - Banksia species to low woodland of Melaleuca species and sedge lands on the moister sites. This area includes the transition of Eucalyptus marginata (Jarrah) to Eucalyptus todtiana (Pricklybark) in the vicinity of Perth.*	Areas 2 and 3.

2.4 Historical *Phytophthora* Dieback Assessment

No previous Phytophthora dieback assessment report for this site was found in the public domain. An online review of the Dieback Information Delivery and Management Systems (DIDMS) database did not show any evidence of previous sampling for *Phytophthora cinnamomi* within Lot 64.

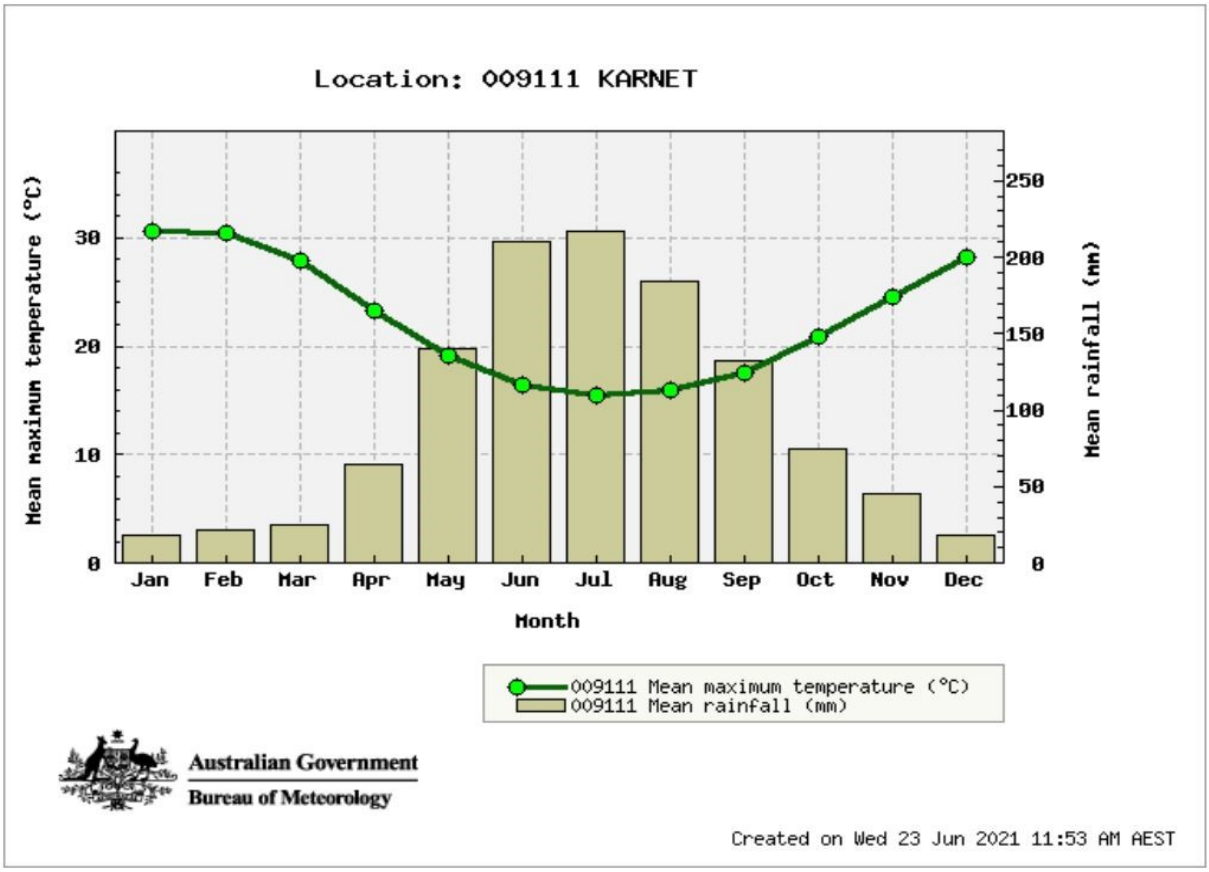
2.5 Site Disturbance

All assessment areas are subject to ongoing grazing which has caused the vegetation to become degraded to completely degraded.
At the time of assessment, there was no fire damage to site vegetation that could otherwise limit the Dieback assessment.

2.6 Climate and Rainfall Data

The local climate can be described as Mediterranean with hot dry summers and cool wet winters.
The mean annual rainfall for years 1965 to 2021 is 1137.9mm and the mean maximum temperature recorded for the last 58 years between 1963 to 2021 is 22.6°C. Table 2 summarises these statistics as recorded at a proximate Bureau of Meteorology weather station. These climate statistics combined with the vegetation complex mapping are evidence that Lot 64 falls within the 'Vulnerable Zone'of the south west land division where *Phytophthora* disease can develop and thrive (DPaW, 2015).

Table 2: Climate statistics (Rainfall and Temperature) for location 009111 Karnet.



3. METHODOLOGY

3.1 Dieback Interpretation

Field Dieback interpretation followed the comprehensive assessment methodology described in the "*Forest and Ecosystem Management Division 2015 (047), Phytophthora Dieback Interpreter's manual for lands managed by the department, Department of Parks and Wildlife, Perth, Western Australia*." (DPaW, 2015).

Presence or absence of *Phytophthora cinnamomi* ('the pathogen') was determined through desktop review, field observations and supporting evidence from laboratory testing of field-collected soil and plant tissue samples. Non-differential, hand-held Global Positioning System (GPS) receivers were used for navigation and to record tracks, walking trails, assessment boundaries and waypoints within the area with a nominal accuracy of 3 to 5 metres. Field data was mapped using GIS and relevant *Phytophthora* Occurrence Categories were then allocated (Table 3) with consideration of the assessability of vegetated and non-vegetated areas (Table 4).

Table 3: *Phytophthora* Occurrence Categories

***Phytophthora* occurrence category**	**Description**
Infested	Determined by a registered interpreter to have plant disease symptoms consistent with the presence of *Phytophthora cinnamomi.*
Uninfested	Determined by a registered interpreter to be free of plant disease symptoms which indicates the presence of *P. cinnamomi.*
Uninterpretable	Where susceptible plants are absent or too few to enable the interpretation of *P. cinnamomi* presence or absence
Temporarily Uninterpretable	Areas of temporary disturbance where natural vegetation is likely to recover.
Not Yet Resolved	Areas where *P. cinnamomi* occurrence diagnosis cannot be easily made within the required timeframe because of inconsistent evidence
Excluded (not coloured)	Areas of long-term high disturbance where natural vegetation has been cleared and is unlikely to recover.

Table 4: Accessibility of vegetated and non-vegetated areas

Vegetation Condition	*Phytophthora* occurrence category	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. Indicator Species Deaths (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 Dieback interpretation.
	Not Yet Resolved	Usually reliable indicator species in an environment not favourable to disease.	Negative sample results for all *Phytophthora* species.
Vegetation structure temporarily altered. *Phytophthora* occurrence assessment is will be possible when vegetation structure recovers. Recovery times will be variable depending on severity and type of disturbance.	Temporarily Uninterpretable	Indicator species masked by disturbance typically from fire, harvesting, temporary flooding, poisoning.	Occasional reliable indicator species, but disturbance prevents accurate placement of *Phytophthora* occurrence
Vegetation structure severely altered. Keighery disturbance rating 5 or greater. *Phytophthora* occurrence assessment is not possible. Can be determined by desktop assessment (aerial photo). Small vegetated areas can exist and may be excluded from the assessment area considering total environmental context.	Excluded (not coloured on figures)	Pasture, pits, easements, infrastructure, large roads (sealed and unsealed) permanent flooding, plantations, parkland tree stands.	Sporadic reliable indicator species

3.2 Demarcation

Following consultation with DORAL it was agreed that no Dieback category boundary demarcation was required at this stage and that GIS data files would be suitable.

3.3 Soil and tissue sampling

Soil and plant tissue samples were collected from dead or dying indicator plant species as further evidence to confirm the presence or absence of *Phytophthora* spp. Sample point locations were recorded with GPS receivers for GIS mapping and the sampled material was delivered to the Vegetation Health Service (VHS) laboratory in Kensington, where diagnostic baiting-techniques were used to detect any Phytophthora spp.

4. RESULTS

4.1 *Phytophthora* Dieback occurrence category distribution

One Dieback occurrence category has been assigned for all assessment areas within Lot #64 and the total hectares (ha) is given in Table 4. A description of this category follows and a Dieback Occurrence Map has been prepared that shows the spatial distribution of this disease mapping (see Figure 1). Appendix A includes site photographs for each area.

Table 4: Area Statement - *Phytophthora* Occurrence Categories

Occurrence category	Area (ha)
Infested	0
Uninfested	0
Uninterpretable	0
Excluded	11.35
Total Assessment Area:	**11.35**

- **Excluded** – All three assessment areas were Excluded from assessment due to significant vegetation clearing/disturbance leaving an absence of indicator plants to enable Dieback interpretation.
- **Area 1** - was classed as Degraded vegetation;
- **Area 2** – was classed as Completely Degraded condition (this area included a residence and planted exotic trees); and
- **Area 3** – was classed as Completely Degraded (Keighery, 1994).

4.2 Disease expression

No disease detected - no expression to report.

4.3 Current *Phytophthora* disease impact

No disease detected - no evidence was observed of Phytophthora disease impacting vegetation within Lot 64.

4.4 Sampling strategy and results

As expected, both samples returned a negative result for *P. cinnamomi* (Table 5). Finding fresh-dead and dying plants suitable for sampling within this area was difficult. Therefore, the sampling strategies applied were:

i) Strategy 1: Target any available suspicious recently dead susceptible plants to detect Phytophthora spp.
ii) Strategy 2: Request the laboratory to double-bait all samples to increase the probability of detecting *Phytophthora* spp. during a longer laboratory testing process.

Table 5: Sample Results 2021

Sample Date	Sample Label	Plant	Map Reference (MGA94 Z50)	Result
22.06.2021	S1-KB	*Baksia ilicifolia*	E 398410 N 6409844	NEGATIVE
22.06.2021	S2-KB	*Banksia ilicifolia*	E 398430 N 6409900	NEGATIVE

5. CONCLUSION

A comprehensive Dieback assessment was completed over three areas within Lot 64 covering a total area of 11.35 ha. No *phytophthora* Dieback was observed or detected that is supported by laboratory evidence from two negative sample results. Consequently, all three areas were classed as Excluded from assessment due to their extremely high levels of past and current disturbance in largely an agricultural landscape.

Dieback management within Lot 64's assessed areas should be kept simple due to their degraded condition. If any of the three area are retained for conservation/environmental offset purposes that may include revegetation with native plants, it is recommended that the following precautionary Dieback management measures be applied to minimise the risk of introducing Phytophthora within areas for retention of native vegetation:

- Clean-on-entry when operating within retained area/s;
- Purchase seedlings from a NIASA accredited nursery;
- For disturbance operations outside of any of the above areas within Lot 64 will only need to ensure Clean on Arrival to site and can them move freely across Lot 64.

One supporting GIS map has been prepared that shows *Phytophthora* Dieback Occurrence mapping over the three areas within Lot 64.

Dieback Occurrence Map Validity:
All Dieback Occurrence Maps expire for use during proposed disturbance activities after 1 year (August 2022) due to *Phytophthora*s having the ability to spread autonomously and through vectors such as machinery, vehicles, animals, water and footwear. These maps can be re-checked annually for up to 3 years (August 2024) after which a Comprehensive Dieback Assessment should be undertaken to provide accurate and valid mapping to guide disturbance activities and formulation of Dieback Management Plans as required (DPaW, 2015).

6. REFERENECES

Bureau of Meteorology. 2021. Climate statistics. Online: http://www.bom.gov.au/climate/data/.

Department of Parks and Wildlife (DPaW). 2015. Forest and Ecosystem Management Division 2015 (047), *Phytophthora* Dieback Interpreter's manual for lands managed by the department, Department of Parks and Wildlife, Perth, Western Australia.

Department of Primary Industries and Regional Development (DPIRD). 2018. Soil Landscape Mapping – Systems (DPIRD-064) Last Modified 19/06/2018.

Dieback Working Group (DWG). 2000. Managing *Phytophthora* Dieback: Guidelines for Local Government.

Keighery, B.J. 1994. Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA Inc. Nedlands, Western Australia.

Ecoedge. 2021 (Smith, R. & Spencer, C.) 2021. Detailed and Targeted Flora and Vegetation Survey. Keysbrook, Western Australia. Prepared for Doral Mineral Sands, April 2021.

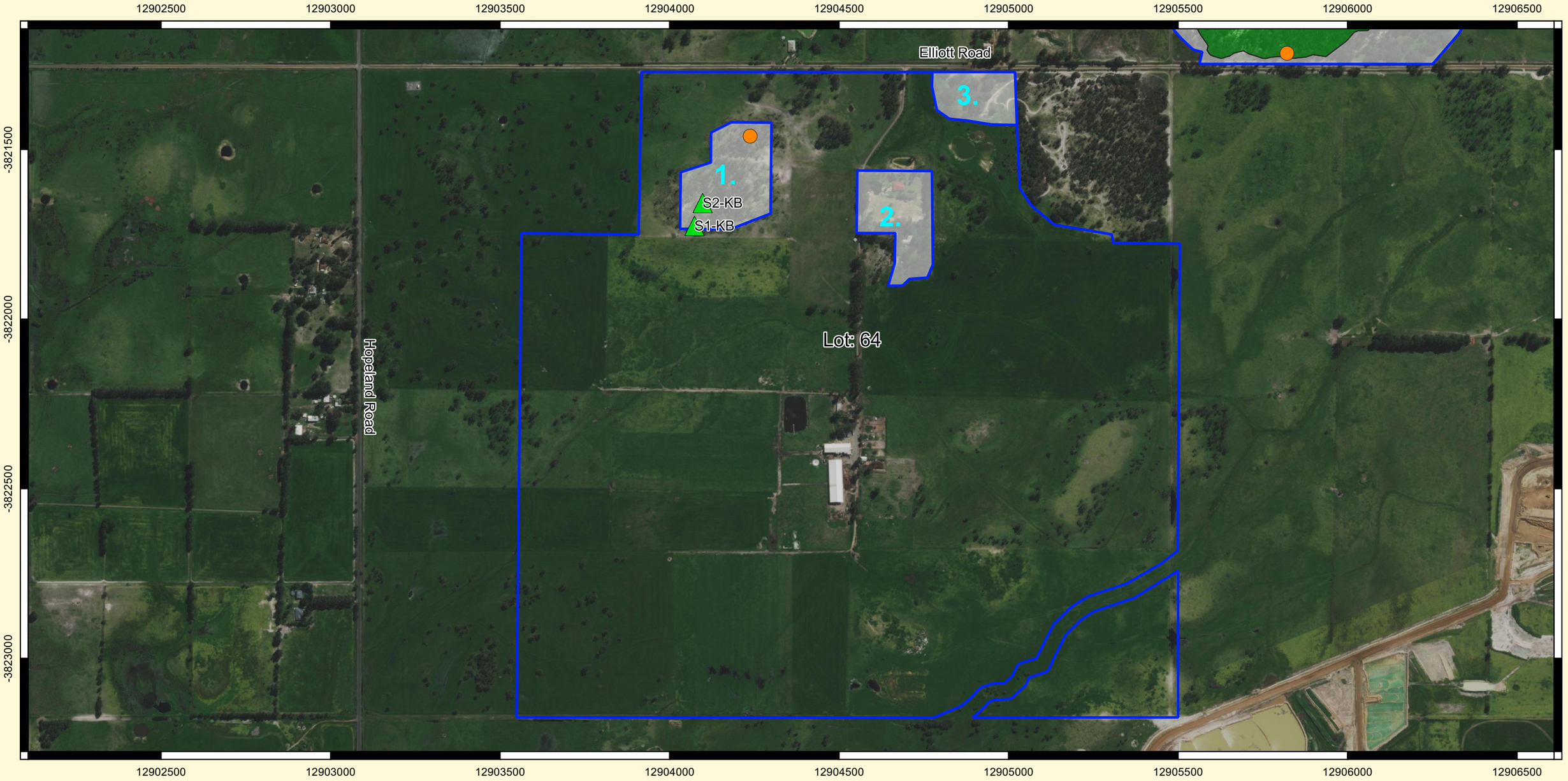
Please reference this report as:

Rikli, B. 2021. *Phytophthora* Dieback Occurrence Report for Lot #64, Keysbrook. A report prepared for DORAL Mineral Sands. BARK Environmental, August 2021.

7. APPENDIX A – PHOTOGRAPHS TAKEN JUNE 2021

Plates 1 and 2: Area 1; Samples 1 (left) Completely Degraded.
Area 1 (Right) surrounding degraded vegetation of *Banksia ilicifolia,* pasture grasses and weed species.

Plates 3 and 4: Area 2 (Left) planted Eucalyptus spp. and Completely Degraded.
Area 3 (Right) parkland cleared and Completely Degraded.



Legend

- Assessment Boundary
- Sample Results: Negative
- Infested
- Uninfested
- Uninterpretable
- Excluded
- Armillaria luteobubalina
- 1. Area Numbers

Phytophthora Occurrence Map Validity:

Pathogens can spread over time, therefore this map:
- Is only valid for 12 months to guide site disturbance activities (Expiry 02.08.2022).
- Can be revalidated for a maximum of 3 years after initial assessment (Expiry 02.08.2024).
- After 3 years, a new assessment is required by a DBCA Registered Interpreter.

Interpreter: B. Rikli
Date of Interpretation: 02.08.2021
Date of Expiry: 02.08.2022
Interpretation Method: Comprehensive

Area Statement

Occurrence Category	Area (ha)
Infested	0
Uninfested	0
Uninterpretable	0
Excluded	11.35
Total Study Area	11.35

N

Datum: GDA 94
Projection: MGA Zone 50
Scale at A3

0 200 400 600 800 1,000 m

Figure 1.

Phytophthora Occurrence Map Keysbrook, Lot 64

Bark Job: BARK_52

Revision 1

BARK Environmental

APPENDIX 6B: *PHYTOPHTHORA* DIEBACK SURVEY 2021B

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Phytophthora Dieback Occurrence Report

for

Lots 507, 508, 201 and 56 - Keysbrook

A report prepared for
DORAL

August 2021

What is Phytophthora Dieback?

Phytophthora Dieback is the disease caused by a group of microscopic soil-borne water moulds in the genus Phytophthora that means 'plant destroyer' in ancient Greek. Phytophthoras can infect and rot the roots of susceptible plants so they cannot effectively uptake water and nutrients. This contributes to them Dying-back that can significantly impact ecosystems and biodiversity! *Phytophthora cinnamomi* is one of the most common species and well-researched in south western Australia where it has had a major impact within forests and bushland.

The greatest plant disease threat to biodiversity conservation (DPaW, 2015)
Phytophthora Dieback threatens biodiversity, placing important flora and fauna species at risk of death or extinction. We are very concerned about how many plant species it can kill. Approximately 40% of the entire flora in the South West Botanical Province (an International Biodiversity Hotspot!) are susceptible. This literally means thousands of plants are threatened and the flow-on negative impacts of this disease can be severe affecting ecosystem health, biodiversity, fauna habitat, amenity; and increased costs for government, industries and landholders to mitigate it.

Phytophthoras can spread easily when their spores in soil, water or organic material are carried on unclean vehicles, equipment and footwear and deposited elsewhere. They also spread between plants via root-root contact. Therefore, integrated management is considered best practice that involves actions to prevent its spread by assessing the risks of proposed disturbance activities, mapping disease distribution and quarantining areas of Uninfested vegetation, applying stringent biosecurity-hygiene protocols and raising stakeholder awareness.

Western Australia's biodiversity is unique and invaluable for current and future generations.
Further research on the Phytophthora pathogen and efficacy of mitigation options is essential. To date there has been excellent collaboration between all tiers of the Australian government, not-for-profit associations, affected industries and communities. But more work is needed to integrate policies and innovative science into practical management that is made accessible to all land managers and public.

You can help STOP its spread by **Arriving Clean and Leaving Clean**

Thank you for your interest in Phytophthora Dieback!

Bruno Rikli
Director, BARK ENVIRONMENTAL PTY LTD

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1. EXECUTIVE SUMMARY

BARK Environmental (BARK) was commissioned by DORAL to complete a comprehensive Dieback assessment within seven highlighted areas of bushland across Lots 507, 508, 201 and 56 in Keysbrook. A comprehensive Dieback assessment was completed over 7 separate areas within the subject Lots. The results of this 2021 comprehensive Dieback assessment mapped disease occurrence over a total area of 123.94 hectares (ha).

One point of Infestation has been identified through sampling in the north part of Area 5. The surrounding Excluded areas within the accessible paddock in Area 5 should be treated with precaution as cattle may have *spread P. cinnamomi* within this area but its impact is not evident due to an absence of susceptible plants and other agents causing the death of plants to enable Dieback Assessment.

Two Uninfested areas have been identified within Areas 5 and 6 and their outer vegetated areas have been impacted by obvious grazing pressure.

All remaining areas were excluded due to their degraded to completely degraded vegetation condition.

One historic recording of a 'Clump of *Synaphea* sp. Fairbridge Farm', a Threatened flora species falls within Area 2. In respect to *Phytophthora* disease impact, research has shown that the *Synaphea* genus includes plants that are susceptible but *Synaphea* sp. Fairbridge Farm is not on the list, that may only mean it was not included in the research but it could still be present and susceptible to the pathogen.

- Therefore, it is suggested that despite Area 2 being in degraded condition, a target search for this threatened flora species is warranted to ascertain the situation and whether any specific precautionary Dieback hygiene is warranted or not within Area 2 in the context of the proposed mining footprint.

- A standard Dieback Management Plan should be prepared for disturbance operations within the areas assessed and any revegetation and management within any retained vegetation areas.

One supporting GIS map has been prepared to show *Phytophthora* Dieback Occurrence (Figure 1) and this has an expiry date (see below).

Dieback Occurrence Map Validity:
All Dieback Occurrence Maps expire for use during proposed disturbance activities after 1 year (August 2022) due to *Phytophthora*s having the ability to spread autonomously and through vectors such as machinery, vehicles, animals, water and footwear. These maps can be re-checked annually for up to 3 years (August 2024) after which a Comprehensive Dieback Assessment should be undertaken to provide accurate and valid mapping to guide disturbance activities and formulation of Dieback Management Plans as required (DPaW, 2015).

This service was delivered by Bruno Rikli, a DBCA Registered Dieback Interpreter with 30 years of professional experience in the Dieback and Biosecurity industry.

Thank you for caring for country, I hope this report helps.

Bruno Rikli, BSc, DBCA Registered Dieback Interpreter
DIRECTOR – BARK ENVIRONMENTAL

2. INTRODUCTION

2.1 Background

BARK Environmental (BARK) was commissioned by the DORAL to complete a Dieback assessment within seven areas of native vegetation, within Lots 507, 508, 201 and 56, (hereafter Lots #507-56) in Keysbrook.

This 2021 report is the first comprehensive Dieback assessment with sampling at this site and covers 123.94 hectares (ha). This report includes details of the methodology, results and conclusion. A supporting GIS map has been prepared that shows the 7 separate remnant areas assessed herein (see attached Figure 1).

This service was delivered by Bruno Rikli, a DBCA Registered Dieback Interpreter with 30 years of professional experience in the Dieback and Biosecurity industry.

2.2 Scope of Work

BARK Environmental was commissioned to undertake:

1. A comprehensive Dieback assessment to map the entire subject areas per current DBCA methodology.
2. Prepare a report, plus 1 x map of 2021 Disease Occurrence within the subject Lots.

2.3 Description of Assessment Area

Lots 507-56 are located in the suburb of Keysbrook, approximately 55km south of the Perth Central Business District, within the Shire of Serpentine-Jarrahdale. The area is comprised of predominantly cleared agricultural land for grazing, with stands of degraded remnant vegetation and waterways occurring sparsely throughout. Of these stands, seven were included for Comprehensive Dieback Assessment, ranging in size from 4.15ha to 52.27ha.

Vegetation across the assessment area classify under two vegetation complexes: the Bassendean Complex – Central and South and the Southern River Complex (Smith & Spencer 2021). Within these, the vegetation structure was limited to canopy and middle story of *Banksia attenuata, Banksia ilicifolia, Eucalyptus todtiana, Eucalyptus marginata/rudis, Corymbia calophylla and Allocasuarina (Sheoak)* with some areas of *Melaleuca sp.* in the western most area (Area 1). Understory vegetation was comprised of weed species and pastural grasses and often bare soil was present, with occasional clusters and scattered *Xanthorrhoea* (grass trees) and *Xylomelum occidentale* (Woody Pear) that are indicator species commonly used during Dieback interpretation. The site sits on the deep, pale sands of the Bassendean Soil Complex (DPIRD 2018).

2.4 Historical *Phytophthora* Dieback Assessment

No previous Phytophthora dieback assessment report for this site was found in the public domain. An online review of the Dieback Information Delivery and Management Systems (DIDMS) database did not show any evidence of previous sampling for *Phytophthora cinnamomi* within the Lots.

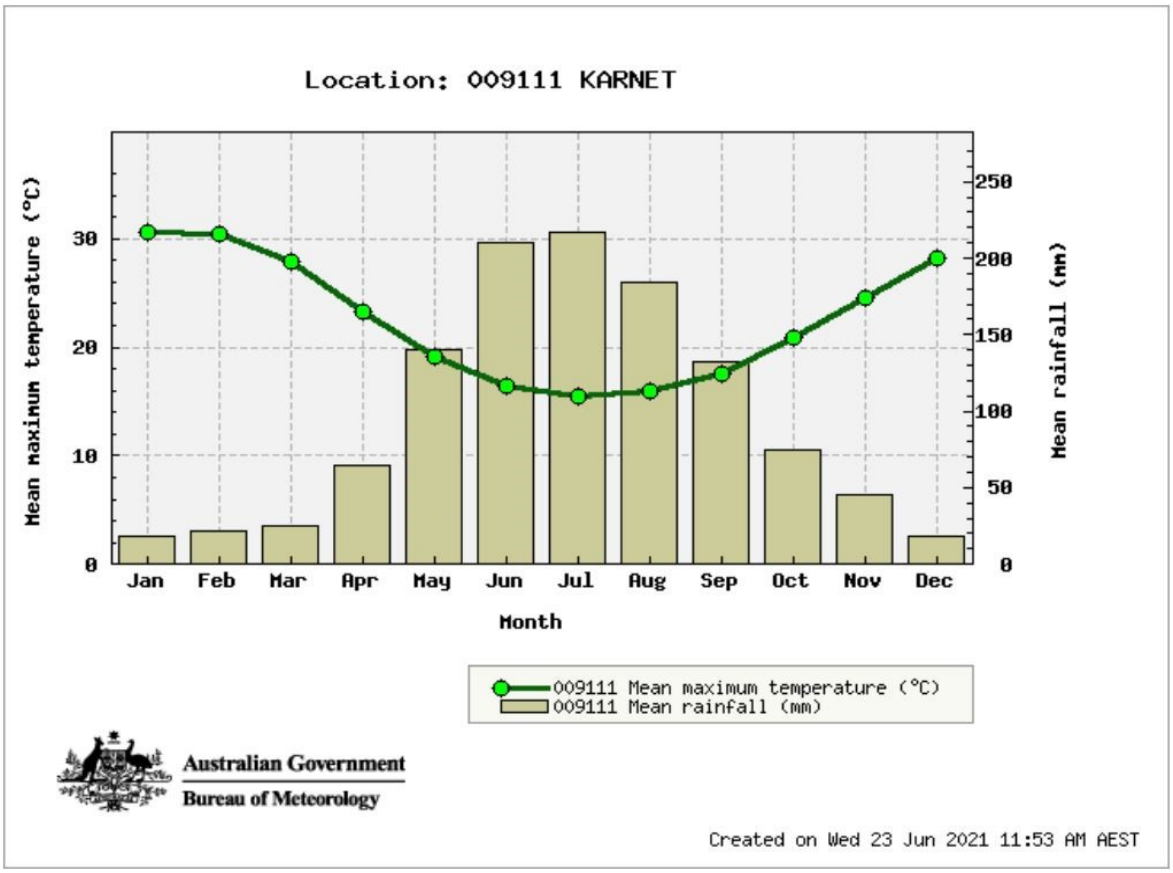
2.5 Site Disturbance

All assessment areas are subject to ongoing grazing (cattle, kangaroos and birds) which has caused the vegetation to become degraded to completely degraded. At the time of assessment, there was no recent fire damage to site vegetation that could otherwise limit the Dieback assessment.

2.6 Climate and Rainfall Data

The local climate can be described as Mediterranean with hot dry summers and cool wet winters. The mean annual rainfall for years 1965 to 2021 is 1137.9mm and the mean maximum temperature recorded for the last 58 years between 1963 to 2021 is 22.6°C. Table 2 summarises these statistics as recorded at a proximate Bureau of Meteorology weather station. These climate statistics combined with the vegetation complex mapping are evidence that Lot 64 falls within the 'Vulnerable Zone'of the south west land division where *Phytophthora* disease can develop and thrive (DPaW, 2015).

Table 1: Climate statistics (Rainfall and Temperature) for location 009111 Karnet.



3. METHODOLOGY

3.1 Dieback Interpretation

Field Dieback interpretation followed the comprehensive assessment methodology described in the "*Forest and Ecosystem Management Division 2015 (047), Phytophthora Dieback Interpreter's manual for lands managed by the department, Department of Parks and Wildlife, Perth, Western Australia*." (DPaW, 2015).

Presence or absence of *Phytophthora cinnamomi* ('the pathogen') was determined through desktop review, field observations and supporting evidence from laboratory testing of field-collected soil and plant tissue samples. Non-differential, hand-held Global Positioning System (GPS) receivers were used for navigation and to record tracks, walking trails, assessment boundaries and waypoints within the area with a nominal accuracy of 3 to 5 metres. Field data was mapped using GIS and relevant *Phytophthora* Occurrence Categories were then allocated (Table 2) with consideration of the assessability of vegetated and non-vegetated areas (Table 3).

Table 2: *Phytophthora* Occurrence Categories

***Phytophthora* occurrence category**	**Description**
Infested	Determined by a registered interpreter to have plant disease symptoms consistent with the presence of *Phytophthora cinnamomi.*
Uninfested	Determined by a registered interpreter to be free of plant disease symptoms which indicates the presence of *P. cinnamomi.*
Uninterpretable	Where susceptible plants are absent or too few to enable the interpretation of *P. cinnamomi* presence or absence
Temporarily Uninterpretable	Areas of temporary disturbance where natural vegetation is likely to recover.
Not Yet Resolved	Areas where *P. cinnamomi* occurrence diagnosis cannot be easily made within the required timeframe because of inconsistent evidence
Excluded (not coloured)	Areas of long-term high disturbance where natural vegetation has been cleared and is unlikely to recover.

Table 3: Accessibility of vegetated and non-vegetated areas

Vegetation Condition	*Phytophthora* occurrence category	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. Indicator Species Deaths (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 Dieback interpretation.
	Not Yet Resolved	Usually reliable indicator species in an environment not favourable to disease.	Negative sample results for all *Phytophthora* species.
Vegetation structure temporarily altered. *Phytophthora* occurrence assessment is will be possible when vegetation structure recovers. Recovery times will be variable depending on severity and type of disturbance.	Temporarily Uninterpretable	Indicator species masked by disturbance typically from fire, harvesting, temporary flooding, poisoning.	Occasional reliable indicator species, but disturbance prevents accurate placement of *Phytophthora* occurrence
Vegetation structure severely altered. Keighery disturbance rating 5 or greater. *Phytophthora* occurrence assessment is not possible. Can be determined by desktop assessment (aerial photo). Small vegetated areas can exist and may be excluded from the assessment area considering total environmental context.	Excluded (not coloured on figures)	Pasture, pits, easements, infrastructure, large roads (sealed and unsealed) permanent flooding, plantations, parkland tree stands.	Sporadic reliable indicator species

3.2 Demarcation

Following consultation with DORAL it was agreed that no Dieback category boundary demarcation was required at this stage and that GIS data files would be suitable. However, as one small spot of Infestation was identified, its buffered perimeter was flagged with pink tape tied to trees at chest height with the knots facing towards the buffered Infested sample point area.

3.3 Soil and tissue sampling

Soil and plant tissue samples were collected from dead or dying indicator plant species as further evidence to confirm the presence or absence of *Phytophthora* spp. Sample point locations were recorded with GPS receivers for GIS mapping and the sampled material was delivered to the Vegetation Health Service (VHS) laboratory in Kensington, where diagnostic baiting-techniques were used to detect any Phytophthora spp.

4. RESULTS

4.1 *Phytophthora* Dieback occurrence category distribution

Three Dieback occurrence categories have been assigned and their areas (ha) are given in Table 4. A description of this category follows and a Dieback Occurrence Map has been prepared that shows each categories' spatial distribution (see Figure 1). Appendix A includes site photographs for each area.

Table 4: Area Statement - *Phytophthora* Occurrence Categories.

Occurrence category	Area (ha)
Infested	0.15
Uninfested	30.04
Uninterpretable	0
Excluded	93.76
Total Assessment Area:	**123.95**

- **Infested** – One small area was classed as Infested within Area 5 (see Figure 1) where a buffer was applied to surround a sample point that tested positive to *P. cinnamomi* (see Table 5). As the surrounding vegetation and cleared area was in Degraded (5) and Completely Degraded condition it was not possible to map a larger Dieback Infested boundary beyond this point. Given *P. cinnamomi* was detected in Area 5 and cattle move through the area, a precautionary management measure would be to treat the outer Excluded areas within this paddock as Infested.

- **Uninfested** – Two Uninfested areas, one within Area 5 and the other in Area 7, had vegetation in good to better condition remaining. Negative sample results in these areas support this (see table 5).

- **Excluded** – Areas 1, 2, 3, 4 and 6 were completely Excluded from this assessment due to significant vegetation clearing/disturbance leaving an absence of indicator plants to assess. Vegetation surrounding the Infested and Uninfested areas within Areas 5 and 7 and a small, cleared area within the central part of Area 7, was also Excluded. Of note the vegetated outer perimeters of Areas 5 and 7 were Excluded due to extensive grazing and trampling impacts by cattle.

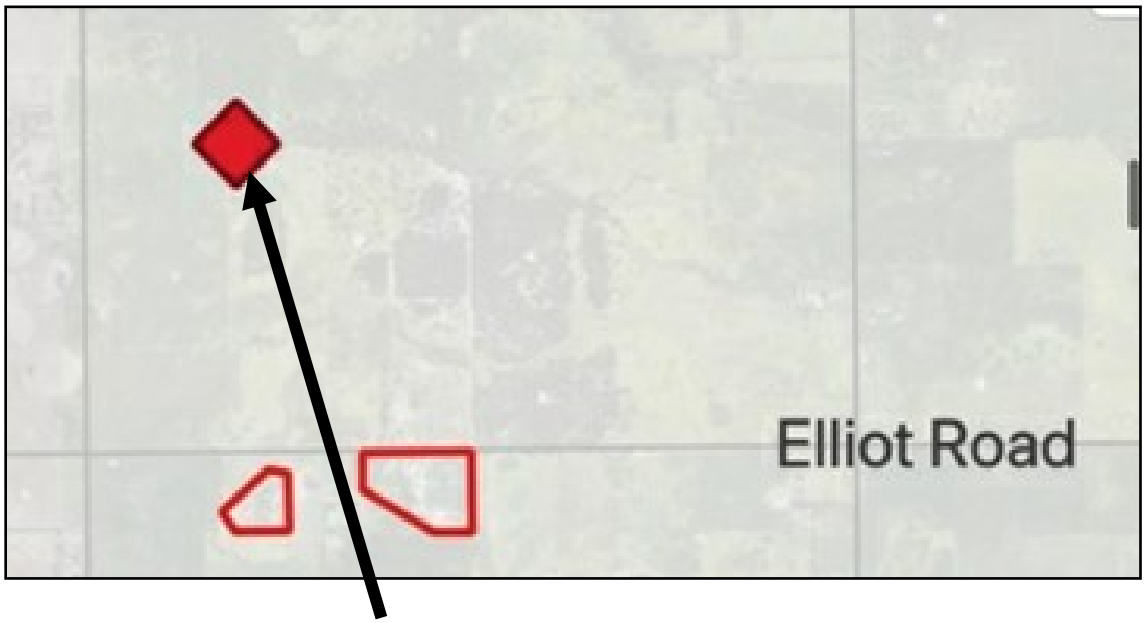
4.2 Disease expression

One Infested point was identified through sampling of a very old Banksia attenuata, with scattered susceptible tree deaths (also very old) around it. Because these areas have cattle grazing, manure build up and seasonally high soil moisture a wide range of fungi were observed that can also cause tree and understorey health to decline. Therefore, disease expression is not obvious at this site and there were no recent fresh dead indicator plants as could normally be expected in this locality.

4.3 Current *Phytophthora* disease impact

A Moderate impact rating is given, because other factors appear to be causing the decline and death of susceptible plants within the subject Lots, including, but not limited to, grazing (cattle, kangaroos, parrots grazing on grass trees), senescence, waterlogging, abundance of fungi, *Armillaria luteobubalina* (Australian honey fungus) points were detected, and the fungi may be more widespread as the environmental conditions are highly suitable in all subject areas.

- Review of the Detailed and Targeted Flora and Vegetation Survey Keysbrook (Ecoedge, 2021) revealed one historical record from the WA herbarium data set of a threatened flora species that may occur within Area 2 (see below). It was historically reported as a 'Clump of *Synaphea* sp. Fairbridge Farm', but this area was outside of the Ecoedge 2021 survey area. In respect to *Phytophthora* disease, research has shown that the *Synaphea* genus includes plants that are susceptible but *Synaphea*. sp Fairbridge Farm is not on the list, that may only mean it was not included in the research. Therefore, despite Area 2 being in degraded condition, a target search for this threatened flora species is warranted to ascertain the situation and whether any specific precautionary Dieback hygiene is warranted or not within Area 2 in the context of the proposed mining footprint.



Historic recorded location of 'Synaphea sp. Fairbridge Farm' that falls within Area 2. Extract from Figure 5. Location of Threatened and Priority flora within a 10 km radius of the Survey Area (DBCA 2020e) in Ecoedge (2021, p. 24).

4.4 Sampling strategy and results

Finding fresh-dead and dying plants suitable for sampling within the subject lots was difficult. There were many very old deaths Therefore, the sampling strategies applied were:

i) Strategy 1: Target any available suspicious recently dead susceptible plants to detect Phytophthora spp.
ii) Strategy 2: Request the laboratory to double-bait all samples to increase the probability of detecting *Phytophthora* spp. during a longer laboratory testing process.

Table 5: Sample Results 2021

Sample Date	Sample Label	Plant spp.	Map Reference (MGA94 Z50)	Result
02.08.2021	S3-KB	*Xanthorrhoea gracilis & Banksia attenuata*	E 399132 N 6411183	NEGATIVE
02.08.2021	S4-KB	*Banksia menziessii*	E 399722 N 6411010	NEGATIVE
02.08.2021	S5-KB	*Xanthorrhoea preissii*	E 399692 N 6411140	NEGATIVE
02.08.2021	S6-KB	*Banksia attenuata*	E 399963 N 6411591	***P. cinnamomi***
02.08.2021	S7-KB	*Xanthorrhoea preissii*	E 399896 N 6410470	NEGATIVE
02.08.2021	S8-KB	*Banksia attenuata*	E 399775 N 6410598	NEGATIVE

5. CONCLUSION

A comprehensive Dieback assessment was completed over 7 separate areas within the subject Lots. One point of Infestation has been demarcated within the north part of Area 5. It was not possible to map the disease beyond this point due to the degraded condition of surrounding vegetation caused by a range of factors at this site, especially grazing. The Excluded area of vegetation within the accessible paddock in Area 5 should be treated with precaution as cattle may have *spread P. cinnamomi* in these areas but its impact is not evident due to an absence of susceptible plants to enable Dieback Assessment.

Two Uninfested areas have been identified within Areas 5 and 6 and their outer vegetated areas have been impacted by obvious grazing pressure.

All remaining areas were excluded due to their degraded to completely degraded vegetation condition.

One historic recording of a 'Clump of *Synaphea* sp. Fairbridge Farm', a Threatened flora species, appears to be within Area 2. In respect to *Phytophthora* disease, research has shown that the *Synaphea* genus includes plants that are susceptible but *Synaphea*. sp Fairbridge Farm is not on the list, that may only mean it was not included in the research but it could still be present and susceptible to the pathogen.

- Therefore, it is suggested that despite Area 2 being in degraded condition, a target search for this threatened flora species is warranted to ascertain the situation and whether any specific precautionary Dieback hygiene is warranted or not within Area 2 in the context of the proposed mining footprint.

- A standard Dieback Management Plan should be prepared for disturbance operations within the areas assessed and any revegetation and management within any retained vegetation areas.

One supporting GIS map has been prepared to show *Phytophthora* Dieback Occurrence (Figure 1) and this has an expiry date (see below).

Dieback Occurrence Map Validity:
All Dieback Occurrence Maps expire for use during proposed disturbance activities after 1 year (August 2022) due to *Phytophthora*s having the ability to spread autonomously and through vectors such as machinery, vehicles, animals, water and footwear. These maps can be re-checked annually for up to 3 years (August 2024) after which a Comprehensive Dieback Assessment should be undertaken to provide accurate and valid mapping to guide disturbance activities and formulation of Dieback Management Plans as required (DPaW, 2015).

6. REFERENECES

Bureau of Meteorology. 2021. Climate statistics. Online: http://www.bom.gov.au/climate/data/.

Department of Parks and Wildlife (DPaW). 2015. Forest and Ecosystem Management Division 2015 (047), *Phytophthora* Dieback Interpreter's manual for lands managed by the department, Department of Parks and Wildlife, Perth, Western Australia.

Department of Primary Industries and Regional Development (DPIRD). 2018. Soil Landscape Mapping – Systems (DPIRD-064) Last Modified 19/06/2018.

Dieback Working Group (DWG). 2000. Managing *Phytophthora* Dieback: Guidelines for Local Government.

Keighery, B.J. 1994. Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA Inc. Nedlands, Western Australia.

Ecoedge. 2021 (Smith, R. & Spencer, C.) 2021. Detailed and Targeted Flora and Vegetation Survey. Keysbrook, Western Australia. Prepared for Doral Mineral Sands, April 2021.

Please reference this report as:

Rikli, B. 2021. *Phytophthora* Dieback Occurrence Report for Lots 507, 508, 201, 56 Keysbrook. A report prepared for DORAL Mineral Sands. BARK Environmental, August 2021.

7. APPENDIX A – PHOTOGRAPHS TAKEN JUNE 2021

Plates 1 – 6: Samples 3 to 8 (left to right from the top).
Red box image is the *Banksia attenuata* sample #6 that tested positive with *P. cinnamomi*.

Plates 7 – 10: Areas 1 to 4 (Left to right from the top) showing degraded and Excluded vegetation and historic clearing.


Plates 11 and 12: Area 5 showing Excluded (Left) and Uninfested (Right) vegetation.

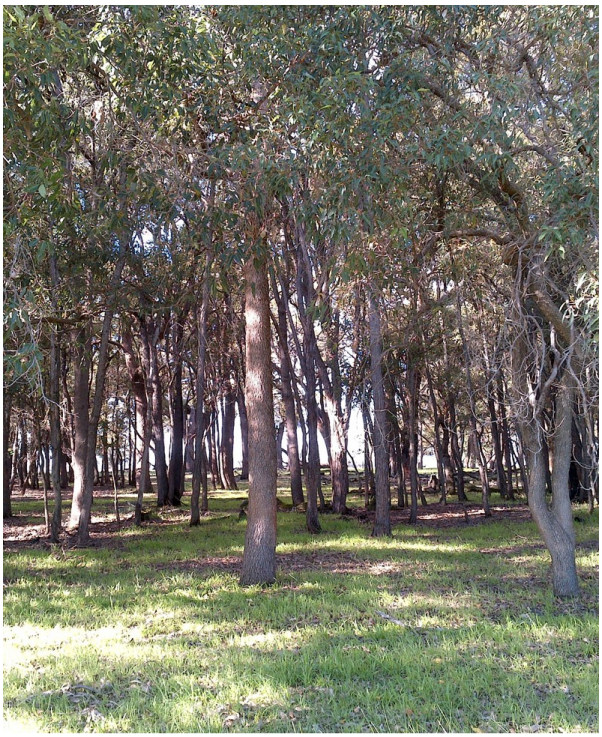
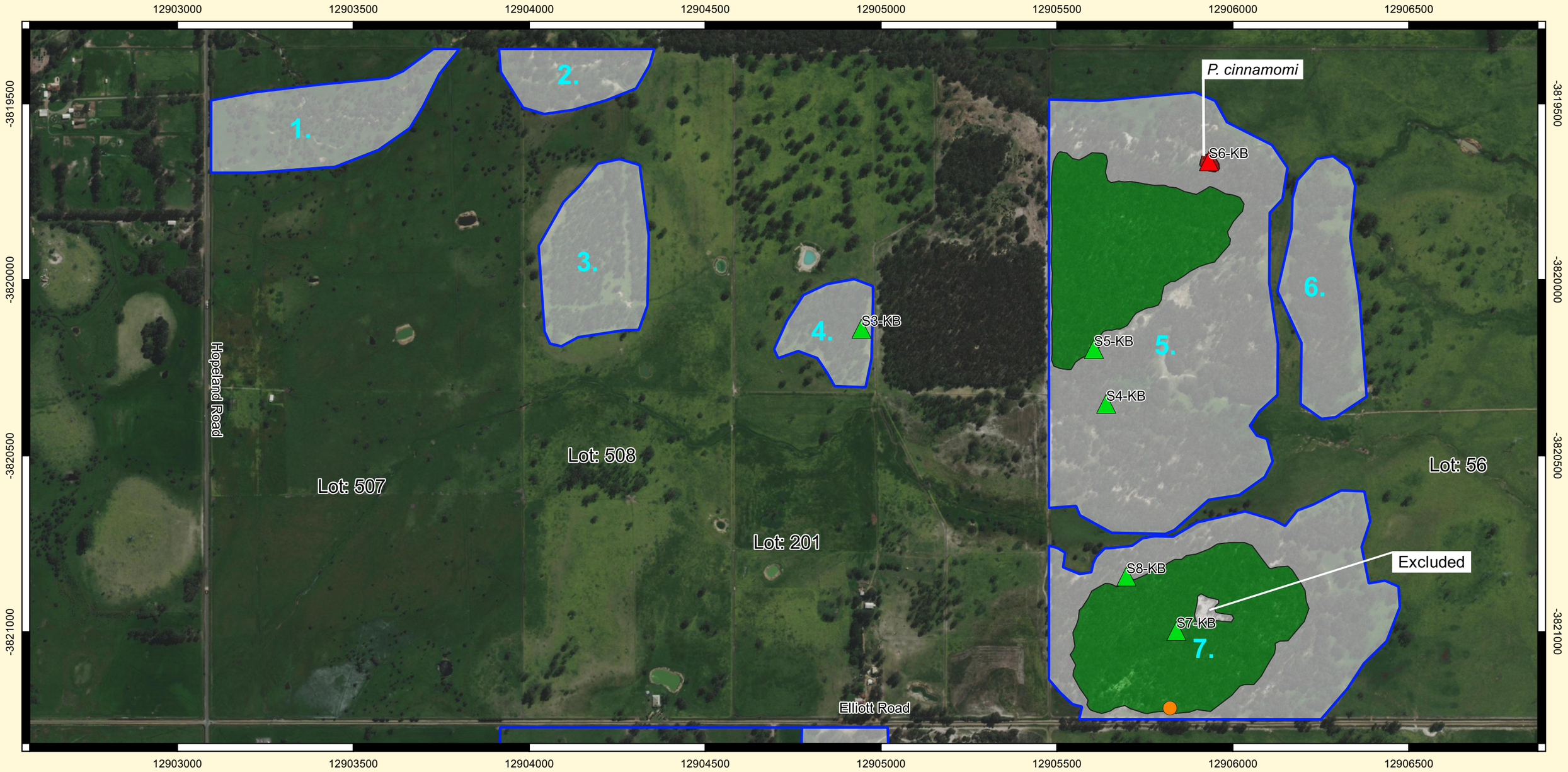


Plate 13: Area 6 showing Excluded vegetation.

Plates 14 and 15: Area 7 showing Excluded perimeter (Left) and central Uninfested area with greater density of healthy *Xanthorrhoea* and *Banksia* spp. (Right).



Legend

- Assessment Boundary
- Sample Results: Positive
- Sample Results: Negative
- Infested
- Uninfested
- Uninterpretable
- Excluded
- Armillaria luteobubalina
- 1. Area Numbers

Phytophthora Occurrence Map Validity:

Pathogens can spread over time, therefore this map:
- Is only valid for 12 months to guide site disturbance activities (Expiry 02.08.2022).
- Can be revalidated for a maximum of 3 years after initial assessment (Expiry 02.08.2024).
- After 3 years, a new assessment is required by a DBCA Registered Interpreter.

Interpreter: B. Rikli
Date of Interpretation: 02.08.2021
Date of Expiry: 02.08.2022
Interpretation Method: Comprehensive

Area Statement

Occurrence Category	Area (ha)
Infested	0.15
Uninfested	30.04
Uninterpretable	0
Excluded	93.76
Total Study Area	123.95

N

Datum: GDA 94
Projection: MGA Zone 50

Scale at A3

0 200 400 600 800 1,000 m

Figure 1.

Phytophthora Occurrence Map Keysbrook, Lots 507, 508, 201 and 56

Bark Job: BARK_52

Revision 1

BARK Environmental

APPENDIX 6C: *PHYTOPHTHORA* DIEBACK SURVEY 2023

BARK Environmental
Professional Consulting Services for Govt. / Mining / Private / Community

Expert's in:
Mapping-Management
Monitoring-Treatment
DBCA Registered Dieback Interpreter
Dept Health Registration #2308

BARK Environmental
www.barkenviro.com
Dieback Treatment

E: barkenv@gmail.com M: 0400 208 582 W: barkenviro.com ABN: 98 607 090 060

Phytophthora Dieback Occurrence Report

for

Lots 63, 62 and 200 – Keysbrook

A report prepared for

DORAL MINERAL SANDS PTY LTD

MARCH 2023

What is Phytophthora Dieback?

Phytophthora Dieback is the disease caused by a group of microscopic soil-borne water moulds in the genus Phytophthora that means 'plant destroyer' in ancient Greek. Phytophthoras can infect and rot the roots of susceptible plants so they cannot effectively uptake water and nutrients. This contributes to the plants Dying-back that can impact to biodiversity and ecosystems! *Phytophthora cinnamomi* is one of the most common, widespread and well-researched types Western Australia's south west region where it has severely impacted forests and bushland.

The greatest plant disease threat to biodiversity conservation (DPaW, 2015)

Phytophthora Dieback threatens biodiversity, placing important flora and fauna species at risk of death or extinction. We are very concerned about how many plant species it can kill. Approximately 40% of the entire flora in the South West Botanical Province (an International Biodiversity Hotspot!) are susceptible. This literally means thousands of plants are threatened and the flow-on negative impacts of this disease can be severe affecting ecosystem health, biodiversity, fauna habitat, amenity; and increased costs for government, industries and landholders to mitigate it.

Phytophthoras can spread easily when their spores in soil, water or organic material are carried on unclean vehicles, equipment and footwear and deposited elsewhere. They also spread between plants via root-root contact. Therefore, integrated management is considered best practice that involves actions to prevent its spread by assessing the risks of proposed disturbance activities, mapping disease distribution and quarantining areas of Uninfested vegetation, applying stringent biosecurity-hygiene protocols and raising stakeholder awareness.

Western Australia's biodiversity is unique and invaluable for current and future generations. Further research on the Phytophthora pathogen and efficacy of mitigation options is essential. To date there has been excellent collaboration between all tiers of the Australian government, not-for-profit associations, affected industries and communities. But more work is needed to integrate policies and innovative science into practical management that is made accessible to all land managers and public.

You can help STOP its spread by **Arriving Clean and Leaving Clean**

Thank you for your interest in Phytophthora Dieback!

Bruno Rikli

Dieback Specialist 30 Years

Director, BARK ENVIRONMENTAL PTY LTD

ARRIVE CLEAN – LEAVE CLEAN

TABLE OF CONTENTS

Page

1. EXECUTIVE SUMMARY

BARK Environmental (BARK) was commissioned by Doral Mineral Sands Pty Ltd (DMS) to undertake a comprehensive Dieback assessment over the three adjoining Lots 507, 508, 201 in Keysbrook.

The results show that site vegetation composition and structure in the assessment area has been so severely altered by historic disturbance activities that assessment was not possible. Sampling was not possible due to an absence of dead/dying susceptible plants and was not required to make this determination. A GIS map has been prepared that shows the allocated P*hytophthora* Dieback Occurrence category of 'Excluded' over the entire assessment area (Figure 1).

Simple recommendations for Dieback management have been given for the subject Lots because there is no susceptible plant community remaining for the disease to cause an impact. These include:

- The key tactic to adopt at Excluded sites is to 'arrive clean and leave clean' to avoid the introduction and/or spread of diseases and weeds within and beyond the subject area.
- Should any areas be retained for revegetation that includes plants susceptible to Phytophthora disease, it is recommended that standard Dieback hygiene protocols are included during inductions, at entry/exit points, clean-down of footwear/vehicles/equipment and the sourcing of seedlings is preferrable from a NIASA accredited nursery to minimise risk of disease introduction.
- Plants within any revegetation areas displaying disease symptoms could be sampled as soon as practicable for early detection, diagnosis and treatment using Phosphite application.

Assessment was completed per the Department of Biodiversity, Conservation and Attractions (DBCA) methodology in February 2023 by Dieback Interpreter Bruno Rikli who is registered by the DBCA and has over 30 years of experience in Dieback interpretation and management.

Thank you for caring for country.

Bruno Rikli BSc Env, Cert. Conservation & Training

DIRECTOR, BARK ENVIRONMENTAL PTY LTD
Scientist, Trainer, Dieback and Biosecurity Specialist
Department of Biodiversity, Conservation and Attractions – Registered Interpreter
Department of Health Western Australia – Registered Business
Dieback Working Group Inc Western Australia – Management Committee
T 0400 208 582 E barkenv@gmail.com W barkenviro.com

ARRIVE CLEAN - LEAVE CLEAN in all natural areas!

2. INTRODUCTION

2.1 Background

BARK Environmental (BARK) was commissioned by DMS to complete a Comprehensive Dieback assessment within adjoining Lots 63, 62 and 200 in Keysbrook as part of the environmental assessment process for proposed mineral sand mining. This 2023 report is the first comprehensive Dieback assessment within the aforementioned lots and covered a total area of 631.32 hectares (ha).

Assessment was completed in February 2023 by Dieback Interpreter Bruno Rikli who is registered by the Department of Biodiversity, Conservation and Attractions and has over 30 years of experience in Dieback interpretation and management.

2.2 Description of Assessment Area

Lots 63, 62 and 200 are located in Keysbrook approximately 60 kilometres (km) south of Perth and 15 km east of Western Australia's coastline. The assessment area is comprised of predominantly cleared agricultural grazed farmland with fragmented remnant and non-local treed corridors along some of the access tracks. Where vegetation is present the understorey is absent or no longer intact and these areas have been mapped as degraded and completely degraded. Only one very small vegetated area on the western boundary has been mapped as good condition (Ecoedge, 2023).

2.3 Historical *Phytophthora* Dieback Assessment

A desktop search revealed no previous Phytophthora dieback assessments within the subject lots.

An online review of the Dieback Information Delivery and Management Systems (DIDMS) database shows historic sampling records show seven samples tested positive for Phytophthora spp. in the lots to the immediate east.

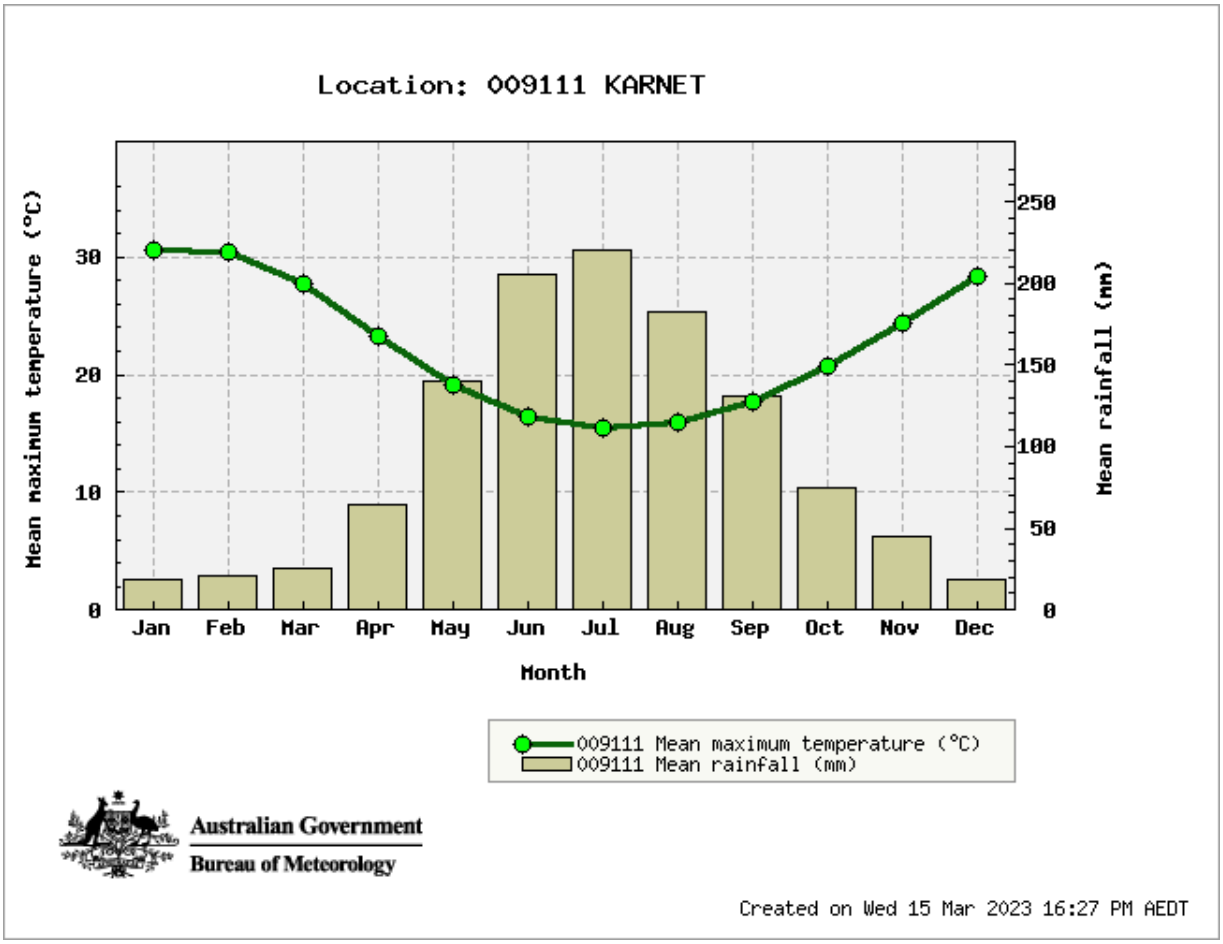
2.4 Site Disturbance

The subject area is highly disturbed from historic vegetation clearing and farming activities, including stock grazing, track development and installation of underground services.

2.5 Climate and Rainfall Data

The local climate can be described as Mediterranean with hot dry summers and cool wet winters. The mean annual rainfall recorded at Karnet weather station over the past 58 years was 1131.6 mm and the mean maximum temperature recorded for the last 57 years between 1963 to 2023 was 22.5°C. Table 1 summarises these statistics. All subject lots falls within the 'Vulnerable Zone' of the south west land division where *Phytophthora* disease can develop and thrive in rainfall isohyet zones exceeding >400 mm (DPaW, 2015).

Table 1: Climate statistics (Rainfall and Temperature) for location 009111 Karnet.



3. METHODOLOGY

3.1 Dieback Interpretation

Field Dieback interpretation followed the comprehensive methodology described in the "*Forest and Ecosystem Management Division 2015 (047), Phytophthora Dieback Interpreter's manual for lands managed by the department, Department of Parks and Wildlife, Perth, Western Australia*." (DPaW, 2015).

Presence or absence of Phytophthora cinnamomi ('the pathogen') was determined through desktop review, field observations and supporting evidence from laboratory testing of field-collected soil and plant tissue samples. Non-differential, hand-held Global Positioning System (GPS) receivers were used for navigation and to record tracks, walking trails, assessment boundaries and waypoints within the area with a nominal accuracy of 3 to 5 metres. Field data was mapped using GIS software and relevant Phytophthora Occurrence Categories were then allocated to map products (see Table 2) with consideration of the assessability of vegetated and non-vegetated areas (Table 3).

Table 2: *Phytophthora* Occurrence Categories

***Phytophthora* occurrence category**	**Description**
Infested	Determined by a qualified interpreter to have plant disease symptoms consistent with the presence of *Phytophthora cinnamomi.*
Uninfested	Determined by a qualified interpreter to be free of plant disease symptoms which indicates the presence of *P. cinnamomi.*
Uninterpretable	Where susceptible plants are absent or too few to enable the interpretation of *P. cinnamomi* presence or absence
Temporarily Uninterpretable	Areas of temporary disturbance where natural vegetation is likely to recover.
Not Yet Resolved	Areas where *P. cinnamomi* occurrence diagnosis cannot be easily made within the required timeframe because of inconsistent evidence
Excluded (shown as transparent white on maps)	Areas of long-term high disturbance where natural vegetation has been cleared and is unlikely to recover.

Table 3: Assessability of vegetated and non-vegetated areas

Vegetation Condition	*Phytophthora* occurrence category	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. Indicator Species Deaths (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 Dieback interpretation.
	Not Yet Resolved	Usually reliable indicator species in an environment not favourable to disease.	Negative sample results for all *Phytophthora* species.
Vegetation structure temporarily altered. *Phytophthora* occurrence assessment is will be possible when vegetation structure recovers. Recovery times will be variable depending on severity and type of disturbance.	Temporarily Uninterpretable	Indicator species masked by disturbance typically from fire, harvesting, temporary flooding, poisoning.	Occasional reliable indicator species, but disturbance prevents accurate placement of *Phytophthora* occurrence
Vegetation structure severely altered. Keighery disturbance rating 5 or greater i.e. Degraded or Completely Degraded. *Phytophthora* occurrence assessment is not possible. Can be determined by desktop assessment (aerial photo). Small vegetated areas can exist and may be excluded from the assessment area considering total environmental context.	Excluded (shown as transparent white on maps)	Pasture, pits, easements, infrastructure, large roads (sealed and unsealed) permanent flooding, plantations, parkland tree stands.	Sporadic reliable indicator species

3.2 Demarcation

Demarcation of Dieback boundaries was not applicable to the subject lots.

3.3 Soil and tissue samples

Soil and plant tissue samples were not applicable to the subject lots.
The absence of susceptible understorey plants and general degraded vegetation condition at this site meant sampling was not possible.

4. RESULTS

4.1 *Phytophthora* Dieback occurrence category distribution

The Excluded category applies to the entire areas within Lots 63, 62 and 200 (see Figure 1 attached and Table 4). Vegetation structure in the assessment area is severely altered, that made *Phytophthora* assessment not possible per DBCA adopted standards. The absence of suitable vegetation is shown in the site photos of Appendix A and the locations of these photos are plotted as numbered points on Figure 1.

Table 4: Area Statement – Key *Phytophthora* Occurrence Categories mapped at Keysbrook.

Occurrence category	Area (ha)
Infested	0.00
Uninfested	0.00
Uninterpretable	0.00
Excluded	631.32
Total Assessment Area:	631.32

4.2 Disease expression

No disease expression to report, due an absence of indicator plants.
Evidence of fire and drought-caused deaths was observed at this site, where some paddock trees had died a very long time ago.

4.3 Current *Phytophthora* disease impact

No disease impact to report, due to an absence of indicator plants.

4.4 Sampling strategy and results

No samples were collected because of the absence of suitable plant material. Thorough field attempts were made to detect suitable indicator plant deaths to sample based on the following strategy:

Strategy 1: Sample any observed suspicious dying or dead susceptible plants, with preference to deaths within or proximate to vectors and drainage points.

5. CONCLUSION AND RECOMMENDATIONS

A comprehensive Dieback assessment has been completed in February 2023 within adjoining Lots 63, 62 and 200 in Keysbrook. Vegetation composition and structure in the assessment area has been severely altered by historic disturbance activities. The overall absence of suitable native indicator plants necessary to enable assessment resulted in the entire subject area being mapped as Excluded. A GIS map has been prepared that shows mapped *Phytophthora* Dieback Occurrence (Figure 1). The Department of Biodiversity, Conservation and Attractions methodology for Dieback assessment notes that in areas where Keighery disturbance rating of 5 or greater occurs (i.e. Degraded or Completely Degraded areas), that assessment is not possible (DPaW, 2015).

The Dieback Management Plan / EMP tactics for disturbance activities within Lots 63, 62 and 200 should be kept very simple because there is no significant vegetation remaining at risk. Furthermore, due to the historic disturbances in the assessment area, Phytophthora disease may be present but not observable through plant symptoms at this time. If susceptible plants are used for any revegetation at this site, they could be monitored and sampled if their symptoms present as typical of Phytophthora disease.

This assessment was completed in February 2023 by Dieback Interpreter Bruno Rikli who is registered by the Department of Biodiversity, Conservation and Attractions and has over 30 years of experience in Dieback interpretation and management.

Recommendations

- The Dieback Management Plan / EMP tactics for disturbance activities within Lots 63, 62 and 200 should be kept very simple because there is no susceptible intact vegetation remaining at this site.
- The key tactic to adopt at Excluded sites is to 'arrive clean and leave clean' to avoid the introduction and/or spread of diseases and weeds within and beyond the subject area.
- Should any areas be retained for revegetation that includes plants susceptible to Phytophthora disease, it is recommended that standard Dieback hygiene protocols are included during inductions, at entry/exit points, clean-down of footwear/vehicles/equipment and the sourcing of seedlings is preferrable from a NIASA accredited nursery to minimise risk of disease introduction.
- Plants within any revegetation areas displaying disease symptoms could be sampled as soon as practicable for early detection, diagnosis and treatment using Phosphite application.

6. REFERENCES

Bureau of Meteorology. 2023. Climate statistics. Online: http://www.bom.gov.au/climate/data/.

Department of Parks and Wildlife (DPaW). 2015. Forest and Ecosystem Management Division 2015 (047), Phytophthora Dieback Interpreter's manual for lands managed by the department, Department of Parks and Wildlife, Perth, Western Australia.

Dieback Working Group (DWG). 2000. Managing Phytophthora Dieback: Guidelines for Local Government.

Keighery, B.J. 1994. Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA Inc. Nedlands, Western Australia.

Ecoedge. 2023. Unpublished Vegetation Condition Map – Keysbrook.

Please reference this report as:

BARK Environmental. 2023. Phytophthora Dieback Occurrence Report for Lots 63, 62 and 200 – Keysbrook. A report prepared for DORAL Mineral Sands Pty Ltd. March, 2023.

7. APPENDIX A – SITE PHOTOS FEBURARY 2023

Plate 1.

399310 / 6407987

Plate 2.

399140 / 6408469

Plate 3.

398815 / 6408003

Plate 4.

398353 / 6407764

Plate 5.

398042 / 6407166

Plate 6.

398035 / 6407167

Plate 7a.

397699 / 6407047

Plate 7b.

397697 / 6407051

Plate 8.

397986 / 6407712

Plate 9.

398563 / 6405254

Plate 10

398246 / 6404923

Plate 11.

398622 / 6404726

Plate 12.

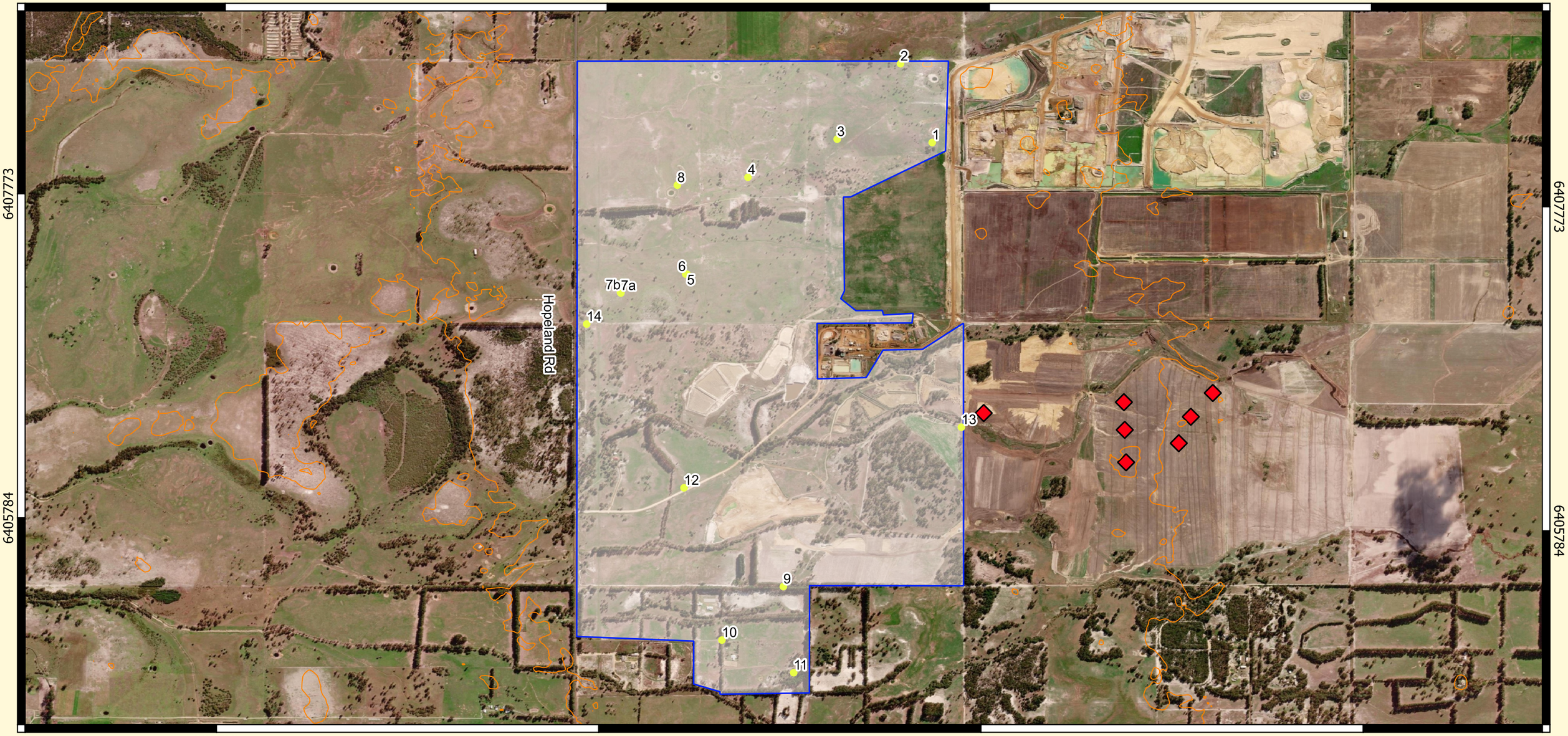
398039 / 6405855

Plate 13.

399479 / 6406241

Plate 14.

397523 / 6406855



Legend

- Assessment Area
- Excluded Area
- 10m Countours
- Photos

Samples

- DIDMS (2021)

Interpreter: B. Rikli
Assessment completion: 25/02/2023
Interpretation Method: Comprehensive

Map Validity:

Map revalidation due on 25/02/2024. This map should not be used for operational purposes for more than 1 year after assessment completion. Map may be revalidated after a re-check assessment for up to 3 years following initial assessment.

Map limitations:

Information shown on this map is positioned relative to mapped features and was captured by hand-held GPS so it may not be entirely accurate. Therefore, field demarcation should be followed.

Area Statement

Occurrence categories	Area (ha)
Infested	0.00
Uninfested	0.00
Uninterpretable	0.00
Excluded	631.32
Total	**631.32**

N

Datum: GDA 94
Projection: MGA Zone 50

0 200 400 600 800 1,000 m

Scale @ A3 1:15,000

Figure 1.

Phytophthora Occurrence Map: Doral - KeysBrook

Bark Job: BARK_8_2023

Version 1

BARK Environmental

APPENDIX 6D: WDMP

KEYSBROOK MINERAL SANDS PROJECT

DIEBACK AND WEEDS ENVIRONMENTAL MANAGEMENT PLAN, KEYSBROOK MINERAL SANDS PROJECT, MS810

DOCUMENT REFERENCE

DIEBACK AND WEEDS ENVIRONMENTAL MANAGEMENT PLAN

28-AUG-23

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DOCUMENT DETAILS

DOCUMENT ID	REPORT TITLE	DATE	PREPARED FOR
DIEBACK AND WEEDS ENVIRONMENTAL MANAGEMENT PLAN	DIEBACK AND WEEDS ENVIRONMENTAL MANAGEMENT PLAN, KEYSBROOK MINERAL SANDS PROJECT, MS810	28-Aug-23	EPA

AMENDMENT REGISTER

Date	Rev	Description of Revision	Approved
Nov 2010	1	Initial Document	MM
Jan 2011	2	Updated EMP	MM
Apr 2018	3	Updated EMP to support S45C	PG
Aug 2022	4	Updated EMP to support S45C (Lot 56)	CB
Apr 2023	5	Updated EMP to support S45C (Lot 63)	CB
Aug 2023	6	Updated EMP to support S.40AA (Western Extension)	CB

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GLOSSARY

TERM	DEFINITION
BAM ACT	*Biosecurity and Agriculture Management Act 2007*
CAR	Compliance Assessment Report
DBCA	Department of Biodiversity, Conservation and Attractions
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EMP	Environmental Management Plan
KLPL	Keysbrook Leucoxene Pty Ltd
MS	Ministerial Statement
PER	Public Environmental Review
WDMP	Weed and Dieback Management Plan

SUMMARY

This Weed and Dieback Management Plan (WDMP) has been prepared to meet Condition 9 of Ministerial Statement No. 810 for the Keysbrook Mineral Sands Mine (the Project) as indicated in Table 1. The proponent for the Project is subsidiary Keysbrook Leucoxene Proprietary Limited (KLPL), a subsidiary of Doral Mineral Sands Pty Ltd (Doral).

TABLE 1: WDMP SUMMARY

Proposal Name	Keysbrook Mineral Sands Mine
Proponent Name	Keysbrook Leucoxene Proprietary Limited
Ministerial Statement Number	MS810
Purpose of the EMP	Fulfil the requirements of Implementation Condition 9.
EPA Key Environmental Factor/s, outcome/s and objective/s	**Flora and vegetation:** • Prevent the introduction of new weed species within the Project area; • Minimise the spread of existing weeds and dieback within the Project area; • Provide control measures to progressively reduce the distribution/abundance of existing priority weed species within the Project area.
Implementation Condition Clauses	Condition 9 Condition 6.2 Condition 7.2 Condition 8.3
Key Provisions of the Plan	1. Annual weed survey to identify and record locations of declared and priority weeds within the Project area; 2. Management measures to prevent introduction and spread of weeds and dieback within Project area. 3. Provision of control measures to progressively reduce the distribution/abundance of existing priority weed species on and around the Project area.

1. CONTEXT, SCOPE AND RATIONALE

1.1. PROPOSAL

Doral Mineral Sands Pty Ltd (Doral) through its subsidiary Keysbrook Leucoxene Proprietary Limited (KLPL), operate a mineral sand mine and primary processing plant (the Project) within an area of rural land near the townships of Keysbrook and North Dandalup, 70 km south of Perth (Figure 1). The Project is within the Shire of Murray and the Shire of Serpentine-Jarrahdale.

The Keysbrook Mineral Sands Mine targets a deposit containing high grade leucoxene. Leucoxene is a fine, granular, weathered titanium mineral used as feedstock for titanium pigment plants. The surface mining operation migrates across the land, and the shallow mine void is backfilled to pre-disturbance contours and generally rehabilitated within two years of mining.

The Project is located on privately owned land, used for grazing and other rural land uses. The currently approved area of disturbance is 1,532ha, within a 3,015ha Development Envelope (Attachment 3, Figure 2 of MS810). Two additional requests under Section 45C for additional mining areas were submitted to EPA in August 2022(Lot 56) and May 2023 Lot 63. No clearing was required for the amendments. Inclusion of these two requests will result in a total disturbance area of 1,745ha. Native vegetation approved for clearing ranges in condition from good to degraded. Doral has secured 75 hectares of native vegetation in two parcels through conservation covenants as per Condition 6 MS810. The area of mining approved under MS810, provides for 9 years of mining, which commenced in October 2015.

Based on the current mining schedule, ore reserves within the approved mine area as defined in (Attachment 3, Figure 2 of MS810), are due to be exhausted in 2024. In order for the continuation of the mine and workforce, KLPL seeks a significant amendment to the approved Proposal under Section 40AA to include an additional 511.64ha of mine area located immediately to the west of the currently approved Proposal. The 'amendment area' would increase the total mine area from approximately to 2,249ha. The additional disturbance area includes 21.04ha of degraded to completely degraded native vegetation, with the remainder comprising cleared pasture and some planted non-native vegetation. Mining the amendment area will result in approximately 5.5years additional mining for the Project.

To support the request to EPA to amend the Project under Section 40AA, KLPL has updated this Weed and Dieback Management Plan (WDMP) to incorporate the amendment area and demonstrate the amendment can be managed in accordance with Condition 9 of MS810.

1.2. KEY ENVIRONMENTAL FACTOR

The key environmental factor relevant to this WDMP is Flora and Vegetation. While the majority of the approved mining area is cleared pasture, competition from weeds can impact the quality of remnant native vegetation and constitutes a threatening process in the establishment of successful rehabilitation (pasture or native vegetation). Similarly, the presence of *Phytophthora* dieback infestations in the Project area has the potential to spread the pathogen into areas of native vegetation currently unaffected by dieback.

Potential weed and dieback related risks arising from the Project are summarised in Table 2.

TABLE 2: POTENTIAL WEED AND DIEBACK PROJECT RISKS

SOURCE	ACTIVITY	POTENTIAL IMPACT	INHERENT RISK
Mining and Exploration	Clearing and grubbing.	Spread of weed species to uninfested areas.	Low
	Topsoil removal and movement.	Spread of weed species to uninfested areas. Spread of dieback to uninfested areas.	Low
	Heavy and light vehicle movements.	Introduction of new weed species.	High
		Spread of weed species to uninfested areas	Low
		Spread of dieback to offsite uninfested areas.	Low
	Ore extraction and material replacement in pit.	Spread of dieback to new areas	Low
	Material imports to site (e.g., limestone)	Introduction of new weed species	Medium
	Revegetation using seed and tube stock. Pasture re-establishment using purchased seed.	Introduction of new weed species through planting tube stock in rehabilitation areas Introduction of new weed species in purchased seed spread in rehabilitation areas	High
Natural events	Localised flooding.	Introduction of new weed species Spread of dieback	Medium

1.3. CONDITION REQUIREMENTS

The Project was assessed and approved under Part IV of the *Environmental Protection Act 1986* on 19 October 2019, with the issuing of Ministerial Statement 810. Revisions to the Project were approved via Section 46C in June 2011 and Section 45C in February 2013 and October 2019. A Section 46 amendment to extend the time limit for commencement of the Project was made in October 2014. Further requests under Section 45C (Lot 56 and Lot 63) were requested in August 2022 and May 2023.

This WDMP has been prepared to address the following Conditions in MS810.

TABLE 3: CONDITION REQUIREMENTS

CONDITION NO.	CONDITION	RELEVANT SECTION OF WDMP
9	Weed and Dieback Management	

CONDITION NO.	CONDITION	RELEVANT SECTION OF WDMP
9.1	*Prior to the commencement of operations, the proponent shall prepare and submit a Dieback and Weed Management Plan to the requirements of the CEO.*	Completed: January, 2011.
6	Protection of native vegetation	
6.1	*Prior to the commencement of clearing the proponent shall, in consultation with the DEC, ensure that a minimum of 75 hectares of native vegetation within the area cross-hatched in Figure 2 is protected in perpetuity by an instrument or instruments approved by the CEO.*	N/A
6.2	*The instrument or instruments referred to in 6.1 shall include the following:* b. *measures which have the objective of maintaining a functioning and self-sustaining vegetation community*	Section 2 Management Targets 1-4 (Table 4)
7	Protection of watercourses and wetlands	
7.1	*The proponent shall not clear vegetation or undertake mining activities:* a. *within 20 metres of the banks of watercourses shown in Figure 9 of the PER document*;	N/A
	b. *within 100 metres of the boundary of a conservation category wetland.*	N/A
7.2	*The proponent shall implement management measures (including but not limited to weed and disease control, revegetation and monitoring) in respect to the areas under 7.1 to achieve a functioning and self-sustaining vegetation community.*	Section 2 Management Targets 1-4 (Table 4)
8	Rehabilitation management plan	
8.3	*The rehabilitation management plan shall:* c. *identify measures to eradicate weeds in the revegetation areas;*	Section 2 Management Targets 1-4 (Table 4)
	d. *identify measures to use dieback un-infested topsoil and dieback resistant species in the revegetation areas*	Section 2 Management Targets 4 (Table 4)

1.4. RATIONALE AND APPROACH

1.4.1. SURVEY AND STUDY FINDINGS

WEEDS

Baseline surveys of the proposal area recorded 34 weed species, excluding pasture species (Bennett Consulting, 2004) (Appendix 1). The weed species are collectively known as environmental weeds (introduced plants that have established in a natural ecosystem and adversely contributing to a decline of natural communities).

There are a number of Declared Plants as listed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) known to occur in the Shire of Serpentine - Jarrahdale and Shire of Murray (Appendix 1). The Department of Primary Industries & Regional Development (DPIRD) (2017) has developed a Declared plant surveillance plan for the South West Land Division of Western Australia which lists 15 prioritised declared weeds for control across Western Australia (including Weeds of National Significance). Community, industry and biosecurity groups have selected another seven species as high priority surveillance targets:

- *Gomphocarpus fruticosus* (narrow leaf cotton bush)
- *Zantedeschia aethiopica* (arum lily)
- *Echium plantagineum* (Paterson's curse)
- *Solanum* species (silverleaf nightshade *S. elaeagnifolium* and apple of Sodom *S. linnaeanum*)
- *Emex australis* and *E. spinosa* (doublegee)
- *Moraea flaccida* and *M. miniata* (cape tulip)
- *Rubus laudatus* (blackberry)

These species have been selected as priority targets as they are agricultural weeds which have an adverse effect on agricultural production or systems and are likely to be found in the South West Land Division of Western Australia.

Weed surveys undertaken across the Project area and along roads bordering the project during October/November 2017 have identified three of the high priority declared plants in the vicinity of the project area (Figure 2):

- *Gomphocarpus fruticosus* (Narrow Leaf Cotton Bush);
- *Zantedeschia aethiopica* (Arum Lily);
- *Echium plantagineum* (Paterson's Curse).

Additional Flora and Vegetation surveys of the proposed amendment area was conducted by Ecoedge (2021; 2022; 2023) to support the request for amendment under S40AA. Three introduced species were identified; Cape tulip (**Moraea flaccida*), Arum Lily (**Zantedeschia aethiopica)* and Cotton Bush (**Gomphocarpus fruiticosus*) that are Declared Pest plants in Western Australia under the *Biosecurity and Agriculture Management Act 2007*.

The location of the Arum Lily is within the northeast portion of Lot 64 and is outside of the proposed disturbance area.

The location of the Cape Tulip is within the southern portion of the Proposal area within Lot 20 and Lot 211 and are outside of the proposed disturbance areas.

The location of Cotton Bush is within the southern portion of the Proposal area within Lot 62 and is within areas proposed for disturbance.

Phytophthora Dieback

A 2006 baseline survey identified *Phytophthora cinnamomi* in the Project area (Figure 3; MBS, 2006). Additional surveys undertaken in 2013 and 2016 confirmed the presence of the pathogen in an area of highly disturbed remnant vegetation (Terratree, 2013 & 2016). The cleared, grazing areas that

formed the majority of the 2013 and 2016 survey areas were determined to be unmappable (uninterpretable) given the absence of indicator species. Remnant vegetation in the area surveyed is classified as degraded, with few indicator species remaining. A 2017 Dieback risk assessment determined that these areas must be assumed to be infested and managed accordingly (Terratree, 2017). This determination can be applied to much of the project area given intensive and unrestricted livestock movement between areas of infested and excluded vegetation and periods of seasonal inundation across the lower areas. Similarly, the risk assessment concluded it is likely *P. cinnamomi* is present in the drainage lines and tributaries in the surrounding areas and hence the areas should be managed as if designated infested.

A *Phytophthora* Dieback assessment was completed by BARK Environmental (2021a; 2021b; 2023) for the amendment area. Due to historical disturbance activities, there is an overall absence of suitable native indicator plants necessary to enable assessment, which resulted in the entire subject area to being mapped as excluded. A *Phytophthora* Dieback Occurrence map is provided in Figure 3. The Department of Biodiversity, Conservation and Attractions (DBCA) methodology for Dieback Assessment notes that in areas where Keighery disturbance ratings of 5 or greater occurs, such as Degraded or Completely Degraded areas, that assessment is not possible (DPaw, 2015). The assessment concluded that the amendment poses no significant risk to flora and vegetation as there is no significant vegetation remaining to be at risk. The assessment (BARK Environmental, 2023) recommends that:

- The Dieback Management Plan / EMP tactics for the disturbance activities within the proposal area should be kept simple because there is no susceptible intact vegetation remaining at the site;
- The key tactic to adopt at Excluded sites is to 'arrive clean and leave clean' to avoid introduction and/or spread of diseases and weeds within and beyond the subject area;
- Should any areas be retained for revegetation that includes plants susceptible to *Phytophthora* disease, it is recommended that standard Dieback hygiene protocols are included during inductions, at entry/exit points, clean-down of footwear/vehicles/equipment and the sourcing of seedlings is preferrable from a NIASA accredited nursery to minimise risk of disease introduction;
- Plants within any revegetation areas displaying disease symptoms could be sampled as soon as practicable for early detection, diagnosis and treatment using Phosphite application.

1.4.2. KEY ASSUMPTIONS AND UNCERTAINTIES

The key assumptions and uncertainties with this WDMP include:

- The Flora and Vegetation surveys conducted for the Project have accurately recorded the presence of all high priority declared plants;
- Results of annual weed surveys undertaken for the Project area since commencement of mining have been relied upon;
- The cleared, grazing areas that formed the majority of the 2013 and 2016 dieback survey areas were determined to be unmappable (uninterpretable) given the absence of indicator species. A 2017 Dieback risk assessment determined that these areas must be assumed to be infested and managed accordingly (Terratree, 2017);
- The (BARK Environmental, 2023) Dieback assessment for the proposed amendment area was also determined to be excluded, given it comprises cleared pasture with no indicator species.

1.4.3. MANAGEMENT APPROACH

As the Project area is predominantly pasture used for agriculture (dairy and beef cattle), weed control is focused on Declared and Priority Plants as listed under the BAM Act given that these agricultural weeds pose the greatest risk to agricultural production.

Environmental weeds will be targeted for control within native vegetation enhancement and rehabilitation areas where monitoring identifies action is warranted.

A clean vehicle and equipment policy is implemented to minimise the potential of weed and *Phytophthora* dieback material being introduced or spread by plant and equipment.

1.4.4. RATIONALE FOR CHOICE OF PROVISIONS

An Objectives based EMP has been selected to meet MS810 Condition 9, (prepare and submit a Dieback and Weed Management Plan) to minimise introduction and spread of weeds and dieback, as far as practicable, to protect flora and vegetation values within the Project area.

2. ENVIRONMENTAL MANAGEMENT PLAN PROVISIONS

Table 4 provides a summary of the objective based EMP to meet legal requirements of Condition 9 of MS810.

TABLE 4: OBJECTIVE BASED EMP PROVISIONS

MANAGEMENT TARGETS	MANAGEMENT ACTIONS	MONITORING / PERFORMANCE INDICATOR	TIMING/ FREQUENCY OF ACTIONS	REPORTING
Management Target 1 Identify location of Declared or priority weed species at the Site.	**Management Actions 1** Annual survey of known Declared or priority weed locations to ensure appropriate control measures are planned and implemented. Information on Declared or priority weed species identified at Site to be included in site inductions to allow for identification and reporting by staff. Location data of all Declared or priority weed populations to be captured digitally. Ensure seed collected for use in rehabilitation is weed free.	Annual survey of known Declared or priority weed locations. WDMP updated as required. Location data to be updated digitally. Use accredited seed collectors and suppliers.	Annually (July–August) Ongoing Annually Ongoing	KLPL Weed Management Register KLPL Weed Management Register KLPL Weed Management Register Internal seed records
Management Target 2 Control Declared or priority weed species identified at the Site.	**Management Targets 2** Implement DPIRD recommended control measures for known Declared or priority weed populations. Inspection of areas post control to ensure control technique has been effective.	Infestations are treated annually to prevent seeding. Annual survey of known Declared or priority weed locations.	Ongoing as required. Ongoing – as required following control implementation	KLPL Weed Management Register KLPL Weed Management Register
Management Target 3 Prevent the introduction and	**Management Actions 3** Ensure all plant and equipment are clean,	Site induction includes clean on	Ongoing – as required	

MANAGEMENT TARGETS	MANAGEMENT ACTIONS	MONITORING / PERFORMANCE INDICATOR	TIMING/ FREQUENCY OF ACTIONS	REPORTING
spread of weeds by plant and equipment	inspected and certified prior to entry into KLPL area of operations. Clean on entry requirement is implemented by all personnel working within KLPL area of operations.	entry requirement and references KLPL Weed & Seed Vehicle Checklist. Entry into area of operations is controlled (clean on entry).		KLPL Weed & Seed Vehicle Checklists
Management Target 4 Prevent the introduction and spread of *Phytophthora* dieback	**Management Actions 4** All personnel entering KLPL operations are informed of *Phytophthora* Dieback risk, potential impacts and key management requirements. Ensure all heavy plant and equipment are clean, inspected and certified prior to entry/exit. Clean on entry/exit requirement is implemented by all personnel working within KLPL area of operations. Signage to be installed at dieback identified locations to inform all personnel entering site that *Phytophthora* Dieback is present. Hard stand areas and internal roads to be constructed of limestone where practicable (as its high pH suppresses *Phytophthora* Dieback).	Site induction includes pertinent information relating to *Phytophthora* Dieback its impact and management Inspections upon entry/exit to Site. Inspections upon entry/exit to Site. Ensure signage is installed. Ensure hard stand areas are constructed with limestone.	(Ongoing – as required)	Induction content Weed & Seed Vehicle Checklists Induction content

MANAGEMENT TARGETS	MANAGEMENT ACTIONS	MONITORING / PERFORMANCE INDICATOR	TIMING/ FREQUENCY OF ACTIONS	REPORTING
	Road haul trucks collecting product and delivering sand tailings are managed so not required to be certified clean on entry and exit. Identify and plan for use of plant species resistant to *Phytophthora* Dieback in rehabilitation areas.	Entry into area of operations is controlled. Loading operations isolated from site extraction and processing operations. Rehabilitation plans identify *Phytophthora* Dieback resistant species for revegetation projects.		Rehabilitation Management Plan

3. ADAPTIVE MANAGEMENT AND REVIEW OF THE EMP

This EMP applies the principles of adaptive management through monitoring, corrective actions and implementing changes. The EMP is intended to be dynamic and will be updated to reflect changes in management practices over the life of the Proposal. This will also allow flexibility to respond to new environmental impacts and adopt new technologies/management measures.

3.1. MONITORING TRIGGERS, THRESHOLDS AND CONTINGENCY

Triggers, thresholds and contingency for weeds and dieback are included in Table 5 based on the management targets and actions previously described.

If monitoring identifies a non-conformance/non-compliance with EMP targets, the incident will be assessed and corrective actions implemented. The corrective actions are aimed at preventing recurrences of the incident taking place.

TABLE 5: MONITORING TRIGGERS, THRESHOLDS AND CONTINGENCY ACTIONS

MONITORING PARAMETER	TRIGGER	CONTINGENCY ACTION
Introduction and/or spread of weeds	Weeds: An increase as a community component by 10%.	Investigate cause. Conduct additional weed spraying. Further restrict access to at risk weed areas. Review weed inspection protocols (i.e., clean on entry/exit) Monitor outcomes.
Introduction and/or spread of *Phytophthora* dieback	Presence of *Phytophthora* impact detected within areas previously absent of dieback.	Investigate cause. Qualified Dieback Interpreter to recheck specific area for Phytophthora Dieback per DBCA (2015) methodology. Further restrict access to at risk vegetation areas (dieback). Review dieback controls and management in consultation with Dieback specialist. Consider application of Phosphite with relevant environmental approvals by a Dept of Health W.A. Licensed Technician qualified to implement Dieback Treatment. Monitor outcomes.

3.2. EMP REVISIONS

This EMP will be reviewed on an annual basis during the life of the Project, or as required. The EMP review will take into account the adaptive management and continual improvement process, new or revised information relevant to weeds and dieback and/or changes to the Project.

3.3. REPORTING

This EMP will be reported annually in KLPL's Annual Compliance Assessment Report (CAR), to meet Condition 4 of MS810.

3.4. AUDITING

Doral (on behalf of KLPL) is committed to its environmental performance and has developed, implemented and continually improved its Environmental Management System (EMS) since it was established in 2001. Doral's EMS is in line with the requirements of the Australian/New Zealand Standard AS/NZS ISO 14001:1996 (ISO 14001).

Doral's EMS consists of the following key elements:

- Environmental Policy and Objectives;
- Environmental Planning;
- Implementation and Operation;
- Checking and Corrective Action;
- Management Review.

The Checking and Corrective Action component of Doral's EMS relates to the monitoring and evaluation of Doral's environmental performance and consists of the following elements:

- Monitoring and measurement;
- Non-conformance and corrective and preventive action;
- Records;
- EMS audits;
- Annual review and update of the Environmental Risk Assessment and management procedures for the Project.

Doral will achieve continuous improvement for the Project by conducting an annual review and update of the Environmental Risk Assessment, risk treatments and management plans/procedures. Any additional risks and/or alternative forms of treatment/management that result in an improved outcome for site activities will be adopted and the EMS will be updated accordingly.

4. STAKEHOLDER CONSULTATION

Commencing prior to initial approval, the Keysbrook operations has continued a program of consultation with local residents and other key stakeholders, including the Shire of Murray and the Shire of Serpentine-Jarrahdale since 2005.

The Keysbrook Community Consultation Group (CCG) was formed in 2012 as a formal means of regular information exchange with stakeholders. The CCG comprises two Shire of Murray and Shire of Serpentine Jarrahdale Councillors, two community representatives from both Shires, an independent Chairperson and two KLPL (Doral) personnel. The CCG met monthly until 2017 and continues as a quarterly schedule.

Environmental management and performance are communicated through the CCG and regulatory reporting. The regulatory reports, CCG minutes and approved environmental management plans are available on the Doral website.

Stakeholder engagement is set through a Stakeholder Interaction and Policy Procedure which provides for the program of engagement and investigation, response and closure of any community complaints.

Stakeholders who have been identified as having an interest in the environment surrounding the proposed amendment been consulted and will continue to be consulted and informed through the approvals phase. KLPL has been engaging with all stakeholders since project commencement in 2012 and startup of operations in 2015. This consultation has been in the form of regular community updates (every 6 – 12 weeks), newsletters and meetings as required for specific development or operational updates. Communications and meetings with key stakeholders specific to the proposed amendment has been undertaken subject to environmental and landholder approval.

The existing stakeholder communications database and register has been utilised for the Section 40AA amendment, including the continued documentation of stakeholders issues/ concerns raised and the outcome of the consultation.

A summary of stakeholder engagement for the Section 40AA request is outlined in the following table.

TABLE 6: STAKEHOLDER ENGAGEMENT

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
Doral owned property Lot 63 – Hopelands Road	Leaseholder receives regular site update letters, various meetings held. Extension update 4/4/23, 14/4/23, 23/8/23 and various discussions with Mine Manager	Under agreement. Doral purchased in 2022, subject to lease arrangement. Ongoing engagement. Property included in western extension.	Seek alternative grazing pasture when mining commences.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
Lot 507 Lot 1 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone conversation with family 10/07/23	Discussions ongoing in regard to extension proposal.	Amenity agreement discussion in progress, commitment to keep in informed in regard to project milestones.
Lot 508 – Elliott Road	Receives regular site update letters, various meetings held. Extension update 4/4/23, 14/4/23, 23/8/23	Under Mining Agreement, regular engagement on various matters in relation to mining agreement. Property included in western extension.	Supportive of project, timing around commencement of mining is highest concern, seeking early mining commencement.
Lot 64 – Elliott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held on 15/08/2023	Under Agreement, ongoing engagement, primary concerns are noise and dust. Property is included in extension, no mining agreement secured.	Continue to work with landholder in regard to management of these matters. Proactive actions remain being avoidance of topsoil removal in high winds, water cart usage on roads, predictive noise modelling to manage mine activities based on weather. Keep informed of timing associated with Lot 63. Continued discussion with Mine Manager on operational matters.
Doral Owned property Lot 212 – Elliott Road	Doral purchased in August 2023. Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call with tenant 22 /08/23	Doral owned, tenant under Agreement. Property included in extension.	Ongoing engagement with tenant, new lease agreement in progress.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
Doral owned property Lot 20 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 22/08/23	Under agreement. Ongoing engagement. Tenant informed of extension and timelines.	Query in regard to length of tenancy in relation to western extension, extended stay permitted subject to approvals. Commitment to keep informed.
Doral owned property Lot 211 – Hopelands Road	Ongoing engagement Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	Under Agreement. Tenanted, informed of extension and timelines.	Keep informed in regard to approval developments for Lot 63 and broader western extension.
Lot 212 – Hopelands Road	Ongoing engagement, receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting 9/06/23	Under agreement. Tenanted, various conversations with owner, receives community updates.	Keep informed in regard to approval developments for Lot 63 and broader western extension.
Lot 11 – Hopeland Road	Regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	No residence.	Keep informed in regard to approval developments for Lot 63 and broader western extension.
Lot 12 – Readheads Road 2 residences	Ongoing engagement Receives regular site update letters.	Advised had noticed water table had dropped, no other issues raised.	Advised we had community bore monitoring program and could be included on this. Will revert if any issues, will also pass on message to neighbour. Keep informed in regard to approval developments for Lot 63 and

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 16/08/23		broader western extension. Meeting to be requested in regard to amenity agreement discussion.
Lot 101/ 102 – Readheads Road	Ongoing engagement Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting 23/08/23	At meeting discussed proposed mine plan and timings. Queried if exploration had been completed on property.	Meeting in progress to provide information on exploration data. Keep informed in regard to approval developments for Lot 63 and broader western extension. Meeting to be requested in regard to amenity agreement discussion.
Lot 5 – Readheads Road	Ongoing engagement Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 16/08/23 – phone call attempt, no answer.	Deceased estate, unaware of new owner details.	In progress to ascertain new owner details. Correspondence has been sent to same address as previously.
Lot 506 – St Blaise Grove	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 16/08/23	No issues. Receives all site community update letters, issued quarterly.	Will keep informed of any developments.
Lot 3 – Hopeland Road	Receives regular site update letters.	No issues, mining not a problem in previously mined areas.	Commitment to keep informed in regard to approvals and the western extension, meeting to be requested

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Extension update 4/4/23, 14/4/23, 23/8/23 Phone conversation 14/08/23		in regard to amenity agreement discussion.
Lot 309 and 310 – Hopeland Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	No feedback received in regard to extension letters.	Keep informed in regard to approval developments for Lot 63 and broader western extension. Meeting to be requested in regard to amenity agreement discussion.
Lot 700 – Hopeland Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call and text 23 /08/23	Under agreement, house is tenanted, no issues	No concerns, commitment to provide updates when available. Will continue to keep informed.
Lot 701 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held 15/7/23 Phone call 21 /08/23	Under agreement. Ongoing engagement. Concerns raised as to proximity of mining to residence, noise and dust.	Advised same mitigation measures will be implemented and commitment to further discussion and collaborative approach when mining relocates closer to residence.
Lot 12 – Hopelands Road (2 residences)	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	Under agreement, two houses. Discussions held around western extension.	No specific concerns, advised same mitigation measures will be implemented and commitment to further discussion and collaborative approach. Continue to keep informed, will contact when

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Meeting 3/5/23 Text on 21 /08/23		available for further meeting in relation to Lot 63.
Lot 503 – Elliott Road	Phone call 25/07/23. Copy of letter dated 4/4/23 and 24/08/23 sent via email.	No issues, house not tenanted. Land managed by caretaker / farm manager, owner resides overseas, no intention to rent. Western extension letter sent to Farm Manager to forward on to owner. Farm manager advised no issues with the proposal and will seek feedback from owner.	Will keep informed of any developments.
Lot 500 – Elliott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone conversation 7/08/23	Property is Under Offer, has been on market for significant time. Various conversations around Iluka tenement. Email received from Owner on 7/10/21 providing approval to EPA for Doral to mine Lot 64. No issues in regard to current western extension.	Was not willing to sign amenity agreement whilst property remains for sale. Doral requested when property is sold, to advise who the new owners are to arrange a meeting.
Lot 20 – Elliott Road	Receives regular site update letters. Meeting 3/8/21 Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held 15/08/23, site tour on 23/08/23	Under agreement. No major issues, noted on some occasions can hear site on still nights, clearing of native vegetation.	Toured site on 23/08/23, will keep informed of any developments.
Lot 1, 2, 67 – Hopelands Road	Receives regular site update letters.	Various discussions, amenity agreement previously presented.	Environment Manager detailed mitigation and preventative measures to be implemented to address concerns raised. Advised

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
(2 residences)	Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held 23/08/23	Issues include: noise can be heard at night on occasions, dust is a significant concern and especially in regard to the race horses, clearing of native vegetation.	further meeting beneficial to run through finalised environmental plans. Advised will follow up in the new year in regard to amenity agreement. Offered site tour.
Lot 2 – Hopelands Road	Obtained details from owner of Lot 1,2,67	Meeting request in progress.	
Lot 501 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held 23/08/23	No issues, has worked with Doral (previously MZI Resources previously).	Follow up meeting in progress in regard to amenity agreement. Will keep informed of any developments.
Lot 500 – Hopelands Road		In progress to ascertain contact details.	
Lot 70 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 21/08/23	No residence Phone conversation, provided update on Lot 63 and the western extension.	Will keep informed of any developments.
Lot 71 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	No residence. Discussions have been around exploration access for neighbouring property.	Will keep informed of any developments.
Lot 56 – Westcott Road	Receives regular site update letters.	Under Agreement, ongoing engagement. Concerns raised in regard to Doral owned Lot	Continue to work with landholder in regard to lease arrangement.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Extension update 4/4/23, 14/4/23, 23/8/23 Various meetings. Phone call 23/08/23	212 and existing lease arrangement as currently leases from previous owner.	
Lot 4 – Westcott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Various meetings.	Under agreement for proposed mining for Lot 56. Ongoing engagement. Concerns raised in regard to dust and noise in regard to mining on Lot 56.	Advised same mitigation measures for current operations will be implemented and commitment to further discussion and collaborative approach. Further discussion required for amenity agreement for western extension
Residents south of Readheads Road	Contact details to be obtained and is in progress.		Intention is to have those within close proximity to be under agreement, consultation in progress.
NEAR NEIGHBOURS			
Lot 1 – Elliott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting in April 2023 with Environment Manager Phone call 14/08/23	Receives all site update letters, involved in site native revegetation program and in contact with Doral team. Dust and operational impact on water table is primary concern.	Various meetings to run through annual water monitoring data. Participates in the community bore monitoring program, bore is tested every quarter. Advised noise not an issue.
Lot 501 – Elliott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	Receives all site community update letters, issued quarterly. Primarily noise, can sometimes hear loader at night, not	Feedback noted. Aware of sites native revegetation program.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Phone call 16/08/23	constant. Concerns around clearing of native vegetation.	
Lot 508 – St Blaise Grove	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 16/08/23, received text	No issues. Receives all site community update letters, issued quarterly.	Will keep informed of any developments.
Lot 13 and 14 – Westcott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call and email, 16/08/23	No issues. Receives all site community update letters, issued quarterly. Have met previously through discussions regarding mine access to Lot 56.	Will keep informed of any developments.
Lot 54 – Westcott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone conversation 7/08/23	No issues. Receives all site community update letters, issued quarterly. Various meetings over the years. Advised mining for Lot 56 is delayed and advised plans for Western Extension.	No issues in regard to Western Extension. Advised we would keep them informed as to any plans in regard to Lot 56, which is closer to their residence than the Western Extension.
OTHER STAKEHOLDERS			
Local MP Robyn Clarke MLA	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Email: 21/08/23	No issues, supportive of Company's community funding program.	Annual meeting requested for late 2023.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
Local MP Hugh Jones MLA	Receives regular site update letters. Extension update 4/4/23, 14/4/23 23/8/23 Email: 21/08/23	No issues, supportive of Company's community funding program.	Annual meeting requested for late 2023.
CY O'Connor Research Facility	26 July 2023	Presentation to Group on western extension. Questions in regard to mine life, water allocation, rehabilitation techniques.	Advised of monthly water monitoring and reporting process and rehabilitation commitments. Offered site tour for those interested.
North Dandalup and Keysbrook Volunteer Bushfire Brigades	Annually, every October	An annual site visit by the Groups to ensure members are provided with the latest information in regard to its operations and identify and confirm the site's ability to respond to emergency situations.	Any corrective actions or suggestions will be implemented as identified.
COMMUNICATIONS			
Western Extension letter, sent to closest neighbours for western extension.	Dated 4 April 2023. Sent to 44 neighbours.	Detailed letter outlining environmental measures and operating details associated with the Western Extension.	No phone calls or feedback received on receipt of letter.
Keysbrook site updates, sent to all on community database.	Dated 14 April 2023. Sent to 85 neighbours, close and interested neighbours.	Western Extension update. Community update letters are sent approximately every 8 – 12 weeks and have been sent to nearest neighbours since 2012.	No phone calls or feedback received on receipt of letter.
Keysbrook site updates, sent to all on	Dated 23 August 2023.	Western Extension update.	No phone calls or feedback received on receipt of letter.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
community database.	Sent to 85 neighbours, close and interested neighbours.	Community update letters are sent approximately every 8 – 12 weeks and have been sent to nearest neighbours since 2012.	
Keysbrook Community Consultative Group (CCG), meeting since 2012	2 May 2023 2 August 2023 Next: 1 November 2023	Both meetings focused on the western extension and current timings, community consultation, approvals process. Queries were based on mine life, future deposits, ongoing employment and crossing of Elliott Road.	Continue to keep informed of developments, timings and any community concerns raised during the consultation period. Minutes are made available on the Doral website.
Annual Newsletter	Planned for October 2023	To include details of western extension.	

5. CHANGES TO AN EMP

A summary of changes to the EMP are summarised in the below table.

TABLE 7: CHANGES TO EMP

COMPLEXITY OF CHANGES		MINOR REVISIONS ✓	MODERATE REVISIONS	MAJOR REVISIONS
NUMBER OF KEY ENVIRONMENTAL FACTORS		One ✓	2-3	>3
DATE REVISION SUBMITTED TO EPA		Aug 2023		
PROPONENT'S OPERATIONAL REQUIREMENT TIMEFRAME FOR APPROVAL OF REVISION		<1 month	<6 months	>6 months✓
ITEM NO.	EMP SECTION NO.	EMP PAGE NO.	SUMMARY OF CHANGE	REASON FOR CHANGE
1	Section 1.1	1	Updated to include proposed S.40AA details for Amendment Area (Western Extension)	Update EMP to include proposed Amendment Area to support submission of S.40AA
2	Section 1.3	2-3	Section reworded to include proposed S.40AA details	Heading changes to be consistent with EPA EMP guidance, reworded to include proposed S.40AA.
3	Section 1.4	3-5	Inclusion of additional weed and dieback surveys for proposed S.40AA	Section updated to be consistent with EPA EMP guidance. New information included relevant to proposed Amendment Area (S.40AA).
4	Section 4	12-22	Updated Stakeholder Consultation	Updated Stakeholder Consultation required for S.40AA request
5	Section 5	23	Table of Changes to EMP	As required by EMP guidance

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FIGURE 1: SITE LOCATION

396000 399000 402000

N

0 250 500 750 1,000 1,250
Meters

6411000 6408000 6405000 6402000

Lot 2 Lot 66 DIRK BROOK Lot 54 Lot 1 DIRK RD
Lot 67 Lot 4964
Lot 1 MYARA BROOK
Lot 7 Lot 8
Offset Area Lot 202
Lot 507 Lot 508 Lot 201 Lot 56
Lot 2
WESCOTT RD Lot 5 Lot 9 Lot 11 Lot 12 BADEN RD
ELLIOTT RD
Lot 4965
Lot 20 Lot 12
Lot 1
Lot 57
Lot 64
Lot 701
Lot 700
Lot 52
Lot 50
Lot 105 Lot 101 Lot 111 Lot 105 Lot 1
PAGE RD
Lot 103 Lot 104 Lot 112 Lot 104
Lot 63
HOPELAND RD
Lot 70
Lot 6 Lot 113 Lot 103 Lot 1
Lot 62
Lot 59
Lot 300 Lot 301
ATKINS RD
Offset Area Lot202
Lot 71
Lot 20 Lot 101 Lot 506 Lot 505
Lot 100
Lot 1
Lot 5
Lot 12 Lot 102
WESTCOTT RD
ST BLAZE GR
Lot 110
READHEADS RD
MCMAHON RD
BEAU SOVEREIGN CT
JENNIE PL
SOUTH WESTERN HWY

Legend

Ministerial Statement 810
- Development Envelope
- Approved Mining Area
- Lot 202 Offset Area
- Lot 62 Offset Area

Section 40AA Request
- Proposed Development Envelope
- Proposed Mining Area

Section 45C Request
- Amendment Area

Regional Cadastre
- Regional Cadastre

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S40AA Request – Proposal Area

Scale	Datum: GDA2020	Sheet Size A3
1:30,000	Projection: MGA Zone 50	
Figure: 2-2		14/08/2023

FIGURE 2: WEED LOCATIONS

396500 397000 397500 398000 398500 399000 399500 400000 400500 401000 401500

6412000 6411500 6411000 6410500 6410000 6409500 6409000 6408500 6408000 6407500 6407000 6406500 6406000 6405500 6405000 6404500

N

0 200 400

Meters

Legend

Ministerial Statement 810

- Development Envelope
- Approved Mining Area

Section 40AA Request

- Proposed Development Envelope
- Proposed Mining Area

Section 45C Request

- Amendment Area

Declared Weeds

- Cape Tulip
- Gomphocarpus fruticosus
- Zantedeschia aethiopica

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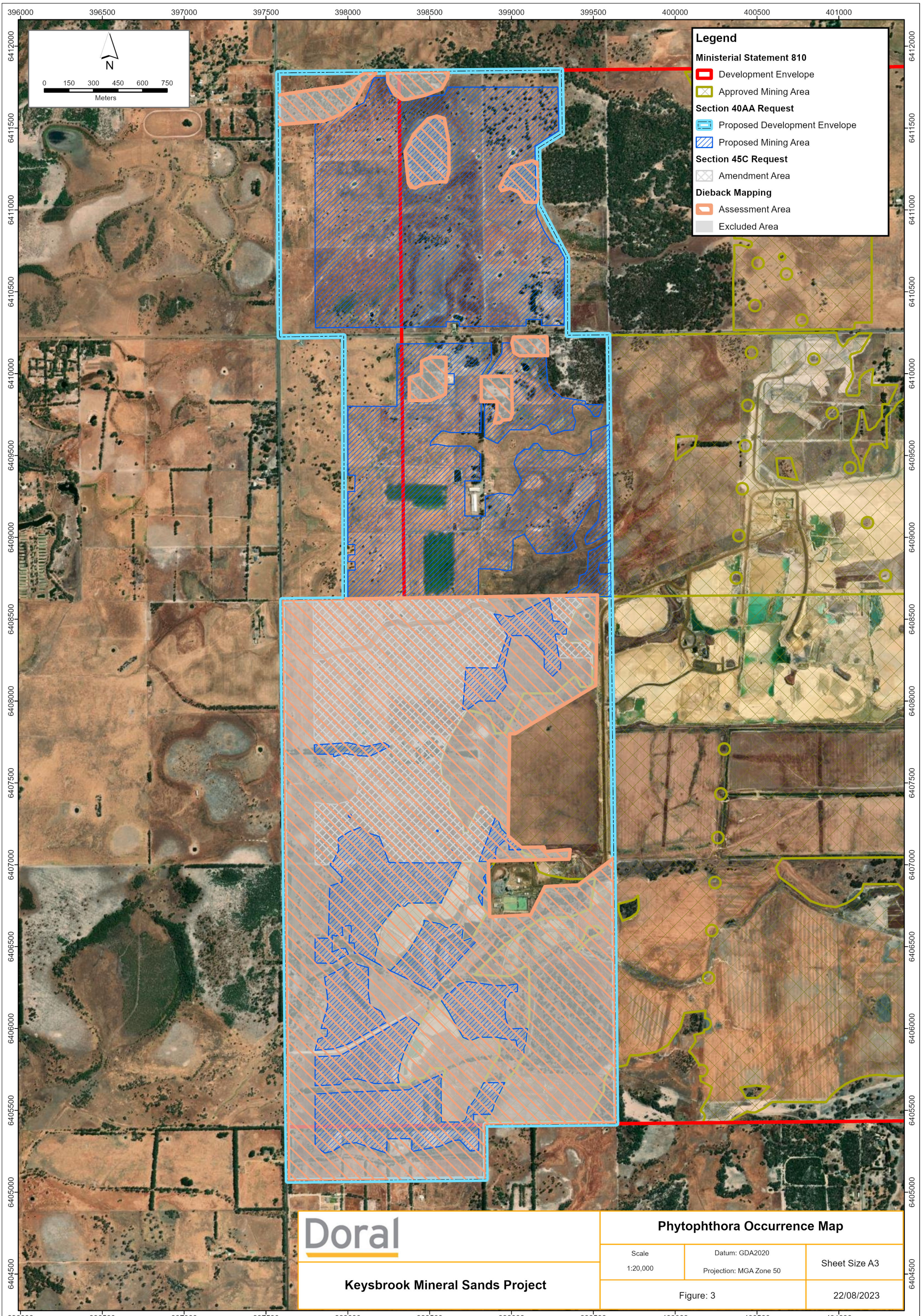
Declared Weeds

Scale	Datum: GDA2020	Sheet Size A3
1:20,000	Projection: MGA Zone 50	
Figure: 5-6		18/08/2023

FIGURE 3: DIEBACK MAPPING



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Keysbrook Mineral Sands Project

Phytophthora Occurrence Map

Scale	Datum: GDA2020	Sheet Size A3
1:20,000	Projection: MGA Zone 50	
Figure: 3		22/08/2023

APPENDIX 1: PRIORITY WEED LIST

KLPL Priority Weed List

Taxonomic Name	Common Name	Declared Weed	Weed of National Significance	Treatment Priority	Baseline Survey	Observed around project area	Not recorded to date but known to occur in the Shire	Weed Strategy Rating (1999)
Asparagus asparagoides	Bridal creeper	Yes - C3	Yes	High			√	High
Rubus spp.	Blackberry	Yes - C3	Yes	High			√	Moderate
Echium plantagineum	Paterson's curse	Yes - C3		Very High (Treat as 1st priority)		√		
Emex australis	Doublegee	Yes - C3		High			√	Low
Gomphocarpus fruticosus	Narrow leaf cotton bush	Yes - C3		Very High (Treat as 1st priority)		√		Moderate
Moraea flaccida	Narrow leaf cape tulip	Yes - C3		High			√	
Moraea miniata	2 leaf cape tulip	Yes - C3		High			√	
Silybum marianum	Variegated thistle	Yes - C3		High			√	Low
Solanum linnaeanum	Apple of Sodom	Yes - C3		High		√	√	Moderate
Zantedeschia aethiopica	Arum lily	Yes - C3		Very High (Treat as 1st priority)		√		High
Eragrostis curvula	African lovegrass			High		√		High
Leptospermum laevigatum	Victorian teatree			High	√			High
Bromus diandrus	Great brome			Medium	√			High
Citrullus lanatus	Pie Melon			Medium - treat opportunistically in rehabilitation areas		√		Low
Ehrharta calycina	Perennial veldt grass			Medium	√			High
Oenothera drummondii	Evening beach primrose			Medium		√		Moderate
Phytolacca octandra	Red inkweed			Medium – treat opportunistically		√		Mild
Ricinus communis	Castor oil plant			Medium – treat opportunistically		√		Low
Solanum nigrum	Black berry nightshade			Medium	√			Moderate
Rumex crisps	Curled dock			Medium	√			Mild
Watsonia sp.	Watsonia			Medium - treat opportunistically in rehabilitation areas		√		Moderate
Aira caryophyllea	Silvery hairgrass			Low	√			Moderate

Taxonomic Name	Common Name	Declared Weed	Weed of National Significance	Treatment Priority	Baseline Survey	Observed around project area	Not recorded to date but known to occur in the Shire	Weed Strategy Rating (1999)
Aira cupaniana	Hairgrass			Low	√			Moderate
Arctotheca calendula	Cape weed			Low	√			Moderate
Avena barbata	Bearded oat			Low	√			Moderate
Briza maxima	Blowfly grass			Low	√			Moderate
Briza minor	Shivery grass			Low	√			Moderate
Callitriche stagnalis	Common starwort			Low	√			Moderate
Carduus pycnocephalus	Slender thistle			Low	√			Moderate
Cucumis myriocarpus	Paddy melon			Low	√	√		
Cynodon dactylon				Low	√			Moderate
Cyperus tenellus	Tiny flat sedge			Low	√			Moderate
Disa bracteata	South African orchid			Low	√			Moderate
Ehrharta longiflora	Annual veldt grass			Low	√			Moderate
Hordeum leporinum	Barley grass			Low	√			Moderate
Hypochaeris glabra	Flat weed			Low	√			Moderate
Juncus bufonius	Toad rush			Low	√			Moderate
Juncus capitatus				Low	√			Moderate
Lolium rigidum	Annual ryegrass			Low	√			Moderate
Orobanche minor	Lesser broom rape			Low	√			Moderate
Parentucellia latifolia	Red Bartsia			Low	√			Moderate
Romulea rosea	Guildford grass			Low	√			High
Trifolium campestre	Hop clover			Low	√			Moderate
Ursinia anthemoides	Ursinia			Low	√			Moderate
Vulpia bromoides	Squirrels tail fescue			Low	√			Moderate
Vulpia myuros	Silver grass			Low	√			Moderate
Aira praecox	Early hairgrass			Low	√			Low

Taxonomic Name	Common Name	Declared Weed	Weed of National Significance	Treatment Priority	Baseline Survey	Observed around project area	Not recorded to date but known to occur in the Shire	Weed Strategy Rating (1999)
Bromus hordeaceus	Soft brome			Low	√			Low
Lotus suaveolens	Hairy birdsfoot trefoil			Low	√			Low
Ornithopus pinnatus	Slender serradella			Low	√			Low
Polygonum aviculare	wireweed			Low		□		Low
Trifolium hirtum	Rose clover			Low	√			Low

Weed Strategy Ratings (CALM, 1999) indicate the following:

High indicates this weed is prioritised for control and/or research
Moderate indicates control or research effort should be directed to it where possible, and it should be monitored
Low indicates that this species would require a low level of monitoring

C3 Weeds are defined as plant species declared under Section 22(2) of the BAM Act and are otherwise known as widespread or established weeds. They are categorised as C3 (management) control category under the BAM Act.

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