



Department of **Biodiversity,
Conservation and Attractions**



Phytophthora Dieback Management Manual

Version: 1

Last Updated: 1 December 2023

Approved by: Executive Director,
Conservation and Ecosystem
Management Division

Custodian: Manager, Ecosystem Health
Branch

Review date: As required

Version number	Date approved	Approved by	Brief Description
0.1	March to June 2017	N/A	Document prepared by Plant Diseases Program Coordinator, Ecosystem Health Branch
0.2	July 2017	D. Tarrant	Reviewed and updated for feedback by relevant department staff including region and district staff and operational staff
0.3	August to September 2017	Relevant department staff	Reviewed and updated with feedback received on version 0.2
1.0	September 2017	Corporate Executive	Final draft provided for consideration by Corporate Executive members
1.1	June 2020	E. O'Gara	Revisions approved by Executive Director Conservation and Ecosystem Management Division in consultation with Executive Director Regional and Fire Management Services Division
1.2	October 2020	E. O'Gara	Comments from Executive Director Biodiversity and Conservation Science incorporated

1.3	December 2023	K. Ireland I. Moore N. Ashburner T. Mennen	<p>Revised to be consistent internally and with 2022 Corporate Policy 3 updates, including amended protectable areas section.</p> <p>DHSO endorsed checkbox added to DMP form to support 2023 Auditing Procedure.</p> <p>Formatting and contacts updated and section on related documents added to match current corporate report template and other PDP documentation.</p>
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Department of **Biodiversity,
Conservation and Attractions**



Phytophthora Dieback Management Manual

Plant Diseases Program

Conservation and Ecosystem Management Division

FEM079

Plant Diseases Series

October 2020

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October 2023

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The recommended reference for this publication is:
Department of Biodiversity, Conservation and Attractions, 2020, *Phytophthora Dieback Management Manual*, Department of Biodiversity, Conservation and Attractions, Perth.

This document is available in alternative formats on request.

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1. Introduction

1.1 Overview

Phytophthora cinnamomi (dieback) is a key threatening process for the biodiversity of south-west Western Australia. Dieback refers to the disease caused by soil-borne plant pathogens from the genus *Phytophthora*. Over forty species of *Phytophthora* have been identified in Western Australia.

The microscopic plant pathogens from the genus *Phytophthora* live in soil and infested plant material and can be spread by any mechanism in which infested soil, plant material or water is moved into uninfested areas. Although *Phytophthora* can be spread by native and feral animals, in surface and subsurface water or by root to root contact, human activities have the capacity to move it further and faster than any other means of spread. Consequently, vehicles and equipment need to remain free from infested plant material and soil when working on lands managed by the Department of Biodiversity, Conservation and Attractions (DBCA) in the south-west.

1.2 Purpose

This document describes the process to complete a Dieback Risk Assessment and Management Plan form (Appendix 1) to assess and mitigate the risks of spreading dieback during planned disturbance activities or when entering lands managed by the department. While *P. cinnamomi* is the primary focus of this document, the practices and procedures that it describes will help reduce the spread of other soil-borne pathogens and weed seeds.

1.3 Context

The procedures in the document are designed to complement and augment existing department processes for planning disturbance activities and are consistent with DBCA's [Corporate Policy Statement No. 3 - Managing Phytophthora Dieback](#).

1.4 Scope

This document is to be used for all planned disturbance activities on lands managed by the department within the dieback 'vulnerable zone' of Western Australia. The 'vulnerable zone' is the geographic region in which conditions enable dieback to occur and persist. This zone includes all areas of the south-west land division, west and south of the 400mm rainfall isohyet (Appendix 2).

For this document, a disturbance activity is one in which soil has the potential to be intentionally or unintentionally disturbed and/or moved, or where dieback is likely to be transported. Disturbance activities that will always require a Dieback Management Plan (DMP) and include (but are not limited to) earthworks, road and trail construction and maintenance, building and construction works, harvesting and drilling operations.

Common activities such as bushwalking, tree marking, flora and fauna surveys, resource assessment work and driving on well-formed roads are generally low risk,

and don't require a DMP. These activities should be managed using basic dieback management (see section 3.9). Conducting any activity in wet conditions and in areas of high biodiversity value will increase the chance of spreading dieback so under these circumstances it is recommended that a risk assessment is conducted and a DMP completed if required.

Areas of land that are already managed with highly detailed plans (that include dieback specific management and operational controls) are not required to complete an additional DMP, provided the dieback management of these areas aligns with the expectations of this document. Regional management plans and individual conservation reserve management plans that specify the need for dieback management should ensure that the management is undertaken with reference to, and aligns with, the expectations of this document. The management of Kings Park would be an example of this style of management.

1.5 Audience

This document is for those planning, approving, implementing and/or overseeing a planned disturbance activity on lands managed by the department contained within the dieback 'vulnerable zone' of Western Australia (unless a DMP is not required as described in section 1.4 Scope). A summary of the relevant roles and responsibilities for managing this process are included in Appendix 3.

1.6 Document framework and supporting resources

The information in this document is structured so that sections 1-3 provide background information and understanding of dieback management, while sections 4-6 provide detailed instructions on how to complete a DMP. Further information is referred to and provided in the Appendices and the DBCA [Phytophthora Dieback](#) internet webpages. This document is intentionally brief to make it accessible to an operationally focussed audience. If further information or advice is required, please contact the Disease Hygiene Standards Officer (DHSO; dhs@dbca.wa.gov.au).

The department develops and promotes a range of resources to guide dieback management which should be read and utilised in conjunction with this manual:

- [Phytophthora Dieback Risk Assessment and Management Plan Form](#) FEM079 (2023)
- [Machinery and Vehicle Inspection Checklist Form](#) FEM080 (2019)
- Dieback Working Group Inc. – [Best Practice Guidelines for Management of Phytophthora Dieback in the Basic Raw Materials Industries](#) (2021) and [FAQs about dieback-free basic raw material](#).
- *Phytophthora Dieback Management during Bushfire Suppression*. DBCA Fire Management Services Branch FIRE SOP 103 (2020)
- [System Guidelines for Phytophthora Dieback Interpreter Registration](#) FEM068 (2023)
- [Procedure for the Auditing of Phytophthora Occurrence Assessments](#) FEM068-A (2023)

- Phytophthora Dieback Interpreters Manual for Lands Managed by the Department FEM047 (2015)
- [Corporate Policy No. 3: Management of Phytophthora Disease](#) (2022)
- Green Card training course in dieback awareness and basic management
- Dieback Management Planning course

1.7 Custodianship and management of this document

This document falls under custodianship of the Manager Ecosystem Health Branch, once it has been approved by the Deputy Director General and Director General. This document will be updated and reviewed as necessary or as new information becomes available.

Forest Management Branch is the custodian of all dieback occurrence information collected on lands managed by the department. It is a department requirement that all interpretation reports and maps be submitted to the Forest Management Branch for addition to the dataset.

Responsibility for the implementation of this manual across the department's regional operations rests with the Executive Director Regional and Fire Management Services Division.

2. Objectives of dieback management

There are two predominant dieback objectives when managing planned disturbance activities in the 'vulnerable zone', aimed at protecting uninfested landscapes. These are:

- Minimise the potential for dieback to be introduced to a site as a result of the activity; and
- Minimise the potential for further spread of dieback as a result of the activity.

3. Background

Dieback has been managed in Western Australia for over 50 years and the management principles and many of the systems developed over that time are still relevant today.

3.1 Disease Risk Areas

Areas of State Forest were proclaimed as Disease Risk Areas (DRA) in the 1970s (Figure 1). The powers relating to the establishment and regulation of DRA are in the *Conservation and Land Management Act 1984*, Forest Management Regulations 1993 and Conservation and Land Management Regulations 2002.

DRA are areas of public land that have been identified as being at risk from the impacts of dieback. Under the Forest Management Regulations, access to enter DRA is restricted and requires a written permit signed by a departmental officer. The location and extent of DRA can be found in the corporate spatial data.

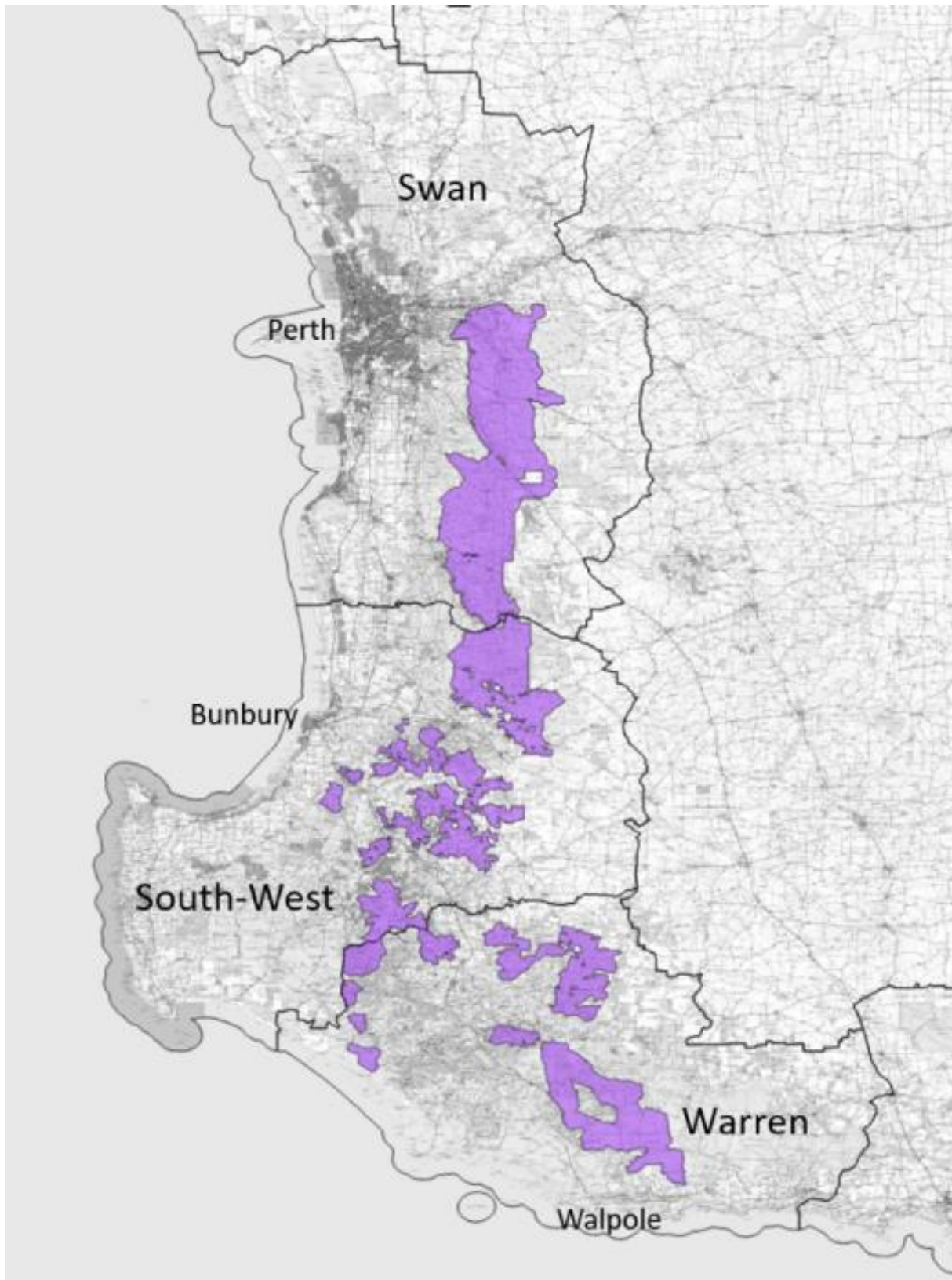


Figure 1: Map of south-west Western Australia showing Disease Risk Areas (purple shading) and boundaries of the DBCA Swan, South West and Warren Regions from corporate GIS: DBCA Operations > Disease Risk Areas.

Restricted access can also apply to lands outside of the forested area, by the creation of 'Plant Disease Management Areas' in accordance with Regulation 41(c) of the Conservation and Land Management Regulations.

3.2 Protectable areas strategy

In the late 1990s the department adopted a strategy to identify areas for protection from dieback where hygiene management rules, including clean on entry, will apply. These areas are generally free of disease but can also include areas that are uninterpretable.

Protectable areas are areas of high conservation and/or socioeconomic value (e.g. a small uninfested area which contains a known population of a susceptible species of threatened flora) within the vulnerable zone, that are:

- determined to be free of dieback by a registered Phytophthora Dieback Interpreter (Interpreter); and
- positioned in the landscape and of sufficient size (e.g. greater than four hectares with axis greater than 100 metres in forested areas) such that an Interpreter judges that *Phytophthora* will not autonomously infest it, in the short term (a period of up to several decades).

Protectable areas are generally identified through the following process:

- a registered Interpreter field truths and maps the disease occurrence to three main categories: uninfested; uninterpretable (including subcategories); and infested;
- Interpreter identifies preliminary protectable areas;
- protectable areas are then decided upon in consultation with the Regional Manager (or delegate); and
- a 'Protectable Areas Map' is produced, which incorporates the disease occurrence information for operational reference.

In the absence of dieback occurrence information, and particularly in an emergency such as a bushfire, the Regional Manager (or delegate) can declare an area protectable and deploy tactics to reduce dieback risks to that area.

3.3 Unprotectable areas

An unprotectable area is defined as a disease-free area that is likely to become infested within a given time – see the *Phytophthora Dieback Interpreter's Manual for Lands Managed by the Department* (FEM 047; PDIM). This may be a period of several decades depending on the biodiversity values and/or assets at risk of the impacts of dieback, with the decision being the responsibility of the Regional Manager (or delegate). Areas already determined to be infested may be included into the unprotectable category for dieback management purposes.

As roads, trails and tracks have the potential to introduce and/or spread dieback, a manager may decide to construct new access through infested or unprotectable areas rather than compromise protectable areas. Similarly, drainage or runoff might be preferentially directed into infested and unprotectable areas.

3.4 Phytophthora Dieback Interpreters

The department has had a dieback mapping program since the early 1980s. Interpreters are specially trained and registered by the department to detect, diagnose and map the presence of *Phytophthora cinnamomi* in the landscape based on the signs and symptoms of disease coupled with targeted sampling of soil/tissue. Interpretation procedures and standards are described in the *Phytophthora Dieback Interpreters Manual for Lands Managed by the Department* (FEM047; PDIM).

It is a departmental requirement that dieback interpretation and mapping undertaken on lands managed by the department be undertaken by a registered Interpreter. Contact details for [department and private sector registered Interpreters](#) can be found on the DBCA [Phytophthora Dieback](#) website.

3.5 The Vegetation Health Service

The department's Vegetation Health Service is a dedicated commercial *Phytophthora* diagnostic laboratory based at Kensington. Samples of soil, plant material or water can be sent to the laboratory for testing. Please refer to the [Vegetation Health Service](#) web pages for further information or contact the laboratory on (08) 9219 9587 with any sampling or testing queries.

3.6 Priority Protection Areas

Priority Protection Areas (PPA) were identified through [Project Dieback](#) (2012-2016), a project funded by State NRM, managed by South Coast Natural Resource Management Inc., in which the department was a partner. Identified PPAs should be considered when developing a DMP (Appendix 5).

PPAs were identified based on criteria that included: remnant vegetation >50ha; areas of moderate to high dieback susceptibility; uninfested or largely uninfested areas (although there are some infested PPA with high biodiversity assets); low hydrological risk sub-catchments; and areas that support threatened and priority flora and ecological communities.

3.7 Hygiene management

Dieback management focuses on hygiene practices that are critical for controlling both the introduction or spread of dieback. 'Clean on entry' (COE) is the primary principle upon which entry into protectable areas is based, and means that any person, machine and/or equipment is to be and remain free of all material that could be carrying dieback prior to entry, preventing the opportunity for dieback to be introduced and spread.

Management infrastructure (permanent and temporary) that contributes to how dieback hygiene is managed for an activity include: protectable area boundaries; gates or other barriers to control access; COE points, clean down points, and signs etc.

3.8 Dieback management (Green Card) training

The department, through Ecosystem Health Branch, provides [training in dieback awareness and management](#) (note: DBCA intranet site). Green Card training is mandatory for nominated staff who work in the field within the vulnerable zone. Contact greencard@dbca.wa.gov.au for more information.

Green Card training is also a requirement for external proponents and contractors working on approved planned disturbance activities that have been assessed as posing a 'High' or 'Moderate' risk of dieback spread. External proponents can be referred to the Dieback Working Group who offer Green Card training that is consistent with department standards.

Ecosystem Health Branch also provides Dieback Management Planning training to provide assistance and understanding of the requirements of completing the DMP. This training is recommended for all staff and external proponents who may be involved with developing or implementing DMPs on lands managed by the department.

3.9 Basic dieback management

The department expects all personnel working on lands managed by the department in the vulnerable zone will:

- have completed Green Card training;
- leave the depot with clean potential carriers (machinery, vehicles, footwear, tools);
- regard all natural areas as protectable unless known otherwise;
- plan to operate in uninfested areas prior to operating in infested areas (where relevant);
- schedule work (as far as possible) in dry soil conditions;
- avoid driving through areas where dieback could exist (i.e. low-lying areas, boggy creeks, puddles);
- carry information and equipment for minor, unplanned hygiene compliance; and
- report any observed breaches of hygiene to their line manager.

3.10 Dieback management during bushfire suppression

Bushfire suppression activities may pose a significant risk of introducing and spreading dieback, especially where they intersect with areas of moist soil, creek lines and swamps.

Phytophthora Dieback Management During Fire SOP103 can be found on the [Fire Management Services hub](#) (note: DBCA intranet site) outlining the principles of dieback management during fire suppression and specific roles and responsibilities within the incident management system to minimise the risk of dieback spread during bushfire suppression.

4. Dieback Risk Assessment and Management Plan form

The [Phytophthora Dieback Risk Assessment and Management Plan Form \(FEM079\)](#), an example of which can be found in Appendix 1, is to be used for:

- assessing the dieback risks associated with planned disturbance activities in the vulnerable zone on, or adjacent to, lands managed by the department;
- documenting how those risks will be minimised; and
- verifying that approved dieback management actions have been implemented according to the plan.

The three parts of the form, their purpose and requirements for completion are described in Table 1. The roles and responsibilities of each component of the DMP are tabled in Appendix 3.

Table 1: Dieback Risk Assessment and Management Plan (DMP) parts, purpose and requirements

Part	Purpose	Requirement
Part A	Cover page (disturbance activity decision tree, details about the activity)	A decision tree is provided to assist in determining if an activity requires a risk assessment. Complete this page in event that decision tree points to the need for risk assessment and: DMP not required as risk 'Low' (attach and file with completed risk assessment); or DMP required as risk 'Moderate' or 'High' (attach and file with completed risk assessment, DMP and dieback management map).
Part B	Risk assessment	A proponent may choose not to conduct a risk assessment and go directly to Part C only if the risk is already known to be 'High'.
Part C	Dieback Management Plan (DMP)	Part C of the form is not required where the risk has been assessed as 'Low'. Where the risk has been assessed as 'Low' the proponent can proceed with the activity using basic dieback management (see section 3.8). If the risk is 'Moderate' or 'High' complete Part C. For reporting and auditing purposes assign a unique DMP number which is to be allocated by the district completing the DMP using: 'District-Activity No.-Year-location' e.g. BWD-001-2017-park/reserve description.

5. Risk assessment (Part B)

A proponent may choose not to conduct a risk assessment and go directly to Part C only if the risk is already known to be 'High'.

5.1 Step 1: Forecast the MOISTURE conditions during the activity

Higher moisture during a disturbance activity will increase the likelihood that soil will stick to carriers, and that the pathogen will become established if it is introduced to an uninfested area.

The first step in the risk assessment process is to determine the likely moisture conditions the activity will be done in:

- Dry – where dust forms when exposed soil is disturbed
- Moist – where soil is damp but does not stick to carriers
- Wet – where soil and moisture combine so that soil sticks to carriers

If during a disturbance activity the soil moisture becomes higher than what has been forecast, the DMP should be reviewed to confirm that all management actions remain appropriate (as the risk rating of the activity is likely to increase with additional moisture).

5.2 Step 2: Determine the LIKELIHOOD of introducing or spreading dieback

The likelihood of introducing or spreading dieback is significantly influenced by the type, scale and extent of an activity, and whether any material that contains dieback will be imported to or around the site.

Disturbance type

The disturbance type (refer to Table 2 for examples) influences the likelihood of dieback introduction or spread as the physical action involved will influence how far and how much soil will be moved as a result of an activity.

Table 2: Disturbance types with examples

Disturbance type	Examples
Heavy earth moving, tracked vehicles	Ripping, ploughing, trenching, excavating
Soil disturbance over a distance	Dragging, grading, snigging
Soil disturbance at single points	Drilling or boring at a discrete spot; installing a fence, gate or sign
Rubber tyred vehicle, bicycle	Any rubber tyred vehicle on- or off-road
Human, animal traffic	Bushwalking, horse-riding

Importing raw material

Raw material refers to any material in which *Phytophthora* can survive and be transported in a viable form. Raw material includes but is not restricted to: Basic Raw Materials (BRM), soil, mulch, vegetative material and/or seedlings for revegetation.

Access

Any access to a site provides the opportunity to introduce dieback, and the more frequent the access the higher the probability. Frequent and repeated access dislodges leaf litter exposing the soil, which increases the chances that soil will be picked up by tracked machinery, tyres or footwear and inadvertently moved.

Complexity of activity

The likelihood of introducing or spreading dieback generally increases as the complexity of an activity increases, as complex activities are more difficult to manage than non-complex activities. If it is not possible to reduce the complexity of an activity, sound planning, effective communication and adequate training of all involved personnel will reduce the likelihood of spreading or introducing dieback.

A highly complex activity may include a range of operations, have multiple operational and dieback boundaries and have multiple proponents. A non-complex activity might involve only a single proponent, operating within a single management boundary.

Extent of activity

As the extent of the proposed disturbance activity increases so does the likelihood of introducing or spreading dieback. Extent relates to the geographic area covered by an activity. Mini-catchments (the catchment area of a first order stream) are used to define areas of extent because this is usually the unit of area impacted when dieback is introduced into an area.

When managing an activity with a significant extent, it is possible for certain areas within the activity to have different risk ratings. In this scenario, consideration can be given to dividing the activity into separate management units, managing each section according to the assessed risk rating. Appendix 6 provides direction on when best to divide an extensive operation into separate management units, for dry and wet soil operations.

Duration of activity

A disturbance activity with an extended duration will likely increase the risk of dieback spread. Appendix 7 provides options on how to reduce dieback risk for activities with an extended duration.

Drainage

The risk of spreading dieback increases as the amount of water at the site increases. Water might be intentionally brought to site for operational purposes (e.g. for a road-grading operation) or unintentionally brought to site or concentrated at the site through changes to natural drainage resulting from the disturbance activity. See Appendix 8 for options to reduce dieback risk associated with drainage.

Unmanaged access

A disturbance activity may result in unmanaged access to a site being made easier (e.g. illegal firewood collection following a timber harvesting operation). Unmanaged access will increase the likelihood of spreading dieback.

5.3 Step 3: Determine the CONSEQUENCE of introducing or spreading dieback

The possible consequence of introducing or spreading dieback due to a disturbance activity is determined by considering the:

- area put at risk;
- predicted disease impact at the site; and
- biodiversity values and sensitive areas at risk.

Area put at risk

To establish the area put at risk:

- establish location, extent and topographical position of activity;
- define landscape unit boundaries; and
- overlay all available dieback occurrence information (e.g. corporate data, Dieback Information Delivery System (DIDMS)).

To determine what area has the potential to become infested by the activity:

- calculate the estimated protectable area downslope of the activity to which the landscape unit extends (note that it may be necessary to consider areas outside the immediate landscape unit if the activity has the potential to infest these areas).

When no dieback occurrence information is available presume all areas downslope of the activity (including the activity) is protectable and that the activity has the potential to infest the entire area. This will give by default the highest consequence rating, which could be reduced by obtaining any form of dieback occurrence information.

Predicted impact

The impact of dieback at a site can be predicted according to the vegetation type. The Interpreters Manual provides dieback predicted impact ratings for vegetation types in:

- northern jarrah forest based on Havel vegetation types;
- jarrah forest of the Blackwood Plateau (sunkland) based on McCutcheon soil and vegetation types; and
- southern jarrah forest based on Strelein vegetation types.

An Interpreter, or local flora conservation officer, may be required to assist with predicting dieback impact for areas outside the vegetation types above, in the absence of available corporate data. Table 3 provides a general guide to assessing impact based on the process used by Interpreters.

Table 3: Predicted dieback impact rating and associated consequence rating

Dieback impact rating	Description of dieback impact <i>(max. impact 50 years after <u>Phytophthora</u> introduced)</i>	Associated consequence rating
Very High	>50% overstorey will die	Severe
High	10% to 50% of overstorey will die	Significant
Moderate	<10% of overstorey and high numbers of understorey will die	Intermediate
Low	No overstorey and minimal understorey will die	Minor

Biodiversity values and sensitive areas at risk

Biodiversity values and sensitive areas at risk refer to flora, fauna, critical habitat and/or threatened ecological communities that need to be considered because they are at risk of extinction, are rare, or otherwise in need of special protection. Dieback is a key threatening process for many values. If these values occur in or nearby the area of the activity, advice should be sought from Regional or District nature conservation staff (See Appendix 9 for relevant corporate and external data sets).

5.4 Step 4: Determine the overall dieback RISK rating

A series of tables (Table 4) is used to combine the likelihood rating, the moisture condition and the possible consequence to determine an overall dieback risk rating for the disturbance activity by:

- selecting the table corresponding with the MOISTURE conditions (Step 1);
- identifying the overall dieback RISK rating as the intersection of the LIKELIHOOD rating (Step 2) and the CONSEQUENCE rating (Step 3).

Table 4: Series of risk assessment tables (identified by soil MOISTURE) used to determine the overall dieback risk of an activity

DRY SOIL		CONSEQUENCE				
LIKELIHOOD	Disturbance examples	Insignificant	Minor	Intermediate	Significant	Severe
Very likely	Tracked machines ripping, pushing soil	Low	Moderate	High	High	High
Likely	Snigging/light surface skim over distance	Low	Moderate	Moderate	High	High
Possible	Installing posts, exploration drilling	Low	Low	Moderate	Moderate	High
Unlikely	Driving with rubber tyres	Low	Low	Low	Moderate	Moderate
Very Unlikely	Walking	Low	Low	Low	Low	Low

MOIST SOIL		CONSEQUENCE				
LIKELIHOOD	Disturbance examples	Insignificant	Minor	Intermediate	Significant	Severe
Very likely	Tracked machines ripping, pushing soil	Low	High	High	High	High
Likely	Snigging/light surface skim over distance	Low	Moderate	High	High	High
Possible	Installing posts, exploration drilling	Low	Moderate	Moderate	High	High
Unlikely	Driving with rubber tyres	Low	Low	Low	Moderate	High
Very Unlikely	Walking	Low	Low	Low	Moderate	Moderate

WET SOIL		CONSEQUENCE				
LIKELIHOOD	Disturbance examples	Insignificant	Minor	Insignificant	Significant	Severe
Very likely	Tracked machines ripping, pushing soil	Low	High	High	High	High
Likely	Snigging/light surface skim over distance	Low	High	High	High	High
Possible	Installing posts, exploration drilling	Low	Moderate	High	High	High
Unlikely	Driving with rubber tyres	Low	Moderate	Moderate	High	High
Very Unlikely	Walking	Low	Low	Low	Moderate	Moderate

5.5 Step 5: Can the RISK be reduced by altering the parameters of the activity?

If the risk rating is 'High' consideration should be given to:

- Cancelling the activity which avoids the risk; or
- Postponing until conditions are dry for activities scheduled during moist or wet conditions.

If cancelling or postponing the activity is not possible it is recommended that the activity be re-assessed to determine if the risk can be reduced by altering some of the parameters of the activity. For example, tyred machinery generally causes less soil disturbance and are easier to clean, compared to tracked machines which cause more damage and pick up soil in the cleats which is hard to remove. Refer to the appendices for further guidance on reducing risk associated with an activity.

5.6 Step 6: Determine requirements based on the RISK rating

The higher the RISK rating the more stringent the conditions placed on proceeding with the disturbance activity. For disturbance activities that pose a 'High' or 'Moderate' dieback risk, Part C of the plan must be completed. If the risk is assessed as 'Low' Part C is not required to be completed and the activity can proceed using basic dieback management (section 3.8).

5.7 Step 7: Risk assessment sign-off

Risk assessment sign-off is required by the person conducting the risk assessment and should be checked and signed-off by the Regional Manager (or delegate).

6. Dieback Management Plan (Part C)

This section provides guidance for determining relevant management actions for activities that pose a 'High' or 'Moderate' risk.

6.1 Step 1: Dieback occurrence information

The risk rating of the activity will determine the type of dieback occurrence information needed to develop the DMP.

There are two categories of dieback occurrence information:

- Valid comprehensive
- Conditional

Valid comprehensive

Valid comprehensive information has a high confidence of accuracy and must be used when the risk of the activity is 'High'. In the first instance check with the relevant Region/District and/or corporate data, followed by Forest Management Branch to determine if valid (less than 12 months old) occurrence information already exists for the site of the disturbance activity.

Comprehensive information is generally the result of field work, collection of soil and/or plant tissue samples for laboratory analysis for the presence of dieback, and ultimately the preparation of a report and a map. When required, it is important that the proponent of the disturbance activity engages an Interpreter early in the planning process so that there is sufficient time for a comprehensive assessment to be completed and endorsed by the DHSO as per the [Procedure for the Auditing of Phytophthora Occurrence Assessments](#) (FEM068-A; Auditing Procedure).

Conditional

Conditional information may originate from comprehensive information but the accuracy is compromised because it is no longer valid (i.e. it is expired as it is more than 12 months old, or equivalent information was obtained in consultation with the DHSO). Mapped dieback boundaries will become less accurate over time, therefore mapping 'expires' after 12 months. In most landscapes, the longer the period since the mapping was undertaken the less reliable the information becomes to inform management boundaries (although high confidence infested areas will always remain infested).

Appendix 11 lists the various types of conditional dieback occurrence information available, and how it can be accessed (note time limitations on use of conditional information in Table 5). Conditional information should not be used where the dieback risk is 'High' but can be used to manage 'Moderate' dieback risk activities. Corporate data should be labelled to show the assessment year. Proponents may contact the Interpreter who produced the data or the DHSO regarding the currency of the existing dieback occurrence information where this is not clear or there are any outstanding questions.

The older the dieback occurrence information the greater the chance that areas originally mapped as uninfested have since become infested. Consequently, there is a point at which conditional information is considered obsolete (i.e. it can no longer be used for the management of dieback risks associated with disturbance activities).

The threshold set for conditional information becoming obsolete depends on the rainfall of the area in question (Table 5). In areas of high rainfall (average annual rainfall greater than 800mm) conditions favourable to *Phytophthora* spread and establishment are more prevalent than they are in lower rainfall areas. Permanently uninterpretable and excluded category boundaries will likely remain fixed except in some exceptional circumstances.

Table 5: Point at which conditional dieback occurrence information becomes obsolete according to average annual rainfall of the area.

Rainfall zone	Uninfested areas	Infested and uninterpretable areas
>800mm	5 years	never
600-800mm	10 years	never
400-600mm	15 years	never

Dieback management map

A dieback management map is an essential component of a DMP and is always required where the risk rating of a disturbance activity is 'High' or 'Moderate'.

A dieback management map should include:

- the location of the proposed activity;
- dieback occurrence information;
- protectable areas;
- access routes; and
- the location of any dieback management infrastructure and points (such as signs, gates, road closures, clean down points, drainage points or management points).

All operational staff/contractors involved in the disturbance activity should have access to a copy of the dieback management map to ensure that the risk mitigation tactics are effectively and consistently deployed.

6.2 Step 2: Dieback Management Plan meeting

The objective of a DMP meeting is to bring all the relevant stakeholders together to:

- discuss the dieback risks of the disturbance activity;
- discuss the dieback status of the site;
- maximise the protectable area;
- determine the most appropriate risk management tactics to reduce the risk; and
- compile the final DMP and dieback management map.

The DMP meeting will usually be convened by the supervising officer who will involve the other stakeholders including the Interpreter, proponent and any other relevant department staff.

6.3 Step 3: Risk management tactics

The number of risk management tactics typically increases as the risk rating increases, so higher risk activities will normally require more risk management tactics compared to lower risk activities. Appendix 12 outlines options for reducing the risks associated with various types of disturbance.

Scheduling activities

Scheduling activities to commence work with clean machinery/equipment in protectable or uninfested/uninterpretable areas before moving to infested areas can reduce the dieback risk of an activity. Once carriers have moved into an infested area, they ideally should not be moved back to the protectable or uninfested/uninterpretable area. This tactic will significantly reduce the amount of in-field hygiene that is required.

Consider scheduling work in:

- protectable before unprotectable;
- uninfested before infested or uninterpretable; and
- upslope before downslope.

Hygiene

Hygiene is a series of practices that help prevent disease spread, especially through cleanliness. It is the first line of defence against the spread of dieback because the pathogen can survive in BRM, soil, mulch, vegetative material and water. Sound hygiene practices will also potentially reduce the spread of other soil-borne pathogens, pests and weeds.

Clean down

Clean down is the practice of physically removing any material that could be carrying dieback from a 'carrier' (e.g. machinery, vehicles, footwear, tools). There are two main types of clean down; wet and dry. Wet clean down, such as the high pressure washing of a machine or vehicle, is typically the quickest and easiest way to remove unwanted material. However, there will be occasions when wet clean down might increase the dieback risk by adding water to an otherwise dry situation. In such circumstances dry clean down may be more appropriate. Appendix 13 provides a summary of the methods for different types of clean down.

Clean down point

A clean down point refers to a designated area where wet or dry clean down is undertaken. Clean down points will often be associated with COEs in the field but they may also occur independent of COEs, for example at a commercial car wash or a washdown facility at a depot or district office. Elements of a standard clean down point are included in Appendix 14.

Clean on Entry

Clean on Entry (COE) refers to the requirement that carriers are clean before entering native vegetation in the dieback vulnerable zone, as all areas should be treated as protectable unless there is evidence to the contrary. COE is systematically deployed in managing the dieback risk of disturbance activities where COE points: are established at the entrance to protectable or uninfested/uninterpretable areas and marked with a signpost; sequentially numbered and recorded in the DMP; and are marked on the dieback management map.

COE is most easily achieved when activities are scheduled for dry soil conditions. In establishing COE points, provision must be made for carriers that do not meet the hygiene standard to exit safely without encroaching on surrounding vegetation (Appendix 15 outlines the standards required for COE points), options include:

- a turnaround;
- an intersection where a carrier can turn safely;
- the facility to bypass the COE and continue along the road; or
- the establishment of a 'management point' prior to the COE where the decision is made on whether you can comply with COE or not.

If records of COE are required the [Machinery and Vehicle Inspection Checklist form](#) (FEM080), an example of which can be found at Appendix 16, can be used to provide a written record of carrier inspection, and any remedial actions needed to meet the department's hygiene standards.

In addition, the following tactics may be utilised:

- ensuring the vehicle, equipment and boots are clean before departing to the site (it is much harder to clean down effectively in the field);
- transport clean machine to the COE point on low-loaders;
- planning to operate in uninfested sites before proceeding to infested sites;
- avoiding driving through areas where dieback could exist e.g. unsealed roads, low-lying areas, boggy creeks, puddles; and
- ensuring the vehicle is equipped with a portable hygiene kit (clean water, small brush, broom, spray bottle with 70% methylated spirit (to spray on cleaned footwear) and garbage bags to remove contaminated soil for use when accessing sensitive high-risk sites on foot).

Clean on Exit

Clean on Exit refers to the requirement that carriers are clean before leaving known infested areas, or areas with a high probability of being infested such as low-lying or water gaining sites. As it is difficult to clean down properly in the field especially under muddy conditions, try to remove as much of the mud as possible and if necessary, go directly to a designated clean down point to clean the carrier properly without accessing uninfested or protectable areas en route.

Management point

A management point is a point before or at the site of the activity where some decision or action needs to be taken to manage dieback risk. If an activity has

management points the DMP must clearly describe the decision or action. Where the action or decision relates to the hygiene of a carrier, there must be an associated capacity to turn the carrier around or otherwise bypass the management point in the event that the hygiene standard is not met.

Disinfection

Disinfection refers to the use of a chemical disinfectant to kill *Phytophthora*. Disinfection of machinery, vehicles, tools and footwear will only be effective after complete removal of soil. Disinfection will not be effective when used in isolation and should only be used in conjunction with other hygiene management tactics. Appendix 17 provides suggested application and the recommended application rates for a range of disinfectants that are effective against *Phytophthora*.

Managing access

Effective management of access will significantly reduce the dieback risk associated with an activity. The location of a road, track or trail will determine the ability to manage the dieback risk to that area (e.g. a road located high in the landscape can put all downslope areas at risk). Unmanaged access may increase the likelihood of spreading dieback. The lowest risk option is to control access to uninfested sites, or sites for which the disease status is unknown (protectable areas). For example, access to Disease Risk Areas requires a permit issued by the District with specified conditions to limit the risk of introducing dieback.

Options to reduce risk through careful selection of access routes, restricting access, and considerations for construction and maintenance of access are provided in Appendix 18.

Roading

Roads (meaning roads, tracks, trails and easements) can be a potential source of dieback. The department manages over 34,000 kilometres of roads and tracks across the state, with varying levels of construction, maintenance and use.

When managing roads, the dieback status of adjacent vegetation must also be considered. In managing the potential spread of dieback from roads (into adjacent vegetation) the following classifications are used

- Infested – road is known to be infested with dieback
- Uninfested – road is known to be free from dieback
- Unknown – unable to determine the dieback status of the road

Generally, the running surface of roads are uninterpretable because they are devoid of vegetation. However, in some circumstances there may be evidence that a road is infested or uninfested based on the adjoining vegetation.

Where there is evidence that a road is infested and particularly where the road runs through an infested area (as determined by an Interpreter) there are no dieback management requirements for the use, maintenance or upgrade of the road.

Where there is evidence that a road is uninfested (e.g. the vegetation adjacent is interpreted as uninfested, including in downslope areas), dieback risk will be

managed through the risk assessment, DMP, tactic implementation and monitoring process.

Closing roads to minimise human access to protectable areas is one of the most effective ways of reducing dieback risk. Roads may be closed temporarily (e.g. seasonally, when conditions are wet and the likelihood of dieback spread is greatest) or permanently. Strict COE and No Soil Movement will be applied to all access. Any maintenance or upgrade of the road will be managed as if this was a new road construction.

A road that is unknown (i.e. has not been assessed by an Interpreter) or has been assessed as uninterpretable by an Interpreter, with protectable areas adjacent, will be managed to prevent dieback spread to adjacent vegetation. Key aspects of management are the use of uninfested raw material, ensuring drainage from the road surface does not put adjacent vegetation at risk and using COE when entering adjacent vegetation from the road. If the proposed road use does not differ from existing use, basic dieback management principles for access are required, in particular ensuring that carriers are clean and avoiding wet and boggy conditions.

Appendix 19 provides guidance on the management of roads relative to the dieback status of the road. Appendix 20 provides details on some of the techniques used for closing roads to minimise the risk of spreading dieback.

Management of the overall access route(s) to a proposed disturbance site should also be considered as part of the DMP or as a separate consideration using Appendix 19. For example, some road uses (such as timber haulage and car rallies) can significantly raise the dieback risk on unsealed roads due to breaking up the road surface enabling vehicles to pick-up and transport soil. Where there is a likelihood of this occurring a DMP should be developed and implemented to mitigate the dieback risk.

No Soil Movement

No Soil Movement (NSM) refers to activities where soil movement must not occur. NSM can generally be achieved in dry conditions but not in wet conditions. It is an appropriate requirement for activities such as walking, driving (rubber tyred vehicles only), spraying, scrub rolling or slashing vegetation (as long it does not expose or move mineral earth). A NSM requirement on roads is indicated on management maps using a COE with a yellow background where NSM starts (a point where traffic can turnaround or be redirected) and with yellow diamonds shown on the road alignment.

There are some activities for which NSM is impossible to achieve regardless of the moisture conditions, for example heavy earth moving. When NSM conditions are a requirement of a DMP, soil must not be moved regardless of the moisture conditions at the site (i.e. even during dry conditions).

Importing raw materials

The risk of introducing or spreading dieback when using raw materials (e.g. to construct roads or rehabilitate areas) can be eliminated by finding a way to do the activity without introducing raw materials to the site. Raw materials (soil, sand, mulch, seedlings) can also be carriers of other pathogens such as *Armillaria*, marri and banksia cankers, and weeds.

However, if required, options to lower the likelihood of introducing or spreading dieback as a result of importing raw materials to a site are presented in Appendix 21

For revegetation of high conservation sites with seedlings consider testing of the seedlings prior to purchase.

Sourcing 'uninfested' Basic Raw Materials

Identifying and developing an 'uninfested' BRM source requires substantial planning and management. 'Uninfested' BRM that meets departmental standards needs to be sourced from a site that has been:

- assessed as uninfested by an Interpreter; and
- managed and monitored according to an ongoing pit management plan.

Appendix 22 provides guidance on the use of BRM on sites with different disease categories. Additional information can be drawn from the Dieback Working Group's [Best Practice Guidelines for Management of Phytophthora Dieback in the Basic Raw Materials Industries](#) (2021) and related [FAQs](#).

'Green bridges'

Under particular circumstances, access into and around a disturbance activity may be improved by the construction of a 'green bridge'. A 'green bridge' is created when a section of road is constructed using dieback free material placed over dieback infested or uninterpretable soil, resulting in a road surface that is free from dieback. Appendix 23 provides further information on the use of green bridges.

Split-phase activities

Conducting a disturbance activity in split-phase (see Appendix 24) refers to confining parts of the activity to certain dieback categories to minimise the:

- frequency that machines, vehicles or personnel cross the boundary between the dieback categories; and
- the amount of field hygiene that must be conducted.

6.4 Step 4: Dieback management map checklist

The dieback management map is the document that will be consulted most frequently by those implementing the plan on the ground. The checklist is to ensure that all the tactics in the DMP, deemed necessary to mitigate the dieback risk of the activity, are reflected on the map.

6.5 Step 5: Proponent sign-off

In the event that the disturbance activity is being undertaken by an external proponent, it is important that they understand their obligations and agree to the risk mitigation tactics in the DMP.

6.6 Step 6: Dieback Management Plan approval

It is the responsibility of the Regional Manager (or delegate) to approve the Dieback Management Plan, including confirming the risk rating assessment and that the range of management actions will effectively manage the disturbance activity.

6.7 Step 7: Dieback Management Plan close-out

Close-out of the plan is the responsibility of the supervising officer or proponent, who needs to be satisfied that all tactics were implemented as approved and that any corrective actions have been completed.

6.8 Step 8: Dieback Management Plan sign-off

Sign-off of the plan is the responsibility of the Regional Manager (or delegate). The signatory needs to be satisfied that the plan has been implemented and closed-out as approved.

6.9 Step 9: Document management checklist

Once the plan has been signed off, all associated documents are to be filed in the appropriate locations as per the instructions on the template.

7. Appendices

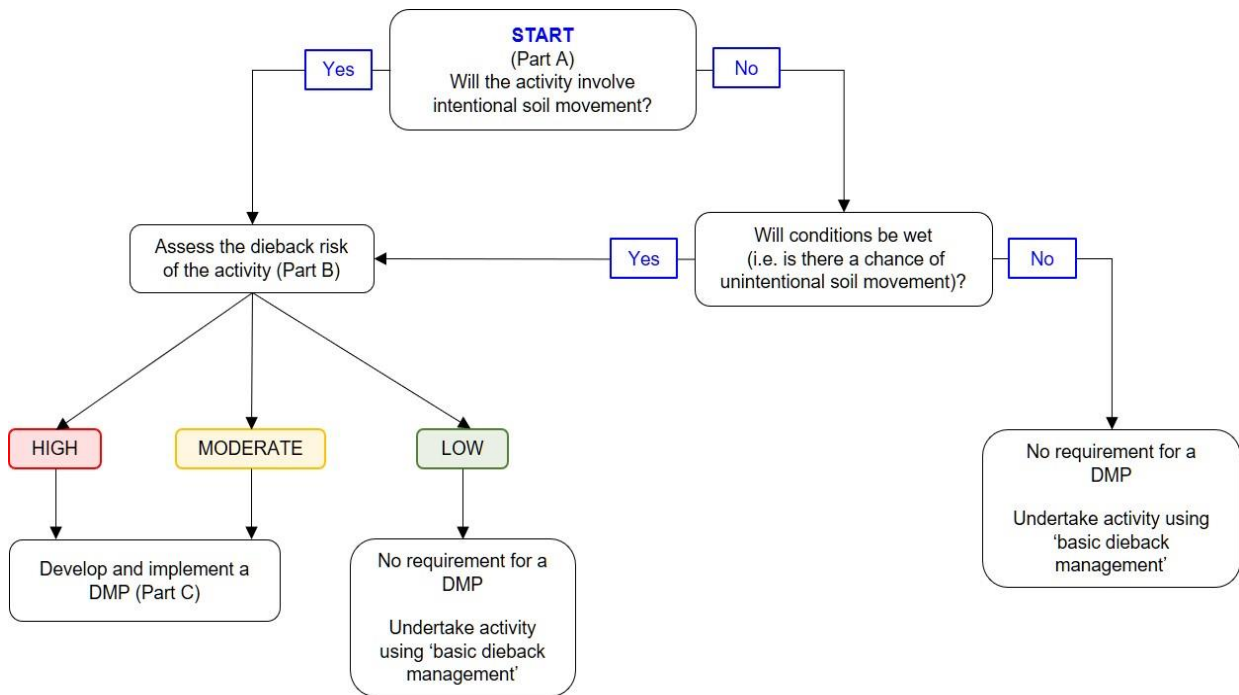
Appendix 1 Dieback Risk Assessment and Management Plan form

Dieback management form (FEM079) templates may be updated from time to time. Current forms are available from the DBCA [Phytophthora Dieback Managing Dieback Risk Associated with Disturbance Activities](#) web page.

A sample form follows here for information.

PART A: DISTURBANCE ACTIVITY (SAMPLE ONLY)

The decision tree below will help determine if the activity constitutes a disturbance and requires a risk assessment (Part B), and the risk assessment will determine if a DMP is required (Part C).



Details of disturbance activity

Region/District of activity:		Date of activity: <i>(give date range if a prolonged activity)</i>	
Location of site of activity: <i>(Forest Block, Reserve or coordinates)</i>		Disease Risk Area: <i>(yes or no)</i>	
Vegetation type/complex:			
Description of the activity: <i>(timber harvesting, road upgrade etc.)</i>			
Proponent of the activity: <i>(DBCA, FPC, MRWA, Water Corp. etc.)</i>			
Departmental objective for dieback management:	To minimise the potential for the introduction or spread of dieback associated with planned disturbance activities.		

Indicate what parts of the form have been completed for the activity described above:

Part	Purpose	Requirement	Tick parts completed
B	Risk Assessment	To be completed if decision tree in Part A indicates that intentional or unintentional soil movement will occur during the activity.	
C	DMP	To be completed if risk is assessed in Part B to be 'High' or 'Moderate'	
		Dieback Management Plan No. <i>Allocated by District</i>	

PART B: RISK ASSESSMENT

Step 1: MOISTURE conditions

Higher moisture during a disturbance activity increases the likelihood that soil will stick to a carrier (e.g. vehicles, equipment and/or footwear). Tick the box adjacent to the moisture conditions that are forecast for the period of the activity. If the activity will continue for an extended period, planning should consider the highest possible risk (wettest) conditions that may occur. If the activity is planned for dry conditions but the conditions change to become wetter prior to or during the activity, a contingency plan is required.

Dry soil	where dust forms when exposed soil is disturbed	
Moist soil	where soil is damp but does not stick to tyres, equipment and/or footwear	
Wet soil	where soil and moisture combine so that soil sticks to tyres, equipment and/or footwear	

Step 2: Determine the LIKELIHOOD of introducing or spreading dieback

Circle the description in each column that best describes the activity. An activity may fit between descriptions, in which case write a description into the appropriate blank cell.

The overall likelihood rating is determined by the criteria with the highest rating.

Disturbance type (e.g. action)	Introduction of raw material	Access	Complexity of activity	Extent of activity	Duration of activity	Drainage	Unmanaged access	Likelihood rating
Heavy earth moving, tracked vehicles	Infested or unknown raw material	Access crosses water (irrespective of frequency)			Activity area disturbed & map expired so impossible to revalidate boundaries		Increased public access in area of high public use	Very likely
Soil disturbance over a distance		Activity requires frequent access to site	Highly complex	Vehicle traverses several mini-catchments	Activity extends over several wet seasons	Surface water increased		Likely
Soil disturbance at single points	Crushed rock with no organic fraction		Complex		Activity occurs during a single wet season		Increased public access, but access restricted and/or site remote	Possible
Rubber tyred vehicle, bicycle	'High confidence' uninfested raw material	Activity requires infrequent access to site		Single mini-catchment	Entry in short timeframe under dry conditions	Minimal increase in surface water		Unlikely
Human, animal traffic			Not complex	Point or human traffic	Single entry in short timeframe under dry conditions		Activity does not alter frequency of access to site	Very unlikely

Step 3: Determine the CONSEQUENCE of introducing or spreading dieback

Determine the potential CONSEQUENCE that introducing or spreading dieback may cause by going through the table below systematically and circling the description in each column that best estimates the consequence.

The overall consequence rating is determined by the criteria with the highest rating.

Area put at risk	Predicted impact	Biodiversity and sensitive areas at risk	Consequence rating
Ongoing potential ¹ to completely infest all protectable areas in activity landscape unit ²	Predicted very high impact: (majority of species at the activity area are susceptible and/or introducing dieback will result in extinction of species or populations) or Wet areas which contain any <i>Banksia</i> species or jarrah	>1 threatened/priority plant or animal species, critical habitat, TEC and/or Ramsar wetlands that is susceptible to dieback and/or Old-growth jarrah forest	Severe
Potential to infest all protectable areas in activity landscape unit ¹	Predicted high impact: (many susceptible species and/or introducing the pathogen will result in loss of populations or localised extinction of species) or Where predicted impact cannot be determined, jarrah forest on upland areas	At least one threatened/priority plant or animal species, critical habitat, TEC and/or Ramsar wetlands that is susceptible to dieback and/or Sensitive neighbouring property	Significant
Potential to infest more than 5% of any protectable area or 4 ha's (whichever is greater – assessor may set a lower minimum protectable area where appropriate)	Predicted moderate impact: (moderate numbers of susceptible species and/or introducing the pathogen will result in a reduction in species/populations)		Intermediate
	Predicted low impact (low numbers of susceptible species)	Fauna Habitat Zones	Minor
No protectable areas estimated within any related landscape unit and/or The area is already infested ³	No susceptible species and/or the activity area is in the 'excluded' category. or Introducing dieback will have no impact discernible outside natural variation ³	No threatened/priority plant or animal species; critical habitat; TEC; and/or Ramsar wetlands that are susceptible to dieback. or As the activity area is already infested there will be no increased risk to threatened species and communities present ³	Insignificant

¹ Ongoing potential for an area to become infested occurs when the disturbance activity involves construction of permanent infrastructure e.g. roads or camp sites especially high in the landscape

² Landscape unit is an area bounded by features such as creeks, ridges, saddles, open roads and/or freehold land

³ Provide a map showing evidence that area is infested and attach to the risk assessment

Step 4: Determine the overall dieback RISK rating

- a) Refer to the table below that corresponds to the soil MOISTURE conditions (Step 1)
- b) Circle where the LIKELIHOOD rating (Step 2) intersects the CONSEQUENCE rating (Step 3)

This is the overall dieback RISK rating for the activity.

DRY SOIL						
LIKELIHOOD	Disturbance examples	CONSEQUENCE				
		Insignificant	Minor	Intermediate	Significant	Severe
Very likely	tracked machines ripping, pushing soil	Low	Moderate	High	High	High
Likely	snigging/light surface skim over distance	Low	Moderate	Moderate	High	High
Possible	installing posts, exploration drilling	Low	Low	Moderate	Moderate	High
Unlikely	driving with rubber tyres	Low	Low	Low	Moderate	Moderate
Very unlikely	walking	Low	Low	Low	Low	Low

MOIST SOIL						
LIKELIHOOD	Disturbance examples	CONSEQUENCE				
		Insignificant	Minor	Intermediate	Significant	Severe
Very likely	tracked machines ripping, pushing soil	Low	High	High	High	High
Likely	snigging/light surface skim over distance	Low	Moderate	High	High	High
Possible	installing posts, exploration drilling	Low	Moderate	Moderate	High	High
Unlikely	driving with rubber tyres	Low	Low	Low	Moderate	High
Very unlikely	walking	Low	Low	Low	Moderate	Moderate

WET SOIL						
LIKELIHOOD	Disturbance examples	CONSEQUENCE				
		Insignificant	Minor	Intermediate	Significant	Severe
Very likely	tracked machines ripping, pushing soil	Low	High	High	High	High
Likely	snigging/light surface skim over distance	Low	High	High	High	High
Possible	installing posts, exploration drilling	Low	Moderate	High	High	High
Unlikely	driving with rubber tyres	Low	Moderate	Moderate	High	High
Very unlikely	walking	Low	Low	Low	Moderate	Moderate

Step 5: Can the RISK be reduced by altering the activity or conditions?

If the risk rating is ‘High’ consideration should be given to:

- Cancelling the activity which avoids the risk; or
- Postponing the activity until conditions are dry for activities scheduled during moist or wet conditions.

If cancelling or postponing is not possible the activity should be re-assessed to determine if the risk can be reduced by altering some of the parameters of the activity. For example, tyred machinery generally causes less soil disturbance and are easier to clean, compared to tracked machines which cause more damage and pick up soil in the cleats which is hard to remove. Refer to the appendices for further guidance on reducing risk associated with an activity.

Step 6: Determine requirements based on RISK rating

Tick the box adjacent to the RISK rating of the activity as determined by the risk table.

Hig h	<ul style="list-style-type: none"> • Complete Part C based on valid comprehensive dieback interpretation with Regional Manager (or delegate) approval before implementation, and sign-off after close-out • Green Card training¹ for all proponents and contractors involved in activity
Mo der ate	<ul style="list-style-type: none"> • Complete Part C based on valid comprehensive dieback interpretation OR conditional dieback occurrence information with Regional Manager (or delegate) approval before implementation, and sign-off after close-out • Green Card training¹ for proponent and contractors involved in activity
Low	<ul style="list-style-type: none"> • Part C not required. Activity can proceed using basic dieback management • Green Card training¹ for all proponents and contractors involved in activity

¹ Green Card training is mandatory for nominated departmental staff

Step 7: Risk Assessment sign-off

	Full Name	Position	Signature	Date
Risk Assessment conducted by:				
Risk Assessment checked by: <i>(Regional Manager or delegate)</i>				

Additional comments or conditions:

PART C: DIEBACK MANAGEMENT PLAN

Dieback Management Plan No. <i>Allocated by District</i>	
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Step 1: Dieback occurrence information & map *(supervising officer/proponent)*

Valid comprehensive occurrence information		or	Conditional occurrence information	
Interpreter report/map no. and/or name	Is the assessment evidence DHSO endorsed?		Source	

Step 2: DMP meeting *(supervising officer/proponent)*

Date:		Convened by:	
Attended by:			

Step 3: Risk management tactics *(supervising officer/proponent)*

Tactic no.	TACTICS TO BE DEPLOYED <i>Refer to the Appendices in the Phytophthora Dieback Management Manual for guidance</i>	To be implemented <i>(✓= required)</i>	Implemented <i>(initialled when complete)</i>	Checked <i>(initialled when checked)</i>
MOISTURE CONDITIONS				
1	Moisture conditions as per Part B/Step1 dry <input type="checkbox"/> moist <input type="checkbox"/> wet <input type="checkbox"/>			
2	Contingency in event that conditions become wetter than those planned for before or during the activity:			
	• postpone/cease activity			
	• fall back to low risk area (e.g. infested area)			
	• risk reassessed and new DMP developed based on wetter conditions			
PROTECTABLE AREAS <i>(and other management boundaries)</i>				
3	Protectable area (and management unit boundaries within them) have been established in the field and are identified as P <input type="checkbox"/> to P <input type="checkbox"/> on the attached dieback management map			
4	Management boundaries (unrelated to Protectable Areas) have been established in the field and identified on the management map e.g. mini-catchments, impact etc.			

Tactic no.	TACTICS TO BE DEPLOYED <i>Refer to the Appendices in the Phytophthora Dieback Management Manual for guidance</i>	To be implemented <i>(✓= required)</i>	Implemented <i>(initialled when complete)</i>	Checked <i>(initialled when checked)</i>
HYGIENE				
5	Clean on Entry (COE) points and No Soil Movement (NSM) roads identified on map and signs installed in-field (record COE numbers in appropriate boxes): <input type="checkbox"/> COE road access <input type="checkbox"/> COE entering vegetation / protectable areas <input type="checkbox"/> COE NSM			
6	<input type="checkbox"/> COE gates installed and indicated on map against COE no.			
7	<input type="checkbox"/> turnarounds for COE points, numbered and marked on map			
8	COE points <input type="checkbox"/> will be closed to Type <input type="checkbox"/> when the operation is to cease for <input type="checkbox"/> weeks, and on completion of all <input type="checkbox"/> activities all temporary COE will be closed to Type <input type="checkbox"/> by the proponent			
9	Cleandown points established in field and indicated on map How is effluent to be managed for wet cleandown?			
10	Machines and vehicles with portable hygiene kits			
11	Records kept (circle relevant): <input checked="" type="checkbox"/> COE <input type="checkbox"/> clean down <input type="checkbox"/> NSM			
12	Management points (if applicable) numbered on map. Provide detail below on the decision or action that must be taken at each management point: M1: M2:			
TRAINING AND COMMUNICATION				
13	Staff/contractors with Green Card training			
14	DMP briefings (circle relevant): <input checked="" type="checkbox"/> at commencement <input type="checkbox"/> weekly <input type="checkbox"/> daily <input type="checkbox"/> other			
DISTURBANCE				
15	Machinery type(s):	Machine Nos: <input type="checkbox"/>		
RAW MATERIALS				
16	Type:	Supplier/Source:		
17	Status (attach evidence):			

Tactic no.	TACTICS TO BE DEPLOYED <i>Refer to the Appendices in the Phytophthora Dieback Management Manual for guidance</i>		To be implemented <i>(✓= required)</i>	Implemented <i>(initialled when complete)</i>	Checked <i>(initialled when checked)</i>
ACCESS					
18	Disease Risk Area permit obtained if required (attach copy)				
19	Access route planned to place least amount of protectable area downslope at risk, and shown on map				
20	Road maintenance uses tactics to mitigate harm to protectable areas:	use interpreted boundaries			
21		push soil downslope only			
22		clean bucket, shovel, auger after digging culverts/holes			
23		use uninfested/low risk material to patch road			
24	[] roads to be closed, each road closure is numbered and marked on map				
25	Each road closure has been constructed to effectively control access				
26	Roads effectively closed/rehabilitated within [] weeks of end of activity				
27	Road construction uses tactics to mitigate harm to protectable areas:	located in infested/unprotectable categories when possible			
28		low in profile			
29		high crown for better drainage			
30		deep roadside drains & coarse material to minimise erosion			
31		mitre/offshoot drain preferentially located towards base of the slope			
32	'Green bridge' implemented (mark on map)				
33	Activity to be undertaken using split-phase (provide detail):				
DURATION					
34	Duration of activity >1 year, engage Interpreter to recheck the boundaries				
EXTENT					
35	Divide area into management units for work in dry, moist or wet (circle relevant)				
36	Select factors to be used to split dry, moist and wet soil management units	1	Protectability		
37		2	Presence of biodiversity values		
38		3	Predicted impact		
39		4	Potential for spread		
40		5	Machine/vehicle floatation		
41		6	Access prone to bogging		
42		7	Ability to control unmanaged access		
43		8	Distance from roads		
44	Operate to mini-catchments				

Tactic no.	TACTICS TO BE DEPLOYED <i>Refer to the Appendices in the Phytophthora Dieback Management Manual for guidance</i>		To be implemented <i>(✓= required)</i>	Implemented <i>(initialled when complete)</i>	Checked <i>(initialled when checked)</i>
DRAINAGE					
45	Drainage directed away from protectable areas, and drainage points numbered and marked on map				
46	Imported water	Source:			
47		Disinfectant type and dosage:			
WEEDS					
48	In areas infested with Declared/Prohibited or very high to moderate priority weeds, which are marked <input type="text"/> on the map, the proponent (circle appropriate): a) will not enter area b) will clean down machinery when leaving area				
ADDITIONAL CONDITIONS					

Step 4: Dieback management map checklist *(supervising officer/proponent)*

Tactics decided on above should be clearly marked on the map using the symbols in brackets. Each point will have a unique no. (e.g. COE1; COE2; X1) and the total number recorded below (e.g. total 2 COE points; 1 road closure)
Note: staff and contractors in the field must be briefed and supplied with a management map

DMP No. recorded on management map <input type="text"/>	Road drainage points (D): No. <input type="text"/>
Protectable areas and/or management units <input type="text"/>	Roads/areas with 'No Soil Movement' (NSM): No. <input type="text"/>
'Clean on Entry' points (COE): No. <input type="text"/>	Road closures (X): No. <input type="text"/>
COE with gates (COE with gates): No. <input type="text"/>	Turnarounds and roads for rehab. (map legend)
Management points (M): No. <input type="text"/>	Access route (map legend)
Clean down locations (W): No. <input type="text"/>	

Step 5: Proponent sign-off *(external i.e. non-DBCA proponent)*

I, the undersigned, agree to implement the above DMP:

Full Name	Position	Agency/Organisation	Signature	Date

Step 6: DMP approval *(Regional Manager or delegate)*

I, the undersigned, have reviewed the Risk Assessment and approved the DMP:

Full Name	Position	Signature	Date
Comment <i>(if required)</i>			

Step 7: DMP close-out *(supervising officer/proponent)*

All tactics identified in the DMP were implemented as approved?

Yes

No

Full Name	Position	Signature	Date
Comment <i>(if required)</i>			

Step 8: DMP sign-off *(Regional Manager or delegate)*

I, the undersigned, am satisfied that the DMP has been implemented and closed-out as approved:

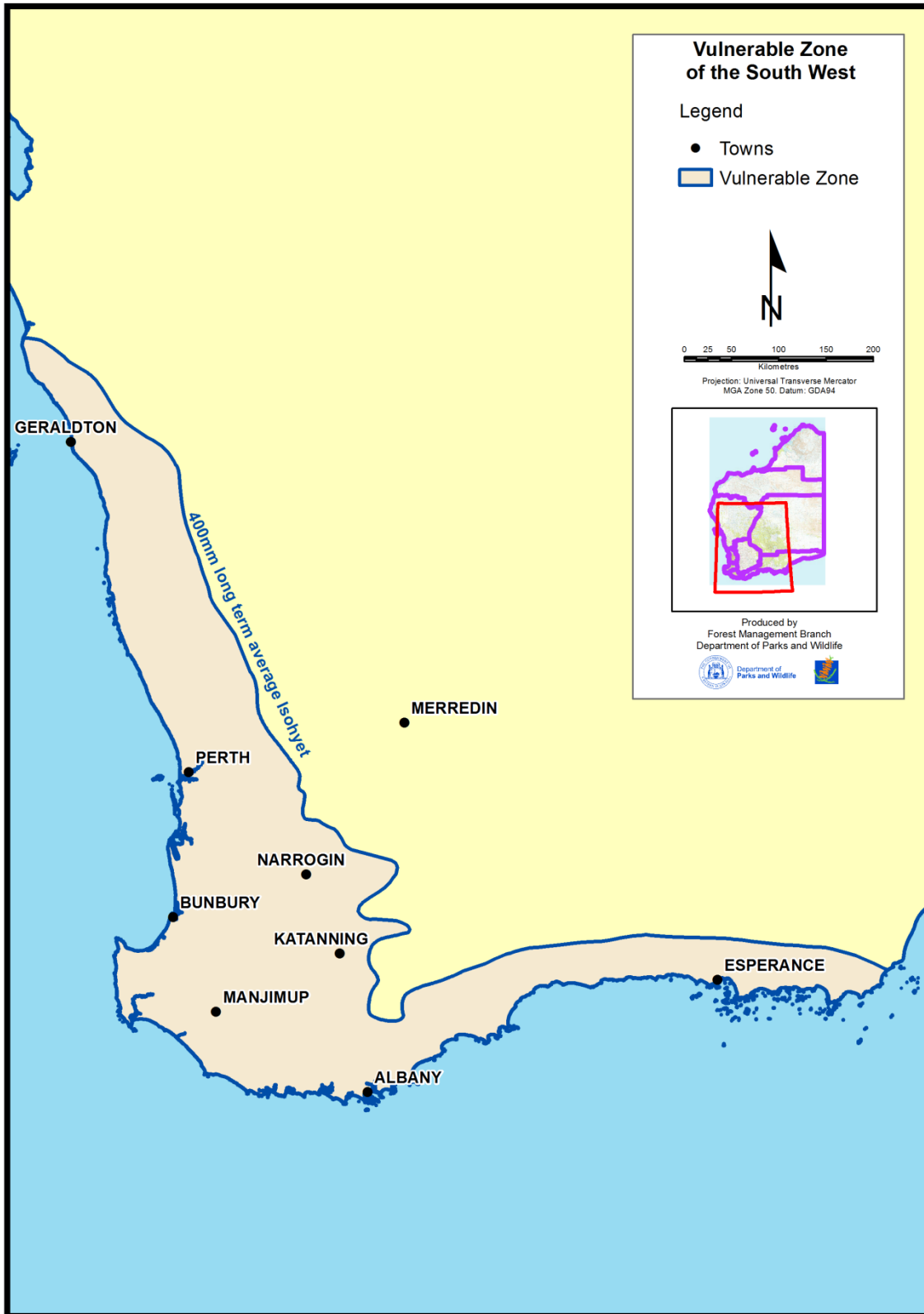
Full Name	Position	Signature	Date
Comment <i>(if required)</i>			

Step 9: Document management checklist

Records ticked below are filed in the following location:

	Dieback occurrence information (Interpretation report and map) have been uploaded to DAS . If a DAS is not required, then forward FEM079 and occurrence information to Forest Management Branch at femweb@dbca.wa.gov.au
	Dieback Management Map
	Dieback Risk Assessment and Management Plan form (Parts A, B and C)
	COE and clean down records
	Disease Risk Area permit

Appendix 2 Dieback vulnerable zone of the south-west



The vulnerable zone boundary corresponds to the 400mm isohyet which was derived from rainfall data captured by the Bureau of Meteorology up to 1979.

Appendix 3 Roles and responsibilities for dieback management during planned disturbance activities

What	Who	How	When
Disturbance Approval System (DAS)	Supervising Officer (i.e. the staff member who is responsible for managing the activity)	Complete a DAS proposal	Planning phase of disturbance activities
Conduct dieback risk assessment	Supervising Officer or proponent	Complete: <i>Part B Risk Assessment</i>	
Obtain dieback occurrence information	Interpreter or Supervising Officer	High-risk: engage Interpreter to provide valid comprehensive information Moderate risk: search databases (Appendix 11 for conditional information)	
Develop Dieback Management Plan (DMP)	Supervising Officer or proponent	Complete: <i>Part C: Management Actions</i> following the requirements associated with the risk rating of the activity	
Approve DMP	Regional Manager (or delegate)		
Implement DMP	Supervising Officer or proponent		Prior to, during and after completion of activity
Close-out DMP			On completion of DMP implementation
Sign-off DMP	Regional Manager (or delegate)		On completion of close-out
Manage documentation	Supervising Officer	Register all documents associated with risk assessment and DMP on FEMweb or Inf0Base	Through-out process, but completed after close-out
Monitor risk assessment, DMP development and implementation	Supervising Officer or proponent	Check implementation according to risk rating – the higher the risk the greater the scrutiny	Prior to, during and after completion of activity
	Disease and Hygiene Standards Officer (DHSO), from Ecosystem Health Branch (EHB)	Periodic checks to ensure compliance with Manual	Periodic

Appendix 4 Protectable areas

Protectable areas are usually:

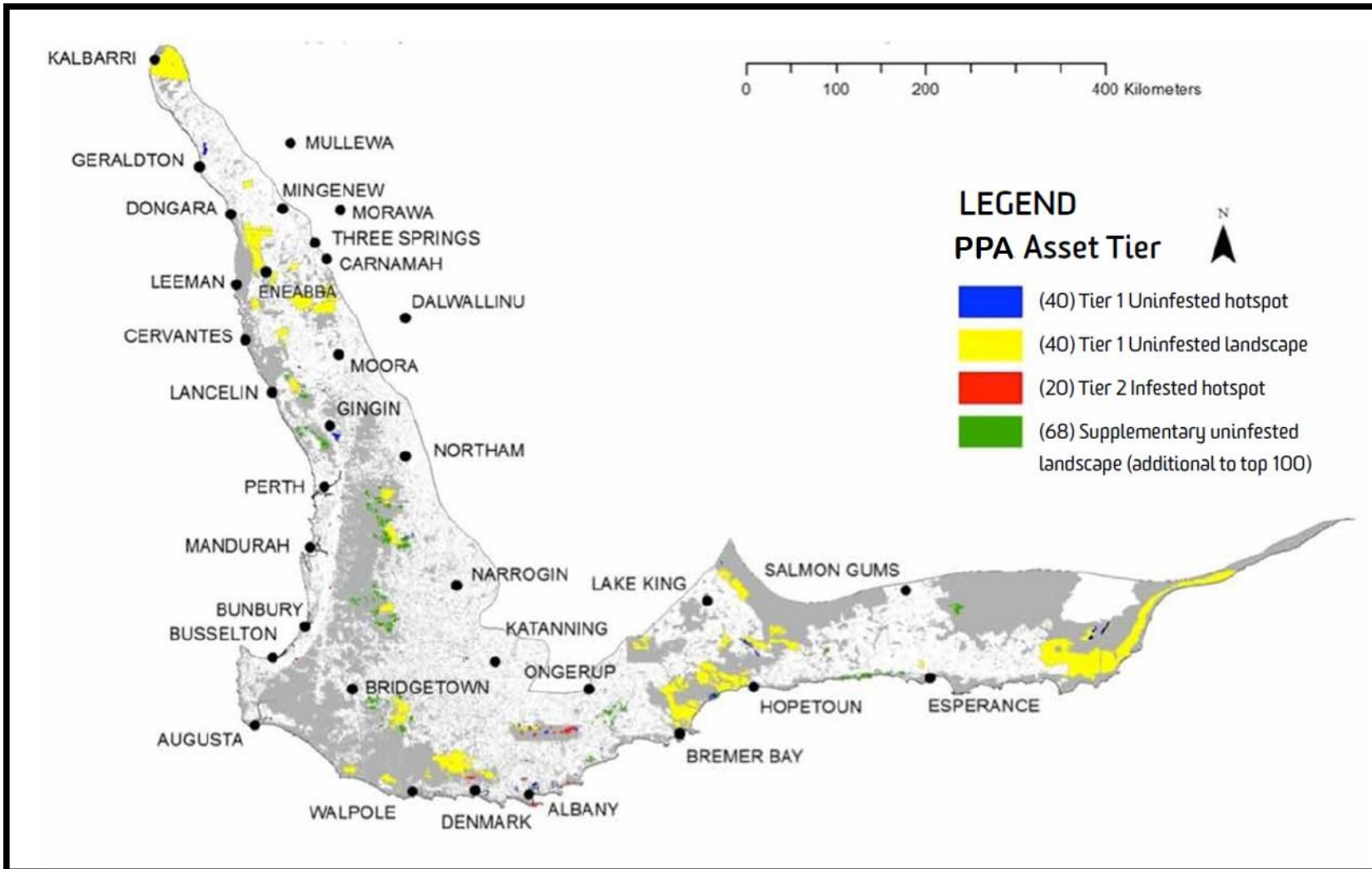
- free of Phytophthora dieback (as determined by an Interpreter)
- not at immediate risk from an existing dieback infestation (e.g. not downslope)
- large enough that natural spread of dieback will not overrun them in the short term (consult an Interpreter, typically two decades)
- small uninfested areas if they contain high conservation or social value
- areas that can be protected from dieback spread caused by human disturbance or uncontrolled access.

Dieback management planning for protectable areas:

1. Identify protectable areas or likely protectable areas during the planning process (usually done by an Interpreter).
2. During planning, determine practical management boundaries for protectable areas. Clearly demarcate boundaries between protectable and unprotectable areas in the field. Protectable areas are to be clearly identified in the DMP form and the dieback management map and explained to all parties involved in the activity.
3. Specify COE when entering protectable areas in the DMP and ensure entry points are shown on the dieback management map.
4. Prevent cross contamination (between infested and uninfested) during the activity:
 - Actively minimise and manage access to the area (close or rehabilitate unwanted roads and trails);
 - Only use uninfested raw material in protectable areas;
 - Consider the use of barrier systems where possible to confine machinery/vehicles to either uninfested or infested areas (see Appendix 24 on split-phase operations). Alternatively start clean machinery in uninfested area and work out to the infested area (crossing the boundary as few times as possible);
 - Consider limiting entry to protectable areas to 'No soil movement' conditions; and
 - Ensure drainage from infested areas is directed away from uninfested areas.
5. Check the DMP is properly implemented.

More detail about protectable areas is available in the *Phytophthora Dieback Interpreters Manual for Lands Managed by the Department* (FEM047; PDIM).

Appendix 5 Project Dieback Priority Protection Areas (PPA)



(map reproduced from State Phytophthora Dieback Management and Investment Framework, Version 1 / July 2014)

Appendix 6 Options to reduce dieback risk associated with the extent of an activity

Factors in priority order	Divide activity into dry and wet management units based on these factors	Use management boundaries to group and schedule one or more of the following criteria as far as practical*	
		Schedule activities in dry soil conditions	Schedule activities in wet soil conditions
1	Protectability	Protectable	Unprotectable and Infested
2	Presence of biodiversity values	High biodiversity values	Low biodiversity values
3	Predicted impact	Uninfested, predicted moderate to very high impact	Uninfested, predicted low impact or area is uninterpretable
4	Potential for spread	Mid slope, upper slope and ridge areas	Lower mid slope, lower slope and gully areas
5	Machine/vehicle floatation	Poor Floatation	Good Floatation
6	Access prone to bogging	Access prone to bogging	Well-drained access (sheds water quickly)
7	Ability to control unmanaged access	Difficult to manage access	Easy to manage access
8	Distance from infrastructure	Area further away from current road infrastructure	Area close to current road infrastructure

* Combine compatible criteria to maximise the reduction of dieback risk. For example, avoid scheduling infested areas in wet conditions when machine floatation could be a problem.

Appendix 7 Options to reduce dieback risk associated with duration of an activity

How activities with extended duration can increase the chance of spreading dieback	Tactics to reduce the risk of spreading dieback	
Autonomous dieback spread from infested areas into protectable areas.	Machine assisted breach of infestation	<ul style="list-style-type: none"> • Where possible, aim to operate in protectable areas first. • Increase buffers in areas planned for an extended duration. • Avoid operating in the buffers near demarcation, especially when the duration will extend for several wet seasons. • If possible, adopt dry soil strategies near the edge of dieback categories, and work infested material away from the uninfested area. For example, when new road construction is created to access protectable areas, wherever the alignment follows adjacent protectable area demarcation, push material away from the protectable area and avoid leaving windrows near the protectable area boundary.
Activity unexpectedly extends over a longer duration.	Unseen autonomous movement	<ul style="list-style-type: none"> • Where possible, aim to operate in protectable areas first. • Increase buffers in areas planned for an extended duration. • When extended duration is realised during the operation, undertake interpretation of remaining undisturbed boundaries. If the activity has already disturbed many boundaries, seek advice (from an Interpreter) on buffer extensions based on known local disease movement and then extend buffers to allow for the remaining duration.

Appendix 8 Options to reduce dieback risk associated with drainage

Control discharge into protectable areas	Water binding, Dust control	<ul style="list-style-type: none"> • Apply water in dry conditions • Use chemical dust retardant or seal where practicable • Limit the amount of water applied to avoid run-off • Limit the width of the water spray to the road surface only to avoid spraying adjoining vegetation • Apply water so that it does not enter mitre drains (stays within the table drain) • Maintain and use sumps to capture unplanned run-off
	Dewatering	<ul style="list-style-type: none"> • Use berms, bunds, or sumps to hold water within the activity area • Discharge water directly into a watercourse if water quality and turbidity allow • Discharge water into unprotectable areas (with consideration given to disease intensification)
	Construction	<ul style="list-style-type: none"> • Keep water in antagonistic (harsh) environment (lime, cement, concrete) • Contain water from wash down in tanks • Avoid draining water into protectable areas
	Reticulation	<ul style="list-style-type: none"> • Maintain reticulation system and repair leaks promptly • Consider the use of sterilant for the water supply, particularly in nursery applications • Keep system discharge within the unprotectable area
	Roads, trails	<ul style="list-style-type: none"> • Avoid building mitre drains that discharge into protectable area (evaluate area at risk) • Reduce number of mitre drains • Make certain table drains can cope with expected inflow • Design roads to shed water quickly • Design, construct and use low-profile roading (low-profile within the landscape)
	Campsite	<ul style="list-style-type: none"> • Channel drainage to minimum outfall sites • Ensure outfall enters low-profile, unprotectable areas by shortest route (with consideration given to disease intensification)
	Landing	<ul style="list-style-type: none"> • Avoid locating landings so captured water can drain into protectable area (use slope to drain water back towards roads and tracks)
Manage severe consequence	Protect uninfested	<ul style="list-style-type: none"> • Use physical barriers to withhold drainage (membranes, bunds, or sumps) from drainage coming away from infested area (tactic most effective in low rainfall areas) • Use dams of sufficient size to catch and hold all water runoff, allow to evaporate over summer or pump or cart water away between rain events (effective in low rainfall areas)
Use water with low inoculum	Fire suppression	<ul style="list-style-type: none"> • Use water from standpipes or mains wherever possible • Use chemical retardant • Use brackish water • Use deep, cold water • Use water that is not turbid

Appendix 9 Corporate data location of biodiversity datasets

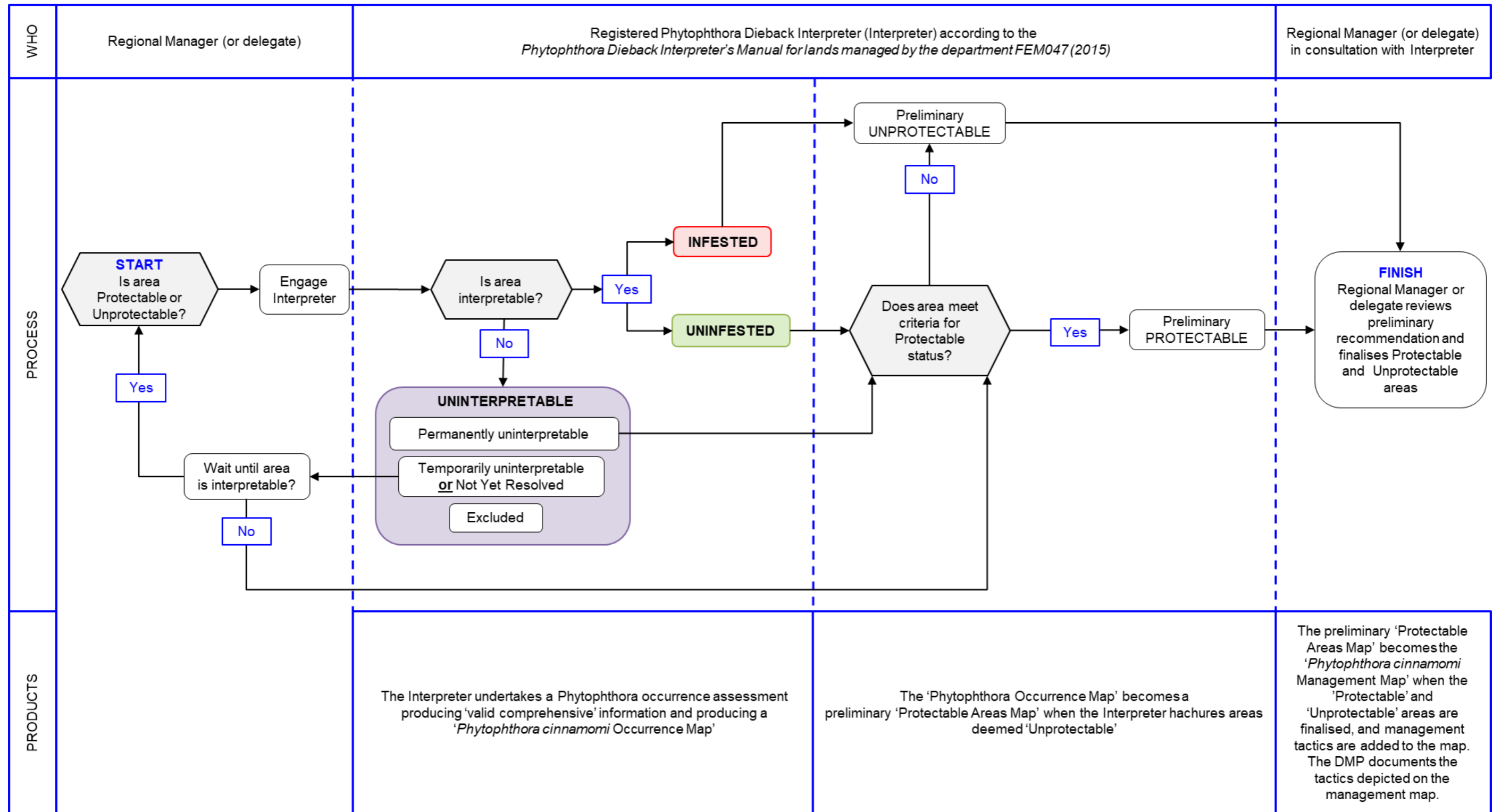
Value	Location of information	
Threatened ¹ & priority ² flora	Florabase District/Regional Offices and/or Species and Communities Branch/ Corporate GIS: Flora/Threatened & Priority Flora	Australian Government Department of Environment & Energy/Threatened Flora
Threatened ¹ & priority ² ecological communities	District/Regional Offices and/or Species and Communities Branch Corporate GIS: Vegetation/Threatened Ecological Communities	Australian Government Department of Environment & Energy/Threatened Ecological Communities
Threatened ¹ & priority ² fauna	District/Regional Offices and/or Species and Communities Branch. Corporate GIS: Fauna	Australian Government Department of Environment & Energy/Threatened Fauna
Critical habitat	Consult with local conservation staff to access information from relevant documentation including Recovery Plans	
Fauna Habitat Zones	Corporate GIS: Forest Management Plan/Fauna Habitat Zones Maps of the locations, categories and status of fauna habitat zones in our south-west forests updated annually on the DBCA About our forests web pages.	
Ramsar wetlands	Corporate GIS: Hydrography/Ramsar Sites	
Old-growth forest	Corporate GIS: Imagery/Landsat/Old Growth Forest Image Map of known old-growth forests in the south-west updated annually on the DBCA About our forests web pages.	
Important Western Australian wetlands	Corporate GIS: Hydrography/Important wetlands Western Australia	
Priority Protection Areas	Project Dieback, Dieback Information Delivery and Management System (DIDMS) via external website (Appendix 5).	

Local nature conservation staff should be consulted to validate currency and accuracy of corporate datasets.

¹ *Western Australian Government Biodiversity Conservation Act 2016; Australian Government Environment Protection and Biodiversity Conservation Act 1999*

² Lists administered by the Department of Biodiversity Conservation and Attractions

Appendix 10 Process for determining protectable¹ and unprotectable areas



¹ Note that a Regional Manager (or delegate) can deem an area protectable at any time without going through this structured process.

Appendix 11 Types of conditional dieback occurrence information and location

Format	Location of information
Polygons of dieback mapped by Interpreters, depicted in half-hectare block format ¹	Corporate GIS: DBCA Operations > Dieback Occurrence
Hard or electronic copies of Interpreter reports and maps	Department Regional and/or District files Forest Products Commission files Contact Forest Management Branch Disease Hygiene Coordinator or local Interpreter for the relevant region
Electronic copies of Hygiene Management Plans (pre-2018); Dieback Management Plans and associated maps	Forest Management Branch FEMweb (note permission is required for access)
Data points for presence of <i>P. cinnamomi</i> and other species from sample analysis by Vegetation Health Service ²	Corporate GIS: DBCA Operations > Dieback Sample Points ¹
Broadscale Mapping, typically used outside the main forest belt for mine exploration over extensive areas where historic information is unavailable.	<i>Phytophthora Dieback Interpreters Manual for Lands Managed by the Department (FEM047)</i>

¹ Turn assessment year labels on to know when uninfested area is too old as per Table 5.

² Sample point data is insufficient on its own as conditional information but may provide useful supplementary information to mapping.

Appendix 12 Options to reduce dieback risk associated with disturbance type

Modify	<p>Use tyred rather than tracked machinery as: tyred can be more effectively cleaned tracked machines churn up the ground more.</p> <p>Alternatives to ploughing or grading to mineral earth for vegetation removal: scrub rolling slashing and/or herbicide application.</p> <p>When moving a bulldozer from one site to the other 'walk' it with blade up to minimise soil disturbance.</p>
Postpone	<p>Postponing the activity until there are dry conditions (where dust rather than mud is produced when soil is disturbed) reduces the risk of spreading or introducing dieback.</p>
Cancel	<p>Cancellation of the activity may be considered when the risk of an activity is 'High' and it is a severe or significant consequence.</p>

Appendix 13 Method, application and standards of clean down types

Clean down type		Method	Application examples	Standard	Notes	
WET CLEAN DOWN	Washdown	High pressure water	Suitable for large carriers and all types of soil	The carrier is completely free of clods of soil, mud, and vegetative material	Washdown to standard is difficult in the field.	
	Wash	Footbath, hand sprayers	Suitable for small carriers, and all types of soil		Disinfectant may be used after soil and organic matter has been removed. Wet clean down potentially produces infested effluent that should not be disposed of into intact native vegetation	
DRY CLEAN DOWN	Blowdown	Compressed air (available on trucks with air brakes, low-loaders)	Suitable for large and small carriers. Suitable for slightly moist soil, sand, dry clay.		The carrier is completely free of clods of soil, mud, and vegetative material	These methods will result in an accumulation of potentially infested waste material which should be disposed of appropriately
	Brush down	Broom, brush or cloth	Not suitable for mud, slurry, compacted soil or trapped vegetation			
	Shakedown	Agitation				
	Pick-off	Tools (e.g. crowbar or spike)	Suitable for large and small carriers to remove dried/compacted soil or trapped vegetation	Generally used in conjunction with other clean down methods		

Appendix 14 Elements of a standard Clean down point


1	Physical separation between the object being cleaned and the effluent produced
2	Permanent (e.g. vehicle wash at depot): effluent contained, treated and/or removed to waste
	Temporary (e.g. set up in field at COE point): locate facility at entry to protectable area; contain effluent or confine it within infested/unprotectable area, and direct it away from the path of traffic (see photo below)
3	Adequate and appropriate equipment is available to reach the required standard of cleanliness
4	Easy and safe access to the clean down point for the cleaner and inspector of the carrier
5	Appropriate signage



Appendix 15 Elements of a standard Clean on Entry (COE) point

1	COE point established prior to the commencement of the activity
2	Provision for carrier to turn around or otherwise exit safely and without encroaching on surrounding native vegetation if cleanliness standards are not met
3	Easy and safe access to the clean down point for the cleaner and inspector of the carrier
4	Appropriate signage
5	Clearly marked on dieback management maps
6	Where appropriate, gates installed to control access

Appendix 16 Machinery & Vehicle Hygiene Inspection Checklist form **(SAMPLE ONLY)**

	Machinery & Vehicle Hygiene Inspection Checklist	FEM080			
<p>Important notes</p> <p><input checked="" type="checkbox"/> A 'carrier' has the potential to 'carry' soil harbouring <i>Phytophthora</i> and act as a vector of disease. Carriers include but are not restricted to: machinery, vehicles, equipment, motorbikes, bicycles, footwear and horse's hooves</p> <p><input checked="" type="checkbox"/> Taking a dirty carrier onto DBCA estate may constitute a breach of the Conservation and Land Management Act 1984 & Regulations</p> <p><input checked="" type="checkbox"/> All inspections should be undertaken by DBCA staff (or endorsed delegate) who have undertaken Green Card training</p> <p><input checked="" type="checkbox"/> See overleaf for DBCA standards for methods of cleandown, disinfectants and standards for cleandown and Clean on Entry points</p>					
Vehicle registration or machine type:		Organisation:			
Driver's name:		Make and Model:			
BUSH FIRE ACT COMPLIANT (circle appropriate) YES / NO					
General condition of vehicle on arrival and or prior to inspection:					
The DBCA hygiene standard: Carrier is completely free of clods of soil, slurry, mud, and plant material					
All vehicles and machines (incl. trailers)	NA	Compliant	Not Compliant	Comment / Instruction	Initial
SOIL & MUD CHECK					
Wheels: tyre tread incl. inside wheels					
Tracks					
Fenders: mud flaps, wheel arches					
Underneath: diff, axel, chassis, suspension, belly-plate, spare tyre					
Outside: running boards (under), towbar, bull bar, bumper, grill, all panels, spare tyre					
Bucket, blade, forks					
Rippers					
Inside: cab (mats) tray, between cab & tray					
OTHER CHECKS					
Hygiene kit onboard: brush and rubbish bag					
Fluid leaks (oils, hydraulics) etc					
Weeds and/or seeds					
Other (describe):					
SIGN-OFF					
This carrier has been inspected and, in relation to DBCA's hygiene standard, it (tick the appropriate box):					
	<input type="checkbox"/> meets the standard				
	<input type="checkbox"/> meets the standard after cleandown				
	<input type="checkbox"/> does not meet the standard				
Inspector's name	Signature	Date	Time	Agency	
<p>Commenced: 24 January 2019 Last updated: 12 February 2019 Custodian: Coordinator, Plant Diseases Program Approved by: Manager, Ecosystem Health Branch</p>					

Appendix 17 Disinfectants effective against dieback and application rates

Disinfectant	Application examples	Application rate	Notes
Methylated spirit	After complete removal of soil, spray small items such as footwear or tools liberally	70 per cent in water	Disinfectants kill or damage living organisms, and chlorine dioxide is very toxic to aquatic organisms, consequently if using: <ul style="list-style-type: none"> • use judiciously • complete a Job Safety Analysis • undertake formal and/or informal chemical training • review and understand the relevant Material Safety Data Sheet • complete Chemical Exposure Record Sheet.
Phytoclean® (sold as 10 per cent active ingredient)	Step into footbath (footwear), or dip small equipment/tools after removal of soil	100mL in 1L water	
	Spray machinery/vehicles after complete removal of soil	200mL in 10L water	
Chlorine dioxide tablets ¹	This method may be used when large volumes of water from an infested or unprotectable waterbody are required or to treat contained effluent before release	3 ppm in water left for a minimum of 4 minutes before use	

¹The research underpinning the recommendation for chlorine dioxide was conducted largely by the nursery industry. Consequently, any use of chlorine dioxide by the department should be monitored for efficacy, off-target impacts such as phytotoxicity, and safety or handling issues. Test strips are available from chlorine dioxide suppliers and should be used to test the concentration of chlorine dioxide in treated water prior to use to minimise staff/contractor and environmental risks.

Appendix 18 Options to reduce dieback risk associated with access

Road/track maintenance	<ul style="list-style-type: none"> • when grading a road, work to mapped dieback occurrence boundaries (preferred). If the road is not able to be interpreted, only push material downslope • frequently check and fill in potholes and puddles using uninfested/low risk material
Road/track construction	<p>Where practicable construct roads/tracks:</p> <ul style="list-style-type: none"> • to remain within the infested or unprotectable categories • low in the profile such as parallel to a riparian zone • with a rumble strip at the entry to protectable areas so loose soil falls away prior to entry • with high crown for better drainage • with deep roadside drains and coarse material to minimise erosion • with off-shoot drains preferentially located towards the base of the slope • that are sealed (if viable)
Green bridge	<p>Construct a green bridge over an infested or unprotectable portion of road/track or over an area that is likely to become boggy with frequent access</p>
Plan route	<ul style="list-style-type: none"> • use sealed or well-formed roads • avoid muddy puddles and creek crossings • have a contingency plan for worst case scenarios (i.e. getting bogged) • schedule access as far as possible during dry conditions • communicate planned route to staff and contractors with maps and/or signs
Restrict access	<ul style="list-style-type: none"> • conduct the activity in split-phase • establish Clean on Entry (COE) point(s) to restrict access to carriers that meet cleandown standards • control access using gates, fencing (full or partial) or barriers such as mounding, concrete blocks, boulders, logs or trenching • close access permanently using gates and/or ripping/rehabilitating first 100m of track • quarantine an area

Appendix 19 Advice for maintenance of roads, tracks and trails according to dieback status

Dieback status of road and adjacent areas			Maintenance	Goal
Adjacent area	Road surface (route) ¹	Adjacent area	e.g. grading, upgrade, vegetation clearing or repair	
Uninfested (protectable)	Uninfested (protectable)	Uninfested (protectable)	Undertake risk assessment and develop/implement DMP if required Use uninfested BRM	Minimise the potential for dieback to be introduced or spread at a site as a result of a planned disturbance activity
Uninfested (protectable)	Unknown	Uninfested (protectable)	Undertake risk assessment and develop/implement DMP if required Use uninfested BRM	Minimise the potential for dieback to be introduced or spread to an adjacent area as a result of a planned disturbance activity
Unknown	Unknown	Unknown		
Infested	Unknown	Infested	DMP not required. Use any category of BRM	Minimise the potential for further spread of dieback as a result of a planned disturbance activity
Infested	Infested	Infested		

¹ Generally the running surface of roads are uninterpretable because they are devoid of vegetation. However, in some circumstances there may be evidence that a road is infested or uninfested. A road that is overgrown so that the vegetation is contiguous with adjacent areas may be interpretable.

Appendix 20 Road closure techniques

The following table provides a number of road closure tactics. In some circumstances multiple techniques may need to be employed simultaneously, or other techniques may be implemented provided they are able to effectively close the road.

Technique	Description
Physical barrier	Placing a physical barrier at the end of the road section to be closed to prevent further access. Following forest operations large, non-utilisable logs are typically placed across the portion of the road to be closed. Large boulders or rocks can also be used. The effectiveness of this technique can be enhanced with 'ripping' of the road surface.
Debris	Following harvesting, logging slash and debris can be purposely left on a road so that it remains untrafficable.
Mounding	Roads can also be closed by the construction of suitably sized mounds along the road to prevent vehicular access.
Gate (optional fencing)	Installing gates at the end of the road to be closed can effectively control access. Locked gates can also provide ongoing access to land managers while restricting access to others. The construction of fencing either side of a gate can also be effective, particularly to prevent vehicles driving around the gate.
Rehabilitation	Where permanent road closure is sought, areas can be 'ripped' and rehabilitated to prevent further access.

Based on the 'physical barrier' road closure techniques above, this table provides specifications for types of road closures commonly used by the timber-harvest industry.

Type of closure	Logs ¹ across entrance	Logs within sight of entrance	Rip first 100m of track	Rip turnaround	Leave debris on track / shunt
1	1				
2	1	2			
3	1	2	yes		
4	1	3			
5	1	2	yes	yes	
6 ²	1	2			yes
7					yes

¹The preferred dimensions of logs across entrance is a minimum diameter of 400mm

²Type 6 closure needs to be installed prior to the commencement of the activity

Appendix 21 Options to reduce dieback risk associated with importing raw materials

Low likelihood infested	<ul style="list-style-type: none"> • Source 'uninfested raw materials' • Source freshly mulched material from the vicinity of the activity and ensure that it is not contaminated with soil • Source seedlings from a nursery accredited with the Nursery Industry Accreditation Scheme Australia (NIASA)
Swap	<p>Revegetate using seeds rather than seedlings</p> <p>Use raw material from within the same landscape unit and disease category rather than importing it</p>
Avoid	<p>Find a way to do the activity without introducing raw materials to the site. This is highly advisable at sites where the consequences of dieback spread are significant or severe.</p>

Note: other pathogens such as Armillaria and marri and banksia cankers can be spread in mulch.

Appendix 22 How BRM can be used across dieback categories

BRM extracted from:	BRM can be used within:
Uninfested (unprotectable uninfested can be used when its assured it still remains uninfested at the time of extraction)	Protectable uninfested
	Protectable temporarily uninterpretable
Permanently uninterpretable	Permanently uninterpretable (when located within the same protectable unit)
Excluded	Infested or unprotectable
Infested ¹	Infested or unprotectable

¹ When extracting and transporting infested BRM ensure that infested soil is not inadvertently introduced to uninfested areas adjoining the infested pit; en route to the site of import, and; adjoining the site of import.

Appendix 23 Green bridges

Green bridges to reduce dieback risk

Carriers can inadvertently spread dieback when they pick soil up from the running surface of infested roads and 'carry' it to uninfested areas. Through the creation of a continuous uninfested and well drained running surface 'green bridges' can significantly reduce the likelihood of spreading dieback.

Green bridges are constructed by adding a layer of *Phytophthora*-free BRM over an infested, low-lying or permanently wet section of road. The green bridge must be sufficiently thick and well-constructed to prevent contact between the carrier and underlying infested material and to prevent contamination of the green bridge from the underlying infested material.

Green bridge applications

Green bridges have been used in the following applications:

- provide uninfested access between protectable areas;
- reduce multiple clean down points in close proximity during an activity that requires access along an alignment that traverses discrete infestations; and
- reduce the dieback risk of access associated with mining; timber-harvesting; powerlines and pipelines.

Temporary versus long-term green bridges

A green bridge may be required to provide uninfested access: temporarily during a discrete disturbance activity; or long-term such as across low-lying areas or permanently wet crossings. Regardless of the purpose, a green bridge requires monitoring and maintenance to remain effective in reducing dieback spread.

Temporary green bridges constructed during a disturbance activity should consider additional and supporting dieback management tactics including, but not restricted to: split phase access (e.g. between timber harvesting and timber haulage); split phase by mini-catchment and; restricting the season of the proposed activity to lower risk periods (i.e. not wet).

Considerations in deciding to construct a green bridge

The green bridge option should not be used as justification to construct high profile roads or for putting additional areas at risk from dieback. The decision to construct a green bridge should only be taken after considering:

- alternative dieback management options which can also prevent vehicles from picking up infested material:
 - close road or use alternative access routes;
 - split an activity to avoid the infested area(s);
 - require 'no soil movement' access;
 - seal road and/or build a bridge over the stream.
- the lead-in time required to plan (see following section on planning requirements) and construct a green bridge *prior* to use during an associated disturbance activity;

- the feasibility of constructing a green bridge to the required use and engineering specifications e.g.:
 - a temporary versus a longer-term structure;
 - the type, frequency and speed of traffic that will use the green bridge and will the road be used as strategic access for future use (e.g. fire) as these all influence engineering requirements;
 - engineering and ecological requirements where a green bridge will span a watercourse requiring the installation of drainage;
 - the length of bridging required.
- the monitoring and maintenance requirements to ensure the green bridge continues to be effective in reducing dieback risk over its lifespan;
- the availability of uninfested BRM; and
- green bridges should be discouraged on [category E](#) 'tracks' as by nature they have poor road surface drainage due to basic design. All alternatives should be considered in the first instance.

Planning requirements in green bridge construction

While designed to reduce dieback risk, construction of a green bridge is itself a disturbance activity that poses a dieback risk due to the involvement of heavy machinery, soil movement and introduction of BRM. Consequently, construction of a green bridge requires:

- a DAS application and as part of that:
 - a dieback risk assessment and most likely the development and implementation of a DMP;
 - development of a Road Access Plan (CEM 018).
- the DMP for the construction and ongoing maintenance of a green bridge should include the following dieback risk reduction approaches:
 - seek to reduce the dieback risk as low as practically possible and ensure that the area put at risk from dieback is minimised;
 - carried out in dry conditions;
 - road closed to all other traffic during construction and maintenance;
 - machine work with appropriate separation and hygiene to prevent the spread of dieback between infested and uninfested areas;
 - installation and maintenance of appropriate drainage to ensure the green bridge is free draining, rutting or ponding does not occur and drainage water is not directed into uninfested areas during, or as a result of the construction;
 - careful sourcing, transport, delivery and installation of uninfested BRM so that it does not become contaminated during construction;
 - installation of tape and/or appropriate signage to indicate the extent of the green bridge, COE requirements, adjacent infested areas and the requirement to avoid entering them;
 - if water is required for compaction use scheme or tank rainwater, but if local open water sources must be used treat the water before application (Appendix 17); and
 - suitable clean machinery and records of vehicle / machinery onsite.

Materials used in green bridge construction

The types of BRM that are typically used to construct green bridges in the dieback vulnerable zone are described briefly in the following table.

BRM	Advantages	Disadvantages
Quarried blue metal ballast	<ul style="list-style-type: none"> • Can support heavy traffic • Works well as base and top layer • Strong and not prone to dissolving or leaching • Free draining • Generally mostly free of soil and root material • Could be washed in-situ to remove any contaminating material 	<ul style="list-style-type: none"> • Expensive, except in vicinity of mines that sell as by-product (e.g. around Greenbushes) • Will generally need to be transported long distances for DBCA applications • Cannot be compacted unless fines included as in granite road base • Can be difficult to verify dieback status
Gravel	<ul style="list-style-type: none"> • Locally available in many parts of the vulnerable zone • Does not dissolve and does not modify chemistry in areas of use • Relatively inexpensive 	<ul style="list-style-type: none"> • Turns to mud when laid down in very wet conditions • Known to harbour <i>Phytophthora</i> • Can be difficult to verify dieback status
Shale	<ul style="list-style-type: none"> • Does not dissolve and does not modify chemistry in areas of use • Relatively inexpensive 	<ul style="list-style-type: none"> • Restricted availability • Good as a base layer but requires a top layer of gravel for a smooth surface • Difficult to compact • Can corrugate in dry conditions • Known to harbour <i>Phytophthora</i> • Can be difficult to verify dieback status
Crushed limestone	<ul style="list-style-type: none"> • Readily compacted • Considered to be inhibitory to <i>P. cinnamomi</i> 	<ul style="list-style-type: none"> • Prone to breaking up (in summer), dissolving and washing away • Good as a base layer but requires a top layer of gravel • Dissolved materials with potential to leach into surrounding areas and water courses altering pH • Not inhibitory to <i>P. multivora</i> • Can be difficult to verify dieback status

Uninfested BRM

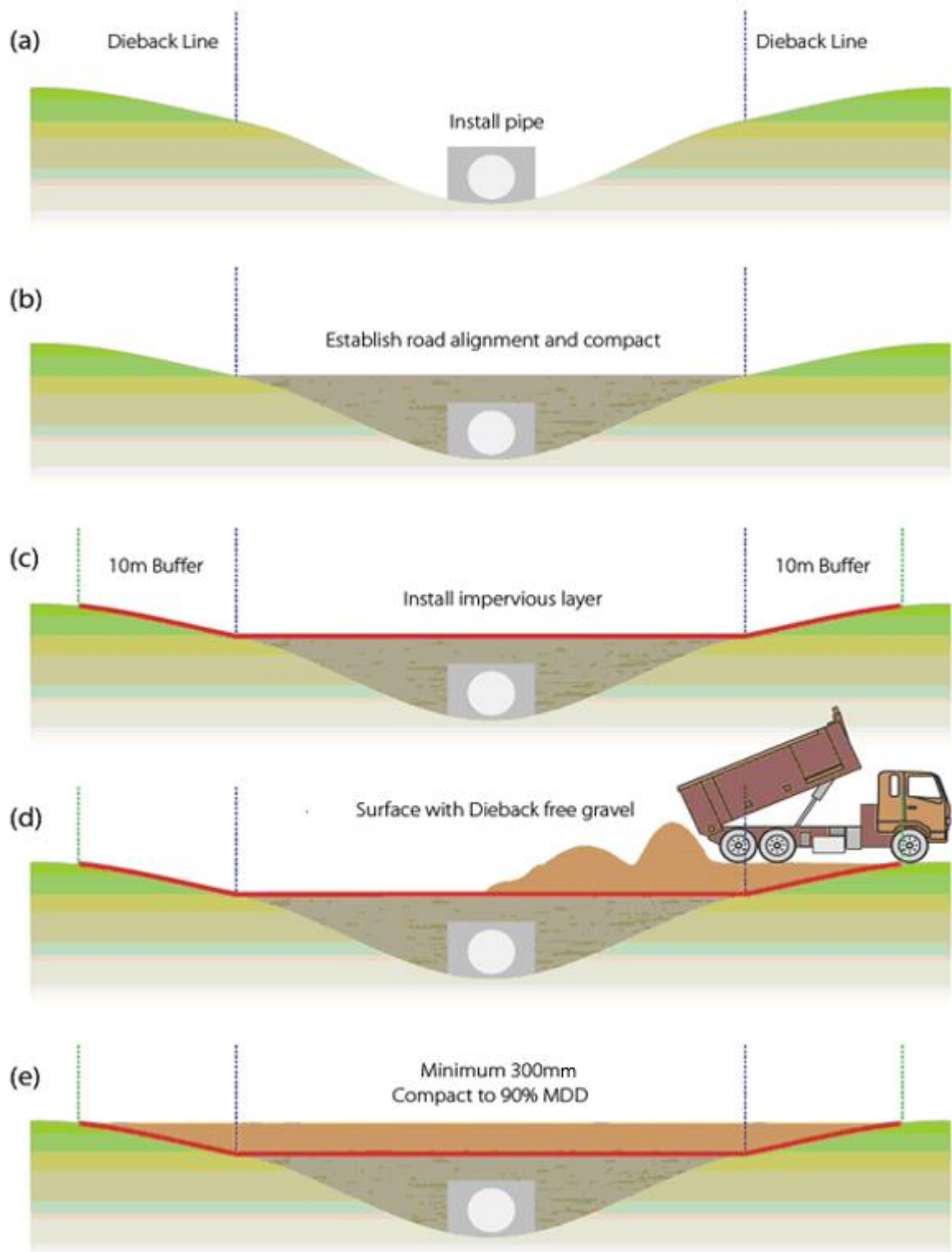
One of the most important criteria for BRM used in the construction of a green bridge is that it is uninfested (also referred to as dieback-free). Currently the department's standard for uninfested BRM is that:

- It has been sourced from a site that was assessed as uninfested by an Interpreter;
- The site has been managed and monitored since assessment to maintain the uninfested status (including hygienic excavation and transport of the BRM to the site of use).

It has been noted in the table above that it can be difficult to verify the dieback status of BRM. The reason for this statement is that gravel is often sourced from quarries or pits that, even if initially assessed as uninfested, have not been managed to maintain their uninfested status. Gravel is sometimes sourced from agricultural paddocks and this is usually of unknown dieback status, also quarries and pits that are unmanaged for dieback can be contaminated with *Phytophthora* through the use of dirty machinery in excavation and stockpiling, or by dirty haulage vehicles.

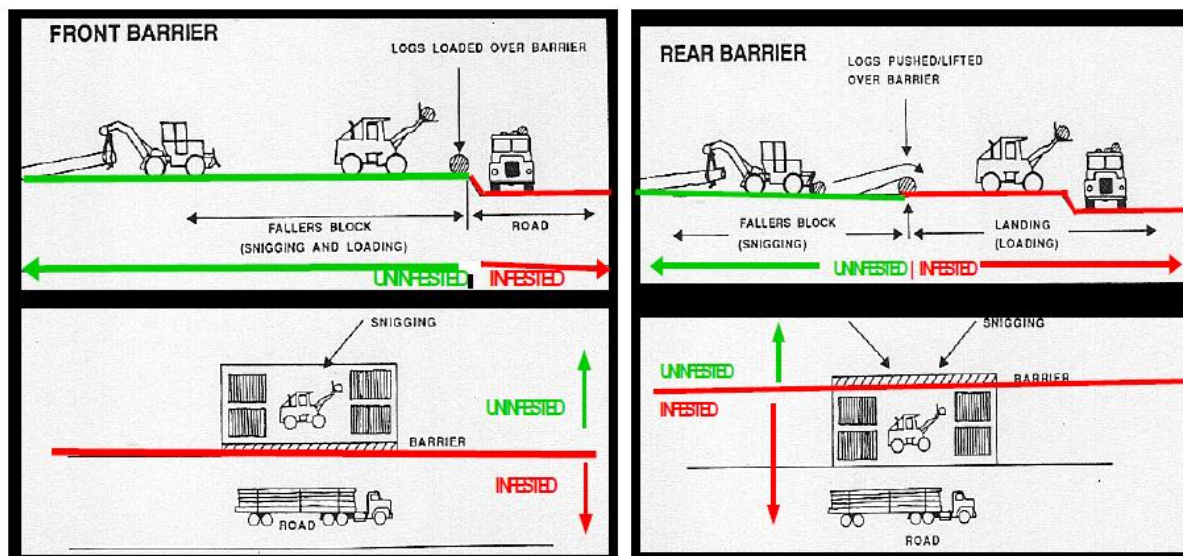
Where the dieback status of BRM from unmanaged quarries or pits, and paddocks is unknown, the unknown dieback status can theoretically be tested in the laboratory for the presence of *Phytophthora*. However, the number of samples needed to give a statistically valid result is very high (in the 100s) making it a cost-prohibitive option.

Metham sodium has recently been registered for treating gravel to kill *Phytophthora*. DBCA are currently collaborating with Main Roads on developing a protocol for commercial scale treatment of gravel with metham sodium and an associated compliance system. The eventual uptake of the technology will provide another and potentially more sustainable option for sourcing uninfested gravel than excavating it from uninfested forest.



A schematic cross-section of a green bridge over an infested depression in the landscape in which drainage has been installed, and uninfested (dieback free) BRM has been used to fill the depression and construct a 10 m tapered buffer of uninfested BRM on either side of the bridge.

Appendix 24 Principles of split-phase management



Split-phase management of disturbance activities refers to isolating machinery and equipment within dieback occurrence categories. This process is useful for reducing the amount of field hygiene required, as well as minimising the frequency that machines, equipment and personnel need to cross dieback categories.

In the 'Front Barrier' diagram above, a forest operation has been established using split-phase management. In this example, the snigging and loading part of the operation are isolated in an uninfested area, while the truck arriving to haul the logs is operating in the infested area. The snigging and loading machinery are operating under a COE system and remain within the uninfested category (and therefore only needed to be 'clean' the first time they arrived at the site). The haulage truck remains in the infested area that doesn't require COE, and therefore doesn't need to clean down prior to each trip.

While the above example is based on timber harvesting, the principles of split-phase management can be applied to a range of disturbance activities.

8. Glossary

Term	Definition
Authorised officer	Under the <i>Conservation and Land Management Act 1984</i> an authorised officer means a wildlife officer, forest officer, ranger, conservation and land management officer and a person appointed to an honorary office under section 46 of the Act
Basic dieback management	Basic principles of being clean and dry to minimise the chances of spreading dieback, other diseases and weed seeds
Basic Raw Material (BRM)	BRM is used in general construction, road construction and maintenance, and as fill. It includes materials such as sand, limestone, clay, hard-rock and gravel aggregate. Because BRM can contain small bits of plant material it can harbour <i>Phytophthora</i>
Carrier	Anything with the potential to 'carry' soil harbouring <i>Phytophthora</i> and therefore act as a vector of dieback. Carriers include but are not restricted to: machinery, vehicles, equipment, motorbikes, bicycles, footwear and horse's hooves
Clean down	The practice of physically removing any material from a carrier that could harbour <i>Phytophthora</i> and other contaminants, such as weed seeds. There are two main types of clean down; wet (e.g. washing) and dry (e.g. brushing)
COE	'Clean on Entry' which is the requirement and practice of ensuring a carrier is clean before passing a designated point
Clean on Exit	The requirement and practice of ensuring that a carrier is clean before leaving a known infested area
Conditional information	Comprehensive dieback occurrence information that has expired (i.e. more than 12 months old and has not been revalidated, or equivalent information in consultation with the DHSO). Conditional information is less accurate than valid comprehensive information and therefore cannot be used to manage 'High' risk disturbance activities but can be used for 'Moderate' activities
Consequence	In the context of a dieback risk assessment, it is the potential impact of <i>Phytophthora</i> if it is introduced to and becomes established in an uninfested area
DBCA	Department of Biodiversity, Conservation and Attractions
DHSO	Disease Hygiene Standards Officer
Dieback risk	Likelihood and consequence of <i>Phytophthora</i> being introduced to an uninfested area and becoming established to cause dieback

Term	Definition
Dieback status	Refers to whether an area is infested, uninfested, uninterpretable or unknown as assessed by a registered Phytophthora Dieback Interpreter
Disturbance activity	An activity in which soil is intentionally or unintentionally disturbed and/or moved, or where <i>Phytophthora</i> is likely to be transported
DMP	Dieback Management Plan
Dry	Conditions where dust forms when exposed soil is disturbed
Expired information	Comprehensive dieback occurrence information which is more than 12 months old and has not been revalidated. See also conditional information
Hygiene	Practices centred around the cleaning and standards of cleanliness of carriers to reduce the likelihood that <i>Phytophthora</i> will be introduced to uninfested areas and spread from infested areas
Infested	A dieback occurrence category for an area that an Interpreter has determined is infested with <i>Phytophthora cinnamomi</i> through a systematic assessment
Interpreter	A registered Phytophthora Dieback Interpreter
Lands managed by the department	'Public land' as defined in section 81 of the <i>Conservation and Land Management Act 1984</i> : <ul style="list-style-type: none"> a) a State forest or timber reserve; and b) any land vested in the Crown and not contracted to be granted or transferred in fee simple and includes: <ul style="list-style-type: none"> i. land of which pastoral leases are held under Part 7 of the <i>Land Administration Act 1997</i>; ii. land held as mining tenements under the <i>Mining Act 1978</i>; and c) any land reserved or dedicated under the <i>Land Administration Act 1997</i> but the care, control and management of which are placed with some person other than the Crown.
Likelihood	In the context of a dieback risk assessment, the chance that <i>Phytophthora</i> will be introduced to an uninfested area
Management point	A point before, or at, the site of the activity where some decision or action needs to be taken to manage dieback risk
Mini-catchment	The catchment area of a first order stream
Moist	Conditions where soil is damp but does not stick to carriers

Term	Definition
No Soil Movement (NSM)	Activities where soil movement must not occur. NSM can generally be achieved in dry conditions but not in wet conditions.
Obsolete	With reference to conditional dieback occurrence information, refers to the period after which it can no longer be used for the management of dieback risks associated with disturbance activities
<i>Phytophthora</i>	<i>Phytophthora</i> is a genus of plant pathogens. Over 40 species of <i>Phytophthora</i> have been detected in Western Australia including <i>Phytophthora cinnamomi</i> , which is considered one of the greatest threats to the biodiversity of the south-west of the State
Phytophthora Dieback (dieback)	The common name for the disease in native ecosystems caused by plant pathogens from the genus <i>Phytophthora</i> .
Registered Phytophthora Dieback Interpreter (Interpreter)	Refers to an individual trained, experienced and registered by the department to undertake occurrence assessments to detect, diagnose and map the presence of <i>Phytophthora</i> in the landscape
Phytophthora occurrence assessment	A systematic assessment of an area, undertaken by an Interpreter, to detect, diagnose and map the presence of <i>Phytophthora</i> . Also referred to as 'interpretation'
Protectable	Protectable areas are areas deemed to be uninfested or uninterpretable and protectable from an incursion of <i>Phytophthora</i>
Protectable Areas Strategy	Strategy developed and implemented by the department that identifies significant 'protectable' areas (those for which the values at risk are significant and the benefits likely to be sustained for more than a few decades), prioritises them, and concentrates available resources on protecting them
Raw material	Any material in which <i>Phytophthora</i> can persist and be transported in a viable form. Raw material includes but is not restricted to: Basic Raw Materials (BRM), soil, mulch, plant material and/or seedlings for revegetation
Relegation	In reference to roads, a change in the designation of a road and its subsequent removal from departmental maps
Road	A trafficable surface that provides access for vehicles. Under this definition, it also includes unformed 'tracks' and may also include trails and easements for the consideration of disease management
Slurry	Consisting of a mixture of soil, plant material and water. More watery than mud.

Term	Definition
Turnaround	A specially constructed loop in a road (e.g. intersection or small clearing) where vehicles and/or trucks can safely exit from an area without encroaching on intact vegetation
Uninterpretable	Uninterpretable is collective name for the following dieback occurrence categories: Permanently uninterpretable; Temporarily uninterpretable; Not Yet Resolved; Excluded. In all cases the dieback status is unknown because there are insufficient signs and symptoms of disease to enable an Interpreter to determine if the area is uninfested or infested
Unknown	The disease status of a site where the disease status is not known because either: i) there is no dieback occurrence information, or; ii) the site has been assessed as uninterpretable by an Interpreter
Uninfested	An area that an Interpreter has determined to be free of plant disease symptoms that indicate the presence of <i>Phytophthora cinnamomi</i>
Unprotectable	Areas that are generally infested, or uninterpretable and uninfested but are likely to be engulfed by autonomous spread of the pathogen in the short term. An Interpreter makes a preliminary recommendation that an area is unprotectable and it is reviewed and finalised by a Regional Manager (or delegate)
Valid comprehensive dieback occurrence information	Information that is valid (less than 12 months old) and has been collected by an Interpreter through a comprehensive and structured field assessment of the signs and symptoms of disease, coupled with targeted sampling of soil/tissue
Vulnerable zone	The area of the south-west of Western Australia where dieback occurs when <i>Phytophthora</i> is present. The zone includes all areas of the south-west land division, west and south of the 400mm rainfall isohyet
Wet	Conditions where soil and moisture combine so that soil sticks to carriers