DIEBACK DISEASE

HYGIENE MANUAL

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

REVISED JULY 1992

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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1. DIEBACK DISEASE

In Western Australian Dieback Disease is caused by microscopic root rotting fungi belonging to the genus Phytophthora. These fungi are not native to WA and are thought to have been introduced to WA in the early 1900's. The fungi can attack and kill many of our native plants. Some plant communities are affected to such a serious extent that local extinctions of plants and the animals that depend on them may have occurred.

Dieback Disease is currently affecting parts of forest, heathland and woodland communities throughout the south west. At present there is no practical cure and every attempt must be made to confine its spread until such time as a cure is available.

New infections are primarily caused by human activities which move infected soil and root material from infected to healthy areas.

This booklet contains guidelines which, if followed, will minimise the spread of dieback disease. To reduce the risk of spreading dieback disease the community of W.A. must ensure that all operations likely to spread the disease are closely scrutinised and appropriate hygiene practices are planned and implemented.

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Caring naturally

Revised 1st July 1992

2. DIEBACK DISEASE MANAGEMENT STRATEGIES

There is a logical process involved in determining whether dieback disease is an issue associated with any particular operation. If it is, then practical strategies and tactics can be developed to achieve dieback disease control.

When determining a hygiene strategy for any operation the planner should never depend on one tactic only. Several integrated and mutually supportive tactics should be built into the operation to ensure successful hygiene.

The following factors should be considered when planning an operation to determine the relative importance of dieback disease and its management.

(a) What kind of operation is planned? Do any parts of the operation involve the possible transfer of infected soil, plant material or water.

(b) Are there areas of susceptible vegetation that could be placed at risk by the operation?

(c) Are the land use values on site or adjacent to the operation likely to be effected by dieback disease? Conservation or production values such as habitat, water quality, wildflower growing, timber production etc are examples of vulnerable land uses.

(d) Is dieback already present?

(e) Is dieback disease so widespread that any attempts at control within the project are likely to be futile? If the answer is yes, then no further consideration within the project is required. Preventing the spread to other sites will need to be considered.

(f) If dieback disease is not present, or present but not widespread, what is the risk of introducing or spreading dieback disease?

(g) What resources are currently available to implement disease management? If resources are limiting and the potential for disease impact is high it may be appropriate to defer the operation until sufficient resources are available.

(h) Is the state of knowledge about dieback disease on the site such that the project should be deferred until more information is available?

(i) Is there some other factor present on the site or on adjacent land which precludes any effective management solely for this operation.

3. RECOGNITION AND MAPPING OF DIEBACK DISEASE SYMPTOMS

Identification and mapping of dieback disease can be very difficult. It should be carried out by a specialist with suitable training and experience, particularly if it is to be used as the basis for a detailed disease management strategy involving considerable resources.

Adequate mapping is a prerequisite for implementing detailed dieback disease control procedures. However, an indication of the extent of dieback disease is often sufficient for deciding whether dieback disease is an issue at a particular site.

* The presence of dieback disease can be deduced from the death of susceptible plants (called indicator species).
* A sound knowledge of susceptible plants and their reliability as indicators in each locality is required.
* The time taken for a new infection to be expressed as visible symptoms is variable depending on local site and climatic factors. This time lag can vary from less than 6 months in parts of the jarrah forest to several years on more hostile sites. This can mean that dieback disease is present, but cannot be visibly detected (called incipient disease).
* Many other agents can be responsible for plant death eg: drought, insects, salt, old age, frost, mechanical damage, fire, herbicides, other fungi etc. Care must be taken to discount these other agents.
* A single dead susceptible plant (eg: a dead Banksia) could be dieback. It is best to assume it is dieback if two or more dead plants are seen, or dead plants of two or more different species are present, or there is evidence of a progression of deaths over time or evidence of vehicle access nearby which could have introduced the infection.
* Presence of dieback disease can sometimes be determined by laboratory testing of samples of soil or root material from dying or recently dead plants.
* Dieback disease is difficult to detect in areas which have been recently burnt due to foliage being consumed by the fire, destroying visible symptoms of the disease. Other areas are uninterpretable because there are too few indicator species present.
* Spring and Autumn or periods after heavy summer rain are the best time to map dieback disease symptoms. Soil moisture and temperature at these times favours the activity of the fungus.
* If dieback disease is evident in a water course then it must be assumed the water course IS infected and dieback disease WILL be present downstream from the infection. Therefore it is important to identify the furthest upstream infection in the water course.
* If dieback disease occurs on a ridge or upper slope, then areas downslope will become infected in time.
* Dieback disease is most likely to occur in moisture gaining sites such as gullies, creeks, drains and culverts.

The interpretation and integration of all these factors is what makes it difficult to routinely identify and map dieback with a high degree of accuracy.

The end result classifies areas as:

- dieback infected;
- dieback free, or
- uninterpretable, Suspect or not effectively quarantined which means it is not possible to say whether dieback is present or not.
- area at risk from natural spread downslope from disease.

Table 1. summarises information on dieback disease recognition.

Table 1.
Relative importance of observable factors associated with the interpretation for the presence or absence of dieback disease

Relative Importance of Observable Factors
Associated with the Interpretation for Presence or Absence of P. cinnamomi

	Observable factor indicating high likelihood of P. cinnamomi presence			Observable factor indicating low likelihood of P. cinnamomi presence
Observation Factors				
IND SPS DEATH	Multiple	Cluster	Scattered	Isolated
SPECIES	Some or most indicator plants	Any one indicator	Any indicator plant	Any indicator plant
PATTERN DEVELOPMENT	Obvious			Not obvious
TOPOGRAPHIC SITUATION	Gully/Flat	Lower to midslope	Midslope to upper slope	Ridge
CAUSAL AGENT	Obvious			Not obvious
INTERPRETATION RESULTING FROM OBSERVATIONS:	High likelihood of P. cinnamomi presence			Low likelihood of P. cinnamomi presence
REQUIREMENT FOR SOIL AND TISSUE SAMPLE:	Low requirement for soil and tissue sample	High requirement for soil and tissue sample	High requirement for soil and tissue sample	Low requirement for soil and tissue sample

4. ASSESSING THE RISK OF INTRODUCTION AND SPREAD OF DIEBACK DISEASE

One of the fundamental questions which must be addressed in determining any hygiene strategy is:
"What is the risk of this operation introducing or spreading dieback disease?"

This question can be approached by considering three factors:

i) Is the type of operation likely to move infected material around (soil, roots, water). For example are tracked or rubber tyred machines to be used; is earthmoving likely; will the operation be in muddy or sticky soils?

ii) Are soil conditions such that soil is likely to stick to machinery and be moved around (moist and sticky).

iii) Are soil conditions such that the fungus will survive if delivered to a new site (moist).

THE RISK OF INTRODUCING OR SPREADING DIEBACK DUE TO THE NATURE OF THE PROPOSED OPERATION.

Highest Risk	Lowest Risk
Operation over large area	Operation over small area
Complex operation	Simple operation
Much machinery	Little machinery
Much movement of soils	Little movement of soils
Untrained personnel	Well trained personnel
Inexperienced personnel	Experienced personnel

THE RISK OF INTRODUCING OR SPREADING DIEBACK DUE TO THE NATURE OF THE SITE.

Highest Risk	Lowest Risk
Wet conditions	Dry conditions
Sticky soils	Non-sticking soils
Low lying site	Elevated site
Dieback known nearby	Dieback not known nearby

5. ASSESSING THE DIEBACK DISEASE HAZARD

Dieback disease hazard is a term which describes the final impact of the disease on a site if the disease were introduced. The final impact of dieback disease on a site depends on:

* The susceptibility and abundance of plant species present.
* The fertility, chemical and physical properties of the soils.
* The lateral and vertical drainage characteristics of the site.
* Topography, and
* Climate.

Assessing hazard allows the project manager to gauge the consequences of a hygiene breakdown on the land use values of the site. The magnitude of the consequence combined with a judgement on the level of risk associated with the operation allows the project manager to determine the level of resources that need to be committed to hygiene tactics.

Assessment of hazard is an imprecise science. It involves using vegetation associations, landform classifications and soil types as indices of the potential impact of dieback disease. It requires extensive knowledge of plant associations, disease biology and aetiology and experience of disease impacts on various sites. This task is most confidently performed by an expert.

6. DIEBACK DISEASE MANAGEMENT TACTICS

Dieback disease management should be considered in the planning phase of every operation. The incorporation of very simple tactics in the planning phase is usually easier, cheaper and a more reliable means of ensuring disease management than implementing haphazard tactics at the operational phase.

The following points should be considered in planning hygiene tactics:

Consider changing from grading or ploughing for vegetation control and firebreaks to mowing, slashing or herbiciding where dieback is a problem. Methods which do not disturb the soil are always preferable.

Consider the type of machinery to be used. Vehicles which do not readily pick up soil are preferred. Vehicles such as front end loaders with large rubber tyres could be used in preference to tracked vehicles. Vehicles which can be cleaned readily will be an advantage. Tracked vehicles are the most difficult to clean.

Where possible, operations should be carried out under dry soil conditions. This is particularly important for high risk operations such as drain cleaning and batter grading. Consider using contract machinery to increase the amount of work carried out within the drier, more favourable season.

Develop a network of known dieback free basic raw material sources which can be used for unexpected road repair works. If the sources are known to be dieback free they can be used by trained personnel without prior approval or supervision. This method removes the need for many dieback controls in road repair work. Special effort should be made to ensure these resources remain dieback free. This may include fencing and gating gravel pits, working them during dry soil conditions and the use of hygiene barriers during pit operation.

Consider upgrading drains so that they require less maintenance and are less likely to flood. Maintenance of wet drains is a high risk activity, and sites prone to flooding are particularly favourable to the establishment of dieback infections.

Only work dieback free borrow pits and quarries from the downslope edge so that any dieback introduced does not infect the whole resource.

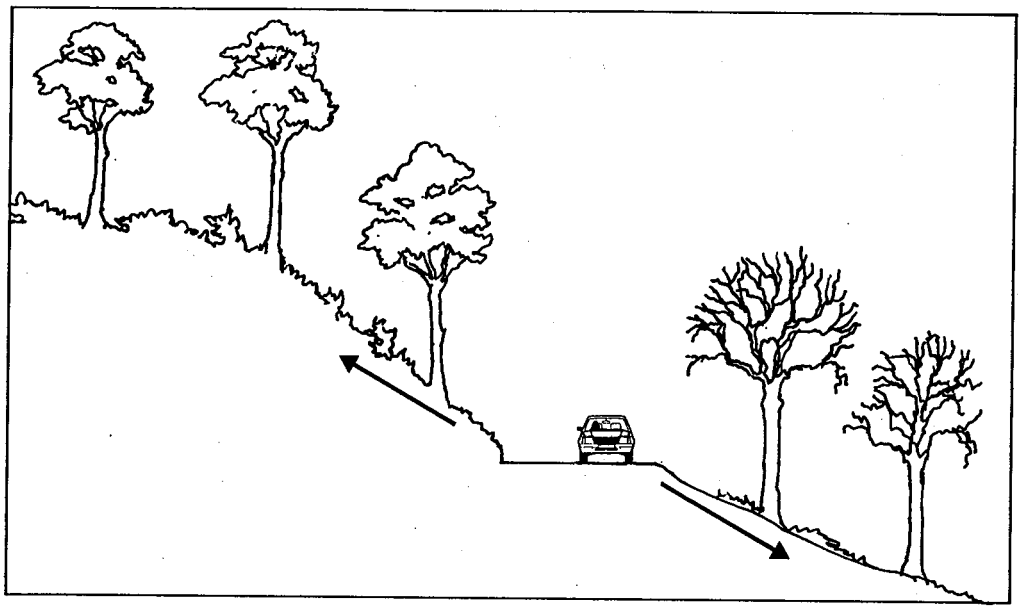
Sterilise water used in operations such as fire control or road binding with an appropriate fungicide or utilise water sources free of dieback disease.

Minimise the area put at risk of infection by an operation by segmenting the operation into discrete, small areas separated by a cleandown or hygiene barrier and minimising the area of susceptible vegetation downslope of the operation.

The following pages are illustrated examples of appropriate hygiene tactics which can be applied to common operations.

ROADING LOW IN THE LANDSCAPE PROFILE

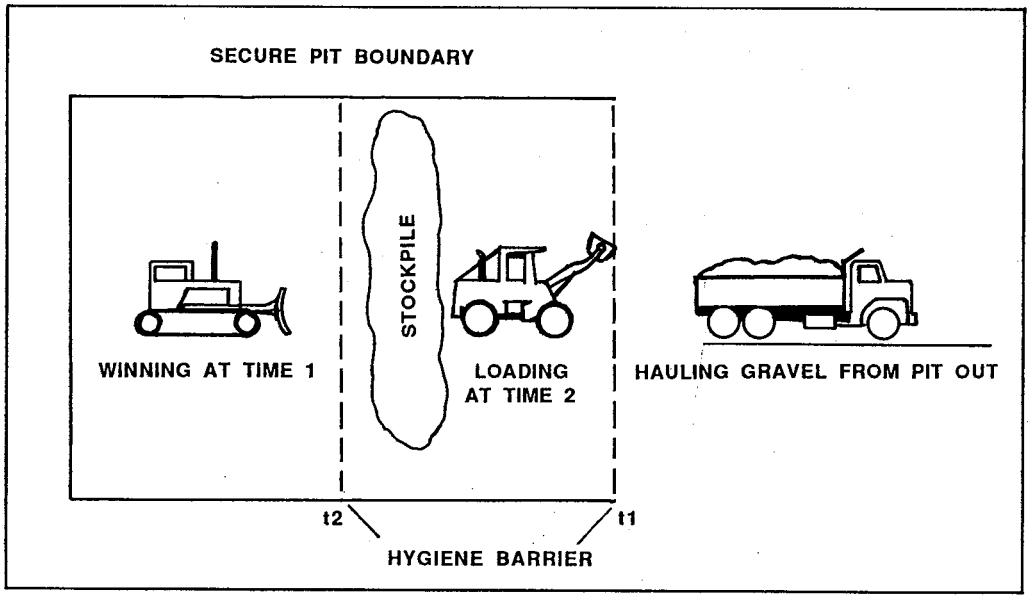
This minimises the area put at risk of infection downslope of the road. Roads have a high likelihood of becoming infected either by use under moist conditions or by maintenance operations.



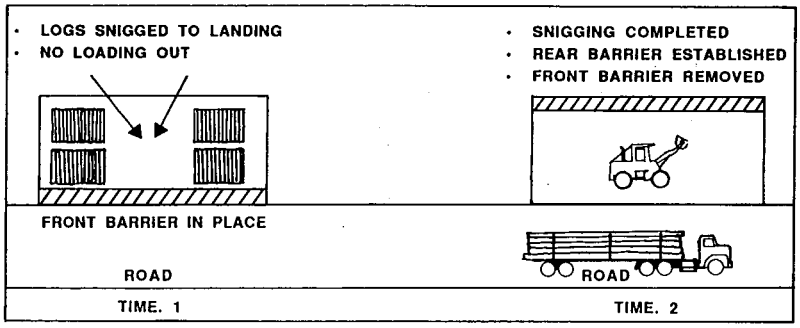
SPLIT PHASING AND HYGIENE BARRIERS

This breaks up any operation into small independent microcatchments that will limit or contain the spread of disease if an infection is introduced.

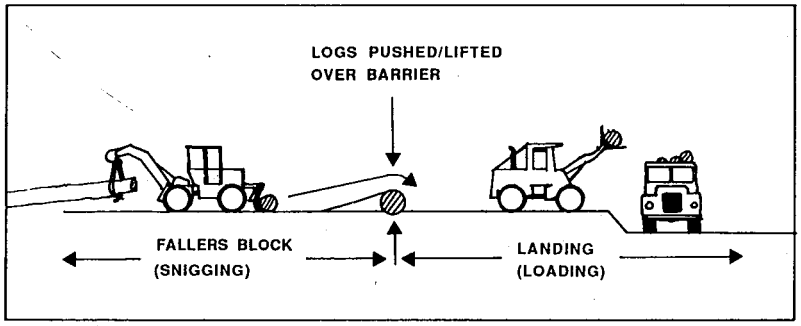
GRAVELLING

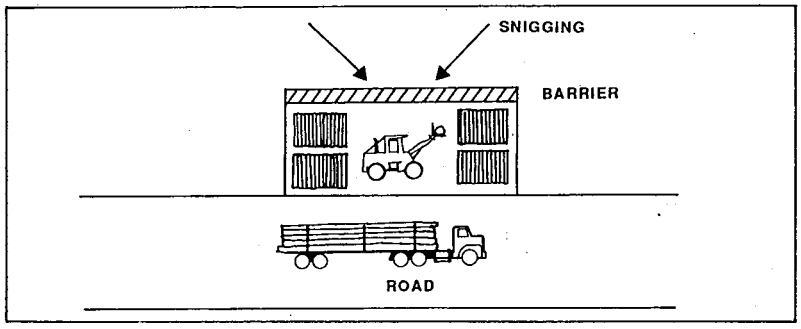


LOGGING SPLIT PHASE IN TIME

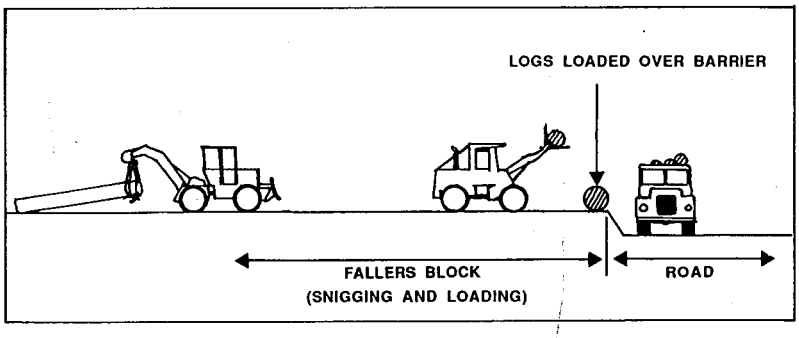


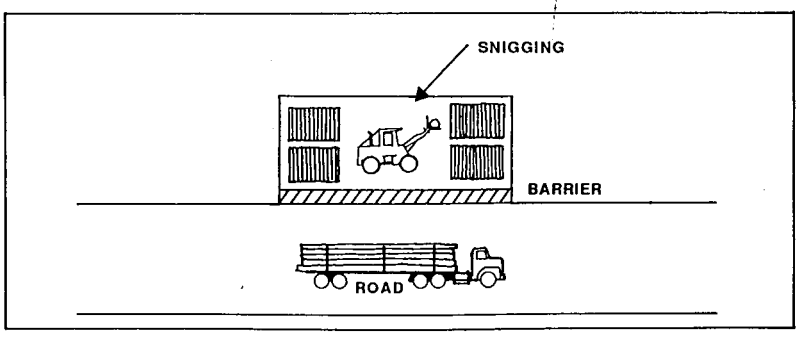
REAR BARRIER





FRONT BARRIER

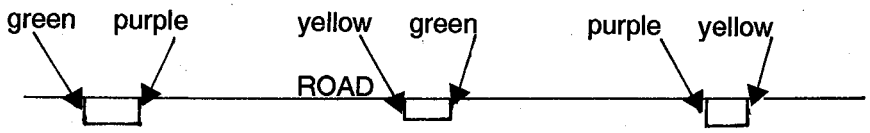




6.1 GROUND DEMARCATION OF HYGIENE CATEGORIES

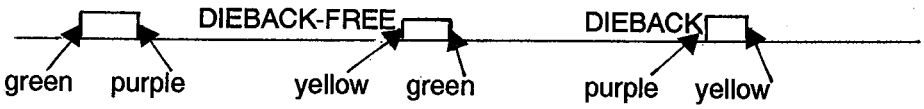
(1) In interpretable areas (unburnt for 4-5 years and with sufficient indicator species). Boundaries between dieback, dieback-free and uninterpretable, areas will be marked on the ground (pegs, survey tape, paint etc) before any operation involving use of machinery. Where earthmoving operations are involved boundaries will be pegged.

(2) Pegs will indicate to machine operators where dieback, dieback-free and uninterpretable patches start and finish.



Uninterpretable

Uninterpretable



MARKER PEGS

(3) Pegs will be 1 metre in length (0,7m above ground), 75mm in width.
Side visible when entering dieback painted yellow.
Side visible when entering dieback-free painted green.
Side visible when entering uninterpretable painted purple.

(4) Pegs to be located 5 to 20 metres uphill from visible symptoms or into dieback-free in the case of uninterpretable.

(5) Where there are no evident symptoms, creeks or shallow flats are to be pegged as dieback if dieback occurs upstream from the crossing. Pegs to be located 5 to 20 metres each side of water course, or edge of flat, depending on slope.

6.2 CLEANING DOWN

NOTE: Use brush or compressed air rather than washing, if soil is dry and can be removed by this method.

AT HEADQUARTERS:

DO	use designated ramps or pads to washdown vehicles. Keep the ramp or pad clean of mud.	DON'T	forget to remove mud & soil from cleats and underside of protection plates on track vehicles.
DO	ensure run-off flows into a sump where it can be treated with fungicide.	DON'T	drive vehicle through washdown effluent.
DO	use high pressure spray to remove caked-on mud and soil. Use spade or bar to assist removal.		

IN THE FIELD:

DO	washdown at designated washdown point or on bridges, rocky crossings or hard well drained surfaces, within dieback areas. Keep the wash-down point clean of mud.	DON'T	washdown in dieback-free areas.
DO	treat washing down water in tankers with fungicide (Sodium hypochlorite, 2 lts per 3000 lt tank).	DON'T	fail to clean any machine capable of carrying dieback disease from infected to uninfected areas.
DO	renew NaOCl dosage every 24 hours.	DON'T	drive vehicles through washdown effluent.
DO	use a brush, bar or spade to help remove compacted soil where necessary.	DON'T	use excessive quantities of Sodium hypochlorite as it is corrosive.
DO	washdown before moving to the next job.	DON'T	use treated water for drinking.

6.3 ROAD AND FIREBREAK SELECTION

DO	assess existing road and firebreak systems for adequacy using relevant criteria (strategic effectiveness, block size, ease of hygienic maintenance, erosion, other).	DON'T	duplicate existing access.
DO	determine known and suspect dieback along the intended route, using dieback plans, air photos and field check on foot, where possible.	DON'T	use vehicles, bulldozers, tractors in initial selection of roads.
DO	avoid crossing dieback to dieback-free boundaries.		
DO	demarcate by pegging dieback/ dieback-free boundaries.		
DO	select roads low in the landscape.		

6.4 ROAD AND FIREBREAK CONSTRUCTION

DO	programme earthmoving work for months when soil is dry. (Usually December-March)	DON'T	commence road or firebreak construction unless correct selection procedure has been followed.
DO	segregate machine work, in interpretable areas, so that machines do not travel from dieback to dieback-free areas, as pegged, without cleaning down BEFORE leaving dieback.	DON'T	assume machinery is clean. Always inspect before allowing entry, or commencement of work.
DO	segregate machine work, in uninterpretable areas, so that machines do not cross sub-catchment boundaries, or move uphill from gullies, without cleaning down BEFORE crossing such boundaries. (See Appendix I for details)	DON'T	construct turn-off drains which result in ponding.
DO	construct roads and firebreaks to shed water and dry quickly.	DON'T	forget to write dieback specifications into contracts.
DO	construct deep table drains to carry run-off swiftly and directly into nearest natural water course.	DON'T	remove infected soil and plant material resulting from clearing from site.
DO	use slashed or mown firebreaks in heath country if possible.		
DO	use dieback-free materials on dieback-free or uninterpretable areas.		
DO	manage topsoil resources so that they are identified, separated and replaced in appropriate positions.		

6.5 ROAD AND FIREBREAK MAINTENANCE

DO	design a works programme for regular maintenance of roads and firebreaks.	DON'T	grade deeper or wider than prescribed.
DO	peg roads before maintenance commences in interpretable areas. Check previous pegging	DON'T	grade or move soil from dieback into dieback-free areas as pegged in interpretable areas, or across sub-catchment boundaries or uphill from gullies in uninterpretable areas.
DO	segregate machine work, in uninterpretable areas, so that machines do not cross sub-catchment boundaries, or move uphill from gullies, without cleaning down BEFORE crossing such boundaries.		
DO	as much maintenance as possible in dry weather.		
DO	clean out table drains when soil is dry.		
DO	clean machinery before leaving dieback affected areas.		
DO	ensure dieback specifications are written into maintenance contracts and are strictly adhered to.		
DO	include general specification on grading method and operation of the machine (angle of blade etc) to avoid carrying infected earth long distances into dieback-free areas.		
DO	include specification applicable to the individual job.		
DO	provide tender vehicle with yard broom & small tank, pump and fungicide.		
DO	use dieback-free materials on dieback-free or uninterpretable sites.		

6.6 SHOULDER AND BATTER GRADING

DO	clean down the machine before it is shifted to a new area.	DON'T	assume a machine is clean on arrival - always inspect it and clean it if necessary.
DO	clean down machinery every time an infection or uninterpretable area is exited.	DON'T	grade from infected areas into uninterpretable areas without cleaning down. The uninterpretable area may be uninfected.
DO	clean down machinery before leaving a micro catchment in an area where disease location is not known.	DON'T	grade from uninterpretable areas into dieback-free areas without cleaning down. The uninterpretable area may be infected.
DO	work from ridge to valley in areas where disease distribution is not known as disease is more likely to occur in lower parts of the landscape.	DON'T	grade up out of swamps, water courses, or sites prone to flooding without cleaning down the machine unless their dieback-free status is confidently known.
		DON'T	increase the surface area graded by going beyond the areas previously graded.

6.7 GRAVELLING

DO	programme work for months when soil is dry. (Usually December-March)	DON'T	use infected gravel on roads and firebreaks except where specified in diseased areas.
DO	select gravel pits at least 100m away and upslope from nearest visible dieback disease symptoms, unless job is entirely in dieback.	DON'T	allow water to pond in gravel pit.
DO	wash incoming plant before commencement of gravelling.	DON'T	leave dieback-free pits open. Secure them against infection and ensure their future disease free status.
DO	plan haul routes from pit to job to avoid crossing dieback areas, unless job is entirely in dieback.	DON'T	allow run-off to enter a dieback-free pit.
DO	remove vegetation and stumps from gravel pit before carting commences.	DON'T	allow any contaminated vehicle to enter a dieback-free pit, either during or after the operation.
DO	arrange for sampling & testing of gravel prior to work beginning where there is any doubt whether the disease is present.		
DO	ensure dieback hygiene specifications are included in contracts and are strictly adhered to.		
DO	use gravel 'in situ' whenever possible.		
DO	use gravel from uninterpretable areas for uninterpretable forest, provided it is used 'in situ' (within the same micro catchment).		
DO	Lay gravel from the pit out so that trucks run on a mattress of clean gravel.		

NOTE: The above rules should be applied to other materials such as shale and sand.

6.8 DRAIN CONSTRUCTION AND CLEANING

The same rules apply as used in grading with the addition of:

DO	construct and maintain drains & culverts in summer when soils are dry.	DON'T	allow drains to pond water.
DO	work from ridge to valley.		
DO	clean down between drains or culverts.		

6.9 EMERGENCY ROAD REPAIR

Emergency works are dangerous because the urgency often leads to poor planning.

Where materials must be used the following points should be considered:

DO	ensure machinery is clean before leaving headquarters.	DON'T	move machinery between sites without cleaning down.
DO	use materials of appropriate disease status ie; - dieback material to a dieback site; - dieback-free material to a dieback-free or uninterpretable site; - uninterpretable material only to uninterpretable sites in the same micro catchment or diseased sites.	DON'T	allow untrained personnel to be involved in unsupervised emergency repair work.
DO	establish and maintain in a dieback-free status stockpiles of material at strategic locations.		

6.10 FIRE MANAGEMENT - PRESCRIBED BURNING

DO	observe other sections of this manual for hygiene use & operation of machines.	DON'T	travel through boggy creeks.
DO	select burn boundaries on well formed hard surfaced roads.	DON'T	move machinery from diseased to dieback-free areas without cleaning.
DO	travel vehicles only on hard surfaced roads.	DON'T	grade roads unless absolutely necessary.
DO	consider alternatives to grading (ie; sweeping, slashing, handraking).	DON'T	use bulldozers if fire can be suppressed with hand tools.
DO	divide sectors of fire in accordance with hygiene categories.	DON'T	mop-up with water from creeks or water points unless Sodium hypochlorite is added.
DO	ensure all water used for mopping up is disinfected.		
DO	encourage the use of herbicides or slashing to provide breaks.		
DO	ensure plant and vehicles are clean before entry to dieback-free areas.		
DO	nominate clean down points for incoming and outgoing plant and vehicles.		

6.11 FIRE MANAGEMENT - WILDFIRE SUPPRESSION

DO	complete Controllers Fire Suppression Guide (Dieback) CLM Form 613.	DON'T	use bulldozers if fire can be suppressed with hand tools.
DO	despatch forces along hard-surfaced roads.	DON'T	mop-up with water from creeks or water points unless sodium hypochlorite is added.
DO	ensure plant and vehicles are clean before entry to dieback-free areas.		
DO	use hand tools to suppress fire where this method will succeed.		
DO	plan firelines to avoid crossing dieback boundaries if bulldozers are used.		
DO	nominate cleandown points for incoming and outgoing plant and vehicles.		
DO	ensure cleandown on fireline where vehicles are likely to move infected earth into dieback-free areas.		

6.12 UNINTERPRETABLE AREAS

In uninterpretable areas, boundaries between dieback, dieback free and uninterpretable will be marked on the ground (pegs, survey tape, paint etc.) before any operation involving the use of machinery.

Fire break construction and maintenance will be as shown in appendix 1 of this booklet.

Remember that uninterpretable areas may be diseased but not showing any symptoms (incipient disease).

DO	clean machinery when it is to operate in an uninterpretable area.	DON'T	use gravel from uninterpretable areas in areas which are secure dieback free.
DO	clean machinery when it has completed its work and before it is transferred to other areas		

6.13 SITE DEVELOPMENT

DO	select sites, wherever possible, dominated by dieback tolerant tree and understorey species.
DO	determine known and suspect dieback in the areas proposed for development, using dieback plans, aerial photographs, or field check on foot.
DO	avoid crossing from dieback to dieback-free boundaries.
DO	select sites on free draining soils and access roads low in the landscape.
DO	program earthmoving work for the months when soil is dry (usually December to March).
DO	construct site to shed water and dry quickly.
DO	ensure control of vehicle movement through careful siting and demarcation of parking areas and internal access tracks.
DO	channel pedestrian traffic through the provision of walk tracks located so as to minimise the risk of disease spread.
DO	provide the public with on-site information about dieback and the control measures being taken.

DON'T	duplicate existing access.
DON'T	use any machinery or vehicles in initial site selection.
DON'T	assume machinery is clean. Always inspect before allowing use.
DON'T	construct drains which result result in ponding.
DON'T	forget to write dieback specifications into contracts.

APPENDIX I

HYGIENE PRESCRIPTION FOR FIREBREAK CONSTRUCTION AND MAINTENANCE IN UNINTERPRETABLE AREAS

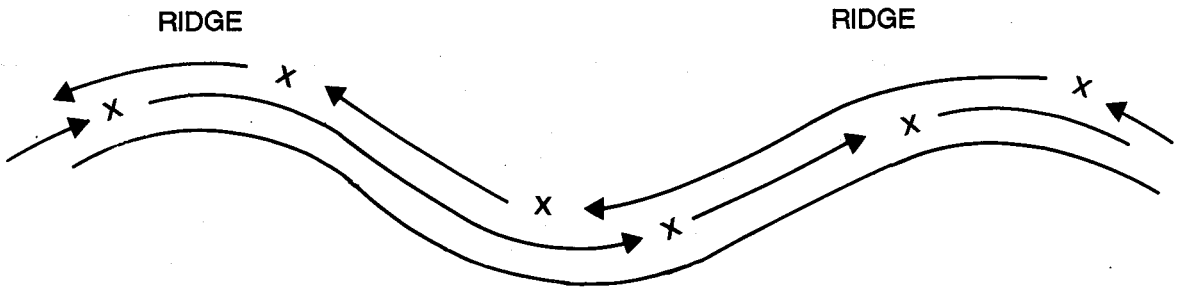
1. All works should be carried out under dry soil conditions.

2. All machines to be clean prior to work commencing and cleaned down as required.

3. Firebreaks should be adequately drained to ensure there is minimum ponding of water on road surface.

4. Works should be separated so that soil is not carried across ridge lines or upslope from gullies.

   ie:



→ direction of work
X cleandown required

5. If gravelling is required, only dieback-free gravel should be used unless the gravel is obtained from within the same mini-catchment and upslope of the area to be gravelled. Pits should be sampled prior to use.

SAMPLING PROCEDURE FOR PHYTOPHTHORA SPECIES.

Upon reaching the site and thoroughly investigating the area. Select a recently killed plant for sampling. The plant should still have the leaves attached, they should be just turning yellow.

(a) Ensure the mattock has been sterilised. This is achieved by cleaning and thoroughly wetting the entire head of the implement with alcohol.

(b) Clean leaves soil and twigs from around the base of the plant.

(c) Chop sections of root, bark and cambium from all sides of the plant. Take samples from a variety of depths below surface soil level. These samples are to be placed in a plastic bag and kept separate from the soil sample. The name of the officer taking the sample, the location of the sample site, the sample number, the district and the date are to be recorded on the bag with a permanent marker and on an aluminium tag that is to be placed inside the sample bag before it is sealed with a cable tie.

Banksia species: Collect sections of the collar region, including lateral roots.

Xanthorrhoea species: Collect small radiating brittle roots and sections of the pithy core.

Patersonia species: Collect all below ground sections of the plant, including the small brittle roots.

Persoonia longifolia: Collect as for banksia.

Podocarpus drouyniana: Collect parts of the large underground stem, lower stem and parts of the roots.

Macrozamia riedlei: Collect sections of the fibrous tissue from the bole and roots.

(d) Collect several handfuls of soil from around the base of the plant. The mattock can be used to lift the soil into a second sample bag. This reduces the possibility of saprophytic fungi in the soil sample interfering with the tissue samples. Irrigate the soil sample with distilled or deionised water if necessary to keep the sample moist until it can be delivered to the laboratory.

(e) The tissue sample bag is placed inside the soil sample bag which is secured tightly with a cable tie.

(f) Label the outside of the bag with a permanent marker showing the name of the person taking the sample, the sample site, sample number, the district and date.

(g) Attach an aluminium tag to the plant being sampled or a healthy plant nearby showing the name of the person taking the sample, date and sample number.

(h) The sample is to be kept in a cool place and transported to the detection service at Como research station as quickly as possible. No more than two days is recommended between sampling and processing.

(i) Always indicate clearly in the sample label if a sample is taken from a gravel pit or sand pit

(j) The sample sheet (attached) should be completed for each sample. A general rating of the impact at the site sampled should be entered **where applicable**. This will give the Detection Service information on the activity of the *Phytophthora* species isolated. It appears that some

Phytophthoras act in a way similar to *P. cinnamomi* in causing high impact graveyard sites, while others are often associated with isolated plant deaths only.

Enter: H for high impact (multiple ISD).
I for isolated plant death.

This column can be left blank if the impact is unclear. Further information on site can be provided under "comments" if necessary.

(k) For full identification of all phytophthoras found in the sample, tick under "full". For a general identification only (results would be given as either "CIN", "P. sp." or "NEG"), tick under "P.cin &/or P.sp.". The general identification will be quicker than the full, and may be adequate for some purposes.

Results will be coded as follows when the information sheet is faxed back to the interpreter

CIN	=	P.cinnamomi
CIT	=	P.citricola
CRY	=	P.cryptogea
DRE	=	P.drechleri
PMM	=	P.megasperma var megasperma
PMS	=	P.megasperma var sojae
PNN	=	P.nicotianae var nicotianae
P.sp.	=	Phytophthora species - general I.D. - a sp other than CIN
NEG	=	Negative

Mating type (A1 or A2) will be noted where applicable.

Sampling of plants suspected of being susceptible to phytophthora.

1. If plant identity is unknown, collect a sample of the leaf, branch, flower and fruit. These may be identified later in the office or sent to the W.A. Herbarium if necessary.

2. Collect root and collar tissue plus a soil sample from around the plant. Where root plating is required, root and\or stem base samples should **always** be sealed in a separate bag within the soil bag.

3. The sample is processed in the normal manner except that:

   (a) The detection service is to be notified of the nature of the sample ie. a plant being tested for susceptibility as an indicator of phytophthora.

   (b) Ask for the roots to be surface sterilised and plated.

   (c) If the root material is found to have phytophthora the species of phytophthora, the number of cuttings plated and the number of cuttings showing fungal growth are to be recorded.

   (d) If a sample returns a positive result only in the cup on the first process, it must be processed again as a positive result on the plate is essential to establish if the fungus is present in the root tissue or just the surrounding soil.

   (e) It is essential to know the disease condition of the area that the sample is taken from as this affects later calculation of the plants susceptibility rating.

   (f) It is essential that the sampler keep clear and accurate records of all sampling done to test the reliability or the susceptibility of plants as phytophthora indicators.

DIEBACK DISEASE DETECTION SERVICE
SAMPLE INFORMATION SHEET

SHEET No. ___ of ___

CONTACT DETAILS

Name _____

Fax No. _____ Phone No. _____

Region/District _____

DDDS USE ONLY
Date received
Date faxed

Sample Date	Sample label	Plant species sampled (if soil only, mark "S")	Plant specimen supplied (✓) (1)	Site Impact H or I (2)	Map Ref (3)	Identification ✓ if required		DDDS Use Only
						P. cin &/or "P. sp."	Full	Results

1. For all plants other than well-known "Indicator Species", voucher specimens should be supplied.
2. Site impact - H = high (multiple plant deaths); I = isolated plant death.
3. Map reference (CALM or A.M.G.) must be supplied for all samples.

SEND TO: Dieback Disease Detection Service, CALM Como Research Centre

COMMENTS: _____

SAMPLE INFORMATION SHEET

CELL NUMBER _____

DATE _____

SAMPLE NO. _____

RUN _____

FRAME _____

INTERPRETER _____

PLANT SAMPLED _____

I.S.D. CLASS _____

PROBABLE DISEASE VECTOR _____

PATTERN DEVELOPMENT _____

TOPOGRAPHICAL SITUATION _____

SITE DESCRIPTION AND INTERPRETATION FACTORS

HAVEL TYPE _____

LANDFORM TYPE _____

ASPECT _____

OVERSTOREY (%) _____

UNDERSTOREY IMPACT _____

OVERSTOREY IMPACT _____

PREDICTED IMPACT _____

SOIL TYPE _____

SLOPE _____

DRAINAGE _____

DROUGHT EVIDENCE _____

FIRE EVIDENCE _____

ARMILLARIA PRESENT _____

SITE DISTURBANCE (LOGGING/ANIMAL etc) _____

OTHER INDICATOR SPECIES _____

OTHER FACTORS:

DECISION	RESULT				