Phytophthora (Dieback) Control Environmental Instruction

Government of South Australia
Department for Infrastructure and Transport

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Document Management

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ABBREVIATIONS

Term / Acronym	Meaning
CEMP	Contractor's Environmental Management Plan
DEW	Department for Environment and Water (SA)
DIT or the Department	Department for Infrastructure and Transport
EHIA	Environment and Heritage Impact Assessment
EHTM	Environment and Heritage Technical Manual
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
LG Act	Local Government Act 1999
LSA Act	Landscape South Australia Act 2019
NV Act	Native Vegetation Act 1991
NV Regulations	Native Vegetation Regulations 2017
NVAP	Native Vegetation Assessment Panel
NVB	Department for Environment and Water (SA), Native Vegetation Branch
NVC	Native Vegetation Council
PC-ENV2	Project Controls – Environmental Protection Requirements
PIRSA	Departments of Primary Industries and Regions
VIA	Vegetation Impact Assessment

GLOSSARY

Term	Meaning
Conducive Soil Types	Neutral to acidic soils (pH <4 around native vegetation or <6.5 around cropping land)
Contract Documentation	Contract Scope and Technical Requirements; Functional and Operational Requirements; Contract or Project Scope
Contractors	Contractor engaged by the Department to undertake the planning, design or construction of a project (including maintenance projects)
Dieback	A symptom of plant disease in which there is a progressive death of individual plants, or a general decline in the health and numbers of plants in the landscape as a result of disease caused by the genus Phytophthora
Project Area	Area in which a project can have an effect on environmental and heritage aspects. Includes the construction, operational and maintenance footprints
Significant Remnant Vegetation	Patches of natural vegetation that still exists or, if the natural vegetation has been altered, is still representative of the structure and florisitics of the natural vegetation
Susceptible	Lacking the inherent ability to resist disease or attack by Phytophthora

1 INTRODUCTION

The Phytophthora (Dieback) Control Environmental Instruction has been developed by the Department for Infrastructure and Transport (DIT – the Department). The Department has a responsibility to ensure that its activities, and the activities of its contractors, do not adversely impact the environment. This includes ensuring that *Phytophthora* is not introduced or spread by the Departments' activities, and those of its contractors.

The risk of spread of *Phytophthora* can be minimised by the adoption of appropriate management procedures within the control zones, as outlined in this Environmental Instruction. Like all quarantine procedures, management procedures can be made ineffective by even a single failure.

The overarching goal of this Environmental Instruction is to protect vegetation by minimising the risk of introducing and spreading *Phytophthora*.

This Environmental Instruction applies to a range of Department programs and projects including road, rail, marine and other infrastructure, as required. The Environmental Instruction applies to employees of the Department (direct or contracted) and others operating under the direction of the Department (including lessees) undertaking the following activities:

- routine maintenance;
- construction;
- field inspection and survey; and
- landscaping and land management works.

This Environmental Instruction provides information on the importance of controlling the spread of *Phytophthora* and provides a risk assessment process that can be adopted to determine the level of control required for construction and maintenance activities undertaken by the Department and its contractors.

2 WHAT IS *PHYTOPHTHORA* AND HOW IS IT SPREAD

Phytophthora (pronounced fy-TOFF-thora) is a genus of parasitic pathogen that lives in soil and water, which attacks the roots and basal stems of plants. This pathogen has been introduced to South Australia and can cause extensive damage to vegetation by killing or injuring native plants and agricultural crops.

Phytophthora is listed under the *Environmental Protection and Biodiversity Conservation* (EPBC) *Act* 1999 as a key threatening process. Once a site is contaminated, Phytophthora can survive in the soil for over 10 years. There are 99 *Phytophthora* species reported in Australia, including *Phytophthora cinnamomi* which is the species most frequently associated with vegetation dieback.

The only outward sign of *Phytophthora's* presence is sickness or death of the plants it attacks. Some plants are more susceptible to *Phytophthora* than others and can be used as "indicator" species to detect the possible presence of *Phytophthora*. Disease symptoms can vary between plant species and visual symptoms may take years to develop. If the presence of *Phytophthora* is suspected, always treat the area as if its presence has been confirmed.

In South Australia, dieback caused by *Phytophthora* has been found in a number of sites within high rainfall areas, in particular the Adelaide Hills, Fleurieu Peninsula and Kangaroo Island. Though records in South Australia are mainly focused on the effect of *Phytophthora* on native vegetation, based on correspondence with PIRSA, some species of *Phytophthora* attack pulse crops (chickpeas, faba beans, lucerne), and in rarer instances fruit and nut trees, ornamental trees and shrubs, and vegetables including tomatoes, and eggplant.

New infections of *Phytophthora* are mainly caused by human activities involving the movement of infested soil and roots on vehicles, footwear, equipment and tools. Consequently, the only way to prevent *Phytophthora* from spreading is by controlling these human activities. High-risk areas for *Phytophthora* in South Australia include high rainfall areas with remnant native vegetation (see Figure 1). In transport corridors, high risk activities include working in and around areas of native vegetation or cropping, in wet areas and low-lying areas such as road verges, drains, watercourses and wetlands, and sites adjacent to significant remnant native vegetation or cropping in close proximity to known *Phytophthora* infestations.

A wide range of activities undertaken within or associated with the maintenance of transport corridors, can spread *Phytophthora*. These include shoulder grading, drain clearing, earthmoving, stock-piling, vegetation control, extraction of raw materials, off-road vehicle use, site inspections and survey works. Other activities such as firebreak construction and maintenance, fencing, drilling, land clearing and the installation of services such as power, gas, telecommunications and water can also spread the pathogen.

There is no known method to eradicate *Phytophthora* once it has become established. Whilst the spread and impacts of *Phytophthora* can be suppressed, to a degree, using phosphite treatments, this has been known to lead to phytotoxicity. Therefore, appropriate hygiene procedures as identified in Section 6, must be adopted to minimise the risk of spreading *Phytophthora*. Practices and procedures described in this document can reduce the spread of other soil-borne pathogens and weed seeds.

3 PHYTOPHTHORA CONTROL PRINCIPLES

This section details general control measures that can be adopted to prevent the spread of *Phytophthora.* In general, the risk of spreading *Phytophthora* can be minimised by keeping machinery, equipment and footwear clean from soil or plant material, and by not further dispersing soil or plant material within a site. Movement of soil, plant material and water can spread *Phytophthora* and therefore must be controlled. Collectively these controls are called *Phytophthora* hygiene procedures. A 'hygiene kit' should always be accessible, containing:

- A hard brush to clean footwear;
- A spray bottle of disinfectant:
    - Methylated spirits (undiluted); or
    - Household bleach (diluted 1 part with 4 parts water); or
    - Sodium hypochlorite (pool chlorine, diluted 1 part with 1500 parts water.); or
    - A phytophthora specific disinfectant.

The following principles apply to reducing the risk of spreading *Phytophthora*, particularly within High Risk Areas.

Avoid leaving formed areas

Avoid contact with the natural soil. Restrict movement of vehicles and personnel to the road formation, and other formed areas such as stockpile sites and borrow pits, particularly in wet conditions.

Avoid work in wet conditions

Operations should be carried out under dry soil conditions, particularly during the higher risk months of August to November inclusive. This is particularly important for high-risk activities such as drain cleaning and grading.

Ensure equipment is clean

Phytophthora is spread in soil or water. Objects (boots, vehicles, plant or equipment) must be free of soil, mud, slurry consisting of soil and water, or plant material (especially roots and lower stems). All machinery must be clean before leaving the depot for a new work site, and before leaving the work site.

When in the field, all plant and equipment should be cleaned or washed down when moving:

- from *Phytophthora*-infested to *Phytophthora*-free or *Phytophthora*-status unknown areas; and
- from *Phytophthora*-status unknown to *Phytophthora*-free areas.

Avoid native/crop vegetation

Select plant lay-down areas or stockpile sites away from native/crop vegetation and watercourses. Select sites down-slope of vegetation.

Avoid sites prone to flooding or ponding

These are sites at high risk of infection. Work within drains and watercourses is a high-risk activity.

Ensure raw materials are Phytophthora-free

Raw materials must be sourced from *Phytophthora*-free pits. These areas must be secured against unauthorised entry.

Use low impact vegetation control methods

Vegetation control methods that do not disturb the soil such as mowing, slashing or herbicide application should be used in preference to grading.

4 KNOWN INFESTATIONS AND AREAS POTENTIALLY UNDER THREAT OF *PHYTOPHTHORA*

Areas of the State that are vulnerable to *Phytophthora* (i.e., where rainfall and temperature are conducive to the parasite) are estimated in Figure 1. Known (reported) infestations are shown on the Department of Environment and Water's Nature Maps database[1].

There are three categories of areas under threat of *Phytophthora*:

- High Potential Threat Areas are those parts of the State that occur above the 500 mm rainfall isohyet (but including the eastern portion of Kangaroo Island receiving less than 500 mm annually) and may contain soils that are conducive to the establishment of *Phytophthora*.
- Moderate Potential Threat Areas of the State occur between the 400 mm and 500 mm rainfall isohyets, with the exception of eastern Kangaroo Island[2].
- Low Potential Threat Areas are the remainder of the State.

Further details regarding each category of potential threat areas are provided later in this section.

The need for further assessment of risk (as per the process detailed in Section 5) and application of control procedures, is dependent on whether the work or activity is proposed to be undertaken in a High or Moderate Potential Threat Area of the State. Figure 1 should be used as a high-level guide to determine the potential threat for the project area with more detailed, project area specific assessment undertaken using online mapping tools such as the Bureau of Meteorology climate data, Nature Maps or weather station data.

No further assessment of risk is required for work proposed to be undertaken within Low Potential Threat Areas. The risk assessment procedure is to be followed to determine if the works area is subject to a High Risk, Medium Risk or Low Risk with regard to the need to implement appropriate *Phytophthora* hygiene procedures.

[1]Refer to the layer called 'Phytophthora Records' under the sub-category of 'Fauna and Flora'

[2]1990 Bureau of Meteorology climate data

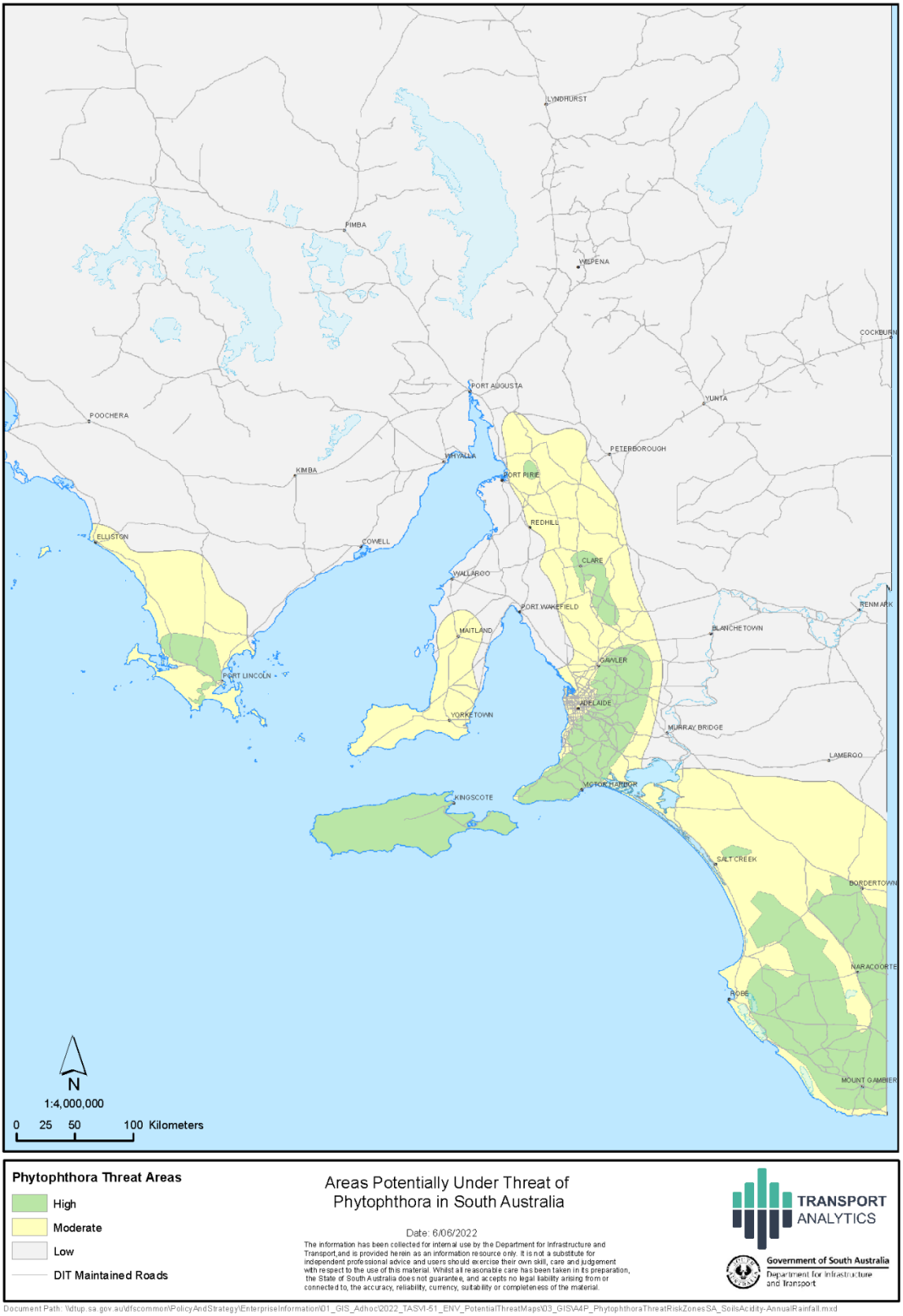

Figure 1. Areas Potentially Under Threat of *Phytophthora* in South Australia

4.1 High Potential Threat Areas

Definition

High Potential Threat Areas of the State are those which are conducive to the spread of *Phytophthora* and the establishment of disease, based on climatic and soil factors and location of known infestations (Figure 1 and Appendix A as well as online resources reporting known infestations). *Phytophthora* is known to be present at sites within these areas.

The High Potential Threat Areas are:

- Mt Lofty Ranges (Angaston to Cape Jervis);
- Kangaroo Island; and
- Parts of the South East.

Procedure

Within High Potential Threat Areas, *Phytophthora* control procedures may not be necessary at every site where an activity or work is to occur. Each work site must be assessed to determine if it is High, Medium or Low Risk (refer to Section 5). Relevant information may be provided in a Vegetation Assessment or Vegetation Survey. An individual project may have multiple sites, including a material source (e.g., quarry), each of which must be classified according to risk.

4.2 Moderate Potential Threat Areas

Definition

Moderate Potential Threat Areas of the State occur where *Phytophthora* has not yet been recorded but where there is a moderate potential of it becoming established (Figure 1).

The Moderate Potential Threat Areas are:

- Parts of the Adelaide Plains and Mid-North;
- Southern Eyre Peninsula;
- South East; and
- Southern Yorke Peninsula.

Procedure

Within Moderate Potential Threat Areas, *Phytophthora* control procedures may be necessary if a proposed work site has been assessed as a High or Medium Risk. An individual project may have multiple sites, including a material source (e.g., quarry), each of which must be classified according to risk.

Within Moderate Potential Threat Areas of the State, High or Medium Risk sites have a greater potential to occur where:

- areas containing susceptible species in or adjacent to the site is present;
- the site is located between 5 km and 10 km from a known infested site (irrespective of whether susceptible species have been identified in or adjacent to the site); and

- the land is prone to flooding or ponding.

4.3 Low Potential Threat Areas

Definition

Low Potential Threat Areas of the State exist where *Phytophthora* has not yet been recorded and where there is a low likelihood of it becoming established.

Low Potential Threat Areas include parts of the State that are neither High Potential nor Moderate Potential Threat Areas (Figure 1).

Procedure

No *Phytophthora* control procedures are required in Low Potential Threat Areas.

5 PHYTOPHTHORA RISK ASSESSMENT

Within High Potential and Moderate Potential Threat Areas of the State, each site must be assessed prior to commencement of works to determine if there is a High, Medium or Low risk of *Phytophthora* becoming established or spreading.

Unless otherwise specified, the *Phytophthora* risk assessment must be undertaken during the Proving and/or Pre-Delivery phase of a project, as part of the Environment and Heritage Impact Assessment (the EHIA Guideline is accessible through the DIT Environment and Heritage Technical Manual at https://www.dit.sa.gov.au/documents During the Deliver phase, if there is no information available in the project documentation regarding the level of *Phytophthora* control required, the risk assessment must be undertaken.

The risk assessment must analyse the likelihood and consequence of infection for species of flora and ecological communities, as well as cropping land at or adjacent to the site. Once the assessment is completed, the level of risk and the *Phytophthora* control procedures appropriate to the site risk must be recorded in the EHIA report and the Contractor's Environmental Management Plan. These *Phytophthora* control procedures must then be implemented.

The risk assessment procedure, to determine the appropriate level of *Phytophthora* control, is detailed in Figure 2.

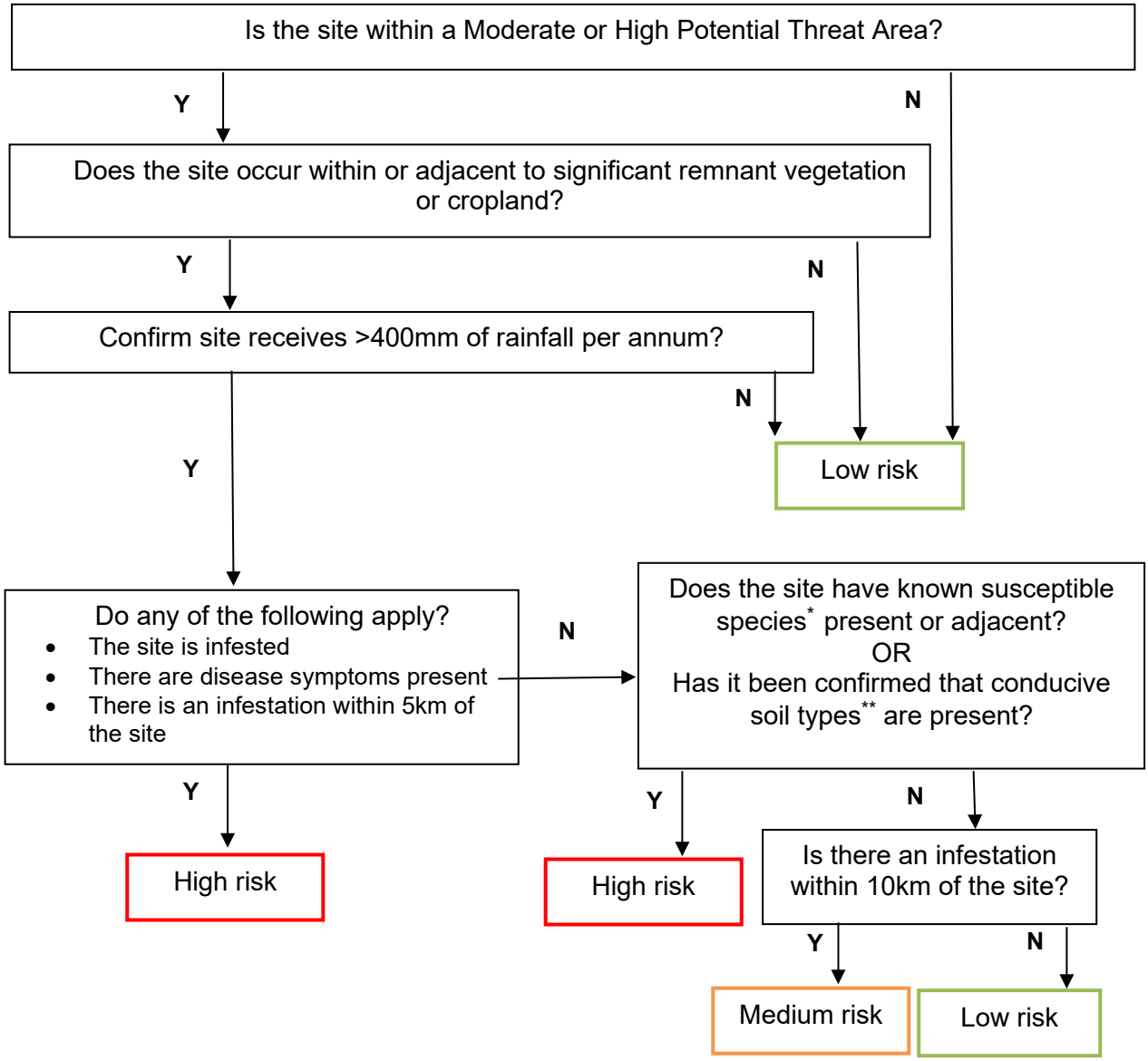

Figure 2. Risk assessment process

* Susceptible species include remnant native vegetation and some crop varieties. See Appendix E for a full list of susceptible native species. Records in South Australia are mainly focussed on the effect of phytophthora on native species, however, based on correspondence with PRISA some species of phytophthora are known to attack pulse crops (chickpeas, faba beans, lucerne) and in rare instances fruit and nut trees, ornamental trees and shrubs and some vegetables including tomatoes and eggplant.

** Conducive soil types are neutral to acidic. Around native vegetation, pH <4 is considered conducive for *P. cinnamomi*, while soil pH <6.5 should be considered for Phytophthora species around cropping land.

6 PHYTOPHTHORA HYGIENE PROCEDURES FOR HIGH, MEDIUM AND LOW RISK AREAS

Within each Potential Threat Area there are sites with varying risk levels (to be determined using the risk assessment procedure detailed in Section 5):

- High Risk Sites – Occur within the High Potential Threat Area or Moderate Potential Threat Area of the State only. Within the Moderate Potential Threat Area, a High Risk Site would typically occur in an area with relatively high soil moisture levels, adjacent to significant native vegetation or cropland, with a confirmed infestation within 5 km of the site (irrespective of whether susceptible species have been identified in or adjacent to the site).
- Medium Risk Sites - Occur within the High or Moderate Potential Threat Areas of the State only. *Phytophthora* is not yet suspected or confirmed but has the potential to be infected based on the presence of significant remnant vegetation or cropland, appropriate rainfall and the site location falling within 10 kilometres of an infestation.
- Low Risk Site - *Phytophthora* is not suspected or confirmed and the potential for *Phytophthora* to become established is low. Any site within the Low Potential Threat Area of the State is recognised as a Low Risk Site. Low Risk Sites however may also occur within High Potential and Medium Potential Threat Areas of the State (Figure 1).

6.1 High Risk Sites

6.1.1 Definition

- Site is within a Moderate or High Potential Threat area;

  AND

- Site occurs within or adjacent to significant remnant native vegetation or cropland;

  AND

- The site meets any of the following criteria:
  - it is located within 5 km of a confirmed infested site;
  - it is confirmed or suspected to be infested; and/or
  - disease symptoms are present.

  OR

- Known susceptible species are present or adjacent.

6.1.2 Pre-Works and On-Site Management Measures

The following procedures apply to any work site that has been designated as a High Risk Site. As the focus is on prevention of disease establishment or spread, High Risk Sites must be avoided wherever practicable (including material sources). The Contractor must implement the following management measures where a High Risk Site cannot be avoided.

Guidelines are given in Appendix B and Appendix C for the cleaning and wash-down of vehicles, equipment and footwear, where this has been identified in the following measures.

6.1.3 Hygiene Plan

The Contractor must:

- prepare a *Phytophthora* Hygiene Plan in advance of works. This plan may form part of a Contractor's Environmental Management Plan (CEMP);
- identify the location of any disease boundaries (e.g., known sites containing and adjacent to *Phytophthora* infestations);
- identify the necessary control measures, including 'no go zones' where appropriate,
- indicate equipment access and soil handling activities;
- indicate the work site access and materials sources; and
- nominate the location and construction method of wash down areas (in accordance with the management measures outlined in Appendix B).

6.1.4 Training

The Contractor must include relevant information and procedures to minimise the risk of spreading *Phytophthora* in the pre-works induction for all personnel working on the site.

In addition, the start-up or toolbox meetings must include relevant information and procedures to minimise the risk of spreading *Phytophthora*.

6.1.5 Vehicle movement

The Contractor must contain movement of vehicles to formed areas wherever practicable, particularly in wet conditions.

The Contractor must ensure all plant is cleaned (Figure 3) with an appropriate disinfectant (See section 3) prior to:

- arriving at a site;
- moving to another High or Medium Risk site; and
- transporting gravel and other construction materials.

The Contractor must ensure plant is washed down in designated wash down areas.

The Contractor must ensure that work is scheduled to move from un-infested (*Phytophthora*-free) or status unknown areas to known infested areas, wherever practicable.

Figure 3. Example of clean down equipment
Photo Credit: Alcoa, Dieback Management, http://www.alcoa.com/australia/en/info_page/mining_dmanagement.asp, accessed July 2015.

6.1.6 Earthworks

Wherever practicable, the Contractor must:

- avoid leaving the road except under dry soil conditions;
- avoid using tracked vehicles as they are difficult to clean effectively;
- avoid grading beyond the areas previously graded (e.g., patrol grading); and
- conduct routine activities in “bounds” of several kilometres (e.g., 3-4 km), each interrupted by a clean-down to minimise the exposure risk of vegetation down-slope of the operation.

6.1.7 Topsoil removal

The Contractor must contain topsoil within the infested area or dispose of it to a licensed waste depot where applicable (and advise that topsoil may be contaminated with *Phytophthora*).

If offsite disposal is required, the Contractor must secure and contain the material for transport, to prevent any potential to spread *Phytophthora*.

6.1.8 Drains

Wherever practicable, the Contractor must:

- clean out or repair drains in dry conditions only, unless during an emergency;

- avoid grading in watercourses or areas prone to flooding;
- ensure drains are constructed to avoid ponding of discharge water; and
- clean or wash down plant and equipment before moving away from a culvert or drain, if working outside formed areas.

6.1.9 Vegetation management and disposal

The Contractor must use vegetation control methods that do not disturb the soil. Methods such as mowing, slashing, hand-pruning or herbicide application are preferred to grading.

Wherever practicable, the Contractor must carry out all works outside the formation in dry conditions only. The Contractor must avoid drains wherever practicable.

Where practicable, the Contractor must clearly mark on site, e.g., via bunting and signage, the areas which have been identified as *Phytophthora*-infested.

The Contractor must dispose of vegetation in the following way:

- Trees for removal must be cut a minimum of 1 metre above the ground. The vegetative material above this point (upper trunk and canopy) can be considered *Phytophthora* free as long as it has not been in contact with soil, and must be mulched and retained on site, or must be disposed of at the discretion of the Contractor, subject to Contract Documentation.
- Vegetative material from weed species cut a minimum of 1 metre above the ground must be disposed of in accordance with Master Specification PC-ENV2 and any other relevant Contract Documentation.
- All vegetation under 1 metre, including tree stumps, must be excavated, stockpiled at a nearby secure location (to prevent unauthorised collection for firewood) and burnt once dry, if practicable. The material must be burnt on site or at a suitable location proposed by the Contractor and approved by the Principal. The Contractor must comply with all fire bans and restrictions, and must obtain an appropriate permit from the Local Government or other relevant authority, and approval from the landowner, to carry out burning.

  Alternatively, the stumps can be ground out in accordance with Master Specification Part PR-LS-C11 Tree Pruning and Removal and any relevant Contract Documentation. Where there is ground vegetative material that is not from a weed species, it is to be retained and spread on site.
- All other vegetation (native and exotic) under 1 metre in height requiring clearance from within the *Phytophthora* infected area, must be mulched and retained on site.

The Contractor must ensure all equipment used has been washed down and cleaned of any soil.

The Contractor must undertake stump removal work in dry weather to minimise the spread of *Phytophthora* through water movement.

If mulched and cleared vegetative material cannot be contained within the infected area, the Contractor must dispose of it at a licensed waste depot. If offsite disposal is required, the Contractor must contain the material prior to transport, to prevent any potential to spread *Phytophthora*.

6.1.10 Materials

The Contractor must ensure materials brought onto the work site are free of *Phytophthora*.

The Contractor must store materials at the work site on a hard, dry, well-drained surface that does not drain towards vegetation, and is already clear of vegetation.

6.1.11 Water

The Contractor must ensure chlorinated mains water, sources free of *Phytophthora*, or water sterilised with an appropriate fungicide or pool chlorine (60 mL to every 100 L of water) are used (refer Appendices C and D).

6.1.12 Plant nursery stock

The Contractor must ensure plant nursery stock is *Phytophthora*-free prior to planting to ensure that *Phytophthora* is not introduced to *Phytophthora*-free or *Phytophthora* status-unknown sites. Nursery stock must be sourced from Nursery Industry Accreditation Scheme Australia (NIASA)[3] accredited nurseries wherever practicable.

6.1.13 Hygiene breakdowns

The following measures must be implemented by the Contractor in the event of soil, plant material, wash-down effluent, or other potentially *Phytophthora*-infested material being deposited on a *Phytophthora*-free or *Phytophthora* status-unknown site:

- Demarcate a fenced buffer of 2 metres around the site of the breakdown.
- Move personnel, plant, equipment or vehicles out of the site only after wash-down.
- Sign-post the site "*Phytophthora*-Infested No Unauthorised Entry" or "Dieback Infested No Unauthorised Entry" and manage accordingly.
- Raise a non-conformance if appropriate.
- If the hygiene breakdown is a result of Contractor activities, the Contractor must (at the expense of the Contractor):
- Treat the site as if it is contaminated until known otherwise.
- Monitor the site annually for a period of three years (during which time there needs to be a wet spring or a wet summer season) for possible development of disease. If after two years there have been sufficient wet spring and/or wet summer seasons to allow *Phytophthora* symptoms to become evident, two years monitoring is sufficient. Monitoring must be undertaken towards the end of the active growing season (at the end of a wet spring or wet summer). Monitoring must be via visual inspection (including the use of photo points) and soil/plant tissue sampling (of dead or dying plants suspected of being infected with *Phytophthora*), with results confirmed via laboratory testing.
- Undertake any soil/plant tissue sampling in accordance with laboratory requirements. The Contractor must obtain instructions from the laboratory on how to take a sample, the best time to take the sample, and how to store and

[3] The NIASA is a national scheme run by the Nursery & Garden Industry for production nursery and growing media businesses, which operate in accordance with a set of national 'best practice' guidelines designed to minimise weeds and disease.

transport it. Sampling usually involves digging up a dead or dying plant to get to the roots. Appropriate hygiene procedures are required during sampling activity.

- If an infestation is confirmed, the Contractor must:
  - Notify the SA Department for Environment and Water (DEW) in order to update the *Phytophthora* database.
  - Prepare a management plan for the site upon confirmation of the infestation. The management plan must be prepared by a suitably qualified person (with a background in ecology or equivalent expertise) and endorsed by the Principal.
  - If the hygiene breakdown is a result of Departmental activities, the above steps must be implemented by the Department.

6.1.14 Kangaroo Island Phytophthora Risk Area

Phytophthora is known at a number of locations on Kangaroo Island. The above procedures apply to all areas identified in this Environmental Instruction; however, the following additional specific procedures apply to Kangaroo Island. The Contractor must:

- Avoid if practicable any works off the seal (particularly grading of unsealed shoulders, drain maintenance and sourcing of materials), particularly during the high-risk months of August to December;
- Assess gravel pits as *Phytophthora*-free prior to use to ensure that *Phytophthora* is not introduced to *Phytophthora*-free or *Phytophthora* status-unknown areas;
- Use a power wash-down unit for cleaning mobile plant and equipment. There are two units available for hire from the District Council of Kangaroo Island (contact the Council's Technical Program Manager or the depot). The Department part funded one of these units, therefore the Department is not required to pay a hire fee but may be required to contribute to the provision of chemicals; and
- Before leaving Kangaroo Island for the mainland, clean (wash down) all mobile plant and machinery.

For any activities off the seal along the ***Playford Highway*** (in particular grading of unsealed shoulders and drain maintenance), the Contractor must commence from Kingscote proceeding towards Parndana using the following procedure:

- Carry out activity such as grading in "bounds" of 3-4 km maximum length;
- Wash down plant at the end of each "bound" before proceeding on; and
- Wash down plant at the end of the last "bound" before returning to Kingscote.

The Landscape South Australia Kangaroo Island 'Phytophthora Fieldwork Hygiene Protocol' (2021) can be viewed at:
https://cdn.environment.sa.gov.au/landscape/docs/ki/phytophthora-fieldwork-hygiene-protocol-22.pdf

6.2 Medium Risk Sites

6.2.1 Definition

- Site is within a Medium or High Potential Threat area;

  AND

- Site occurs within or adjacent to remnant vegetation or cropland;

  AND

- The site receives over 400 mm of rainfall per annum;

  AND

- The site is located more than 5 km, but less than 10 km, from a confirmed infested site.

6.2.2 Pre-Works and On-Site Management Measures

The following procedures apply to any work site that has been designated as a Medium Risk Site.

Guidelines are given in Appendix B and Appendix C for the cleaning or wash-down of vehicles, equipment and footwear, where this has been identified in the following procedures.

6.2.3 Training

The Contractor must include relevant information and procedures to minimise the risk of spreading *Phytophthora* in the pre-works induction for all personnel working on the site.

In addition, the start-up or toolbox meetings must include relevant information and procedures to minimise the risk of spreading *Phytophthora*.

6.2.4 Vehicle movement

The Contractor must contain movement of vehicles to formed areas wherever practicable, particularly in wet conditions.

The Contractor must ensure all plant is free of mud, soil and plant material (e.g., by dry brushing and/or clean with an appropriate disinfectant (See section 3)) based on a visual inspection prior to:

- arriving at a site;
- moving to another Medium Risk site; and
- transporting gravel and other construction materials.

The Contractor must ensure plant is washed down prior to entering a Medium Risk Site.

The Contractor must ensure that work proceeds from un-infested (*Phytophthora*-free) or status unknown sites to known infested sites, wherever practicable.

6.2.5 Earthworks

Wherever practicable, the Contractor must:

- avoid leaving the road except under dry soil conditions;

- avoid using tracked vehicles as they are difficult to clean effectively;
- avoid grading beyond the areas previously graded (e.g., patrol grading); and
- conduct routine activities in “bounds” of several kilometres (e.g., 3-4 km), each interrupted by a clean-down to minimise the exposure risk of vegetation down-slope of the operation.

6.2.6 Drains

Wherever practicable, the Contractor must:

- clean out or repair drains in dry conditions only, unless during an emergency;
- avoid grading in watercourses or areas prone to flooding;
- ensure drains are constructed to avoid ponding of discharge water; and
- clean or wash down plant and equipment before moving away from a culvert or drain, if working outside formed areas.

6.2.7 Vegetation control

The Contractor must use vegetation control methods that do not disturb the soil, such as mowing, slashing, hand-pruning or herbicide application, in preference to grading.

Wherever practicable, the Contractor must carry out all works outside the formation in dry conditions only. The Contractor must avoid drains wherever practicable.

6.2.8 Materials

The Contractor must ensure materials brought onto the work site are free of *Phytophthora*.

The Contractor must store materials at the work site on a hard, dry, well-drained surface that does not drain towards vegetation, and is already clear of vegetation.

6.2.9 Plant nursery stock

The Contractor must ensure plant nursery stock is *Phytophthora*-free prior to planting to ensure that *Phytophthora* is not introduced to *Phytophthora*-free or *Phytophthora* status-unknown sites. Nursery stock must be sourced from Nursery Industry Accreditation Scheme Australia (NIASA) accredited nurseries wherever practicable.

6.3 Low Risk Sites

6.3.1 Definition

- Site is within a Low Potential Threat area;

  OR

- Site with no remnant native vegetation or cropland in or adjacent to the site;

  OR

- Site that has non-conducive soil types;

  OR

- Site receives less than 400 mm of rainfall per annum;

  OR

- Site that meets <u>all</u> of the following criteria:
  - there is no infestation within 10 km of the site'
  - it is not within a confirmed or suspected infested area; and
  - there are no disease symptoms present;

    OR

- Sites within built-up areas.

6.3.2 Pre-Works and On-Site Management Measures

No *Phytophthora* control procedures are required.

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APPENDIX A – DEPARTMENT MANAGED ROADS WITHIN PHYTOPHTHORA HIGH POTENTIAL THREAT AREAS

Phytophthora High Potential Threat Areas of the State defined in Figure 1 include the following Department maintained roads:

Adelaide Hills and Fleurieu Peninsula

RN 4384	Barossa Valley Way	From MM 6.2 to 24.0
RN 4480	Angaston – Birdwood	From MM 5.85 to 40.26
RN 4483	Lyndoch – Chain of Ponds	Entire Length of Road
RN 4486	Williamstown – Birdwood	Entire Length of Road
RN 4489	Tea Tree Gully – Mannum	From MM 0.0 to 56.30
RN 4490	Mount Torrens – Tungkillo	Entire Length of Road
RN 4492	Chain of Ponds – Cudlee Creek	Entire Length of Road
RN 4495	Birdwood – Verdun	Entire Length of Road
RN 4498	Cudlee Creek – Verdun	Entire Length of Road
RN 4500	South East Highway	From MM 0.0 to 41.14
RN 4510	Nairne Road	Entire Length of Road
RN 4515	Aldgate – White Hill	From MM 0.0 to 29.0
RN 4516	Hahndorf – Echunga	Entire Length of Road
RN 4640	Blackwood – Goolwa	From MM 0.0 to 65.54
RN 4643	Stirling – Strathalbyn	Entire Length of Road
RN 4646	Mount Barker – Strathalbyn	Entire Length of Road
RN 4652	Callington – Goolwa	Entire Length of Road
RN 4655	Echunga - Meadows	Entire Length of Road
RN 4664	Meadows – Willunga	Entire Length of Road
RN 4685	Mount Compass – Goolwa	Entire Length of Road
RN 4688	Victor Harbour – Goolwa	From MM 0.0 to 8.18
RN 4760	Noarlunga – Victor Harbor	Entire Length of Road
RN 4763	Noarlunga – Cape Jervis	Entire Length of Road
RN 4787	Willunga – Myponga	Entire Length of Road
RN 4790	Myponga – Hindmarsh Valley	Entire Length of Road
RN 4793	Yankalilla – Victor Harbor	Entire Length of Road
RN 5015	Gawler – Kersbrook	Entire Length of Road
RN 5036	Elizabeth – Williamstown	From MM 5.67 to 22.72
RN 6000	Gorge Road	Entire Length of Road
RN 6021	Magill – Lobethal	Entire Length of Road
RN 6039	Burnside – Balhannah	Entire Length of Road
RN 7380	Mount Pleasant – Walker Flat	From MM 0.0 to 9.52
RN 44809	Balhannah – Little Hampton	Entire Length of Road
RN 44824	Echunga – Mount Barker	Entire Length of Road
RN 47600	Myponga Reservoir Access	Entire Length of Road

Kangaroo Island

RN 4880	Playford Highway	MM 0.00 to 17.10
RN 4883	Kingscote – Penneshaw	MM 0.00 to 53.14
RN 4886	Muston Hill – American River	MM 0.00 to 9.50

APPENDIX B – HYGIENE GUIDELINES FOR VEHICLES

Cleaning vehicles and machinery is the single most important management action available apart from avoiding contact with *Phytophthora*.

Any equipment or vehicles that have been working in *Phytophthora* infected material must be cleaned down before travelling on *Phytophthora*-free surfaces.

Cleaning is a quarantine measure and therefore must be done properly every time and always carried out when specified in the *Phytophthora* control procedures for a project or operation. The value of the quarantine procedures can be destroyed by even a single failure.

Vehicles and Machinery

- Use vehicles that are easy to clean, such as machines with rubber tyres rather than tracks.
- Situate the clean-down site just inside the infested zone to prevent the spread of *Phytophthora* to an un-infested area (Figure 7).
- The clean-down site must be maintained in a clean state, and must be avoided by clean vehicles and machinery.
- Clean down every piece of equipment, machinery and vehicle that has come into contact with soil or which could carry *Phytophthora*.
- Where practicable, treat effluent by adding sodium hypochlorite, mixing it in thoroughly and leaving it to stand one day.
- Consider the disposal of the effluent as it may contain *Phytophthora*. For example, a drain could be constructed to collect and treat the effluent (
- Figure 8). Drains could direct water to sediment infiltration sumps (which do not allow water to overflow).
- Drains must be made impermeable to water by compaction of suitable materials.
- *Phytophthora* (dieback) boundaries within a work site must be signposted, for example:

DIEBACK FREE.
NO ENTRY.

Or

DIEBACK FREE. AUTHORISED ENTRY ONLY.
CLEAN-DOWN HERE.

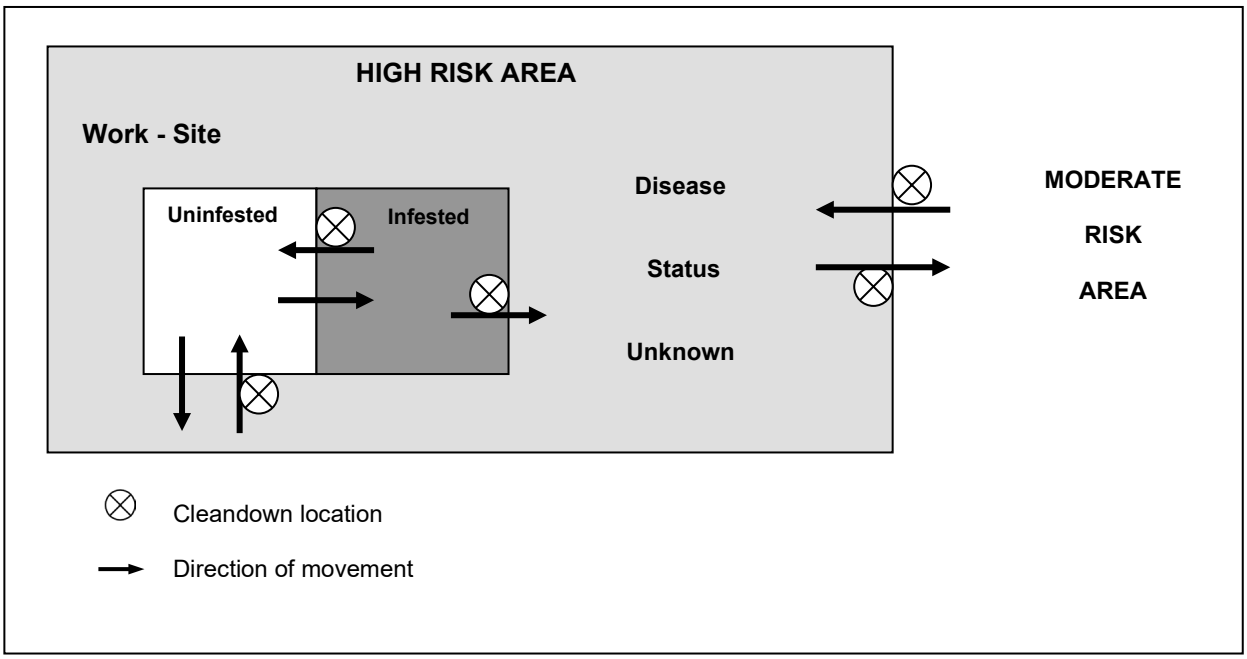

Figure 4. Clean-down locations for entry to an infested work-site

Vehicle and Machinery Clean-Down Procedure

1. Dry brush (when mud is dry where possible) to confirm that vehicles and machinery are free of soil, slurry (water and soil) or plant material. Disinfect all equipment used for dry brushing. If working in a Low – Moderate Risk Area, proceed to step 7. If working in a High Risk Area, continue with steps 2-7.
2. Undertake clean-down on a hard, well-drained site (e.g., road or compacted surface) away from native vegetation, as close as possible to the entry/exit point.
3. Spray down vehicle with pressurised disinfectant dilution, particularly around tyres, mudflaps and underneath the vehicle using ONE of the following chemical solutions:
   - Phytophthora specific disinfectant (biodegradable and non-corrosive): Add the manufacturer specified part of disinfectant to the specified part of water
     OR
   - Sodium hypochlorite (pool chlorine): Add 1 part to 1500 parts water.
4. Move vehicle to rotate the tyres, spray the newly exposed section of tyres.
5. Dry brush all footwells within the vehicle, spray with disinfectant.
6. Allow all disinfectant to penetrate for a minimum of 1 minute, preferably for 10 minutes.
7. Disinfect footwear before entering the vehicle to avoid re-contamination. Do not drive through the effluent. Ensure the effluent does not drain outside the site.

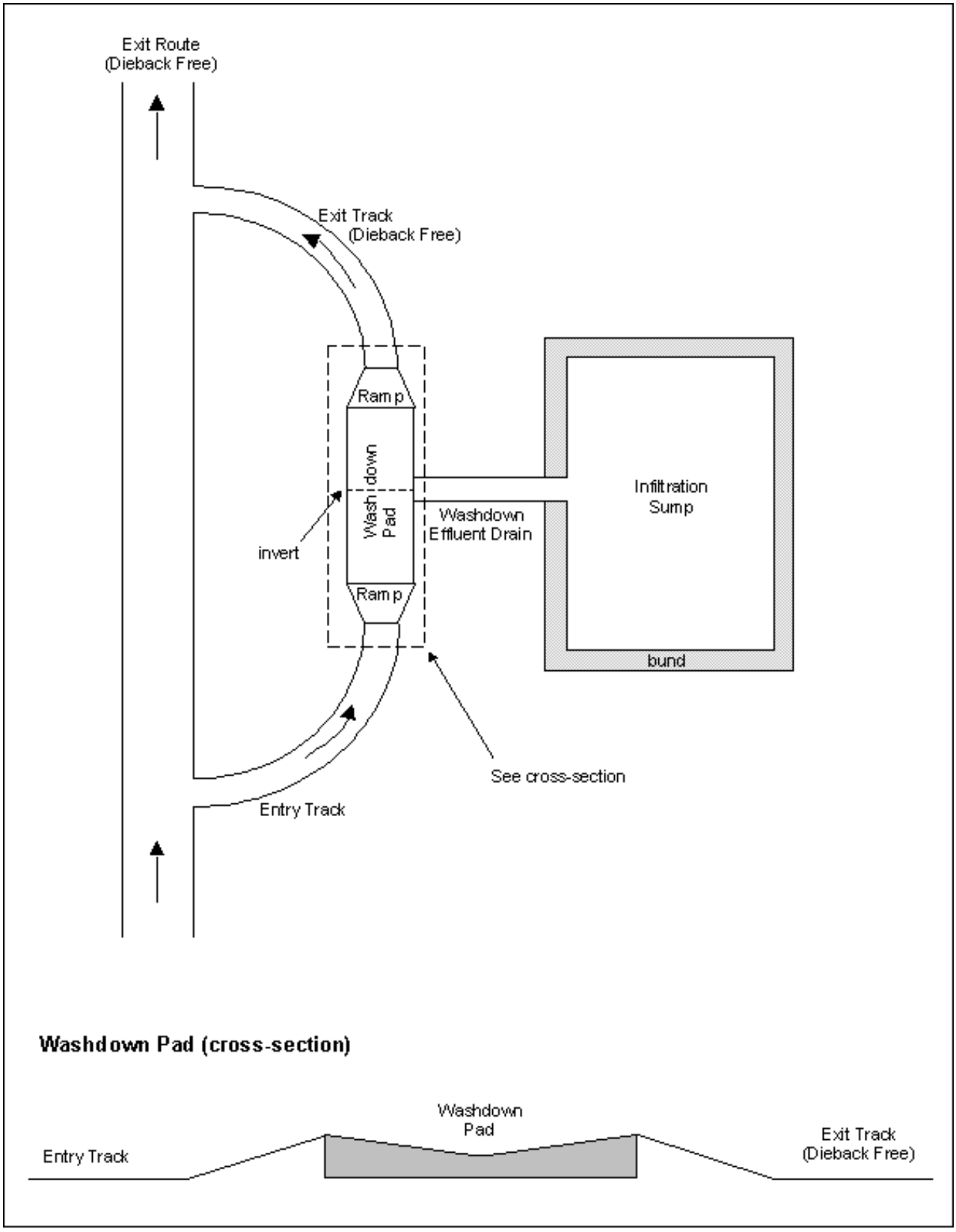

Figure 5. Example Phytophthora washdown facility

Appendix C – Phytophthora Hygiene Procedure for Minor Works and Site Inspections

Vehicles

1. When using vehicles within a *Phytophthora* zone, the Contractor must avoid any part of the vehicle coming into contact with the soil and remain on hard stand surfaces (i.e., a road) where practicable (Table 1). If there is a need to park or move a vehicle through a *Phytophthora* zone where it will come into contact with soil, the Contractor must follow this procedure:
2. When you leave the infection zone, move to an appropriate disinfection area, preferably a hard stand covered area free of soil.
3. Remove any excessive soil build-up with a strong bristled brush.
4. Spray all parts of the vehicle that came into contact with the soil with a phytophthora specific disinfectant using a spray bottle/ in accordance with the manufacturer's recommended dosage. Make sure you remove soil from all areas that came into contact with soil including mud flaps and the underside of the vehicle.
5. Proceed to the uninfected area.

Footwear, Small Equipment and Hand Tools

1. The Contractor must disinfect footwear using a spray bottle or a footbath (Table 1). The latter is useful when a large number of people need to disinfect their footwear at one location. The Contractor must follow this procedure:
2. When you leave the infection zone, move to an appropriate disinfection area, preferably a hard stand covered area free of soil.
3. Mud and soil must first be removed from footwear by brushing the sole of the shoe with a strong bristled brush.
4. Spray the sole of the shoes with disinfectant or if using a footbath step into the bath and move to a hard soil-free area. The dilution should comprise ONE of the following chemical solutions:
    - A phytophthora specific disinfectant applied at the manufacturer specified dosage rate
      OR
    - Methylated spirits**:** 70-100%
      OR
    - Household bleach: 1 part to 4 parts water.
5. Step forward after disinfection to avoid recontamination of the shoes.
6. Small equipment and hand tools must be cleaned by removing all soil and using a spray bottle containing the disinfectant.
7. Disinfect the brush used to remove soil with a phytophthora specific disinfectant, Methylated spirits or household bleach on completion.

8. The Contractor should not leave footbath unattended where children and animals may come in contact with the chemical.

Table 1. Summary of Hygiene Procedures

(Source: *Phytophthora* Technical Group *(2006, 2nd edition), Phytophthora Management Guidelines*, page 34.

	Hygiene Procedure	Disinfectant/rate	Comments
Small equipment, hand tools, footwear	– Dry brushing – Disinfection OR – Dry brushing – Footbath (useful for large groups of people)	Phytophthora specific disinfectant at the manufacturer's specified dosage rate OR Household bleach - 1 part to 4 parts water OR Methylated spirits (70-100%)	– All soil must be removed before disinfecting – Avoid re-contaminating footwear – Remember to disinfect brush or tool used in dry brushing
Vehicles	– Dry brushing – Spray all parts of the vehicle that came into contact with soil with a high-pressure spray bottle	Phytophthora specific disinfectant at the manufacturer's specified dosage rate OR Sodium hypochlorite (pool chlorine) 1 part to 1500 parts water	– Avoid allowing vehicle to come in contact with soil wherever practicable – Remember to use a high-pressure spray bottle to remove soil, including spraying mud-flaps and the underside of the vehicle – Remember to disinfect brush or tool used in dry brushing

Appendix D – Phytophthora Hygiene Kit

Image: Personal *Phytophthora* Hygiene Kit

PHYTOPHTHORA HYGIENE KIT

Phytophthora wash-down standards

Objects (boots, vehicles, plant or equipment) shall be judged *Phytophthora* (Dieback) free, when a visual inspection reveals the objects are free of:

- clods of soil and/or mud;
- slurry consisting of soil and water; and
- plant material especially roots and lower stems.

Hygiene Breakdowns

In the event of soil, plant material, wash-down effluent, or other potentially *Phytophthora* infected material being deposited on a *Phytophthora* free or status-unknown site, the following steps are to be implemented:

- demarcate a buffer of 2 metres around the site of the breakdown;
- move plant, equipment or vehicles out of the site only after wash-down;
- sign post the site "*Phytophthora* Infected" and manage accordingly; and
- raise a non-conformance if appropriate and record area of *Phytophthora* infection.

Appendix E – Native Plant Species Susceptible to *Phytophthora*

The table below (Table 2) shows plant species that are known to be susceptible in South Australia (source: *Phytophthora* Management Guidelines, *Phytophthora* Technical Group 2006, 2nd Edition). Plant species in **BOLD** are endemic to Kangaroo Island.

Table 2. Native Plant Species Known to be Susceptible to *Phytophthora cinnamomi* in South Australia.

Family	Species name	Common name
Casuarinaceae	*Allocasuarina verticillata*	Drooping Sheoak
Dilleniaceae	*Hibbertia* spp.	Guinea-flower
Epacridaceae	***Acrotriche halmaturina***	**Pink Ground-berry**
	Epacris impressa	Common Heath
	Leucopogon virgatus	Common Bearded-Heath
Fabaceae	*Pultenaea daphnoides*	Large Leaved Bush-Pea
	Pultenaea involucrata	Mount Lofty Bush-Pea
	Pultenaea trifida	**Kangaroo Island Bush-Pea**
Mimosaceae	*Acacia myrtifolia*	Myrtle Wattle
Myrtaceae	*Eucalyptus baxteri*	Brown Stringybark
	Eucalyptus obliqua	Messmate Stringybark
	Leptospermum juniperinum	Prickly Tea-Tree
Proteaceae	***Adenanthos macropodiana***	**Kangaroo Island Glandflower**
	Banksia marginata	Silver Banksia
	Banksia ornata	Desert Banksia
	Banksia serrata	Saw Banksia
	Grevillea quinquenervis	**Five-veined Grevillea**
	***Grevillea* rogersii**	**Rogers Grevillea**
	Isopogon ceratophyllus	Cone-bush
	Petrophile multisecta	**Kangaroo Island Conesticks**
Tremandraceae	*Tetratheca pilosa*	Pink-eyed Susan
Xanthorrhoeaceae	*Xanthorrhoea quadrangulata*	Mount Lofty Grass-tree
	Xanthorrhoea semiplana var. semiplan	Tufted Grass-tree
	Xanthorrhoea semiplana var. tateana	Tate's Grass-tree

Symptoms of chlorosis, wilt, dieback and death have been observed AND *Phytophthora cinnamomi* has been isolated from the roots of plants of these species.

The table below (Table 3) shows plant species that may be susceptible in South Australia (source: *Phytophthora* Management Guidelines, *Phytophthora* Technical Group 2006, 2nd Edition).

Symptoms of chlorosis, wilt, dieback and death have been observed and *Phytophthora cinnamomi* has been isolated from soil surrounding the roots of these species but NOT from the roots themselves.

Table 3. Native Plant Species That May Be Susceptible to *Phytophthora cinnamomi* in South Australia.

Family	Species	Common Name
Compositae	*Ixodia achillaeoides* subsp. *alata*	Hills Daisy
Dilleniaceae	*Hibbertia riparia*	Erect Guinea-flower
	Hibbertia sericea	Silky Guinea-flower
Epacridaceae	*Acrotriche fasciculiflora*	Pink Ground-berry
	Leucopogon concurvus	Bearded Heath
Fabaceae	*Daviesia brevifolia*	Leafless Bitter-pea
	Platylobium obtusangulum	Common Flat-pea
Mimosaceae	*Acacia paradoxa*	Kangaroo Thorn
Myrtaceae	*Adenanthos terminalis*	Adenanthos
	Kunzea pomifera	Muntries
Proteaceae	*Grevillea lavandulaceae*	Lavender Grevillea
Rutaceae	*Correa pulchella*	Salmon Correa
	Correa reflexa	Common Correa