JANDAKOT AIRPORT
DIEBACK MANAGEMENT PLAN

CONSERVATION MANAGEMENT PLAN
APPENDIX C

Jandakot Airport Holdings Pty Ltd
16 Eagle Drive
Jandakot WA 6164

Amendment History

Version	Issue Date	Description	Prepared By	Approved By (JAH)	Approved By (DAWE)
8	22/01/2014	Major revision	Joanne Wann (JAH EM)	J. Fraser	S.Gaddes 8/4/14
9	26/06/2015	Minor amendments to reflect updated dieback mapping.	Joanne Wann (JAH EM)	J. Fraser	S.Gaddes 8/9/15
10	03/05/2019	Minor amendments to reflect updated dieback mapping.	Joanne Wann (JAH EM)	J. Fraser	G.Manning 19/7/19
11	23/02/2022	Minor amendments to reflect updated dieback mapping	Joanne Wann (JAH EM)	J. Fraser	TBA

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1 Background

Jandakot Airport is managed by Jandakot Airport Holdings Pty Ltd (JAH) under a lease agreement with the Commonwealth Government. The airport site contains 119 ha of conservation precinct. JAH is regulated by the Commonwealth *Airports Act 1996* (Airports Act) and the associated *Airports (Environment Protection) Regulations 1997*.

The Airports Act requires JAH to prepare and implement a Master Plan every five years, which includes an Environment Strategy that outlines environmental management of the airport. Master Plan 2020 was approved in August 2021 and includes a commitment to implement this Dieback Management Plan.

Phytophthora Dieback (dieback) is caused by an introduced soil and water borne pathogen known as *Phytophthora cinnamomi* which infects the roots of plants causing roots and foliage to die off. This often leads to the eventual death of the infected plant. Many local native plants are susceptible to dieback and its spread can have devastating effects on the ecology of remnant bushland areas. Death of susceptible species in large numbers can encourage weed infestation and impact on fauna habitat and feeding sources. Areas identified as containing dieback cannot be cured once infested, however appropriate management can minimise the spread of the disease (Dieback Working Group, 2015). Jandakot Airport is adjacent to two other conservation bushland areas, Ken Hurst Park and the Jandakot Regional Park Acourt Road Reserve. Whilst these neighbouring properties are also affected by dieback, it is important that the spread of dieback is minimised.

Four *P. cinnamomi* dieback infestations comprising a total of 22.9 ha have been identified and mapped at Jandakot Airport (Glevan Consulting, 2021), and these are mostly associated with *Melaleuca preissiana*/dampland areas (see Figures 1, 2 and 3). Jandakot Airport contains regionally significant bushland, which includes at least one declared rare flora species (*Caladenia huegelii*), and provides habitat for one rare fauna species (Carnaby's Black-Cockatoo) and other priority species (Western Brush Wallaby and Quenda). JAH is committed to protecting these areas by implementing the actions described in this Dieback Management Plan.

Armillaria luteobubalina (Honey Fungus) has also previously been identified at Jandakot Airport. Honey Fungus is a mushroom producing fungus which is probably native to Western Australia, but which also infects the roots of many native plants leading to plant death. Honey Fungus can be spread by soil, water and air which makes it more difficult to manage than *P. cinnamomi* (Glevan Consulting, 2000).

There are also a number of other *Phytophthora* species which can lead to dieback, however *P. cinnamomi* (i.e. Phytophthora Dieback) is the most common and virulent species in Western Australia (Dieback Working Group, 2015). These other *Phytophthora* species are detected through the same process (field interpretation and laboratory analysis of soil and plant tissue) used to confirm the presence of *P. cinnamomi*.

The impact of *Phytophthora* species other than *P. cinnamomi* can vary considerably from site to site, but is typically much lower than that of *P. cinnamomi*. Management of other *Phytophthora* species is normally considered on a case by case basis and is largely dependent on the impact/threat level present in each case. If they are to be managed, then in general, they are managed in the same way as *P. cinnamomi*.

P. nicotianae was identified within a section of highly disturbed remnant vegetation (maintained as an amenity landscaped garden bed) near the JAH Administration building during the 2011 assessment, however given the already degraded state of the vegetation, the threat posed by the pathogen is thought to be minimal. In 2018, *P. elongata* and *P. palmivora* were detected in a drainage basin adjacent to Mustang Road.

2 Management

As previously stated, dieback infested areas cannot be cured and so the main management focus is to minimise its spread. The proposed management measures to be implemented at Jandakot Airport are detailed in the following sections.

Effective management of dieback spread is assisted by identifying areas of high conservation or those which are vulnerable to spread. JAH has identified the following as its priority areas for dieback management;

1. Conservation Precincts 1A and 1B - Areas containing the Endangered / Declared Rare Flora species *Caladenia huegelii*
2. Conservation precincts 2A and 2B
3. Dieback infested areas within bushland scheduled for clearing and development.

2.1 Dieback Treatment

2.1.1 Phosphite Application

Phosphite (phosphonate) treatment has been identified as successful in boosting the defence mechanisms of dieback susceptible plants and minimising the spread of dieback (Dieback Working Group, 2015). Phosphite can be applied by injection directly into susceptible tree species, or by foliar spraying. Phosphite needs to enter a plant's water transport system in order to be effective (Dieback Working Group, 2015).

JAH uses a combination of ground-based spraying (for small understorey species) and trunk injection (for plants with a stem diameter of 10cm-14cm or greater). The exact methodology and concentrations used will be determined by the expert contractor engaged to undertake the treatment in-line with the most up-to-date advice issued by relevant dieback organisations, such as the Dieback Working Group or the Department of Biodiversity, Conservation and Attractions (DBCA).

Treatment will take place during dry weather (preferably autumn) at three year intervals.

JAH has undertaken phosphite treatment of the mapped disease edges in 2012/13, 2015, 2018 and 2021 following completion of triennial dieback assessment and mapping.

2.2 Dieback Prevention and Containment

2.2.1 Access

Restricting access to dieback areas, and particularly across dieback category boundaries, is the most effective method to minimise dieback spread. Much of Jandakot Airport is surrounded by a chain mesh security fence which minimises unauthorised access to bushland areas by trail bikes and the like. In addition, there are numerous internal and airside security fences.

- Precinct 1A is fenced on all boundaries except where it borders Precinct 1B and includes 'wallaby gates' to facilitate fauna corridors,.
- Precinct 1B is fenced on all boundaries except where it borders Precinct 1A.
- Precinct 2A is fenced along all boundaries and includes 'wallaby gates' to facilitate fauna corridors.
- Precinct 2B is located within the secured 'Airside' area.

Airside security fences and fences adjoining airside areas are inspected daily. Other fences are inspected, at a minimum, weekly.

Limestone and other suitable track hardening materials have been laid over parts of the airport perimeter road to ensure tracks are traversable and provide a barrier across dieback category boundaries. This enables emergency response access and fence inspections to occur without fear of spreading dieback. Access to other sand tracks and firebreaks is restricted to JAH personnel and approved contractors (e.g. weed sprayers and wildlife consultants).

Should dieback monitoring indicate that the dieback front is advancing significantly greater than expected (as defined by the consultant within the triennial assessment report), JAH will consider hardening existing access tracks to act as a barrier across dieback category boundaries. However, as the 2014, 2017 and 2020 dieback assessments concluded that the disease distribution was almost identical to the 2011 survey, it is unlikely that track hardening for dieback containment will be required in the near future. The only exception is the small new infestation within Precinct 1B, an area of approximately 1.8 ha. The track along which the infestation occurs is rarely utilised, so JAH is unsure how or when the infestation could have been introduced (or spread from the infestation 150m to the north). Given that access along the track is not essential (there are alternative routes) JAH has taken the approach to restrict access except when it is essential (and only in fine weather when soils are dry). Should there be a demand to access the track on a regular basis (including in wet weather), JAH will install a limestone 'bridge' to traverse the location.

Dieback infested areas are signposted as a reminder to vehicles and pedestrians to keep away, unless access into these areas is necessary and undertaken in an approved manner. All vehicle entry and exits points to dieback infested areas as well as tracks adjacent to infested areas are appropriately signposted. JAH will inspect signs annually. The 2020 assessment found no evidence of the pathogen being spread by vehicles.

Pedestrian access into Conservation Precincts and dieback infested areas is restricted to management activities such as fauna surveys, weed control, etc. This allows for controls to be specified, such as restricting access during wet weather, when there is the greatest risk of dieback spread from footwear.

JAH will continue to implement these access restriction measures.

Access across dieback category boundaries by wallabies and other animals is not currently restricted at Jandakot Airport. While macropods are believed to be responsible for spreading the disease in other locations, it is thought that macropods do not represent a significant risk in relation to disease spread within Jandakot Airport. The 2014 assessment found no evidence of the pathogen being spread by wildlife.

2.2.2 Construction/Earthmoving

If not managed correctly, construction or earthmoving activities which necessitate crossing dieback category boundaries can spread dieback through the movement of infested soil or plant material or via infested soil attached to vehicles and machinery.

A Construction Environmental Management Plan (CEMP) is developed for all construction and earthmoving activities. Where dieback management activities are identified as a high risk and not adequately addressed within the CEMP, the JAH EM will require the contractor to develop a project-specific Dieback Management Plan as part of the Works Permit conditions.

CEMPs and/or project-specific DMPs will be consistent with the JAH Contractor Dieback Hygiene Policy and Guidelines (Attachment 1).

2.2.3 Drainage

Water can easily spread dieback via surface or groundwater flows. There is no standing water at Jandakot Airport, although there are a number of areas which have been identified as damplands (see Figure 3). Stormwater flows are minimal due to the highly free-draining and sandy soils present.

Drainage from developed areas is described in detail within Maser Plan 2020 and the Jandakot Airport Local Water Management Strategy (Essential Environmental 2015). The

majority of stormwater drainage basins on the airport are located within cleared and developed areas well away from Conservation Precincts. There is one artificial infiltration basin in Conservation Precinct 1B which receives stormwater from areas within the older airside developments of the airport. Stormwater previously infiltrated across a wide area until the drainage was redesigned in 2005/06, resulting in stormwater being confined to the Precinct 1B Mustang Road verge. Despite the previous basin area being identified as "completely degraded" (as per the Bush Forever scale) in a 2005 vegetation survey (Cardno BSD, 2005), more recent surveys (Ecoscape, 2016) have defined this area as "good" to "very good". This is due to a significant increase in vegetation biomass within the basin since 2005. The basin has been mapped as dieback uninfested (Glevan Consulting 2021), but it is at high risk of becoming infested in the future as it is directly adjacent to a dieback infested area.

Most of the dieback infested sites at Jandakot Airport are associated with damplands or low points across the airport. This means that stormwater runoff would tend to run towards these areas, thereby minimising dieback spread away from these areas. JAH will ensure that there is no managed stormwater discharge from dieback infested or uninterpretable areas into uninfested areas.

The groundwater at Jandakot Airport flows in an approximately north to north-westerly direction. This means that areas north to north-west of dieback infested areas are high risk areas which may be subject to natural dieback spread via the groundwater. These dieback 'fronts' are routinely targeted during triennial phosphite treatments.

2.2.4 Landscaping and Revegetation

JAH regularly undertakes landscaping in development areas and occasionally undertakes revegetation projects in Conservation Precincts. These need to be managed carefully to minimise dieback spread and ensure successful growth of plants.

The need to undertake rehabilitation or revegetation within the Conservation Precincts of Jandakot Airport can be triggered by:

- Bushfires
- Impacts of weeds on vegetation condition not successfully managed by weed control
- Impacts of dieback on vegetation condition not successfully managed by phosphite and other dieback management measures
- The closure of surplus or non-essential firebreaks and access tracks and
- Verge impacts from the construction of new roads as detailed in Master Plan 2020.

No areas within the Jandakot Airport Conservation Precincts are currently identified as requiring rehabilitation or revegetation. However, in the event that revegetation is required to be undertaken at some future point, the Rehabilitation and Revegetation Guidelines (CMP Appendix D) have been developed to assist in planning.

Sourcing Seed and Plants

It is JAH policy that all revegetation in Conservation Area utilise only provenance seeds where possible and plant species indigenous to the site.

All landscaping in developed areas should be consistent with the Jandakot Airport Landscape Design Guidelines. Landscaping works should consist primarily of species indigenous to the area, with other water efficient native species allowed to supplement.

JAH has limited capacity to propagate plants from seed or cuttings onsite, and the majority of the plants using in landscaping and revegetation will be propagated offsite. Plants grown offsite are to be purchased from NIASA (Nursery Industry Accreditation Scheme Australia) or other appropriately accredited nurseries, to ensure that appropriate dieback hygiene measures have been implemented and minimise the risk of introducing further dieback infections onto Jandakot Airport.

Transplants should not be collected from dieback infested areas as the risk of spreading dieback into uninfested areas is too great. Seed can be collected from dieback infested

areas as long as appropriate dieback clean-down procedures are implemented for all shoes, vehicles and tools.

Revegetation in Dieback and High Risk Areas

In dieback areas, only dieback resistant species (See Attachment 2) should be planted. In areas adjacent to dieback infestations or high risk areas for dieback spread (e.g. areas subject to significant earthmoving), dieback resistant species should be planted.

When the condition of dieback infested areas has declined to the point of requiring revegetation, it can be difficult to maintain the area's original vegetation type. Shearer and Hill (1989) observed that in Banksia woodlands of the Bassendean Dune system of the Swan Coastal Plain, most of the dominants and many understorey species are susceptible to *P. cinnamomi.* *Banksia attenuata*, *B. ilicifolia* and *B. menziesii* are commonly lost from communities, leaving scattered trees of *Eucalyptus todtiana* (Prickly bark) and *Nuytsia floribunda* (W.A Christmas tree), both of which are largely resistant to infection. These species, along with strains of dieback-resistant jarrah identified from areas in the state's south-west, will be considered where there has been significant overstorey decline.

Seedlings are known to be particularly susceptible to death from dieback, even if they are not of a dieback susceptible species. In dieback infested areas, it may be appropriate to revegetate using direct seeding instead of planting seedlings.

Topsoil and Mulch

Topsoil and mulch may be collected from cleared areas for reuse in landscaping as long as materials from dieback infested areas are kept within the infestation boundaries.

2.2.5 Bushfire Management

JAH has in place a Bushfire Management Plan which outlines the planning for and response to fire incidents at Jandakot Airport. Fire access is provided as described in Section 2.2.1. Current dieback mapping is included in the Bushfire Management Plan, along with the following guidelines to address dieback spread during fire response and recovery:

- Try to keep all machinery operations in one area, either in dieback infested or uninfested areas
- Minimise the entry of machinery or vehicles into bushland areas, or keep to marked access tracks
- During earthworks take care not to push dieback infested soil into uninfested areas
- Avoid areas where soil can be picked up e.g. muddy or wet areas, or clean soil off vehicles.

3 Research and Industry Consultation

JAH recognises that research is an important part in improving dieback identification and management measures. In previous years JAH has supported a number of dieback related projects undertaken by Murdoch University students and has been involved with the Dieback Working Group (DWG). JAH will, wherever practicably possible, support future dieback research proposals by facilitating access to dieback infested areas on Jandakot Airport.

In addition to DBCA, there are a number of Phytophthora dieback organisations in Western Australia, including the DWG and the Centre for Phytophthora Science & Management (CPSM). JAH will generally seek expert advice direct from dieback consultants. However, where necessary, JAH will consult with these organisations and dieback professionals to ensure that the most appropriate prevention and treatment methods are being applied at Jandakot Airport.

4 Identification & Monitoring

Dieback infestation is usually identified via two methods – interpretation and laboratory testing. During dieback surveys, all bushland areas are assigned one of the following categories:

- Dieback infested – dieback is present
- Dieback uninfested – dieback does not appear to be present at the time of the survey
- Dieback uninterpretable – the presence or absence of dieback cannot be determined as the bushland is too degraded or does not contain plant species which are susceptible to dieback.

These categories are used to determine appropriate management measures in each area.

4.1 Interpretation

Dieback interpretation is undertaken by a DBCA-registered interpreter according to the standards and procedures defined in FEM047 Chapter 6 (DPAW 2015). Reassessment is recommended every three years.

Dieback interpretation involves a visual assessment of the plant species present in a given area. Deaths of susceptible species and their approximate age are noted as well as the general health of non-susceptible species. Deaths of a number of different aged susceptible species may indicate the presence of dieback. Deaths of non-susceptible species may indicate an alternative cause of death such as drought, fire or other disturbance (Glevan Consulting 2005, 2012, 2015, 2018, 2021).

A combination of interpretation and laboratory testing methods give the most reliable method of dieback identification.

The first dieback interpretation undertaken at Jandakot Airport was in completed in November 2000 (Glevan Consulting 2000). Reassessments were undertaken in November 2005 (Glevan Consulting 2005), 2011 (Glevan Consulting 2012), 2014 (Glevan Consulting 2015), 2017 (Glevan Consulting 2018) and most recently 2020 (Glevan Consulting 2021). The results of the 2020 assessment are shown in Figure 1. Areas shown in red are dieback infested, and all other bushland areas are considered to be dieback 'uninfested'.

The 2020 assessment showed that dieback spread was minimal over the three year period from 2017 (22.7 ha) to 2020 (22.9 ha). The majority of the 0.2 ha increase was as associated with the small infestation in Precinct 1B first mapped in 2017. It is unlikely that this change is the result of rapid disease spread, but rather the full extent of the infested area was not apparent during the 2017 survey (Glevan Consulting 2021). In addition, the western end infestation boundary near Harvard Road in Precinct 1A was extended 10-12 m. *P. elongata* and *P. palmivora* infestations identified in the drainage basin adjacent to Mustang Road in 2017 exhibited minimal evidence of disease activity in 2020 and the impacts of these pathogens appears to be low. JAH propose to undertake dieback reassessment at Jandakot Airport every three years. The next dieback survey will be conducted in 2023.

4.2 Laboratory Testing

Laboratory testing is usually undertaken in conjunction with dieback interpretation and can consist of soil and/or plant tissue samples collected from areas interpreted as dieback infested. There are two main methods of laboratory testing in use – baiting and DNA analysis. Soil and tissue samples taken during assessments are to be to standards and prescriptions defined in FEM047 (PDAW 2015). Taking a soil and tissue sample from dead and dying plants is an integral part of assessment and can provide evidence to

support field diagnostic decisions, although in some cases it is not essential (DPAW 2015).

Soil and tissue samples were collected in both the 2000 and 2005 surveys and sampled using the baiting method. Five of twelve samples collected in 2000 were confirmed to contain *P. cinnamomi*, while only one of thirteen samples collected in 2005 tested positive for the presence of *P. cinnamomi*.

During the 2011 assessment, 22 samples were taken. Twenty one of the samples were taken outside of the known infestations, and all tested negative for the presence of *P. cinnamomi.* The other sample was taken purely as a 'control' from a known infestation where the presence of *P. cinnamomi* was confirmed during the 2005 assessment. Sampling of known infestations is not common practice, but in areas where pathogen dormancy may be a factor, it assists in confirming that the pathogen is being detected by the laboratory process, and that 'false negative' results are not being recorded. *P. cinnamomi* was recovered from the control sample, providing evidence that the pathogen will be recovered if present, and that false negative sample results are not being recorded.

During the 2014 assessment, 18 samples were taken outside of the 2011 dieback boundaries and one control sample was taken from a dieback area. No new Phytophthora Dieback infestations were identified and only minor adjustments were made to the boundaries of the five existing infestations. Minimal disease expression was evident during the assessment, and the lack of expression is most likely the result of ongoing phosphite treatment.

During the 2017 assessment 8 samples were initially taken, with only one sample, associated with the new Precinct 1B infestation, testing positive for *P. cinnamomi*. An additional two samples taken after the initial assessment, in response to suspicious tree deaths in the Mustang Road drainage basin reported by JAH staff, tested positive for *P. elongata* and *P. palmivora*.

During the 2020 assessment 9 samples were taken and all tested negative for the presence of Phytophthora (Figure 1).

In addition to the scheduled site-wide dieback assessments, specific investigations have been conducted as required in response to dieback concerns. In December 2006 Murdoch University's Centre for Phytophthora Science and Management conducted DNA analysis on ten soil and one plant tissue samples collected from an uninterpretable area within the Stage 1 commercial area. The plant tissue sample tested positive but all the soil samples tested negative for *P. cinnamomi*. In 2008, 5 soil and tissue samples were taken from the Compass Road development area by Glevan Consulting. *P. cinnamomi* was not recovered from the vegetation assessed.

4.3 Bushland Condition

There appears to be a relatively strong correlation between bushland condition ratings (Ecoscape 2011, 2017) and the presence of *P. cinnamomi.* While the bushland condition within some of the infested sites is not markedly different from the uninfested areas, the vegetation associated with the infestations in Precincts 2A exhibited slightly higher levels of disturbance than the surrounding uninfested areas (see Figure 4). Bushland Condition thresholds for triggering further management intervention (including rehabilitation and revegetation) are addressed in the Weed Management Plan (Appendix B).

4.4 Ongoing Monitoring

JAH will monitor the effectiveness of this Dieback Management Plan in minimising the spread of dieback via the proposed triennial surveys utilising interpretation and/or laboratory assessment. The methods used (including laboratory testing) will be based on the advice of the expert consultant contracted to undertake the dieback interpretation.

Ongoing bushland condition monitoring results will also be compared with dieback mapping as part of triennial dieback interpretation to determine any correlation between the two.

In addition, opportunistic observations throughout the conservation precincts can be made on a regular basis by the JAH Environment Manager and by other staff whilst undertaking works within or adjacent to Conservation Precincts. Suspected new infestations or suspected rapid spread of existing infestations will be entered into the JAH Safety Management System database as an Environment Incident and actioned accordingly. It is via this method that the *P. elongata* and *P. palmivora* in the Mustang Road drainage basin were identified in 2018.

5 Communication

JAH communicates the contents of this Dieback Management Plan to its stakeholders via the following methods:

- Dieback infested areas are identified via signage (see Table 1, DMP4)
- Publication of the DMP on the JAH website where it is accessible to all staff, tenants, contractors and members of the public
- Inclusion of relevant dieback management information within CEMP templates and Operational Environmental Management Plan (OEMP) templates
- Inclusion of dieback management information in relevant site inductions.

6 Reporting Requirements

Reporting against actions described in this plan will be included within the Jandakot Airport Annual Environment Report (AER). In line with the *Airports (Environment Protection) Regulations 1997*, the AER will be submitted to the Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) by 28th October each year. A copy of the report will be provided to the Department of Agriculture, Water and the Environment (DAWE) by 28th October each year.

Reporting relevant to the DMP will also be included in an annual compliance report, as required under Condition 16 of EPBC 2009/4796, and published on the JAH website by 28th October each year.

7 Review and Amendment of Dieback Management Plan

As with the overarching Conservation Management Plan, the Dieback Management Plan will require regular review and amendment in order to meet practical requirements on site as changing circumstances demand.

Once amended, the Dieback Management Plan will be submitted to DAWE for the Minister's approval (ref Conditions 6 and 12 of EPBC 2009/4796 approval). The approved management plan will be implemented.

The JAH Environment Manager will review this Dieback Management Plan every three years to ensure that it is up to date and its control measures are effective. This review is planned to occur following the triennial dieback assessment, which will determine whether existing management measures have been effective in halting, or at least slowing, the spread of the disease. If required, new or amended management measures will be identified and included within the Dieback Management Plan.

However, if new relevant information comes to light before the three-yearly review is undertaken (e.g. a new infestation is identified, new or improved treatment methods are discovered etc.), a review of the Dieback Management Plan will occur before the scheduled action.

8 Summary of Actions

The Table below contains a list of summary actions relating to the Jandakot Airport Dieback Management Plan.

Table 1. Dieback Management Plan Summary of Actions.			
Action		**Responsibility**	**Timing**
Dieback Treatment			
DMP1	Undertake phosphite (or other appropriate) treatment of dieback infested areas utilising methods recommended by dieback experts (refer to DMP14).	JAH EM	Triennially (next due 2024).
Dieback Management – Prevention and Containment			
Access			
DMP2	Inspect airside security fencing daily (other fences weekly) and repair immediately if necessary.	JAH ASOs (airside) and JAH Senior Groundsman (landside).	Daily/weekly (dependent on location).
DMP3	Investigate the feasibility of hardening existing access tracks to act as a barrier across the relevant dieback category boundaries, where the dieback front is advancing significantly* and additional control actions are required (as determined via triennial assessments). *Significantly, as defined by the dieback consultant undertaking assessment.	JAH EM in consultation with JAH Operations Manager and JAH Facilities Manager.	Feasibility investigation to be completed within 6 months of the triennial assessment that initially identified the issue.
DMP4	Plan and implement works recommended within the feasibility investigation (DMP3).	JAH EM in consultation with JAH Operations Manager and JAH Facilities Manager.	Timing as recommended within feasibility investigation.
DMP5	Install (or if appropriate, relocate) dieback awareness/warning signs at all entry/exit tracks to infested areas and along adjacent tracks when a new dieback infestation is detected or an existing dieback infestation boundary has increased beyond the existing signage.	JAH EM.	Within 3 months of a new infestation being detected or an existing dieback front assessed as having increased beyond the existing signage.
DMP6	Inspect dieback signage and replaced/update if required.	JAH EM.	Annually (July each year).
Construction and Earthmoving			
DMP7	Prepare a JAH-approved CEMP or project-specific DMP for all construction and earthmoving activities. CEMPs and project-specific DMPs will be consistent with the JAH Contractor Dieback Hygiene Policy and Guidelines (Attachment 1).	JAH EM in liaison with contractors.	Prior to works commencing.
DMP8	Implement the JAH-approved CEMP or project-specific DMP for all construction and earthmoving activities prepared under DMP7.	Construction and earthmoving contractors	During construction and earthmoving works.
Drainage			

Table 1. Dieback Management Plan Summary of Actions.			
Action		**Responsibility**	**Timing**
DMP9	Design new developments/drainage works to avoid stormwater discharge from dieback infested or uninterpretable areas into uninfested bushland areas.	JAH EM in consultation with contractors and JAH staff.	Where relevant, to be included in CEMP prior to works commencing.
Landscaping and Revegetation			
DMP10	Revegetation shall be consistent with CMP Appendix D Bushland Rehabilitation and Revegetation Guidelines.	JAH EM	At all times
DMP11	Landscaping in developed areas shall be consistent with the Jandakot Airport Landscape Design Guidelines.	JAH EM	At all times
Research and Industry Consultation			
DMP12	Assess research proposals requesting access to Jandakot Airport dieback infestations in regards to feasibility, safety, relevance, impost on JAH resources, etc.	JAH EM	Timing of assessment to be agreed upon between JAH and relevant research institution requesting the access.
DMP13	Facilitate access by researchers to Jandakot Airport dieback infestations (subject to assessment and approval as described in DMP12).	JAH EM	Following receipt of request from a research institution or government agency.
DMP14	Consult with dieback organisations and/or professionals to ensure that the most appropriate prevention and treatment methods are being applied at Jandakot Airport.	JAH EM	Prior to undertaking phosphite (or other appropriate) treatment and during triennial review of the DMP.
Monitoring and Contingency Requirements			
DMP15	Undertake dieback reassessment.	JAH EM.	Triennially (next due 2023).
DMP16	Enter suspected new infestations or suspected rapid spread of existing infestations observed in between triennial dieback assessments into the JAH Safety Management System database as an Environment Incident.	JAH EM	Within 7 days of a suspected new infestation or rapid spread of an existing infestation being reported.
DMP17	Implement actions identified from the Environment Incident investigation process commenced under DMP16	JAH EM	In accordance with timing identified under Environment Incident investigation process.
Communication			
DMP18	Publish the amended DMP on the JAH website.	JAH EM	Within 4 weeks of DMP review completion (or, if applicable, within

Table 1. Dieback Management Plan Summary of Actions.			
Action		**Responsibility**	**Timing**
			one month of endorsement by relevant government regulator).
DMP19	Update the JAH CEMP and tenant OEMP templates with relevant dieback management information (only required if information within current CEMP and OEMP templates is not consistent with the current DMP).	JAH EM	Within 3 months of DMP review completion (or, if applicable, within one month of endorsement by relevant government regulator).
DMP20	Ensure all CEMPs and OEMPs submitted to JAH for review and endorsement adequately addresses dieback management, relevant to the activities proposed to be undertaken.	JAH EM	Prior to endorsing CEMP or OEMP.
DMP21	Include relevant dieback management information within inductions or written instructions for contractors working across dieback boundaries (e.g. weed spraying contractors).	JAH EM	Ongoing – Inductions to be completed before works commence.
Reporting Requirements			
DMP22	Report against actions of the DMP within the Jandakot Airport Annual Environment Report (AER) and provide copies to DITRDC and DAWE.	JAH EM	28 October Annually.
DMP23	Report against actions of the DMP within an Annual Compliance Report (ref Condition 16 of EPBC 2009/4796) and publish on the JAH website.	JAH EM	28 October Annually.
Review and Amendment of DMP			
DMP24	Review and update (if required) DMP following triennial dieback survey.	JAH EM	June 2024, then Triennially.

9 Glossary

AER	Annual Environment Report
ASO	Airport Services Officer
CEMP	Construction Environmental Management Plan
CMP	Conservation Management Plan
DAWE	Department of Agriculture, Water and the Environment (formerly DOEE, DOE, DSEWPaC and DEWHA)
DBCA	Department of Biodiversity, Conservation and Attractions (formerly DPAW, DEC and CALM).
DEC	Department of Environment and Conservation. On 1 July 2013 the Department of Environment and Conservation separated into two agencies, the Department of Parks and Wildlife (DPAW – now DBCA) and the Department of Environment Regulation (DER – now DWER).
DEWHA	Department of Environment, Water, Heritage and the Arts (now DAWE)
DIRDC	Department of Infrastructure, Regional Development and Cities (now DITRDC)
DIT	Department of Infrastructure and Transport (now DITRDC)
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications (formerly DIT, DIRD and DIRDC)
DMP	Dieback Management Plan
DOEE	Department of the Environment and Energy (now DAWE)
DPAW	Department of Parks and Wildlife (formerly DEC). On 1 July 2017 DPAW was merged with three other Departments to become DBCA.
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DAWE)
EPBC	Environmental Protection and Biodiversity Conservation Act 1999
JAH	Jandakot Airport Holdings
JAH EM	Jandakot Airport Holdings Environment Manager
OEMP	Operational Environmental Management Plan
OM	Operations Manager
SMS	Safety Management System (an access database used by JAH to record all Incidents).

10 References

Cardno BSD (2005), *Jandakot Airport Land Caladenia huegelii (Declared Rare Flora) Search*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

DEC (1999) *Phytophthora cinnamomi and the disease caused by it. Volume III – Phosphite Operations Guidelines.* Department of Environment and Conservation.

Department of Parks and Wildlife (2015). FEM047 *Phytophthora Dieback Interpreter's Manual for lands managed by the department.* Unpublished.

Dieback Working Group (2015), *Managing Phytophthora Dieback in Bushland*, Edition 7.

Ecoscape (2011). *Jandakot Airport Weed Assessment and Bushland Condition,* unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Ecoscape (2017), *Jandakot Airport Weed Survey and Bushland Condition Assessment.* Unpublished report Prepared for Jandakot Airport Holdings Pty Ltd.

Essential Environmental (2015), *Jandakot Airport Local Water Management Strategy*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Glevan Consulting (2000), *Jandakot Airport Interpretation for Phytophthora (Dieback) Species*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Glevan Consulting (2005), *Jandakot Airport Dieback Assessment*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Glevan Consulting (2012), *Jandakot Airport Dieback Assessment*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Glevan Consulting (2015), *Jandakot Airport Triennial Phytophthora Dieback occurrence assessment*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Glevan Consulting (2018), *Jandakot Airport Triennial Phytophthora Dieback occurrence assessment*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Glevan Consulting (2021), *Jandakot Airport Triennial Phytophthora Dieback occurrence assessment*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Groves, E., Hardy, G. & McComb, J. (date unknown), *Western Australian Natives Resistant to Phytophthora cinnamomi*, unpublished report prepared by for Murdoch University.

Groves, E., Hardy, G. & McComb, J. (date unknown), *Western Australian Natives Susceptible to Phytophthora cinnamomi*, unpublished report prepared by for Murdoch University.

Murdoch University Centre for Phytophthora Science and Management Diagnostic Facility (Murdoch University) (2006), *Development of a Soil Sampling Regime for Jandakot Airport Holdings Pty Ltd*, unpublished report prepared for Jandakot Airport Holdings Pty Ltd.

Shearer BL, Hill TC (1989) Diseases of *Banksia* woodlands on the Bassendean and Spearwood Dune systems. *Journal of the Royal Society of Western Australia* **71**, 113–114.

FIGURE 1. JANDAKOT AIRPORT PHYTOPHTHORA CINNAMOMI OCCURRENCE 2020

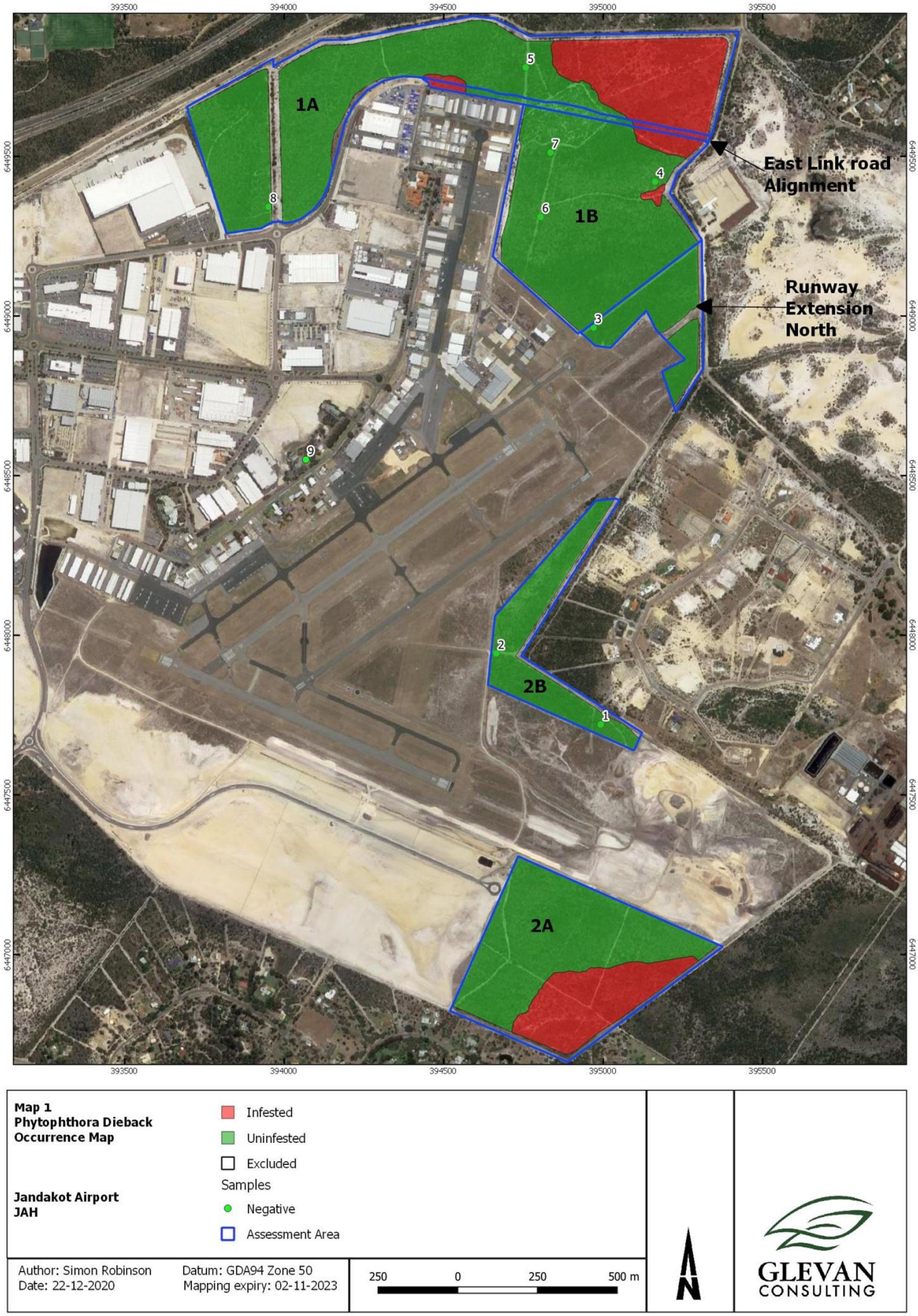


FIGURE 2. VEGETATION COMMUNITIES MAPPING 2016

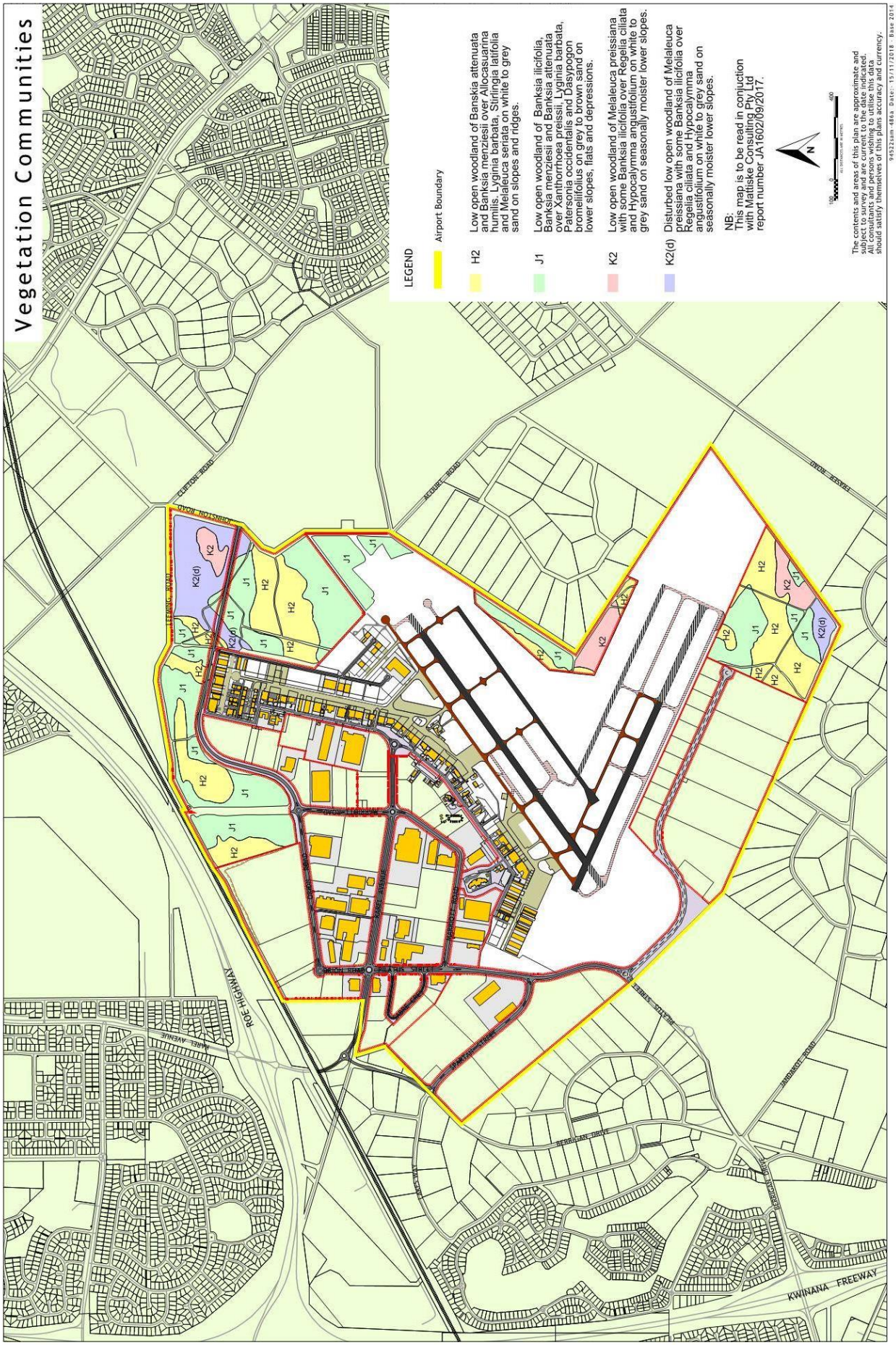
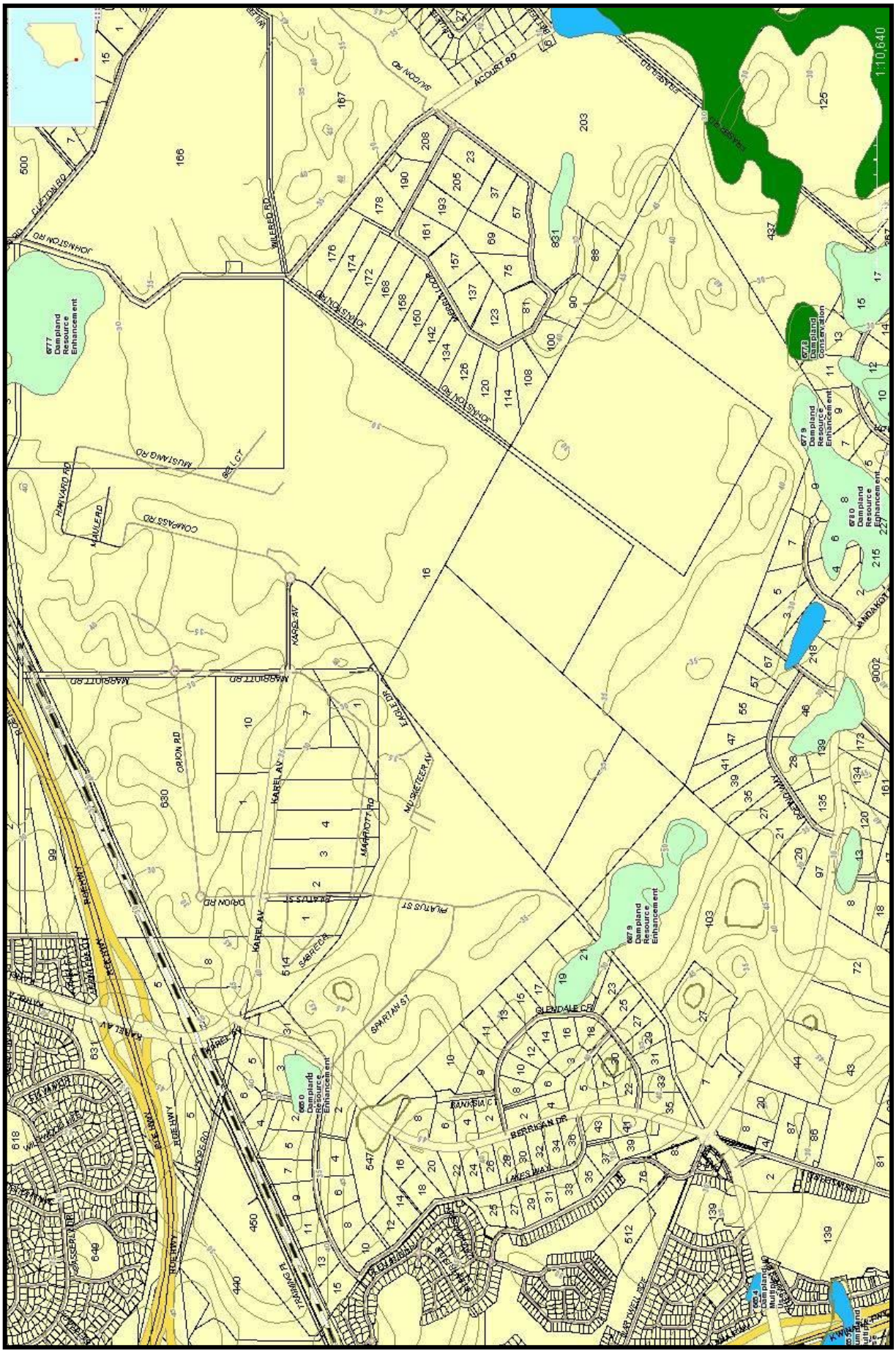
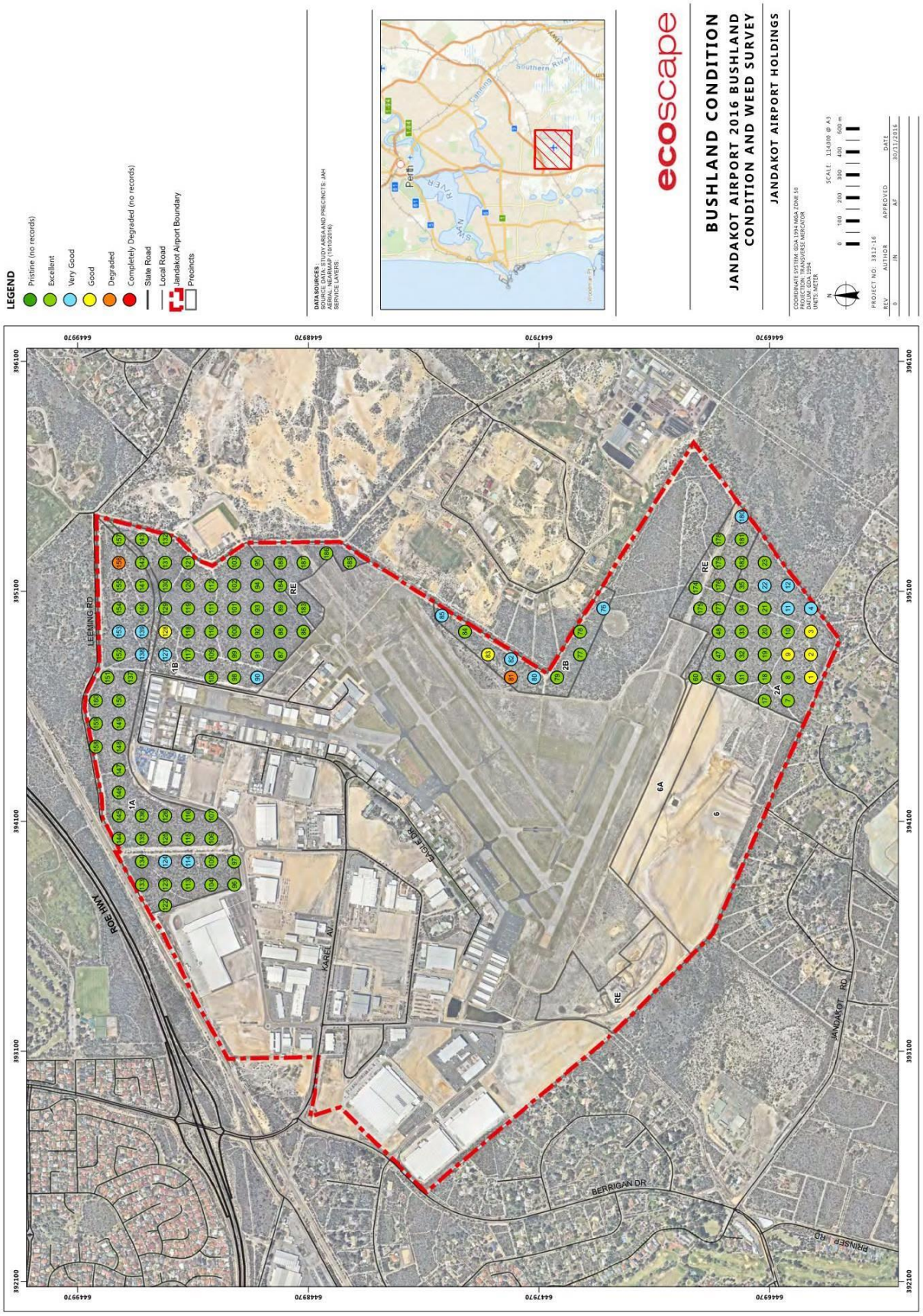


FIGURE 3. DAMPLANDS



Source: WA Atlas, Landgate 2015.

FIGURE 4. BUSHLAND CONDITION MAPPING 2016



Attachment 1. JAH Contractor Dieback Hygiene Policy and Guidelines

DIEBACK HYGIENE POLICY

The objective of dieback management is to protect all vegetation within Jandakot Airport by minimizing the risk of introducing and spreading *Phytopthora cinnamomi.*

BACKGROUND

Phytophthora cinnamomi, also known as 'dieback' or 'jarrah dieback', is a soil-borne pathogen that kills a wide range of plant species in the southwest of WA by destroying their root systems. *P. cinnamomi* causes disease in a range of vegetation communities and affects a diverse range of plants. Native plant communities particularly at risk from *P. cinnamomi* include those dominated with Banksia species – such as the vegetation at Jandakot Airport.

A number of known dieback infested areas exist at Jandakot Airport. These areas have been mapped and Jandakot Airport Holdings aims to ensure that dieback is not spread via unhygienic practices from these areas into uninfested areas either elsewhere on the Airport estate or offsite.

Similarly, Jandakot Airport Holdings aims to ensure that unhygienic practices do not result in new dieback infestations being introduced to the airport from off-site sources.

SPREAD

Dieback can spread:

- by water (drainage, irrigation or groundwater flow)
- in soil (transported by bulk soil deliveries, containers, shoes, tools, vehicles and other equipment)
- by the movement of infected plants and plant materials.

Natural spread dieback is generally slow and is achieved through movement of the pathogen along plant root systems or, on a faster scale, through the movement of microscopic spores in surface and sub-surface water flows, and by animals.

Human-related vectors can disperse the pathogen much more quickly and are believed to be the primary reason for the widespread distribution of dieback in WA. Any activity that transfers soil and plant material (either intentionally on non-intentionally) from one location to another is a potential vector. Examples of activities that can contribute to the spread of the pathogen include:

- road construction and civil works
- earth moving
- vegetation clearing
- revegetation activities
- off-road/four-wheel driving.

CONTRACTOR CONSTRUCTION/DIEBACK MANAGEMENT PLANS

In order to ensure that appropriate hygiene controls are in place to prevent dieback spread, contractors undertaking activities that can contribute to the spread of dieback will need to address dieback management within a project-specific Construction Environment Management Plan (CEMP) or Dieback Management Plan (DMP).

BASIC DIEBACK HYGIENE MANAGEMENT MEASURES AND GUIDLEINES

- Where possible, schedule activities that involve soil disturbance for dry summer months (November – March) or dry conditions.
- Minimise soil disturbance – consider mowing, slashing or use herbicide, rather than ploughing and grading, whenever possible.
- When undertaking works across dieback category boundaries (i.e. in areas that include both infested and uninfested), where possible complete activities in the uninfested part of the bushland, before moving to the infested part of the bushland.
- In the uninfested parts of the estate/bushland:
  - Do not bring in soil/sand/gravel. If it is required, it should be obtained from certified phytophthora-free sources.
  - Landscape supplies should be sourced from either certified phytophthora-free sources or accredited Nursery Industry Association suppliers.
  - Prevent vehicles and machinery entering bushland. If they must enter, they must be free of soil and mud, and restricted to a hard, dry surface wherever possible.
  - Vehicles are to be cleaned off-site prior to initially accessing the airport for works. If vehicles temporarily leave site, they must be re-cleaned before returning unless they have remained on sealed roads in low-risk areas (e.g. trucks that make multiple daily journeys to cart sand from Jandakot airport development areas to off-site storage facilities).
  - Footwear to be free of mud and soil when entering bushland.
  - Any water used in earthworks etc. must be from approved sources (e.g. mains supply, approved bores etc.)
- In the infested parts of the estate/bushland
  - Prevent vehicles and machinery entering. If they must enter, restrict them to hard, dry surfaces and vehicles are to be free of soil and mud when exiting the infested bushland.
  - Do not remove soil/sand/gravel from the infested part of the bushland. If it must be removed, it must be placed at a site that is also infested with *P. cinnamomi* or managed in accordance with the approved CEMP or project-specific DMP.
  - Footwear must be free of mud and soil when exiting the bushland.

GUIDELINES FOR CLEANING EQUIPMENT AND VEHICLES

Cleaning will be easier and more effective if completed at a depot or designated cleaning area prior to accessing the airport. In instances where on-site cleaning must occur (e.g. prior to exiting dieback infested areas), the below guidelines are provided to assist in the development of a CEMP or project-specific DMP.

Field-based cleaning requires:

- A hard, well-drained surface (e.g. road or ramp) that is well away from native vegetation. Any wash-down effluent (water, mud and slurry) must be collected on-site and must not be allowed to drain into uninfested bushland.
- Minimise water use to remove soil and mud from equipment/vehicles. This can be achieved by preferentially dry cleaning techniques e.g. stiff brushes.

- Pay particular attention to mudflaps and tyres.
- Do not drive through effluent generated from cleaning when exiting the washdown facility.

Guidelines for cleaning footwear

- Try to remove mud and soil when it is dry. Remove as much mud and soil as possible with a stiff brush or stick and minimise the amount of water used.
- Collect all mud and soil removed and dispose of at a site that is infested with *P. cinnamomi*.

Guidelines for sterilising

Sterilisation of equipment, footwear and vehicle tyres can be used as an extra precaution. Sterilisation of nursery equipment using steam is common practice; however the use of steam is not practical in the field. The following sterilisation methods can be used in the field.

- Spray 70% methylated spirits on small hand tools and footwear covering all surfaces and allowing a few minutes for it to soak into all soil material.
- Spray diluted bleach (sodium hypochlorite) onto equipment and footwear allowing a few minutes before rinsing the bleach off using water. Dilute bleach so that solution contains 1% active ingredient sodium hypochlorite. Be sure to follow any of the manufacturer's safety instructions provided on the bleach container.
- Phytoclean® or other effective disinfectants can be used in footbaths, washdown facilities and during the cleaning of equipment. See the manufacturer's details for directions.

Attachment 2 - Jandakot Airport Flora Species Dieback Susceptibility

S = Dieback Susceptible; R = Dieback Resistant

Acacia applanata	
Acacia huegelii	R
Acacia pulchella	R
Acacia saligna	R
Acacia stenoptera	S
Acacia willdenowiana	
Actinotus glomeratus	
Adenanthos cygnorum	S
Adenanthos obovatus	S
Allocasuarina fraseriana	S
Allocasuarina humilis	S
Amphipogon laguroides	
Amphipogon turbinates	
Anigozanthos humilis	
Anigozanthos manglesii	R
Aotus sp. procumbent	
Arnocrinum preissii	
Astartea fascicularis	R
Astartea scoparia	
Asteraceae sp.	
Astroloma pallidum	
Astroloma xerophyllum	S
Austrodanthonia occidentalis	
Austrodanthonia pilosa	
Austrostipa compressa	
Austrostipa elegantissima	?
Baeckea camphorosmae	R
Banksia attenuata	S
Banksia dallanneyi	S
Banksia grandis	S
Banksia ilicifolia	S
Banksia littoralis	S
Banksia menziesii	S
Banksia nivea	S
Baumea articulata	
Beaufortia elegans	
Beaufortia squarrosa	
Boronia busselliana	
Boronia crenulata	R
Boronia fastigiata	
Boronia ramosa	
Bossiaea eriocarpa	S
Brachyloma preissii	
Burchardia congesta	R
Burchardia umbellata	
Hovea trisperma	R

Caladenia discoidea	
Caladenia flava	
Caladenia huegelii	
Caladenia longicauda	
Caladenia paludosa	
Calectasia narragara	
Calytrix angulata	
Calytrix flavescens	R
Calytrix fraseri	S
Calytrix strigosa	
Cassytha flava	R
Cassytha glabella	R
Cassytha racemosa	
Centrolepis aristata	
Centrolepis drummondiana	
Centrolepis humillima	
Chamaescilla corymbosa	R
Chordifex microcodon	
Comesperma calymega	R
Conospermum stoechadis	S
Conospermum triplinervium	S
Conostephium minus	
Conostephium pendulum	S
Conostephium preisii	
Conostylis aculeata	R
Conostylis aurea	
Conostylis caricina	
Conostylis juncea	
Conostylis serrulata	?
Conostylis setigera	R
Crassula colorata	
Croninia kingiana	
Cryptostylis ovata	R
Cyanicula gemmata	
Cyanicula sericea	
Cyathochaeta avenacea	R
Dampiera linearis	R
Danthonia pilosa	
Dasypogon bromeliifolius	S
Daviesia gracilis	
Daviesia incrassata	S
Daviesia juncea	
Daviesia nudiflora	
Daviesia physodes	S
Daviesia triflora	
Lomandra micrantha	

Desmocladus asciculatus	
Desmocladus fasciculatus	R
Desmocladus flexuosus	R
Dianella revoluta	S
Dielsia stenostachya	
Diuris corymbosa	
Diuris emarginata	
Diuris laxiflora	
Diuris longifolia	
Drosera erythrorhiza	R
Drosera glanduligera	
Drosera macrantha	R
Drosera menziesii	
Drosera paleacea	
Drosera pulchella	
Eremaea asterocarpa	
Eremaea pauciflora	
Eriachne sp.	
Eucalyptus gomphocephala	R
Eucalyptus marginata	S
Eucalyptus rudis	R
Eucalyptus todtiana	S
Euchilopsis linearis	
Euchiton sphaericus	
Eutaxia virgata	
Gastrolobium capitatum	
Gompholobium capitatum	R
Gompholobium confertum	
Gompholobium scabrum	
Gompholobium tomentosum	R
Gonocarpus pithyoides	
Goodenia pulchella	
Haemodorum paniculatum	R
Haemodorum spicatum	
Hardenbergia comptoniana	R
Helichrysum leucopsideum	
Hemiandra pungens	R
Hensmania turbinata	
Hibbertia aurea	
Hibbertia huegelii	S
Hibbertia hypericoides	S
Hibbertia racemosa	R
Hibbertia sericosepala	
Hibbertia subvaginata	
Homalosciadium homalocarpum	
Podotheca chrysantha	

Hyalosperma cotula	
Hypocalymma angustifolium	R
Hypocalymma robustum	S
Hypolaena exsulca	
Hypolaena pubescens	
Isolepis marginata	
Jacksonia furcellata	S
Jacksonia sternbergiana	S
Juncus kraussii	
Kennedia prostrata	R
Kunzea ericifolia	S
Kunzea glabrescens	
Lagenophora huegelii	R
Laxmannia ramosa	
Laxmannia squarrosa	
Lechenaultia biloba	R
Lechenaultia expansa	
Lechenaultia floribunda	
Lepidosperma angustatum	
Lepidosperma effusum	
Lepidosperma longitudinale	
Lepidosperma pubisquameum	
Lepidosperma scabrum	R
Lepidosperma squamatum	R
Lepidosperma tenue	R
Leporella fimbriata	R
Leptocarpus canus	
Leptocarpus tenax	R
Leptomeria empetriformis	
Leptospermum erubescens	R
Lepyrodia muirii	
Leucopogon australis	S
Leucopogon conostephioides	S
Leucopogon insularis	
Leucopogon nutans	S
Leucopogon oxycedrus	S
Leucopogon pendulus	R
Leucopogon polymorphus	S
Leucopogon propinquus	S
Leucopogon pulchellus	S
Leucopogon racemulosus	
Leucopogon sprengelioides	
Leucopogon strictus	
Levenhookia pusilla	
Levenhookia stipitata	
Lobelia tenuior	
Lomandra caespitosa	
Lomandra endlicheri	
Lomandra hermaphrodita	
Thysanotus thyrsoideus	S

Lomandra nigricans	R
Lomandra odora	S
Lomandra preissii	R
Lomandra purpurea	
Lomandra suaveolans	
Lomandra sp.	
Lotus sp.	
Loxocarya cinerea	S
Lyginia barbata	
Lyginia imberbis	
Lysinema ciliatum	S
Lysinema elegans	
Macrozamia fraseri	
Macrozamia riedlei	S
Medicago sp.	
Melaleuca incana	
Melaleuca preissiana	R
Melaleuca scabra	S
Melaleuca seriata	
Melaleuca systena	
Melaleuca thymoides	S
Melaleuca viminea	
Mesomelaena pseudostygia	
Mesomelaena stygia	R
Mesomelaena tetragona	R
Microtis media	
Microtis sp.	
Millotia tenuifolia	R
Monotaxis grandiflora	
Neurachne alopecuroidea	
Nuytsia floribunda	R
Opercularia vaginata	S
Patersonia occidentalis	S
Pericalymma ellipticum	S
Persoonia saccata	R
Petrophile linearis	S
Philotheca spicata	
Phlebocarya ciliata	R
Phlebocarya filifolia	
Phyllangium divergens	
Phyllangium paradoxum	
Pimelea angustifolia	
Pimelea imbricata	
Pimelea rosea	
Pimelea sulphurea	
Pithocarpa pulchella	
Platysace compressa	S
Platytheca galioides	
Podotheca angustifolia	
Tricoryne tenalla	

Poranthera microphylla	
Prasophyllum parvifolium	
Prasophyllum sp.	
Pterostylis pyramidalis	
Pterostylis recurva	
Pterostylis vittata	
Pterostylis sp.	
Pultenaea reticulata	
Pyrorchis nigricans	
Quinetia urvillei	
Regelia ciliata	
Regleia inops	
Restio microcodon	
Rhodanthe sp	
Ricinocarpus glaucus	
Scaevola paludosa	
Scaevola repens	
Schoenus brevisetis	
Schoenus caespititius	
Schoenus curvifolius	R
Schoenus efoliatus	
Schoenus globifer	
Schoenus sp.	
Scholtzia involucrata	S
Senecio pinnatifolius	
Siloxerus humifusus	
Sowerbaea laxiflora	
Stackhousia monogyna	
Stirlingia latifolia	S
Stylidium brunonianum	R
Stylidium carnosum	
Stylidium guttatum	
Stylidium junceum	S
Stylidium piliferum	R
Stylidium repens	
Stylidium schoenoides	S
Stylidium sp.	
Synaphea spinulosa	
Synaphea sp.	
Tetratheca setigera	S
Thelymitra campanulata	
Thelymitra crinita	
Thelymitra fuscolutea	
Thelymitra sp.	
Thysanotus arbuscula	
Thysanotus manglesianus	
Thysanotus multiflorus	
Thysanotus patersonii	
Thysanotus sparteus	
Xanthorrhoea gracilis	S

Thysanotus triandrus	
Thysanotus sp.	
Trachymene pilosa	
Tricoryne elatior	R

Tripterococcus brunonis	
Verticordia drummondii	
Wahlenbergia preissii	
Waitzia suaveolens	

Xanthorrhoea preissii	S
Xanthosia huegelii	R

Taken from information compiled by E.Groves, G.Hardy and J.McComb, Murdoch University. Species list reviewed by Mark Brundrett, 2011 and the Jandakot Airport floristic surveys 2001-2017 (Mattiske).

Attachment 3. 2020 *Phytophthora cinnamomi* Occurrence Assessment

JAH

Jandakot Airport Triennial Assessment

Phytophthora Dieback occurrence assessment – Version 2.0

GLEVAN
CONSULTING

Client	*JAH*
Report name	*Jandakot Airport Triennial Assessment*

This report has been prepared in accordance with the scope of work agreed between PTA and Glevan Consulting and contains results and recommendations specific to the agreement. Results and recommendations in this report should not be referenced for other projects without the written consent of Glevan Consulting.

Procedures and guidelines stipulated in various manuals, particularly Phytophthora Dieback Interpreters Manual for lands managed by the Department (DBCA), are applied as the base methodology used by Glevan Consulting in the delivery of the services and products required by this scope of work. These guidelines, along with overarching peer review and quality standards ensure that all results are presented to the highest standard.

Glevan Consulting has assessed areas based on existing evidence presented at the time of assessment. The Phytophthora pathogen may exist in the soil as incipient disease. Methods have been devised and utilised that compensate for this phenomenon; however, very new centres of infestation, that do not present any visible evidence, may remain undetected during the assessment.

Executive Summary

Glevan Consulting conducted an assessment of the conservation areas within the Jandakot Airport Study Area for the presence of Phytophthora Dieback. The assessment was conducted from 19-10-2020 to 3-11-2020 by Simon Robinson.

The study area has been assessed previously by Glevan Consulting on several occasions, and most recently in 2017, as part of Jandakot Airport Holdings' (JAH) commitment to undertaking Phytophthora Dieback assessments on a triennial basis. The study area is comprised of Conservation Precincts 1A, 1B, 2A and 2B, plus areas reserved for a future runway extension and a proposed link road. The total study area comprises 129.7 ha.

Four infestations, comprising 22.9 ha (Table 4) were mapped during the assessment. No new infestations were identified. The Dieback boundaries were rechecked and adjusted as required. Generally, only minor to moderate disease front movement was detected and the boundaries were not significantly altered, resulting in the total infested area increasing from 22.7 ha (2017) to 22.9 ha. The majority of the increase is associated with changes made to the boundary of the small infestation adjacent to the shooting range. A total of 95.4 ha was observed to be uninfested, while the remaining 11.4 ha was excluded from assessment due to being cleared or degraded.

Minimal disease expression was evident during the assessment, and the lack of expression is most likely the result of periodic phosphite treatment which has occurred several times during the last 15 years. As observed during previous assessments, a significant amount of vegetation decline not related to Phytophthora Dieback was observed during the assessment, and several soil and tissue samples were taken to assist with the diagnosis of these areas. A total of nine soil and tissue samples were taken, all of which produced negative results.

The Dieback mapping performed during this assessment is valid for 3 years and will expire in November 2023. It is recommended however, where clearing and development works are still occurring beyond 12 months that any Dieback boundaries associated with the works be reassessed.

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Background.

Glevan Consulting was commissioned by JAH to conduct an assessment of the conservation areas within the Jandakot Airport Study Area for the presence of Phytophthora Dieback. Under the EPBC Conditions of Approval and JAH's Dieback Management Plan, it is a requirement that Phytophthora Dieback occurrence mapping is conducted at Jandakot Airport every three years. The updated occurrence mapping will also provide boundaries for the upcoming phosphite treatment program, and proposed clearing activities that may occur in the next three years.

1.2 Location of Study Area.

Jandakot Airport is located within the suburb of Jandakot, approximately 15 km south of Perth CBD. The study area for the assessment is comprised of the Conservation Precincts (121.2 ha) plus an additional 8.5 ha of remnant vegetation surrounding the airport facilities (Figure 1).

1.3 Study team

The assessment was conducted by Simon Robinson of Glevan Consulting in November of 2020. Mr Robinson is accredited by the Department of Biodiversity, Conservation and Attractions (DBCA) in the detection, diagnosis and mapping of Dieback disease. This accreditation recognises the skills and experience of Mr Robinson.

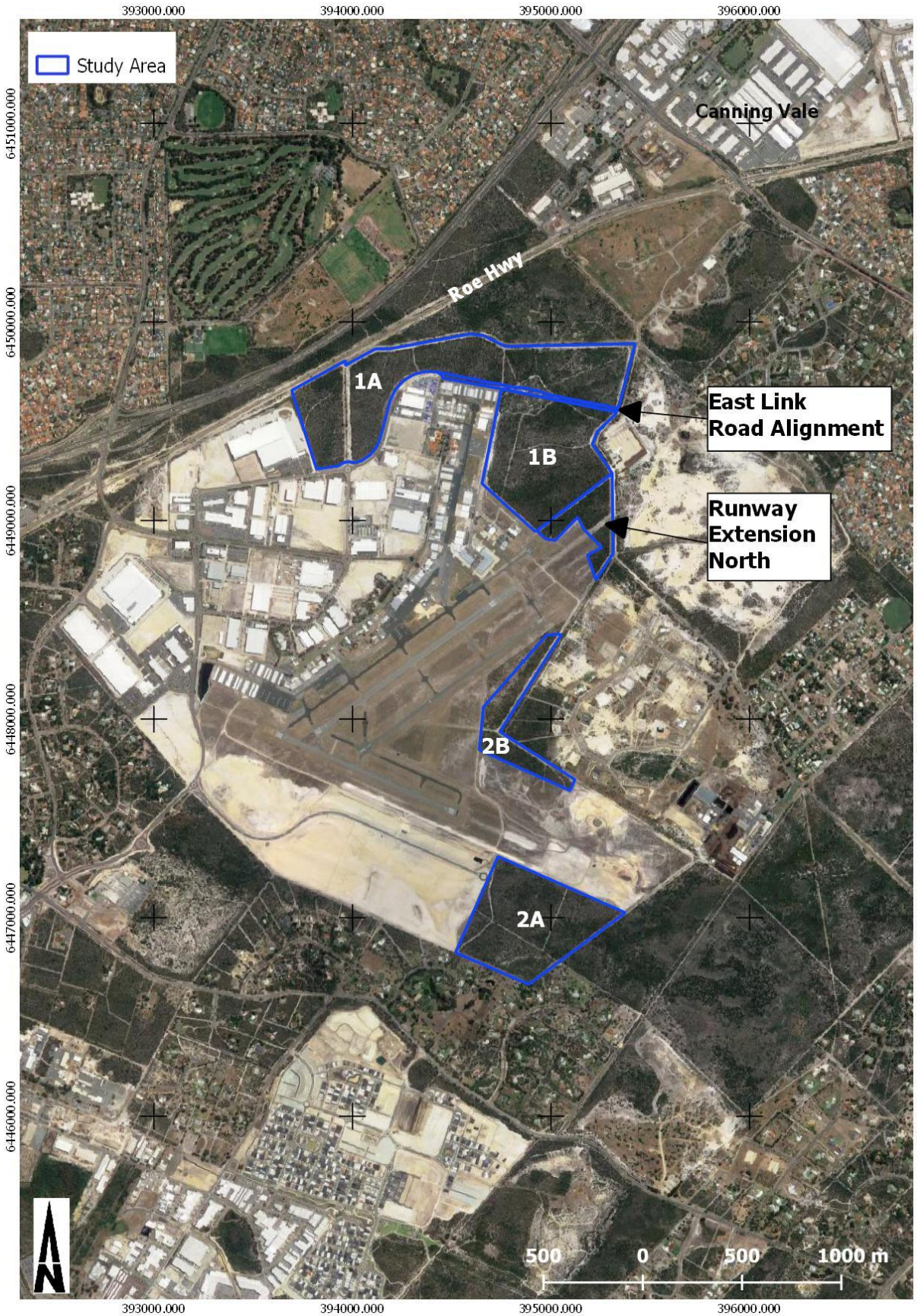


Figure 1 - Study area location

2 Background

Thousands of Australian native plant species are susceptible to Phytophthora dieback—a destructive disease caused by the pathogen *Phytophthora cinnamomi* and other Phytophthora species. This disease is a major threat to Australia's biodiversity, placing important plant species at risk of death, local extirpation or even extinction. Its dramatic impact on plant communities can also result in major declines in some insect, bird and animal species due to the loss of shelter, nesting sites and food sources. Phytophthora dieback can cause permanent damage to ecosystems. Once an area is infested with the pathogen, eradication is usually impossible. Awareness that human activity can easily spread the pathogen will help prevent an increase in the extent of this disease (Commonwealth of Australia, 2018)

Phytophthora spp. are a group of microscopic water moulds that belong to the class Oomycetes. Oomycetes organisms are filamentous and absorptive and reproduce both sexually and asexually. *Phytophthora* spp. are considered parasitic. The species behave largely as a necrotrophic pathogen causing damage to the host plant's root tissues because of infection and invasion. (Department of Parks and Wildlife, 2015) The pathogen infects a host when it enters at a cellular level and damages the cell structure.

Phytophthora Dieback is the result of interaction between three physical components forming a 'disease triangle': the pathogen (*Phytophthora* spp.), the environment and the host. All three components are needed for the disease to develop over time. The relationship between the presence of *Phytophthora* spp. and the development of Phytophthora Dieback disease is variable and based on the susceptibility of native plant species and the different environmental characteristics, landform types and rainfall zones across bioregions.

Armillaria Rot Disease (ARD) is a pathogen frequently encountered during Phytophthora Dieback assessments. It is caused by an indigenous fungus which is endemic to the south-west of Western Australia, occasionally presenting symptoms consistent with Phytophthora Dieback presence. The impact of the fungus on the vegetation may range from single dead plants to complete devastation of understorey and overstorey species.

3 Materials and methods

3.1 The assessment area

As per Department of Parks and Wildlife (DPAW) (2015), areas within the study area are excluded from assessment if the vegetation is suffering from significant disturbance. This disturbance (Table 1) is based on Vegetation Condition Scales (Keighery, 1994). The remaining area, including the area outside of the development envelope if necessary, will be categorised post-assessment into Phytophthora Dieback occurrence categories (Table 2, Map 1).

Table 1 - Keighery Vegetation Condition Scale

Scale		Vegetation condition
1	Pristine	Pristine or nearly so; no obvious signs of disturbance.
2	Excellent	Vegetation structure intact; disturbance affecting individual species and weeds are non-aggressive species.
3	Very good	Vegetation structure altered; obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
6	Completely degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

.

Table 2 - Phytophthora Dieback assessment for vegetation condition

Vegetation Condition	Phytophthora occurrence category
Naturally vegetated areas. Keighery disturbance rating of 3 or less Phytophthora occurrence categorisation is possible.	Infested - Determined to have plant disease symptoms consistent with the presence of *Phytophthora cinnamomi.*
	Uninfested - Determined to be free of plant disease symptoms that indicate the presence of *P. cinnamomi*
	Uninterpretable - Undisturbed areas where susceptible plants are absent, or too few to make a determination of the presence or absence of *P. cinnamomi.*
	Not yet resolved.
Vegetation structure temporarily altered.	Temporarily Uninterpretable - Areas of disturbance where natural vegetation is likely to recover.
Vegetation structure severely altered. Keighery disturbance rating 4 or greater. Phytophthora occurrence assessment is not possible	Excluded.

3.2 The assessment method

All Phytophthora Dieback detection, diagnosis and mapping was performed to standards and procedures defined in FEM047 Chapter 6 (DPAW 2015). These procedures are grounded on the presence in the vegetation of Indicator Species, and the observance of deaths in these plants. An indicator species is a plant species that is reliably susceptible to *Phytophthora cinnamomi*. Indicator species deaths (ISDs) alone do not necessarily indicate disease presence and it is necessary to consider all environmental and ecological factors that may be present. These other factors (as listed in FEM047) include:

- Chronology of deaths;
- Pattern of deaths;
- Topographical position;
- Vectoring – causal agencies, and;
- Biomass and biological diversity reduction.

Other causes of plant deaths need to be considered when determining the presence of Phytophthora Dieback, including (from FEM047):

- *Armillaria luteobubalina*;
- various cankers;
- insects;
- drought, wind scorch and frost;
- salinity and waterlogging;
- fire and lightning;
- senescence and competition;
- physical damage, and;
- herbicides and chemical spills.

The assessment was performed using the comprehensive (featuring transect lines) assessment type and performed to standards defined by Chapter 8, FEM047. Prior to assessment, all information relevant to the project was assembled to assist the interpretation process (as defined in Chapter 7, FEM047). This information included previous assessments of the area, history of burning and possible other disturbances.

3.3 Other *Phytophthora* species

Phytophthora species other than *P. cinnamomi* are identified using DNA analysis by the Centre for Phytophthora Science and Management (CPSM) at Murdoch University following the identification of the presence of a *Phytophthora* species in baiting analysis performed by Vegetation Health Service (VHS) at the Department of Biodiversity, Conservation and Attractions (DBCA).

3.4 Collection of evidence of Phytophthora Dieback

During the assessment process, the collection of evidence to support the field diagnosis is recorded using a tablet running the ESRI Collector application. Waypoints are recorded at locations to show evidence of:

- where field diagnosis is certain or almost certain of Phytophthora Dieback infestation;

- healthy indicator species where field diagnosis is almost certain of the site being uninfested;
- sites with too few or devoid of indicator species, thus supporting uninterpretable classification, or
- areas of disturbance, which are temporarily uninterpretable or excluded from assessment.

Additional waypoints recorded include:

- points requiring soil and tissue sampling;
- points located where samples have been taken;
- points located at ISDs, and
- points that need to be revisited for further examination.

3.5 Soil and Tissue Samples

Soil and tissue samples taken during the assessment were to standards and prescriptions defined in Chapter 11 of FEM047. All samples were analysed in the Vegetation Health Services (DBCA) laboratory using best-practice techniques.

Taking a soil and tissue sample from dead and dying plants is an integral part of assessment – although in some cases sampling is not essential. Sample results provide evidence to support field diagnostic decisions. The following table (Table 3) shows the need for sampling to assist the disease diagnosis process (Department of Parks and Wildlife, 2015).

Table 3 - Determination of requirement for sampling

Observable factors indicating likelihood of *Phytophthora cinnamomi* presence				
ISD type	Multiple	Cluster	Scattered	Isolated
Species	Some or most indicator species	Any indicator plant	Any indicator plant	Any indicator plant
Pattern development	Obvious			Not obvious
Chronology	Obvious			Not obvious
Topographic situation	Gully/flat	Lower to mid slope	Mid slope to upper slope	Ridge
Causal agent	Obvious			Not obvious
Requirement for soil and tissue sample	Low	High	High	Low

4 Results

4.1 Phytophthora Dieback Occurrence

Four infestations, comprising 22.9 ha (Table 4) were mapped during the assessment. No new infestations were identified. The Dieback boundaries were rechecked and adjusted as required. Generally, only minor to moderate disease front movement was detected and the boundaries were not significantly altered, resulting in the total infested area increasing from 22.7 ha (2017) to 22.9 ha. A total of 95.4 ha was observed to be uninfested, while the remaining 11.4 ha was excluded from assessment due to being cleared or degraded (as per DPAW 2015).

Table 4 - Area Summary

Category	Area (ha)	% of assessed total area
Infested (with *Phytophthora)*	22.9	19
Uninfested	95.4	81
TOTAL AREA ASSESSED	118.3	100.0
Excluded Area	11.4	
TOTAL AREA	129.7	

4.2 Disease symptoms and expression

Disease expression was subtle throughout most of the infested area, with minimal recent ISDs observed. The lack of expression is most likely the result of periodic phosphite treatment which has occurred several times during the last 15 years. The infested areas are however still obvious due to the reduced biomass and changes in vegetation structure.

4.3 Other *Phytophthora* species

No other *Phytophthora* spp. were identified during the assessment.

4.4 Armillaria Root Disease

No infestations associated with ARD were observed during the assessment.

4.5 Sample results

Nine soil and tissue samples were taken during the assessment. The results are presented in section 7.1.

5 Discussion

A total of four infestations comprising a total of 22.9 ha were observed and mapped during the assessment. This represents an increase of 0.2 ha since the 2017 assessment. The majority of the increase is associated with changes made to the boundary of the small infestation adjacent to the shooting range, where ISDs were observed several metres beyond the area previously (2017) thought to be the disease front. It is unlikely that this change is the result of rapid disease spread. It is more likely that the full extent of the infested area was not apparent during the 2017 survey.

Another moderate change was made to the boundary (tapes moved 10-12m over a short section) at the western end of the small infestation adjacent to Mustang Road. Old Banksia stags were observed approximately 10m beyond the existing boundary demarcation. The cause of the deaths is not obvious and may not be related to Phytophthora dieback. However, there were no recent deaths to sample to confirm the presence of the disease. As a result, the Banksia deaths have been included dieback boundary as a precaution. The remainder of the disease boundaries were almost identical to the 2017 survey, with only minor changes made to the existing boundaries.

The *P. elongata* and *P. palmivora* infestations identified in the drainage basin adjacent to Mustang Road during the 2017 survey exhibited minimal evidence of disease activity and the impact of these pathogens appears to be very low at this stage.

A number of areas exhibited evidence of vegetation decline, including several ISDs. However, the pattern of decline was not consistent with the presence of Phytophthora dieback and samples were taken to assist in confirming the presence / absence of the disease in these areas. All nine of the soil and tissue samples taken during the assessment tested negative for the presence of Phytophthora supporting the view that the decline is related to factors other than Phytophthora dieback.

The areas excluded from assessment were primarily perimeter tracks/firebreaks that were largely devoid of vegetation. Other areas were also excluded due to being cleared or completely degraded.

Existing dieback management strategies appear to be effective and should be maintained. No new infestations have been created and there is no evidence of disease spread associated with human activities.

6 Bibliography

Commonwealth of Australia. (2018). *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi.*

Department of Parks and Wildlife. (2015). *FEM047 Phytophthora Dieback Interpreter's Manual for lands managed by the department.* Unpublished.

Glevan Consulting (2017) *Jandakot Airport Phytophthora Dieback Assessment 2017*. Unpublished report for JAH.

Keighery, B. (1994). *Bushland Plant Survey: a Guide to Plant Community Survey for the Community.* Wildflower Society of WA (Inc.).

7 Appendices

7.1 Sample Summary

Nine soil and tissue sample were taken during the assessment, all of which returned a negative result for the presence of *Phytophthora* (Table 5).

Table 5 Sample Results

Sample no	Plant Sampled	Easting	Northing	Result
01	***Xanthorrhoea gracilis***	394992	6447719	***Negative***
02	***Xanthorrhoea preissii***	394665	6447944	***Negative***
03	***Banksia attenuata***	394969	6448963	***Negative***
04	***Banksia menziesii***	395162	6449420	***Negative***
05	***Banksia attenuata***	394757	6449779	***Negative***
06	***Banksia attenuata***	394804	6449512	***Negative***
07	***Xanthorrhoea preissii***	394834	6449512	***Negative***
08	***Banksia attenuata***	393949	6449342	***Negative***
09	***Banksia grandis***	394067	6448551	***Negative***

7.2 Phytophthora Dieback Occurrence map

The provided map is the Phytophthora Dieback occurrence map. The project area is displayed as a blue boundary line. The following categories are also shown (if present in the project area):

- Excluded (shown as uncoloured). Areas of high disturbance where natural vegetation has been cleared and is unlikely to recover to a level that is interpretable.
- Infested (shown as red). Determined from the assessment to have the plant disease caused by *Phytophthora cinnamomi*. Phytophthora Dieback caused by other *Phytophthora* species will be displayed as other colours, typically shades of orange and yellow.
- Uninfested (shown as green). Determined from the assessment to be free of plant disease Phytophthora Dieback.

- Uninterpretable (shown as purple). Undisturbed areas where susceptible plants are absent, or too few to decide the presence or absence of Phytophthora Dieback.
- Temporarily Uninterpretable (shown as grey). Areas of disturbance where natural vegetation is likely to recover.

Additional spatial data that may be shown include:

- Sample location

7.3 Mapping Metadata

DATASET DESCRIPTION	
Title	Jandakot Airport Triennial Assessment
Data Created	27-10-2020
Date Last Updated	02-03-2021
Abstract	Phytophthora Dieback Occurrence and sample location shapefiles for the Jandakot Airport Triennial assessment
Purpose	Dieback category boundary mapping
Document Number	20-1093
Contact Organisation	Glevan Consulting
Contact Name	Simon Robinson
Contact Position	Phytophthora Dieback Interpreter
Contact Phone	0427 113 336
Contact Email	simon.robinson@glevan.com.au
Lineage	All field data recorded using ESRI Collector on a GPS enabled tablet.
Datum / Coordinate System	GDA94 Zone 50
Geographic Description	Jandakot Airport Conservation Areas
Restrictions	None

7.4 Shapefile spatial data

Spatial data is contained in the attached file named Jandakot_Airport_Triennial_Assessment _Shapefiles.zip.

Map 1
Phytophthora Dieback Occurrence Map

Jandakot Airport
JAH

Infested
Uninfested
Excluded

Samples
Negative
Assessment Area

Author: Simon Robinson
Date: 22-12-2020

Datum: GDA94 Zone 50
Mapping expiry: 02-11-2023

250 0 250 500 m

N

GLEVAN CONSULTING

END OF DOCUMENT