

JANDAKOT AIRPORT EXPANSION:
CLEARING OF NATIVE VEGETATION
EPBC REFERENCE 2009/4796
ADDITIONAL INFORMATION FOR
EPBC ACT REFERRAL

Prepared for:

JANDAKOT AIRPORT HOLDINGS

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Prepared by:

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STATEMENT OF LIMITATIONS

Scope of Services

This environmental site assessment report (“the report”) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and ENV.Australia Pty Ltd (ENV) (“scope of services”). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, ENV has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report (“the data”). Except as otherwise stated in the report, ENV has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (“conclusions”) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. ENV will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to ENV.

Environmental Conclusions

In accordance with the scope of services, ENV has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions. Also it should be recognised that site conditions, including the extent and concentration of contaminants, can change with time.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

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Other Limitations

ENV will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

1 INTRODUCTION

ENV Australia (ENV) has prepared this report in response to a request for additional information from the Department of Environment, Water, Heritage and the Arts (DEWHA) in relation to the proposed Jandakot Airport expansion project. Jandakot Airport Holdings (JAH) is required under the Airports Act 1996 to develop a Master Plan for the Airport every 5 years, describing the development of the Airport over the next 20 years. JAH prepared and submitted a referral under the *EPBC Act* on 13th March 2009 in relation to the Master Plan 2009. Comments were received on the information provided in the referral on 1st May 2009 (Refer to Appendix A)

This report is to be read in conjunction with the JAH *EPBC Act* Referral, as it provides additional information requested by the Department of Environment, Water, Heritage and the Arts (DEWHA) as part of the referral process. A copy of the letter from DEWHA requesting this additional information is included in Appendix A.

1.1 THE JANDAKOT AIRPORT MASTER PLAN 2009

Jandakot Airport is an important piece of State infrastructure on an area of 622 ha of Commonwealth land 16 km south of the City of Perth. The draft Jandakot Airport Master Plan 2009 outlines the proposed future development of parts of the site for aviation and non-aviation uses for the next 20 years (Refer to Figure 1).

The total eventual development footprint of the airport including existing airport infrastructure, the fourth runway, runway extensions, aeronautical and commercial development is 451 ha. The onsite conservation areas will total 171 ha including Precinct 6 and 6A. (Figure 1). If the proposed 32 ha of runway extensions do not take place, the conservation areas will total 203 ha.

The site includes areas of native bushland which contains rare flora species the Grand Spider Orchid (*Caladenia huegeli*) and possibly the Glossy Leaved Hammer Orchid (*Drakaea Elastica*) and species which provide food for the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*). Part of the site is also within the Jandakot Groundwater Mound Underground Water Pollution Control Area. The Jandakot Mound provides part of Perth's drinking water supply.

The proposal will result in staged clearing of 167 hectares of native vegetation for the airport development (refer to Figure 2), the rehabilitation of 90 ha of land formerly used for sand mining and the creation of a large contiguous conservation area of over 650 ha linking the presently isolated Ken Hurst Park with Jandakot Regional Park (refer to Figure 11).

The staged clearing of 167 ha of native vegetation will ultimately result in the loss of 1.2% of the total Carnaby's Cockatoo habitat within 20 km of the Airport. The impact of this habitat loss will be significantly reduced through the rehabilitation of 90 ha of land adjacent to the Airport and the creation of a large contiguous conservation area of approximately 657 ha.

Ken Hurst Park, the Jandakot Regional Park and Jandakot Airport conservation areas are presently fragmented. The development includes rehabilitation of 90 ha that will form the critical link which will create a continuous conservation area connecting the presently isolated Ken Hurst Park with Jandakot Airport Conservation Precincts and Jandakot Regional Park. JAH proposes to manage over half of this conservation area (322 ha, including Ken Hurst Park, Precincts 7 and 8 and the conservation area within the Airport) under a Conservation Area Management Plan. Jandakot Regional Park will continue to be managed in accordance with existing arrangements.

A total of 164 Grand Spider Orchids will remain in situ in Precinct 1A, creating an orchid conservation precinct into which 40 other Grand Spider Orchids and up to 4 Glossy Leaved Hammer Orchids will be translocated.

The proposed development will result in the connection of the Airport site to reticulated sewer. This will have a positive environmental impact on groundwater quality and reduce the site's impact on the Jandakot Mound.

1.2 REPORT STRUCTURE

This report addresses each item of additional information requested from DEWHA in individual sections, as follows:

POTENTIAL IMPACTS OF THE PROPOSAL ON EPBC ACT LISTED THREATENED SPECIES

Section 2: The impact of the presence of listed threatened species on the design of the proposal, mitigation measures and impacts;

Section 3: The potential impact of removal of habitat for Carnaby's Cockatoo, Grand Spider Orchid and Glossy-Leaved Hammer Orchid;

Section 4: Potential changes to long term management of habitat for listed threatened species on the site during implementation of the Master Plan;

POTENTIAL IMPACTS OF THE PROPOSAL ON COMMONWEALTH LAND

Section 5: The long term viability of remaining patches of Banksia woodland;

Section 6: The ecological function of Banksia woodland before and after construction of the Jandakot Airport expansion, including edge effects;

Section 7: Potential impacts on WA listed threatened species;

Section 8: Potential impacts on the Jandakot Groundwater Mound;

Section 9: Impacts from roads and fences on connectivity in conservation areas within Jandakot Airport and with surrounding areas;

PROPOSED MITIGATION MEASURES

Section 10: A consolidated list of mitigation measures to be undertaken to prevent, minimise or compensate for the relevant impacts on listed threatened species;

Section 11: Mitigation measures to maintain connectivity between conservation areas within Jandakot Airport and with surrounding areas, including through the use of fencing;

Section 12: Mitigation measures to avoid impacts on the Jandakot Groundwater Mound;

Section 13: Assessment of the expected or predicted effectiveness of the mitigation measures and offsets and any outstanding risks;

Section 14: The cost of mitigation measures and offsets;

PROPOSED OFFSETS

Section 15: Potential offsets to compensate for the loss of Carnaby's Black Cockatoo habitat;

Section 16: Expected success of vegetation rehabilitation in the proposed offset areas, including estimates of time taken for rehabilitated vegetation to become established and functional;

Section 17: Progress of negotiations with relevant parties to acquire proposed offsets; and

Section 18: Alternative options for offsets if negotiations to acquire proposed offsets are unsuccessful

Each item where further information was requested is stated at the beginning of each section, and is followed by the requested information.

POTENTIAL IMPACTS OF THE PROPOSAL ON *EPBC ACT* LISTED THREATENED SPECIES

2 THE IMPACT OF THE PRESENCE OF LISTED THREATENED SPECIES ON THE DESIGN OF THE PROPOSAL, MITIGATION MEASURES AND OFFSETS

Development of Jandakot Airport, as a Commonwealth leased Airport, is undertaken within the regulatory framework of the Airports Act 1996. A requirement of the Act is the preparation of a Master Plan every 5 years and the Master Plan 2009 is a review of the approved Master Plan 2005, which was approved by the then Minister for Transport and Regional Services on 3 January 2006.

One of the key differences between the Master Plan 2009 and the approved Master Plan 2005 is a change in land use at the Airport to secure areas of environmental significance. These areas have been defined as a consequence of substantial investigations into the key environmental elements at the Airport.

The Master Plan 2005 relates only to the Airport site. JAH has identified that there are significant positive environmental benefits which can be achieved through involvement in the wider area that surrounds the Airport. Consequently the Master Plan 2009 includes the rehabilitation of adjoining City of Canning sand mining areas to achieve positive environmental outcomes. This rehabilitation work will provide a critical link between conservation areas at the Airport, Ken Hurst Park, Bush Forever Site 388, the Acourt Road Bushland and Jandakot Regional Park.

2.1 MASTER PLAN 2005

The approved Master Plan 2005 describes the current development scenario (Refer to Figure 3), which differs from the Master Plan 2009. When the Master Plan 2005 was developed, one Grand Spider Orchid (*Caladenia huegelii*) had been identified at the Airport, in Precinct 2. Precinct 2 was proposed for conservation to protect this orchid. Precincts 1B, 5 and 6 were also retained for conservation. The Master Plan 2005 proposed that Precinct 1A, which is now known to contain 164 Grand Spider Orchids, would be cleared for development. Precinct 5 is mapped as a conservation area in the Master Plan 2005.

Under the Master Plan 2005, the conservation areas at the airport are three separate areas, fragmented and isolated from one another by runways, with little or no connectivity between them.

2.2 MASTER PLAN 2009

The draft Master Plan 2009 has been prepared after lengthy discussions with both Commonwealth and State environmental agencies to identify and secure significant conservation areas at the Airport. A primary focus has been to ensure that the draft Master Plan 2009 takes into account the 225 Grand Spider Orchids identified at the Airport.

Precinct 1A is a proposed new conservation area designed to accommodate in situ the 164 Grand Spider Orchids (*Caladenia huegelii*) identified (refer to Figure 4). Retention of Precinct 1A for conservation will, more importantly, also increase connectivity between Ken Hurst Park and conservation areas within the Airport.

Precinct 1B contains 20 Grand Spider Orchids and consequently it will be retained for conservation. Retention of Precinct 1B for conservation will also increase connectivity between Ken Hurst Park and conservation areas within the Airport. A total of 184 Grand Spider Orchids will be retained in situ within Precincts 1A and 1B, adjacent to the largest known population of Grand Spider Orchids, which occurs in Ken Hurst Park.

Precincts 2 and 6 remain part of the conservation area at the airport. Precincts 3 and 4 are existing development areas at the Airport.

Precinct 5, mapped as a conservation area in the Master Plan 2005, is proposed as a development area under the Master Plan 2009. This allows for a similar area of development as approved in the Master Plan 2005. This will result in the disturbance of two Grand Spider Orchids. The two orchids from Precinct 5 will be translocated into Precinct 1A prior to the clearing of Precinct 5. Precinct 5 is isolated bushland, with little or no connectivity with conservation areas within and adjacent to the Airport, in contrast to the connectivity of Precinct 1A to Precinct 1B and Ken Hurst Park.

Precincts 7 and 8 have been identified as important areas adjacent but external to the Airport. Through the efforts of JAH it is considered that these areas will be able to contribute to a better overall environmental outcome for the project, in addition to offsetting the clearing that will be required for the Master Plan 2009. Precincts 7 and 8 are located east of the Airport and are presently used for sand mining by the City of Canning. Ken Hurst Park, Bush Forever Site 388, Jandakot Airport conservation areas and the Jandakot Regional Park are currently isolated and fragmented from one another. Under the Master Plan 2009, this sand mine will be rehabilitated to create an area of native vegetation that forges an ecological link of over 650 ha between Ken Hurst Park, Bush Forever Area 388, the Airport conservation areas, Acourt Road Bushland and the Jandakot Regional Park. This is considered to be a significant environmental benefit of the project.

3 THE POTENTIAL IMPACT OF REMOVAL OF HABITAT FOR CARNABY’S COCKATOO, GRAND SPIDER ORCHID AND GLOSSY-LEAVED HAMMER ORCHID

3.1 CARNABY’S COCKATOO

The proposed development will involve staged clearing of 167 ha of bushland which is identified as potential foraging habitat for the Carnaby’s Cockatoo (refer to Figure 5). The area to be cleared however is not considered significant in comparison with the vegetation remaining in the region including that contained within Jandakot Regional Park. Importantly, the area to be cleared contains no breeding habitat for Carnaby’s Cockatoo.

Mapping of potential Carnaby’s Cockatoo habitat in the region indicates that there is approximately 13,756 ha of suitable vegetation within a 20 km radius of Jandakot Airport (Figure 6).

Approximately 7,317 ha of this habitat is within Bush Forever sites and 4,986 ha is within Parks and Recreation reserves, providing a significant level of security for retention of bushland.

The proposed development will involve staged clearing of approximately 167 ha of vegetation which is approximately 1.2% of the area of potential cockatoo foraging habitat in the region (within a 20 km radius). Rehabilitation of Precincts 7 and 8 will add 90 ha to the vegetated areas in and around Jandakot Airport and establish a significant regional ecological corridor between Ken Hurst Park and Jandakot Regional Park.

The then Department of Environment and Heritage published Significant Impact Guidelines for Matters of National Environmental Significance (NES) in 2006. The guidelines include significant impact criteria by which to assess if an action is likely to have a significant impact on a critically endangered or endangered species.

An assessment against these criteria (Refer to Table 1) indicates that the Master Plan 2009 is considered highly unlikely to have potential to affect the distribution and size of Carnaby’s Cockatoo populations, in consideration of the scale of the impact compared to the area of feeding habitat available to the species. Vegetation of Jandakot Airport is currently fragmented and will benefit from the proposed offset of rehabilitation of Precincts 7 and 8 adjacent to the Airport. The rehabilitation of Precincts 7 and 8 will result in a contiguous environmental corridor better suited to cockatoo requirements.

Table 1: Significant Impact Criteria Addressed for Jandakot Airport

Significant Impact Criteria	Likelihood	Response in Context of Jandakot Airport
Lead to long term decrease in the size of the population;	Appears unlikely	The area of clearing (167 ha) is not considered critical in the context of secure regionally available habitat of over 13,756 ha within a 20 km radius.
Reduce the area of occupancy of the species;	Unlikely	Species may visit but does not occupy the site on a permanent basis. Therefore, this is not considered a possibility.
Fragment an existing population into two or more populations;	Unlikely	As above. Not considered a possibility.
Adversely affect habitat critical to the survival of a species;	Unlikely	Habitat onsite is not considered critical therefore; it is not considered a possibility.
Disrupt the breeding cycle of a population	Unlikely	No breeding habitat or potential nesting trees are found onsite. Therefore, this is not considered a possibility.
Modify, destroy, isolate or decrease the availability of habitat to the extent that the species is likely to decline;	Appears Unlikely	The project area is a small proportion of the available feeding habitat of the species which includes Banksia woodland and pine plantations on the Swan Coastal Plain. As above, therefore, this is not considered a possibility.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered species or critically endangered species habitat;	Unlikely	No invasive species that are harmful to Black Cockatoos are included in the proposal. There are some weeds in the project area however, the implementation of weed management and Dieback Management plans for the areas to be retained will ensure that the viability of conservation precincts is maintained.
Introduce disease that may cause the species to decline; or;	Possible	The proposal has a low potential to introduce diseases that may cause species decline. Dieback and weed management plans will ensure that viability of retained conservation areas is maintained.
Interfere with the recovery of the species	Possible	The clearing of any feeding habitat for Carnaby's Black Cockatoo has potential to interfere with recovery efforts. The project area is not near a potential breeding habitat. The size of the proposal relevant to the total feeding habitat available on the Swan Coastal Plain including Banksia Woodlands and Pine plantations is not considered significant however, the cumulative effects are difficult to assess. The staged nature of the clearing combined with the rehabilitation of Precincts 7 and 8 ameliorate any impact.

3.2 GRAND SPIDER ORCHID (*CALADENIA HUEGELII*)

The proposed development at Jandakot Airport will impact up to 40 individual plants but will protect the majority of plants (185) in situ. The plants impacted upon by the Master Plan 2009 will be translocated in conjunction with Kings Park and Botanic Gardens into the Conservation Precinct 1A. Importantly, the proposal will result in significant contiguous habitat creation.

3.2.1 Current Status

Caladenia huegelii was declared as Declared Rare Flora as *Caladenia* sp (*Coastal Plain*) SD Hopper 3400 in September 1987 and as *Caladenia huegelii* in November 1990, under the *Western Australian Wildlife Conservation Act 1950*. It is ranked as Critically Endangered (CR) under World Conservation Union (ICUN 2001) criterion B2ab(i,ii,iii,iv) due to the severe fragmentation of populations and the continuing decline in the extent of occurrence, area of occupancy, quality of habitat and number of locations. *C huegelii* is also listed as Endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* (DEC, 2008).

Caladenia huegelii is currently known from 33 extant populations with surveys conducted over the last decade recording 1,614 mature plants. At the time of the most recent survey, 17 of the 33 extant populations contained less than five flowering plants each, and in many cases no plants were recorded. However, as habitat appears intact in these areas some populations may still be extant. Three hundred and sixty three plants (22%) occurred within Nature Reserves. An additional 196 plants (12%) occurred on land that has been or is currently in the process of becoming reserved for conservation, largely as a result of negotiations with developers. If improved tenure or conservation management is negotiated for Populations 6 in Ken Hurst Park and 56 in Jandakot Airport (which are in fact a single large population split over two adjoining properties), a further 805 plants or 50% of the total number of known plants and their extensive supporting habitat would be protected (DEC, 2008).

Although it appears that there are a high number of populations of this species, most are very small disjunct remnants of natural vegetation on the Swan Coastal Plain, and many are subject to development pressures. Threats include urban development, degraded habitat, poor recruitment, weed invasion, roadworks, firebreak maintenance, inappropriate fire regimes, recreational activities and dumping of rubbish (DEC, 2008).

Table 2 includes the location and number of plants to be removed due to the proposed development:

Table 2: *Caladenia huegelii* to be removed

Precinct	No. of plants
3	1
4	37
5	2

3.3 GLOSSY LEAVED HAMMER ORCHID (*DRAKAEA ELASTICA*)

The proposed development at Jandakot Airport will impact the location where 4 plants were previously identified. These were identified in 2005 but have not been located in subsequent surveys conducted by Matiske Consulting. If these plants can be located, they will be translocated in conjunction with Botanical Gardens and Parks Authority into the conservation Precinct 1A.

3.3.1 Current Status

Drakaea elastica is currently known over a range of approximately 350 km between the townships of Cataby in the north and Busselton in the south. The species grows on bare patches of grey-white sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps and flats, typically in Banksia Woodland or Spearwood thicket vegetation (DEC, 2008).

The decline of some populations may be partly due to increased density of native understorey vegetation following fire, leading to increased competition. Although the species occupies bare patches of soil within its habitat, the increased rates of survival in sites with relatively little direct sun exposure indicate a requirement for shady canopy cover to be present (DEC, 2008).

Construction of East Link will result in clearing of land where 4 Glossy Leaved Hammer Orchids were identified by DEC in 2005. Subsequent surveys by Matiske Consulting failed to locate any Glossy Leaved Hammer Orchids at Jandakot Airport and it is unlikely that these orchids will be found at the Airport, as their preferred habitat is considered to be unlikely or restricted within the Airport area (Matiske, 2009).

An additional targeted survey will be conducted to attempt to identify any Glossy Leaved Hammer Orchids present at the Airport (refer to Section 4.2.1 and Appendix B). Should this survey locate the Glossy Leaved Hammer Orchids identified in 2005 by DEC, the Master Plan 2009 will result in the relocation of 4 Glossy Leaved Hammer Orchids into Precinct 1A.

4 POTENTIAL CHANGES TO LONG TERM MANAGEMENT OF HABITAT FOR LISTED THREATENED SPECIES ON THE SITE DURING IMPLEMENTATION OF THE MASTER PLAN

Section 4.1 outlines the commitments stated in the Environment Strategy 2004, for the protection and management for orchids and bushland located within the project area. Section 4.2 then outlines the commitments from the draft Environment Strategy 2009, to illustrate the increased level of effort for management of threatened species habitats.

4.1 ENVIRONMENT STRATEGY 2004

JAH committed to conserve the Grand Spider Orchid at the Airport by closing non-essential tracks running through the area, increasing chemical control of introduced weeds in the area to reduce competition with the orchid, and by identifying the plot as a priority bushfire protection area on fire plan maps and in staff training.

4.2 DRAFT ENVIRONMENT STRATEGY 2009

The approved Master Plan 2005 proposed that Precinct 1A be developed for commercial land use. Flora surveys have identified a number of Grand Spider Orchids (*Caladenia huegelii*) on site, the majority of which are in the development precinct proposed by the Master Plan 2005.

Following consultation with the Department of the Environment, Water, Heritage and the Arts, JAH proposes to retain Precinct 1A, previously identified for commercial development, for conservation. This Precinct contains the majority of the rare flora at the Airport and, importantly, maintains an ecological linkage to Ken Hurst Park which is bushland reserve to the north of the Jandakot Airport. Ken Hurst Park has the largest known population of the Grand Spider Orchid (*Caladenia huegelii*).

JAH have consulted widely, including with the Department of Environment and Conservation WA, Botanic Parks and Gardens Authority (BPGA) and propose the exchange of Precinct 1A for Precinct 5. This will ensure that the majority of the orchids are retained in situ. The proposed exchange will have the environmental benefit of maintaining the orchid population on Jandakot in a contiguous link with the orchid population at Ken Hurst Park within a total contiguous bushland habitat area of 130 ha.

Preservation of Precincts 1A and 1B (79 ha) for conservation will maintain the ecological linkage to Ken Hurst Park, an area of 51 ha of bushland, which also

supports the Grand Spider Orchid (*Caladenia huegelii*). This will ensure that retention of orchid habitat including pollinators (specific species of wasp) and mycorrhizae (soil fungi). The opportunity for a joint management of Ken Hurst Park will also be investigated with key stakeholders.

4.2.1 Monitoring

A monitoring program has been developed by Mattiske Consulting in consultation with orchid specialists from Botanical Gardens and Parks Authority (BGPA) (Refer to Appendix B). In accordance with this monitoring program, JAH will undertake the following monitoring:

- *Caladenia huegelii* monitoring – a series of permanent monitoring sites will be established in the spring of 2009 to capture approximately a third of the population (as currently known) in representative areas in different sections of Jandakot Airport. The timing of the field work will align with the peak of flowering. The peak of flowering may vary each year as rainfall events are not consistent. Therefore inspections of current populations will be undertaken prior to the work each year to assess and determine the optimum time for the field assessments to be undertaken. These monitoring sites will be assessed on an annual basis for three years. The monitoring will include re-assessing individual plants in permanent quadrats. Every three years an audit of all plants will be undertaken. Reporting will be supplied on an annual basis. After three years the monitoring program will be reviewed in consultation with BGPA orchid specialists (Mattiske, 2009)
- *Drakaea elastica* monitoring – targeted searching within bushland areas on Jandakot Airport following discussions with BGPA orchid specialists will be undertaken in July/August 2009 and will include weekly checking of sites that may support the species (based on habitat preference information from BGPA orchid specialists). Additional targeted searching will be undertaken in consultation with orchid specialists from BGPA in potentially preferred habitats. Mattiske indicates that the targeted areas to be searched are the K1 and adjacent J1 communities in the northwest corner of the Airport, in Figure 7. This approach is based on the current detailed knowledge of this species habitat preference (which is unlikely or restricted within the Airport area). This work will be undertaken on a regular basis (fortnightly in early spring to late spring). As the basal leaf is quite distinctive this work does not need to align totally with the flowering period of this species. If any plants are located then a detailed monitoring program (along similar lines to that for *Caladenia huegelii*) will be determined in consultation with Kings Park orchid specialists (Mattiske, 2009)

4.2.2 Weed Management

Weed management is addressed in a specific Environmental Weed Management Plan as part of the Conservation Area Management Plan. This will be updated to incorporate the proposed conservation areas.

4.2.3 Dieback (*Phytophthora cinnamomi*)

There are several dieback affected areas of bushland on the site (see Figure 8). A Dieback survey and mapping was undertaken in 2005. Treatment is undertaken in affected areas and vehicle hygiene procedures are maintained to ensure that dieback disease is contained. JAH is currently working with two universities on studies and treatment of dieback.

A draft dieback management plan has been prepared by JAH in 2008 (Refer to Appendix D).

Dieback infested areas can not 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 below:

- Restricting access to dieback areas;
- Strict hygiene measures involving the clean down of all machinery and vehicles;
- Prevent stormwater discharge from dieback infested areas into uninfested areas; and
- Phosphite (phosphonate) treatment through aerial spraying.

All construction at the Airport is undertaken in accordance with a Construction Environmental Management Plan. These Plans are developed for each individual construction project. Construction Environmental Management Plans are required to address a number of potential environmental risks during construction, including dieback management.

Proactive management of the conservation areas is imperative to prevent habitat loss.

POTENTIAL IMPACTS OF THE PROPOSAL ON COMMONWEALTH LAND

5 THE LONG TERM VIABILITY OF REMAINING PATCHES OF BANKSIA WOODLAND

Viability is a measure of the ability of an ecological community to be self-sustaining in supporting and maintaining the full range of living organisms it naturally contains over a long time frame, that is, for at least 50 years. Viability depends a great deal on the inherent resilience of an ecological community. Resilience is the natural ability of a community to resist or recover from disturbance, for example, weed invasion, fire, diseases, pests and other threats (Del Marco et. al, 2004).

An important factor influencing viability is the level of management input. Small, degraded areas may be viable with intensive management. However, it is important to consider whether the level of management required to make an area viable is worth the potential biodiversity outcomes anticipated.

The five easily measured components of viability are as follows:

- Size;
- Shape;
- Perimeter to area ratio;
- Condition; and
- Connectivity.

5.1 SIZE

Size is an important factor in determining the long-term viability of a natural area: the bigger the area, the greater its capacity to retain its biodiversity, maintain ecological function and resist disturbance factors and threatening processes. However, the minimum size for a given area to be viable varies greatly between different ecological communities and depends on the presence of threats and how well these can be controlled.

The *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* (Del Marco et. al, 2004), has outlined the guidelines for viability assessment and determining ecological linkages. The size classes outlined in Table 3 can be applied to Local Natural Areas as a general guide to help determine viability.

Table 3: Size Classes

Size	Viability	Cost of Management
Greater than 20 ha	Higher Viability	Lower Management Costs
Greater than 10 ha but less than 20 ha	Higher Viability	Lower Management Costs
Greater than 4 ha but less than 10 ha	Higher Viability	Lower Management Costs
Greater than 1 ha but less than 4 ha	Lower Viability	Higher Management Costs
Less than 1 ha	Lower Viability	Higher Management Costs

5.2 SHAPE

Shape influences the level of impact that threats may have on the edges of a natural area. These edge effects can be observed extending into natural areas. The degree that edge effects extend into natural areas varies greatly between different ecological communities and depends on the types of threats and how well these can be controlled.

In the metropolitan region, edge effects are typically observed to extend up to at least 25 m into natural areas. Therefore, as a general guide, natural areas less than 50 m wide will end up containing mostly edge habitat of low viability.

The *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* has outlined a number of criteria, which apply to shapes of local natural areas in aiding their viability. These are described in detail in Table 4.

Table 4: Shape Criteria

Viability	Shape
Higher	Circle, square or squat rectangle, oval, squat oblong or symmetrical triangle. Irregular shape with few indentations. Irregular shape with many indentations
Lower	Long thin shape with large proportion of area greater than 50 m wide
Very Low	Long thin shape with large proportion of area less than 50 m wide

5.3 PERIMETER TO AREA RATIO

Perimeter to area ratio is determined by size and shape and therefore can be a useful indicator of viability, as this is calculated by dividing the length of the perimeter by the area. The higher the score, the lower the viability, as the natural area will be impacted more by edge effects.

The perimeter to area ratios described in Table 5 can be applied to Local Natural areas as a guide in determining viability.

Table 5: Perimeter to Area Ration Viability

Perimeter to Area Ratio	Viability
Less than 0.01	Higher Viability
Greater than 0.01, less than 0.02	High Viability
Greater than 0.02, less than 0.04	High Viability
Greater than 0.04	Lower Viability

5.4 CONDITION

Vegetation condition is a rating given to vegetated natural areas to categorise disturbance related to human activities. This rating refers to the degree of change in the structure, density and species present in native vegetation in relation to

undisturbed “pristine’ native vegetation of the same type (Government of Western Australia, 2000).

The project area was mapped for bushland condition using field data and the condition scale used to derive B.J. Keighery (1994) and Connell (1995) after Trudgen (1991) in *Bush Forever* (Government of Western Australia 2000).

The condition of vegetation within a remnant or patch of bushland will have a direct effect on its viability. Bushland in a degraded condition will have little if any viability, whereas bushland in good to very good condition is quite viable and retains high ecological functionality.

The vegetation surveys performed by Mattiske (Mattiske, 2001, 2006, Refer to Figure 9), found most of the vegetation within the current and proposed conservation areas to be good to very good condition. All precincts also contained areas of vegetation mapped as poor condition, however, these were found to be in the minority.

5.5 CONNECTIVITY

The viability of any natural area depends on its connectivity - the proximity to other natural areas and the quality of the linkage between them. These two factors influence the movement of individual living organisms and the flow of genetic material between natural areas. In turn this determines the long term survival of species, their genetic variation, their ability to adapt to changes in the environment (including re-invasion following local extinction) and the maintenance of ecosystem processes. The viability of a given natural area will increase:

- The closer it is to other protected natural areas (for example, DEC Conservation Areas, Bush Forever Sites and Regional Parks);
- The greater the number of protected natural areas within close proximity; and
- The better the condition of the surrounding natural areas.

If the surrounding natural areas are degraded only a limited number of species will use these areas for linkage or as habitat to live in. The better the condition and structural complexity of surrounding natural areas, the more effective they will be as links to larger natural areas and as habitat.

5.6 SUMMARY

Based on the criteria used to measure the viability of Local Natural Areas, the precincts within Jandakot Airport identified as conservation, either existing or

proposed, have been examined to determine their viability in the long term. Table 6 outlines each precinct's viability score.

Table 6: Precinct Viability

Components of Viability						
Precinct	Size	Shape	Perimeter to area ratio	Condition	Connectivity	Viability Score
1A	32 ha	Irregular with few indents	0.0097	Good - Excellent	Yes - Ken Hurst Park	High
1B	47 ha	Irregular with few indents	0.0061	Poor - Excellent	Yes - Ken Hurst Park	High
2 (North)	11 ha	Irregular with few indents	0.0248	Disturbed - Very Good	No	Low
2 (South)	28 ha	Trapezoid (rectangle)	0.0079	Good - Very Good	Yes - Jandakot Regional Park	High
6	43 ha	Squat rectangle	0.0067	Poor - Excellent	No	High
6A	10 ha	Long thin shape with large portion of area greater than 50 m	0.0214	Poor - Excellent	No	High - Low

There are two separate parcels of land which in combination make up Precinct 2; these parcels are not connected. Therefore to measure the viability of precinct 2, these areas have been looked at separately and have been referred to as Precinct 2 (North) and 2 (South).

Based on the table the Precincts which are viable are Precinct 1A, 1B, 2 (South) and 6 and 6A. Precincts 6 and 6A have no external connectivity or ecological linkage unless Precinct 2 (South) is retained as conservation, and therefore acting as a linkage to Jandakot Regional Park. The viability, however, of

Precincts 6 and 6A remains high based on the remaining criteria used to measure viability.

Precincts 7 and 8 have not been included in this viability study as they are predominantly void of vegetation being earmarked for rehabilitation and future conservation. Currently their viability would be low seeing as the condition of the vegetation is degraded to completely degraded, however, by utilising rehabilitation methods and applying careful management this area has the ability to achieve a higher viability outcome.

Overall, the Master Plan 2009 indicates that viability of the retained vegetation is high. Considered separately, all Precincts other than Precinct 2 (North) have high viability and in the longer term they will be integrated areas of larger size, further enhancing their viability. Precinct 2 (North) has lower viability due to its size, shape and location on the site. JAH will ensure the management of this area within its Conservation Area Management Plan (Refer to Section 10.5) to maintain habitat for the Grand Spider Orchid located within Precinct 2 (North).

6 THE ECOLOGICAL FUNCTION OF BANKSIA WOODLAND BEFORE AND AFTER CONSTRUCTION OF THE JANDAKOT AIRPORT EXPANSION, INCLUDING EDGE EFFECTS

For vegetation remnants to have a basic level of ecological function, they require fallen timber, soil crusts and perennial vegetation cover to retain resources (Del Marco et. al, 2004). Seemingly the criteria used to determine viability would also apply to ecological function, meaning larger remnants of native vegetation with a low perimeter to area ratio will ultimately function better ecologically than smaller remnants.

Jandakot Airport Holdings are proposing to retain 171 ha of bushland in the form of precincts 1A, 1B, 2 (North and South), 6 and 6A for conservation purposes. Precincts 7 and 8 are to be rehabilitated over a 7 year timeframe, having previously been mined. The functionality and viability of these areas will be taken into account once rehabilitation is complete.

The condition of the vegetation for the Jandakot Airport area varies from excellent to poor (Mattiske, 2006). Vegetation condition is based on the abundance and aggressiveness of weed species relative to native species but does not take into consideration the occurrence of dieback. Of the 396 sites surveyed within the survey area, the greater majority of the area was of either good, very good or excellent condition with most areas which were rated as poor condition being associated with disturbance either due to airport operations or human activities and the presence of aggressive introduced species such as *Gladiolus caryophyllaceus* and *Ehrharta calycina*.

There is a possibility that a decrease in ecological function will occur within some of the precincts due to the development, however, in other precincts it will remain unaltered. For example the East Link is proposed to go through precinct 1B effectively cutting this precinct into two sections, and continuing along the length of 1A. Roads introduce edge effects which in turn reduce viability and ecological function, so increased management effort will be required. The ecological function of Precinct 2 North will be affected from edge effects, this remnant is isolated and lacks connectivity with other areas of bushland. The long term viability of Precinct 2 North is low.

Precincts 2 (South), 6 and 6A will undergo no change to their ecological function, remaining largely unaffected by the proposed development.

Therefore Precincts 1A, 1B, 2 (South) and 6 should retain their ecological function, as they contain patches of vegetation in excellent condition with the majority of the vegetation in good to very good condition. Their size alone

suggests edge effects will not reduce their viability and most if not all precincts will have some connectivity to other conservation areas.

7 POTENTIAL IMPACTS ON WA LISTED THREATENED SPECIES

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) ('the *EPBC Act*') aims to protect matters of national environmental significance. Under the *EPBC Act*, the Commonwealth Department of Environment, Water, Heritage and the Arts ('DEWHA') lists threatened species and Threatened Ecological Communities (TECs) in certain categories determined by criteria set out in the Act (www.environment.gov.au/epbc/index.html). Under the *EPBC Act*, there are three listed threatened species which have been identified as present at the Airport. These include:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*)
- Grand Spider Orchid (*Caladenia huegelii*); and
- Glossy Leaved Hammer Orchid (*Drakaea elastica*)

The potential impact of the Master Plan 2009 on these three species has been discussed both in the Referral document and in other sections of this report.

The following sections describe state legislation and any species which are identified as threatened under this state legislation. We note, however, that these species are not a focus of the *EPBC Act* and that the actions taken to protect the above federally listed species will have a positive impact regarding the conservation of other species and communities.

7.1 FAUNA

Fauna species can be classified as conservation significant on an international, commonwealth, state, or local level, in accordance with the EPA Guidance Statement No. 56 (EPA 2004). Under each level, the conservation status of fauna is determined by a number of different Acts and Agreements.

7.1.1 Commonwealth Level

At the Commonwealth level, as has already been discussed above, there is the *EPBC Act*.

7.1.2 State Level

- *Wildlife Conservation (WC) Act* (1950): The Minister for the Environment produces a notice where fauna taxa are listed as protected and are classified as Schedule 1 through to Schedule 4 according to their relative need for protection.

- DEC Priority species: The DEC produces a list of Priority species that have not been assigned statutory protection under the *WC Act*. Priority Fauna are under consideration as ‘Scheduled’ fauna, but are in urgent need of further survey or require regular monitoring, and although not currently threatened may become so in the future.

Under the *WC Act*, there is one listed threatened fauna species which has been identified as present at the Airport: Carnaby’s Cockatoo (*Calyptorhynchus latirostris*).

There are no other species recorded at the Airport which are described as threatened under the *Wildlife Conservation Act*.

7.2 FLORA

7.2.1 *Wildlife Conservation Act 1950 (WA)*

The Western Australian DEC recommends flora taxa for listing under the provisions of the *Wildlife Conservation Act 1950 (WA)* (*‘WC Act’*) as protected according to its need for protection.

Flora species are given Declared Rare status when their populations are geographically restricted or are threatened by local processes. In addition, under the *WC Act*, by Notice in the Western Australian Government Gazette of 9 October 1987, all native flora (spermatophytes, pteridophytes, bryophytes and thallophytes) is protected throughout the State.

The Act makes it an offence to ‘take’ threatened species without an appropriate licence. There are financial penalties for contravening the Act.

7.2.2 *Environmental Protection Act 1986 (WA)*

Declared Rare Flora (DRF) and TECs are given special consideration in environmental impact assessment, and areas covered by TECs have special status as Environmentally Sensitive Areas (ESAs) under the *Environmental Protection Act 1986 (EP Act)* and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

The protection of DRF and TECs is a ‘clearing principle’ for assessing applications for permits to clear native vegetation, where exemptions for a clearing permit under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply. There are substantial penalties (financial and/or imprisonment) for unlawfully damaging ESAs.

7.2.3 DEC Priority Lists

The DEC lists 'Priority' flora species that have not been assigned statutory protection under the *WC Act*, but which are under consideration for declaration as 'Rare Flora' under the Act. Species assessed as Priorities 1-3 are in urgent need of further survey, whilst Priority 4 species require monitoring every 5-10 years.

Considering the above information and the data collected during surveys conducted by Mattiske Consulting Pty Ltd 2001, 2006, DEC surveys 2002/3, 2004 and 2005; and Cardno BSD 2005, two species of flora scheduled under the *WC Act* or the *EPBC Act* were recorded on site. These are:

- Grand Spider Orchid (*Caladenia huegelii*); and
- Glossy Leaved Hammer Orchid (*Drakaea elastica*)

7.3 SUMMARY

In summary, there are three species which are listed as threatened under WA state legislation. These are:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*)
- Grand Spider Orchid (*Caladenia huegelii*); and
- Glossy Leaved Hammer Orchid (*Drakaea elastica*)

As all three species are also listed as threatened under the *EPBC Act*, there are no additional threatened species present on the Airport site which are not already discussed in other sections of this report and the Referral.

8 POTENTIAL IMPACTS ON THE JANDAKOT GROUNDWATER MOUND

The potential impacts of concern associated with development proposals on the Jandakot Groundwater Mound are related to groundwater quality, as this groundwater is used for drinking water. The Jandakot Groundwater Mound provides approximately 2.8% of Perth's drinking water.

At a state level, the areas requiring protection are identified through the declaration of Public Drinking Water Source Areas (PDWSA) for general protection, and Wellhead Protection Zones (WHPZ) for more stringent protection around drinking water bores.

8.1 WELLHEAD PROTECTION ZONES

The only WHPZ areas which are in proximity to the Airport are located in Precincts 7 and 8, which are not on the Airport site and are proposed for conservation and rehabilitation. No development will occur in these Precincts and the activities in this area will be limited to rehabilitation works. The rehabilitation of Precincts 7 and 8 is unlikely to impact upon the Jandakot PDWSA; in fact, it should enhance it.

8.2 PUBLIC DRINKING WATER SOURCE AREAS

The precincts located in the Jandakot PDWSA are Precinct 2, a small portion of Precinct 3, Precincts 5, 6 and 6A. Apart from Precincts 3 and 5, all these precincts are currently proposed for conservation under the Master Plan 2009 (refer to Figure 10).

8.2.1 Precinct 3

The portions of Precinct 3 which fall within the Jandakot PDWSA are proposed to be cleared to make space for the fourth runway and associated runway extensions. No development will take place on these areas and so the portion of Precinct 3 which falls within the Jandakot PDWSA is unlikely to have an environmental impact on the Jandakot Groundwater Mound.

8.2.2 Precinct 5

Modelling by CyMod (2009, Refer to Appendix E) demonstrates that groundwater underlying parts of the Precinct 5 development is likely to be captured by at least 3 drinking water bores. The report also indicated that it would take approximately 10 years to flow from Precinct 5 to the production bores. Precinct 5 is proposed as a 'green warehousing' precinct. This precinct will be sewered, and bulk

storage of chemicals and pesticides will not be allowed within the precinct (VDM, 2008). The text below refers to activities that may take place in Precinct 5.

The development of Precinct 5 will comply with the Metropolitan Water Supply, Sewerage and Drainage By-laws (1981), which provide the state level guidance for activities allowed in the PDWSA. The development response to the by-laws is given in Table 8 (VDM, 2008).

As identified by the by-laws, activities in Precinct 5 that could impact upon water quality are:

- Chemical (including pesticides and petroleum) storage, processing and manufacture;
- Wastewater disposal;
- Discharge of chemicals or polluted water;
- Trades deemed offensive under the *Health Act 1911*; and
- Automotive businesses.

Automotive businesses, offensive trades and bulk storage and manufacturing of chemicals will not be allowed on the site. All premises will be sewered, so wastewater will not be disposed of on the site. The potential impacts are therefore limited to the discharge of polluted water to the mound.

Potential sources of polluted water are:

- Rainwater from roofs;
- Stormwater and fire water from hardstand areas; and
- Stormwater from road areas.

Within Jandakot Airport there are no natural drainage channels or defined areas of surface water because of the depth to groundwater and high infiltration capacity of the sandy soils of the site. Such conditions are common on the Swan Coastal Plain. The only potential pathway for pollutants is therefore infiltration of water directly into the ground.

8.3 MODELLING OF POTENTIAL IMPACTS

Precinct 5 is proposed to be a green warehouse precinct, as described in Section 8, with no bulk chemical storage. Small quantities of pesticides and cleaning chemicals will be present on the site for maintenance requirements. Vehicles will access the site and present the risk of fuel leaks or spills. There will be

landscaping areas within the Precinct which are likely to be fertilized. Consequently, a Local Scale Groundwater Solute Transport Model of Jandakot Airport (CyMod, 2009, Appendix F) was undertaken to investigate the potential impact of a spill of any of these chemicals in Precinct 5. The report includes modelling of three types of chemicals, namely organochlorides (pesticides), petrochemicals (fuels and oils) and nitrates (fertilisers and cleaning products).

The modelling study is conservative in assuming that any spill will directly impact groundwater. This is because the mitigation measures JAH will implement to prevent any spill from reaching groundwater and the effect of dispersion and assimilation in the aquifer have not been taken into account.

Modelling was undertaken based on the maximum known abstraction for the three Water Corporation production bores nearest the Airport. The maximum total monthly abstraction from these bores varies from approximately 25,000 to 160,000 kL per month. This is greater than the Water Corporation's proposed future abstraction from these bores, which varies from approximately 15,000 to 95,000 kL per month.

Both a long term contamination, low concentration release and a single accidental release were simulated to determine the maximum quantity of contaminants reaching groundwater in Precinct 5 which would not exceed the Australian Drinking Water Guidelines levels for that pollutant at any of the Water Corporation abstraction bores during a period of 20 years following the contamination. The maximum quantity discharged to groundwater which will not exceed the Australian Drinking Water Guidelines levels for that chemical at any of the Water Corporation production bores is summarised in the Table 7 below. (CyMod, 2009).

Table 7: Maximum chemical quantity discharged to groundwater

Type of Chemical	Long Term Contamination	Single Accidental Release
Organochlorides	106 kg	85 kg
Petrochemicals	8 kg	6 kg
Nitrates	128 T	103 T

It is concluded that it is highly unlikely that the quantities of contaminants described in the above table will be discharged to the groundwater given the proposed development for the area and the land management that is to be employed to prevent discharges. Actions to be taken to prevent discharges of such scale are described below in Table 8. In addition the modelling does not take into account degradation processes that would result in the breakdown of

the chemical compounds described. Consequently it is considered that the modelling indicates that the development would not impact on the groundwater of the Jandakot Mound.

Table 8: Relevant Bylaws for Proposed Development (*Metropolitan Water Supply, Sewerage and Drainage By-laws 1981*) (Source: VDM)

Metropolitan Water Supply, Sewerage and Drainage By-Laws 1981		Relevance to the Proposed Development
5.4.1	In a pollution area the use, storage and transport of pesticides, the disposal of pesticide containers and the disposal of spilled pesticides shall be in compliance with the provisions of the Health (Pesticides) Regulations 1956 as amended from time to time	JAH do not propose to store or dispose of pesticides in the proposed development area.
5.4.5	In a pollution area installation or operation of septic tanks, leach drains, soak wells and other apparatus for the disposal of domestic waste waters shall be carried out in conformity with the Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 as amended from time to time and where the site is within 100m of a production well a person shall obtain prior consent for the installation or operation from the Commission which may impose further conditions and restrictions as to the siting, construction or operation of the apparatus, in which event the Commission shall meet any consequential extra cost incurred in the initial construction of the apparatus.	The development will be connected to deep sewerage, and hence no impact on the JUWPCA will occur. The installation of reticulated sewerage which does not currently exist at the airport, will reduce the impact on the JUWPCA.
5.4.6	In a pollution area or a part of a pollution area a person shall not dispose of or discharge onto or into the ground, or into any lake, swamp or drain industrial wastes, chemicals, radioactive material, petroleum or petroleum products, polluted water, or refuse unless that person has been granted permission in writing by the Commission to do so.	The proposed design would discharge "unpolluted water" only to the ground, and treat all other surface runoff water before discharging it to the ground.
5.5.1	A person shall not establish an offensive trade in accordance with the provisions of the <i>Health Act 1911</i> , in a pollution area, unless they have obtained the consent of the Board to do so, and unless they comply with any conditions which the Board may impose in relation to the establishment of that offensive trade.	<p>The proposed development will be warehouse services and offices. We propose to obtain approval with conditions from the board. These conditions being:</p> <ul style="list-style-type: none"> • Stormwater runoff from hardstand areas through biofiltration swales. • Road runoff through biofiltration swales. • Roof runoff through biofiltration swales • Roof runoff direct to groundwater or to rainwater tank • Internal areas to be collected, tested and disposed of accordingly (i.e. to sewer) • Design guidelines to ensure best management practice is incorporated into the design.

		<ul style="list-style-type: none"> • Construction Environmental Management Plan to manage impacts on the JUWPCA during construction. • Street sweeping during operation • Environmental Management Plan to be updated with emergency response and contingency planning in case of spills within the JUWPCA. • Limit tenants operations through design guidelines by identifying no bulk chemical or no chemical storage operations be allowed within the JUWPCA.
5.5.2	<p>The establishment or operation of any premises for the storage, packaging, formulating, processing, manufacturing, sale, testing or use of chemicals or other substances liable to pollute underground water in a pollution area shall be subject to the following terms, provisions and conditions -</p> <p>(a) applications shall be made to the Commission in writing for a permit to operate existing or proposed premises and the application shall set out -</p> <p>(i) The process or processes of manufacture, packaging, storage, formulating, testing, or use of all raw materials and fuels, intermediate products and final products including waste material and effluents whether gaseous, liquid or solid.</p> <p>(ii) The quantities of raw materials, and fuels used and the intermediate and final products, waste materials, effluents, being or proposed to be produced.</p>	<p>Offices and warehousing is proposed within the development area. No bulk chemical or chemical storage operations are allowed within the development area.</p> <p>No effluent will be discharged to the JUWPCA. Stormwater values will be defined as part of the Water Management Strategy (WMS). No chemicals or wash down/storm water from storage areas will be discharged to JUWPCA.</p>

	(iii) The methods proposed to treat and dispose of any wastes, by-products and effluents; including stormwater and washdown water where this may be or could become polluted.	Biofiltration swales will be utilized to manage storm water from roads and hardstand areas. Roof runoff will be returned to the groundwater mound. Sewer will be connected to the Water Corporation's reticulated sewerage system. Internal drainage, including waste fire water, will be collected and disposed to the sewer reticulation system or offsite.
	(iv) Plans and procedures proposed to prevent pollution of underground water, including emergency plans and procedures for contingencies such as accidental spillage or malfunction of any manufacturing, storage, transport or treatment process or system, both on and off the premises where this is applicable.	Emergency management plans and procedures will be provided as part of the Environmental Management Plan for the JAH Management area. The emergency procedures manual will include: Operational checklists for spills and incidents Emergency contact information, key contractors, government departments Requirements for regular inspection and reporting Installation and monitoring of bores within the Precinct. Clean up criteria (soil removal methods, water testing methods) Post spill sampling program
	(v) Such other information required by the Commission to assess the pollution risk to underground water and to assist with measures to prevent pollution.	A detailed Water Management Strategy for the Master Plan 2009 has been drafted. It is the aim of this document to provide detail on the water management and environmental impacts throughout the development.
5.5.4	Any person handling petroleum and other flammable liquids in a pollution area shall store and handle those liquids in accordance with the <i>Flammable Liquids Regulations 1967</i> , as amended from time to time and in addition shall comply with the following requirements -	
	(a) Underground tanks for the storage of petroleum products shall not be installed within 100 m of a production well.	No underground petroleum or flammable liquid tanks.

	(b) All underground tanks for the storage of petroleum products shall be installed in impervious containment structures or membranes approved by the Commission capable of preventing any leakage from the storage tank to the ground or ground water.	Refer (a)
	(c) Any bunds or compounds on any premises licensed under the Flammable Liquids Regulations 1967, as amended from time to time, shall be constructed so that the walls and floor of the bund or compound are of impervious material to the approval of the Commission.	All bunds and compounds are to meet Flammable Liquids Regulations 1967
	(d) Where a person intends to store flammable liquids in a pollution area, they shall apply to the Commission for its prior approval, setting out the location of proposed structures, buildings and tanks and shall abide by any conditions which the commission may impose.	No flammable liquids are to be stored within the proposed development area.
5.6.2	Regardless of any other provision of these by-laws, a person shall not establish within a priority 1 or a priority 2 source protection area -	None of these items are proposed as part of the proposed development area.
	(a) a ground storage tank system;	
	(b) any automotive business premises; or	
	(c) An elevated storage tank system inside a wellhead protection zone.	

9 IMPACTS FROM ROADS AND FENCES ON CONNECTIVITY IN CONSERVATION AREAS WITHIN JANDAKOT AIRPORT AND WITH SURROUNDING AREAS

A key issue is the protection and management of natural areas that are important for maintaining connectivity at the regional and local scale. This helps to ensure viability of retained and protected areas and the continued survival of connectivity-sensitive species within these areas. It allows living organisms to move freely along environmental gradients in response to various threats, such as wildfire.

The objective of ecological linkage is to connect natural areas, preferably with continuous corridors of native vegetation, in ways that allow fauna and flora (for example pollen and seeds) to move between these areas to access food resources and suitable habitat for survival and reproduction.

Regional Open Space and remnant bushland provide potential connectivity, but obstructions to the dispersal of biota must be limited. This can be achieved by fences being minimised or removed, roads and footpaths being narrowed and traffic being “calmed” where wildlife is known to cross roads, and underpasses will be installed where fences and roads prevent biota from dispersing along important corridors.

9.1 PRECINCTS 1A AND 1B

Precincts 1A, 1B and Ken Hurst Park are adjacent to one another and already have a level of connectivity. These areas are separated from one another by fencing and fire breaks, with fencing providing some barrier to fauna movement. Fencing between Precinct 1A, 1B and Ken Hurst Park will be removed. The outer borders of Precincts 1A and 1B will be fenced to prevent unauthorised access. Precincts 1A and 1B will be fenced with security fencing with fauna underpasses on East Link when it is built. Firebreaks will continue to be necessary and will be determined through fire management planning for the airport.

9.2 KEN HURST PARK

The current fence type used for Ken Hurst Park perimeter is typically 1.25 m – 1.5 m and is mostly of a star picket type with lower netting (large enough for a bandicoot). Jandakot Airport Holdings does not propose fencing Ken Hurst Park but if so it would pursue a suitable fencing design consistent with that used in Jandakot Regional Park.

The border of Ken Hurst Park adjacent to Roe Highway is fenced with a security fence, which consists of 1.8 m high cyclone fencing. It is not proposed to alter this fencing.

9.3 EAST LINK

To facilitate access to the new commercial areas from the north east, a new access road (East Link) is proposed through Precinct 1B and Precinct 1A. This will consist of a dual carriage way approximately 10 m wide for an estimated length of 375 m. The construction of the road will require clearing of 6 ha of vegetation and re-contouring including battering of some slopes.

East Link will be fenced on both sides to prevent fauna access to minimise the number of fauna road deaths. This fencing will also protect the conservation areas from unauthorised access.

Fauna underpasses will be constructed beneath East Link, to permit fauna to move between the northern and southern parts of Precinct 1B. This will therefore provide some eventual capacity for fauna to move between Precincts 7 and 8 through to Precinct 1A and Ken Hurst Park.

9.4 PRECINCTS 7 AND 8

Precincts 7 and 8 will be progressively fenced with security fencing as rehabilitation commences in each zone of the rehabilitation area. The rehabilitation area has been divided into five separate zones, which will be progressively rehabilitated over seven years. Fencing of these precincts will only include those areas which have been or are currently being rehabilitated.

9.5 APPROPRIATE FENCING FOR WILDLIFE

Fencing can have negative impacts on wildlife and is a major cost. There are many types of fences, which vary in materials and design, according to the required purpose of fencing.

The types of fences in current use and proposed will allow for the movement of smaller mammals on site such as the Quenda, however, security fencing will have an impact on the movements of the larger mammals such as the Western Brush Tail Wallaby and the Western Grey Kangaroo. Opportunities to facilitate movement between the southern portion of Precinct 1B and Precincts 7 and 8 will be investigated following completion of rehabilitation activities, as movement between the northern section of Precinct 1B, and Precinct 1A and Ken Hurst Park is desirable.

PROPOSED MITIGATION MEASURES

10 A CONSOLIDATED LIST OF MITIGATION MEASURES TO BE UNDERTAKEN TO PREVENT, MINIMISE OR COMPENSATE FOR THE RELEVANT IMPACTS ON LISTED THREATENED SPECIES

For the purpose of this report, mitigation measures are considered to be the range of actions that can be undertaken to reduce the level of impacts of a development (typically undertaken on-site) (DEWHA, 2007). Offsets are considered to be actions taken outside a development site that compensate for the impacts of development - including direct, indirect or consequential impacts (DEWHA, 2007). The rehabilitation of Precincts 7 and 8 and support of the Botanical Gardens and Parks Authority are considered offsets and are not considered here.

JAH will undertake the following mitigation measures:

- Retention of Precinct 1A;
- Retention of Precinct 1B;
- Retention of Precinct 2;
- Retention of Precinct 6;
- Clearing Management;
- Landscaping;
- Preparation of a Conservation Area Management Plan;
- Translocation of orchids; and
- Rare Orchid Research Program with Botanic Gardens and Parks Authority.

These are explained in further detail in the sections below.

10.1 RETENTION OF PRECINCT 1A

The retention of Precinct 1A (32 ha previously approved for development) will conserve 164 known Grand Spider Orchids (*Caladenia huegelii*) and habitat suitable for Carnaby's Cockatoo.

10.2 RETENTION OF PRECINCT 1B

Precinct 1B will be retained as a conservation area, which will conserve 20 known Grand Spider Orchids and habitat suitable for Carnaby's Cockatoo.

10.3 RETENTION OF PRECINCT 2

Precinct 2 will be retained as a conservation area which will conserve one known Grand Spider Orchid and habitat suitable for Carnaby's Cockatoo.

10.4 RETENTION OF PRECINCT 6

Precinct 6 will be retained as a conservation area which will conserve habitat for Carnaby's Cockatoo.

10.5 CLEARING MANAGEMENT

All clearing at the Airport must be conducted in accordance with a Clearing Environmental Management Plan. This Plan includes protocols to minimise the direct impact of clearing on fauna species.

Any direct impacts on Carnaby's Cockatoos will be minimised by the timing and staging of the clearing. Clearing will be timed to avoid the times that cockatoos are likely to be present on the site. Cockatoos are most likely to be on the site during the non-breeding season (Johnson 2003). In spring, which is their breeding season, adult cockatoos leave the coastal plain feeding areas and return to nesting habitat, generally in the Wheatbelt. Consequently clearing of bushland would need to be done in spring, to correspond with the cockatoo breeding season.

Clearing will be staged in line with the Rehabilitation Plan to reduce the impact on habitat. In addition, plants, mulch and topsoil from cleared areas will be retained to assist in rehabilitation of Precincts 7 and 8.

10.6 LANDSCAPING

All landscaping at the Airport must be undertaken in accordance with JAH's Landscape Design Guidelines (Refer to Appendix G). This includes a list of acceptable species, all of which are Australian native species. A number of these are species which Carnaby's Cockatoo is known to feed on (Birds Australia, 2005, 2008). These include:

- *Banksia attenuata*;
- *Grevillea* sp.;
- *Eucalyptus marginata*;
- *Eucalyptus tottiana*;
- *Corymbia calophylla*; and

- *Callistemon* sp.

Whilst the majority of landscaping will be undertaken by tenants at the Airport, some will be undertaken by JAH. An example of the landscaping undertaken by JAH includes the landscaping along Marriot Road.

10.7 PREPARATION OF A CONSERVATION AREA MANAGEMENT PLAN

JAH will prepare a Conservation Area Management Plan in consultation with key stakeholders to provide ongoing protection and management of Conservation Precincts 1A, 1B, 2, 6, the rehabilitated Precincts 7 and 8 and Ken Hurst Park. This Plan will also address any potential impacts and measures associated with the alignment of East Link.

10.8 TRANSLOCATION OF ORCHIDS

A total of 40 Grand Spider Orchids, which are presently located in Precincts 3, 4 and 5, and up to 4 Glossy Leaved Hammer Orchids (Refer to Sections 3.3 and 4.2.1), will be translocated with the assistance of the Botanic Gardens and Parks Authority (BGPA) into Precinct 1A. These will be monitored annually, through follow up spring surveys, in conjunction with the Research Program outlined in Section 10.9.

10.9 RARE ORCHID RESEARCH PROGRAM WITH BOTANIC GARDENS AND PARKS AUTHORITY

Botanic Gardens and Parks Authority (BGPA) has an internationally renowned orchid research and conservation program. The research team has expertise in propagation, translocation and ex situ (off-site) storage of seed and associated mycorrhizal fungi. This research programme is focused on establishing a sound research basis for understanding biological and ecological factors that influence the rarity and conservation of native Western Australian orchids.

It is intended that a research and management program for *Caladenia huegelii* will be undertaken by Botanic Gardens and Parks Authority (BGPA) researchers through funding and on site assistance and management activities by JAH. The specific aim of this research will be to ensure the longevity and increase the numbers of *Caladenia huegelii*. This approach will not only assist in improving the research of *Caladenia huegelii*, but will also assist in our understanding of other threatened and endangered *Caladenia* species in Western Australia.

The research proposal by BGPA includes the following objectives (Refer to Appendix C):

1. Genetic fingerprints of targeted *C. huegelii* plants and indicative rare and threatened taxa (benchmarked as appropriate with common spider orchid taxa for comparative purposes).
2. Determination of key individuals or groups of plants considered genetically significant.
3. Optimisation of the propagation of orchids from seed through ex situ and in vitro methodologies.
4. Optimisation of the reintroduction and survival of orchid seedlings to field sites through scientific research and monitoring.
5. Ex situ conservation of genetically significant material (orchid seed and Mycorrhizal fungi), identified from molecular genetics work.
6. Development of conservation initiatives for *Caladenia* pollination agents: thynnid wasps and host plants
7. Development of a *Caladenia* phylogeny with an extension to *Arachnorchis* sub-genus and resolution of species complexes in problematic species.
8. Collection and maintenance of the rescued plant material will be undertaken in summer with plants to be maintained as a seed orchard for conservation production of seed for both reintroduction and long term seed banking.

The research package prepared in consultation with orchid specialists at BGPA covers gaps in research knowledge and aims to increase the number of Grand Spider Orchids on the site. It is deemed critical to the long term survival of the species.

11 MITIGATION MEASURES TO MAINTAIN CONNECTIVITY BETWEEN CONSERVATION AREAS WITHIN JANDAKOT AIRPORT AND WITH SURROUNDING AREAS, INCLUDING THROUGH THE USE OF FENCING

Precincts 1A, 1B and Ken Hurst Park are adjacent to one another with some barriers created by fencing and fire breaks.

11.1 PRECINCTS 1A, 1B AND KEN HURST PARK

Fencing between Precinct 1A, 1B and Ken Hurst Park will be removed. The outer borders of Precincts 1A and 1B will be fenced to prevent unauthorised access.

11.2 EAST LINK

East Link interrupts fauna movement, as it will be fenced on both sides to prevent unauthorised access and minimise the chance of fauna deaths.

Fauna underpasses will be constructed beneath East Link, to permit fauna to move between the northern and southern parts of Precinct 1B. This will therefore provide some capacity for fauna to move between Precincts 7 and 8, Precincts 1A and 1B and Ken Hurst Park.

11.3 PRECINCTS 7 AND 8

Precincts 7 and 8 will be progressively fenced as rehabilitation commences in each zone of the rehabilitation area. The rehabilitation area has been divided into five separate zones, which will be progressively rehabilitated over seven years. Fencing of these precincts will only include those areas which have been or are currently being rehabilitated until rehabilitation is complete and both Precincts are surrounded by fencing.

Opportunities to facilitate movement between the southern portion of Precinct 1B and Precincts 7 and 8 will be investigated following completion of rehabilitation activities.

12 MITIGATION MEASURES TO AVOID IMPACTS ON THE JANDAKOT GROUNDWATER MOUND

The Department of *Water's Decision Process for Stormwater Management in WA* (DoE and SRT, 2005) requires that development maintains pre-development hydrology off the site. In the pre-development situation, all rainfall would have infiltrated on site as is common on the sandy soils of the Swan Coastal Plain. Because of this, there are no natural water courses or drains in the area. Stormwater and rainwater that is not utilized for reuse through rainwater tanks will therefore be treated and infiltrated on site.

12.1 RAINWATER FROM ROOFS

Rainwater from roofs is generally very clean, apart from slightly elevated metal concentrations from metal roofs. Mitigation measures for rainwater from roofs will include:

- Rainwater from roofs will be captured in tanks for re-use if feasible; and
- Zinc and asbestos roofs will not be permitted in future development (VDM, 2008).

Soakwells will be used to infiltrate roof water that is not reused.

12.2 STORMWATER AND FIRE WATER FROM HARDSTAND AREAS

Stormwater and fire water from hardstand areas can be a potential source of hydrocarbons, metals and other pollutants. Mitigation measures to avoid impacts can include both structural and non-structural methods.

12.2.1 Structural Methods

Structural methods involve physical barriers to pollution. Structural methods to maintain stormwater and fire water quality for proposed hardstand areas at Jandakot include:

- Oil and grease separators to trap hydrocarbons in stormwater;
- Gross pollutant and sediment traps;
- Provision of bins for litter removal; and
- Bunded hardstand areas with sealed sumps that can contain large volumes of fire water. Fire water in sumps will be tested and/or treated prior to discharge either offsite or sewer (VDM, 2008).

12.2.2 Non-structural Methods

Non-structural methods are non-physical measures to prevent incidents occurring. Under their existing environmental management framework, JAH has a number of control measures in place in order to protect groundwater quality from the impact of airport operations. These include:

- Requirements for tenants to prepare Environmental Management Plans;
- Regular audits of tenant operations;
- Spill management campaigns;
- Spill management training;
- Groundwater monitoring; and
- Store safe education (Refer to Environment Strategy 2009).

All JAH vehicles will be maintained properly to reduce the risk of spills and ensuring that hardstand areas are regularly cleaned to prevent hydrocarbon build up (VDM, 2008).

12.3 SPILL MANAGEMENT

Spills can be a major source of contaminants. All staff and tenants at Jandakot Airport are required to comply with spill management procedures. Chemical spills are reported to JAH if they:

- Are greater than 2L
- or
- Come into contact with soil (Refer to Environment Strategy 2009).

Reported spills are initially investigated by the Environmental Manager. Following the initial investigation, the Environment Manager and the tenant determine appropriate control measures to reduce the risk of the spill recurring (Refer to Environment Strategy 2009). The tenant implements control measures and, if necessary, the site is remediated. Where the remediation required will be ongoing, the site will be subject to an Environmental Improvement Program, which documents the remediation process and monitoring requirements (Refer to Environment Strategy 2009).

12.4 STORMWATER FROM ROADS

Stormwater from roads will be managed through the use of bioretention swales along the road reserves to manage and treat stormwater (VDM, 2008). Low-lying areas will be utilized as overflow areas for large (100 year) storm events (VDM, 2008). Bioretention swale areas are designed to infiltrate stormwater, while removing sediments and nutrients.

12.5 MONITORING

Groundwater quality monitoring will occur for two years following development to ensure that the development maintains acceptable water quality with respect to nutrients, pH, electrical conductivity, suspended solids and dissolved oxygen (VDM, 2008). This will help assess compliance of local groundwater quality with drinking water criteria. Ongoing monitoring of perimeter bores will ensure early detection of any groundwater impact and therefore facilitate early remediation.

12.6 AQUIFER REMEDIATION

Should a spill occur, aquifer restoration by pumping can be used to prevent the movement of contaminants into a drinking water bore. CyMod (2009) suggests that localized releases of solute in Precinct 5 can be effectively remediated using aquifer restoration via recovery bores. In the case of a long term contamination release, it is less likely that successful remediation of the aquifer can be achieved using conventional recovery bores. Consequently, land use controls and control measures in Operational Environmental Management Plans for all tenants in Precinct 5 will ensure long term contamination does not occur (CyMod, 2009).

The Local Scale Groundwater Solute Transport Model of Jandakot Airport report modelled the following remediation options if a contaminant is detected in the monitoring bores. These options are:

- Using a 100 metre recovery bore spacing; in excess of 1000 m³/day of abstraction may be required to prevent solute concentrations exceeding drinking water standards at Water Corporation production bore J400 in the long term; and
- Using a 10 metre recovery bore spacing; less than 100 m³/day of abstraction may be required to prevent solute concentrations exceeding drinking water standards at J400 in the long term.

13 ASSESSMENT OF THE EXPECTED OR PREDICTED EFFECTIVENESS OF THE MITIGATION MEASURES AND OFFSETS AND ANY OUTSTANDING RISKS

13.1 ESTIMATED SUCCESS OF MITIGATION MEASURES FOR POTENTIAL IMPACTS ON THE JANDAKOT GROUNDWATER MOUND

Risk assessment with and without management measures for water pollution was undertaken by VDM as part of the Local Water Management Strategy (VDM, 2008).

13.1.1 Rainwater from Roofs

Rainwater from roofs is relatively uncontaminated and it is considered that the residual risk of contamination from these measures is low (VDM, 2008).

13.1.2 Stormwater and Firewater from Hardstand Areas

Stormwater from hardstand areas can contain hydrocarbons and other contaminants. With the utilization of the above management measures, the residual risk of contamination is considered to be low to moderate (VDM, 2008).

Fires are a rare occurrence, but leakage can have significant consequences. The residual risk of contamination after the above control measures are introduced is considered to be moderate (VDM, 2008).

13.1.3 Stormwater from Roads

Stormwater from roads can contain hydrocarbons and other contaminants. With the utilization of the above management measures, the residual risk of contamination is considered to be low to moderate (VDM, 2008).

13.1.4 Aquifer Remediation Following Spills

CyMod (2009) indicates that aquifer remediation following small spills of hydrocarbons, organochlorides or nitrates over areas up to 100 m² is likely to prevent contamination of bores.

13.2 ESTIMATED SUCCESS OF MITIGATION MEASURES AND OFFSETS FOR POTENTIAL IMPACTS ON THREATENED SPECIES

13.2.1 Orchids

Orchids relocated to Precinct 1A may not survive. Orchids will be transplanted with the assistance of orchid experts from Botanic Gardens and Parks Authority

(BGPA). According to DEC (2008), translocation of Grand Spider Orchids from Roe Highway Stage 7 to Ken Hurst Park in 2004, which was also undertaken with the assistance of BGPA, had a success rate of approximately 90%. Transplantation of Glossy Leaved Hammer Orchids has so far proved unsuccessful (DEC, 2008), however it is still uncertain whether Glossy Leaved Hammer Orchids will be impacted by the Master Plan 2009. Further targeted surveys are proposed to determine whether this species will be impacted, or whether it is no longer present on the Airport.

13.2.2 Carnaby's Cockatoo

The proposed development will involve staged clearing of 167 ha of native vegetation, which is identified as potential foraging habitat for endangered species Carnaby's Cockatoo, however the area of clearing is not considered significant in comparison with the vegetation remaining in the region such as the Jandakot Regional Park. Rehabilitation of Precincts 7 and 8 will, over time, offset the impact of clearing, as discussed in Section 4 of the Referral. This habitat creation will have a significant positive environmental impact.

All precautions will be taken to ensure that clearing is undertaken whilst cockatoos are breeding and not on the site. Cockatoos which are too young or too old to breed may still visit the site during the breeding season, however fauna management practices addressed in Clearing Environmental Management Plans and implemented during clearing will minimise the risk posed to any individual cockatoos present when clearing takes place.

The species list for landscaping includes known cockatoo food plants. The Cockatoos may choose not to use feeding habitat in landscaping areas due to proximity to buildings, humans or commercial operations, however there are many recorded cases of cockatoos feeding on garden plants in residential areas so this risk is considered unlikely.

13.2.3 Rehabilitation of Precincts 7 and 8

It is estimated that the rehabilitation of Precincts 7 and 8 will take 5 years from the initial planting of the site to be successful.

The rehabilitation of Precincts 7 and 8 could take longer to become established than planned through a number of environmental reasons. Should the rehabilitation be delayed due to environmental reasons, the monitoring undertaken by JAH will identify this and it will modify the rehabilitation plan and undertaking additional planting and direct seeding accordingly. This will most likely result in additional financial cost to JAH and more time taken for rehabilitated vegetation to become established and functional.

Precincts 7 and 8 will form a contiguous conservation area with Bush Forever Areas and conservation Precincts at the Airport, which is superior to the presently fragmented native vegetation in and around the Airport.

14 THE COST OF MITIGATION MEASURES AND OFFSETS

14.1 CONSERVATION AREAS

The setting aside of the conservation areas is a significant initiative designed to ensure the preservation of bushland while allowing the development of the Airport. The value of land retained in the conservation areas is significant. Retention of the conservation areas comes at a cost of 171 ha or 28% of Airport land, which will be 203 ha or 33% if runway extensions do not take place. These conservation lands represent a substantial lost opportunity from a development perspective and will significantly reduce the potential cash flow derived from leasing the land. In addition these areas will need to be actively managed in the long term to ensure conservation outcomes and this will come at significant cost.

14.2 RETENTION OF PRECINCT 1A

The retention of Precinct 1A comes at a cost of 32 ha of land which was previously approved under the Master Plan 2005 for development. JAH propose to exchange this land in Precinct 1A for the current conservation area in Precinct 5, which will be isolated from other conservation areas by the proposed southern link road.

Fencing of Precincts 1A and 1B has an estimated cost of \$250,000.

14.3 LANDSCAPING

Native landscaping along Marriot Road will cost approximately \$20,000.

14.4 RARE ORCHID RESEARCH PROGRAM WITH BOTANIC GARDENS AND PARKS AUTHORITY

The estimated cost of this research program is approximately \$700,000 over five years.

14.5 GLASSHOUSE UPGRADE

Upgrades to the BGPA glasshouse will cost approximately \$60,000.

14.6 REHABILITATION OF PRECINCTS 7 AND 8

The rehabilitation of Precincts 7 and 8 is predicted to cost in excess of \$9 million over seven years. This cost includes:

- Weed control;
- Surveys;
- Seed collection:
- Plant salvage and propagation;
- Fencing;
- Feral animal control;
- Irrigation and water supply;
- Bank guarantee to the City of Canning;
- Lease costs;
- Topsoil salvage and transport;
- JAH staff time; and
- Monitoring.

14.7 SUMMARY

All of the mitigation measures and offsets proposed by JAH will cost over \$10 million. The cost of various mitigation measures and offsets is summarised in Table 9.

Table 9: Cost of mitigation measures and offsets

Measure	Cost
Fencing for Precincts 1A and 1B	\$250,000
Landscaping along Marriot Road	\$20,000
BGPA orchid research and management programme	\$700,000
BGPA glass house upgrade	\$60,000
Rehabilitation of Precincts 7 and 8	\$6,032,000
JAH staff time involvement managing the rehabilitation	\$1,000,000
Legal costs of lease of Precincts 7 and 8	\$20,000
Water supply to Precincts 7 and 8	\$100,000
Additional Fencing of Precincts 7 and 8	\$130,000
Clearing, mulching, topsoil stripping of Precincts 4 and 5 and new road links	\$1,400,000
Topsoil transport to Precinct 7 and 8	\$500,000
Total	\$10,212,000

The setting aside of the conservation areas is a significant initiative designed to ensure the preservation of bushland while allowing the development of the Airport.

PROPOSED OFFSETS

15 POTENTIAL OFFSETS TO COMPENSATE FOR THE LOSS OF CARNABY'S COCKATOO HABITAT

JAH propose to rehabilitate the sand mine currently present in Precincts 7 and 8, on the eastern boundary of the Airport, which has a total area of 120 ha (Refer to Sections 4.1.5, 4.2.3 and 4.5.2). JAH has developed a Rehabilitation Plan to manage the rehabilitation of these precincts over the next 7 years (Refer to Appendix H)

This rehabilitation will be undertaken in conjunction with the staged clearing, to allow plant species, including mature trees, to be translocated directly to the rehabilitation area. Top soil and mulch will also be relocated from cleared areas to Precincts 7 and 8. This will be done in accordance with the Rehabilitation Plan.

Rehabilitation of these two precincts will create a contiguous vegetation corridor of over 650 ha linking the presently isolated and fragmented Ken Hurst Park, Bush Forever Site 388, the Airport conservation areas, the Acourt Road Bushland and Jandakot Regional Park. JAH proposes to manage Ken Hurst Park, the Airport conservation areas and the newly rehabilitated Precincts 7 and 8 under a single Conservation Area Management Plan, which aims to consolidate the management of all of these areas of native vegetation, with positive outcomes for both the Airport and the natural environment in Jandakot.

15.1 REHABILITATION OF PRECINCTS 7 AND 8

Precinct 7 (Lot 166) is currently owned by the Crown, reserved for the City of Canning and Precinct 8 (Lot 167) is owned by the City of Canning.

The areas currently form a buffer to the airport from surrounding urban development. JAH will undertake rehabilitation of these areas to complement the retention of Conservation Precinct 1B and create an ecological corridor of over 650 ha via the Acourt Road Bushland through to the Jandakot Regional Park to the south (Figure 11). Jandakot Regional Park is approximately 3,800 ha in size, extending from the Acourt Road Bushland to Casuarina Prison (approximately 34 kilometres south east of the Perth central business district). Rehabilitation of Precincts 7 and 8 by JAH will have significant environmental benefits in linking currently isolated areas of bushland with ongoing environmental management to ensure that the integrity and ecological values of the conservation bushland are retained.

Vegetative material in the form of salvaged tubers, seed, mulch and topsoil from cleared areas will be used in the rehabilitation of Precincts 7 and 8. The rehabilitation of Precincts 7 and 8 will take place in a staged approach, in accordance with the Rehabilitation Plan (Refer to Appendix H), over a period of 7 years.

Baseline surveys will be carried out on the remnant site vegetation and immediately connecting areas of similar landform prior to any on-ground works to address the following:

- Vegetation – species diversity, species cover, condition and health;
- Fauna – feral and natives;
- Presence of *Phytophthora cinnamomi* (Dieback);
- Extent of erosion;
- Level of disturbance;
- Presence of weeds; and
- Activity of feral animals.

Local provenance seed collection will occur in all JAH precincts. All seed collection will be undertaken by suitably licensed operators and statutory returns recording all seed collected will be submitted to DEC on a quarterly basis.

Plants will be salvaged from areas to be cleared at the Airport and areas within Precincts 7 and 8 which will be disturbed by earthworks. Plants to be salvaged include small, understory plant species and larger, slow growing iconic species such as *Xanthorrhoea preissii*, (Grass tree) *Macrozamia reidleyi* (Zamia) and *Nuytsia floribunda* (Western Australian Christmas Tree). Salvaged plants will be transplanted into pots, and stored in the Jandakot Airport nursery and managed until planted out.

Plant propagation will be undertaken in nurseries certified as accredited under the Nursery Industry Accreditation Scheme Australia (NIASA) guidelines. Upper storey Banksia Woodland species (*Banksia*, *Allocasuarina* and *Eucalyptus* spp.) will be propagated in nurseries, with the majority of understorey species to be derived from direct seeding, natural regeneration and salvaged plant return.

The surface of the rehabilitation area will be re-contoured as required with topsoil and mulch from cleared areas at the Airport. Where re-contouring will require clearing of vegetation, clearing permits will be obtained from the WA Department of Environment and Conservation.

Rehabilitation areas will be progressively fenced and subject to weed management spraying. Rabbit baiting will be undertaken in the rehabilitation area.

After initial plantings, rehabilitation areas will be irrigated until plants are well established. Each rehabilitation zone will be irrigated for two years.

Rehabilitated areas will be monitored biannually against agreed bushland regeneration success criteria, as specified in the Rehabilitation Plan (Refer to Appendix H)

Presently, Precincts 7 and 8 are used as a sand mine. With the implementation of the Master Plan 2009, the rehabilitation of Precincts 7 and 8 will form a consolidated north-south ecological corridor of over 650 ha between Ken Hurst Park and Jandakot Regional Park (Figure 11). This corridor does not currently exist and its establishment is important to the ecological functioning of the area. Currently, the conservation area at Jandakot Airport is 253 ha (Precincts 1B, 2, 5, 6 and the vegetation at the end of runways in Precinct 3) and fragmented.

JAH proposes to manage 322 ha of this continuous conservation area, including Ken Hurst Park, the Jandakot Airport conservation area and Precincts 7 and 8, under a single Conservation Area Management Plan (Refer to Section 10.7).

Eventually, based on the successful accomplishment of rehabilitation criteria, Precincts 7 & 8 could potentially become part of the Jandakot Regional Park and be included within the Park's management framework.

15.2 GLASSHOUSE UPGRADE

In conjunction with the rare orchid research described in Section 4.1.5, JAH will fund an upgrade to a BGPA glasshouse to assist with this research.

16 EXPECTED SUCCESS OF VEGETATION REHABILITATION IN THE PROPOSED OFFSET AREAS, INCLUDING ESTIMATES OF TIME TAKEN FOR REHABILITATED VEGETATION TO BECOME ESTABLISHED AND FUNCTIONAL

The success criteria for the rehabilitation of Precincts 7 and 8 are related to the following factors (NAM, 2009):

- Plant species diversity;
- Native vegetation cover;
- Native vegetation condition;
- Native vegetation health;
- Dieback (*Phytophthora cinnamomi*) control
- Native fauna;
- Feral animal control;
- Stakeholder and community participation;
- Disturbance control; and
- Weed control.

For full details of the success criteria, refer to the Rehabilitation Plan in Appendix H.

There are five zones of rehabilitation within Precincts 7 and 8, to be rehabilitated consecutively. Zone 1 will therefore commence first with respread topsoil and material from clearing at Jandakot Airport.

Planting in Zone 1 will commence in 2010 and direct seeding will commence in 2011. Based on estimates that the rehabilitation vegetation should be viable within 5 years of planting, the first section of Precincts 7 and 8 to be rehabilitated is estimated to be established in 2016. If all planting is complete by 2015, the entire rehabilitation area is estimated to be established by 2020.

The Rehabilitation Plan indicates a time period of seven years from commencement to when rehabilitation efforts are complete. At this point, the rehabilitation should meet the assigned success criteria, which are outlined above, and the rehabilitation should be considered established in that it will then

essentially transition to a natural area with decreasing levels of management intervention.

Different aspects of functionality will depend largely on the maturation rates of individual species within the rehabilitation area. Functionality in terms of soil stability and basic habitat will commence following initial topsoil spreading, planting and seeding efforts.

In recent trials, there has been increased interest in direct transferral of topsoil and vegetation components of cleared areas to rehabilitation sites. The availability of fresh topsoil has been shown to be an important factor in the success of rehabilitation efforts. As has already been discussed, JAH will coordinate clearing with rehabilitation, to ensure that fresh topsoil is available for rehabilitation areas as required.

It is considered that the sequencing of topsoil respreading, planting, seeding, weed control, irrigation, feral animal control and regular monitoring provides a high level of confidence that the rehabilitation will be successful.

17 PROGRESS OF NEGOTIATIONS WITH RELEVANT PARTIES TO ACQUIRE PROPOSED OFFSETS

The City of Canning has conditionally agreed to JAH rehabilitating Precincts 7 and 8. This was resolved at their Council meeting on 26 May 2009 and amended at their Council meeting of 9 June 2009 (Refer to Appendix I). The conditions imposed are as follows:

- the Council's approval of detailed management, maintenance and implementation plans prepared by Jandakot Airport and including details of standard and methodology of revegetation, fencing of the rehabilitation area, construction of walk trails, protection of remnant bushland, bush fire risk management measures and retention of landforms which may assist in noise attenuation;
- recontouring and grassing of the eastern edge of Lot 166 (outside the groundwater protection zone) to the Council's satisfaction and having regard to the protection of remnant vegetation and landform features which may offer noise attenuation benefits;
- leasing and access arrangements to the Council's satisfaction, to a maximum of ten years at \$100 per annum and including provisions to ensure maintenance, management, implementation and completion occurs to an agreed standard and timeframe to supplement requirements stipulated by the Federal Department of Environment;
- establishment and ongoing management of a representative committee, to the satisfaction of Council, involving organisations such as the Department of Environment and Conservation, local community representatives and Kings Park and Botanic Gardens with the objective of working with the City and the Airport in implementing the agreed management plan;
- overriding principles and commitments with respect to the rehabilitation proposal to Council's Satisfaction, being outlined in a Memorandum of Understanding between Council and Jandakot Airport;
- All works associated with the planning, implementation and completion of the rehabilitation proposal including preparation of plans, statutory approvals, legal cost, cost of materials and costs to carry out the works being met by Jandakot Airport;
- Approval is in no way to be construed as tacit approval or in principle agreement to construction of any access roads (now or in the future) on land owned by the City of Canning which abuts Jandakot AA Lots 166 and 167;

- Perimeter fencing of Lots 166 and 167 together with recontouring and grassing of the eastern edge of Lot 166 and 167 (with recontouring having regard to the protection of remnant vegetation and landform features which may offer noise attenuation benefits), is to be completed to the Council's satisfaction as part of the first stage of the revegetation project;
- Prior to commencement of the revegetation project, Jandakot Airport Holdings are to provide a bank guarantee to an amount of \$300,000 in favour of the City of Canning as security against the completion of the rehabilitation project. The bank guarantee is to be held until the Council deems the project is complete, in accordance with the approved management, maintenance and implementation plans.
- Staging arrangements of the rehabilitation project, the corresponding relationship to clearing of land on the Airport site and the associated conditions of approval issues by the Federal Environment Department stipulating the vegetation of Lots 166 and 167 are to be acknowledged and incorporated into the required management, maintenance and implementation plans, the leasing arrangements and the Memorandum of Understanding to the satisfaction of the Council.

18 ALTERNATIVE OPTIONS FOR OFFSETS IF NEGOTIATIONS TO ACQUIRE PROPOSED OFFSETS ARE UNSUCCESSFUL

Negotiations have been successful with the City of Canning, so it is considered that alternative options are not necessary (Refer to Appendix I).

19 REFERENCES

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