9.0 TERRESTRIAL ECOLOGY AND NATURE CONSERVATION

9.1 INTRODUCTION

St Helena is noted for its unique range of landscapes and habitats and for its endemic flora and fauna (i.e. those species that are found nowhere else in the world). The loss of a number of unusual and endemic species to past woodland clearance and the effects of introduced domestic and wild species has been well documented and repeats a typical account of such impacts on many small oceanic islands. Ecological issues are therefore of particular importance to the island currently and in relation to future development. This chapter of the Environmental Statement considers the main implications of high significance relating to the proposed construction of the airport on Prosperous Bay Plain (PBP) and supporting infrastructure and the possible effects of the airport operation on the ecological and nature conservation resources of the island. Measures are identified for reducing the extent of adverse effects and incorporating appropriate mitigation or compensation measures. A detailed impact assessment is provided in Appendix 9.1, Volume 4 of this ES. Supporting information, including the findings of baseline surveys is also included in Appendices 9.2 to 9.5 in Volume 4. The effects of the proposed wharf in Rupert's Bay are assessed in the Marine Environment, Chapter 14, Volume 2 of the ES.

9.2 METHODS

The ecological study commenced with a review of existing documented information on the ecology of St Helena and in particular of the Eastern Arid Area in which PBP is situated. Of particular relevance is the work undertaken by Ashmole & Ashmole (2000) and their specific studies on the invertebrates of PBP (2004) in respect of a previous proposal for an airfield. Work by Cronk (2000) provides a grounding in the vegetation of St Helena with particular reference to endemic species while the studies of McCulloch (1992) provides a baseline of information on the Wirebird, St Helena's only remaining endemic bird.

Dedicated field work for the current proposal commenced in October 2005 during which extensive and locally detailed surveys were completed and an extensive programme of consultation and data collection undertaken. Key surveys undertaken at this stage are indicated in Table 9.1 below with further details available in Appendices 9.2 to 9.5, Volume 4 and also Chapter 14 of Volume 2 of the ES which covers the Marine Environment.

Table 9.1 Preliminary Surveys

Survey	Methodology	Location	Key Outputs
Vegetation and Habitats (see appendix 9.2 in Volume 4 of this ES)	Walkover survey by appropriate specialists	Prosperous Bay Plain (airport site)	Habitat descriptions, vegetation community map, location of some key rare endemic species
		Haul roads to Prosperous Bay	Habitat descriptions, identification of constraints e.g. locations of endemic species
		Haul/access roads to Rupert's Bay	
Wirebird distribution (see Appendix 9.4 in Volume 4 of this ES)	Census by McCulloch (2005)	Island-wide	National population census, breeding-bird distribution along access routes and at PBP
Inshore marine survey, habitats and species (see Appendix 14.1, 14.2 & 14.3)	Snorkel survey by appropriate specialists	Prosperous Bay and Rupert's Bay	Comparative ecological assessment of two wharf options considered Rupert's bay to be the preferred option on ecological criteria

Where the results of this work identified the need for more detailed investigation in order to inform the environmental assessment and the preliminary design for the airport and its supporting infrastructure, additional studies were undertaken as described in Table 9.2.

Table 9.2 Additional Studies

Survey/study	Methodology	Location	Key Outputs
Lichens (see Appendix 9.3 in Volume 4 of this ES)	Walkover survey by specialist	PBP, haul/access roads from Rupert's Bay, ROLs and navigation aids, quarry in Rupert's Valley,	Species and community descriptions in an island-wide & south-Atlantic context
Wirebird distribution	Breeding bird census (RSPB)	PBP, haul/access roads from Rupert's Bay to PBP	Breeding bird distributions in areas of land-take and disturbance from the airport project
Vegetation & Habitats (see Appendix 9.2 in Volume 4 of this ES)	Walkover survey by botanical specialist	ROLs and navigation aids, water abstraction points, water pipeline route, haul/access roads to inform the development of the reference design	Habitat descriptions, identification of constraints, formulation of mitigation designs
Wind modelling (see Appendix 9.5 in Volume 4 of this ES)	Computational model	PBP and its Central Basin	Report investigating wind effects following land lowering and levelling for runway construction
Marine Survey (see Chapter 14, Volume 2 and Appendix 14.1, 14.2 & 14.3 in Volume 4 of this ES)	Habitats and target species using SCUBA	Rupert's Bay	Report examining ecological impact of wharf construction

The results of the above studies continued to contribute to the evolving reference design for the airport and its supporting infrastructure. Further details of this process and the original reports are contained in Appendix 9.1, Volume 4 of this ES.

The assessment of ecological value and thereby the significance of the potential impacts of the proposals were undertaken with reference to the Guidelines for Ecological Impact

Assessment (IEEM 2006) and the appraisal approach published by the UK Department of Transport (Transport Analysis Guidance on www.webtag.org.uk). Further details of the assessment methodology are given in Appendix 9.1, Volume 4 of this ES.

9.3 EXISTING CONDITIONS

9.3.1 Prosperous Bay Plain

PBP forms part of the Eastern Arid Area of St Helena and comprises a Central Basin of fine dusts and sands, surrounded on three sides by a raised plateau whilst the remaining side on the north-western edge descends into the deep gulley of Fisher's Valley. The location of the Central Basin is shown on Figure 9.1 in Volume 3 of this ES. The ecological communities found in this area are influenced by wind, temperature and moisture levels but perhaps more significantly by the substrates found in the area. The vegetation tends to be dominated by a few species of varying cover including introduced, indigenous and endemic desert species. Figures 9.2 and 9.3 identify the various vegetation categories present within the study area.

Flora on the upper eastern plateau of PBP, the site for the proposed runway, is sparser than elsewhere due to disturbance from stone collection and the associated use of vehicles.

Other areas of PBP are generally less disturbed with a range of endemic and indigenous plants typical of St Helena's arid zone. Patches of alien invasive species are locally present, e.g. creeper and prickly pear. The rocky habitats of the seaward edge of PBP are notable for the occasional colonies of the rare endemic plants scrubwood and tea plant (both categorised by the IUCN as vulnerable). To the south, the land descends sharply into a deeply incised ephemeral stream valley, Dry Gut.

The Central Basin is a unique habitat which has developed through a particular set of geological and climatological factors and such conditions are found nowhere else on St Helena (Ashmole & Ashmole, 2004). Its flora includes a number of endemic and indigenous species, in particular samphire, St Helena goosefoot, babies' toes and desert grasses. Lichens, many endemic to St Helena, form a distinctive component of the plant community, tending to form soil crusts on the desert sands or present in luxuriant form on the surrounding rock outcrops.

In keeping with the unique substrate conditions of the Central Basin, the invertebrate community is of special interest. Ashmole & Ashmole (2000, 2004, 2006) *found "an extraordinary concentration of endemic invertebrates on PBP, ... this area is the main evolutionary centre on St Helena for animals adapted to arid habitats"*. Of the 51 endemic invertebrates present in the Eastern Arid Area, 35-40 occur in PBP and of these, at least 20 are considered to be endemic to PBP itself. Ashmole & Ashmole, 2004, consider that the results of their survey of 22 sample points in PBP between September and December 2003 (see Figure 9.4 in Volume 3 of this ES) may have resulted in the finding of 10 species new to science. Habitats in the Central Basin, in comprising substrates of fine grits, sands and dusts support many endemics such as wolf spiders, nocturnal burrow-dwellers, pseudo-scorpions and particular flies, bugs and beetles associated with the endemic desert plants – see Table 9.5 in Appendix 9.1 of Volume 4 of this ES.

PBP is notable for its breeding population of endemic Wirebird, here nesting in its presumed ancestral habitat. Breeding success appears to be best in the relatively level areas of low, mixed and sparse, semi-desert vegetation and the species tends to avoid the denser carpets of creeper and stands of prickly-pear scrub. Population counts on PBP have varied between around 20-43 individuals, 10-20 breeding pairs (McCulloch 2001), supporting around 10% of the Island's total population. Figure 9.6 provides an indication of the location of Wirbird territories as surveyed in 2005, 2006 and 2007. The island-wide status of the Wirebird is considered further below.

At Gill Point (see Figure 9.1 of Volume 3 of this ES) to the south-east of the proposed airport, nesting by fairy terns, black noddies and Madeiran storm petrels is attempted in most years. However, these species can fall prey to feral cats which may be a factor in the decline of the sooty tern colony at the Point. Two offshore stacks offer protection to breeding birds from land-based predators. Shore Island lies around 100 metres to the south of Gill Point with George Island a further 600 metres to the south-east. The islands support up to 55 breeding masked boobies, 24 sooty terns, 196 brown noddies and over 390 black noddies.

9.3.2 Terrestrial Habitats of the Access Roads and other Airport Infrastructure

Habitats affected by the proposed access roads are generally dominated by introduced alien plant species and there are no areas that would be considered to represent significant refuges of natural indigenous vegetation. However, in places small patches of endemic plants can occur, e.g. approximately 100m north of the existing trig. point on the summit of Rupert's Hill where a small colony of some 30 individual scrubwood remains intact along with a dependent colony of endemic insects.

The most significant sites along the route of the access roads are the pastures of Deadwood Plain and Bottom Woods. Although dominated by introduced grasses, these sites support significant numbers of breeding Wirebird (see Figure 9.6 of Volume 3 of this ES). However, in recent years the quality of the pastures has declined with sub-optimal grazing regimes and a reduction in cattle numbers leading to weed infestation by alien shrubs and tall herbs. This has had a significant adverse effect on the Wirebird population as Table 9.3 below shows and it has been concluded that the sharp national decline in the Wirebird on St Helena is mainly due to scrub invasion in the pastures.

Table 9.3 Wirebird Counts

Site	1988/9	2000/01	2005/06	2006	2006/07
Deadwood Plain	124	92	35	35	44
Bottom Woods	44	12	5	5	19
Prosperous Bay Plain (PBP)	19	19	15	31	18
Island Totals	425	362	208	Key sites only	322

With recent scrub clearance at Bottom Woods, some recovery of the population is seen at this site.

At Cook's Bridge, approaching PBP, the stream course of Fisher's Valley is dominated by wild mango scrub and dense stands of thatching grass. Formerly a site frequented by

Wirebirds and moorhens; clearance and control of the spread of wild mango and restoration of the stream valley to more open habitats has been previously proposed.

Proposed locations for the aircraft navigational aids and the ROLs points do not appear to raise particular ecological issues though their access routes, some of which may impinge on the Central Basin, have not yet been determined.

The water pipeline route, in traversing a variety of substrate and habitat types, impinges upon some areas of ecological interest including areas of lichen-rich, weathered basalt outcrops and boulders, and communities of samphire and babies toes in the sediments of the ephemeral watercourse. The water abstraction source in Sharks Valley is, in contrast to the surrounding area, typified by verdant vegetation though mainly dominated by introduced species.

Sites in Rupert's valley affected by the proposed quarry and bulk fuel installation are dominated by communities of introduced plants (see Appendix 9.2, Volume 4 for community descriptions) and do not appear to pose any particular ecological issues.

9.3.3 The Wharf and the Marine Environment

The effects of the proposed wharf in Rupert's Bay are considered in full in Chapter 14, Marine Environment in Volume 2. At the commencement of the feasibility studies, the option to site the construction wharf and/or an in-shore sea rescue facility at Prosperous Bay was being considered. Consequently, this proposal together with the necessary access road from PBP to the Bay was assessed. In view of the potential impacts that would arise in this area of significant ecological and landscape importance and from the conclusion of the regulator that the positioning of the in-shore sea rescue lifeboat at James Bay or Rupert's Bay would be satisfactory, development at Prosperous Bay contingent to the airport development will not take place.

An account of the work undertaken in respect of the ecological implications of development at Prosperous Bay is given in the Appendix 14.2, Volume 4 Technical Appendices. The results of the preliminary and more detailed SCUBA surveys at Rupert's Bay found this site to be of low diversity in the context of St Helena's wider marine environment and the proposed expansion of wharfing facilities at Rupert's Bay is not considered to be of ecological significance (see Chapter 14, Volume 2 and Appendices 14.1, 14.2 & 14.3 in Volume 4 of this ES).

9.4 NATURE CONSERVATION EVALUATION

9.4.1 Prosperous Bay Plain (PBP)

Under any approach to ecological evaluation, the importance of habitats supporting endemic species merit particular attention as this is of international significance for biodiversity. On this evaluation, PBP is considered to be of international importance for its endemic species, the higher plants, lichens, insects and the Wirebird population. PBP contains semi-desert habitats, in particular the desert deposits of dusts, fine sands and grit, which are not replicated elsewhere in St Helena and which provide the key habitats required by some of the endemic invertebrates. It most probably represents the habitat that forged the evolutionary traits of the Wirebird on St Helena to make it the distinct

species seen today. Ashmole & Ashmole (2004) consider the area to be a rare example of a mature desert on an isolated oceanic island which probably represents the most intact of the habitats on St Helena.

9.4.2 Sites along the Access Roads and other Infrastructure Supporting the Airport

Given the vulnerability of the endemic Wirebird population, habitats elsewhere on St Helena rank as of high to very high importance, depending on the number of breeding pairs supported, even though the floristic composition of these sites is usually dominated by introduced species. Deadwood Plain and Bottom Woods two of such key sites though now in need of management to restore their former condition, both as more productive pasture and as Wirebird habitat. Given this potential these sites should be considered as internationally important areas for the Wirebird.

Other areas affected by airport-related infrastructure are dominated by non-native and introduced species and are therefore of low importance in the St Helena context. One small colony of the endemic scrubwood was found on Rupert's Hill, however, and while the surrounding habitat is no longer representative of the vegetation type that this species once dominated, the colony should be accorded a high conservation importance given the co-existing endemic insects associated and the current scarcity of the species on the island.

Fisher's Valley represents a unique wetland habitat on St Helena, described as *"an oasis like river valley through desert"* (Pienkowski, 2005) and thus should be considered as of high importance for this and for its use by Wirebirds which have bred in small numbers in the linear grazed grassland. Wirebirds and their young may also derive some benefit from the damp conditions and shallow pools that can form near Cooks Bridge. Moorhen is also present, a species thought to have naturally established being first recorded in 1670. The valley has been considered as a possible candidate Ramsar site, wetland of international importance, especially for bird populations.

9.5 POTENTIAL EFFECTS

9.5.1 Potential Construction Effects

Although the majority of effects on ecology and nature conservation, such as land take from important and sensitive habitats, would occur during the construction works they are considered to be effects of a permanent nature and are therefore discussed in section 9.5.2 below.

During construction there is a potential detrimental impact due to dust emissions which may affect sensitive ecological habitats on PBP. Due to the range of activities likely to take place during the construction of the airport, a wide variety of mitigation measures will be required. The strong prevailing winds will carry the dust towards the Central Basin area, potentially affecting habitats there.

Construction of the BFI and quarrying operations in Rupert's Valley and construction of the wharf in the bay are not expected to result in significant ecological impacts. The effects on the marine environment in Rupert's Bay are considered in Chapter 14, Volume 2 of this ES.

There is potential for impact on indigenous Wirebird population at PBP and seabirds on the eastward coastline. The potential impacts of construction noise and vibration on birds on the Island are difficult to predict. As the response of indigenous birds to noise stimuli is not fully understood, the assessment of the potential for impacts during the construction phase must take a precautionary approach. Studies indicate that many bird species are likely to habituate to new noise stimuli, but the degree and rate of habituation is not predictable. For birdlife, the most significant potential impact would be the disturbance of breeding patterns. Mitigation is discussed in section 9.5.4 below.

9.5.2 Potential Permanent Operation Effects

9.5.2.1 Direct Impacts of Land-take

Habitat loss in PBP to land-take for the airport and its related areas of cut and fill earthworks is estimated to be around 170 hectares including land under temporary use. This includes some 15% of the area of the Central Basin. Beyond the lateral safety strip to the east of the runway some prominent landforms will be truncated to achieve the 1:7 slope of the safety "transitional surface". Thus, the areas of cut extend to the seaward cliff edges where populations of the endemic scrubwood and tea plant are present. Proposals for any temporary runway along the southern rim of the Central Basin together with an adjacent contractor's compound will additionally affect a diverse range of arid habitat types covering an area of around 20 ha. Figure 2.1 of Volume 3 of this ES shows the proposed location of these temporary construction facilities..

These works will result in the direct loss of endemic plants and invertebrates. Around 6 Wirebird territories will be lost to the main airport and a further 6-7 to any temporary runway as based on the distribution of recent counts (territories can vary in position from year to year). Effects on a further 8 pairs to partial territory loss or disturbance from construction are likely. At the present population level, this could represent a 15 % loss to the island's breeding population.

Land take for hard surfaces, i.e. runway, terminal, apron and dispersal areas, access roads represent a permanent impact. Of the area lost, however, the levelled safety areas along the lateral edges of the runway, a strip of around 130 metres in width on each side, will have a natural surface, though the emergency runway, 30 metres in width, required alongside and on the eastern edge of the main runway, may need occasional maintenance by grading and rolling. In addition, any temporary runway and related construction areas can be reinstated to some extent. Over the long-term, therefore, permanent loss of Wirebird habitat may approximate to around 5-6 territories.

The safety strips and the areas of locally re-graded landforms beyond, together with any other areas under temporary use (e.g. any temporary runway) can be restored by natural regeneration with, if necessary, replanting with appropriate local species (see The Landscape and Ecological Mitigation Plan in Appendix 10.2, Volume 4 of this ES). Nevertheless there remains a risk that the as yet untried methods of re-instatement of appropriate substrates and the introduction of desert plants may fail to replicate the habitats lost. Equally, there are concerns that formerly disturbed areas may provide habitats for alien invertebrates, e.g. brown widow spider that may have adverse effects on native indigenous and endemic species.

9.5.2.2 Indirect Impacts of Changes in Topography

In addition to the effects of direct habitat loss there is likely to arise an indirect impact upon the Central Basin from the lowering of the eastern plateau, identified for the main runway alignment, from its current height at between 320-325 metres down to 300 metres above sea level to achieve the correct grade and the fill required for the runway and RESA extension into Dry Gut. At present this landform acts as a partial windbreak for habitats within the Central Basin. Following earthworks and runway construction this windbreak will be effectively removed.

The results of the wind-speed modelling (see Appendix 9.5, Volume 4 of this ES) suggest that the wind-speeds experienced over the Central Basin are likely to change significantly. When modelled using a reference wind speed at the approximate location of the runway centreline, the eastern area of the Central Basin experiences a doubling of average wind-speeds from around 4 to 8 m/s following construction of the runway.

The increase in wind speeds is likely to reduce the deposition of fine sands and dusts in the Basin with possible erosion of the existing finer deposits. Part of the erosion source provided by the current landform will be lost to the consolidated surfaces of the runway. Subtle or more radical differences in the nature of the Central Basin ecosystem could result from this which may adversely affect the habitat requirements of the endemic invertebrates, particularly the burrowing species of the finer sediments. Mitigation measures are discussed in section 9.5.4.

In view of this, other options for runway construction which retained the height of the existing eastern plateau were examined but proved to have safety implications, be economically unviable or in some cases would also result in potentially significant environmental impacts. Further details are provided in Section 2.9 of Chapter 2 of this ES.

9.5.2.3 Impacts of the Access Roads and other Infrastructure Supporting the Airport

While the precise alignment of the routes may be subject to refinement at the detailed design stage, ongoing design has recognised the main avenue of mitigation to be avoidance of key ecological receptors. Thus it has been possible to minimise incursions into Wirebird habitat on Deadwood Plain though some habitat at Bottom Woods will be transected. Direct losses to the access roads are estimated to be 5-6 Wirebird territories and a further 3-6 indirectly affected by partial territory loss or disturbance. The routes for overhead power lines, the water supply pipeline and access tracks will also be subject to refinement. Further mitigation is discussed in section 9.5.4.

9.5.3 Operational Impacts

Operational impacts from the airport include the effects of noise and visual disturbance, both constituting novel stimuli to wildlife in this environment. Airport lighting could have effects on Wirebirds, both possibly by extending hours of lighting beyond daylight hours but also risking an increase in predator success on Wirebirds and invertebrates. The effects of noise on the seabird colonies off Gill Point are difficult to predict. Taking account of the low frequency of flights, and the very gradual increase in the number of movements over the first 35 years of operation, it is likely that, as studies indicate, birds

will habituate to the routine passage of aircraft and vehicles. Mitigation for disturbance will include restriction regarding low flying and the strict definition of an approach/take off path employed in the airport's Aeronautical Information Publication, Local Traffic Regulations, to prevent direct passes over Gill Point and the offshore stacks.

The access roads similarly constitute a potential new disturbance to breeding Wirebirds in PBP, Deadwood Plain and Bottom Woods. However, observations of this and related species of plover elsewhere suggest that they can quickly habituate to the movement of passing road traffic and aeroplanes. No significant long-term impact is anticipated given the low number of air movements and traffic volumes.

9.5.4 Mitigation

Mitigation has been developed through the design and incorporated into the technical specification which the Contractor must follow. Mitigation measures have also been developed for the construction and operation of the proposed scheme and these are set out in the EMP in Volume 5 of this ES. In general these require that working practices and techniques will be such that the risks of additional disturbance to adjacent areas of habitats and species to be retained will be minimised. A description of the mitigation measures is included in Appendix 9.1 which is the detailed assessment in Volume 4 of this ES. Examples of such measures are provided below:

- **Mitigation for temporary construction effects**
  - Where practicable, the noisiest activities (notably blasting operations during construction) near to breeding colonies may need to be restricted during the breeding season. For example, as far as practicable such activities will be scheduled to take place once the majority of young birds have fledged. Notwithstanding this, at an early stage observations of bird reactions to noisy construction activities will be carried out to inform mitigation measures for later works if significant adverse impacts are identified.
  - In addition to the mitigation measures described in Chapter 7, section 7.4.2 to control dust arising from the works during construction, a series of high barriers would be used as needed to trap dust. These will be particularly effective at trapping the larger fractions of dust. Due to the large areas, and the scarcity of water available for dust suppression these barriers have the potential to be an effective form of mitigation, assuming they are appropriately positioned. Due to regulations regarding the height of obstacles around an airport, these barriers will need to be removed before the airport is operational.
- **Direct Impacts of Land-take**
  - The safety strips and the areas of locally re-graded landforms beyond, together with any other areas under temporary use (e.g. any temporary runway) will be restored by natural regeneration with, if necessary, replanting with appropriate local species (see Appendix 9.1 and 10.2, Volume 4 of this ES).
  - Proportional compensation for permanent habitat loss on site is not available as the limits of PBP and the Eastern Arid Area is determined by the complex interactions of topography, geology and climate. Mitigation to ameliorate losses to endemic species and indigenous communities can be undertaken by restoring other areas of PBP by successively eradicating the invasive weeds (primarily creeper and prickly pear) that have degraded the habitat. The ratio of land to be restored, to land lost to all temporary and permanent works shall be of the order of 1.5 : 1. Where necessary, endemic plants will be replanted from cultivated stock. All mitigation areas will be strictly protected during the works and managed over the long term for nature conservation (see proposed mitigation areas on Figure 9.6 in Volume 3 of this ES). This may make parts of PBP, currently dominated by invasive alien plants, available once more to endemic plants, invertebrates and the Wirebird. This programme would commence well in advance of construction.
  - In respect of the Wirebird population, regarded as highly vulnerable to extinction (IUCN classification – Critically Endangered, May 2007), restoration of the grazing pastures on St Helena (see Figure 9.6) is regarded as a safer strategy to elevate the breeding population prior to the onset of airport works in PBP. The Wirebird Species Action Plan is being prepared for all of St Helena with the assistance of the St Helena National Trust and the RSPB. The plan's long-term vision is to 'find a way to happily co-exist - allowing St Helena to develop and the Wirebird to thrive'. Within this framework the plan will work towards stabilising the population of the Wirebird and reducing its threatened status from Critically Endangered to Vulnerable (because of its small and isolated population) with a sustainable population by 2017. This should have benefits for both the agricultural sector and the Wirebird as long as the land is managed sustainably over the long-term. A programme of pasture enhancements is currently about to commence with the initial aim of providing additional breeding territories proportional to the expected loss at PBP.
- **Indirect Impacts of Changes in Topography**
  - With the current design proposals, no direct mitigation appears available for the expected changes to wind exposure and erosion in the Central Basin. Some compensatory mitigation may be possible on the sheltered western embankment to be formed to support the RESA in Dry Gut. Here, detailed design will seek to achieve a rising stepped profile with a series of broad level terraces. Fine desert sands, retained from other worked areas will be re-deposited on the sheltered terraces to provide a habitat for the endemic and indigenous plant and invertebrates that are currently typical of the fine desert deposits of the Central Basin. It is not possible to predict the likely response of endemic invertebrates to these artificial habitats.
  - In addition, the application of a wind attenuation/dust screen mesh to the permanent airport fence on the western perimeter may have some local benefit for the zone directly downwind of the fence (and may make the fence more visible to flying Wirebirds). These proposals are cited in technical specification which the Contractor must follow and the EMP in Volume 5 of this ES).
- **Impacts of the Access Roads and other Airport Infrastructure**
  - Further mitigation for damage to any such sensitive features will be available by detailed route alignment and design. Other significant ecological impacts arising from construction of the access roads are not anticipated. Local disturbance to breeding Wirebirds may be mitigated by working outside the breeding season in the more sensitive locations.
  - From the preliminary survey the installation of a water pipeline could have local impacts on endemic communities. Mitigation by appropriate avoidance of key sites together with careful re-instatement of worked areas shall be ensured.

In addition to the key actions for mitigation considered above, a number of additional measures are necessary.

- Continuing habitat survey in advance of detailed design of road access, pipeline routes, overhead power lines and positioning of navigational aids.
- Facilities to be made available for paleontological surveys for fossil remains in the area of works.
- Monitoring of all mitigation undertaken so as to enable corrective measures to be undertaken as required.
- Bio-security measures with respect to accidental introductions of alien species at the airport site.
- Institutional support for the St Helena government to ensure an appropriate level of ecological and environmental management and planning capacity for this major project and future development.

In addition, some programmes are advised where the results of the research will inform future management or for measures that will be more effective on an island-wide basis, e.g. predator control. Such programmes are not specifically part of the proposed Airport and Supporting Infrastructure contract but are being considered in view of ongoing or new potential impacts.

- Specific research on other predators of the Wirebird and Wirebird eggs (information may be gained on this from the results of a PhD studentship about to commence).
- Control of pest species such as house mice which can have locally significant adverse effects on endemic plants species.
- Research on habitat requirements and interactions between alien invertebrates e.g. brown widow spider, and endemic insect species.
- The control programme for feral cats and other predators of endemic and indigenous plants and animals would be more successful on an island-wide basis).

9.5.5 Residual Impacts

Table 9.4 provides a description of the residual effects which would occur during construction and permanent/operation.

Table 9.4 Summary of Residual Effects

Ecological Resource or Receptor: Evaluation	Assessment of Significance Without Mitigation	Proposed Mitigation Measures	Residual Impact
Desert Habitats of PBP including the Eastern Plateau, site for the main airport, and Central Basin, and varied semi-desert communities along the Southern Plateau, proposed site for a temporary runway and works compound. Key Sub-Receptors: endemic plants, invertebrates and the Wirebird.	Land-take for construction of the main airport and, potential impacts from any temporary runway and site compound construction resulting in: 1) Loss of valuable invertebrate habitat and related loss to species populations. 2) Loss of rare endemic and indigenous flora species. 3) Loss of 13-19 breeding territories of the Wirebird.	Seed collection of endemic and indigenous plants, storage, propagation and planting in mitigation areas (see Figure 10.7 in Volume 3 of this ES). Remove substrate from identified areas of cut for later reuse in habitat creation on the level terraces on the western slope of the Dry Gut RESA embankment and on reformed landforms lateral to the runway.	Success of mitigation is uncertain and therefore risks of ecological losses remain. There may be no adequate compensatory mitigation available for increase in erosion of fine sand and dust substrates in the Central Basin or in other exposed graded and levelled areas. Lack of experience in restoration of desert habitats, plants, and in particular, substrate

Ecological Resource or Receptor: Evaluation	Assessment of Significance Without Mitigation	Proposed Mitigation Measures	Residual Impact
Ecological interest considered Very High Value and of International Importance.	4) Increase in wind erosion to fine sand and dust substrates of the Central Basin from the lowering of the upwind landform. 5) Challenging mitigation in graded areas of the Southern Plateau following reclamation of land for any temporary runway and construction compound. 6) Dust emissions during construction could affect sensitive ecological habitats. Temporary effects are predicted, largely as a result of the ecological sensitivity of the area and the potential shortage of water for dust suppression, considering the size of the area affected and the dry and windy conditions. Potentially a very large adverse impact.	Restoration of native semi-desert communities to the wider area of PBP by eradication and control of invasive alien plant species. See Figure 10.7 in Volume 3 of this ES. Preparation of EMP and preparation of mitigation and monitoring protocols as part of contract requirements. Restrict working area to minimum required. Seek to further minimise land-take from valued habitat during detailed design (for haul/access roads, drainage, areas of peripheral cut and grading). Prevent all access to adjacent valuable habitats to be retained. Dust suppression techniques to be used in working areas as described in Table 7.2 of Chapter 7 of this ES. High wind breaks may be used in some areas to minimise dispersion of dust. Undertake removal of invasive alien plants from valued habitats and control pests to reduce grazing	characteristics required by endemic invertebrates. Restoration of levelled and graded areas for any temporary runway and works compounds may be difficult and effectively constitute a permanent impact. Mitigation of impacts on Wirebird population relies on off-site habitat enhancements over a wider area of PBP and in appropriately managed agricultural land elsewhere on St Helena. Ecological impacts at PBP are therefore assessed as being between **Very large Adverse to Large adverse** depending on scale of land-take for construction and success of mitigation
Endemic and Indigenous Birds of PBP Wirebird Habitats of ornithological importance adjacent to the airport site. Wirebird habitats of	Habitat loss and disturbance during construction for Wirebird considered Large Adverse Disturbance to birds from air and road traffic during airport operation. Given low frequency of air	Restoration of native semi-desert communities as Wirebird habitat on the wider area of PBP by eradication and control of invasive alien plant species. Appropriate refinement	With the implementation of habitat restoration in PBP as **Wirebird** mitigation, impacts likely to be reduced to **moderate adverse** (see below for an Island-wide assessment). Operational impacts on

Ecological Resource or Receptor: Evaluation	Assessment of Significance Without Mitigation	Proposed Mitigation Measures	Residual Impact
Very High Value and International Importance. Seabird colonies considered of High Value, of Regional Importance	and road traffic anticipated during, at least, the first few yeas of operation, and the capacity of many bird species to habituate to routine stimuli, operational impacts for Wirebird and seabirds are anticipated to be minor adverse. No significant effects are predicted on Fisher's Valley possible candidate Ramsar site.	of route of haul/access road to the airport during detailed design to avoid key Wirebird breeding territories. Prevent access to adjacent areas so as to avoid disturbance to breeding birds Undertake pest control to reduce predation Flight take-off and approach protocols to avoid flying over the islands off Gill Point	**seabird colonies** may be **minor adverse**.
Other habitats for Wirebird between Rupert's Bay and airport site. Deadwood Plain would be considered of High to Very High Value for its breeding Wirebird population	Some habitat loss to Rupert's Bay access/haul road on Deadwood Plain, Wirebird habitat. Potential for loss to small remnants of endemic vegetation. Impacts may be minor adverse given the relatively small area of land-take and expected capacity for habituation by Wirebird to potential disturbance	Minimise land take and severance of Wirebird breeding habitat through detailed design. Habitat enhancements, weed clearance and improved grazing regime on Deadwood and pastures elsewhere to improve breeding areas for Wirebird Detailed survey and route design to avoid areas of endemic vegetation	Impacts considered to be **neutral** assuming successful mitigation and sustainable improvements to pasture and breeding success.
Other habitats for endemic plants at Rupert's Bay and airport site. Deadwood Plain would be considered of High Value	Impacts likely to be mainly obviated by route refinement with translocation of plant material (e.g. lichens) if needed. Potential Minor adverse effect	Translocations as a last resort. New planting of endemics and indigenous species.	Residual impacts **Minor beneficial to Moderate beneficial** given success in planting schemes for endemic species.

9.6 SUMMARY

Dedicated ecological studies for the EIA of the proposed airport development commenced in October 2005 and have continued to date. The results have guided the feasibility design and enabled the predictions of potential impact and prescriptions for the approach to mitigation.

Ecological conditions at PBP appear to be unique and are not replicated elsewhere on St Helena. The area represents a centre of endemism for a number of higher plants and lichens of the semi-desert ecosystem, insects and spiders and the Wirebird.

While the habitat losses in PBP to airport construction is a measurable proportion of the area available for the specialist and endemic species of plants and animals, with all other factors being constant, and mitigation applied successfully, a greater proportion of habitat will remain following the restoration of areas under temporary use. Nevertheless, for the reasons summarised below, the airport project is likely to result in a large adverse impact on ecological receptors.

There is considerable uncertainty at present over the degree of success to be expected in replicating former conditions on land taken for construction (temporary and permanent) works.

In addition there is also significant uncertainty over the future conditions in the Central Basin of PBP, the centre for endemic invertebrates of fine sandy deserts, following the potentially significant change to the upwind landforms as a result of earthworks for runway construction. The expected increase in wind speeds experienced in the Central Basin is likely to lead to changes in substrate composition with respect to particle size of substrates. The response of populations of endemic burrowing invertebrates in the affected areas cannot be predicted with any certainty.

The formation of broad, level terraces on the sheltered western embankments of the RESA embankment across Dry Gut will in part mitigate for potential losses of fine dusty deposits in the Central Basin and provide a suitable substrate for burrowing invertebrates. The efficacy of this novel approach remains to be tested and there are clear uncertainties attached to this method.

The current uncertainties as to the success of mitigation in an area of very high ecological interest requires significant effort to be applied to mitigation strategies, in particular, the reclamation of native semi-desert by eradication and control of invasive species from the wider area of PBP and an enhancement of the population of endemic plants. Eradication of invasive plants from this area is expected to improve habitat conditions for endemic plants, invertebrates and the Wirebird. This mitigation should apply to an area of PBP 1.5 times the size of the areas lost to temporary and permanent works. Mitigation will commence in advance of the construction programme.

However, it is unlikely that this alone will mitigate for the loss of Wirebird breeding territories to the airport project and pasture re-instatement elsewhere on the Island is essential in order to fully compensate for the impacts upon the Wirebird population. Mitigation will commence in advance of the construction programme.

Where practicable, the noisiest activities (notably blasting operations during construction) near to breeding colonies may need to be restricted during the breeding season. For example, as far as practicable such activities will be scheduled to take place once the majority of young birds have fledged. Observations of the reaction of birds to noise stimuli early in the programme will help determine the scope and scale of effects of continuing operations. If it is considered that the magnitude is likely to cause significant effects in the medium to long-term, further management measures may be required.

Given the low frequency of flights, and the very gradual increase in the number of movements over the first 35 years of operation, studies indicate that birds are likely to

habituate to the routine passage of aircraft and vehicles. Adoption of a strict flight path, avoiding the islands at Gill Point, should further control the impacts to nesting birds.

Rigorous monitoring will be necessary to assess the results of mitigation and guide any remedial works required. Further research in some key areas would be of benefit, e.g. interactions between alien and endemic invertebrates of the arid zone.

Institutional strengthening will be necessary to ensure that the SHG has the capacity to apply appropriate ecological, environmental management and planning control over this and future developments.

In summary, there will be significant impacts upon the habitats of PBP from direct habitat loss and habitat modifications. There are a number of uncertainties regarding the likely success of mitigation. In view of this, and adopting the precautionary principle with regard to mitigation, a large adverse impact is therefore predicted for the desert ecosystems of PBP and its Central Basin.

Impacts upon the Wirebird population, given the permanent loss of breeding sites at PBP and the vulnerability of this species, would represent a moderate adverse impact. The impacts upon the Wirebird population on an island-wide basis are considered to be neutral assuming successful mitigation and sustainable improvements to pasture and breeding success.