

St Helena Airport and Supporting Infrastructure:

Addendum to the Environmental Statement

Prepared by: Approved by:

Iain Bell/ Ruth Mauritzen/ Phil Smart Iain Bell

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AECOM

1 Tanfield

Edinburgh

Eh35DA

United Kingdom

Website: http://www.aecom.com

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Executive Summary.

**Background and Summary of Main Design Changes**

AECOM (formerly Faber Maunsell/ AECOM) undertook the Environmental Impact Assessment (EIA) for the St Helena Airport and its associated infrastructure and wrote the Environmental Statement (ES) in 2008 that supported the application for development permission.

The St Helena Government (SHG) and the Department for International Development (DFID) now propose to make amendments to the reference design for the airport. The purpose of this report is to identify and review the environmental effects (both positive and negative) of the revised design and identify any additional mitigation measures.

The most important design changes that are relevant to the environment are:

* A reduction in the overall runway length of about 200m and the adoption of an Engineered Material Arrestor System (EMAS) at the southern end of the runway, replacing the Runway End Safety Area (RESA).
* The 2011 airfield design is based on a smaller reference aircraft, B737-700W (the previous design was based on a B737-800). The B737-700W carries approximately 125 passengers per flight instead of about 160. This means that in order to carry the same number of passengers per annum there will need to be an increase in flights.
* A reduction in earthworks necessary to build the runway including a reduction in the scale of works required in Dry Gut. As a result of the reduced earthworks the runway would be elevated approximately 4.8 meters higher than the 2007 reference design. The Airport Development Area Boundary (ADAB) and the footprint of the airport earthworks would be reduced.
* Additional works in Fisher’s Valley to supply water for the operation of the airport comprising a borehole, pipeline, access road and overhead power lines. This water source may also be used during construction.

**Summary of Changes in Environmental Effects**

Section 3 below identifies the environmental effects associated with the changes to the reference design and compares the results against the conclusions made in the 2008 ES. The headline results for the key environmental issues are provided below. A summary statement has been made as to whether the change in design has been positive, negative or neutral in comparison with the 2007 design. Where negative changes have been identified further mitigation is proposed.

| **Topic** | **Description of Change between the 2007 and 2011 Reference Designs** | **Whether the Change is Positive, Negative or Neutral** |
| --- | --- | --- |
| Land Use | Slight increase in land take in Fisher’s Valley, but reduction in land required at Woody Ridge, Prosperous Bay Plain and Dry Gut. No private property adversely affected.   * 2008 ES Significance: **Minor Adverse** * Revised Significance: **Minor Adverse** | **Neutral** |
| Noise | Slight reduction in noise from smaller aircraft but slight increase resulting from increase in number of flights. Changes too small to affect overall conclusions of original ES.   * 2008 ES Significance: **Negligible** * Revised Significance: **Negligible** | **Neutral** |
| Air Quality and Dust | No change in local air quality. Potential for reduction in dust over construction period and more protection of areas of fine, dusty material on Prosperous Bay Plain from wind resulting from change in earthworks.   * 2008 ES Significance: **Minor Adverse** * Revised Significance: **Minor Adverse** | **Neutral** |
| Carbon Emissions | Slight increase in CO2 in long term.  2008 ES Significance: **Minor Adverse (in long term)**  Revised Significance: **Minor Adverse (in long term)** | **Negative** (slight increase over 2008 assessment) |
| Ecology – Fisher’s Valley | Adverse effects from water abstraction. Effects uncertain.   * 2008 ES Significance: **Not assessed** * Revised Significance: **Major to Minor Adverse (Uncertain)** | **Negative** (uncertain – see mitigation below) |
| Ecology – Prosperous Bay Plain and Dry Gut | Significant reduction in land-take from Central Basin. In addition, effects of wind on Central Basin habitat are likely to be reduced.   * 2008 ES Significance: **Very Large/Large Adverse** * Revised Significance: **Large /Moderate Adverse** | **Positive** |
| Landscape Character | Works in Fisher’s Valley will extend the influence of the airport and supporting infrastructure within Local Character Area 5.   * 2008 ES Significance: **Minor Adverse** * Revised Significance: **Minor-Moderate Adverse** for localised areas only. **Minor Adverse** remains for wider LCA | **Negative** (slight for a localised part of the LCA) |
| Visual Amenity | Works in Fisher’s Valley will appear in views of residential properties at Longwood Hangings and in immediate views of walkers using the footpath in Fisher’s Valley.   * 2008 ES Significance: **Minor Adverse** (Longwood Hangings) and **Minor Adverse-Neutral** (Fisher’s Valley footpath) * Revised Significance: **Minor-Moderate Adverse** (depending on orientation of view for properties at Longwood Hangings) and **Moderate Adverse** (for short sections of the Fisher’s Valley footpath)   Reduced ADAB in Sharks Valley will reduce the visual impact for walkers using the upper sections of the Post Box walk.   * 2008 ES Significance: **Moderate Adverse** (for short sections of the route) * Revised Significance: **No impact** on upper sections of the route, **Moderate Adverse** remaining for the lower sections. | **Negative**  **Positive** (for upper sections of the route) |
| Cultural Heritage | Works in Fisher’s Valley not predicted to have significant adverse effects.   * 2008 ES Significance: **Not assessed** * Revised Significance: **Slight to None** | **Neutral** |
| Roads, Traffic, Footpaths | Improved access in Fisher’s Valley. Minor adjustments to Post Box Walk alignments.   * 2008 ES Significance: Fisher’s **not assessed**. Diversion of walks was **Moderate Adverse**. * Revised Significance: **Minor Beneficial** for access. **Moderate Adverse** for walks | **Positive** for improved access.  **Neutral** for walks |
| Surface Water and Ground Water | Abstraction from Fisher’s Valley unlikely to have effects at a regional level but may have localised effects in the vicinity of the borehole. Further data required.   * 2008 ES Significance: **Not assessed** * Revised Significance: **Uncertain** | **Uncertain** |

**Summary of Additional Mitigation**

The mitigation proposed in the 2008 ES and incorporated into the EMP will still apply. The previously agreed mitigation is adequate for most of the additional issues that will arise from the changes to the reference design. For the following issues, further mitigation and/or data collection will be carried out:

* **Ecology** – a mitigation strategy for works in Fisher’s Valley will be prepared in tandem with additional data collection on ground and surface water conditions. This strategy will be incorporated into a revised Landscape and Ecological Management Plan.
* **Landscape** – in addition to the revised Landscape and Ecological Management Plan for Fisher’s Valley, additional measures will be implemented to minimise the effects of the water supply infrastructure on the landscape.
* **Surface and ground water** – further data will be collected to better understand the hydrological conditions in Fisher’s Valley and at the position of the proposed borehole.
* **Carbon emissions** - research into the feasibility of carbon offsetting on St Helena is under consideration.

Section One.

Introduction and Approach

**1.1 Introduction**

AECOM (formerly Faber Maunsell/ AECOM) undertook the Environmental Impact Assessment (EIA) for the St Helena Airport and its associated infrastructure and published the Environmental Statement (ES) in 2008 that supported the application for development permission. The St Helena Government and the Department for International Development (DFID) now propose to make amendments to the reference design for the airport consisting primarily of a reduction in the overall runway length and the adoption of an Engineered Material Arrestor System (EMAS). This will result in a reduction in earthworks necessary to build the runway including a reduction in the scale of works required in Dry Gut. Water supply proposals for the airport’s operation have been amended and additional works are proposed in Fisher’s Valley. The purpose of this report is to describe the environmental effects (both positive and negative) of the revised design and identify any additional mitigation measures.

**1.2 Approach to Undertaking the Addendum**

It is not the intention of this Addendum to rewrite or reproduce the ES that was published in 2008. The intention is to present a succinct document that compares the 2011 ‘reduced runway’ reference design with the 2007 ‘long runway’ reference design as assessed in the ES. The approach has therefore been to:

* Describe the changes to the scheme design that are of relevance to the EIA (see Section 2 below).
* Identify the potential effects of these changes for each of the environmental topics of relevance (both positive and negative).
* Identify any additional mitigation measures.
* Provide a succinct comparison of the environmental effects of the 2007 and 2011 reference designs.
* In tandem with this Addendum, make revisions to the Environmental Management Plan (EMP) to incorporate additional mitigation measures.

**1.3 Scope of Addendum**

The Scope of the original ES is described in Section 3.6, Volume 2. The topics covered in the original ES are listed below and a comment is provided on the main issues that are to be covered in this Addendum. As stated above, it is not the intention of this Addendum to undertake a new EIA. The coverage is therefore limited to those issues which are directly related to changes to the reference design and which are likely to result in changes to the overall conclusions of the original ES, including the need for additional mitigation.

| **ES Topics** | **Coverage in this Addendum** |
| --- | --- |
| Planning Context | The summary of relevant planning policy in the original ES covers the majority of the key issues relevant to Fisher’s Valley. For this Addendum, any additional planning policy issues will be covered in the specialist chapters below e.g. Terrestrial Ecology and Nature Conservation. |
| Land Use | Effects on land use as a result of the inclusion of water supply works in Fisher’s Valley are included. |
| Noise and Vibration | Changes resulting from the type of aircraft and frequency of flights are considered. Reference to works in Fisher’s Valley is included. Whilst the scale of works has been reduced at the airport it is considered that the noise and vibration effects during the construction phase will remain as stated in the ES. |
| Air Quality, Dust and Carbon Emissions | Changes resulting from the type of aircraft and frequency of flights are considered with respect to air quality and changes to carbon emissions. Whilst the scale of works has been reduced at the airport it is considered that the effects during the construction phase (related to dust) will remain as stated in the ES. Reference to works in Fisher’s Valley is included. |
| Terrestrial Ecology and Nature Conservation | Key issues covered are the additional works and water abstraction in Fisher’s Valley and the reduced scale of earthworks at the airfield and Dry Gut. |
| Landscape and Visual Amenity | Key issues covered are the additional works in Fisher’s Valley and the reduced scale of earthworks at the airfield. |
| Cultural Heritage and Archaeology | The additional works in Fisher’s Valley are covered in the Addendum. |
| Roads, Traffic and Footpaths | Changes include an upgraded road in Fisher’s Valley, the removal of the access to Sharks Valley and the realignment of Post Box Walks. |
| Geology, Contaminated Land and Hydrogeology | Key issue relates to water abstraction in Fisher’s Valley. To simplify the assessment, ground and surface water are considered together in a single section in this Addendum. The 2008 ES concluded that there would be no significant effects on geology or from contaminated land. As the 2011 reference design involves a smaller amount of earthworks it is considered that there will be no additional effects associated with contaminated land or geology and these issues are not covered in this addendum. |
| Marine Environment | As there are no changes to the works in Rupert’s Bay this topic is not covered in the Addendum. |
| Surface Water | Covered together with hydrogeology above. |
| Waste management | There is the potential for changes in amount of waste material resulting from reduced scale of earthworks, although the amount of waste is uncertain. The original ES proposed that a Waste Management Plan be prepared prior to construction commencing. The Plan will be based on the most up-to-date design and information on wastes arising. Waste is therefore not covered in this Addendum. |
| Combined Effects | The changes to the reference design do not affect the conclusions of the assessment undertaken previously. It is not covered in this Addendum. |

**1.4 Approach to Assessment**

Each of the environmental topics identified above will be considered following a common structure:

* Changes to the Scheme Design Relevant to the Topic
* Description of Existing Conditions in the Extended Airport Development Area Boundary (ADAB) at Fisher’s Valley
* Potential Effects of Changes to Reference Design
* Additional Mitigation Required (if any)
* Comparison of 2007 and 2011 Reference Designs and Summary of Effects

In tandem with the production of this Addendum, the Environmental Management Plan (EMP) has been updated. The EMP will take into account the changes to mitigation measures that are identified in this Addendum.

Section Two.

Changes to Scheme Design

**2.1 Introduction**

Development permission for the airport and its associated infrastructure was granted in 2008 based on a reference design prepared in 2007. A description of the proposals was provided in the ES (Volume 2, Section 2). This included both construction and operational aspects of the development. The purpose of this section of the Addendum is to describe the main changes that have been made to the reference design in 2011 that are relevant to the EIA. The changes are summarised below.

**2.2 Airport Development Area Boundary**

The changes to the airport and other infrastructure components have allowed the refinement of the Airport Development Area Boundary (ADAB). Figure 1 shows the new ADAB and Figure 2 compares the old and new boundaries.

The ADAB within Rupert’s Bay and along much of the haul road route remain unchanged between the 2007 and 2011 designs. The most significant changes are at Prosperous Bay Plain and in Fisher’s Valley. Within Fisher’s Valley the 20m wide ADAB has been extended from Cook’s Bridge to Longwood. In reality, the works will require a much smaller corridor; the 20m corridor width is to allow for flexibility to route and site infrastructure in the most appropriate location, taking into account the need to avoid or minimise environmental effects.

Within the 2011 design the ADAB at Prosperous Bay Plain has been refined. To the west of the runway, the boundary has been moved eastwards by some 20m reducing the intrusion into the Central Basin. To the east of the runway, the ADAB has been moved westwards along much of the eastern boundary of the runway. To the south of the runway, in Dry Gut, the boundary has been moved northwards.

The area identified near Government Garage has been slightly extended to cater for navigational aid equipment.

**2.3 Airfield Geometry (Length, Width etc)**

Figure 3 provides an overview of the airport components. The 2011 airfield design is based on a smaller reference aircraft, B737-700W (the previous design was based on a B737-800). This has allowed several changes to the size of the airfield. These changes to the design have reduced the overall length of the runway and associated areas by over 200m.

To the northern end of the runway, a runway starter extension incorporating a Runway End Safety Area (RESA) is provided in both the 2007 and 2011 designs. The major difference of the 2011 design over the 2007 design is the shortening of the runway. The 2011 design has the runway shortened by 100m to 1550m whilst the 240m long Runway End Safety Area (RESA) at the southern end of the runway has been replaced by a shorter Engineered Material Arrestor System (EMAS) of 132m. The distance between the EMAS (or RESA in the 2007 reference design)and the end of the runway has also been reduced from 60m in 2007 to 30m in the 2011 design. The other change to the geometry of the airfield is the reduction in area of the turn pads at each end of the runway. These have been reduced from 3900m2 to 600m2. The emergency runway in the 2007 design has also been omitted. This has helped reduce the graded and cleared area to the east of the site by 15m.

**2.4 Earthworks**

The changes to the airfield geometry have led to significant changes to the earth works required to construct the airport. Overall, infill has been reduced from 10,000,000m3 in the 2007 design to 6,500,000m3 in the 2011 design. The changes to the area of earthworks are shown on Figure 3. A section through the runway is provided in Figure 4 together with a comparison with the 2007 design.

The most significant change has come about from the reduction in the length of runway and the use of EMAS rather than RESA. As a consequence of this the scale of corresponding works required in Dry Gut has been reduced. The 2007 design proposed the creation of an embankment some 700m long and 100m high. The 2011 design proposes a much reduced embankment extending around 400m into Dry Gut. As a result of this reduction in the scale of the embankment, a number of other changes to the works required within Dry Gut have been achieved.

A seasonal stream runs through Dry Gut. In order to keep this flowing, a culvert is required to be constructed through the embankment. Within the 2007 design this culvert extended to a length of some 800m. This has been reduced in the 2011 design to around 570m. The number of side streams that would also require to be diverted as a result of the embankment has been reduced from 9 stream diversions in the 2007 design to 1 stream diversion in the 2011 design.

As a direct result of this reduced requirement for infill, the amount by which the ground levels will require to be lowered to provide the materials for the infill will also be reduced. The runway will therefore be approximately 4.8m higher than the previous reference design which in turn will reduce the effects on local landforms and reduce the overall footprint for the development.

**2.5 Terminal Building**

As a result of the smaller reference aircraft size, the terminal building has been redesigned to suit. The terminal building has been shortened by 12m with 6m being removed from each end. The height of the terminal has also been reduced by 1.5m.

**2.6 Fisher’s Valley Water Supply**

A permanent water supply is required for the operation of the airport. The 2007 design identified Sharks Valley as the source. The Sharks Valley source is still included within the 2011 design and may still be used but an additional proposal to use water abstracted from a borehole in Fisher’s Valley has been included. The works in Fisher’s valley are shown on Figure 5.

Water would be pumped from a borehole (referred to as location SK9). An above ground pipeline would carry water to a break pressure tank after Cook’s Bridge before terminating at water storage tanks at the airport on Prosperous Bay Plain. Power for the operation of the borehole and pumping system would originate from Longwood. The electrical cables would be carried by poles. The track that runs from Cook’s Bridge to the borehole would be upgraded to improve access for construction purposes and for the long term maintenance of the water supply infrastructure if this potential water source is developed.

**2.7 Aircraft and Flight Numbers**

The 2011 airfield design is based on a smaller reference aircraft, B737-700W (the previous design was based on a B737-800). The B737-700W carries approximately 125 passengers per flight instead of about 160. This means that in order to carry the same number of passengers per annum there will need to be an increase in flights. New aircraft that may come into service in the future may carry a different number of passengers but the numbers above have been used as approximations for the purpose of carrying out the assessment. The table below summarises the number of flights for both the 2011 and 2007 reference designs.

**Table 2.1 Visitor and Flight Numbers**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year of Operation | Projected Visitor Numbers | Aircraft per Year  2011 Reference Design\* | Aircraft per Week  2011 Reference Design Forecast\* | Aircraft per Week  2007 Reference Design Forecast |
| 1 | 7023 | 70.2 | 1.5 | 1 |
| 2 | 7196 | 72.0 | 1.5 | 1 |
| 3 | 8080 | 80.8 | 1.5 | 1 |
| 4 | 9791 | 97.9 | 1 | 1 |
| 5 | 12463 | 124.6 | 2 | 2 |
| 6 | 13813 | 138.1 | 3 | 2 |
| 7 | 15623 | 156.2 | 3 | 2 |
| 8 | 17069 | 170.7 | 3 | 2 |
| 9 | 18876 | 188.8 | 4 | 2 |
| 10 | 20945 | 209.5 | 4 | 3 |
| 11 | 23328 | 233.3 | 4 | 3 |
| 12 | 26049 | 260.5 | 5 | 3 |
| 13 | 29164 | 291.6 | 6 | 4 |
| 14 | 32683 | 326.8 | 6 | 4 |
| 15 | 36770 | 367.7 | 7 | 5 |
| 20 | 56990 | 569.9 | 11 | 7 |
| 25 | 787790 | 787.9 | 15 | 9 |
| 30 | 80801 | 808.0 | 16 | 10 |
| 35 | 82584 | 825.8 | 16 | 10 |

\*Assumption: 125 seat aircraft @ 80% load factor. Aircraft numbers are rounded up or down slightly to reflect air service operation.

Section Three.

Assessment and Comparison

**3.1 Introduction**

The Section provides an assessment of the 2011 Reference Design covering the environmental topics identified in Section 1.3 above, and compares the results with the conclusions of the 2008 ES (which were based on the 2007 Reference Design).

**3.2 Land Use**

**Changes to the Scheme Design Relevant to this Topic**

This section considers the effects on land uses resulting from the change in the reference design. With respect to this topic the key design changes are:

* The reduced development footprint in the vicinity of the runway including Dry Gut and Prosperous Bay Plain
* The removal of the access road to running from Woody Ridge to Sharks Valley.
* The increase in the development footprint for the Fisher’s Valley Water supply for the purpose of:
  + A pumping station to extract water
  + An above ground pipeline from the pumping station to the airport
  + An upgraded road in Fisher’s Valley to provide access to the pumping station during construction and for its long term maintenance
  + An electricity supply running from Longwood to the pumping station
* A small additional area of land at the contractor’s compound near Government Garage

**Description of Existing Conditions in the Extended ADAB at Fisher’s Valley**

The main land use category found within Fisher’s Valley is pasture, with much of the valley split into paddocks and used as grazing land for cattle. However, other land use categories are present within, and in the immediate surrounds of Fisher’s Valley and each of these are briefly described below. Land use categories used in this Addendum correspond with those used within the 2008 ES (see Volume 2, Section 5). Photographs of Fisher’s Valley are provided in Sections 3.5 and 3.7 below.

*Residential - All types of residential property including adjacent garden land*

The upper part of Fisher’s Valley is occupied by a group of properties on an unmetalled track above Winegrove, north of Bonfire Ridge. Further north, additional properties are present on the road to Longwood, approximately 300m to the northwest of the valley floor. Disused properties, such as Willow Bank, Teutonic Hall and a former swimming pool, are situated at the head of the valley.

*Pasture & Arable - All land which supports grazing livestock & All land which is used for crop production*

In its lower part, from Winegrove eastwards to Cook’s Bridge, the valley floor is flatter and broader, with a swathe of wet pasture approximately 50 – 100m wide. This area is used for cattle grazing and a small amount of market gardening. These parcels of land are managed under a 20-year licence from the Agriculture & Natural Resources Department (ANRD) by a syndicate of cattle owners. There are five cattle owners, each with three cattle and one bull to serve all the cattle. The cattle get all their water from the stream and there is no piped supply.

The grassland is divided into 6 paddocks totalling 14.16 acres. A two-year rolling management plan is attached to the licence that sets out an agreed programme of how the land will be managed. Part of the land management agreement sets out protocols for removal of invasive plant species wild mango (Schinus terebinthifolius). The western fence line has already been cleared in preparation for the construction of a drainage channel to take surface water runoff from the road and eroded valley slopes to prevent flooding of the pasture.

*Woodland Scrub* - The western extent of Fisher’s Valley, to the east of Bonfire Ridge, comprises a relatively narrow corridor, with dense woodland on both sides of the existing access track.

*Rough Ground* - Land which is not utilised, including ground which has been colonised by plant material as well as arid and eroded ground, was previously termed as Crown Waste. This term has since been changed and where it is owned by SHG is termed Coastal Zone’. Much of the land either side of the existing access track through Fisher’s Valley primarily consists of eroded rough ground, with pockets colonised by invasive species.

*Future Land Use -* A small area of land between the pastoral paddocks and Cook’s Bridge is unmanaged and has become colonised by invasive wild mango. It is the intention of the ANRD that this area be cleared of wild mango and fenced to provide an additional paddock for the syndicate. In addition, the eastern fence is proposed to be cleared of invasive wild mango in preparation for the construction of a drainage channel to take surface water runoff from the road and eroded valley slopes to prevent flooding of the pasture.

**Potential Effects of Changes to Reference Design**

Potential effects resulting from the installation of overhead line, water supply works and upgraded access road through Fisher’s Valley during both construction and operation are summarised below.

*Construction*

The majority of potential impacts on land use relate to temporary land take associated with the construction works to install the overhead line, water supply and upgrade the access track. As such, construction activities may result in temporary reduction in available pasture for cattle grazing.

During construction there is the potential for short term, temporary disturbance on residents in Longwood during the installation of the power supply.

The contractor’s compound near Government Garage has been slightly increased in size and this lies in an area of rough ground within the Coastal Zone.

*Permanent and Operational*

Based on available information, no privately owned land is permanently required by the development; all land permanently required is owned by St Helena Government and, as such, impacts are likely to be neutral. However, the precise location of the poles for the overhead line is not known at this time. There may be additional permanent impacts resulting from the loss of function of land use, including the loss of pasture land for land required to improve and upgrade the existing access track. Along the route Fisher’s Valley a small number of areas of woodland scrub would be permanently cleared.

There will be a reduction in the land take from Prosperous Bay Plain and Dry Gut (Crown Waste).

**Additional Mitigation Required**

The mitigation identified in the ES should be applied to Fisher’s Valley. Mitigation will ensure that fields remain accessible, functional and viable. Where fields including drainage or irrigation systems are temporarily affected by construction works they will be reinstated to their original condition to ensure and enable continued future farming practices. As such, impacts relating to temporary loss of pastoral land are anticipated to be minor adverse.

Land temporarily affected by construction including all work sites, compounds, lay down areas and camps will be reinstated to its original condition. Implementation of the mitigation measures described relating specifically to land use will ensure the residual impacts resulting from temporary land take are considered to be neutral.

**Land Use: Comparison of 2007 and 2011 Reference Designs and Summary of Effects**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Location** | **Residual Effect from 2007 Reference Design** | **Potential Effects of 2011 Reference Design** | **Additional Mitigation Required** | **Residual Effect from 2011 Reference Design** |
| Sharks Valley/ Woody Ridge | Temporary Minor Adverse Effects resulting from land take at Woody Ridge to provide access to Sharks Valley | None. Access no longer part of reference design. | None | Change from Temporary Minor to **No Effect**. |
| Prosperous Bay Plain and Dry Gut | Minor Adverse | None. Reduced area of landtake. | None | Remains **Minor Adverse** |
| Compound near Government Garage | Minor adverse but most of land take is temporary. | Small additional area of land take (not privately owned) | Generic measures outlined in EMP will apply. | Remains **Minor Adverse** |
| Fisher’s Valley | None. Area was not part of original design. | Temporary loss or disruption to land use/ pastoral land | Design will ensure loss of land kept to a minimum and access maintained. Fully restore land after works completion. | Temporary **Minor Adverse** |
| Permanent loss of pastoral land and other land take. | Design will ensure loss of land kept to a minimum and access maintained. | **Minor Adverse** |

**3.3 Noise and Vibration**

**Introduction and Relevant Changes to the Scheme Design**

The design changes of most relevance to this topic are:

* The reduced runway length will result in the use of a different (and slightly smaller) aircraft (a Boeing 737-700W instead of a Boeing 737-800, or its equivalent).
* An increase in the number of flights (See 2.7 above) resulting from the use of a smaller aircraft with fewer seats.

In addition, the following will be briefly considered:

* Additional works in Fisher’s Valley

**Description of Existing Conditions in the Extended ADAB at Fisher’s Valley**

The land uses in Fisher’s Valley are described in Section 3.2 above. During construction of the water supply (including power supply), the only additional areas potentially affected are dwellings at Longwood. Dwellings at Woody Ridge would no longer be affected by the proposed access improvements to Sharks Valley.

**Potential Effects of Changes to Reference Design**

*Construction*

The noise impacts on Sharks Valley had previously been assessed as negligible due to their short duration and the limited scale of works. The works in Fisher’s Valley are of a similar nature and the effects on properties are also considered to be negligible.

*Operation*

The original ES concluded that the operational effects resulting from airborne aircraft would be negligible as a result of the very low frequency of flights and the location of the flight paths which avoid flying over residents and other sensitive receptors.

The smaller 737-700W aircraft will be slightly quieter than the 737-800 aircraft on take-off and have a similar noise level on landing. The increase in the number of flights is not considered to be sufficient to change the results of the original assessment. The 2008 ES concluded that even in future years when there would be one flight per day, the overall effects would be negligible. The conclusion stated in the original ES remains unchanged.

**Additional Mitigation Required**

The standard conditions set out in the EMP should be applied. No additional mitigation is required.

**Noise and Vibration: Comparison of 2007 and 2011 Reference Designs and Summary of Effects**

| **Location** | **Residual Effect from 2007 Reference Design** | **Potential Effects of 2011 Reference Design** | **Additional Mitigation Required** | **Residual Effect from 2011 Reference Design** |
| --- | --- | --- | --- | --- |
| Construction Works in Fisher’s Valley | Not assessed | Noise associated with installation activities. These will be short term and temporary. | Standard conditions set out in EMP including good plant maintenance and restrictions on working hours. | **Negligible**. |
| Prosperous Bay Plain and aircraft flight path | Noise from landings, take-offs and flyovers were assessed as Negligible. | Smaller aircraft will have slightly less noise but increase in flights will increase noise slightly. Overall remains negligible effect. | No additional mitigation required. | Remains **Negligible**. |
|  | Aircraft noise affecting birds assessed as Minor adverse. | No change in assessment. | No additional mitigation required. | Remains **Minor Adverse**. |
|  | Noise from general apron operations | No change in assessment | No additional mitigation required. | Remains **Negligible** |
|  | Noise from passenger and vehicle traffic | No change in assessment | No additional mitigation required. | Remains **Negligible** |

**3.4 Air Quality, Dust and Carbon Emissions**

**Changes to the Scheme Design Relevant to this Topic**

The Design changes of most relevance to this topic will occur during the operation of the airport:

* The reduced runway length will result in the use of a different (and slight smaller) aircraft (a Boeing 737-700W instead of a Boeing 737-800, or its equivalent)
* The smaller number of passengers per flight will mean an increase in the number of flights per annum.
* In addition the following will be considered with respect to construction:
  + Reduced earthworks in the vicinity of the airport
  + Additional works in Fisher’s Valley

A calculation of carbon emissions from aircraft is provided in Appendix A. (Notably, only emissions of the key greenhouse gas carbon dioxide (CO2) were considered in detail; emissions of other greenhouse gases, such as methane and nitrogen oxides, have not been considered (CO2 is frequently used as a proxy for all greenhouse gases, assessing the scenarios in this way provided a robust basis for comparisons to be made). A Wind Modelling Study to inform the dust assessment has been updated and is included in Appendix B1.

**Description of Existing Conditions in the Extended ADAB at Fisher’s Valley**

The existing conditions described in the 2008 ES for other parts of the study area are similar to those in Fisher’s Valley. No air quality monitoring has been undertaken on St Helena but given its lack of pollution sources air quality is considered to be very good.

**Potential Effects of Changes to Reference Design**

*Construction*

The 2008 ES considered potential impacts to air quality that may arise as a result of the construction and operation of the proposed airport development and its supporting infrastructure. Potential impacts on local air quality during the key phases of construction were described, and were mainly associated with dust generating activities, such as the construction of wharfs, quarrying, and construction of the runway (including earthworks). Once the construction works are complete potential impacts were identified and described, such as emissions from aircraft and ancillary vehicles.

The 2008 ES concluded that the residual effects of greatest concern were all predicted due to activities impacting upon the sensitive ecosystems of Prosperous Bay Plain. Effective mitigation measures for activities elsewhere were predicted to be capable of minimising the predicted impacts to minor adverse. Dust generating activities on Prosperous Bay Plain will occur over a long period of time, the area is dry and dusty with little vegetation, the sensitive ecosystems are dust-sensitive, it is exposed to the strong prevailing south-easterly winds, and the water required for dust suppression may be scarce. In addition, permanent changes to the topography of the Central Basin were concluded to potentially result in long-term dust impacts.

A shorter runway would involve a decrease in the amount of cut and fill during construction which would result in a less significant adverse dust impact; nevertheless the residual impact would still be of concern due to the reasons summarised above and in the 2008 ES. The shorter runway would also be higher than the original proposal assessed in the ES. Less of the landform sheltering the basin from winds would need to be removed and as such this would reduce the wind effects across the Central Basin area, and hence result in less dust impact once built (see Appendix B1 for the results of the Wind Modelling Study). A shorter runway is also likely to reduce the duration of the construction phases, and hence reduce the duration of adverse impacts in several of the areas, including Rupert’s Bay.

*Permanent and Operational*

A shorter runway will necessitate the use of smaller aircraft, capable of carrying fewer passengers and less freight. Consequently, the balance of road traffic during the operational phase of the airport will change. The movement of passengers to and from the airport will be more frequent but there will be fewer passengers to transport each time. This is not considered to be a significant impact in terms of local air quality.

Despite the shorter runway resulting in overall greater CO2 emissions than the original longer runway, CO2 emissions during the first years after opening the airport would be lower than those emitted by the RMS St Helena, at least on a per passenger and per trip basis. However, in the longer term CO2 emissions will increase and be greater than that calculated for the 737-800 aircraft, although the number of aircraft flights will remain very small (see Section 2.7 above). More detailed information is provided in Appendix A.

**Additional Mitigation Required**

With respect to dust the generic mitigation measures identified in the EMP will be applied. No further mitigation is necessary.

With respect to carbon emissions, the St Helena Government and DFID are exploring opportunities for research into the feasibility of carbon offsetting on St Helena. Whilst no terms of reference have yet been agreed, any research is likely to examine the carbon absorption rates of Gumwood and similar species in order to develop a carbon offsetting programme. The research could also consider how carbon offsetting might be linked to eco-tourism in order to secure funding to support the restoration of native dryland habitats through projects like the Millennium Forest.

**Air Quality, Dust and Carbon Emissions: Comparison of 2007 and 2011 Reference Designs and Summary of Effects**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Location** | **Residual Effect from 2007 Reference Design** | **Potential Effects of 2011 Reference Design** | **Additional Mitigation Required** | **Residual Effect from 2011 Reference Design** |
| Prosperous Bay Plain/ Central Basin | Construction phase effects associated with dust were assessed as Minor negative. | Potential for slight reduction in amount and duration of dust due to reduced earthworks. | No additional mitigation required. | Remains **Minor Adverse.** See Section 3.5 for ecological effects. |
| Fisher’s Valley | Not assessed | Negligible effects associated with installation. | No additional mitigation required | **Negligible** |
| Global effects of green house gas emissions | In longer term carbon emissions would be greater compared with the RMS. | Carbon emissions will be slightly greater than the 2007 reference design. | No additional mitigation required | Assessment conclusions remain unchanged. **Potentially significant in long term**. |

**3.5 Terrestrial Ecology and Nature Conservation**

**Introduction and Relevant Changes to the Scheme Design**

The changes to the scheme design of greatest relevance to this topic are:

* The inclusion of additional water supply works in Fisher’s Valley. The scheme components consist of a borehole, a pipeline, an upgraded access track and an overhead electricity line running from Longwood to the borehole;
* The reduction in the footprint of the airport at Prosperous Bay Plain and at Dry Gut; and
* The removal of the access road from Woody Ridge to Sharks Valley.

To assist with the ecological impact assessment an additional wind modelling study was undertaken. The full report is included in Appendix B1 to this Addendum and summarised in the assessment below. A vegetation survey was carried out – the results are presented in Appendix B2. This section should also be read with reference to Figures 6, 7 and 8.

**Description of Existing Conditions in Extended ADAB at Fisher’s Valley**

**Protected Areas**

*Important Bird Area (IBA) Birdlife International*

Fisher’s Valley lies within the Important Bird Area (IBA) North East St Helena (STH003). The IBA is described as covering the north-eastern part of the island, north of the line linking Long Point in the south-east and Bank’s Point in the north-west, via Hutt’s Gate in the interior. It provides important habitat for the Wirebird (Charadrius sanctae-helenae) and Red-billed Tropicbird (Phaethon aethereus) (Sanders, (ed) 2006). An IBA is an internationally agreed priority for conservation action, containing key bird species that are vulnerable to global extinction or whose populations are otherwise irreplaceable.

*Ramsar*

In 2004 The UK Overseas Territories Conservation Forum (UKOTCF) was commissioned by Defra to review all existing and potential Ramsar sites in the Overseas Territories and Crown Dependencies. This formed part of a review of all the Ramsar sites in domestic UK and its associated territories. Ramsar Sites are Wetlands of International Importance under the Convention on Wetlands signed at the city of Ramsar, Iran in 1971.

As a result of his assessment, Dr Mike Pienkowski prepared draft Ramsar Information Sheets for three potential sites identified on St Helena:

* St Helena Central Peaks;
* St Helena inland waters, stacks and cliffs; and
* Fisher’s Valley.

A map of the proposed area is shown on Figure 7. To date, no progress has been made to secure designation of the proposed sites, however, they were given recognition within the Land Development Control Plan (LDCP, section 14.6) to which planning policy C.N.3 applies. This assessment treats the area as having an enhanced level of protection.

*C.N.3 Any application involving land in the possible Wetlands of International Importance will be referred to the Environmental Co-ordinator for advice as to whether or not the application would significantly affect the ecological, geological or marine-biological interest of the area. The* [Land Planning and Development Control] *Agency will take account of this advice in coming to a decision.*

In the case of Fisher’s valley the LDCP also states:

*“There are some complications due to the proximity of the airport and related development. Considerable work is needed on this proposal but the importance of the area should be noted in respect of considerations of potential developments in this area.”*

It is anticipated that progress to formalise the status of St Helena’s protected areas will be made in the context of the current (2011) revision of the LDCP.

**Habitats and Vegetation**

*Habitats*

The land under assessment belongs to the St Helena Government. Land parcels 123 and 38 Longwood South are managed, under a 20-year licence from the Agriculture & Natural Resources Department (ANRD), by a syndicate of cattle owners. There are five cattle owners, each with three cattle and one bull to serve all the cattle. The cattle get all their water from the stream and there is no piped supply.

The grassland is currently divided into 3 paddocks. A two-year rolling management plan is attached to the licence that sets out an agreed programme of how the land will be managed. It is currently in its first year of implementation. Under the current management plan wild mango (*Schinus terebinthifolius*) has been cleared along the northern fence line in preparation for the construction of a drainage channel to take surface water run off from the road and eroded valley slopes to prevent flooding of the pasture. Wild mango is an alien invasive species that is a rampant invader choking the island’s coastal watercourses and spreading across arid areas. Further removal of wild mango from the southern fence line is planned in the second year.

A small area lying between paddock 1 and Cook’s Bridge is currently unmanaged (photo 3.5.1). It has a small amount of grass and a higher density of wild mango, and other woody species including *Eucalyptus sp*., and salt bush (*Attriplex nummularia*). It is the intention of the ANRD that this area will be cleared of wild mango and other scrub and fenced to provide an additional paddock for the syndicate. This could take place under year two of the management agreement.

Following land clearance a drainage ditch will be cut, running from approximately the area of the test bore hole (SK9) to Cook’s Bridge. The ditch will run along the length of the northern fence line before dovetailing into Cook’s Bridge where the drain underneath the bridge will be reinstated.

There is no active management of the wetland downstream of Cook’s Bridge. There was no stream flow observed at Cook’s Bridge on the first visit (30/12/10). However, on the third visit (8/2/11) there was a considerable flow of water across the road (photograph 3.5.2).

The test borehole area is located within an area of wet pasture and marshland. Fisher’s Valley is “virtually the only stream valley in St Helena which retains wet conditions and green vegetation throughout its length” Pienkowski (2004). It is one of only five perennial streams, radiating out from the high central ridge. A small expanse of marsh (approx 100m x 20m) is situated within paddock 2, within approx 50m of the test bore hole (SK9) (photograph 3.5.3). An area of marshy wetland dominated by thatching grass (*Pennisetum macrourum*) and wild mango extends from Cook’s Bridge into the deep canyon system that extends to Prosperous Bay.

*Plantlife*

The wetland of Fisher’s Valley is of some botanical and ecological interest. Following his survey of the vegetation of the island, botanist Phil Lambdon considers it to be “the best we have left, and even though it's got quite a lot of aliens in it, at least there is potential for restoration here.”

The vegetation making up the wetland area contains a rare example of man-made habitat that support indigenous and endemic species. Non-natives, including those considered to be alien invasive species, dominate the vegetation. However it also contains plant communities considered to have ecological value such as the *Isolepis prolifer*, *Cyperus laevigatus* and *Apium graveolens* community and represents the best semi-native wetland assemblage present on St Helena.

**Protected Species**

*General*

The valley bottom has been described as providing an important drinking and bathing area for birds, including the endemic Wirebird (*Charadrius sanctaehelenae*), indigenous moorhen (*Gallinula chloropus*) and other species such as the naturalised partridges (Pienkowski, 2004).

*Moorhen (Gallinula chloropus)*

In world terms, the St Helena Moorhens are not particularly significant, but as they are (almost certainly) indigenous, they are of potential local significance as they could differ genetically from the source colonisers (Prater, pers com). The moorhen probably became established on the island by chance after the arrival of man, when changes to the native vegetation structure and extinction of endemic rails created suitable habitat conditions (Rowlands et al.1998, McCulloch, 2004). They are most closely associated with the Madagascar or black yam (Colocasia sp.) that became established in valley bottoms (Rowlands et al.1998).

The moorhen is a very shy secretive bird. Little is known about its current population status on St Helena. Comparison of historical and recent records of sightings together with an observed decline in suitable habitat indicates that the population is likely to be in decline (McCulloch pers com., Beard, pers com). A full description of historical sightings can be found in Rowlands et al. (1998). In the last 10 years moorhens have been recorded in Fisher’s Valley, Sandy Bay, Spring Gut and Harpers Dam (EPD Dec 2010 summary of moorhen sightings). Descriptions from Rowlands et al. (1998) and McCulloch (2004) indicate that the population in Fisher’s Valley has declined.

The current conditions in the paddock adjacent to test bore hole SK9 provide suitable habitat, a dense stand of black yam with thatching grass over flowing water bordered by wet open grassland. This habitat type is now very rare on St Helena as vegetation around guts and wet valleys has increased making habitats unsuitable. The massive growth of woody scrub (notably wild mango at both Sandy Bay and Fisher's Valley) may also have made them harder to see and reduced numbers.  Predation could also be a factor in the decline. Cat prints were observed in the study area and rats may take eggs, although they are on the large size for a rat. Whether these are significant predators is not known.

*The St Helena Wirebird (Charadrius sanctaehelenae)*

Wirebirds are regularly recorded in Fisher’s Valley but numbers are generally low. Larger numbers of Wirebirds do occasionally occur there but these are temporary aggregations of non-breeders, predominantly sub-adults.

**Table 3.5.1. Summary of the Wirebird Census Database**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1988/89 | 2000/01 | 05/  06 | 06/  07 | 2008 | 2009 | 2010 |
| Fisher's Valley | 2 | 2 | 2 | 0 | 0 | 3 | 7 |

 (Extract from the annual Wirebird census database)

The territories have always been located in the central, and probably driest, part of the valley - the lower cattle grazed paddocks at maximum distance from scrub cover but it is not known if they have successfully bred there. Part of the reason for the small number of Wirebirds could be that the valley is rather overgrown. The area is considered to be a feeding site for birds in the Prosperous Bay Plain and other areas - ringed birds from Prosperous Bay Plain, Bottom Woods and Deadwood have been observed here by Neil McCulloch and Annalea Beard. The area probably plays a part in the annual/diurnal cycle. This may have been more important when there were open areas of pooled water at Cook’s Bridge. Although he was never able to establish the full significance of Cook’s Bridge pools for the Wirebird populations in the vicinity, Neil McCulloch confirms that ‘*surface water is undoubtedly attractive to Wirebirds’* and that it serves *‘as a regular loafing area for notable numbers of immature birds with up to 20 being present at times’.*

*Invertebrates*

An invertebrate survey was not carried out as part of this study. Neil McCulloch did a limited invertebrate sampling exercise in the valley in 1999 when assessing invertebrate prey abundance for Wirebirds. The site held substantially fewer invertebrates than Deadwood Plain but was comparable to Broad Bottom and held more invertebrates than Man and Horse. Given that Fisher’s Valley has one of the few permanent flowing streams and the highest quality wetland on the island, it is likely that the Valley will contain invertebrates of conservation interest.

**Photo 3.5.1 Paddock 1**



**Photo 3.5.2 Water flow at Cook’s Bridge**



**Photo 3.5.3 Foreground lower section of Paddock 2**



**Photo 3.5.4 Moorhen habitat in Paddock 2**



**Potential Effects of Changes to Reference Design**

*Potential Effects of the Water Supply Proposals in Fisher’s Valley*

**Protected Areas**

*Important Bird Area (IBA) Birdlife International*

The key species determining designation are the St Helena Wirebird and Red-billed Tropicbird. As the proposals are not considered to affect the usage of the area by Wirebirds the IBA will not be detrimentally affected by the proposals.

*Ramsar*

The proposed Ramsar site contains one of the few perennial streams with a sizeable floodplain, and is therefore a scarce habitat type on the island. A change in the volume of stream flow has the potential to impact upon the rare wetland habitat in the upper valley, immediately downstream of SK9. As this is the most notable section of wetland, supporting important assemblages of indigenous and non-native plant communities and the indigenous Moorhen, the status of the area as a potential Ramsar wetland could be devalued.

**Habitats and Vegetation**

*Habitats*

A reduction in the volume of stream flow/surface water or the water table could result in a change in the distribution and abundance of plant species within the key wetland habitat. A reduction in flow could reduce the competitive advantage of the black yam and favour the spread of species, such as wild mango, that could change the nature of the habitat. Removal of wild mango under the syndicate management agreement supported by ANRD’s pasture improvement programme has potential to improve habitat conditions for the Wirebird. Additionally, reduction in the volume of trees from within and around the watercourse and improved management to prevent re-occurrence should reduce the amount of water uptake, improve stream flow, and reduce the rates of regeneration.

Any in-combination effect with the ANRD drainage scheme will need to be determined and action taken to remedy any adverse impact.

**Protected Species**

*Moorhen (Gallinula chloropus)*

Abstraction could potentially have a major adverse impact on the wetland habitat within Fisher’s Valley and consequently the moorhen. Moorhens require grass/relatively low emergents and open water and nest over water in cover.  They typically spend most time in and at the edge of emergent cover, and as such, a reduction in wetland habitat could adversely impact upon the habitat on which this species depends.  Fisher’s Valley is one of three main areas for this species on St Helena.

*The St Helena Wirebird (Charadrius sanctaehelenae)*

Abstraction is not considered to have a significant effect on the usage of Fisher’s Valley by Wirebirds. The major issue here is more likely to be maintaining sufficient grazing pressure to keep the grassland in appropriate condition for nesting and preventing scrub encroachment on the pastures. The ANRD pasture improvement programme with the removal of wild mango from the fenceline (year 1 the northern boundary, year 2 the southern boundary planned) and on the upper side of Cook’s Bridge is likely to be a benefit to Wirebirds. Increasing scrub will also, almost certainly, provide additional cover for predators. It is unlikely that any changes in hydrology of the valley would materially affect the availability of invertebrate prey for Wirebirds.

*Invertebrates*

Further survey work would be required to ascertain any potential impacts on invertebrates within Fisher’s Valley.

*Potential Effects of the Reduction in the footprint of the development at Prosperous Plain and Dry Gut*

The main effects relating to the reduction in the footprint of the development in Prosperous Bay Plain and Dry Gut are the direct impacts from the reduction of land-take and indirect impacts from topographical changes as a consequence of the change in landform on the Eastern Plateau.

**Direct impacts of the reduction in land-take**

*Invertebrates*

|  |  |  |
| --- | --- | --- |
| **Area/Location** | **2007 design (hectares)** | **2011 design (hectares)** |
| Approximate Area of ADAB in Central Basin (based on Ashmoles Dec 04 & proposed extensions = 70 hectares in total) | 14.22 | 8.11 |
| Approximate Area of ADAB in Prosperous Bay Plain and Dry Gut | 198 | 163 |

The reduction of the ADAB on the eastern side of the Central Basin, within an area of very high ecological value is a positive change resulting from the new design. Under the new design approximately 11% of the area will be lost to construction, compared to 20% under the 2007 design. The reduced footprint can be expected to reduce the area of habitat lost for invertebrates.

The number of sample sites (Ashmole & Ashmole, 2004), representing a set of habitats that will be at risk, which will be directly affected by the construction, remain the same. Sample sites 4, 6, 17 and 21 will be destroyed by the construction. Sample sites 2, 3, 7 and 12 will be immediately adjacent to the edge of re-graded or filled areas and so will still be directly affected by the construction. Site 22 is potentially at reduced risk of direct impact but is likely to be indirectly impacted by the change in topography. The other sites in the Central Basin will be subjected to a lower wind regime and the long-term consequences on the ecology are not known. Site 5 is immediately adjacent to the proposed contractor’s camp and temporary runway and will still be directly impacted. Table 9.5 (ES Volume 4 App 9 Terrestrial Ecology 9.1 Detailed Assessment) shows the endemic species recorded from these sites.

A reduction in the footprint of the runway in Dry Gut will reduce land take on the valley floor and on southern slope of Dry Gut and the adjacent landform east of Bencoolen. This could be expected to result in a reduction in loss of habitat for invertebrates. This could be beneficial for example for species like the generic endemic spider *Bonapruncinia sanctaehelenae*, which because of its rarity and highly restricted distribution is a species that is considered to be at serious risk from the development (Ashmole & Ashmole, 2004).

The change in landform created by the construction of the embankment will alter the environmental conditions in Dry Gut. Wind modelling (see Appendix B1) shows significantly reduced wind velocities in the valley west of the embankment. Sheltered from the prevailing south-easterly trade winds, precipitation and condensation patterns are likely to be affected. This change is expected to alter the ecological structure and function within Dry Gut. It is proposed that the formation of broad, level terraces on the sheltered western embankments of the embankment could be a positive way of capitalizing on this change when it was previously identified (ES Vol 4: Appendix 9.1) as possibly being the only strategy to mitigate for potential losses of fine dusty deposits in the Central Basin following lowering of the upwind landform for runway construction.

The intermittent watercourse draining south of Bencoolen into Dry Gut before it reaches Gill Point Waterfall will no longer be directly impacted by the construction of the embankment. Natural freshwater in the coastal zone is rare. Seasonal rainfall creates ephemeral watercourses, temporary pooling of water and damp muddy areas in guts and below waterfalls. These areas are potentially important for invertebrates, birds and plants. The creation of drainage and culverts to channel water will need to be managed to prevent the creation of artificial environments favouring non-native and predatory species.

*Wirebirds*

The impact on Wirebirds will not be materially affected by the reduction in footprint of the ADAB in PBP. Under the 2007 design, the construction was predicted to directly and indirectly impact upon 13-19 territories. Territory data for 2011 provided by Tony Prater (RSPB) and Gavin Ellick (SHNT) indicates that there are currently 18 territories in the area. This is a significant proportion (approx 10%) of the current island population estimate of 350. Annual Wirebird census data from the SHNT since 2007 provides a clear indication of the value of the PBP area as an internationally important site for Wirebirds, holding on average over 5% of the world population.

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. Enhancement of habitats for Wirebirds on agricultural land has been implemented under the Wirebird Mitigation Project. A management programme responding to monitoring data will be required to sustain the gains made.

Doctoral Research by Fiona Burns (not yet complete) indicates that without feral cat control Wirebird numbers, island-wide, are unlikely to remain stable in the long-term even with pasture or habitat improvements. Rats are a secondary nest predator. To achieve the ecological objectives of mitigation, predator control will be required as part of long term management programmes for Wirebird mitigation sites and areas of habitat restoration. Any control measures for cats will need to include provision to keep rats and mice under check, both for Wirebirds but also for the endemic invertebrates and plants.

**Table 3.5.2 Survey and Annual Wirebird census data for Prosperous Bay Plain**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Adult Wirebirds** | | | | | | | | |
| **Location** | 1988/89 | 2000  /01 | 2005/  06 | 2006/  07 | 2008 | 2009 | 2010 | 2011 | Long term % of population |
| **Prosperous Bay North** | 14 | 9 | 2 | 4 | 7 | 20 | 16 | 9 | 3 |
| **Upper Prosperous Bay** | 20 | 39 | 22 | 32 | 31 | 52 | 47 | 50 | 10.1 |
| **Prosperous Bay Plain** | 19 | 19 | 15 | 18 | 29 | 25 | 15 | 12 | 5.8 |
| **Island Totals** | 425 | 370 | 208 | 322 | 373 | 322 | 397 | 350 |  |

 (Extract from the SHNT annual Wirebird census database)

*Plantlife*

The rocky habitats of the seaward cliffs and edges are notable for the occasional colonies of tea plant (*Frankenia portulaceaefolia*) and scrubwood (*Commidendrum rugosum*), both categorised by the IUCN as vulnerable. Lichens, particularly the foliose species, are often abundant and luxuriant. A reduction in the footprint of the ADAB away from the seaward cliff edges has positive benefits for protecting important relict populations of vulnerable endemic flora.

*Indirect impact from changes in topography - Central Basin*

The key issue with the original design was that the changes to the landform on the Plain would mean that the Central Basin would not really be a basin anymore, so that major changes in habitats within it were likely. The modelling results for the 2011 design (see Appendix B1) suggest that on average wind velocities will be generally lower in the proposed case by approximately 25% than in the existing case. The magnitude of this change is also significant. The primary reason for the decreased wind velocities shown in the model is that the construction of the runway has created a lip around its perimeter. This sudden rise in terrain is directly adjacent to the Central Basin and when modelled causes the wind to be deflected upwards just before it enters the area. Therefore at ground level, the wind velocities are seen to decrease. It was noted that the gradient of the Central Basin land also slopes away from the proposed runway, further increasing the effect of the calmer region being caused by the rise. The actual wind velocities experienced will vary with the regional wind velocity.

There is a wide variety of habitats within the Central Basin but it is the deep accumulation of dust and grit that is the main feature of the basin environment. Survey work carried out by Ashmole & Ashmole (2004) indicates that different habitats favour different species. However it is not possible to adequately predict the effect of the changes to be caused by the construction because little is known of the specific habitat requirements of the most significant species. The Central Basin has formed over several million years, sometimes under significantly differing wind regimes. If we consider that conditions are relatively stable at present and the animals are adapted to these, then the significant change in topography and consequently average wind speeds, as predicted by the wind model, should be considered to be Major adverse and attempts should be made to minimise the change.

*Potential Effects of the Removal of the Access to Sharks Valley Water Supply*

No significant ecological impacts were anticipated in the construction of the access to Sharks Valley water supply.

**Additional Mitigation Required**

*Fisher’s Valley*

Due to the inclusion of an additional area at Fisher’s Valley and the potential for water abstraction at this site, additional mitigation measures will be required to be adopted to reduce potential adverse impacts on ecology. Further assessment of the effects of ground water abstraction on stream flow will be required. This should include impacts of abstraction higher in the catchment and the consideration of alternative sites. A mitigation strategy for Fisher’s Valley will be incorporated into the Landscape and Ecology Mitigation Plan (LEMP) to maintain the nature conservation value of the areas as a wetland. Mitigation measures will include but will not be limited to the following:

* The feasibility of implementing flow management techniques to mitigate the effects on wetland habitats will be investigated and suitable techniques will need to be implemented.
* Setting of abstraction limits and monitoring to inform responsive management;
* Evaluation of in-combination effects with the ANRD drainage channel;
* Integrating wetland management requirements into ANRD/syndicate pasture management;
* Clearance of wild mango and other invasive species from the Fisher’s Valley watercourse;
* Planting of gumwood and ebony along Fisher’s Valley and particularly around the structures associated with the abstraction point (borehole and control kiosk); and
* Further survey work on invertebrates to inform the design of the mitigation strategy.

*PBP and Dry Gut*

There is an opportunity during detailed design for the Contractor to consider whether the slope of the bank can be modelled to create conditions in the Central Basin more closely resembling present conditions.

The design of the drainage and culvert for the embankment in Dry Gut will minimize adverse effects on the hydrology, quality, geomorphology and ecology of the surface water in and draining into Dry Gut.

**Terrestrial Ecology and Nature Conservation: Comparison of 2007 and 2011 Reference Designs and Summary of Effects**

| **Location** | **Residual Effect from 2007 Reference Design** | **Potential Effects of 2011 Reference Design** | **Additional Mitigation Required** | **Residual Effect from 2011 Reference Design** |
| --- | --- | --- | --- | --- |
| PBP, including Eastern Plateau, site for the main airport, the Central Basin and Dry Gut | Very large adverse to Large adverse depending on scale of land-take for construction and success of mitigation. | Effects are as those stated for the 2008 ES but with a reduced amount of land take and potentially greater protection from wind. Potentially a Very large adverse impact | Mitigation as for 2008 ES but with modifications reflecting the changes in design. | Success of mitigation is uncertain. Therefore assessed as being between **Large Adverse to Moderate** adverse depending on success of mitigation |
| Fisher’s Valley  Key Sub-Receptors: wetland habitat for indigenous Moorhen, plants and invertebrates and the Wirebird  Ecological Interest considered High value | Not assessed | Potentially a **Large adverse** impact but this could change in the light of full information. | Further assessment of the effects of ground water abstraction on stream flow is needed.  A mitigation strategy will need to be put in place to maintain the nature conservation value of the area as a wetland. | There is a level of uncertainty with regards full understanding of the impacts on stream flow and the ecological structure and function of the wetland.  Ecological impacts at Fishers are therefore assessed as being between **Major adverse to minor adverse** depending on full information and success of mitigation. |
| Sharks Valley/ Woody Ridge | Access works not assessed as having significant effects. Minor Adverse | Access works removed from reference design | None required. | **No Effect** |

**3.6 Landscape and Visual Amenity**

**Introduction and Relevant Changes to the Scheme Design**

This section considers the effects on landscape character and visual amenity and how the 2011 Reference Design has the potential to change the effects assessed previously in the Environmental Statement. The landscape and visual impact assessment is contained in Volume 4: Appendix 10.1 of the Environmental Statement.

In order to inform this comparative appraisal, the Zones of Theoretical Visibility (ZTV) have been re-run to reflect the 2011 Reference Design. Two of the original photomontages have also been re-produced to reflect the revised design from two of the closest viewpoints to the airfield (Viewpoint 8 (Prosperous Bay Signal Station) and Viewpoint 9 (Dry Gut).

The changes in the scheme design are related to the change in the footprint of the development as defined by the ADAB (Figure 1). In summary these include the following elements:

* Reduced footprint (ADAB) in the vicinity of the runway including Dry Gut and Prosperous Bay Plain (PBP);
* Increase in finished airfield elevation as a result of reduced airfield footprint;
* Reduced footprint for the access to Sharks Valley water supply;
* Increase in footprint for the Fisher’s Valley water supply (operation only) for the purpose of:
  + Extraction
  + Above ground pipeline
  + Upgraded access track
  + Electricity supply (overhead line on wooden poles)
  + Water storage tanks

**Description of Existing Conditions in Extended ADAB in Fisher’s Valley**

***Landscape Character***

The extended ADAB in Fisher’s Valley lies within Landscape Character Area (LCA) 4 – Longwood, LCA 5 – eroded slopes with extensive gulley systems and LCA 12 – upper slopes covered in flax and woodland planting interspersed with settlements. These character areas are described in full in Volume 4: Appendix 10.1 and illustrated in Volume 3: Figure 10.2. The key characteristics of these LCAs are also summarised below.

*LCA 4 – Longwood*

Longwood is one of the larger communities on St Helena and has spread from its historic core centred on Longwood Avenue. Longwood Gate defines the western entrance to the settlement and is flanked by two gate houses with distinctive yellow gate piers. Residential development extends from the central, historic core to the north around Mulberry Gut and Longwood Farm, south along Longwood Hangings and east to Bottom Woods where the properties form the eastern built edge. Landform generally defines the built edge although individual properties continue to be built on the steeper and often eroded slopes particularly along the upper reaches of Fisher’s Valley. Views are particularly expansive however, from the peripheral areas of Longwood and extend east towards PBP and north to the dramatic landforms of The Barn and Flagstaff Hill.

*LCA 5 – Eroded Slopes with extensive gully systems*

This area is characterised by extensive, eroded slopes and deeply incised valleys where the weathered rock has resulted in the formation of colourful substrates. The landform across this area is typical of the effects of a highly eroded and consequently folded topography. Although the amount of bare ground is variable throughout the area, vegetation is generally limited to the more invasive species such as creeper, prickly pear (Opuntia vulgaris), Wild Pepper (Cluytia pulchella), English aloe (Furcraea gigantean) and wild coffee (Chrysanthemoides monilifera) which are abundant in the guts, eroded gullies and exposed valley sides. A variety of forestry and other dryland species have also been planted to control erosion such as Acacia longifolia with Mimosa acacia which are also regenerating successfully on the upper, more densely vegetated slopes. The valley floors often contain fine soil and dust resulting in a greater density of vegetation, largely due to the intermittent water which flows along the ephemeral watercourses. The apparent lushness of the vegetation in such areas contrasts sharply with the eroded valley sides. This character area is largely uninhabited with the exception of the occasional property, building or road. There is a sense of wildness about this landscape which is accentuated by the changing weather conditions which have a strong bearing on the experience and perception of this landscape.

*LCA 12 - Upper Slopes covered by flax and woodland planting interspersed with settlements*

This area is characterised by the more central, steep sided slopes which rise towards the high peaks in the centre of the island. Deeply incised valleys are typical of this landscape and with the exception of the outer peripheral areas which are more sparsely vegetated with creeper and Opuntia scrub the majority of the area is covered by a dense swathe of New Zealand flax (Phormium tenax) and Eucalyptus dominated woodland. The upper flax covered slopes are generally more stable and less prone to erosion which contrasts with the more eroded outer slopes where bare ground is dominant and vegetation cover is marginal. Woody Ridge forms a prominent projection of pastoral land and contrasts with the adjacent, more heavily eroded slopes. Silver Hill and Level Wood form the two main communities in the area, where typically single storey properties sit along the ridgelines or upper slopes. The Peaks create a strong focus and backdrop to views although the majority of properties are orientated towards the sea to maximise the panoramic views which extend east to the arid area of Prosperous Bay Plain and the dramatic landforms which punctuate the skyline including Great and Little Stone Tops and The Barn.

***Visual Amenity***

Receptors with the potential to experience views of the works associated with the extended ADAB in Fisher’s Valley include the following:

* Dwellings and buildings within Longwood, Longwood Hangings, Bottom Woods, Government Garage at Bradleys;
* Residential properties to the east of the Devil’s Punch Bowl and some properties in Level Wood, Silver Hill and Woody Ridge;
* Public open space and recreational facilities used by residents and visitors including Longwood golf course and The Millennium Forest;
* Views from The Barn, Great Stone Top and Prosperous Bay Signal Station (accessed by post box walk paths; and
* Users of Fisher’s Valley footpath and the upper sections of the post box walks to King and Queen Rocks (Prosperous Bay Signal Station), Prosperous Bay and Gill Point which share the same section of route from Bradleys descending towards the PBP area.

**Potential Effects of Changes to Reference Design**

***Construction Effects***

The residual construction effects on landscape character associated with the construction activities or reduction in extent of them associated with the 2011 Reference Design are discussed below in respect to the affected Landscape Character Areas. Similarly the residual construction effects on visual amenity are discussed in respect to visual receptors (views from buildings, outdoor locations and footpaths). The revised ZTVs for construction have been used to inform the appraisal and are presented on Figures 9.1 – 9.8.

***Residual Construction Effects on Landscape Character***

*Reduction of the ADAB at PBP and Dry Gut (LCAs 6 and 8 respectively)*

The revised ADAB in the vicinity of the runway will result in a slightly reduced earthworks footprint at PBP. However, given the scale of construction activity proposed on PBP it is not considered that the reduced footprint would materially reduce the previous assessment of a Major Adverse impact during construction on LCA 6. Similarly, whilst the reduction in extent of earthworks in Dry Gut will reduce the extent of construction activity, the scale of the construction works required will be such that the magnitude of change will remain high. The works will remain out of scale with the deeply incised valley system where high scenic quality and wild land characteristics are key features. This character area will remain substantially affected by the construction activity despite the reduced area of works. Major Adverse impacts on both landscape character Areas 6 and 8 will remain.

*Reduction in ADAB associated with the access to Sharks Valley water supply (LCA5, LCA10 and LCA12)*

The revised ADAB will result in the removal of the requirement for the upgrading of access tracks and the construction of an overhead electricity line previously associated with the water supply in Sharks Valley. Previously a Minor Adverse impact was assessed on LCAs 5 and 12 and Moderate Adverse for LCA10 due to the construction of these components. Whilst the ADAB removes these components from the character areas, the remaining elements of infrastructure associated with the water supply will remain in LCAs 5 and 10. Consequently there will be no change in impact previously assessed for LCA 5 and 10 with no direct residual effect on LCA12 due to the reduced ADAB.

*Increase in ADAB associated with the Fisher’s Valley water supply (LCA4, LCA5 and LCA12)*

The construction phase works associated with the Fisher’s Valley water supply will involve the construction of the borehole, control kiosk, power supply and telemetry (above ground on concrete piers as far as Cook’s Bridge), overhead electricity line (OHL) from the borehole to Longwood and an access track from the haul road at Cook’s Bridge to the borehole.

In addition to the effects outlined in the ES, the construction of the overhead electricity line will result in a direct effect to a peripheral section of LCAs 4 and 12. The construction of the OHL will result in the possible loss of a swathe of woodland and scrub planting along the OHL corridor rising from the valley floor to the boundaries of properties on Longwood Hangings. The ES considered that the impacts during construction associated with LCA 5 would be Moderate Adverse and for LCA 12, Minor Adverse for localised sections of these character areas. The additional construction activity associated with the OHL for the Fisher’s Valley water supply is not considered to further increase the level of impact previously assessed although it will affect peripheral parts of these character areas which were previously un-affected by the construction works thereby extending the influence of the construction works.

Construction effects on LCA 5 were previously assessed as being Moderate Adverse due to the various construction activities associated with the haul road, construction compounds, temporary airstrip and Remote Obstacle Lighting. The additional construction works associated with the Fisher’s Valley water supply will extend the area of influence of construction activity within the character area, However, it is not considered that the additional construction works associated with the water supply will worsen the affects previously assessed in the ES of Moderate Adverse.

***Residual Construction Effects on Visual Amenity***

*Reduction of the ADAB at PBP and Dry Gut*

The reduction in the ADAB at PBP and Dry Gut has had the resultant effect that the overall elevation of the airfield has increased by 4.8m. This increase in elevation has meant that some areas of land which previously had no view of the works, now will. When comparing the ZTVs produced for the LVIA in the ES with Figure 9.7 in this Addendum, it is apparent however, that this change in extent of visibililty is not particularly pronounced and that the areas which will be newly affected do not include new visual receptors (views from buildings, outdoor locations, scenic vantage points or footpaths).

In conclusion there are no new principal receptors with views of the construction works associated with PBP or Dry Gut and therefore the affects previously considered for all the previous receptors assessed with views of this area will remain unchanged.

*Reduction in ADAB associated with the access to Sharks Valley water supply*

The reduction in ADAB associated with the removal of the access track and overhead line power supply to facilitate the Sharks Valley water supply will mean that residential properties in Level Wood, Silver Hill and Woody Ridge who previously had views of these components no longer will. It should be noted, however, that, these receptors will continue to experience views of the wider airfield construction activity and consequently the overall impacts previously assessed of Minor Adverse will not change despite the reduction in the ADAB in the upper part of Sharks Valley.

Walkers on the Post Box walk along Sharks Valley were previously assessed as experiencing Moderate adverse impacts during construction for short localised sections of the route. Whilst there will be benefit for walkers in the upper sections of the Post Box walk where the access track and overhead line works will no longer intrude into the view, the lower sections of the route will remain affected due to the construction works associated with the remaining infrastructure of the water supply. Overall the effects are not considered to change with Moderate Adverse affects remaining for short sections of the walk.

*Increase in ADAB associated with the Fisher’s Valley water supply*

Residential properties in Longwood Hangings will experience immediate, foreground views of the construction of the overhead electricity line resulting in Moderate Adverse impacts depending on the orientation of their outlook. Similarly walkers along Fisher’s Valley footpath will experience immediate, foreground views of the construction works associated with the water supply. Moderate Adverse impacts will be experienced by walkers along the entire section of the footpath between Longwood and Cook’s Bridge.

The visual effects for the remaining receptors listed above (under ‘Description of Existing Conditions in Extended ADAB in Fisher’s Valley - Visual Amenity’) will remain unchanged despite the additional works in Fisher’s Valley due to the extent of construction activity associated with the wider airfield and haul road already visible in views from these receptors.

***Permanent and Operational Effects***

The following section considers the permanent and operational effects associated with the changes in the Reference Design and whether these differ from the residual effects identified in the ES. As with construction effects the appraisal considers effects on landscape character areas and visual receptors

***Permanent and Operational Effects on Landscape Character***

*Reduction of the ADAB and increase in finished airfield elevation at PBP and Dry Gut (LCAs 6 and 8)*

Despite the reduced ADAB and increase in airfield elevation at PBP and Dry Gut to accommodate the airport and its essential support facilities, the development will continue to exert a Moderate Adverse impact on the unique character of the landscape of PBP (LCA 6). Whilst the embankment in Dry Gut is smaller in footprint and no longer extends across two valleys it will still create a permanent structure which will infill a large section of Dry Gut. The structure will remain out of scale with the valley landscape and will essentially change the character of what is an enclosed, steep sided, deeply incised valley system. Major Adverse impacts will remain on this character area (LCA 8).

*Reduction in ADAB associated with the access to Sharks Valley water supply (LCA5, LCA10 and LCA12)*

The removal of the intermittent use by maintenance vehicles along the access track to the break tanks in Sharks Valley and the overhead electricity line will remove all of the previous components previously proposed for this part of LCA 12. No residual impacts will result on this character area. Whilst the reduced ADAB will remove the access track and OHL components from LCAs 5 and 10, the permanent infrastructure associated with the water supply in Sharks Valley will remain resulting in Minor Adverse residual effects.

*Increase in ADAB associated with the Fisher’s Valley water supply (LCA4, LCA5 and LCA12)*

The introduction of the permanent structures and pipeline to abstract water in Fisher’s Valley along with the overhead line will result in the introduction of new, permanent infrastructure along a valley where previously none exists. The LCAs which cover the ADAB in Fisher’s Valley (LCAs 4, 5 and 12) are all affected by permanent infrastructure associated with the airfield and its operation. Whilst the increase in ADAB in Fisher’s Valley will extend the influence of the works with an increased effect on localised areas of LCA 5, it is not considered to increase the overall effects on these character areas.

***Permanent and Operational Effects on Visual Amenity***

*Reduction of the ADAB and increase in finished airfield elevation at PBP and Dry Gut*

Whilst the reduced ADAB and increase in finished airfield elevation at PBP increases the theoretical visibility of the wider airport development (Figure 9.8) the change in visual amenity for receptors with views of this development area will not materially change. Figure 10.1 and 10.2, representing photomontages from two viewpoints with immediate views of the airfield (Figure 10.1, Prosperous Bay Signal Station and Figure 10.2 footpath running through Dry Gut) illustrates how the airport and its supporting permanent infrastructure, including the Dry Gut embankment remain prominent elements in views from both these locations.

*Reduction in ADAB associated with the access to Sharks Valley water supply*

The removal of the overhead electricity line and requirement for vehicles to access the Sharks Valley water supply infrastructure will have benefit for some of the receptors in Silver Hill, Level Wood and Woody Ridge (Figure 9.4). The majority of these residential properties however, also have views of the wider airport and supporting infrastructure and so whilst there is a visual benefit in the reduction in the ADAB, Minor Adverse residual impacts will remain due to the remaining airport development which will remain in their views (Figure 9.8).

There is also visual benefit for walkers using the Sharks Valley Post Box walk. The visual amenity of upper sections of the walk will remain unaffected although the lower sections will remain affected by the water supply infrastructure with Moderate Adverse effects for short sections of the route.

*Increase in ADAB associated with the Fisher’s Valley water supply*

The permanent infrastructure associated with the water supply in Fisher’s Valley will be visible for a number of visual receptors including more immediate views for the properties in Longwood Hangings and Government Garage, more distant views from properties to the east of the Devil’s Punch Bowl, Longwood, Bottom Woods, and some properties in Level Wood, Silver Hill and Woody Ridge (Figure 9.4). The works will also be visible in more elevated views from Longwood golf course and the Millennium Forest as well as for walkers using the various Post Box walks which descend from Bradleys to PBP. Walkers using the footpath along Fisher’s valley will be newly affected by the permanent water supply proposals.

Visual effects will remain unchanged for all receptors other than for the properties in Longwood Hangings which depending on their orientation and proximity to the overhead line could result in Minor to Moderate Adverse effects. Walkers using the footpath in Fisher’s Valley will experience Moderate Adverse effects on the visual amenity of the section of route between Longwood and Cook’s Bridge.

**Additional Mitigation Required**

Additional mitigation will be required for the extended ADAB along Fisher’s Valley. This will be developed as part of a wider mitigation strategy for Fisher’s Valley and will be incorporated into the Landscape and Ecology Mitigation Plan (LEMP). Mitigation will include but will not necessarily be limited to the following:

* Managed compensation flow, setting of seasonal abstraction limits and monitoring to inform responsive management;
* Evaluation of in-combination effects with the ANRD drainage channel;
* Integrating wetland management requirements into ANRD/syndicate pasture management;
* Clearance of wild mango and other invasive species from the Fisher’s Valley watercourse;
* Planting of gumwood and ebony along Fisher’s Valley and particularly around the structures associated with the abstraction point (borehole and control kiosk);
* Creation of additional wetland habitat within Fisher’s Valley to compensate for the potential loss in habitat resulting from the water abstraction works;
* Routing of the pipeline from the borehole to airport shall sympathetically fit into the landscape avoiding routes along ridgelines or across open visible landforms, following existing tracks wherever possible. Where possible it should be buried;
* Non-reflective colour tones that blend into the landscape to be used on the above ground pipework and the raw water break tank;
* Routing of the overhead line from the power source in Longwood to the borehole shall sympathetically fit into the landscape avoiding routes along ridgelines or across open visible landforms, following existing tracks wherever possible. The route shall also not impinge on the immediate visual amenity of residential properties particularly those situated along Longwood Hangings or to the east of the Devil’s Punch Bowl; and
* Maintain safe access for walkers along Fisher’s Valley footpath.

**Landscape and Visual Amenity: Comparison of 2007 and 2011 Reference Designs and Summary of Effects**

| **Location** | **Residual Effect from 2007 Reference Design** | **Potential Effects of 2011 reference Design** | **Additional Mitigation Required** | **Residual Effect from 2011 Reference Design** |
| --- | --- | --- | --- | --- |
| **Landscape Character** | | | | |
| **LCA 4** | Minor Adverse | Minor Adverse | Fisher’s Valley Mitigation Strategy | **Minor Adverse** |
| **LCA 5** | Minor Adverse | Moderate Adverse for localised areas only. Minor Adverse effects will remain for the wider LCA | Fisher’s Valley Mitigation Strategy | **Minor-moderate Adverse** for localised areas only. **Minor Adverse** effects for the wider LCA |
| **LCA 6** | Moderate Adverse | Moderate Adverse | No additional mitigation required | **Moderate Adverse** |
| **LCA 8** | Major Adverse | Major Adverse | No additional mitigation required | **Major Adverse** |
| **LCA 10** | Minor Adverse | Minor Adverse | No additional mitigation required | **Minor Adverse** |
| **LCA 12** | Minor Adverse | Minor Adverse (due to Fisher’s Valley increased ADAB) | Fisher’s Valley Mitigation Strategy | **Minor Adverse** (due to Fisher’s Valley increased ADAB) |
| **Visual Amenity** | | | | |
| Users of Sharks Valley Post Box walk | Moderate Adverse for short sections of the route | No impact on upper section of the route with Moderate Adverse remaining for short sections of the lower part of the route | No additional mitigation required | **No impact** on upper section of the route with **Moderate Adverse** remaining for short sections of the lower part of the route |
| Residential properties at Longwood | Minor Adverse | Minor-Moderate Adverse (depending on orientation of view) | Fisher’s Valley Mitigation Strategy | **Minor-Moderate Adverse** (depending on orientation of view) |
| Users of Fisher’s Valley footpath | Minor Adverse-Neutral | Moderate Adverse | Fisher’s Valley Mitigation Strategy | **Moderate Adverse** (short sections of the route only) |
| Effects on the visual amenity of all other receptors will remain unchanged. | | | | |

**3.7 Cultural Heritage**

**Introduction and Relevant Changes to the Scheme Design**

This section considers the effects on archaeology and cultural heritage resulting from the change in the reference design. With respect to this topic, the changes in effects result from the revisions to the ADAB, in summary:

* The reduced development footprint in the vicinity of the runway including Dry Gut and Prosperous Plain
* The removal of the access road to running from Woody Ridge to Sharks Valley.
* The increase in the development footprint for the Fisher’s Valley Water supply for the purpose of:
  + A borehole to extract water
  + An above ground pipeline from the borehole to the airport
  + An upgraded road in Fisher’s Valley to provide access to the borehole during construction and for its long term maintenance.
  + An electricity supply running from Longwood to the borehole
* A small additional area of land at the contractor’s proposed compound near Government Garage.

**Description of Existing Conditions in Extended ADAB in Fisher’s Valley**

An archaeological walk-over survey was undertaken by Dr Andrew Pearson. Fisher’s Valley was walked from a location in the upper valley to the west of Bonfire Ridge (Grid Ref: 211510,8234080[[1]](#footnote-1)), to Cook’s Bridge (214587,8234880). Although a cursory map study has been undertaken (based on an 1872 map), further map regression would be required to bring the level of study up to that for areas of the ADAB addressed by the 2008 Environmental Statement.

The upper part of Fisher’s Valley, east of Bonfire Ridge, comprises a relatively narrow corridor, flanked by dense woodland on both sides. It is not occupied, except for a group of properties on an unmetalled track above Winegrove, north of Bonfire Ridge. Higher up, there is a line of properties on the road to Longwood c. 300m to the northwest of the valley floor. Disused properties, and a former swimming pool, are situated at the head of the valley (Willow Bank; Teutonic Hall).

In its lower part, from Winegrove eastwards to Cook’s Bridge, the valley floor is flatter and broader, with a swathe of wet pasture, 50 – 100m wide. This area is uninhabited, but is used for cattle grazing and a small amount of market gardening. The track along the valley floor is part of a post box walk that leads from Longwood to Cook’s Bridge. Whilst this is of interest, the route does not appear to have any particular historic connections. The military path follows the ridge to the south of the valley; the revetting can still be seen at a number of locations.

*Historic features*

The 1872 revision of Palmer’s 1850 map of the island shows a variety of properties within the valley corridor, again from Teutonic Hall in the southwest, to Bradleys, a little to the east of Cook’s Bridge. Most were still occupied at that date, though others are marked as ruins. All were domestic houses associated with farming, other than Teutonic Hall, which has its origins as a plantation house.

Few of the sites in the upper part of the valley were seen during the walkover. Those more than a few metres from the stream corridor are now subsumed by woodland. Most notable of the visible remains are a series of ruins that are probably those of Winegrove (211915,8234785).

In the lower valley the principal surviving historic structures are Vine Cottage (212552,8234735) and an adjacent cottage 50m to the southwest, on the opposite side of the valley floor (212535,8234686). The former is still intact, with roof and glazing, though it does not appear occupied. The latter is a roofless ruin. Another ruined structure, now converted to stock pens, exists further to the east (213129,8234500).

The modern OS map labels an ‘Old Water Channel’ in the valley immediately to the west of Cook’s Bridge. This appears to be nothing more than an earth-cut drainage ditch on the north side of the valley, which no longer functions. The date at which the channel was cut is not known, but it was probably a 20th-century creation and was still in operation in 1959. It was badly neglected by 1972 (see Teale, 1972, St Helena: A History of the Development of the Island, Volume 2, p.134).

Fisher’s Valley is mentioned in East India Company records and was settled at an early stage of the island’s colonisation. The ruins here are of historic interest, though none are obviously of such an early date. Most probably have 18th or 19th century origins, and most were abandoned in the later 19th or the earlier 20th century. Vine Cottage may have been given up fairly recently.

**Potential Effects of Changes to Reference Design**

With respect to works in Fisher’s Valley, none of the identified historic features are at risk from the works to construct the water abstraction borehole, or from a pipeline (buried or over ground) leading down the valley from this location.

**Additional Mitigation Required**

The baseline survey carried out has not been as detailed as that undertaken for the 2008 ES and there is the potential for unknown archaeology. The generic mitigation identified in the EMP and ES should be applied to the Fisher’s Valley area. The Contractor, prior to commencement of any construction work, is to submit a scheme for archaeological mitigation for approval, setting out the proposed measures to be taken to prevent damage to known and unknown archaeological remains.

**Cultural Heritage: Comparison of 2007 and 2011 Reference Designs and Summary of Effects**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Location** | **Residual Effect from 2007 Reference Design** | **Potential Effects of 2011 Reference Design** | **Additional Mitigation Required** | **Residual Effect from 2011 Reference Design** |
| Woody Ridge to Sharks Valley | No archaeological features were identified in this location. | None. Area removed from reference design. | None | **None** |
| Fisher’s Valley | Not previously considered. | None of the historic features are at risk but there the baseline survey has not been as comprehensive. | Generic mitigation stated in EMP ad ES should be applied. | **Slight to None**. |

**Photo 3.7.1: Upper Fisher’s Valley**



**Photo 3.7.2: Lower Fisher’s Valley**



**Photo 3.7.3: Vine Cottage (foreground); unnamed ruined cottage (background)**



**Photo 3.7.4: Modern track (right of photograph); old water channel (centre)**



**3.8 Roads, Traffic and Footpaths**

**Introduction and Relevant Changes to the Scheme Design**

The design changes of relevance to this topic are:

* Upgraded access in Fisher’s Valley
* Changes to the Post Box Walk Diversion around the airport

**Description of Existing Conditions in the Extended ADAB at Fisher’s Valley**

A track currently runs through Fisher’s Valley from Cook’s Bridge to Longwood. Between Cook’s Bridge and the site of the proposed borehole the track is in poor condition along much of its length, has limited drainage and inaccessible to most types of vehicle in wet weather.

**Potential Effects of Changes to Reference Design**

The upgrade of the current access track will result in minor positive impacts, with improved access for residents and those using the pasture.

There would still be a need for the diversion of the Post Box Walks and other footpaths (e.g. used by fisherman) at Prosperous Bay Plain. The altered design would make only a minor difference to these diversions.

**Additional Mitigation Required**

The measures proposed in the EMP would be applied to the revised design. No additional mitigation is required.

**Roads, Traffic and Footpaths: Comparison of 2007 and 2011 Reference Designs and Summary of Effects**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Location** | **Residual Effect from 2007 Reference Design** | **Potential Effects of 2011 Reference Design** | **Additional Mitigation Required** | **Residual Effect from 2011 Reference Design** |
| Fisher’s Valley | Not previously assessed. | Minor positive impact of improving access to Fisher’s Valley. | None required | **Minor Beneficial** |
| Post Box Walks | Moderate adverse effects assessed due to significant diversions around airport. | Small reduction in diversions but little overall change. | None required. | Remains **Moderate Adverse** |

**3.9 Surface Water and Hydrogeology**

**Introduction and relevant Changes to the Scheme Design**

With respect to this topic, the main changes to the assessment of effects will result from the following changes to the Reference Design:

* The addition of the Fisher’s Valley Water supply proposals, including:
  + A borehole to extract water
  + An above ground pipeline from the borehole to the airport
  + An upgraded road in Fisher’s Valley to provide access to the borehole and pipeline during construction and for its long term maintenance.
* The reduced scale of works in Dry Gut and reduction in the length of the culvert in the Gut.

This Section of the Addendum should be read with Figure 5 which shows the location of the water supply infrastructure.

**Description of Existing Conditions in Extended ADAB in Fisher’s Valley**

It is proposed that a borehole drilled in Fisher’s Valley provides the water supply for the airport operations. This water supply may also be used by the Contractor during the construction period.

Fisher’s Valley is “virtually the only stream valley in St Helena which retains wet conditions and green vegetation throughout its length” Pienkowski (2004). It is one of only five perennial streams, radiating out from the high central ridge. The majority of watercourses on St Helena are usually dry and only carry water on a seasonal basis.

Summary information on the pumping tests of borehole SK9 (Figure 5 shows the position of the borehole) are provided in the Subadra report of November 2010, entitled ‘Preliminary Assessment of Groundwater Resources in Fisher’s Valley, St Helena’. The log of the abstraction borehole and an adjacent observation borehole has also been provided. Based on this information, it is considered that:

* The geology comprises a surface layer of superficial deposits of grey clay, overlying greyish-green and purplish-red rock (assumed to be basalt) from a depth of approximately 6m.
* The groundwater level is shallow, within 1m of the ground surface
* The abstraction of 30m3/day will result in a drawdown of approximately 1.15m in the abstraction borehole and the effects of pumping will extend approximately 110m from the borehole (Subadra 2010)
* The groundwater quality is a mixture of poorer quality surface water and higher quality groundwater. This suggests that there is inflow to the borehole of surface water, most likely from the adjacent watercourse.
* The borehole (at location SK9) was drilled to a depth of 17m. The borehole was tested at three different rates of abstraction up to a maximum 43.2m3/day, which resulted in a drawdown in the groundwater level at the borehole of 1.67m. The response of the groundwater level to the tested abstraction rates suggests that yields above 43.2m3/day can be achieved. Water demand from the airport will be approximately 30m3/day. Based on the results of the pumping test, it is concluded that the borehole is capable of providing the required supply for operational purposes at the airport.

**Potential Effects of Changes to Reference Design**

***Fisher’s Valley***

Abstraction of groundwater from borehole will cause the development of a cone of depression in the groundwater table around the pumping location. The cone of depression will extend a distance from the abstraction point, which depends on the hydraulic characteristics of the aquifer. In the Subadra report, it is suggested that the cone of depression will extend approximately 110m from the borehole based on an abstraction rate of 30m3 per day. The amount of drawdown will decrease with increasing distance from the borehole.

As the groundwater level is shallow and as there is a watercourse in close proximity to the abstraction borehole, it is likely that pumping will intercept groundwater which naturally is flowing towards the stream and also may be drawing water from the stream into the borehole. Both effects will lead to a reduction in the volume of water in the stream, by approximately 30m3/day.

Information from a report by Toens & Partners (2000) ‘An Assessment of the Groundwater Resources of St Helena Island’ and flow monitoring during 2008 and 2009 suggests that the flow in the watercourse in Fisher’s Valley varies between 324m3/day and 1296m3/day. Based on these flow estimates, an abstraction of 30m3/day would use between 9% and 2.3% of the water resources estimated to be available within Fisher’s Valley.

It is considered that at the higher surface water flow rates, the abstraction will have no measurable impact on the water resources of the Fisher’s Valley catchment. During dry periods, when flows are lower, the abstraction would have a minor adverse impact on flows and regional water resources.

Accordingly, from a regional perspective, it is unlikely that the abstraction will have a significant impact on water resources. However, there is a potential for impacts on a local scale in the vicinity of the borehole, particularly within the cone of depression. From a water resources point of view, it is unlikely that such an impact will be significant, unless the abstraction causes the stream to dry up. The main potential impact is whether the abstraction in an area of shallow groundwater will cause an adverse ecological impact. The ecological effects and proposed mitigation measures are covered in Section 3.5 above.

***Dry Gut***

The culvert in Dry Gut will be reduced in length from 800m to 570m. This will reduce the disruption to the channel in Dry Gut.

**Additional Mitigation Required**

There are uncertainties over the impacts resulting from water abstraction from the borehole in location SK9 in Fisher’s Valley. Further data collection is required in tandem with a comprehensive mitigation strategy for the area. The following hydrogeological information is required to facilitate a robust assessment of the proposed abstraction:

* Additional flow monitoring of the watercourse in Fisher’s Valley. Flow gauging should be taken at a number of locations (roughly every 500m, or whereever this is practicable) along the valley to establish if there are any sections of the stream which accrue higher volumes of flow, consistent with a greater input of groundwater. Flow gauging should take place over a range of weather conditions, in particular after a period of dry weather, as this would be the most sensitive conditions for abstraction from the borehole and when groundwater discharge has the greatest effect on stream flow.
* The groundwater level should be measured in all of the boreholes drilled along Fisher’s Valley at the same time as the flow gauging.
* An assessment should be made of the cumulative impacts of abstraction from Willow Bank.
* A review of other sources that may or may not have been examined previously e.g. Hutt’s Gate, ground water abstraction below the airport.

The mitigation will be applied to both the groundwater and surface water environment. The mitigation strategy is likely to include the following:

* The Contractor will be required to minimise the demand for water as far as possible so as to minimise the volume of water that is required during construction and operation.
* The abstraction from borehole SK9, or from an alternative water supply source, shall not exceed 30m3/day (the amount necessary for the operation of the airport) unless the additional data collected provides evidence that this quantity can be increased without further effects on the environment.
* Effects on groundwater levels and stream flows will be monitored, as will changes to environmental baseline conditions.
* Management to control loss of water-dependent species will be required. The feasibility of implementing flow management techniques to mitigate the effects on wetland habitats will be investigated and suitable techniques will need to be implemented.
* Temporary and permanent culverts and bridges will be designed and constructed to ensure flow paths are maintained and the risk of erosion and flooding is reduced.

Further ecological mitigation is provided in Section 3.5 above.

**Surface Water and Hydrogeology: Comparison of 2007 and 2011 Reference Designs and Summary of Effects**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Location | Residual Effect from 2007 Reference Design | Potential Effects of 2011 Reference Design | Additional Mitigation Required | Residual Effect from 2011 Reference Design |
| Dry Gut embankment and culvert | Minor Adverse | Slight reduction in scale of works and disruption to channel. | No additional mitigation required. | Remains **Minor Adverse** |
| Fisher’s Valley | Area was not part of original design. | Change in flows and levels of streams due to abstraction for water supply leading to changes in water levels in wetland habitats within the Fisher’s Valley | Mitigation Strategy to be prepared and further data to be collected. To include: Abstraction quantities will be kept to a minimum. Monitoring of flows and changes to environmental baseline conditions.  Flow management to mitigate as far as possible any changes to the water levels in wetland areas within Fisher’s Valley and mitigation to control the potential loss of water dependent species. | **Uncertain** as to the scale and nature of potential impacts in Fisher’s Valley and possible changes in wetland areas, habitats and species. NOTE: Proposals for further investigations are provided above. |

Appendix A Carbon Emissions

**Carbon Emissions**

*Introduction*

The ES considered and compared carbon emissions associated with accessing St Helena by ship and by aircraft. Carbon emissions were covered within Section 8 of Volume 2, and Section A8 of Volume 4.

Emissions of carbon dioxide (CO2) were calculated for a number of scenarios, with and without the proposed airport. This allowed the CO2 emitted per scenario and per passenger to be compared for the various scenarios. Currently the island may be accessed by ship from the UK, Cape Town or Walvis Bay, or by RAF flight from the UK to Ascension (and then by ship to St Helena). Following completion of the proposed airport, it is unlikely to be possible to travel by ship as a passenger. There will be regular flights from South Africa to St Helena, and possibly from other countries.

To undertake these emissions calculations and comparisons several assumptions had to be made. Notably, only emissions of the key greenhouse gas CO2 were considered in detail; emissions of other greenhouse gases, such as methane and nitrogen oxides, were not considered (CO2 is frequently used as a proxy for all greenhouse gases, assessing the scenarios in this way provided a robust basis for comparisons to be made). Only emissions from aircraft and ships; emissions from other sources, or emissions resulting from a potential increase in development on the island, were not considered. The following comparisons were made:

* Total CO2 emissions per 1-way trip;
* Total CO2 emissions per 1-way trip per (St Helena bound) passenger; and
* Total CO2 emissions per year (for St Helena bound passengers).

Scheduled air traffic forecasts after opening of the airport on St Helena were based on the use of a B737-800, with 162 seats. It was assumed that in the first year 135 of the seats (80%) would be occupied per flight on average. Whilst scheduled flights may originate from various airports, such as Cape Town, Johannesburg, Walvis Bay and London airports, for the purposes of the assessment, it was assumed that all flights would originate from Cape Town.

It was concluded that:

* To access the island from Cape Town, approximately 10 times more CO2 would be emitted from the RMS St Helena than from an aircraft. Per passenger this equated to approximately 8.5 times more CO2. Annually, about 1.5 times more CO2 was predicted to be emitted from the RMS St Helena, based on six sailings and 52 flights per year from Cape Town.
* Accessing the island from the UK exclusively by air was predicted to be more efficient in terms of CO2 emissions, than the three existing UK scenarios. The greatest emissions were associated with accessing the island from the UK exclusively by ship.
* On a per-passenger basis, approximately three times less CO2 was predicted to be emitted by accessing the island from the UK by aircraft, than by the current combination of aircraft and ship.
* On a per-trip and per-passenger basis, travel by air is more efficient in terms of emissions of CO2 than travel by RMS St Helena.
* The with-airport calculations were based on passenger numbers in the first year after completion of the airport. Passenger numbers were assumed to rise in the 30 or so years after the completion of the airport. Total CO2 emissions will therefore also rise, even if accompanied by improvements in aircraft efficiency. Annually, CO2 emissions may be up to 10 times greater in 2040 than 2011, assuming 10 flights per week in 2040, rather than one in 2011. However, this may be considered to be a worst-case estimate due to likely improvements in aircraft efficiency and fuel use, and the likelihood of direct flights to the island from a greater number of airports.

In summary, the comparison suggested, at least on a per passenger and per trip basis, that CO2 emissions during the first years after opening the airport would be lower than those emitted by the RMS. A number of assumptions were made in undertaking the study which meant that the difference between the two modes of transport were likely to be lower than calculated. In the longer term CO2 emissions will increase although the number of aircraft flights would remain very small.

It was also noted that another important issue is the differing effects of CO2 emissions at altitude; the global warming potential of carbon emissions at altitude is greater than that at ground level. Therefore the calculated aircraft emissions should be increased by a factor of approximately 1.75 to make them comparable with the ship emissions in terms of their global warming potential. Therefore annually, the global warming potential of accessing the island from Cape Town by air would be slightly greater than accessing the island by RMS St Helena, based on six sailings and 52 flights per year from Cape Town.

*The Revised Runway*

As summarised above, it was assumed that a B737-800, with 162 seats, would service the island. However a smaller aircraft would be required for the currently proposed shorter runway. In the short term, a B737-700W, a smaller aircraft with fewer seats, has been identified as a suitable aircraft for the shorter runway. Alternative similar sized aircraft should be available in the next 5-10 years, such as the Bombardier CS100, which is reported to burn 20% less fuel than comparable aircraft.

The calculations performed for the ES (detailed in Section A8, Volume 4) have been updated to account for the use of the smaller B737-700W instead of the B737-800. However, it is now possible to obtain estimates of carbon emissions for various aircraft, based on flight distance, taking account of increased emissions during the Landing and Take Off (LTO) cycle. The EUROCONTROL Agency provide a spreadsheet, designed to be used by aircraft operators to estimate fuel consumption and carbon dioxide emissions for EU ETS monitoring and reporting purposes. The spreadsheet is available on the EUROCONTROL website[[2]](#footnote-2) and was downloaded during January 2011 (version 1.01, last modified 2010). The spreadsheet was used to recalculate aircraft emissions for all the scenarios which were originally considered. In addition the method used to calculate CO2 emissions for the flight from London Heathrow to Cape Town has been updated, by making use of the (International Civil Aviation Organisation) ICAO passenger CO2 emissions calculator[[3]](#footnote-3).

The assumptions and limitations, as listed in the ES Section A8.2.3 and A8.4.2 (Volume 4) remain valid, but with the addition of the following:

* 70 return flights (B737-700W) per year from South Africa to St Helena have been assumed for the opening year (100 passengers per flight).

*Results*

CO2 emissions were calculated for the six scenarios originally considered in the ES. The scenarios are described below:

Without St Helena Airport:

1. Cape Town – St. Helena (RMS St. Helena)

2. UK Brize Norton – Ascension – St. Helena (RAF flight and RMS St. Helena)

3. UK Portland – Tenerife – Ascension – St. Helena (RMS St. Helena)

4. UK Heathrow – Cape Town – St. Helena (commercial flight and RMS St. Helena)

With St Helena Airport:

5. Cape Town – St. Helena (commercial flight)

6. UK Heathrow – Cape Town – St. Helena (commercial flight)

The updated CO2 emissions are presented in Table A1.1.

**Table A1.1: CO2 Emissions Results (tonnes CO2)**

|  |  |  |
| --- | --- | --- |
| **Scenario 1: Cape Town – St Helena (RMS St Helena)**  Emissions from the RMS St Helena have been calculated from Cape Town to St Helena, via Walvis Bay and by the direct route. The split of passengers going by each route was not known therefore for the purposes of this assessment an average of the mileage and fuel consumption for the two routes was used: | | |
| * Emissions per trip (tonnes CO2) | 372 | |
| * Emissions per passenger (tonnes CO2) | 2.31 | |
| * Annual Emissions (tonnes CO2) | 3464 | |
| **Scenario 2: UK Brize Norton – Ascension – St Helena (RAF flight and RMS St Helena)**  Emissions from the RAF aircraft and RMS St Helena have been summed and are summarised: | | |
| * Emissions per trip | 352 1 | |
| * Emissions per passenger | 3.19 1 | |
| * Annual Emissions | 1242 1 | |
| **Scenario 3: UK Portland – Tenerife – Ascension – St Helena (RMS St Helena)**  Emissions from the RMS St Helena have been calculated from the UK to St Helena: | | |
| * Emissions per trip | 903 | |
| * Emissions per passenger | 17.1 per passenger bound for St Helena | |
| * Annual Emissions | 1807 | |
| **Scenario 4: UK Heathrow – Cape Town – St Helena (commercial flight and RMS St Helena)**  Emissions from the RAF aircraft and RMS St Helena have been summed and are summarised: | | |
| * Emissions per trip | 627 1 | |
| * Emissions per passenger | 3.07 1 | |
| * Annual Emissions | 1537 1 | |
| **Scenario 5: Cape Town – St Helena (commercial flight)**  Aircraft (B737-800 (or -700W)) emissions are summarised: | | |
|  | **Original Length Runaway**  B737-800 | **Shorter Runway**  B737-700W |
| * Emissions per trip | 33.7 1 | 30.7 |
| * Emissions per passenger | 0.25 1 | 0.31 |
| * Annual Emissions | 1751 1 | 2153 |
| **Scenario 6: UK Heathrow – Cape Town – St Helena (commercial flight)**  Aircraft (various & B737-800 (or -700W)) emissions are summarised: | | |
|  | **Original Length Runaway**  B737-800 | **Shorter Runway**  B737-700W |
| * Emissions per trip | 355 1 | 352 |
| * Emissions per passenger | 1.01 1 | 1.07 |
| * Annual Emissions | 4432 1 | 4834 |

1 These figures are different to those presented in the ES due to the revised methodology used to calculate aviation CO2 emissions, as described above.

As can be seen from the results for Scenarios 5, the shorter runway (utilising a smaller aircraft) will generate approximately 9% fewer CO2 emissions per trip, but approximately 23% greater emissions per passenger. Annually the emissions will also be greater (by 23%), due to the greater number of flights required to transport the same number of visitors to the island.

The Scenario emissions comparison table originally provided in the ES (Table 8.9, Appendix 8), has been updated and is presented below (Table A1.2)

**Conclusions and Summary**

The implications of the shorter runway, compared to the longer runway can be summarised:

* Whilst each flight will result in fewer CO2 emissions, annually and per passenger, CO2 emissions will be greater, than when compared to the original proposal.

Therefore the overall findings of the study, have been adjusted as follows:

* To access the island from Cape Town, approximately 12 times more CO2 would be emitted from the RMS St Helena than from an aircraft (B737-700W), per inbound trip. Per passenger this equates to approximately 7.5 times more CO2. Annually, about 1.5 times more CO2 was predicted to be emitted from the RMS St Helena, based on six sailings and 70 flights per year from Cape Town.
* Accessing the island from the UK exclusively by air was predicted to be more efficient in terms of CO2 emissions, than the three existing UK scenarios. The greatest emissions were associated with accessing the island from the UK exclusively by ship.
* On a per-passenger basis, approximately three times less CO2 was predicted to be emitted by accessing the island from the UK by aircraft, than by the current combination of aircraft and ship.
* On a per-trip and per-passenger basis, travel by air is more efficient in terms of emissions of CO2 than travel by RMS St Helena.
* The with-airport calculations were based on passenger numbers in the first year after completion of the airport. Passenger numbers were assumed to rise in the 30 or so years after the completion of the airport. Total CO2 emissions will therefore also rise, even if accompanied by improvements in aircraft efficiency. Annually, CO2 emissions may be up to 10 times greater in 2045 than 2016, assuming a 10-fold increase in flights. However, this may be considered to be a worst-case estimate due to likely improvements in aircraft efficiency and fuel use. For instance it is likely that the Bombardier CS100 aircraft will be available in the next 5-10 years, which is reported to burn 20% less fuel than comparable aircraft, such as the B737-700W.
* The global warming potential of carbon emissions at altitude is greater than that at ground level. Therefore the calculated aircraft emissions should be increased by a factor of approximately 1.75 to make them comparable with the ship emissions in terms of their global warming potential. Therefore annually, the global warming potential of accessing the island from Cape Town by air would be slightly greater than accessing the island by RMS St Helena, based on six sailings and 70 flights per year from Cape Town.

In summary, despite the shorter runway resulting in overall greater CO2 emissions than the original longer runway, CO2 emissions during the first years after opening the airport would be lower than those emitted by the RMS, at least on a per passenger and per trip basis. In the longer term CO2 emissions will increase although the number of aircraft flights will remain very small.

**Table A1.2:** **Scenario Emissions Comparison Table**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Scenario** | | | **CO2 emissions / t** | | | | | | | | |
| **1RMS St Helena** | | | **2Aircraft** | | | **Total** | | |
| **/ trip** | **/ year** | **/ passenger** | **/ flight** | **/ year** | **/ passenger** | **/ trip** | **/ year** | **/ passenger** |
| ***Without Air Access*** | | | | | | | | | | | |
| 1 | Cape Town – St Helena | *(RMS St Helena)* | 372 | 3464 | 2.31 |  |  |  | **372** | **3464** | **2.31** |
| 2 | UK Brize Norton – Ascension – St Helena | *(RAF flight & RMS St Helena)* | 144 | 867 | 2.22 | 208 | 375 | 0.96 | **352** | **1242** | **3.19** |
| 3 | UK Portland – Tenerife – Ascension – St Helena | *(RMS St Helena)* | 903 | 1807 | 17.1 |  |  |  | **903** | **1807** | **17.1** |
| 4 | UK Heathrow – Cape Town – St Helena | *(various aircraft & RMS St Helena)* | 372 | 1155 | 2.31 | 254 | 382 | 0.76 | **627** | **1537** | **3.07** |
| ***With Air Access*** | | | | | | | | | | | |
| 5 | Cape Town – St Helena | *(B737-700W)* |  |  |  | 30.7 | 2153 | 0.31 | **30.7** | **2153** | **0.31** |
| 6 | UK Heathrow – Cape Town – St Helena | *(various aircraft & B737-700W)* |  |  |  | 352 | 4834 | 1.07 | **352** | **4834** | **1.07** |

Notes: 1 Inclusive of emissions whilst in port; 2 Inclusive of emissions associated with the LTO cycle

Appendix B1 Wind Modelling Report

Appendix B2 Vegetation Survey

**Fishers Valley Vegetation Survey**

**1. Background**

A vegetation survey was carried out to provide a description of the current status of the vegetation as a basis for evaluating the potential impacts of works in Fisher’s Valley for water abstraction.

**2. Survey area**

The survey was carried out within Fisher’s Valley along the narrow ribbon of vegetation associated with the permanent stream flowing through the valley bottom.

The survey area included the grazed pasture (land parcels 123 and 38 Longwood South) - extending upstream of the test bore hole site only as far as the paddock fenceline and extending downstream (east) to Cook’s Bridge where the road to Prosperous Bay crosses the stream. East of the Cook’s Bridge the composition of the vegetation changes and there is no active land management. The survey area ended at the first waterfall entering into the Fisher’s Valley canyon. The survey area extended across the valley to the field boundaries/fencelines or edge of the stream flood plain, where slope and vegetation structure changes.

**3. Survey methodology**

The area in the immediate vicinity of the borehole (SK9) and valley downstream about 1.3km was traversed on foot.

Additional site visits were made and the observations taken have contributed to this study.

* 30/12/10 overview visit with Ian Mathieson, - who was on holiday the island and Jamie Roberts, St Helena National Trust. Stream flow observations and salinity recordings were taken.
* 18/01/11 attended by Tony Prater, plover specialist, RSPB and Annalea Beard to identify areas of moorhen and Wirebird habitat. Water flow measurements were taken above the test bore hole (SK6) and at the waterfall below Cook’s Bridge (photos WF1 and WF2).
* 08/02/11 Walk-over vegetation survey
* 11/02/11 attended by Darren Duncan, Chief Agriculture & Natural Resources Officer and Andy Timm, Agricultural Development Officer to view planned agricultural drainage works and relate this to the management of the pasture and wetland.

Observations were recorded by paddock up to Cook’s Bridge and then the area from Cook’s Bridge to the waterfall. Plants seen were listed and their abundance across each area recorded on a DAFOR scale shown in table B2.1. The different habitats in which they occurred was recorded and mapped based on the habitat categories described by Lambdon and Darlow (2008). These categories were developed specifically to reflect the predominant broad habitat types on St Helena and Ascension. Each was designated to represent a sub-category of one of the coarser IUCN habitat types to ensure that the data could be usefully compared with other parts of the world. Table B2.2, abstracted from Lambdon and Darlow, shows those habitats and descriptions used in this survey.

**Table B2.1 DAFOR descriptions**

|  |  |  |
| --- | --- | --- |
| **Category** | **Title** | **Description** |
| D | Dominant | Dominant (or co-dominant) over a reasonably large part of the defined area |
| A | Abundant | Sub- or only very locally dominant, but present in large numbers |
| F | Frequent | A common species in the area, occurring regularly but in smaller numbers than above |
| O | Occasional | Scarce but occurring regularly throughout the area, or fairly common over a very restricted area |
| R | Rare | Very thinly scattered across the area, or very locally distributed in a few patches |
| V | Very rare | A few plants only |

**Table B2.2 Habitat categories and definitions**

|  |  |  |  |
| --- | --- | --- | --- |
| **Habitat name** | **IUCN category** | Subcategory | **Description** |
| **Wetland**  Waterfall  Permanent stream  Riparian margin  Riparian Schinus shrub  Riparian scrub (other)  Permanent freshwater marshes/pools **Artificial** Mid-level pasture  Tracks **Artificial aquatic** Ditches | 5.1 Permanent rivers/streams/creeks  5.3 Shrub dominated wetland  5.7 Marshy areas  14.2 Pastureland  15.9 canals and Drainage Channels/Ditches | 1  2  3  1  2  1  1  7  1.1 | Waterfalls  Limnic zone of water courses flowing permanently or most of the year  Littoral zone of (semi-) permanent watercourses  Dense stands of *Schinus terebinthifolius* along watercourses  Other scrub along watercourses  Areas subject to regular indundation forming (temporary or permanent) marsh patches  Seasonally-dry or poor pasture; mainly at mid-altitudes  Unsurfaced tracks  Artificial ditches used at least intermittently as water conduits. |

**4. Description (field notes) of survey area**

**General**

Up to 1995 the stream was regularly kept clear by Government. The stream flows shallowly along the length of the survey area, varying significantly in depth, width and flow depending on vegetation structure and rainfall. There is however always water flow as there are no water troughs and cattle drink from stream in all paddocks.

Wild mango *Schinus terebinthifolius* has been cleared 3-5 metres either side of the northern fenceline – cut and poisoned – for the whole length of the pasture. Larger stumps have been drilled and poisoned and this seems to have been much more effective. Wild mango remains on the southern fenceline but is expected that it will be cleared (2m from fenceline) as part of a management agreement between the ANRD and cattle syndicate in the coming year(s). Removal of wild mango along the southern boundary where it is growing close to the stream might improve stream flows.

*Paddock 1*

Improved grassland (mid level pasture). Cattle grazed. Permanent stream and associated marsh vegetation dominated by *Isolepis* and *Cyperus*. Stream flow visible. Cattle up to their knees grazing in marshy ground close to stream.

Kikuyu grass *Pennisetum clandestinum* is the dominant pasture grass. It flanks the central marshy area where *Isolepis prolifer* and *Cyperus polystachyos* are abundant.

Depth of surface water stream flow at edge of pasture before track was 20 cm (08/02/11).

Within a narrow channel. As it crosses over the track between paddocks 1 and 2 the watercourse broadens. It was observed to have water pooling and flowing on all visits. A number of water based invertebrates and tadpoles were noted. Volume and speed of flow observed on 08/02/11 was notably increased to that observed on previous visits. Water low in oxygen as indicated by algal growth. Orange tube worms present.

*Paddock 2*

Marsh dominated by *Colcasia esculenta* with emergent vegetation dominated by *Isolepis prolifer* grading into improved grassland (mid level pasture).

A large paddock that was previously subdivided, separating the drier grassland from an area of permanent marsh that the cattle do not choose to graze (as evident by the long sward and as described by a grazier). The dividing fence posts are still present but there is no wire and no plans to reinstate it.

The small expanse of permanent wetland marsh (approx 100m x 20m) is situated in the upper section of paddock 2, within approx 50m of the proposed test bore hole (SK9).

2 moorhens were observed (08/02/11) in the open marshy area dominated by *Isolepis prolifer* but were easily startled and flew back into the area dominated by *Colcasia esculenta* (yam) and *Pennisetum macrourum* (thatching grass). Calls of up to four birds were noted on 18/01/11.

A shallow flow of surface water flowers over the roots of the *Colcasia esculenta*. Walking through the area is very difficult – a stick sinks to over 0.5m depth. Roots of vegetation create a spongy mat.

There is an old drainage channel that runs parallel to the wetland and the vehicle track. It has become filled with silt and overgrown in places with vegetation and some pooling of water. Care will need to be taken, where the drainage channel is lower than the adjacent land, when this channel is re-cut to avoid draining water from the wetland.

The vehicle track becomes impassable after periods (it had rained a week previous to this study) of heavy rainfall as water, mud and silt washed off the hillsides creates deep channels and soft mud.

Kikuyu becomes the dominant grass flanking the central band of marshy ground (adjacent to the stream) below the fence posts.

Further survey work required to assess special nature of the permanent wetland and marsh area, which warrants special protection/management.

*Paddock 3*

Improved grassland (mid level pasture) grazed with narrow strip of emergent vegetation associated with permanent stream.

Two wirebirds observed in drier pasture margins and on flanking hillsides – possible that they may have a territory (18/01/11).

Myna bird and pigeon observed.

Mud, stones and silt had washed into the pasture from the track and northern flanking slopes.

*Section between Paddock 3 and Cook’s Bridge*

Neglected area of grassland. Schinus scrub dominated the lower section.

Frogs heard

Peaceful Dove and Myna bird observed.

Area heavily encroached by alien invasive species, most notably wild mango. Other species include wild coffee *Chrysanthemoides monilifera*. Alien plant control work planned in this area after which it will be included as part of the cattle syndicates pastureland.

Water course lost in dense thicket of vegetation around Cook’s Bridge. ANRD plan to re-cut the channel under the bridge.

*Cook’s Bridge to first waterfall*

Schinus scrub dominates the stream bed around Cook’s Bridge grading into thatching grass marshland. Water eutrophic and brackish.

Thatching grass *Pennisetum macrourum* is the dominant vegetation with dense stands of wild mango covering the area around Cook’s Bridge and extending the whole length of the water course.

Water can be seen flowing through the thatching grass in places.

**5. Stream flow rate measurements**

Stream flow measurements were taken on 18/01/11 by timing how long it took to fill a 10 litre bucket, diverting the stream flow through a standard drain pipe.

WF1 – 3 litres per second - just before water flows under Tobacco Plain road bridge in ANRD leased arable land. Water has been diverted from its natural channel in the base of the valley to the north around the arable smallholding. Some water seepage through the natural watercourse is occurring and this was estimated at an additional ½ litre per second but was not measurable.

WF2 – top of first waterfall below Cook’s Bridge - 0.2 litres per second.

Estimates taken on 30/12/10 based on a visual inspection indicated a flow not exceeding 5 l/sec at the Tobacco Plain road bridge dropping to zero at Cooks Bridge but recovering to around 0.5 l/sec at the top of the first waterfall.

There was no observable flow at Cook’s Bridge on 30/12/10 or 18/01/11 but note photo 4.2 by 08/02/11 there was considerable flow after week of heavy rain.

**6. Survey results**

The results of the survey are set out in Table B2.3, supported by a set of habitat photographs. Habitat classifications are included in Figure 6 Ecological Baseline.

Table B2.3 Species and abundance

| **Area** | **Common Name** | **Species** (+ indigenous/possibly indigenous) | **Abundance category (DAFOR)** | **Field notes** |
| --- | --- | --- | --- | --- |
| Paddock 1 | Kikuyu grass | Pennisetum clandestinum | Dominant | Areas flanking permanent moisture |
|  | *Cyperus polystachyos* | Abundant | Very common growing with Isolepis in wetter areas of damp, permanent standing and slow flowing water |
|  | *+ Isolepis prolifer* | Abundant | Areas of permanent standing and slow flowing water |
| Mat grass | *Stenotaphrum secundatum* | Occasional | Pasture margins |
| Thatching grass | *Pennisetum macrocorum* | Rare | Occasional small patches in pasture |
| Yam (black) | *Colocasia esculenta* | Rare | Small clump in pasture |
| Wild mango | *Schinus terrebinthifolius* | Frequent | Mostly Field/track margins |
| Giant rats tail grass | *Sporobolus natalensis* | Rare |  |
|  | *Atriplex semibaccata* | Rare | Field/Track margins |
|  | *Carpobrotus edulis* | Occasional | Field/Track margins |
|  | Bare ground | Occasional | Small patches bare ground on outer edges of pasture – dry cracking clay to mud depending on rainfall |
| Paddock 2 |  | Colocasia esculenta | Abundant | Main moorhen habitat |
|  | *Schinus terebinthifolius* | Frequent | Along fenceline, cut and sprayed – larger stumps drilled and treated, re-growth now needs treatment. <10 small trees growing amongst yam in wetland |
|  | Pennisetum clandestinum | Dominant | Becomes dominant pasture grass below the wetland beyond fenceposts which once divided the paddock from the wetland |
|  | *Cyperus polystachyos* | Frequent |  |
| Thatching grass | *Pennisetum macrourum* | Frequent |  |
|  | *+ Isolepis prolifer* | Abundant | Dominant species within permanent wetland |
| Creeper | *Carpobrotus edulis* |  | Track margins and drainage channel |
| Mat grass | *Stenotaphrum secundatum* |  | Raised drier margins of pasture |
|  | *Echinochloa pyramidalis* | Rare |  |
| Tallowvine | *Commelina diffusa* | Frequent |  |
| Rock rose | *Hibiscus diversifolius* | Very rare | Small clump within yam patch |
| Poison peach | *Diospyros dichrophylla* | Rare | Track margins |
| Wild coffee | *Chrysanthemoides monilifera* | Rare | Track margins |
|  | *Centella asiatica* | Rare | Damp field margins and ditch |
| Nut grass | *Cyperus rotundus* | Rare |  |
|  | *Polypogon monspeliensis* | Occasional |  |
|  | *Bare ground* |  | Bare patches of ground below trees on pasture margins on west side |
| Silky oak | *Grevillia robusta* | Very rare | 2 trees |
|  | *Acacia cyclops* | Occasional |  |
|  | *Ficus benghalensis* | Very rare | 1 poor specimen along fence |
|  | *Atriplex semibaccata* | Rare | In marginal raised bare areas and near track |
|  |  | *Cynodon dactylon* | Rare | Drier margins and around bare ground |
| Paddock 3 |  | *Pennisetum clandestinum* | Dominant | Dominant pasture grass |
|  |  | *Cyperus polystachyos* | Frequent | Around waterlogged stream line |
|  | *+ Isolepis prolifer* | Frequent | Around waterlogged stream line |
|  | *Stenotaphrum secundatum* | Frequent | More competitive on drier pasture |
|  | *Schinus terebinthifolius* | Frequent | Fence line |
|  | *Olea europaea ssp. africana* | Rare | Fence line |
|  | *Lantana camara* | Rare | Fence line |
|  | *Opuntia ficus-indica* | Rare | Fence line |
|  | *Cupressus macrocarpa* | Very rare | Single tree |
|  | *Atriplex semibaccata* | Rare |  |
|  | *Conyza bonariensis* | Rare | field margins |
|  | *Eucalyptus sp* | Rare | 2 groups large trees in pasture |
|  | *Cupressus macrocarpa* | Very rare |  |
|  | *+ Cynodon dactylon* | Occasional | Drier margins and around bare ground |
| Section between paddock 3 and Cook’s Bridge |  | *Olea europaea ssp. Africana* | Occasional | Plans for clearance of wild mango and refence to bring into use for cattle |
|  | *Schinus terebinthifolius* | Abundant | Fenceline and in grassland |
|  | *Cupressus macocarpa* | Rare |  |
|  | *Eucalyptus sp* | Rare |  |
|  | *Chrysanthemoides monilifera* | Rare |  |
|  | *Bare ground/cattle dung* | Rare |  |
|  | *Pennisetum macrourum* | Occasional |  |
|  | *Pennisetum clandestinum* | Dominant |  |
|  | *Stenotaphrum secundatum* | Occasional |  |
|  | *Optunia ficus indica* | Occasional |  |
|  | *Attriplex semibaccata* | Occasional |  |
|  | *Attriplex nummularia* | Occasional |  |
|  | *+ Isolepis prolifer* | Frequent |  |
|  | *Cyperus polystachyos* | Occasional |  |
|  | *Echinochloa pyramidalis* | Occasional |  |
|  | *Conyza bonariensis* | Rare |  |
|  | *Ageratum conyzoides* | Rare |  |
|  | *Lantana camara* | Rare |  |
|  | *Carpobrotus edulis* | Rare |  |
|  | *Sonchus oleraceus* | Very rare |  |
|  | *Atriplex suberecta* | Rare | Pasture, track and channel margins |
| Cook’s Bridge to waterfall |  | *Sporobolus africanus* | Very rare | Dry valley margins |
|  | *Schinus terebinthifolius* | Abundant |  |
|  | *Cyperus sp* | Rare | Open areas around water |
|  | *Apium graveolens* | Rare | In areas of permanent water seepage |
|  | *+ Ficinia nodosa* | Rare | Open areas around water |
|  | *Pennisetum macrourum* | Dominant | Dense stands fill the valley |
|  | *Carpobrotus edulis* | Frequent | Dry valley margins |
|  | *Attriplex semibaccata* | Rare | Dry valley margins |
|  | *Lemna minor* | Rare | Pooled/stagnant water |
|  | *Opuntia ficus-indica* | Rare | Dry valley margins |

**7. Conclusions**

This area of Fisher’s Valley holds important and rare wetland habitat. The area of marsh in Paddock 2 dominated by *Colcasia esculenta* with its associated emergent community dominated by *Isolepis* and *Cyperus* is of particular importance for the rare plant communities but also as habitat for the moorhen and potentially invertebrates associated with permanent water. Further investigation is required to improve understanding of the ecology of the area, predict the effects that water abstraction may have and identify what management actions are required to conserve the habitat and mitigate for any potential adverse impacts.

Reference:

Lambdon, P & Darlow A (2008) Botanical Survey of Ascension Island and St Helena 2008. South Atlantic Invasive Species Project. RSPB.

Figures



AECOM

Tanfield, 1 Tanfield, Edinburgh, EH3 5DA

Telephone: +44 131 301 8600

Website: http://www.aecom.com

1. **\* A comment on coordinates and GPS**

   Coordinates cited are the same as those in the cultural heritage chapter of the 2008 ES, namely:

   System: DOS 71/4 Astro

   Projection: Transverse Mercator

   False Easting: 500000.000000

   False Northing: 10000000.000000

   Meridian of origin: -3.000000 (3° W of Greenwich)

   Latitude of origin: 0.000000 (equator)

   Scale Factor at origin: 0.9996

   Linear Unit: metres

   The same problems of GPS inaccuracy encountered during the 2007 fieldwork persisted for this fieldwork. GPS accuracy varied between 20m and 50m, depending on satellite coverage, overhead conditions and vegetation. GPS proved particularly ineffective in the upper part of the valley. [↑](#footnote-ref-1)
2. <http://www.eurocontrol.int/environment/public/standard_page/small_emitters.html> [↑](#footnote-ref-2)
3. <http://www2.icao.int/en/carbonoffset/Pages/default.aspx> The ICAO calculator is designed for use in carbon off-setting programmes. The methodology is described in a document entitled, ICAO Carbon Emissions Calculator, Version 2 (May 2009) [↑](#footnote-ref-3)