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A10.2 LANDSCAPE AND ECOLOGY MITIGATION PLAN

10.1 INTRODUCTION

The detailed landscape and ecological mitigation commitments have been developed in parallel with the refinement of the reference design in order that impacts can, wherever possible, be mitigated through avoidance, reduction or compensatory measures. The various habitats and landscape character areas, their features, key components and characteristics impacted by the Airport proposals are described in Appendix 9.1 and 10.1, in Volume 4 of this ES respectively. Details of the Wirebird mitigation proposals are presented in Appendix 9.

The landscape and ecology mitigation plan (LEMP) seeks to provide compensatory habitats and landscape treatment to reduce and offset the permanent direct loss of habitat and the direct and indirect impacts on the landscape resource of the island as a result of the Airport and supporting infrastructure proposals. The mitigation of adverse impacts associated with the introduction of the Airport and supporting infrastructure proposals has involved a combination of three approaches:

- **Avoidance**: Avoidance of adverse effects at source. An example of this approach has included avoidance of a specific feature of interest through identification of potential impacts during the reference design process and through close co-operation with the design team, potential impacts have been designed out;
- **Reduction**: Reduction of adverse effects that cannot be eliminated by prevention. An example of this has included sensitive native planting to help assimilate elements of the Airport and supporting infrastructure proposals into the landscape or to screen the visual impact from properties or publicly used areas; and
- **Offsetting**: The provision of alternative or compensatory measures, where appropriate and feasible. An example of this approach has included creation of new habitats to compensate for loss of habitat required for the Airport and supporting infrastructure proposals. These have included off-site compensatory planting or habitat creation and/or management.

The key objectives of the LEMP are to achieve:

- Sympathetic and high quality design which will provide a sensitive solution to the integration of the Airport and supporting infrastructure proposals into the various local environments;
- Planting which uses native species to increase the biodiversity and ecological value and habitat interest of the study area; and
- Landscape planting, earthworks (mounding and earth shaping) and other mitigation measures where appropriate to minimise the visual impact of the Airport and supporting infrastructure proposals and enhance the existing local landscape character and structure.

The key principles upon which the landscape/ecology mitigation commitments are based are as follows:

- Planting proposals focus on the reinforcement and or reintroduction of native species (endemic and indigenous) within their historic ranges (refer to Technical Appendix 10.3 Past and Present vegetation);
- Only native species will be used within the Eastern Arid Area (EAA);
- When establishing plant mixes, consideration will be given to habitat requirements in relation to substrate types, soil chemistry such as salinity or phosphate concentrations, aspect and exposure conditions.

- Non-native species are proposed to reinforce the screening and amenity plantings in Rupert's Valley and for specified sections alongside the access/haul road as appropriate;
- The use of alien invasive species will be avoided in amenity, woodland, forest, screening and hedgerow planting where non native species are proposed. , Where species with potential invasive characteristics are utilised their extent will be limited to areas where they are less likely to become a problem (e.g Acacia longifolia in forest plantings adjacent to Deadwood pastures where they can be managed for fodder) and where they could play a role in successional planting;
- It is anticipated that the majority, of germplasm will be sourced locally without the need for importation of plant material or seed;
- Planting of native species will be designed to maintain the (distinct) sub-populations and local gene pools. That is, as far as is reasonably possible, the planting programme will utilise stock from sources closest to the point of planting. In addition to helping to preserve the natural variation and local adaptations that exist within and between different populations it should help seed sourced individuals posses the potential for re-establishment or reintroduction at the same or similar sites. Only when there isn't local material available will it be sourced from elsewhere on the island. It will therefore be essential that comprehensive records are made at the point of collection and thereafter maintained throughout the production process;
- Best practise guidelines will be adopted where they exist or adapted to suit local conditions including the RBG Kew Wakehurst Place A Field Manual for Seed Collectors; and the IUCN guidelines for plant reintroduction and established propagation techniques;
- Ecology mitigation planting programmes will refer to any Species Recovery action plans that may exist at the time /.

This document should be read in conjunction with the contractual requirements of Section 4 of the EMP.

10.2 GERMPLASM COLLECTION

Germplasm of native and non-native plant species will be secured through the collection and propagation of seed and cuttings. Short to medium term seed storage facilities are required to enable stocks to be built up so that sufficient seeds are available for propagation when required and that their viability remains optimum. For those species where insufficient germplasm exists in the wild or in cultivation to support mitigation works, field gene banks will be established and maintained.

10.2.1 Seed Collection

Wild populations of old father live-forever, French grass, salad plant, tea plant, boneseed, babies' toes and scrubwood are small, necessitating a cautious approach to seed or cutting collection. The Field Manual for Seed Collections (RBG Kew, Wakehurst Place) advises as a rule to collect no more than 20% of the available seed on the day of collection. This ensures that the population sampled is not endangered by the planned seed collecting. The exception to this is if a population is going to be destroyed. Collection should be over two years for small populations. Annex 5 of the manual refers specifically to collecting from rare and threatened plant populations, judgements on the level of

collecting, from how many individuals and how often is likely to vary between species and source populations.

Many of the species required by the mitigation plan for propagation are annuals, flowering after the winter rains and seeding in spring/early summer. In view of the limited and seasonal availability of seed,, collection of seed will need to start immediately so that collections can be made over two years or more depending on species and population size. It is anticipated that seed for sowing and propagation would take place shortly before the planting schedule requires them (planting as young seedlings (plant plugs)) during the winter or sown directly. If seed is to remain viable until it is needed, short to medium term seed storage facilities will be required. Staff of the Environmental Conservation Section (ECS) sort, dry and store seed at their nursery, in Scotland. However, drying facilities are limited (there is no provision of heat, nor temperature or humidity control) as are storage facilities. A small investment in equipment and training will enable the ECS to improve and expand upon their current activities. The Chief Agriculture & Natural Resources Officer (CANRO) has provisionally agreed that space could be made available within existing laboratories at the ANRD office to expand seed sorting, drying and storage facilities. Some equipment remains from former agricultural and forestry research trial programmes but additional equipment is likely to be required.

Seed of the boxwood is represented in the Millennium Seed Bank at Wakehurst Place and repatriation of seed to support planting will be important. Seed collected from scrubwoods at Prosperous Bay Plain (PBP) is also stored at Wakehurst and this might also be useful.

10.2.2 Cutting Collection

Vegetative propagation will be necessary for some species and to help boost stocks of others.

There are only two, possibly three ebonies growing in the wild and although it has been propagated very successfully and is now represented by several thousand individuals in conservation areas, with few exceptions, the hybrid (redwood x ebony) has been planted close by and hybridisation is possible. Propagation by seed is therefore not advisable unless there is a source of ebony that is not growing close to either redwoods or hybrids. However, vegetative propagation methods for ebony are well established and there are reasonably large stocks of ebonies at High Peak and some at Pounceys from which cuttings could be taken.

10.2.3 Use of Field or Nursery based Gene Banks

Germplasm for the boxwood could be won from the field gene bank at Whites Cottage. The former species survives as a small wild population near Lot's Wife and a field gene bank of approximately 100 individuals near Whites Cottage. It has been extirpated from the area of Prosperous Bay Plain.

The establishment or reinforcement (existing) of other field gene banks either at ECS or in private collections will help where wild stocks are small and widely distributed reducing the impact on wild populations and reducing risk to collectors in reaching the more inaccessible species. This could help facilitate propagation by seed or cuttings,

particularly if species are quick to mature and flower. Species that could benefit from this approach are: old father live-forever, St Helena plantain, French grass, St Helena tuft-sedge, salad plant and bastard gumwood.

10.2.4 Proposed Methodology for Securing Germplasm

It is proposed that germplasm collection will be achieved by a combination of Government and NGO collaboration and private sector involvement, overseen and managed by the ANRD.It is proposed that ECS staff will collect seed as part of their regular programme of field work (when maintaining outlying populations or carrying out biannual surveys). A target quantity will be set and collections monitored to establish whether sufficient seed stock is being collected. Sources will include:

- Gumwood seed to be collected from Deep Valley, Golf Links, Millennium Forest and Peak Dale;
- Boxwood from the field gene bank near Whites Cottage and RBG Kew Wakehurst Place;
- Other species when carrying out biannual surveys e.g. old father live-forever (Gregory's Battery), salad plant & tea plant (Turk's Cap), scrubwood (Rupert's, Prosperous, Turk's Cap), boneseed (Great Stone Top).
- Bastard gumwood from the field gene bank at Scotland

ECS staff will also be involved in collecting cuttings from specific species in particular geographic locations e.g. ebony from High Peak and Pounceys.

Depending on how the collections are progressing, it is envisaged that a proportion of the seed collection will need to be contracted out particularly for the species that are found in the more remote and least accessible locations (not on regular walk tracks or routine work programmes). This could include St Helena Nature Conservation Group (SNCG) members who have experience of the terrain and species. Training in seed collection and storage techniques will be required. The visit of Steve Alton to St Helena from the Millennium Seed Bank in 2004 provided an opportunity for some training to staff of the ECS and Millennium Forest and also to SNCG members. Refreshing and updating skills and knowledge will be required. Taxonomic verification and confirming field identification skills will also be required for species which are little known or for which identification is difficult or uncertain (e.g. French grass (as there are two other very similar non-indigenous species on St Helena), St Helena tuft-sedge, hair grass, and St Helena goosefoot). In addition experimental work may be required to establish seed germination/propagation techniques for those species which haven't previously been grown in cultivation in advance of habitat restoration planting.

Collection reference data which will include provenance details and GPS map reference will be required to be kept and the establishment of a database is encouraged. The programme for seed/cutting collection will be established in conjunction with the Contractor's construction programme to ensure that seed/cuttings are collected at the optimum time for each species and that appropriate species and quantities are available in sufficient time for propagation.

10.3 PLANT PROPOGATION

The outline mitigation design, identifying species mixes, densities and broad quantities has been undertaken in order to inform the EIA process and the initial development and discussions of the plant propagation process with both ANRD and SHDA. As illustrated in Figure 10.7 and described in section 10.6 below, proposed areas of mitigation planting have been identified and prioritised with a supporting rationale and explanation of the individual site requirements and how they contribute to the mitigation strategy as a whole.

The outline design will be developed into a detailed design by the Contractor and refined in parallel with the refinement of the reference design. Further modifications may also be required once construction works commence. All mitigation design modifications and development will be undertaken in consultation with Faber Maunsell's Environmental Monitor (FM EM).

Refinement of the landscape and ecological mitigation design will enable a more accurate estimate of plant quantities which will help inform the seed collection/cutting collection process and the development of nurseries.

Propagation of native and non-native species will be required based on the germplasm collected in order that sufficient plant propagation can be undertaken to implement the LEMP. Details of the various species to be propagated and the source for seed collection and cuttings, is contained in Section 10.7 below.

Prior to the propagation of the various species on a production of sufficient scale to provide the necessary plant quantities to support the LEMP, trial propagation and plant establishment trials will be undertaken. This will be undertaken by the nursery producer and will be monitored by the FM EM.

10.3.1 Propagation Protocols

Propagation protocols drawing on established protocols where they exist and on the experience of ECS staff will be prepared. Additional work will be needed to research or establish propagation protocols for those species that have not previously been propagated (French grass, St Helena tuft-sedge, hair grass, and St Helena goosefoot) and this could be carried out within the nursery producer propagation trials. Others such as bastard gumwood will require support for more intensive action through a combination of controlled pollinations and propagation.

10.3.2 Potting Soils

It is proposed that as far as possible topsoil will be retrieved from appropriate sites of cut associated with the development. An estimate of the potential quantities available will be necessary in order to establish how much additional topsoil will have to be sourced.

The planting programme will take account of the varying sensitivity of sites to introduction of soils and a plan will be produced detailing where soil introduction is permissible for plant establishment. Further work is required to establish growing medium and soils required to achieve satisfactory plant establishment, to match plant requirements and to conform to natural soil types in the area of planting. Soil samples will need to be collected

from various locations and analysed to inform the development of potting soils. This should be undertaken as a priority in order that the propagation process is not delayed.

Preparatory potting composts/growing media and peat are currently imported to the island by local merchants. These soils are a known source of introduction of bryophyte and plant species and are not recommended to be used in the mitigation programme.

Compost is produced locally on a small scale by households, farmers and the ANRD. Production methods vary and utilise different materials, fish waste and ginger are popular. It is likely that soil will need to be manufactured on the island using existing substrate material and processing this with composted organic waste derived from decomposed organic material growing on St Helena, for plantings in areas where soil degradation may be a limiting factor. Technical support to develop green waste composting at Horse Point Plain is planned for in the solid waste management project but it is not timetabled until year four of the project (2012). Technical assistance will be required immediately so that, in collaboration with the solid waste management project and the EU alien invasive species project, techniques for composting, that could include prickly pear and creeper removed from PBP, can be established. The composting process must ensure that soil borne pests and pathogens are destroyed. If sterility of the finished product cannot be achieved it would be best to avoid its use at PBP. Inert additives may be required to supplement reclaimed topsoils to develop suitable potting material for plants grown for PBP. This might include: polyacrylamide gel, perlite or vermiculite.

The demand for soil and soil supplements will be kept to a minimum by growing as many of the species as possible for a short time only in plant plugs, so that they are planted as young seedlings in the right season to facilitate quick establishment. This will be the principal method for the desert annuals and perennials. Tree and shrub species required for screening will need to be grown on longer in 3-3½ inch bags. Beyond that size, planting should be of bare rooted stock because the size of bags and weight of soil will make large scale planting cumbersome and awkward unless machinery can be used. It will also add to the risk of introduction of weed species and pests.

10.4 PLANT PRODUCTION MANAGEMENT

In addition to plant production, there will be a need to manage the processes to ensure that there is a source of sufficient seed or cutting material of the correct provenance to meet production quotas, that material of appropriate provenance is used in the appropriate landscape and ecological planting areas, that the correct soil substrates are used for potting media, and that strict pest and quality control are maintained. There will be a further requirement for monitoring and maintenance of the plantings.

It is proposed that propagation, planting and maintenance (2 years defect period) will be carried out under contract to the private sector. The private nursery sector is currently small but growing with a number of growers having recently taken on the Orchid project and others keen to expand productivity. Initial discussions with SHDA suggest that there is private sector interest on St Helena and that they could provide support to this sector through promoting and developing the skill set of local businesses

Landscape, conservation or agricultural businesses/contractors are limited and it is not clear however, if due to the scale of work required to achieve the mitigation requirements

for the LEMP as well as other island plans, there are enough local contractors who can undertake the work. This should be considered at an early stage. Contractors or full time employees will require to be overseen by a suitably experienced individual. Timing might be pertinent if the contractual base remains small, requiring knowledge of timing of other land management contracts to keep a staggered programme of contract works. Managing contracts as larger and longer term (1+ years) will be an inducement for the private sector to invest (and expand) their business. ANRD is currently working with SHDA on this principal.

It is proposed that ANRD would manage the plant propagation, planting and maintenance contracts, working closely with the Contractor and the FM EM. Additional quality control monitoring will required to be undertaken.

The early appointment of a suitably experienced ecologist to the ANRD is seen as a vital requirement in order to manage the environmental aspects of airport planning and construction issues and enable management of advance mitigation works.

10.5 MAINTENANCE AND LONG-TERM MANAGEMENT REQUIREMENTS

The long-term protection, maintenance and management of the areas of habitat restoration and landscape planting is essential if the mitigation commitments of the LEMP are to be realised and the long-term future of these sites as mitigation for the continuing impact of the Airport and supporting infrastructure proposals, is to be secured.

A landscape and ecological maintenance and long-term management plan will be developed by FM in parallel with the refinement of the scheme design and in collaboration with ANRD, SHNT, and other key stakeholders. This document will outline the maintenance and long-term management required for the habitat restoration and landscape planting proposed under the LEMP. This will include, but will not be limited to the following.

- Alien plant control. Control of invasive species will be necessary to prevent a build up of a soil seed bank and subsequent spread;
- Pest control to reduce predation pressures on existing endemic and indigenous flora as well as all proposed reinstatement planting. This would be initiated in advance of all reinstatement planting works and monitored.
- Quarterly monitoring of plant establishment with replacement planting required on an annual basis in response to plant deaths;
- Irrigation of plant material for a minimum two year period post planting with close monitoring throughout this period. Irrigation will be undertaken and monitored on a site by site basis. Polyacrylamide polymers will be used during planting to increase water retention around the root zone;
- Long-term monitoring programmes (10 years) to monitor results of the reintroduction/habitat restoration programmes with regular review and appropriate actions to address any issues as they arise; and
- Other ecological monitoring (as described in Chapter 9 Terrestrial Ecology and Nature Conservation 9.5.6 Monitoring in Volume 2 of this ES) for an initial period of 10 years.

The maintenance and management of the areas of habitat restoration and landscape planting will be required for a 10 year period post planting during which the requirements detailed in the landscape and ecological maintenance and long-term management plan will be undertaken. . The long-term protection of the areas of habitat restoration and landscape planting is essential. The protection of the Central Basin is paramount in this respect and early designation of the PBP Central Basin as a Sanctuary under the National Parks Ordinance, with the expressed intention that it will become part of the wider Prosperous Bay Plain National Protected Area, must be supported.

The current designation proposed for PBP NPA within the LDCP broadly fits the Ashmoles description of Prosperous Bay Plain used in their study (2004) and extends it slightly to Dry Gut in the south. Limiting NPA status to PBP excises it from its wider outstanding geological and landscape setting of which it is an integral part and potentially reduces strategic land management opportunities for zoning, including establishing buffer zones (e.g for invasive species control), to integrate planning and action for conservation of biodiversity & heritage, recreation & spiritual enjoyment, scientific study and education. Consideration should be given to extending the proposed PBP NPA to include Fisher's Valley (part of the area described by the possible candidate Ramsar site), the ridge below Bradleys Government Garage out to Holdfast Tom and coastline east and south to join with the Gill Point proposed NPA. Designation should run concurrently with the development of a Protected Area Management Plan which would set out the criteria/guidelines for management and should plan and cost the longer term management requirements.

The Protected Area Management Plan would establish the vision, aim, objectives, actions and responsibility for the long term management of a PBP NPA.

In addition a process needs to be agreed to review the response of habitats to the mitigation package. In the event that monitoring reveals that successful establishment or support of biodiversity is not being achieved, additional measures may need to be agreed. The early appointment of a suitably qualified ecologist is seen as a vital requirement in order to manage the environmental aspects of airport planning and construction issues and support the management of advance mitigation works. The role would be considered a permanent addition to SHG environmental staff with a future remit over Protected Areas and related environmental conservation issues. The appointee could be assisted by a working committee of governmental and NGO representatives pending, or concurrent with, the expansion of a permanent environmental department.

Impacts of predators on planting and implementing control measures if shown to be a problem will be required. The scale of the potential impact nor the level of control required is not known. It is advisable to establish and maintain good communications with the Invasive Species Project Officer to inform the planning of the planting works and to ensure that best practice for predator control along the haul/access road and at PBP is developed. Funding will be required to enable collaboration with the EU Invasive Species project, RSPB and SPCA.

10.6 DESCRIPTION OF LANDSCAPE AND ECOLOGY MITIGATION COMMITMENTS

The landscape and ecology mitigation commitments are illustrated on Figures 10.7 and described below. The figures also illustrate planting schedules which identify the proposed species mixes, their proposed densities and approximate areas.

10.6.1 Rupert's Bay and Lower Valley (Refer to Figure 10.7)

For mitigation proposals relating to Rupert's beach refer to Appendix 14, Volume 4.

The existing fuel farm will be relocated further up Rupert's valley enabling this area in conjunction with the new wharf to become a focus for port related activity. The bunds at the existing fuel farm which currently support the fuel tanks on a raised platform will be re-graded and the ground levelled so that future Port Authority related buildings will be constructed on a level similar to the existing ground level of the adjacent wharf area. Future buildings will therefore appear less prominent particularly when viewed in relation to Rupert's lines, thereby improving the historic setting. The desalination chimney will also be de-constructed and sensitively reassembled in a suitable location nearby maintaining the historic connection.

All compound areas both around the bay and within the valley will be fully reinstated and returned to their former use.

The haul/access road between the proposed wharf at Rupert's Bay and the church follows the alignment of the existing road which will be upgraded and widened.

A combination of she-oak and samphire ground cover currently provide a partial screen and boundary treatment to the commercial storage buildings to the immediate south of the existing BFI. Some of this planting will be lost to accommodate the haul/access road alignment. Where possible the existing vegetation will be retained with reinstatement she-oak with samphire ground cover planted between the fence line and the haul/access road to provide a consistent boundary treatment and to help screen the commercial area.

Subject to service constraints and taking into consideration the various access requirements along the western side of the road, she-oak and samphire ground cover will be planted along the haul/access road edge. The boundary planting will provide definition to the road corridor creating a more consistent boundary treatment responding to the commercial boundary planting treatment on the opposite side of the road and will partially screen the commercial buildings in views beyond.

The existing band of amenity planting which fringes a section of the eastern side of the valley road will be partially lost in order to accommodate the haul/access road. The existing amenity planting will be protected and retained wherever possible. Where sections are lost and where gaps currently exist, similar species present in the existing mix will be planted to strengthen and reinforce this important buffer and screen between the line of properties and the road. Species will include sea grape, flamboyant, garden hibiscus, Cordia alliadora, Banyan, Mango, Paw paw and Margossa and will be established by cuttings and seed collection from established local material available from Rupert's and Jamestown. Scrubwood and ebony will also be used at the upper and lower

end to create transitional areas to the amenity planting. Additional amenity planting along this entire section stretching from the church to Haytown House will ensure that views of the haul/access road will be partially screened for the majority of residents. The planting will also be replicated on the opposite side of the road and will reflect the localised change in character and scale engendered by the cluster of residential properties and the associated sense of community, thereby creating a more human scale to this section of road corridor and valley. The species mix and detailed planting design will be undertaken in close consultation with adjacent residents in Rupert's so that they have the opportunity to identify non-invasive species which they would like to see incorporated into the planting thereby encouraging ownership and assisting with the long term management and sustainability of the planting.

The section of haul/access road to the immediate south of the church and the power station will deviate from the existing road and follow a new alignment running across the open ground between the church and the power station. A band of scrubwood will be planted along this section to help integrate the road into the mid-valley landscape. The scrubwood will be planted in low densities and in clusters particularly around the changes in gradient and around junction points where the haul/access road ties in with the existing road alignment. Invasive species such as prickly pear will be cleared in the areas prior to scrubwood being planted.

- Raised bunds at existing fuel farm to be re-graded and levelled;
- she-oak and samphire ground cover planting to provide a consistent boundary treatment and partial screen between the haul/access road and the commercial buildings beyond;
- Reinforce and extend the amenity planting along the road corridor between Haytown House and the church;
- Scrubwood planting in conjunction with invasive species control along road corridor between the church and the power station.

10.6.2 Upper Rupert's Valley (Refer to Figure 10.7)

The section of the haul/access road between the power station and the first hairpin bend beyond the relocated BFI will slowly rise up the valley sides following a consistently steep even gradient. Scrubwood will be planted at relatively low densities in clusters in the area between the haul/access road and the new BFI. Invasive species will be cleared prior to planting the scrubwood. A scrubwood dominated native species mix will also be planted on the uphill side of the haul/access road in order to integrate the road into the valley landscape. Again the native planting will be relatively low density and in pockets where invasive species have been removed to reduce the competition and improve the success rate of establishment. The planting areas will relate to the landform with planting areas rising into the gullies which dissect the valley sides.

Planting along valley floor adjacent to BFI and lower valley sides will help reduce the apparent scale of the BFI in the landscape

- Scrubwood dominated native species planting to integrate the access road into the valley landscape in conjunction with invasive species control

10.6.2.1 Quarry Restoration

There are two possible temporary quarry locations in the upper section of Rupert's valley. The restoration proposals are dependent on the detailed design of the quarry, however, broad mitigation principles will be followed and will include the following.

- The restored quarry will be integrated with its localised landscape setting by using landform, vegetation and boundary features to reflect the landscape character of Rupert's Valley.
- Restoration, including layout of vegetation planting and landform design, will reflect the scale and layout of the quarry.
- Creation of landform such as rollover banks and alteration to benches will be in keeping with existing local landform and landscape setting.
- Vegetation planting will occur directly against the rock face and toe screes by seeding and tree planting.
- In order to integrate the quarry face and the rest of the site, a linkage will be provided between the face and quarry floor using slopes, vegetation and spoil generated during operation
- Where appropriate some existing quarry elements will be retained as landscape features in their own right.
- Where appropriate phased restoration will be implemented during the operation of the quarry. This will allow the landscape to mature earlier and will result in a more natural appearance at the end of operation.
- Progressive reclamation. On-going, progressive reclamation during the operational life of the quarry will allow the landscape to mature earlier and will help minimise visual impacts at an early stage.
- Final landform and site layout will be designed such that it is appropriate for end uses. Consideration will be given to access routes through the quarry and from the surrounding area, the requirement for public access, safety and interpretation.

10.6.3 Upper Rupert's Valley – Rupert's Hill – Banks Ridge (Refer to Figure 10.7)

The haul/access road rises steeply up the valley sides, crossing over a deeply incised gorge below the area of extensive gullying before rounding Rupert's Hill and continuing along Banks ridge adjacent to the Pipe Path until Deadwood Plain. A native species mix, dominated by scrubwood species is proposed along the road corridor. This will provide a continuation of planting from the lower sections of road adjacent to the BFI and will help integrate the road into the valley landscape and the steep sided slopes. The native planting will be planted in clusters, concentrated around gullies, road drains and eroded slopes whilst relating to the landform, reflecting the natural contours. The planting will also be concentrated in sections of the slope where more extensive cut has been required during road construction in order to help further integrate the road into the landscape and reduce the visual impact of scar slopes. Plants will be planted in random clusters of between 3 and 12 plants and will concentrate in areas where invasive species have been removed.

The existing colony of scrubwood on Rupert's Hill will be extended with additional specimens to supplement the existing community and naturally expand the planting in this area.

From Rupert's Hill east along the ridgeline, the scrubwood dominated native mix with ebony, St Helena tuft-sedge and hair grass will extend with the occasional introduction of forestry species to create a transition zone between the more open upper valley sides and the existing forest planting along the ridge. The haul/access road will involve the loss of a swathe of forest planting along the ridgeline which will be reinstated where possible along the road corridor with further planting to strengthen the forest area and to help partially screen the road from wider views along this prominent ridgeline. The forest planting will use similar forest species as existing including silky oak and Acacia longifolia and will be planted at densities of $1/m^2$. Eucalyptus species will not be reinstated. It should be noted that re-establishing forest planting will be difficult due to the ground conditions as exposed rock predominates with no top or sub soil in many areas. The road will not, therefore be entirely screened, however, the creation of false cuttings in conjunction with planting where possible will help partially screen the road from wider views.

Sections of the historic Pipe Path are evident along the ridge and the road alignment will be adjusted locally on site to avoid and preserve the Pipe Path in situ wherever possible. Where crossing the Pipe Path is unavoidable, access along the Pipe Path will be maintained with the sensitive design of crossing points or steps where changes in level necessitate this, thereby ensuring that this historic route remains accessible.

- Scrubwood dominated native species planting to integrate the access road into the steep valley sides in conjunction with invasive species control;
- Extend existing colony of scrubwood at Rupert's Hill;
- Strengthen and extend forest planting along Banks ridge;
- Adjustment of the road alignment locally to avoid the Pipe Path and where this is unavoidable pedestrian access will be maintained with crossing points.

10.6.4 Deadwood Plain – Bottom Woods (Refer to Figure 10.7 in Volume 3 of this ES)

The haul/access road runs adjacent to Deadwood Plain resulting in the loss of a linear swathe of pasture land and some peripheral loss of forest planting before joining the existing road along Deadwood Plain. The existing road will be upgraded and widened involving land take from the eastern side of the road encroaching into the pasture land of Deadwood Plain which is also important for its breeding wirebird population. (Wirebird mitigation is presented separately in Appendix 9.1, Volume 4 of this ES). The haul/access road leaves the existing road and runs through the paddocks infront of Fox's Garage resulting in severance of a small pocket of grazing land adjacent to Fox's Garage as well as a longer linear swathe of pasture before the haul/access road descends into Mulberry Gut. Woodland planting will be lost along the western side of the gut with a swathe of arable land lost from the gut floor. On the eastern side of the gut the haul/access road rises, following an existing track which will be widened and upgraded before crossing Coltshed Road and continuing along the northern edge of Longwood Farm. The haul/access road continues through the former ANRD nursery resulting in the loss of some tree planting before skirting the edge of Bilberry Field Gut, running beneath the new properties currently being constructed before crossing adjacent to the waste stabilisation ponds and the open ground at Bottom Woods where it joins the alignment of the existing road.

10.6.4.1 Deadwood Plain

A new fence line will be established along the eastern edge of the haul/access road to provide a new boundary to the pasture land with additional forest planting using species such as silky oak and Acacia longifolia planted along the western edge where trees have been removed and to help assimilate the road into the landscape.
In consultation with residents, a band of screen planting and a fence is proposed between the haul/access road and the last property on the existing road in order to help screen views from the property of the haul/access road. Further screen planting will be provided along sections of the road where the verge is sufficiently wide to accommodate planting (approximately between chainage 6350 and 6550). Species will create a buffer and visual screen between the road and properties.

Invasive cedar will be removed from Paddock 2 of Deadwood Plain (2.4 ha) adjacent to the haul/access road thereby improving the quality of pasture to compensate for the loss of grazing land both adjacent to Fox's Garage as well as along the length of the haul/access road within Deadwood Plain. The pocket of severed grazing land adjacent to Fox's Garage will be planted with silky oak and gumwood to help provide some screening for properties which will have views extending along a length of the haul/access road.

The fence line will continue along the length of the haul/access road where it runs through pasture land with gated access provided between paddocks, the location of which will be agreed with the leaser. Gates will also be provided adjacent to Fox's Garage to maintain vehicular and pedestrian access to the two properties in Deadwood Plain as well as to provide access to the paddocks and for walkers accessing Flagstaff Hill and The Barn.

10.6.4.2 Mulberry Gut

Woodland will be reinstated and extended (as defined on Figure 10.7 in Volume 3 of this ES) along the west side of Mulberry Gut to integrate the haul/access road into the landscape. Species will reflect the existing composition with an emphasis on species such as Acacia longifolia which will provide a source of wood and fodder. Consultation with the land manager/ANRD will be required to explore opportunities for management of the planting for these purposes.

Where the road crosses the arable fields of Mulberry Gut fencing is proposed with gated access for agricultural traffic. This will be undertaken in consultation with ANRD and leasers to ensure that appropriate access is maintained and indeed whether fencing once the road is operational is required.

As the haul/access road rises out of Mulberry Gut, hedgerow planting is proposed along the down slope side of the road to provide reinstatement planting, create definition to the road corridor and help integrate the road into the landscape. Hedgerow species will include white olive and spore and will not involve additional land take from the arable land. On the up slope side of the haul road, reinstatement planting will be undertaken between the haul/access road and the proposed house plots using a species mix including gumwood and silky oak. This planting will provide reinstatement for the planting lost through the road construction and will help integrate the road into the landscape whilst improving the landscape structure and providing a buffer and screen planting between the future house plots and the haul/access road.

10.6.4.3 Coltshed Road/ Longwood Farm

Subject to land ownership and in consultation with the residents of the property immediately adjacent to the point where the haul/access road crosses Coltshed Road, screen planting is proposed using a mix of gumwood with amenity species to reflect the existing garden planting to help screen the road from views from both the house and garden. Further gumwood planting is proposed along the fence line to help screen the haul/access road from immediate properties on Coltshed Road.

The alignment of the haul/access road once it leaves Coltshed Road will sever an area of grazing land. The future use of this pocket of land will need to be discussed with ANRD as it is likely to be too small to sustain any grazing. However, the existing track could be grubbed up and the arable land extended into this area, alternatively it could be planted with gumwood. There is also an area of raised ground which runs parallel and adjacent to the arable fields which will require to be levelled to accommodate the road corridor. The soil material contained within this bund should be stored and re-used for the landscape mitigation planting. Composting pits along this bund will be relocated.

The existing agricultural track will be re-aligned to accommodate boundary planting comprising gumwood interspersed with thorn tree to reinforce the arable field boundary. The existing hut and compost pits will be relocated in consultation with ANRD and the haul/access road will be fenced along the section where it abuts pasture land.

Tree planting within the former ANRD nursery area will be lost as a result of the access/haul road and it is proposed that invasive weed control is carried out in this area followed by planting with a mixture of silky oak and gumwood. The raised concrete nursery beds of the former forestry nursery will be removed. This will be extended to the south east corner where reinforcement planting using similar species will ensure that the road remains screened from view from the properties in Piccolo Hill.

10.6.4.4 Bilberry Field Gut

Extensive gumwood planting is proposed around Bilberry Field Gut, extending from the haul/access road to the erosion zone. Planting will become progressively less dense at the outer edges to provide a gradual transition area into the less vegetated outer slopes. This planting will help integrate the road into the landscape but will also provide compensatory planting for the major adverse impacts and permanent loss of the landscape resource at Dry Gut. This area of compensation gumwood planting will help regenerate a degraded landscape which formally supported the gumwood plantings of the 'Great Wood' and will create an attractive and valuable landscape and ecological resource. The area of planting will also respond to and ultimately connect with the proposed extension to the Millennium Forest planting identified in the LDCP.

Irrigation for this area of gumwood planting will be from the waste stabilisation ponds. It should be noted, that subject to the stage and extent of repairs undertaken by the ongoing drainage project, additional infrastructure/repairs to the ponds and potential extension to them may be necessary in order to provide adequate irrigation for the first two years of plant establishment.

On the up-hill slope of the haul/access road reinstatement planting using gumwood will be undertaken where necessary to maintain the vegetated slopes and to further integrate the road into the landscape.

10.6.4.5 Bottom Woods

Between the waste stabilisation ponds and the junction with the existing road at Bottom Woods, gumwood planting is proposed along the southern side of the haul/access road in order to provide a visual buffer and partial screen between the road and the existing and proposed housing. This planting will be undertaken as advance planting in order to allow the trees to become more established thereby providing greater structure both during the construction period and once the road is operational. The new planting will be carefully monitored during the construction period and if dust levels become too great, plant washing may be required using a low pressure spray.

Planting is in an area dominated by creeper. Creeper can be retained as a soil cover until gumwoods are established and then gradually removed and replaced with other native ground cover species such as St Helena tuft-sedge

A new fence will define the boundary to the north of the road as this is an area proposed for wirebird habitat restoration (refer to Appendix 9.1 in Volume 4 of this ES for further details).

Once construction is complete and the access road is open, all existing tracks in the area between the waste stabilisation ponds and the junction with the existing road at Bottom Woods will be grubbed up and the ground reinstated. The extensive area of dumped earth will be removed and where suitable used in the adjacent areas of gumwood planting.

- Reinstate fence line along entire length of road which passes through pasture land, providing gated access where necessary to facilitate access requirements;
- Reinstate forest planting along western side of road between Banks ridge and the properties at Deadwood;
- Screen planting and fence between properties and road at particularly visually sensitive locations along Deadwood Plain;
- Gumwood and silky oak planting in area of severed paddock adjacent to Fox's Garage to provide visual screen and structure;
- Reinstate woodland planting on western slopes of Mulberry Gut using species suitable for fodder and wood supply;
- Hedgerow planting and reinstatement planting along eastern slopes of Mulberry Gut to integrate the road into the landscape and to provide additional structure and screen planting between the road and the proposed housing plots;
- Screen planting using gumwood and amenity species adjacent to property on Coltshed Road subject to landownership and in consultation with residents;
- Realignment of agricultural access track in conjunction with gumwood and thorn tree boundary planting adjacent to Longwood Farm;
- Agreement required with ANRD over use of severed grazing land at junction of Coltshed Road and Longwood Farm;
- Relocate hut and compost pits in consultation with ANRD and store and re-use soil excavated from area of raised ground adjacent to existing field boundary at Longwood Farm;
- Silky oak and gumwood planting with former ANRD nursery including reinforcement planting along southern edge to screen the road from visual receptors to the south;
- Extensive gumwood planting at Bilberry Field Gut and subsequent regeneration of a degraded landscape to provide compensation for the major adverse impacts as a result of the permanent loss of the landscape resource at Dry Gut;
- Gumwood planting along the southern side of the road between the waste stabilisation ponds and the existing road at Bottom Woods to provide structure and screen planting between the road and the existing and future housing;
- Fence along the northern side of the road in the above location adjacent to the area of wirebird habitat restoration; and
- Grub up and restore existing access tracks in the Bottom Woods area once the road is operational.

10.6.5 Bottom Woods – Bradleys Government Garage (Refer to Figure 10.7)

At Bottom Woods the haul/access road rejoins the existing road where it descends towards Bradleys Government Garage. The existing road will be widened resulting in the loss of some of the adjacent roadside largely non-native scrub/tree planting. This section of the haul/access road will also become the entrance route for visitors to the Island, providing visitors with their initial impressions of St Helena. The proposed planting will reflect the visual importance of this key access corridor and will create a high quality consistent boundary treatment reflecting the native species which would have once dominated the landscape and formed the 'Great Wood' whilst maintaining views to the dramatic landscapes beyond.

There would also be benefit in SHG considering applying a similar boundary treatment along the section of existing road between Bottom Woods and Longwood. This would

create a strong, legible and consistent corridor treatment which would create an attractive entrance for visitors whilst helping to provide some form of visual continuity along a section of road where the more disparate built elements combine to provide a visually confusing and often less than aesthetic experience.

The gumwood and ebony planting will provide a strong band along the haul/access corridor and will further extend the existing gumwood planting where it passes adjacent to the Millennium Forest. Where sections of sub-rock are exposed at the surface, these will be broken up to enable gumwood and ebony to be planted in densities of $1/m^2$. Between the Millennium Forest and Bradleys Government Garage, gumwood and ebony will be planted along the road corridor extending the area of existing gumwood planting with particular emphasis on the road corridor and along gullies thereby creating visual and ecological connectivity.

The existing access track which runs broadly parallel to the existing road as well as a small section of access track to the north west of Bradleys Government Garage will also be grubbed up and planted with gumwood and ebony.

The crushing plant and array of machinery and material adjacent to Bradleys Government Garage will be removed, the ground de-compacted where necessary and gumwood and ebony planted.

- Gumwood and ebony planting along the haul/access road to create a high quality boundary treatment;
- Planting to extend and respond to existing gumwood planting at the Millennium Forest;
- Grub up existing access tracks where they will become superfluous once the access road is open and plant with gumwood.

10.6.6 Bradleys Government Garage – Prosperous Bay Plain (Refer to Figure 10.7 in Volume 3 of this ES)

A construction camp will be located to the east of the two properties at Bradleys Government Garage on an elevated area of land overlooking Prosperous Bay Plain (PBP). The camp area will require levelling to accommodate the construction camp as well as infilling of some of the erosion gullies to provide vehicle access. The entire camp area will be reinstated with the ground re-profiled to reflect the natural gentle profiles of the adjacent plateau area. The reinstatement will also involve seeding of prostrate forming native species such as babies' toes and samphire. The area surrounding the Remote Obstacle Light (ROL) and navigational aid to the east of Bradleys Government Garage where small patches of samphire and chenopodium exist surrounded by carpeting creeper, will also be reinstated with samphire seeded and planted in conjunction with the gradual removal of creeper. This will provide habitat for invertebrate species such as the Mole spider.

In consultation with residents at Bradleys Government Garage, additional screen planting and fencing if required will be proposed to help screen views of the airport construction and haul road. Long term screen planting will be undertaken if the residents so desire.

Between Bradleys Government Garage and Cook's Bridge the haul/access road will leave the existing

road and descend the slope traversing the land at Bradley's to Cook's Bridge. In order to integrate the haul/access road as much as possible into the landscape and to maintain the high quality treatment provided by the planting between Bradleys Government Garage and Bottom Woods a continuation of a similar treatment is proposed. A mix of gumwood and ebony will be planted along the road corridor, varying in planting width and density with density decreasing at the outer edges to avoid a hard planting line and ensuring a transitional area is created to the less vegetated areas beyond. The planting will be concentrated in the gullies and will flow along the contours, tapering towards Cook's Bridge. At Cook's Bridge wild mango will be cleared from the Fisher's valley water course with gumwood and ebony planting extending up and down the subsequent gut.

The haul/access road will continue from Cook's Bridge to PBP rising steeply to skirt the western and southern perimeter of the Central Basin before reaching the terminal area in steep cut. Mitigation associated with this section of the haul/access road is outlined in section 10.6.4 below.

- Construction camp will be fully reinstated with ground re-profiled and seeded with prostrate forming native species;
- Disturbed ground around the ROL and navigational aid will be reinstated with samphire in conjunction with the gradual removal of creeper;
- In consultation with residents, fencing and screen planting will be undertaken adjacent to the properties at Bradleys Government Garage;
- Gumwood and ebony planting along road to create a high quality boundary treatment and to help integrate the road into the landscape; and
- Wild mango cleared from Fisher's valley watercourse around Cook's Bridge.

10.6.7 Prosperous Bay Plain (Airfield site) (Refer to Figure 10.7 in Volume 3 of this ES)

The mitigation proposed for the PBP area takes the form of an invasive plant control/eradication programme which is an integral component of the mitigation requirements which seek to provide compensatory habitats and landscape treatment to reduce and offset the permanent direct and indirect impacts on the ecological and landscape resource at PBP as a result of the Airport and supporting infrastructure proposals. Figure 10.7 describes the areas where alien plant control and reinstatement, reinforcement and reintroduction planting will be carried out.

The invasive plant control/eradication programme is designed to compensate for or reduce the impacts caused by:

- Permanent habitat loss as a result of land-take for the airport construction site, the haul roads, water pipeline, navigational aids, obstacle lighting and their means of access (excluding land temporarily taken for construction).
- Temporary land-take for the construction programme, e.g. contractor's compounds and lay-down areas for the storage of materials and plant or any other temporary construction sites e.g. temporary airstrip. This includes consideration of the following:

    - The need to carry out extensive excavations for runway construction with lowering of the landform of the Eastern Plateau potentially leading to

changes in wind-based erosion and accretion patterns in the adjacent desert and semi-desert habitats of the Central Basin;
- Levelling and grading of the any temporary runway and construction compound on the Southern Plateau if this option is pursued; and
- The likelihood of successful restoration of former habitat conditions to these levelled and graded areas.

Resources will be made available to restore 125-150 ha of desert and semi desert in the area of PBP to a condition resembling pristine conditions with a predominance of vegetation dominated by endemic and indigenous species. This mitigation is in response to anticipated impacts on three key ecological receptors: plants, higher plants and lichens of the arid zone; endemic and indigenous invertebrates; and the wirebird.

The proposal for any temporary runway and contractor's compound on the Southern Plateau (see Figure 2.1 in Volume 3 of the ES) significantly increases the temporary impacts of construction and may have long-lasting permanent effects with respect to the nature of the desert substrates and their suitability for re-colonisation by certain invertebrates in particular. Should this option be taken forward, the offsite compensation areas in PBP should be proportionately increased from the proposed 125-150 ha to a total that reflects a multiple of 1.5 x the area lost to all temporary construction works.

Compensation enhancements will be achieved by a combination of control and eradication of invasive plants and habitat restoration (through natural regeneration, re-instatement, re-introduction and reinforcement) of native plants in appropriate areas in PBP, extending in the west to meet the eastern edge of Fisher's Valley and on the Dry Gut embankment.

The following plant species will be subject to measures for eradication or reduction in their competitive effect on the indigenous and endemic flora:

- prickly pear;
- wild currant;
- wild tobacco; and
- creeper.

For creeper in particular, gradual removal is preferred as this species does serve to consolidate desert soils, provide refuge for invertebrates (including endemics) and where present as a sparser mosaic, provides feeding areas for wirebird. The rate of removal will therefore equate to the capacity, particularly in areas that might be subjected to wind-blow, for native plants to establish, either by natural regeneration, re-seeding or by planting. No herbicides will be used to eradicate pest species but physical removal only with the plant material taken off site for composting.

The primary aim of the programme will be to enhance and maintain the habitat integrity of the Central Basin in advance of levelling of the eastern ridge. The programme will be designed to:

- Prevent the spread of creeper into areas where it will compete with native plants or cover open ground that is a key resource for endemic animals, particularly in the Central Basin.

Control will focus initially on the Central Basin where outlying creeper plants are encroaching into samphire dominated areas, particularly in the south east, north to north east of widow slope (the prime habitat sites for the lurking wolf spider) and extending to the west of Stone Hill where most of the other spiders typical of the Central Basin, the pseudoscorpion *(Sphallowithus),* the three other wolf spiders, the salticid spider *(Pellenes)* and the heteropteran bug *(Nysius sanctaehelenae)* have their main population centres: the areas which are at most risk from the development.

The programme will extend beyond the Central Basin into the wider PBP area to those areas of ecological constraint and other ecologically sensitive areas not affected by the development (refer to Figure 10.7).

Where the volume of creeper is low, creeper will be pulled up and turned over and can be left in-situ.

- Eradication of all prickly pear, lantana, wild tobacco and other non native species from the Central Basin followed where necessary by establishment of native plants, by re-seeding or by planting.

The programme will focus initially on the Central Basin, requiring the eradication of prickly pear, lantana, wild mango and wild tobacco (or other species such as blue weed where the level of encroachment is low). Extension of the alien plant programme to other prominent non-native species (e.g. saltbush) and rates of removal will be informed by progress and ecological response to the above mentioned species and impacts of the lowered landform.

Initial clearance carried out by volunteers from the SNCG in 2006 has supported a reduction in the amount of prickly pear in the Central Basin. Further involvement by volunteers should continue to be encouraged to further develop 'ownership', although it is envisaged that the majority of physical removal of alien species will be carried out under contract through ANRD necessitating early appointment of the ecologist to support this.

All prickly pear will be required to be physically removed. Brushcutters could be used but roots will need to be dug up and all plant material removed from site. Vehicular support is likely to be needed to remove material from site and contractual arrangements will need to be enforced that strictly limit vehicular movement to the established routes within the Central Basin.

Reinforcement in the Central Basin will be limited to encouraging samphire, through seeding to act as an accretion agent in advance of the lowering of the eastern plateau. Babies' toes and St Helena goosefoot will also be encouraged through seeding. These annuals will provide further ground stabilising cover and refuges. Annual Eragrostis cilianensis is present in greater abundance than these two species in the Central Basin and it is anticipated that it will continue to regenerate naturally.

- Control of all prickly pear, wild mango, lantana, wild tobacco and other non native species from wider environs of PBP, including extending to the west towards Fisher's Valley where the main population of prickly pear is centred to reduce further threats of encroachment to the Central Basin. This will be followed where necessary by the encouragement and establishment of native plants, by re-seeding or by planting.
- Reinforcement and re-introduction planting of native species in areas of creeper carpet, leading to an accumulation of litter and re-establishment of micro-habitats followed by removal of creeper (some creeper may die out naturally through competition and shading).

The programme will include the Central Basin in the large creeper dominated areas notably oil drum creeper (refer to Figure 10.7) and smaller areas to the north bounded by Fisher's valley. In these locations a combination of low density supplementary re-seeding and planting of samphire and gradual removal may be required. (A species of mealy bug is commonly found on the roots of creeper plants and this may reduce the rates of successful establishment of native species within the creeper mats and an alternative approach of small scale gradual removal followed by planting or seeding may be required).

The programme will extend to the wider PBP area, particularly in the south and west, where creeper has replaced the native vegetation and from where it is tending to invade the Central Basin.

The works will need to respond quickly to limit the extent of habitat loss if any temporary runway is required which is considered to equate to a permanent loss of current habitat conditions in realistic timescales.

The composition and density of planting mixes of native species will reflect the variable habitats and aspects.

- Long term maintenance of alien invasive species control programmes to prevent re-invasion and maintain the competitive advantage of native species.

A composting programme for all plant material removed from PBP will be developed in conjunction with the Invasive Species Project Office and the Environmental Health Department of the Department of Public Health and Social Services.

10.6.7.1 Terminal forecourt and visitor interpretation

Substrate and planting within the terminal forecourt will be designed to reflect the ecological landscape within which the terminal is set. A combination of low density and clustered planting of the prostrate desert annuals and shrubby perennials with careful use of varying sized rock, grit and boulder substrates will be carried out to create a naturalised effect linking the terminal to its surroundings. Planted species will include scrubwood, tea plant, boxwood, babies' toes, salad plant, boneseed and old father live-forever, with large lichen encrusted boulders salvaged from the terminal construction area.

Interpretation boards installed within TB depicting 'larger than life' images of the special animals and plants of PBP and other ecological important areas on the island will help generate a feeling of arriving somewhere very special and set the context upon which visitors will launch into exploration of the island. The erection of signs at entry points to PBP are another important component of education and promoting the special nature of PBP. They will help to inform walkers and visitors to the area and provide information on codes of conduct and walk routes.

There has been a considerable increase in the use of off road recreational motor vehicles on St Helena in recent years and this is evident in particular within PBP and the Central Basin, but also the wider arid areas to the west and south. Within these semi-desert environments, where rainfall levels are low, vehicle tracks cause scars on the landscape which remain for years, perhaps decades or longer. Developing and enforcing good environmental practise with regards to 4x4, motorcross or quad bikes will be an important

component in developing tourism activities which do not destroy the very assets tourists come to enjoy.

10.6.8 Gill Point/ Dry Gut

10.6.8.1 Dry Gut Embankment

There is a major adverse impact as a result of the permanent loss of the landscape resource at Dry Gut. There is no opportunity for mitigation for this and extensive gumwood planting at Bilberry Field Gut and subsequent regeneration of a degraded landscape will provide some compensation. The Dry Gut RESA embankment does however create an opportunity to establish new habitat for the PBP flora and fauna.

Detailed design of the terraces will seek to provide perhaps around 5 terraces of around 10 metres, or more, in width, on the sheltered western edge. There are no overriding ecological requirements for the design of the exposed eastern edge of the RESA embankment though there will be an opportunity on the exposed seaward edge to introduce endemic plants typical of this habitat such as scrubwood and teaplant on the seaward edge.

The western terraces will be constructed so as to receive and retain fine sandy and dusty sediments. For this purpose, close packing of fill will be required to prevent voids from remaining in the sub-soils into which the fine surface materials may infiltrate over time. A fine-grade Terram may be more effective for this requirement, retained at its outer edge by blockwork and with a sub-grade layer of coarser fill. Finer sediments, retained for the purpose, will overlay this to a depth of at least 300 mm, reflecting the average burrow depth of some desert spiders at around 20-25 cm. The surface profile of the terrace will be gently concave so as to avoid mobilisation of surface sediments during periodic rainfall events.

- Remove substrate from identified areas of cut for later reuse in habitat creation on formed level terraces on the western slope of the Dry Gut RESA embankment.
- Planting of scrubwood, tea plant, old father live-forever on exposed seaward edge of embankment
- Planting or seeding of samphire, babies toes' and boneseed into the western level terraces.

10.6.8.2 Possible Dry Gut temporary reservoir

The design of the temporary reservoir should aim to minimise disturbance to and retain the fine deep alluvial deposits and flood plain terraces with their associated indigenous flora of samphire and babies' toes or affected soils and plants may need to be removed to appropriate receptor sites and reinstated following construction. Wild mango, creeper and prickly pear where present within the development area will be eradicated.

10.6.8.3 Possible Temporary sea water abstraction

The possible installation of a temporary sea water abstraction facilities and pipeline at Gill Point introduces additional human structures into a wilderness area popular for walking, recreation, fishing and ecological study. The Contractor will be required to retain access along the footpath during construction.

All areas affected by temporary structures will be fully reinstated in compliance with the EMP.

- Avoid permanent closure of footpath to Gill Point and maintain safe access during period of abstraction leaving an upgraded PBW path post construction.
- All areas affected by temporary structures shall be fully reinstated in compliance with the EMP.

10.6.9 Sharks Valley

10.6.9.1 Intakes/ break tank/ pipeline – permanent supply

The introduction of raw water abstraction in Sharks Valley, via a weir constructed at point A1+A2 and ancillary structures including pumping station, mains power supply and security fencing, together with a pipeline (exposed on ascending slopes of Sharks and Dry Gut valleys), break tank, security fencing and overhead electricity cables considerably extends the area of impact of the airport development into landscapes and wildnerness areas that are very different in character to PBP.

Micro-siting of the water pipe on site is required to avoid sensitive lichen and bryophyte sites. Where the pipeline crosses the PBW path safe access will be maintained with sensitively design crossing points. Where the pipeline is above ground, non reflective colour tones that blend into the landscape will be used. The break tank is in a prominent position on the crest of the hill (Breaktank Hill). Attempts will be made to disguise it (partially constructed stone wall on western side) or help it blend in better into the landscape through choice of fencing and tank colour. Consideration must be given to burying the electricity supply underground with subsequent reinstatement of soil profiles in order reduce visual impacts. Trenching across Dry Gut will need to be at a depth below the level of erosion. Soil profiles and terraces will be reinstated. Babies' toes will be seeded back into the area. Wild mango present below the level of the pipeline will be cut down and a systemic poison applied to reduce their rate of spread along the valley bottom. The pipeline route from slope above Dry Gut to Creeper Hill passes through sensitive areas of level ridge ground which provides habitat for Wirebirds, invertebrates and endemic plants. It will be important to minimise damage to the area when burying the pipeline and soil profiles and native plants will be reinstated. The raw water tanks on Creeper Hill are in a highly visible position. Careful consideration is needed regarding obtaining the most discrete location which avoids additional damage to areas of the ridge which are not currently affected by the airfield earthworks.

Preventing the spread of wild mango in the valley to the sea, will be the key activities to ameliorate the temporary reduction in water flow during construction and the permanent reduction in flow during operation. During construction, maintaining safe access along the PBW path will be required should a temporary supply be required from a point close to the beach in Sharks Valley in addition to the 40m^3/day from point A1 and A2. Sensitive upgrading of sections, carried out in consultation with the SNCG and FM EM, of the PBW path from the cairn near Hancock's Hole to the beach will be an important component of the installation and maintenance of any potential temporary water abstraction pipelines running from the beach as well as compensation for the minor adverse landscape impact.

- Non reflective colour tones that blend into the landscape will be used on above ground pipework.
- Disguise break tank (partially constructed stone wall on western side) or help it blend in better into the landscape through choice of fencing and tank colour.
- Cables carrying electricity to the site should be buried upto break tank hill and soil profiles reinstated.
- Babies' toes to be seeded back into the area.
- Minimise area of disturbance when burying the pipeline across the southern plateau.
- Soil profiles, landform (e.g. Dry Gut terraces) and native plants will be reinstated along buried sections of the pipeline.
- Careful location and landforming of raw water tanks to avoid additional damage to areas of the ridge which are not currently affected by the airfield earthworks and minimise its visibility in the landscape.
- Control of wild mango in Sharks and Dry Gut to prevent its further spread in the valleys.
- Maintain safe access and upgrade PBW path to Sharks Valley should a temporary supply be required from the waterfall close to the beach.

10.6.10 Ancillary Components

Remote Obstacle Lights (ROL) are proposed at a variety of locations on high areas of ground in the vicinity of the airport where high terrain has the potential to cause an obstacle to air navigation. The area of ground disturbance associated with the construction and installation of the ROL will be restricted to the absolute minimum required. Any lichen covered rock will be removed and stored nearby prior to construction particularly at the following locations; The Barn, Bencoolen, Great Stone Top, King and Queen Rocks. All disturbed areas will be completely reinstated. Where creeper is the dominant vegetation cover such as at Horse Point and Bradleys Government Garage, reinstatement will involve native species planting such as samphire with the gradual removal of creeper.

The ROL structures will be accommodated within a stone cairn type structure wherever practicable, using local lichen encrusted rock carefully selected wherever possible from the immediate area of disturbance around the ROLs. Refer to Figure 10.3 and Photograph 10.3 for an example of how lichen covered rock will be used to clad the base structure of the ROLs.

Design of the base structures will negate the need for additional security fencing.

10.7 Plant Species required for ecology and landscape reinstatement

The following table provides a plant schedule for the ecology and landscape mitigation planting and habitat reinstatement. It identifies the various species, their reference area, source stock, planting densities and approximate plant quantity. This table should be read in conjunction with Figure 10.7 and the detailed descriptions in section 10.6 above.

Note: Area and approximate plant number to be calculated once final extent of mitigation planting has been confirmed during detailed design.

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
Rupert's Bay and Lower Valley					
She oak	Where possible retain existing vegetation. Extend tree planting	Seed or cuttings from Rupert's or import seed		2m intervals	
Samphire	Where possible retain existing vegetation. Extend tree planting	Seed or cuttings Rupert's		1m intervals	
Scrubwood+	Upper and lower parts of amenity planting and reinforcement of buffer	Seed Rupert's Hill, Bunker's Hill		1m intervals clustered at each end of the amenity plantings and roadside corridors.	
Ebony+	Upper and lower parts of amenity planting and reinforcement of buffer	Cuttings High Peak, Pounceys		1-2m intervals clustered at each end of the amenity plantings.	
Money plant	Amenity planting and reinforcement of buffer	Cuttings from Rupert's		0.5m	
Crassula multicara	Amenity planting and reinforcement of buffer	Cuttings from Rupert's		0.5m	
Acalypha	Amenity planting and reinforcement of buffer	Cuttings from Rupert's or elsewhere		2m	
Hibiscus	Amenity planting and reinforcement of buffer	Cuttings Rupert's and elsewhere		1.5m	
Cup of Gold	Amenity planting and reinforcement of buffer	Cuttings Rupert's and elsewhere		5m (if mixed along amenity planting or 2-4m if clustered for large area ground cover)	
Flamboyant	Amenity planting and reinforcement of buffer	seed from Jamestown or Rupert's		5-10m	
Sea grape	Amenity planting and reinforcement of buffer	Seed or cuttings Jamestown or Rupert's		5-10m	
Banyan	Amenity planting and reinforcement of buffer	Seed or cuttings from Jamestown		10m	

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
		or Sandy Bay			
Peepul	Could be used as boundary treatment and screening & in the amenity planting and reinforcement of buffer			Clustered either at 4m if used as screening cluster or avenue	
Mango	Reinforce buffer closest to dwellings where desired	Seed		Depending on demand	
Cordia alliodora	Amenity planting and reinforcement of buffer	Seed or cuttings from Jamestown (Maldivia) or Rupert's (Fisheries) – with owners conscent - or import seed		5-10m	
Paw Paw	Reinforce buffer closest to dwellings if desired	Seed		Depending on demand	
Indian almond	Amenity planting and reinforcement of buffer	Seed from Jamestown Castle gardens		10m	
Scrubwood+	Road corridor planting	Seed Rupert's Hill, Bunker's Hill		1m clustering with wider spaces between cluster groups to create natural appearance	
Upper Rupert's Valley					
Scrubwood	Valley side planting			1m clustering with wider spaces between cluster groups to create natural appearance	
Ebony	Planting along valley floor			1m clustering with wider spaces between cluster groups to create natural appearance	
Purslane	Valley side planting	Rupert's Valley		0.2-0.3m as plant plugs or seed sown to 100/m2	

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
Samphire	Valley side planting	Rupert's Valley		0.3-0.5m as plant plugs or seed sown to density of 25/m2	
Quarry Restoration					
Upper Rupert's valley – Rupert's Hill– Banks Ridge					
Thatching rush	Eroded slip slopes, false cuttings and open ground between Rupert's Hill and Deadwood	Distant Cottage?		0.3m	
Scrubwood	Along entire section clustered around drains, gulleys, and eroded scars and slopes, with extension planting of colony at Rupert's Hill	Rupert's Hill, Banks Ridge & Flagstaff		1m clustering with wider spaces between cluster groups to create natural appearance	
French grass	Eroded slip slopes, false cuttings and open ground along haul/access road			0.2-0.3m as plant plugs or seed sown to 100/m2	
Purslane	Eroded slip slopes, false cuttings and open ground along haul/access road to Deadwood			0.3m as plant plugs or seed sown to 45/m2	
Ebony	From Rupert's Hill to Deadwood	Cuttings High Peak or Pounceys		1m clustering with wider spaces between cluster groups to create natural appearance	
St Helena Tuft sedge	Upper sections of haul/access route to Deadwood	Seed Woody Ridge or Little Stone Top		0.2-0.3m as plant plugs or seed sown to 45/m2	
Boneseed	Banks Ridge	Flagstaff		0.2-0.3m as plant plugs or seed sown to 100/m2	
Samphire	Eroded slip slopes on	Rupert's Hill		0.3-0.5m as plant plugs or seed	

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
	Rupert's Hill			sown to density of 25/m2	
Hair grass	Upper sections of haul/access road, Rupert's Hill to Deadwood	Bunker's Hill or High Hill		0.3-0.5m as plant plugs or seed sown to density of 25/m2	
Old Father live-forever	Upper sections of haul/access road near ridge	Turk's Cap		0.3-0.5m as plant plugs or seed sown to density of 45/m2	
Hogweed	Banks' Ridge	Banks' battery		0.3-0.5m as plant plugs or seed sown to density of 25/m2	
Lily fern	Open ground along Ridge of Rupert's Hill	Munden's Hill		0.2-0.3m as plant plugs	
Barn fern1	Soil filled cracks and crevices of rocky boulders and outcrops or walls	Munden's Hill		0.2-0.3 as plant plugs	
Acacia longifolia	Reinstatement of forestry species upper Pipe Path	Locally sourced		2-3m	
Silky oak	Reinstatement of forestry species upper Pipe Path	Check seed availability from Scotland Forestry Dept, source from on island or import.		2-3m	
Deadwood Plain					
Gumwood	Screen planting	Golf Links or Deep Valley		4m	
Napoleon's hat tree	Screen planting	Southerns or import seed		5m	
St Helena Rosemary	Screen planting	Lot		1m	

[1] If propagation techniques established

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
Plumbago?2	Screen planting	Cuttings or seed Jamestown (Hospital?)		0.3-0.5 for hedging	
Gumwood	Severed pasture	Golf Links or Deep Valley		3m	
Silky oak	Severed pasture			3m	
Mulberry Gut					
Acacia sp.3	Woodland reinstatement & extension			2m	
Spore4	Woodland reinstatement & extension			2m	
Gumwood	Woodland reinstatement & extension	Golf Links or Deep Valley		2m	
White olive	Hedgerow planting	Plantation		2m	
Spore	Hedgerow planting			2m	
Plumbago?	Hedgerow planting			0.5-1m	
Coltshed Road /Longwood Farm					
Gumwood	Buffer and screen planting alongside house Coltsheds – 8050m	Golf Links or Deep Valley		2m	
Silky Oak	Buffer and screen planting alongside house Coltsheds – 8050m			2m	

[2] blue and white flowered forms of this South African shrub species grown as hedging in Jamestown & elsewhere

[3] Woodland species mix to be confirmed with ANRD and will in part depend on whether there is an interest to outsource management of area to livestock owners for supplementary fodder. If there is no inclination to use as supplementary feed species mix could include gumwood and reduce use of species such as Acacia which have the potential to invade adjacent pasture.

[4] Woodland species mix to be confirmed with ANRD and will in part depend on whether there is an interest to outsource management of area to livestock owners for supplementary fodder. If there is no inclination to use as supplementary feed species mix could include gumwood and reduce use of species such as Acacia which have the potential to invade adjacent pasture.

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
Napoleon's hat tree	Buffer and screen planting alongside house Coltsheds – 8050m	Southerns or import seed		4m	
St Helena Rosemary	Buffer and screen planting alongside house Coltsheds – 8050m	Lot		1m	
Plumbago?5	Buffer and screen planting alongside house Coltsheds – 8050m	Cuttings or seed Jamestown (Hospital?)		1m	
Gumwood	Middle point hedgerow 8150-8500	Golf Links or Deep Valley		2m	
Thorn tree	Middle point hedgerow 8150-8500			5m	
Spore (only if desired to cut for fodder)	Middle point hedgerow 8150-8500			2m	
Gumwood	Screening from Picollo & former ANRD nursery	Golf Links or Deep Valley		2m	
Silky oak	Former ANRD nursery			2m	
Bilberry Field Gut					
Gumwood	Extensive gumwood planting at head of gut	Golf Links or Deep Valley		3-4m random and clustered planting to recreate natural stands	
Bastard Gumwood	Extensive gumwood planting at head of gut	Field gene bank		3-4m random and clustered planting to recreate natural stands	
Silky oak	Reinstatement for road alignment			2-3m	
Bottom Woods-Bradleys Government Garage					
Ebony	Road corridor planting and extension to	Cuttings High Peak or		1-2m	

[5] blue and white flowered forms of this South African shrub species grown as hedging in Jamestown & elsewhere

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
	Millennium Forest	Pounceys			
Gumwood	Visual buffer and screen for waste stabilisation ponds and housing, road corridor planting to Millennium forest and extension to Millennium Forest	Millennium Forest		3-4m random and clustered planting to recreate natural stands in buffer areas.	
Bradleys Government Garage-PBP					
Construction camp					
Boneseed	Re-seeding reinstated areas	Seed Turk's Cap		0.2-0.3m as plant plugs or seed sown to 100/m2	
Babies toes	Re-seeding reinstated areas	Seed PBP		0.2-0.3m as plant plugs or seed sown to 100/m2	
Samphire	Re-seeding/planting reinstated areas	Cuttings or seed Horse Point Plain, PBP		0.5m as plant plugs or seed sown to 25/m2	
ROL (Horse Point and Bradleys)					
Samphire		From immediate vicinity		0.3-0.5m as plant plugs or seed sown to density of 25/m2	
St Helena goosefoot		From immediate vicinity		0.3-0.5m as plant plugs or seed sown to density of 45/m2	
Bradleys Government Garage- Cook's Bridge					
Gumwood	Road corridor and gullies				
St Helena tuft- sedge	Amongst gumwood and ebony, road corridor and gullies			0.3-0.5m as plant plugs or seed sown to density of 45/m2	
Ebony	Road corridor and gullies				
Boneseed	Road corridor flat mounds between gullies			0.2-0.3m as plant plugs or seed sown to 100/m2	

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
PBP - airport and ancillary structures including all re-graded and landformed areas					
Samphire	Replacement following prickly pear removal from areas west of the Central Basin between Central Basin and Cook's Bridge and planting amongst creeper in terminal road creeper area	PBP		0.3-0.5m as plant plugs or seed sown to density of 25/m2	
Babies toes	Re-seeded into clear and graded areas either side of airstrip	PBP		0.2-0.3m as plant plugs or seed sown to 100/m2	
Scrubwood	Reinforcement planting of existing stands and extension along coastal cliffs of eastern plateau	PBP		0.5-1-3m random and clustered planting to recreate natural stands	
Tea plant	Reinforcement planting of existing stands and extension along coastal cliffs of eastern plateau	PBP for reinforcement with Turk's Cap		0.5-1-3m random and clustered planting to recreate natural stands	
Boxwood	Planting through creeper dominated areas west and south of the Central Basin in area described as Terminal access road creeper	Whites Cottage field gene bank & Wakehurst Millennium Seed Bank		0.5-1-3m random and clustered planting to recreate natural stands	
Salad plant	Planting through or replacing creeper dominated areas west and south of the Central Basin in area described as Terminal access road	Turk's Cap, Great Stone Top		0.3-0.5m as plant plugs or seed sown to density of 45/m2	

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
	creeper & on coastal edge of eastern plateau				
St Helena goosefoot	Southern ridge samphire, terminal access creeper	PBP		0.3-0.5m as plant plugs or seed sown to density of 45/m2	
French grass	Re-seeded into clear and graded areas either side of airstrip	PBP		0.2-0.3m as plant plugs or seed sown to 100/m2	
Purslane	Re-seeded into clear and graded areas either side of airstrip	PBP		0.3m as plant plugs or seed sown to 45/m2	
Boneseed	Planting after prickly pear removal in lichen dust bowl, Fisher's Valley scrub,	PBP, Turk's Cap		0.2-0.3m as plant plugs or seed sown to 100/m2	
Old Father live-forever	Cliff top sites east of the airstrips	Gregory's Battery		0.3-0.5m as plant plugs or seed sown to density of 45/m2	
Lily fern	Clear and graded landforms & compacted grit and stoney regraded landform areas	PBP		0.2-0.3m as plant plugs	
Central Basin					
Samphire	Oil drum creeper, north west mixed scrub & south basin samphire	PBP		Seed sown to density of 25/m2	
Babies toes	Southern ridge samphire, south basin samphire and whit grit saddle	PBP		Seed sown to 100/m2	
St Helena goosefoot	Southern ridge samphire	PBP		Seed sown to density of 45/m2	
Terminal forecourt – Same as above to recreate naturalised effect within and between paved areas and buildings					
Boneseed					
Boxwood					

Species	Reference Area	Source stock	Area (m^2)	Density	Quantity (approximate plant numbers)
Scrubwood					
Tea plant					
Old father live-forever					
Reclaimed lichen encrusted boulders					
Salad plant					
Dry Gut & Dry Gut embankment					
Samphire	West facing slope of embankment	PBP		0.3-0.5m as plant plugs or seed sown to density of 25/m2	
Scrubwood	East facing slope of embankment	PBP		0.5-1-3m random and clustered planting to recreate natural stands	
Tea plant	East facing slope of embankment	PBP, Turk's Cap			
Boneseed	East and west facing slope of embankment and south facing slope of Dry Gut	PBP, Turk's Cap		0.2-0.3m as plant plugs or seed sown to 100/m2	
Babies' toes	West facing slope of embankment and south facing slope of Dry Gut	PBP		0.2-0.3m as plant plugs or seed sown to 100/m2	
Dry Gut storage weir					
Samphire	Reinstatement of natural terraces areas	Dry Gut		0.3-0.5m as plant plugs or seed sown to density of 25/m2	
Babies' toes	Reinstatement of natural terraces areas	Dry Gut		0.2-0.3m as plant plugs or seed sown to 100/m2	
ROL sites Great Stone Top, The Barn					
Lichen covered rocks and boulders					