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Advisory Council on the Environment
Nature Conservation Subcommittee

Sha Lo Tung Public-private Partnership (PPP) Pilot Project – Conservation Management Plan for the Proposed Ecological Reserve

Purpose

This paper briefs Members on the conservation management plan for the Ecological Reserve proposed under the Sha Lo Tung Public-private Partnership (PPP) Pilot Project. Details of the conservation management plan are at the **Annex**.

Background

2. In November 2004, the Government announced the New Nature Conservation Policy with a view to better achieve the nature conservation objectives, in particular, to enhance conservation of ecologically important sites which are in private ownership. Under the Policy, the Pilot Scheme for Public-private Partnership (PPP) was introduced to better protect the 12 priority sites identified for enhanced conservation.

3. Under the PPP Pilot Scheme, development of an agreed scale will be allowed at the ecologically less sensitive portion of any of the 12 priority sites, provided that the project proponent undertakes to conserve and manage the rest of the site that is ecologically more sensitive on a long-term basis. A total of six applications were received. An inter-departmental Task Force (Task Force) was set up to examine the applications in accordance with the vetting criteria set out in the Guide to Application.

4. The applications received and the assessment made by the Task Force were presented to this Subcommittee on 9 April 2008 and the main Council on 14 April 2008. After discussion, the Subcommittee and ACE recommended to support the Sha Lo Tung project from a nature conservation angle subject to resolution of some implementation issues.

5. In the Sha Lo Tung proposal, the proponent undertakes that it will surrender all its land in Sha Lo Tung valley (representing 96% of the private land in the valley) to the Government for the establishment of an Ecological

Reserve of about 52 hectares. In exchange, it requests a piece of government land of some five hectares in the adjacent "Green Belt" for the development of a Multi-cultural Education Centre cum Columbarium Complex. To enhance the ecological value of the site, the proponent has agreed to implement a comprehensive management plan for the Ecological Reserve. The Task Force opined that the proposal will provide long-term protection to the valuable habitats and species in Sha Lo Tung Valley.

Conservation Management Plan

Scope of the plan

6. The plan covers the first 5-year period of the Ecological Reserve serving conservation and associated educational purposes. Under the plan, seven conservation objectives are identified:

- to conserve dragonfly biodiversity by protecting and enhancing habitats;
- to enhance upland habitats by removal of exotic vegetation;
- to enhance quality and area of secondary woodland habitat;
- to restore and rehabilitate abandoned agricultural land;
- to sustainably manage tourism;
- to conserve target species; and
- to enhance conservation education opportunities.

7. The management plan is based upon a process approach. The current plan outlines the framework for the management of the Ecological Reserve. It should be regarded as a first step in a process of management evolution over the 5-year period it covers, and should be reviewed and adjusted as needed. Revision to the plan will be subject to approval by the Agriculture, Fisheries and Conservation Department.

8. Recently, the project proponent has consulted green groups, including the WWF Hong Kong, the Conservancy Association and the Kadoorie Farm and Botanic Garden on the proposed conservation management plan and will take into account their comments as appropriate when implementing the plan.

Habitat conservation

9. The whole Sha Lo Tung valley is subdivided into different management zones with a view to distinguishing areas of conservation and to implement various habitat conservation measures. Stream and catchment protection, and systematic baseline surveys and monitoring of dragonfly are proposed for dragonfly conservation. Exotic flora species under regular monitoring will be manually removed from the valley once per year. Native trees will be planted to enhance the woodland habitat. Dry abandoned farmlands will be converted

to butterfly garden whereas wet abandoned farmlands will be restored to marsh or wet riparian habitat.

Species conservation

10. The plan identifies some target species in the valley for enhanced conservation which include the Hong Kong Paradise Fish, the Three-Banded Box Turtle, butterflies, the Chinese Pangolin, and the *fung shui* woods. Specific conservation plans will be further developed following monitoring studies on both physical parameters of the sites and ecology of selected species.

Conservation education

11. A Nature Interpretation Centre will be set up to promote conservation education through production and display of exhibits, organizing workshop and field visits, provision of signage along guided trails and monitoring of the visitation. The project proponent proposes to entrust Green Power to manage the centre.

Administration and financial management

12. The plan will be monitored by the Sha Lo Tung Conservation Management Board (SCMB) which will include the project proponent (Sha Lo Tung Development Co. Ltd.)(SLTDC), the management contractor (Green Power), the Government, and other green group and academic representatives. Majority of the Board members will be appointed by the Government.

13. Apart from the capital costs, the SLTDC will inject $140 million into a trust to finance the long-term operation of the Ecological Reserve and the management and maintenance of the Sha Lo Tung Road.

Advice Sought

14. Members are invited to comment on the conservation management plan for the proposed Ecological Reserve.

Agriculture, Fisheries and Conservation Department
Environmental Protection Department
August 2008

Annex

Pilot Project for
Public-Private Conservation Scheme
Sha Lo Tung Valley, Tai Po

Conservation Management Plan

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List of Abbreviations

SCMB	Sha Lo Tung Conservation Management Board
SLTDC	Sha Lo Tung Development Co. Ltd.
PPP	Public- Private-Partnership
SSSI	Site of Special Scientific Interest
CA	Conservation Area
GB	Green Belt
V	Village

1 Introduction

1.1 Scope of the Management Plan

1.1.1 This management plan covers the first 5-year period. This plan covers the area of the statutory plan, or around 57.3 hectares (ha). Of this, 52 ha are targeted for Ecological Reserve serving conservation and associated educational purposes. The remaining 5.3 ha are earmarked for a Nature Interpretation Centre and Multi-Cultural Education Retreat cum Columbarium, named as the Development Site.

1.1.2 This plan aims to:

- provide information for managers and other stakeholders;
- identify the key resources of the protected area and focus management attention upon them;
- assess those natural and anthropogenic trends that have implications for these key resources;
- define management objectives to neutralize threats to the key resources;
- prescribe actions to be implemented that will lead to achievement of the management objectives;
- outline a monitoring program to ensure that management does indeed achieve its objectives, and to alert stakeholders to unforeseen developments.

1.1.3 Conservation management plans are often considered blueprints or recipes for management actions that allow little flexibility for change. That interpretation has been analyzed in recent years and found to be less effective than an adaptive or process approach where the management plan is a guideline for action but evolves as time passes and experience is gained (Barrow & Murphree 2001). This management plan is based upon the process approach: It should be regarded as a first step in a process of management evolution over the 5-year period it covers, and should be reviewed and adjusted as needed.

1.1.4 The plan will be implemented by a Sha Lo Tung Conservation Management Board (SCMB) which will include three major stakeholders: the Project Proponent (SLTDC), the management contractor (Green Power) and the SAR government. Other green group and academic representatives will be invited to participate in the SCMB.

1.1.5 The current CMP outlines the framework for the management of the Ecological Reserve. Upon the endorsement and approval of the proposed PPP development, further details including the specific habitat management/enhancement work, ecological monitoring methodology, reporting requirement and implementation schedule will be provided for the operation of the reserve.

1.2 Core versus Added-Value Management

1.2.1 The activities prescribed under this plan fall into two categories, core and added-value activities. Biodiversity conservation is the core focus of the Public- Private-Partnership (PPP) programme under which Sha Lo Tung Valley is to be managed. Value-added activities include conservation education, preservation of cultural heritage and any other activities not directly related to biodiversity conservation.

1.3 Justification and Purpose of the Management Plan

1.3.1 This conservation management plan prescribes management to safeguard the ecological value of the area in-perpetuity for the people of Hong Kong. The plan is to be implemented by a partnership between SLTDC, Hong Kong Government, and Green Power.

1.3.2 The statutory zoning serves to protect the site from development, but makes no provision for conservation management of its habitats or species of conservation concern. In the absence of management over prior years, ecological resources have been degraded. Although this has not been quantified, it is highly probable that wildlife exploitation, off-road vehicle use and vegetation removal have damaged the SSSI zone.

1.3.3 The PPP proposal distinguishes three inter-related components under the "pilot project", as shown in Figure 3.1 of the main proposal document (Environmental Assessment Report). These areas are described separately as they differ in their context, conservation management and treatment of later land use approvals under different statutory procedures and arrangements. First are the lands designated for conservation management by the SCMB, hereafter termed the **Ecological Reserve**. Land use zones covered by this area are "SSSI", "CA", "GB" and "V" zones.

1.3.4 Second are lands developed and managed for religious and institutional uses, hereafter termed the **Development Site**. Land use zones covered by this area are the "GB" zone to the south of the Ecological Reserve. This area includes a small area for a public facility which will serve visitors to the Ecological Reserve, patrons of the religious/institutional development concession and Country Park users. This land is located at the development site and will comprise parking, bus/taxi drop off and the Interpretation Center.

1.3.5 Third is the improvement of the Sha Lo Tung Road. The purpose of the proposed improvement is to upgrade the existing roadway to the standard required of a Single Track Access Road that would enable emergency access for fire engines. The detailed project description and environmental consideration of both the development and the road improvement is included in Volume 1 and Volume 3 of the main proposal document.

1.4 Structure of the Plan

1.4.1 This plan is presented in the following sections:

Section 1 discusses the scope, justification and purpose of the conservation management plan
Section 2 describes the physical and ecological resources in the Ecological Reserve
Section 3 describes and assesses existing threats to ecological resources
Section 4 outlines conservation objectives to overcome these threats
Section 5 describes management constraints and potential impacts of conservation
Section 6 outlines the zoning and layout of the Ecological Reserve
Section 7 prescribes an action plan to remove threats
Section 8 discusses sustainability and prescribes research and monitoring projects
Section 9 outlines management structure and financial arrangements
Section 10 lists references cited in this plan

2 Physical Description & Ecological Resources

2.1 Site Description

2.1.1 Sha Lo Tung is a scenic valley surrounded by Pat Sin Leng Country Park. The landscape undulates over grassy hillsides, patches of woodland and abandoned paddy fields. Two narrow streams traverse the valley floor and provide habitats for dragonflies and other aquatic animals. The streams drain Sha Lo Tung Valley northward to Hok Tau Reservoir and downstream to become Tan Shan River, which then flows into Ng Tung River, Shenzhen River and Shenzhen Bay (Deep Bay). Elevations range from around 180 m on the Valley floor to 440 m at the peak of Cloudy Hill (Kau Lung Hang Shan) on the west rim of the Valley.

2.1.2 The remnants of three villages, Cheung Uk, Lei Uk and Lo Wai, which were settled over 500 years ago, now lie abandoned and surrounded by woodland and abandoned farmlands. A designated burial ground is located on the eastern knoll at the entrance to the Valley. While the villagers have left, their traditional rights to New Territories Exempt Housing (NTEH) in the Valley, are still valid. In 1996, the District Officer/Tai Po advised ACE that these rights would require some 160 NTEH sites.

2.1.3 Following abandonment of the indigenous villages, the primary landowner in the Valley proposed to the Administration to re-use most of the private land and intervening Government Land within the statutory plan area for recreational and residential purposes. The proposals included mitigation measures in recognition of the ecological sensitivity of the stream habitats, but were rejected largely on the grounds that construction and occupation of the valley would adversely affect these habitats.

2.2 Habitats

2.2.1 The woodlands support mostly native species and an expected suite of fauna use them for shelter and food. In a Hong Kong context, the woodlands are of average quality and are not the best

examples of this habitat type. The abandoned agricultural land has low ecological value and is subject to ongoing chronic human disturbance. Plant species of local interest include Hance's Viburnum, *Viburnum hanceanum* (an endemic to China) and Convex Utricle Sedge *Carex phacota*.

2.3 Animals and Plants

2.3.1 Sha Lo Tung is of recognized importance for conservation of habitats, flora, dragonflies, fish, and terrapins that are conservation concerns. Sha Lo Tung is not of recognized importance for conservation of butterflies, amphibians, birds, or mammals that are conservation concerns. Of those species that are conservation concerns, survival of some is threatened by human activities of the recent past and/or those that continue to date. The conservation management plan focuses on those species/groups that are conservation concerns and simultaneously under threat from human activity.

2.3.2 The flagship species for the site are dragonflies. The wider Sha Lo Tung area, including the streamcourse down to Hok Tau, is a very important site for breeding and development of an extremely diverse community of dragonflies. Currently, over 72 species of dragonflies have been recorded in the general area out of a total of 112 known in Hong Kong. At this percentage (>64%), the Valley is the most species-rich site in Hong Kong. Many of the species recorded are stream specialists and include the Hainan Hooktail *Lamelligomphus hainanensis* and Small Dragonhunter *Sieboldius alexanderi*, both considered to be rare. The Clubtailed Cruiser *Macromia urania* ("Endangered" in IUCN Red List) and the endemic Spangled Shadow-emerald *Macromidia ellenae* have also been recorded. The streamcourses and associated riparian habitat have been designated as SSSI zone to afford protection to the dragonfly fauna.

2.3.3 Similar to other rural, isolated sites in Hong Kong, Sha Lo Tung supports a considerable diversity of additional fauna including butterflies, fish, amphibians, reptiles, birds and mammals. Species of conservation concern observed at the site over the past 14 years include the Chinese Pangolin *Manis pentadactyla* and the Three Banded Box Terrapin *Cuora trifasciata*. These species have international and China-wide vulnerability ratings due to their widespread consumption and use by local peoples. The fish, *Macropodus hongkongensis* also occurs within the marsh and stream habitats at Sha Lo Tung, and while this fish occurs at several other sites in Hong Kong, it is currently treated as potentially endemic. Bird species of conservation concern include Black Baza, *Aviceda leuphotes*, and the Large Grass Warbler, *Gramminicola bengalensis*.

3 Threats to Ecological Resources

3.1 Village Development

3.1.1 Villages at Sha Lo Tung have been progressively abandoned over the last several decades, and

lands have been sold to SLTDC. No one currently reside permanently in the Valley. SLTDC has acquired over 96% of the private lands in the Valley, leaving only small, isolated plots in the ownership of others. Basically, all uses within the remit of the Sha Lo Tung Outline Zoning Plan are carefully prescribed under the Notes to the various zones. Unless it is one of the permitted uses under that zone and for which no excavation, filling etc is required - otherwise that activity or use requires approval from the Town Planning Board. Thus village development or expansion are anticipated to cause only minimal impacts if any to the natural resources in the Valley.

3.1.2 However, the potential management issues arising from the remaining private lands in Sha Lo Tung Valley will be addressed in the long-term by means of buying up the remaining less than 4% of the private areas in the Valley. This can be achieved by setting aside a portion of money from the capital cost for buying up the remaining private areas (see Appendix 3) or by some other possible means which will be further explored later.

3.2 Hillfire

3.2.1 Hillfire is not natural in Hong Kong, yet fire plagues the Valley because of the many grave sites where fire is carelessly used during ceremonies. Some areas of the Valley burn once or twice per year and have for many decades. On such sites vegetation cover is sparse and species richness limited. The absence of mature forest over the valley floor and the surrounding slopes is explained by the high frequency of hill fire, which maintains the vegetation as a shrub-grass community and precludes natural succession to forest.

3.2.2 The biodiversity implications of frequent hillfire have seldom been quantified, however, it is beyond doubt that species richness of both flora and fauna communities declines where hillfires are frequent. Streams are also subjected to greater loads of eroded sediments, which degrade water quality and stream-bed habitats. This would be expected to degrade habitat conditions for dragonflies at both adult and larval life stages.

3.2.3 The only existing controls on hillfire are fire suppression responses from the relevant government departments. Because there are no permanent residents in the Valley, there is no one to report small fires or extinguish them. In the absence of the proposed PPP pilot project, hillfire would remain one of the most serious threats to natural resources in the Valley.

3.3 Off-road Vehicles and Siltation

3.3.1 Sha Lo Tung Road provides vehicle access to the Valley. This has attracted off-road vehicle enthusiasts during recent decades. The result has been damage to streams, soils and vegetation by vehicles operated on natural habitats. The direct damage is obvious and severe. The indirect damage caused by stream sedimentation due to increased soil erosion is less obvious but possibly more severe. This is because the water quality in the streams and the condition of the

stream-beds is critically important to the survival of dragonflies.

3.3.2 The only means of excluding off-road vehicles from the natural habitats in the Valley is to construct the road terminus to include barricades that would prevent vehicle passage. There are no known government plans for such a project. In the absence of the proposed PPP pilot project, use of off-road vehicles would remain a serious threat to natural resources in the Valley.

3.4 Visitors and War Games

3.4.1 Although the streams in the Valley are known to support wildlife that is of high conservation concern, there is no control over visitor access to and activities in/around these streams. There are trails to guide hikers through the valley to and from the surrounding Pat Sin Leng Country Park. However, there are no personnel, boundary markers, barricades, or other features to ensure that visitors stay on the trails in the interest of protecting habitats and wildlife in the natural habitats.

3.4.2 Conspicuous among visitors that use off-trail habitats are the "war-game" players. The ecological impacts of their activities have not been quantified, and may, indeed by minor. However, in combination with hillfire and off-road vehicle use, their activities could lead to declines in habitat quality and wildlife species richness or population abundance.

3.4.3 In the absence of the proposed PPP pilot project, visitor access to off-trail areas would remain a threat to natural resources in the Valley.

3.5 Exotic Species

3.5.1 The primary threat caused by exotic species is the spread of *Mikania micrantha*, an introduced climbing vine. Sha Lo Tung has not been overwhelmed by Mikania, but there is potential for this species to become more problematic.

3.5.2 Currently only AFCD personnel and volunteers are available to address the threat of exotic species at Sha Lo Tung. In the absence of the proposed PPP pilot project, exotic species would remain an unquantified threat to natural resources in the Valley.

3.6 Exploitation of Wildlife

3.6.1 In prior decades hunters were probably active in the Sha Lo Tung area. They probably used a variety of capture methods including firearms, snares, traps, nets, poisons, and others. In recent years this has diminished as a threat to wildlife because there are fewer residents in such remote areas and fewer people interested to hunt wild animals. The only species thought to be taken from the Valley in recent years is the Three Banded Box Terrapin *Cuora trifasciata.* It is a target of poachers because of its high market price due to its reputed medicinal value as a treatment for cancer.

3.6.2 The result of over-exploitation has been elimination of the species from much of its former range

in south China and Hong Kong. In the absence of the proposed PPP pilot project, exploitation would remain an unquantified threat to the Three Banded Box Terrapin. While the PPP pilot project would station additional personnel in the Valley, the extremely high value of an individual Three Banded Box Terrapin makes it uncertain whether this would lead to greater numbers of terrapins in the wild.

4 Conservation Objectives

4.1 Objective 1: Conserve Dragonfly Biodiversity by Protecting and Enhancing Habitats

4.1.1 Dragonfly species are conservation targets of the PPP project. Dragonfly habitats, including marshes, streams and riparian vegetation, are to be protected, conserved and enhanced in accordance with the stated purpose of the SSSI zoning,. This will also benefit other aquatic and terrestrial target species, as described under Objective 7. Management tasks including baseline surveys will be used along with other information to plan and agree details of the enhancement strategy. Continuous monitoring of the dragonfly community and the habitat structure will also be implemented during operation of the Ecological Reserve. Baseline maps of stream-corridor (Cheung Uk, Lei Uk Streams, Northeast Marsh and Stream) and stream/marsh features (e.g. pool and riffle areas) will be compiled and updated annually. This is a core objective.

4.2 Objective 2: Enhance Upland Habitats by Removal of Exotic Vegetation

4.2.1 Invasion of exotic plant species (climbers, shrubs, and trees) is considered a threat to biodiversity in the Valley. The primary threat is *Mikania micrantha*, but others are present as well. The exotic plant species will be manually removed from the Valley prior the flowering season. Annual survey of exotic plants will be performed, and monitoring reports which include maps showing the location of removal operations will be provided each year. This is a core objective.

4.3 Objective 3: Enhance Quality and Area of Secondary Woodland Habitat

4.3.1 Secondary woodlands have been degraded by a long history of exploitation and hillfire. The habitat quality could be enhanced by planting of native tree species and by transplantation of trees from the Sha Lo Tung Road Improvement works, if any. The newly planted trees will be maintained for 12 months after planting and any dead trees found during the maintenance period will be replaced by healthy plants of the same species and same size. A detailed baseline maps of secondary woodland will be compiled. This is a core objective.

4.4 Objective 4: Restore and Rehabilitate Abandoned Agricultural Lands

4.4.1 Abandoned wet agricultural lands are located in lowlands alongside streams, and they will be

restored to wetlands by restoration of the irrigation system. Abandoned dry agricultural lands will be rehabilitated and converted to a butterfly floral garden and a plant nursery. Debris, basic soil contouring and hydrological modification, if any, will be removed. This is a core objective.

4.5 Objective 5: Sustainably Manage Visitors

4.5.1 Visitors to the Valley include hikers, wildlife watchers, nature lovers and others. The PPP pilot project will maintain existing trails and control access such that most of these users can enjoy outdoor experiences without degrading the natural resources of the Valley. It can be achieved by designing the main access (for hikers) and provision of signage to divert the visitors away from the ecological sensitive areas. Guided tour will be provided to educate the public. Operation of off-road vehicles will no longer be permitted in the Valley through fencing and patrol by staffs. This is a core objective.

4.6 Objective 6: Conserve Target Species/Taxa

4.6.1 While effort would be put for conservation of the intrinsic ecological values of Sha Lo Tung SSSI and its surrounding habitats as a whole, one of the specific objective is conservation of species of conservation concern native to the area and enhancement of their habitats. The taxa/species of conservation interest highlighted in the Nature Conservation Policy for the Sha Lo Tung PPP site are selected as targets for conservation. These are described as below:

Freshwater Fishes

4.6.2 Sha Lo Tung supports 13 native fish species in the two streams and various perennial and seasonal wetlands. One of these is the endemic Hong Kong Paradise fish *Macropodus hongkongensis* (香港鬥魚, formerly considered to be *M. concolor*), which is a considered a target species of the PPP project. Actions taken to achieve Objective 1 (dragonfly conservation) will also benefit conservation of *M. hongkongensis* by ensuring protection and enhancement of freshwater habitats through removal of rubbish and man-made barriers, integrated catchment management of water supply and monitoring studies. This is a core objective.

Three Banded Box Terrapin

4.6.3 Three Banded Box Terrapin is a target conservation taxon. They occupies the stream courses in Sha Lo Tung Valley and in other remote locations where clean upland freshwater streams are found. The population at Sha Lo Tung is known to be exploited by trapping. Secondary woodland enhancement, stream and riparian zone protection, and patrol/enforcement actions will aid conservation of freshwater terrapins. A species recovery plan will also be developed for this taxon. This is a core objective.

Butterflies

4.6.4 Eighty-eight butterfly species occupy the Valley, two of which are rare, Forget-me-not *Catochrysops strabo* and Colon Swift *Caltoris bromus*. Butterfly habitats will be enhanced by improving secondary woodland cover in the Valley (Objective 3) because this will include species known to be larval or adult food plants of local butterfly species. Improving the species diversity and cover of the Valley woodlands will have the added advantage of enhancing the corridor between two butterfly hotspots at Hok Tau and Fung Yuen. This is a core objective.

Chinese Pangolin

4.6.5 Chinese Pangolin *Manis pentadactyla* is listed as lower-risk, near-threatened in the IUCN Redlist. It is protected in mainland China at national level 2 but is not protected in Guangdong Province. It is exploited mainly for food and for use of its body parts in traditional medicines. Sha Lo Tung supports Chinese Pangolin in unknown numbers. It is designated a target species to increase local abundance. Objectives 3 and 6 will support conservation of Chinese Pangolin by enhancing upland habitat quality through native tree planting in secondary and fung shui woods, and extending corridors through the valley (Objective 3), and removing agents of habitat degradation (Objective 6). Levels of human disturbance will be reduced through visitor control and education. This is a core objective.

Fung Shui Woods

4.6.6 Fung shui woods are locally important as reservoirs of genetic biodiversity. They also demonstrate important cultural practices relating to nature conservation. Fung shui woods are designated a conservation target for the PPP project in the interest of maintaining and enhancing their biodiversity and habitat values. This will be supported by Objective 2 (removal of exotics), which will result in removal of vegetation that competes with fung shui woods for light, nutrients and other resources. This will also be supported by Objective 3, which will increase the species richness and cover of secondary woodlands and accelerate succession of shrub-grassland to woodland. Objective 1 (dragonfly conservation) will be supported by conservation of fung shui woods to the extent that adult dragonflies perch on vegetation in fung shui woods. Butterflies will benefit from any increases in diversity or availability of flowers, pollen, nectar in enhanced fung shui woods. This is a core objective.

4.7 Objective 7: Enhance Conservation Education Opportunities

4.7.1 The PPP project will construct a quality Interpretation Centre within the Development Site that provides interactive educational exhibition related to the unique site values of Sha Lo Tung and provides facilities for school workshops. The Centre will have the facilities needed to provide for public access, enjoyment and safe and efficient passage through the Centre and the rest of the site (e.g. parking, toilets). The Centre will provide linked and guided access to key sites, and will provide guided tours to educate the public. It will provide support facilities such as

storeroom, workshop, and administrative areas. It should be noted that increased human activities and disturbance during special Festivals, i.e. Ching Ming or Chung Yeung, may be a potential impact to the Sha Lo Tung Valley. With the provision of sufficient Conservation Ambassadors (i.e. 30 people, organised by Green Power), who will serve as reserve guards to control, advise and educate visitors of the regulations in the Ecological Reserve, human activities and disturbance will be largely controlled. The Nature Interpretation Centre will also be closed during those days to avoid attracting people wandering within the Ecological Reserve. This is a value-added objective.

5 Management Constraints & Potential Impacts

5.1 Management Constraints

5.1.1 Financial Sustainability: The pilot project would be funded by an initial capital outlay by SLTDC. Costs of operations would be funded by income generated by funds placed in trust by SLTDC. The initial investment in the trust fund would be sized to ensure an annual yield adequate to meet the annual operating costs of the pilot project. Thus the project would be financially sustainable.

5.1.2 Villager-Owned Lands: As noted above under threats (Section 3), villager land ownership does not constrain the effectiveness of the PPP project because all but around less than 4% of the land area is owned by SLTDC.

5.1.3 Hillfire Suppression: Under the Sha Lo Tung pilot project, an aggressive fire-suppression programme will be implemented to prevent the occurrence of hill fires. While no burning of incense and effigies will be allowed at the columbarium, the fire suppression programme will also include creation of firebreaks, intensive patrolling and fire watching by ecological reserve staffs and volunteers during festival periods, provision of containers and water for grave visitors, and close coordination with Fire Services Department, Hong Kong Police Force, and other NGOs for public education, law enforcement and fire control. However, the risk of hillfire cannot be entirely eliminated by the PPP pilot project because fires could still start outside the pilot project area. Although outbreak of hillfire could constrain the effectiveness of woodland restoration under the pilot project, this is not considered an overwhelming constraint on the overall effectiveness of the pilot project. Further, the risk of hillfire would be greater in the absence of the pilot project.

5.1.4 Scientific Learning Curve: The proposed management authority, Green Power (GP), is a non-government organisation focused on environmental protection and conservation education. As nature reserve manager GP will assume new roles as supervisor for land management, patrol enforcement and fire-fighting as well as the roles of scientist and conservation biologist. Each of these roles, and particularly the latter two, will require accumulation of scientific knowledge

and field experience before useful results can be expected. This process of accumulating knowledge and experience must be allowed for in programming interventions and expectations. For issues other than off-road vehicles and obvious agents of resource degradation (e.g. poaching, hillfire) it may be appropriate to strive to maintain the ecological status quo for the initial several years of operation. During this time period scientific information and field experience would be accumulated that would enable more effective planning and implementing of any conservation interventions.

5.1.5 Country Park Access: Sha Lo Tung Valley has several access points to the surrounding Pat Sin Leng Country Park. These points must be maintained to enable uninterrupted Park access for visitors. Activities of Park visitors within the PPP project management area can be controlled to a large extent through the provision of marked trails, fencing and guided tours. The authority for access control and trail maintenance and relevant ordinances or guidelines to be followed regarding this issue will be subject to the land grant conditions, which will be further discussed between the Government and Project Proponent.

5.2 Potential Ecological Impacts

5.2.1 The project may be subject to environmental impact assessment following approval by the ETWB's Interdisciplinary Task Force. The following text summarizes current thinking on the types and implications of environmental impacts.

5.2.2 The PPP pilot scheme will not only avoid and minimise ecological impacts but will enhance the conservation value of Sha Lo Tung Valley through the following actions:

- It removes large scale village expansion as a threat to the ecological integrity and conservation value of the valley.
- It protects the area by a controlled site access and enhances the ecological values by active management.

5.2.3 Potential ecological impacts associated with the construction and operation of the Ecological Reserve include minor, short-term stream sedimentation during construction of conservation and development infrastructure. Other potential impacts would include disturbance to habitat and wildlife during construction and operation (e.g. noise, disturbance and increased use by visitors).

5.2.4 Wetland habitats of primary conservation concern are avoided by all infrastructure works. A tree survey and mitigation plan would be conducted during the design stage to further minimise/mitigate the loss of trees by transplanting and compensatory planting.

5.2.5 Potential for adverse impacts to wetlands and associated aquatic fauna are minimised by siting the interpretation centre at the Development Site outside the Ecological Reserve.

5.2.6 Indirect impacts due to noise and traffic disturbance would be minimised by restricting car access to the road and carpark. Disturbance due to hillfire, visitors and vandalism would be

controlled by pro-active management, including patrolling and conservation education. Rubbish and illegal traps would also be constantly removed by site managers.

5.2.7 Direct discharge of surface runoff or sewage to the stream would not be allowed. Sewage would be taken away and surface runoff would be diverted away from streams.

5.2.8 There would be no adverse environmental impacts arising from the proposed conservation management plan.

6 Conservation Layout Plan

Management zones

6.1.1 The zoning map shown as Figure 1 outlines areas where various conservation measures will be implemented. Its main purpose is to distinguish those areas that will be closed to public access in the interest of conservation (core use areas) from those that will be open to public access for visitation and education programmes (added-value use areas). Table 1 lists the habitats and the management strategies that will be applied to each of them.

Dragonfly Habitat Conservation Area - Streams and Riparian Habitat

6.1.2 This area encompasses the most valued parts of the site and includes all of the SSSI zones and those CA zones in the north-east that adjoin the NE SSSI Zone. These will be managed together as a Dragonfly Habitat Conservation Area designated for the preservation and enhancement of dragonflies and other aquatic fauna and flora.

Woodland

6.1.3 Woodland areas include fung shui and secondary woodlands that occur outside the riparian SSSI zones. These will be managed to ensure their persistence in-perpetuity and to control their encroachment to particular parts of the site.

Grassland and Shrubland

6.1.4 Green Belt hillside and grassland areas largely comprise a number of local ridges that straddle the northern, eastern and southern edge of the OZP adjacent to the Country Park boundary. No change in the physical form or use of these areas is intended.

Table 1 Management strategies for habitats and features

Habitats	Existing Structures	OZP Status	Proposed Feature	Purpose	Management Strategy
Streams, riparian, wetland	Paths	SSSI, CA	Dragonfly Habitat Conservation Area – keep as existing	Conservation, Education,	Low-intervention management until scientific knowledge and

			and enhance Use trails for education		experience are accumulated
Abandoned agricultural land	Abandoned school building	CA, GB	flower & butterfly garden, wet farmland restoration, plant nursery	Conservation	Active use and management
Grassland and shrubland	Trails	GB	plant to woodland, use trails for conservation education	Conservation	Restoration management
Secondary woodland	Trails	SSSI, CA, GB	Keep as existing, enhance through plantation, weed removal Use trails for passive recreation, conservation education	Conservation	Low-intervention management
Woodland enhancement	Secondary and/or fung shui woodland	CA, GB, SSSI	enhancement planting	Biodiversity conservation and enhancement	moderate intensity management (planting rare, endangered species, removing exotics)
Village areas	3 indigenous villages	V	none	preservation in-situ	no management

Abandoned Agricultural Land

6.1.5 These areas comprise largely flat land some distance and at higher elevation from the stream courses. These areas provide an excellent opportunity for sustainable re-use and could be successfully reallocated to organic farming, flower gardens and orchards and managed to generate additional funding for conservation activities. A passive recreation area for the Public is also planned for this zone.

Village Areas and School Building

6.1.6 The school building and villages are abandoned and the houses will be retained but not managed.

Trails in the Valley will be retained for Country Park access.

6.2 Infrastructure and facilities

Access

6.2.1 Visitors (Hong Kong students, public as well as tourists) are to be encouraged to enjoy the natural environment at SLT without disturbing the ecology. The site will be accessible to visitors but they will be encouraged to arrange guided tours of the ecologically valuable areas, and will be discouraged from entering these areas unguided. For example, unguided access will not be permitted for sustainable use areas. Visitors to the Multi-Cultural Education Retreat cum Columbarium may visit the site, and will generally visit the interpretation centre of the site. The site will also provide access to the country park for hikers.

6.2.2 Public access (Figure 1) will be provided through the valley to Pat Sin Leng Country Park as in the existing situation. The general public will not, however, have unrestricted access to the sensitive areas within the Ecological Reserve. A drop bar will be installed at the entrance of the Ecological Reserve to prevent off-road vehicles from entering the natural habitats in the Valley. Other than the public access, other footpaths will be reserved as education trails. Wooden gates and signs will be installed between public trails and education trails, while native thorny trees, shrubs and/or vines will be planted along the boundary of the Ecological Reserve to discourage public entering the sensitive areas.

6.2.3 To protect habitats in the Valley, the existing trails and foot paths will be maintained. This will enable some control of visitor access while ensuring access for handicapped.

Public awareness / education

6.2.4 The educational component consists of the interpretation centre, guided tours, information signs and volunteer work. It is important to raise public awareness of the environmental value of this site and of nature in general. Environmental education leads people through the stages of ignorance→ awareness→ appreciation→ understanding→ concern→ action. Educating school children and students is particularly important, as this is when environmental attitudes are formed. Instilling a sense of pride in the environmental and teaching ethical approaches to the natural world can change attitudes and lifestyles.

6.2.5 Education programs for schools and the general public will be formulated to raise public awareness of local biodiversity and nature conservation values. Guided tours will be provided for students and the general public to enhance their understanding of the ecological importance of Sha Lo Tung Valley. Relevant educational pamphlets and booklets will be provided in the Interpretation Center.

7 Action Plan

7.1 Actions to Achieve Objective 1: Enhance Dragonfly Habitat (Core actions)

7.1.1 Dragonflies at Sha Lo Tung have survived deforestation, human settlement, conversion of natural habitats to croplands, farming and animal husbandry, building construction, and environmental vandalism. The result is a hotspot of dragonfly biodiversity in Hong Kong and the south China region. However, the local biology and ecology of Valley dragonflies is poorly understood. Only basic habitat preferences are known. Given our limited scientific knowledge of this group and the high probability that any unscientific intervention would do more harm than good, no specific measures other than stream and general catchment protection are proposed for dragonfly conservation during the 5-year term of this management plan. Species management or recovery plans could, however, be developed at a later date when the ecology of dragonflies and their habitats are better understood.

7.1.2 Dragonfly use of the Valley is concentrated along the two streams that are wooded and have perennial flow. Northeast Stream lacks these characteristics and lacks the dragonfly species richness of the other two Valley streams. A study of the biology, hydrology, and substrates of Northeast Stream could lead to recommendations for stream restoration. If so, this could increase the availability of habitat for dragonfly species that prefer wooded streams.

7.1.3 The endemic dragonfly species Spangled Shadowed-emerald *Macromidia ellenae* prefers forested ravine streams. At least 30% of the local dragonfly species inhabit forested streams. Detailed studies on habitat requirements of the dragonfly species of concern will be implemented before management recommendations for dragonflies will be made. Restoration and enhancement of stream habitats might also benefit Three Banded Box Terrapin while discouraging the spread of *Mikania* along stream bank habitats.

7.1.4 Management tasks will include:

1. Compile baseline maps of stream and marsh features such as pool and riffle areas. Maps should be compiled for both the wet (April to September) and dry seasons (November to March) and update the maps annually.
2. Compile baseline stream-corridor maps for Cheung Uk, Lei Uk Streams, Northeast Marsh and Stream. Update the maps annually to track changes in riparian vegetation.
3. Trial management based on results of studies on habitat requirements of the target dragonfly species.
4. Remove accumulated refuse from streams and marshes.

7.1.5 Performance indicators and monitoring tasks would be as follows:

1. Design and implement systematic baseline surveys of dragonfly communities.
2. Initiate annual quantitative monitoring of dragonfly species richness and abundance for both

adult and larval forms.

7.1.6 Remedial actions will include conducting a specialist review and where appropriate, improving the monitoring programme, adjusting vegetation management including invasive weed/refuse maintenance efforts, habitat enhancements and visitor levels.

7.2 Actions to Achieve Objective 2: Removal of Exotic Species (Core Actions)

7.2.1 All exotic flora species will be manually removed from the Valley. Annual removal projects will be carried out prior to the flowering season for each target species. If free of seed, all removed vegetation will be composted for use in landscaping. Removal and disposal will be carried out by contractors and volunteers.

7.2.2 Annual monitoring will require field survey to locate and plot on maps all exotic species detected in the Valley. Monitoring reports will include maps showing locations of removal operations each year.

7.3 Actions to Achieve Objective 3: Enhance Quality and Area of Secondary Woodland Habitat (Core Actions)

7.3.1 Trees will be planted or transplanted in the woodland restoration and enhancement zones at Sha Lo Tung Valley to mitigate losses of trees due to improvement of Sha Lo Tung Road. Compensatory tree planting will achieve a ratio of 3:1. Woodland plantation will include only native species that are considered ecologically appropriate to plant in the valley (those known to occur here, and those that whose abundance or geographic distribution in the Valley or throughout Hong Kong has declined). Some trees will be transplanted from the works areas of the road improvement project. Others will be purchased from local nurseries. Fruit-bearing and nectar-producing trees will be priorities in species selection. Planted trees will be monitored for survival.

7.3.2 Management and monitoring tasks will include the following:

1. Compile detailed baseline maps of secondary woodland boundaries using aerial photography supplemented by field survey.
2. List and describe tree species in a tree survey report.
3. Update woodland maps annually.
4. Monitor transplanted trees for survival and replace dead trees as needed.

7.4 Actions to Achieve Objective 4: Restore Abandoned Farmlands (Core Actions)

7.4.1 Dry abandoned farmlands are shown in white on Figure 1. Some of these will be converted to a themed butterfly/floral garden. Designing and creating the garden will require selection of

vegetation species for planting based upon their utility to adult and/or larval butterflies. The garden will be planned and landscaped to ensure it does not have a deleterious impact on the fauna and flora in the surrounding habitats. Management will require periodic review of activities and proposed uses to ensure that these are compatible with the overall conservation objectives of the site. Management tasks will include:

1. A suitable area will be identified and allocated for use as the butterfly garden for the purpose of providing a safe and protected habitat for native flowering plants and a safe environment for passive recreation such as butterfly watching.
2. Maintain the grounds of the park/garden on a regular schedule. This will include rubbish control, fire safety control, gardening and safety checks of equipment and paths.
3. Maintain existing hiking trails and relevant signage on a regular schedule.

7.4.2 Wet abandoned farmlands are shown in light pink on Figure 1. Some of these will be restored to marsh or wet riparian habitat. Any buildings or other debris will be removed. Ginger lilies will also be removed because they were cultivated. Basic recontouring of soils will be undertaken to achieve the most appropriate hydrology for aquatic fauna. Any needed hydrological modifications will be described in a plan together with any proposals for planting of indigenous wetland vegetation.

7.4.3 Performance indicators and monitoring will include:

1. Monitoring and maintenance of a database recording species planted and survival date.
2. Review visitor statistics for the park/garden on an annual basis and compare to targets.
3. Analyse maintenance records and compare to targets.
4. Monitor wetland restoration using fixed-point photography and quantitative assessment of vegetation cover by species and area.

7.5 Actions to Achieve Objective 5: Sustainably Manage Visitors (Core Actions)

7.5.1 The guided trails have been planned to provide logical access and good circulation around the site and these have also been planned where possible using existing trails and footpaths in order to avoid impact on the fauna and flora of site value.

7.5.2 Signage will be installed to advise that operation of off-road vehicles is prohibited at all locations in the Valley. Signage will be required to advise visitors of the regulations in the Valley prohibiting war-games and other off-trail activities.

7.6 Actions to Achieve Objective 6: Conserve Target Species (Core Actions)

Stream Fauna (Dragonflies and Freshwater Fishes)

7.6.1 Cheung Uk and Lei Uk streams are known to support high dragonfly species numbers and the

endemic Hong Kong Paradise Fish. These streams will be unmanaged except for removal of rubbish and any obvious man-made barriers to movement of aquatic organisms.

7.6.2 Northeast Stream is similar in gradient and gross physical appearance to Lei Uk Stream. However, Northeast Stream lacks permanent stream flow and supports lower biodiversity than Lei Uk Stream. Northeast Stream supports the Hong Kong Paradise Fish and is hydrologically connected to Northeast Marsh, which lies between the two streams. It is hypothesized that Northeast Stream was converted from a stream to paddy farming by the early settlers in the Valley. A period of monitoring is needed to determine a useful and appropriate stream restoration strategy for Northeast Stream. This will include monitoring of substrate, hydrology, flora, and fauna and details will be specified in the monitoring plan. Should it prove desirable to attempt restoration of Northeast Stream, the objective would be increase in habitat availability for dragonflies and freshwater fishes. Planning consideration will be given to the hydrologic and ecologic relationship between Northeast Stream and the adjacent marsh. Should marsh restoration be indicated by monitoring studies, plans will be developed accordingly.

7.6.3 Based on the existing topography, it is unlikely that Sha Lo Tung Valley ever had ponds. Therefore the focus of habitat restoration will be on streams, marshes, and woodlands. There are, however, some pond dragonfly species that might be attracted to Sha Lo Tung if suitable habitat were available. This will be investigated through a species management and feasibility study.

7.6.4 The marsh between Lei Uk and Northeast Streams is inadequately known at this point to prescribe management. It supports Hong Kong Paradise Fish in addition to at least one species of sedge (*Carex phacota*) that is known in Hong Kong only from Sha Lo Tung Valley. The marsh will be addressed by monitoring of flora, fauna, and hydrology. Should focused management or restoration be required, they will be addressed in a habitat management or restoration plan to be developed later.

7.6.5 Water supply will be managed by adopting an integrated catchment management approach. Tree plantation and fire suppression will be key activities to (i) compensate for prior deforestation; (ii) increase forest cover; (iii) increase infiltration of precipitation; and (iv) increase groundwater and surface water supplies and extend the period of availability to approach predicted pre-human levels.

7.6.6 No new water control infrastructure, facilities, or any type of mechanical device will be installed without general approval of the management organisation and any technical oversight committee.

7.6.7 Monitoring studies will be carried out to describe the ecology of selected species of dragonfly and the Hong Kong Paradise Fish. Based on the outcomes of these studies, plans will be developed for habitat restoration or management. Prospective target dragonfly species include

Macromia urania (IUCN endangered), *Macromidia ellenae* (endemic), *Lamelligomphus hainanensis* (rare), and *Sieboldius alexanderi* (possibly limited in distribution).

Three Banded Box Terrapin

7.6.8 The species is threatened by illegal taking for the traditional medicine trade as a cure for cancer. The Valley is considered a HKSAR black-spot for taking of turtles, although the population is thought to be surviving. The species is at risk of local extinction and has been extirpated from most of its former range in mainland China. Habitat is both available and suitable at Sha Lo Tung.

7.6.9 The ecology of the species is unknown at Sha Lo Tung. Study is required to describe its distribution, habitat use, abundance, breeding ecology, and degree of exploitation. Mark-recapture studies are recommended and will be detailed in a species recovery plan.

7.6.10 Kadoorie Farm and Botanical Garden (KFBG) have a conservation breeding programme that includes the Three Banded Box Terrapin. Communication will be initiated with KFBG to determine whether turtles from KFBG would be available for release at Sha Lo Tung to increase local numbers. This could also enhance the genetic diversity of the population at Sha Lo Tung since this species may be rare in the wild.

7.6.11 ThreeBanded Box Terrapin favors streams in the vicinity of broadleaf forest. Study of Northeast Stream could lead to inclusion of this stream in the species recovery plan for turtles. Details will be elaborated in the species recovery plan to be developed.

7.6.12 Patrol will be undertaken as part of the species recovery plan to (i) remove traps; (ii) identify and report violators of the law; and (iii) reduce or eliminate illegal taking. Patrol must be more intensive in wet season when most trapping occurs. More effort will be spent to patrol in streams and marsh, which are turtle habitats.

7.6.13 While these actions will focus on the ThreeBanded Box Terrapin, they will benefit all turtles that occupy Sha Lo Tung. Monitoring of species and population numbers and trends will cover all turtles in the interest of developing conservation projects for the entire species group.

Butterflies

7.6.14 Butterfly biodiversity is among the distinguishing features of Sha Lo Tung Valley. Planting larval foodplants of uncommon/rare species will be incorporated into the tree plantation project in the interest of butterfly conservation.

Chinese Pangolin

7.6.15 Chinese Pangolin is an anteater. It forages nocturnally on ants, wasps and termites, and occupies burrows during the day. Pangolin habitat requirements are met by existing conditions at Sha Lo Tung. However, these could be improved by enhancement of secondary and fung shui woods, reduced levels of human disturbance and exploitation. Knowledge of the basic

ecology of Chinese Pangolin is limited. Before implementing interventions other than habitat protection, it is advisable to investigate the local ecology of the Chinese Pangolin. This could be accomplished by camera-trapping to identify use areas and locate burrows and mark-recapture studies (using cameras) to estimate population numbers and trends.

Fung Shui Woods

7.6.16 Exotic species of vegetation will be removed from fung shui woods as a first priority. A monitoring project will then be implemented to track the presence of exotic species and plan further removal programs.

7.6.17 No tree or shrub planting is prescribed for the fung shui woods in this plan. Should monitoring projects identify an opportunity to enhance the biodiversity of the fung shui woodland through planting of indigenous species, this could be planned and implemented at a later date.

7.7 Actions to Achieve Objective 7: Enhance Conservation Education Opportunities (Value-Added Actions)

7.7.1 Regular updating and maintenance will be required to maintain the quality and safety of the Interpretation Centre facilities. Management tasks will include:

1. Production and display of new materials and exhibits for the Interpretation Centre;
2. Periodic change of the exhibit display programme;
3. Organize workshops including field visits to the dragonfly pond;
4. Maintain guided trails and relevant signage on a regular schedule.
5. Maintain records of visitor numbers and satisfaction;
6. Provide guidance on code of behaviour and ensure numbers are controlled to levels that do not cause adverse impacts;
7. Manage and maintain the support facilities.

7.7.2 Performance indicators and monitoring will include:

1. Review visitor statistics on an annual basis and compare to Objectives.
2. Analyse maintenance records and compare to Objectives.

7.7.3 If performance indications are poor, then a specialist review will be undertaken and changes in management will be made according to recommendations received.

7.8 Infrastructure

Abandoned School and Villages

7.8.1 All abandoned village homes and the abandoned school will be retained but will not be managed in any way other than to remove exotic/invasive vegetation.

Graves and Urns

7.8.2 Hill fire is considered to be the greatest remaining threat to biodiversity in Sha Lo Tung Valley. In the interest of fire suppression grave sites will be mown twice annually before each grave visitation period such that no flammable vegetation remains within 1 m of any grave site. In addition, special enforcement patrols will be on-site during the grave-sweeping periods to ensure that laws prohibiting use of open fire are respected. Managers will assist grave visitors to control fire by providing appropriate metal containers for containment of fire and will advise the grave worshippers to follow a precautionary guideline for the prevention of hill fires in countryside. Additional manpower will be deployed to patrol the Sha Lo Tung area during annual worshipping days. Fire management is a core action directly related to habitat improvement.

8 Sustainability, Monitoring and Research

8.1 Habitat

8.1.1 Habitat monitoring will be carried out using a combination of remote sensing and field work. Projects will include:

- annual estimation and mapping of habitat coverage by type; and
- annual description of fire location, area, frequency.

8.2 Flora

8.2.1 Monitoring of vegetation will be carried out using field study. Permanent staff will be supplemented by consulting specialists as required. Monitoring projects will include:

- tree plantation survival rate;
- tree plantation replacement requirements;
- presence and coverage of exotic species.

8.2.2 Vegetation specialists will investigate the potential for implementation of a recovery plan for rare or locally extinct species.

8.2.3 The rare sedge (*Carex phacota*) will be monitored to learn more of its local ecology for use in conservation management. A monitoring project will be developed to describe its:

- distribution
- abundance
- site characteristics
- need and potential for conservation management

8.2.4 The rare shrub (*Viburnum hanceanum*) is also poorly known in terms of its ecology and potential

for conservation management. A monitoring project will be developed to describe its:

- distribution
- abundance
- site characteristics
- need and potential for conservation management

8.3 Fauna

8.3.1 Butterfly species richness and numbers will be sampled at target habitats on a seasonal basis. Monitoring efforts will be coordinated with those at Fung Yuen, where a conservation and monitoring project has been implemented to address butterfly biodiversity at the Fung Yuen SSSI.

8.3.2 Hong Kong Paradise Fish and the other 12 species of freshwater fishes at Sha Lo Tung are not well known in terms of their ecology or conservation needs. To address this knowledge gap monitoring studies will be implemented to focus on the Hong Kong Paradise Fish while investigating other species as well. The monitoring project will accumulate date to describe:

- habitat use;
- distribution; and
- abundance and population trend

8.3.3 The Sha Lo Tung dragonfly community has been well studied in terms of species numbers and basic ecology of a few prominent species. However, this level of knowledge is not adequate to make habitat management recommendations to target a single species or even a group of species. The reason for this is that a given intervention may have unintended consequences that adversely affect the overall ecosystem yet do not even achieve the intended conservation objective for the target species. In short, when manipulating nature, it is best to build a vast resource of scientific knowledge and then proceed with great caution. To accumulate knowledge of stream and dragonfly ecology it will be necessary to carry out monitoring and research studies. At a minimum these will include quantification of the following:

- species richness by habitat
- habitat use
- distribution
- abundance

8.3.4 Three Banded Box Terrapin is not well known at Sha Lo Tung. For this reason it is appropriate to initiate basic ecology studies to describe the existing situation including threats to the Valley population. Monitoring studies are needed to:

- estimate the local population using mark-recapture methods;
- count and remove traps/snares;

- assess threats;
- quantify habitat use; and

8.3.5 Map geographic distribution. Mammals at Sha Lo Tung are poorly studied. This includes the Chinese Pangolin. A monitoring project will be implemented to collecting basic information on mammal presence and relative abundance using camera-trapping methods. Cameras will be set at vandal-proof locations around the Valley and operated on a long-term basis. Presence and relative abundance will be quantified based on the resulting photographs of species including:

- Leopard Cat;
- Chinese Pangolin;
- Muntjak;
- Small Indian Civet;
- Ferret Badger;
- Wild Boar; and
- feral dog.

8.3.6 Hydrology and water quality have been studied on short-term bases over a 20 year period. However, there has never been a long-term quantitative study of water quality or hydrology. Such a project will be implemented in the Valley and in cooperation with the Water Supply Department monitoring works at Hok Tau Reservoir. Studies will quantify:

- Flow rates
- Water levels in streams and marshes
- Water quality

9 Management and Finance

9.1 Administration and organization

9.1.1 The SCMB will include three major stakeholders in the project, including the Project Proponent (Sha Lo Tung Development Co. Ltd.), the management contractor (Green Power) and the SAR government, and other green group and academic representatives.

9.1.2 Staff structure and responsibilities are described in Appendices 1 and 2.

9.2 Financial arrangements

9.2.1 A capital budget is shown in Appendix 3. This includes the first-year salary costs because the management contractor will have staff costs during year 1 when construction is in process.

9.2.2 Year 2 recurrent costs are budgeted in Appendix 4.

9.2.3 Capital costs of establishing the pilot project would be funded by an initial capital injection by SLTDC. Costs of operations would be funded by income generated by funds placed in trust by SLTDC. The initial investment in the trust fund would be in an amount to ensure an annual yield adequate to meet the annual operating costs of the pilot project (estimated at HK$4-5 million).

9.2.4 Contingency is estimated at 10% on the capital budget sub-total.

10 Reporting

10.1 Annual Report

10.1.1 Annual habitat management and ecological monitoring reports will be prepared to document the findings of the ecological baselines, evaluation of effectiveness of the action plan and enhancement works undertaken, and recommendations on management measures or trials. The annual report will also include a financial report documenting the annual revenue and operational expenses and a budget report for the coming year. The report will be submitted to the SCMB and concerned parties for review during the operation of the Ecological Reserve so that proper adaptive management could be carried out in the reserve to achieve the conservation objectives.

10.2 Quarterly Report

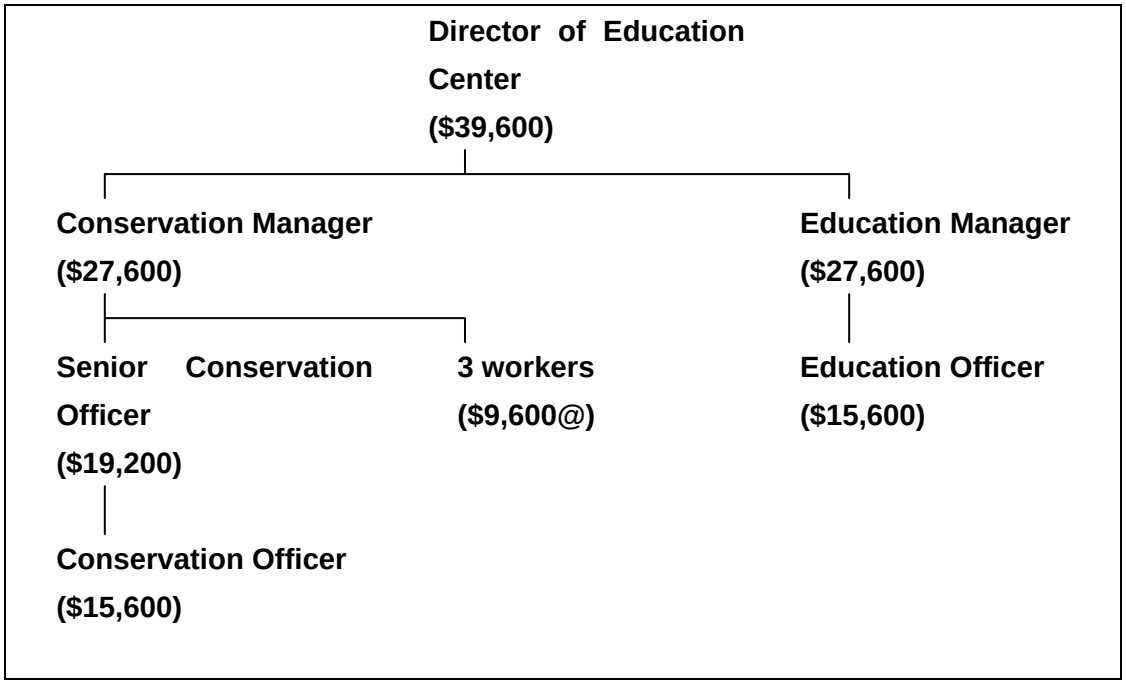
10.2.1 To facilitate the adaptive management, quarterly reports will also be prepared to document the interim findings and exceedance of action/limit levels or anomalies, if any, occurring within the reserve so that proper remedial actions/responses could be taken in time.

11 References

Barrow, E. and M. Murphree. Community Conservation: From Concept to Practice. Chap. 3 in Hulme, D. and M. Murphree (eds) 2001. African Wildlife & Livelihoods: The Promise & Performance of Community Conservation. James Currey Ltd., Oxford, 336p.

Appendix 1 Proposed Staff Budget Plan for Sha Lo Tung Conservation Management

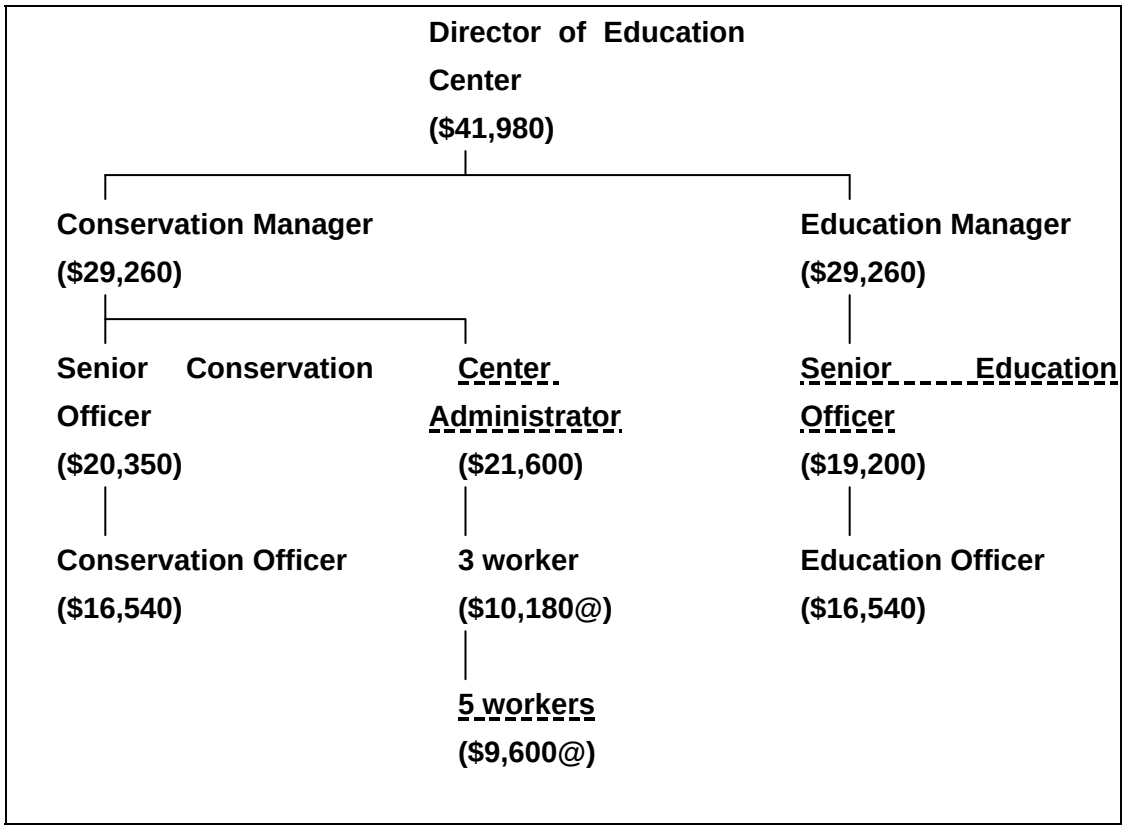
First Year



No. of staff = 9
Salary & MPF:
Monthly= $174,000
Yearly= $2,088,000

(to be continued)

Second Year



No. of staff = 16
Salary & MPF:
Monthly=$273,270
Yearly=$3,279,240

Note:

(1) Staff newly recruited are underlined for that particular year.

(2) It is assumed an annual increase of 6% in salary for the staff employed in the previous year.

Appendix 2 Staff qualification and duty list:

	Post	Qualification	Duty
1.	Director of Education Center	(1) B.Sc./ Master degree in subject related to natural science or nature conservation (2) >5 yrs. experience of in-charging an environmental education center and experienced in field and staff management	(1) Responsible for the implementation of the Sha Lo Tung Conservation Management Plan and in-charging the daily operation of the Interpretation Center (2) Reporting the Sha Lo Tung conservation management related matters to the future Sha Lo Tung Conservation Management Board
2.	Conservation Manager	(1) B.Sc./ Master degree in subject related to natural science or nature conservation (2) >5 yrs. relevant working experience in conservation and habitat management	Responsible for carrying out the day-to-day conservation management practices, species conservation plan (including the species management plans for dragonfly, butterfly, fishes and the Three Banded Box Terrapin) and ecological monitoring at Sha Lo Tung so as to achieve the agreed objectives and management goals stated in the conservation management plan
3.	Senior Conservation Officer	(1) B.Sc./ Master degree in subject related to natural science or nature conservation (2) >2 yrs. relevant working experience in conservation and habitat management	Assist to carry out the conservation management practices, species conservation plan and ecological monitoring at Sha Lo Tung
4.	Conservation Officer	(1) B.Sc. degree in subject related to natural science or nature conservation (2) >2 yrs. relevant working experience in nature conservation	Assist to carry out the conservation management at Sha Lo Tung
5.	Center	Bachelor degree and >5 yrs. relevant	Responsible for the daily operation and

	Administrator	**working experience in managing a center**	**administrative works of the interpretation center**
6.	**Education Manager**	**(1) B.Sc./ Master degree in subject related to natural science, nature conservation or environmental education** **(2) >5 yrs. relevant working experience in environmental education**	**Responsible for carrying out the environmental education program at Sha Lo Tung so as to raise public awareness on the ecological importance of Hong Kong nature and local biodiversity**
7.	**Senior Education Officer**	**(1) B.Sc./ Master degree in subject related to natural science, nature conservation or environmental education related subject** **(2) >2 yrs. relevant working experience in environmental education**	**Assist to carry out the education program at Sha Lo Tung**
8.	**Education Officer**	**(1) B.Sc. degree in subject related to natural science, nature conservation or environmental education** **(2) >2 yrs. relevant working experience in environmental education**	**Assist to carry out the education program e.g., guided visit at Sha Lo Tung**
9.	**Worker(s)**	**>5 yrs. experience in agriculture, horticulture and other related experience in habitat management as well as other relevant experience (e.g., driving)**	**Conduct on-site field conservation works as directed by Conservation Manager**

Appendix 3 Estimated Capital Costs

Item	Description	Unit Name	No. Units	Unit Cost	Subtotal
1	**Interpretation Centre (excluding Public Car Park)***				$8,000,000.00
2	**IT/Education Equipment**				$3,700,000.00
	Office furniture, computers hardwares and softwares				
	CCTV				
	Display design and set up (specimen collection, intranet games, display board, etc.)				
	Pamphlet, brochures, education kits				
	Outdoor signage and display boards				
3	**Public Utilities**				$4,000,000.00
	Reconnection of power, water supply				
	Phone and broadband				
4	**Conservation Work**				
	Phase 1				$11,830,000.00
	Boundary delineation by soft type fencing/planting	metres	4,800	500	$2,400,000.00
	Maintenance of existing footpaths	metres	2,000	1,000	$2,000,000.00
	Site clearance (rubbish and weeds)	contract	1	500,000	$500,000.00
	Plant nursery establishment & nursery stock	ha	1.72	250,000	$430,000.00
	Woodland planting	m2	30,000	100	$3,000,000.00
	Butterfly garden	m2	10,000	200	$2,000,000.00
	Others (e.g. habitat enhancement works or land purchase in SSSIs)				$1,500,000.00
	Phase 2				$9,950,000.00
	Restoration of marsh for Hong Kong Paradise Fish	m2	5,000	150	$750,000.00
	Stream modification for dragonflies/amphibians	metres	1,000	300	$300,000.00
	Tree planting (replacement and new)	trees	10,000	100	$1,000,000.00

	Maintenance of existing footpaths	metres	2,000	200	$400,000.00
	Site clearance (rubbish and weeds)	contract	1	500,000	$500,000.00
	Others (e.g. habitat enhancement works or land purchase in SSSIs)				$7,000,000.00
5	**Company Car**				$600,000.00
6	**Staff Cost**				$2,088,000.00
7	**Others** (including temporary office rent, hydrological and soil study, ecological baseline study, conservation management plan, contracted ecologists for site supervision)				$5,000,000.00
	Subtotal				$45,168,000.00
	10% Contingency				$4,516,800.00
	Total				$49,684,800.00

Appendix 4 Estimated annual recurrent cost during operation (Year 2)

Item	Description	Unit name	No. Units	Unit Cost	Subtotal
1	**Habitat Management**				$814,800
a	Maintenance of Woodland Planting Area	m2	3000	20	$72,000
b	Maintenance of Butterfly Garden	m2	10,000	15	$180,000
c	Maintenance of marsh	m2	3,000	20	$72,000
d	Maintenance of on-site nursery	ha	1.72	25,000	$51,600
e	Maintenance of stream	metre	2,400	10	$28,800
f	Exotic species control	ha	57	2,000	$136,800
g	Erosion control	ha	57	2,000	$136,800
h	Fire prevention including vegetation control at grave sites	ha	57	2,000	$136,800
2	**Facilities Maintenance/Upgrade**				$900,000
a	Basic maintenance/worker equipment - tools, uniforms, etc.	month	12	7,500	$108,000
b	Office Equipment and Supply	month	12	5,000	$72,000
c	Computing Equipment	month	12	5,000	$72,000
d	AV Equipment	month	12	8,000	$115,200
e	Utilities (gas, electricity, water supplies, sewage charges)	month	12	6,000	$86,400
f	Buildings	month	12	10,000	$144,000
g	Trails	month	12	5,000	$72,000
h	Rubbish	month	12	3,000	$43,200
i	Fencing/gate	month	12	5,000	$72,000
j	Vehicle	month	12	8,000	$115,200
3	**Conservation & Education**				$1,096,800
a	Signs	sign	100	200	$24,000
b	Displays	month	12	5,000	$72,000
c	Brochure/pamphlets	month	12	4,000	$57,600
d	Scientific Equipment	month	12	8,000	$115,200
e	Research & Monitoring	contract	5	100,000	$600,000
f	Subsidy for volunteer (if required)	month	12	5,000	$72,000

Item	Description	Unit name	No. Units	Unit Cost	Subtotal
g	Web site update and maintenance	month	12	5,000	$72,000
h	Visiting speakers/lecturers	month	12	7,000	$84,000
	Subtotal				$2,811,600
	less non-personnel items listed above				$1,825,200
	Adjusted Total Recurrent Cost				$986,400

*** Cost excludes:**

Staffing cost

Slope stabilisation works, if required

Revenue generated from admission fee

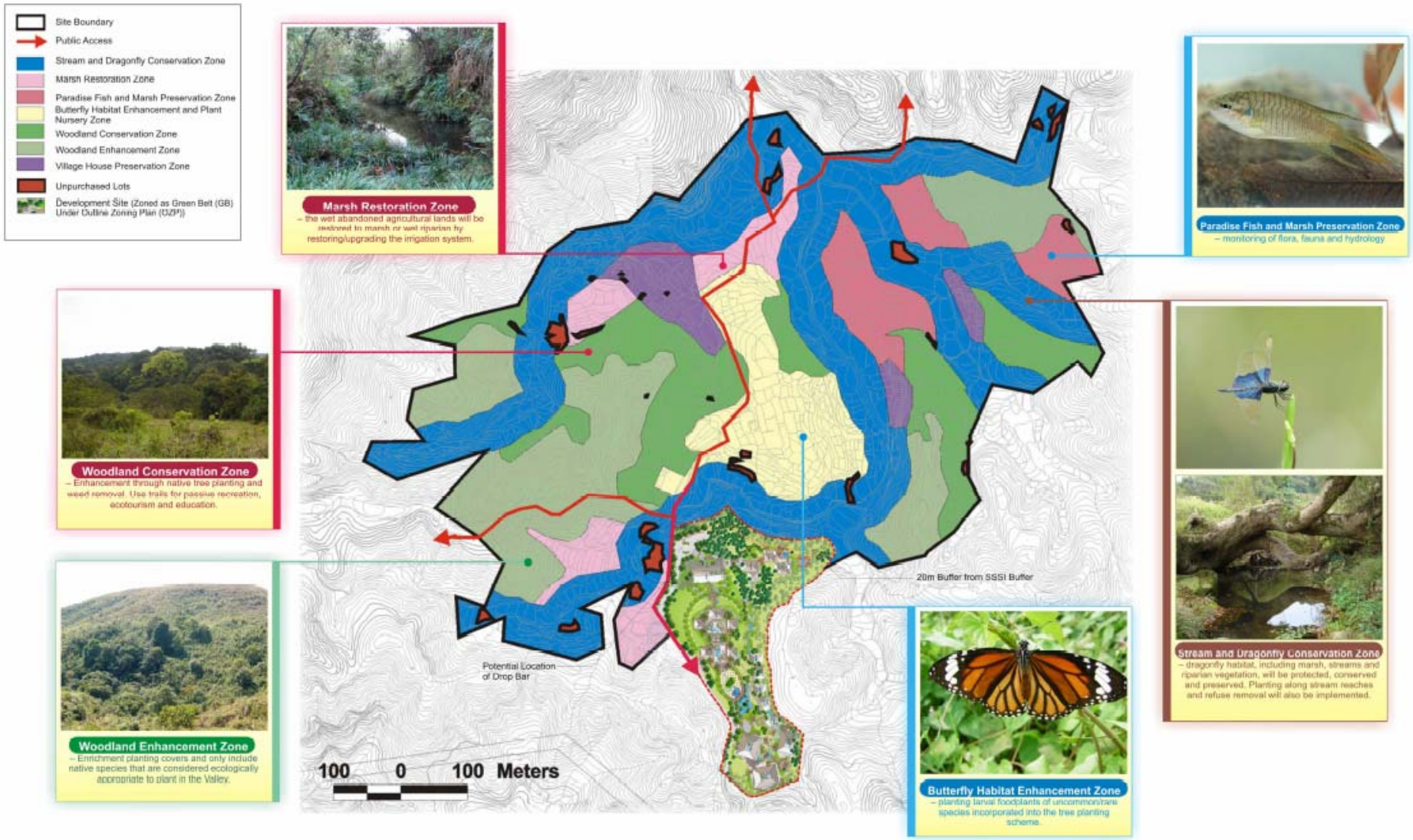


Figure 1 Management zones at Sha Lo Tung Valley