BRINGING THE BENEFITS OF NATURE CONSERVATION TO THE PEOPLE

A Follow-on Technical Analysis of the Mahaweli Environment Project

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Summary While the TAMS reports did a competent job of defining environmental impacts of the Accelerated Mahaweli Development Project, they did not give sufficient attention to the need for the protected area network to bring benefits to the people living in the project area. As pointed out in a later report by McNeely these benefits, particularly as they relate to water resources and private enterprise tourism, far exceed the crop damage mitigation benefits reported by TAMS. In order for these benefits to be realised, the management capacity of the Department of Wildlife Conservation will need to be enhanced through an institution-building process involving a plan for the protected area network in the Mahaweli project area; an institutionalized planning and management process; well-established links between management and research; a personnel structure specifically designed to attain the objectives; training for personnel; explicit means of bringing benefits to the surrounding region; and increased staff, equipment, infrastructure and budget. By building directly on the work of McNeely, this report further specifies the ways and means for AID support to help develop the institutional capacity to bring conservation benefits to the people of the Mahaweli Project area.

1. PREFACE

1.1 Introduction and Acknowledgements

The Environmental Assessment of the Accelerated Mahaweli Development Programme (TAMS 1980) specified the impacts that were likely to accompany the development of the water resources of the Mahaweli Basin. An Environmental Plan of Action was then prepared to guide a number of activities aimed at taking advantage of the positive impacts of Mahaweli development and mitigating adverse impacts (TAMS 1981). The activities relating to wildlife outlined therein formed the basis to a proposal for a five year, $5.0 million, "Mahaweli Environment Project." In May 1982, USAID hired J.A. McNeely (Executive Officer of IUCN's Commission of National Parks and Protected Areas) for twelve days, to assist USAID Colombo and the Government of Sri Lanka's Department of Wildlife Conservation (DWLC) by commencing preparation of the technical analysis required for design of this Project.

This report represents an attempt to complete that task, and is the result of a consultancy carried out from 27th June to 8th August 1982 (See Annex I for terms of reference). In that it builds directly on McNeely's report, this document incorporates many sections, often verbatim, therefrom. Those aspects

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of the present report that represent departures or additions to McNeely's are the results of further discussions with the DWLC, and while thus intended to reflect their thinking accurately, insufficient time for a very thorough review by DWLC of the draft of this report, means some details may remain inaccurate. To McNeely therefore must go all the credit for the overall direction and substance of the report, and to the present author alone responsibility for any shortcomings in the detailed fleshing out, on behalf of the DWLC, of this inherited conceptual and practical framework.

The overall purpose of our two reports has been to present a technical analysis of the project and suggest a number of measures which will enhance project benefits for the people living in the Mahaweli Project area, as well as the nation at large. As pointed out by McNeely it is, therefore, an on-the-ground example of implementing the World Conservation Strategy (IUCN/WWF/UNEP, 1980).

This report was developed in close consultation with Mr. Lyn de Alwis, Director of Wildlife Conservation, and his staff (particularly Messrs. Perera, Sivasambu, Fernando and Mahalingam). The report also greatly benefitted from discussions with Mr. J. McNeely, Mr. M. Jansen, Dr. W. Dittus, Dr. S. Kotagama, Mr. N. Ishwaran, Mr. B. Johnson, and Mr. M. Cockerell. Sarah Jane Littlefield, Vitus Fernando, Mike Philley and Don Clarke of USAID also provided both thoughtful comments and welcome support. Mike Philley and Vitus Fernando guided the content and style of this report (see Annex II). Annette de Silva and her colleagues typed the first draft, and Naima Macan Markar the final draft.

1.2 Overview of Project Technical Soundness

This project will emphasize the improvement and expansion of some existing reserves; the creation of new reserves; the upgrading of specific reserve statuses; and linkages wherever possible between large reserves (sometimes termed "corridors"). A Cabinet Paper submitted in August 1981 seeking clearance to gazette the proposed network was approved in March 1982. The approval so given for the establishment of the Kuda Oya and Nelugala Corridors has since been challenged and will be reconsidered by the Cabinet. However, the outcome in no way effects this project's viability as a whole (see 3.3).

Priority is to be given to developing three major areas: the Somawathie Complex of Reserves; the Wasgomuwa National Park; and the Maduru Oya National Park; as well as their surrounding Buffer Zones (which extend one mile beyond the perimeter of all National Parks) and the Mahaweli Ganga Floodplain Corridor (linking Wasgomuwa to Somawathie). The Somawathie Complex is comprised of the

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Somawathie Nature Reserve (itself a combination of the original Somawathie Sanctuary with the Vappiah-Verugal Forest Reserve), the Tirikonamadu Nature Reserve, and the Mahaweli West Strict Natural Reserve. An as yet to be finalised portion of this Complex will be proposed as a National Park in due course. Wasgamuwa is an existing Strict Natural Reserve, while Maduru Oya will be an entirely new protected area.

Subsequently attention will turn to developing the Hurullu Forest Reserve, the Knuckles Range Nature Reserve, the Kalu Ganga Catchment Nature Reserve, the Elahera-Minneriya Corridor, the Wasgamuwa-Giritale Corridor, and such other linkage reserves as subsequently win approval such as the Kuda Oya, Nelugala, and Maduru Oya/Gal Oya Corridors.

Through establishment of the above protected area network, this project will confer immense economic and social benefits on the people living in the area and the nation at large. These benefits, particularly those relating to water resources, erosion control, and private enterprise tourism, far exceed the crop damage mitigation benefits reported by TAMS. A new set of project objectives, reflecting all benefits both to people and to wildlife, were formulated in the preliminary technical analysis carried out by McNeely (1982), and have since been adopted. That the project will indeed deliver the benefits so described, especially in terms of watershed protection and prolonging the effective lives of reservoirs; river bank stabilization and reduction of downstream sedimentation rates; protection of new inland fish production areas; the creation of economically viable tourist development opportunities; and the provision of hundreds of new jobs; has been confirmed by the Economic Analysis carried out by USAID for the preparation of their Project Paper and incorporated therein.

In addition it can be demonstrated satisfactorily that the specific areas proposed for development under this project will also conform to other objectives by indeed:

- contributing to the integrated development of land resources in the Mahaweli Basin, by conserving outstanding natural areas as national parks, and by utilizing marginal lands as buffer zones and managed forests.
- maintaining a sufficiently large area of land under appropriate management to conserve natural ecological processes, and to ensure the continuity of evolutionary processes, including animal migration (particularly of elephants), the maintenance of genetic diversity, and the complexity of the ecosystem.
- providing facilities and opportunities in natural areas for purposes of education, research, and monitoring of the environment, so that these activities can be linked explicitly with the management of the protected area network as a whole.

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This is not to devalue the justifications given in the TAMS report, namely that the provision of as much contiguous natural habitat as possible would confer the greatest possible benefits in terms of wildlife conservation (particularly as regards endangered and endemic species), and that the reserves would mitigate the problems of displaced animals, particularly those likely to cause damage to crops or property (such as elephants, 800 of which are estimated to inhabit the project area).

Technically this rationale is acceptable. The principles of nature reserve design, derived from recent island biogeographic studies, are now well established. In terms of extinction rates a large reserve is generally "better" (i.e. extinction rates lower) than a small one, and discrete or isolated reserves are better interlinked than otherwise, especially if they are small . Similarly, if the protected areas encompass areas of high wildlife density (as has been established), and especially if their pattern of linkage accommodates the seasonal requirements of the more ecologically and economically significant species (as is claimed, and seems likely; see 3.3), the expectation that problems due to misplaced animals will be mitigated is sound.

However, it must be stressed that these wildlife aspects are a secondary issue to the social and economic benefits of the protected areas. It must be clearly understood that the project will succeed only if it meets the social and economic needs of the people outlined earlier and more fully by McNeely (1982). Through meeting these needs, the wildlife will also benefit. Achieving all this is not going to be easy, but the technical inputs to project design have addressed this challenge from the outset.

The DWLC has done an outstanding job in developing a system of protected areas throughout the country, in developing a capacity to handle "problem elephants", and in managing the country's 5 existing national parks and 28 other protected areas. However, current staff and budget are already inadequate to meet existing needs of DWLC, much less to enable it to meet the serious challenges of the AMP ecosystem. The tasks being faced in Mahaweli are an order of magnitude greater and will require a DWLC which is sufficiently well staffed with trained officers, supported by the necessary equipment, managing a system of protected areas which has appropriate infrastructure, and which is guided by an explicit planning and management process.

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In other words the DWLC will require a considerably greater institutional capacity to manage protected areas, and the specific ways and means this project will help build this required capacity are explained in the ensuing sections below.

2. DWLC INSTITUTION-BUILDING REQUIREMENTS

2.1 Planning and Management System

2.1.1 A systems plan for the protected areas network

A plan for the entire protected area system within the Mahaweli Basin is the first step to attaining the objectives. As was pointed out in the TAMS reports, there should be different sorts of protected areas for attaining different sorts of objectives, and some initial ideas to this effect are already proposed. Some areas should be maintained in an inviolable state for baseline research, while others should be developed for tourism and still others would allow the continuation of current human uses. The system plan will describe the objectives of the system, and relate the different areas to these objectives in order to meet the real needs of the country and region.

The system plan should make the initial determination of objectives for each of the areas within the system, but need not go into detail on management of each of the areas. Based on the objectives, the system plan will suggest levels of manpower required for each area, appropriate management category (national park, conservation park, wildlife management reserve, etc.), and the relationships between the protected area system and other land uses in the region. It will place protected areas firmly in the context of the Mahaweli Development Project. As such, it will be a document which the other institutions involved in Mahaweli will use in developing their own plans; it must therefore be written in clear and concise language, using appropriate graphics to communicate the basic principles and applications of the principles.

It is expected that this system plan will also inspire a system plan for all of Sri Lanka; such a plan may also be relevant to the new World Bank project providing support to a national forestry plan for Sri Lanka, since much of the country's forested land is managed by DWLC.

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2.1.2 An institutionalized planning and management process

The building of an institution effectively to manage the protected areas of the Mahaweli requires a formalization of the management process. This ensures that management practices are independent of the individuals involved, activities can be carried out in different places but expect similar results, all areas are working together as part of a team, all uniforms, signs, and buildings contribute to the image of DWLC, time and energy are concentrated on priorities, data collected in the various areas are compatible, and research contributes to management priorities.

The mechanism for formalizing management is the management plan. A management plan is a document which guides and controls the management of the resources and uses of a protected area and directs the design of subsequent programmes of management; it defines the type, character, and location of development, and provides guidelines for resource management, interpretation, and visitor use. A management plan is a working tool which orients and facilitates all activities to be implemented in an area. It is subject to modification as new information is obtained (particularly in regards to the effects of management actions), but all changes should be made within the scope, context, and overall continuity of the plan. Plans should be reviewed and approved by the appropriate planning boards, and discussed with local people in order to settle any conflicts that may be involved.

Management plans have been prepared in a wide range of formats, but they typically contain at least the following: Objectives for the area; Description of the area (regional setting, current access, climate, geology, soils, topography, hydrology, flora, fauna, human use, any other factors of special significance); Management constraints; Management prescriptions (boundaries, zones, roads, infrastructure, tourism development, public relations, research, etc.); and Management requirements (staff, equipment, buildings etc. required to carry out the plan).

The planning process can be broken into 13 steps:

a. Forming the planning team. In order for the plans for the protected areas in the AMP area to be consistent in content and style, yet reflect the individuality of the various areas, responsibility for overall coordination will rest with the Director of DWLC. He will have a Park Planning Officer attached to him at National Headquarters. In addition, to the Planning Officer, the planning team will include the DWLC Ecologist, the Mahaweli Environment Officer, and representatives of

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other government agencies which will be significantly affected by the plan. In addition it is important to co-opt the individual who will be responsible for implementing the plan for the area (e.g. Park Warden), as well any Ecological Field Assistant stationed there. It is also important that local people be appropriately represented in the planning process, so the DWLC Rural Sociologist will also be involved.

b. Gathering of basic background information. The planning process begins in the office with an overview of the resource material available on the area in question. The information supports the preparation of a base map which is ready before the team assembles in the field. Much of this will have been done during the preparation of the TAMS reports and the system plan.

c. Field inventory. Although the content and intensity of this step can vary considerably, all planning requires fieldwork to gather new information, check and update existing data, and to view the area with new perspectives. If possible therefore, the classification and mapping of landscape features and habitats (an essential first step in ecological monitoring also) should be one feature of field inventory. Generally a review is made of environmental resources and visitor use. Attention is also given to archaeological sites and contemporary cultures, regional economics, poaching, transportation network, and attitudes of local people. Particular attention is devoted to particularly important habitats, areas with potential for tourism, areas of potential conflict, areas which need buffer zones etc. The area manager and his staff, being most familiar with the area, play a key role in accumulating the various data.

d. Analysing the limitations. Constraints of an environmental, economic, political, or legal nature should be recognised and analysed at this point. It is important that limitations be addressed explicitly so that the plan is based on what is real and possible, not what is desirable but unattainable.

e. Defining the objectives. The general objectives will have been defined in the systems plan, but with the above steps completed it will be possible to spell out in detail the values and objectives of the area in question in relation to its particular set of resources and to the country, and indeed the world, as a whole.

f. Dividing the area into management zones. Each area will need a system of zones which are a primary means of determining which human uses (varying from tourism development to complete protection) are to be allowed or encouraged in different parts of the area. The zones will be based on the inventory, limitations, and objectives, in order to maximise the benefits the area can bring.

g. Establishing/reviewing boundaries. Few parks or reserves have ideal boundaries from an ecological point of view. With the inventory, objectives, and zoning stages of the plan in place, the team may wish to recommend boundary modifications. Either way clear and explicit boundaries must be established so that the people living in the surrounding area and government officials working for other institutions have a clear and unambiguous idea of where the area is. The boundary markers should be of a consistent design, difficult to remove or deface, and placed at appropriate locations.

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h. Designing the management programme. Once the zoning concept has provided the basis for what is to be done where, the task is to ascertain the question of how and who. This is the action-oriented component of the management plan that addresses all of the steps required in management, including staffing, physical designs, roads, trails, camping grounds, as well as visitor use, education, interpretation, research, administration and maintenance. It also includes determining the timing of development, phasing of personnel hiring, development of trails etc. and their relevant priorities.

i. Cost-benefit analysis. An analysis of the development options being considered, indicating the economic and/or social benefits of each alternative is carried out. This analysis may be necessary for negotiations with Treasury, Ministry of Finance and Planning, or USAID.

j. Evaluating the plan. The plan should be carefully evaluated by all government agencies who are related to the area, perhaps through the MASL sub-committee on Environment (see 4.1). Once the plan is in a form which is acceptable to all concerned, it should also be subject to public review, by local people, by relevant members of Parliament and the provincial administration, by District Ministers, and by various non-governmental conservation groups.

k. Publishing and distributing the plan. With authorized approval from the Director the plan should be published in sufficient quantity so that every person involved in the preparation, evaluation, and implementation of the plan has a copy. Wide distribution of the plan helps ensure that it will be supported and implemented effectively.

l. Implementing the plan. A management plan must receive a commitment by the DWLC to carry the plan to completion. Some team members will be involved to ensure that the plan can be understood and followed. New or amended legislation may be required to assist management in meeting the objectives and enforcing policies recommended in the plan.

m. Evaluating and revising the plan. This is quite different from step j), since it is based on the impact the plan is having on the ground. Once the plan moves into the implementation stage staff will act to monitor its effectiveness. Are the objectives being met? Are the management steps effective? Are new problems cropping up? Are the local people satisfied with their relationship with the area? Problem areas can be identified and some re-planning may be necessary. As such this step, which should be carried out at least once a year, involves a built-in feedback mechanism, so that planning is a continuous process which involves, ideally, every individual in the area. Continuous planning of this sort will help ensure that the management of the area is steadily improving.

2.2 Applied Research and Ecological Monitoring

2.2.1 Establishing links between management and research

Research has a vital role in improving the capacity to manage. The point has already been made about the importance of enabling the management of the various protected areas to adapt to changes, both in terms of wildlife and of humans. Managers should be as concerned as much with generating new knowledge to improve management, as they are with implementing management decisions made in response

to current knowledge. It is essential that research and monitoring programmes be established to provide management with the information needed to adapt management programmes to changing conditions, just as management plans must be designed in such a way that they remain responsive to the results of research and monitoring.

At present the capability of the DWLC to carry out research and monitoring of the type required in negligible. Hitherto, the little management-oriented research that has taken place in the parks has been conducted by local and foreign university personnel, often with the backing of international organisations such as the Smithsonian Institution and the World Wildlife Fund, and with counterpart assistance provided by the DWLC. Although this project is designed to furnish the DWLC with its own in-house capacity to carry out priority management-oriented research and baseline ecological monitoring (see below), this sort of collaborative effort must continue. The DWLC will probably never be able to address all the lower priority, more academic, but nonetheless valuable and appropriate research that should be undertaken. Indeed it is likely that help even with priority matters will be welcome. Local universities, especially Peradeniya and Colombo, should be significantly involved in the overall effort. The fact that the Director of DWLC is a member of the Natural Resources, Energy, and Science Authority and other relevant committees should help facilitate this. It is also important for the DWLC to maintain links with international agencies involved in research and monitoring, including IUCN, UNEP, and UNESCO (among others).

By establishing an in-house research capability, an institutionalised feedback mechanism between research and management will be created within the DWLC. By also providing the Director of DWLC with control over research in the protected areas, and by involving universities in the process, the DWLC will in these ways develop the capacity to adjust its management activities to changing requirements.

The sorts of data required to guide management activities can already be identified on a priority basis. These are described below.

2.2.2 Baseline ecological monitoring

If management is to respond to changes, a programme must be established to ensure that changes in parameters of management concern are detected in the first place.

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More than a cursory treatment of the subject of ecological monitoring is beyond the scope of this analysis, and is limited here to basic principles and to an indication of those parameters that will merit monitoring in the areas to be developed under this project. Which data to collect will depend on the area in question and the reason for monitoring in the first place. Monitoring can cover any ecological factor but, clearly, for practical reasons, the field has to be narrowed to what are judged to be the chief factors. The following should be monitored in the AMP protected areas:

a. Rainfall. In the tropics rainfall is the most important climatic element, and its patterns determine the nature of whole ecosystems through their effects on topography, soils, hydrology, vegetation, and both animal and human distributions. Therefore, one of the principal aims of ecological monitoring is to record the rainfall pattern of an ecosystem and how the pattern varies over both time and space. To do this a network of rain gauges is necessary. Storage rain gauges, read monthly, are the most practical. Ideally the gauges should be distributed evenly on a hexagonal grid system, within an area somewhat larger than the one under study to give adequate cover.

b. Hydrology and soil erosion. Water run-off, soil erosion, soil moisture, water tables, water depths in floodplains and swamps, and water quality, are all important environmental variables, but while they relate directly to the benefits of this project as a whole, they are perhaps not suited to the monitoring activities of the DWLC as such. Fortuitously the MASL is already engaged in monitoring these variables. There must be a free exchange of data between MASL, DWLC, and any other body engaged in environmental monitoring activities within the AMP area.

c. Grassland dynamics. Grassland communities are not static but may be changed by a variety of influences including climate, flooding, water tables, fire, grazing by herbivores and human activity. A distinction must be made between monitoring designed to document (1) changes in the vegetation itself, and (2) changes in the vegetation as a food supply to herbivores.

   In the former case, the recording intervals are longer (e.g. a year or more), the point at issue being the population dynamics of the vegetation. Here measurements are designed to record the distribution and abundance of plants of each species, and possibly other information also. Some techniques for measuring these changes include photo-ecological plots, permanent transects, sample areas, and treated plots. Great care must be exercised in the placement of experimental plots, priority being given to areas where rapid ecological change is suspected.

   In the latter case, the recording system should aim at documenting short-term changes (monthly or seasonally). Variables that can be monitored include grass greenness, grass height, green biomass by spectro-radiometry, productivity, structure, and chemical composition.

d. Fire. Since fire is a potent agent of grassland and woodland change it is important to document its occurence. For monitoring purposes, fire maps for the whole area should be prepared regularly. For large areas this can only be done effectively from the air.

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e. Woodland dynamics. As with grasslands, forest communities are characteristically in a state of flux, being chiefly influenced by climate, man, fire, and elephants. Woodlands may be monitored on a broad scale, based on an index of canopy cover but may also be monitored on a more detailed scale, in which tree species composition, density, size, structure and population dynamics are documented.

f. Animal numbers. The question of how many animals there are in a particular area is often asked by wildlife managers. Counts are especially required for (1) endangered species which may be declining in numbers; (2) relatively abundant species that may be causing habitat change (e.g. buffaloes in some of the Sri Lankan Parks), possibly justifying a management decision to remove a certain proportion of the population; (3) species of special importance for tourist viewing. There is now a extensive literature on the subject of counting animals, and the pros, cons and pitfalls of the various methods need not be dwelt on here.

g. Animal distribution. The distributions of particular animals, over both space and time, show the total annual and seasonal ranges and whether these ranges are changing with time. Detailed surveys of animal distribution also show the relative use of different habitat types. The object of distribution surveys may be to determine the total annual range of a particular species, or to discover the intensity of use by the species of its range within a wildlife area or both. Having decided on the survey area, a systematic sample design should be aimed at.

h. Others. The gathering of quantitative data on the following also need to be incorporated into the overall monitoring programme if possible: crop damage in surrounding areas; visitor use of the Parks; and the use of forest goods in the buffer zones.

An ecological monitoring programme addressing preferably all of the above is necessary for the protected areas of Mahaweli if we are to understand how they are changing over time. Given such knowledge, it has then to be decided what action, if any, to undertake. This will depend on the objectives and management plans for the particular conservation area.

2.2.3 Priority management-oriented research: elephant movements

The Asian Elephant is a species of special historical economic and ceremonial value to Sri Lanka that is also endangered world-wide (see 2.3). As a large, wide-ranging, slow-maturing, long-lived creature, it is also the most likely to suffer, in both the short and long-term, from the reduction and fragmentation of its range. In the short-term the disruption of migration routes between wet and dry season ranges is expected to make the elephant a problem of considerable economic proportions within the wider AMP area. For example the enormous damage done by elephants to teak in Sri Lanka is only a relatively recent phenomenon, and can only be ascribed to changing habitat conditions. In the long-term the effects of ecological stress as well the increasing fragmentation of elephant populations may well adversely (and even irreversibly) affect

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breeding success and survivorship, although there may be a very considerable time lag before evidence for this became apparent. It must also be borne in mind that elephants are the species with the greatest latent potential for disrupting or destroying the very areas set aside for them and other wildlife.

There are powerful reasons therefore why the needs of the elephant population have had, and should continue to have, an influence on project design disproportionate to that of any other species. These concerns, however, have led to the most contentious disputes over land-use priorities (see 3.3), and it is clear that objective data are needed to resolve present issues, to pre-empt similar controversies elsewhere in the future, to enable the prediction and prevention of human-elephant conflict, and to keep management appraised of the changing needs of the elephant population as development proceeds so it can respond appropriately.

A management-oriented elephant research programme is therefore urgently required on a priority basis. In order to formulate an optimal yet adaptive strategy for the conservation and management of wild elephants, there is a need for four discernible sets of data, and the nature of these data and the urgency with which they are required in turn suggest the nature of the actual research activity and methodology to be utilized. In this context time scale is an important criterion. Data are needed that can be interpreted in order to:

a. Minimise and mitigate the adverse impacts of wild elephant populations on development programmes, and vice versa. To acquire such data, short-term (1-2 years) intensive research into the seasonal distribution and movements of elephants in areas of planning concern is suggested. These data can be used to resolve disputes as to whether corridors are needed or not, and if so, to help plan their optimum boundaries, dimensions, locations, and alignments, for example.

b. Develop cost-effective management techniques in elephant ranges. To acquire such data, medium-term research into distribution and movements in relation to food, water, habitats, and seasons is suggested. These data can be used in designing various habitat management techniques, and in deciding where to apply them, to remove or reduce "boundary conflicts" around protected areas and corridors (see 3.2).

c. Evaluate and improve management techniques both of elephants and their ranges. To acquire such data, monitoring of distribution and movements both before and after application of a management technique is necessary to evaluate its effectiveness and suggest improvement. This is so whether the management technique involves the animals themselves (e.g. driving or translocation: monitoring movements, feeding, and social behaviour of the evicted animals in their new range) or their habitats (e.g. new water sources, or new or altered vegetation within or on the borders of protected areas: monitoring resultant changes in population distribution patterns and their significance for further managerial measures).

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d. Improve and optimise the long-term survival prospects of viable free-ranging populations of wild elephants. The long-term future of the species in the wild lies in the National Parks, and these areas are themselves liable to direct and indirect adverse impact from development activities. To acquire data for the above purpose therefore, research into distribution, movements, numbers, ecology, population structure and dynamics is suggested over a long time-frame. These data will put the long-term management of the protected areas and the elephants they contain on a sound scientific footing.

It is notable that all four of the above sets of needed data demand a study of elephant movements. In view of the importance of the data, and the urgency with which some of it is required, and in view also of the limitations of alternative methods and the forested nature of the habitats, the only way to obtain reliable, objective data on movements quickly, is through a well planned, comprehensive radio-tracking programme.

2.2.4 Radio-tracking in Sri Lanka: feasibility with special reference to elephant research and management.

For the special elephant research requirements existing in Sri Lanka (see previous section), radio-tracking is a methodology whose time has come. The technique would prove immensely useful in the management of problem elephants also (see next section). During elephant drives for example, the radio-collaring of individuals would help keep permanent tabs on pocketed groups, thus enabling them to be re-located rapidly when they disappear or backtrack so that corrective action could be taken expeditiously and most effectively. Furthermore, such radio-tagging would allow evaluation of operational and socio-ecological success after the animals are relocated (see c. above).

All this has been recognised locally for sometime, and recently two DWLC officers (one from the Elephant Conservation Unit) were sent to Front Royal, Virginia, with USAID assistance, for training in radio-tracking methods. The technique of elephant immobilisation, which is an essential preliminary to radio-collaring, is an area which various GSL and University veterinarians, as well as the DWLC's Elephant Conservation Unit, have had long experience.

Radio-tracking as a management-oriented research tool has been widely adopted in North America and Africa for sometime, and in the latter continent has frequently been applied to elephants. Radio-tracking has been far less widely, but nonetheless successfully, applied in Asia, where experience gained with elephants and gaur in the tropical rainforest of Malaysia, tigers in the mixed habitats of the Nepal terai, and pandas in the bamboo thickets of China, have all contributed to the technical analysis given here.

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Radio-tracking, even in the thickest Sri Lankan forest, is not only entirely feasible, but is probably the only way objective data on movements can be obtained in such habitats. The technique enables one to find individuals reliably, and so to discover rapidly the ranges and movements of those animals, and to discover when they go outside their normal ranges. Radio-collared animals can be tracked from the ground or from the air. In general, the greater the height above the ground of both transmitter and receiving aerial the longer the range from which the signal can be detected. For average equipment, in fairly flat and open country, a standing elephant should be detectable from about 2 miles away from an observer holding an aerial on a car roof. Under the conditions prevailing in the AMP study-areas (in terms of terrain, vegetation, access routes), animals would frequently be "lost," and without access to an aircraft from which the range would be up to 10 times as far, the performance of a radio-tracking programme would suffer accordingly, (in terms of the ratio-between data returns and cost investment in equipment). It was for this reason that the Nepal tiger-tracking programme resorted to the use of an aircraft as often as possible. The Malaysian experience has shown the elephants can be located rapidly from the air in dense forest, even at long intervals, without ever being directly sighted.

The peculiarities of radio-tracking elephants on the one hand, and in forests on the other, impose certain important design requirements on the equipment used. First of all transmitters must have both a very long range and very long life; such a specification is not feasible with small animals, but with elephants it is. Secondly, the transmitter should include a "mortality" device whereby the signal can inform the researcher that the collar has fallen off the animal (or the animal is dead). This is very important for "blind" tracking in forests. Thirdly, the phenomenal stresses and strains to which elephant collars are liable, demand that a material be used that can withstand these. No fully satisfactory answer to this problem has yet been found, but a machine belt and a poly-synthetic belt securely bolted together at regular intervals may be the best material available.

Theoretically the technical skill exists in Sri Lanka to build the equipment locally, but there is no prior experience in the field and this option should not be entertained. On the other hand radio-tracking equipment is produced commercially by a number of firms and university labs in the USA, and it is suggested that the requirements of this project, both qualitative and quantitative, be competed out amongst them. It might be most effective to ask the U.S.

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Fish and Wildlife Service to handle this. A tenderer would have an advantage if they had direct prior experience of constructing collars especially for elephants. The experience of the large radio-programme in Nepal makes it clear that a radio-technician from the contracted organisation should accompany the equipment into the field to check its performance, tune the receivers, and adjust paired antennae for aerial tracking. Provision should also be made for the periodic return of equipment to the USA for repair or servicing, and/or a repeat visit to the field by a technician.

Remembering the overall rationale and importance of the exercise, if aerial support for radio-tracking is not available (see 2.6), an automatic tracking system should be considered. Either way, provision should be made under this project for a feasibility study, because an automatic programme can be fully integrated with any pre-existing conventional (as above) programme anyway. Existing automatic systems can identify, locate, and collect data from more than a 100 transmitters simultaneously, automatically and continuously over a period of many months. The system embodies the principle of "hyperbolic navigation." Three, widely spaced fixed triangulating receiving stations measure the differential arrival times of signals from transmitters attached to free ranging animals.

One of the receiving stations is designated the "master" and computes the transmitters' locations from the information provided by itself and the two "slave" stations. The minicomputer installed at the master station also resolves any ambiguities which may arise, computes position errors, processes and stores data, and makes available a graphic display and hard copy output. Increasing digital speeds, and decreasing power consumption, size, and cost of components now make the techniques, in 1982/83, exceedingly attractive in terms of the urgent needs for comprehensive objective data on elephant movements in Sri Lanka.

It must be noted that while elephants provide the prime justification for setting up a radio-tracking programme, once this is done (and no matter whether conventional or automatic), there is no reason why other species of management concern cannot be incorporated also, and at relatively negligible extra cost.

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2.3 The Special Requirements of Elephant Management

The TAMS reports quite properly stressed the importance of elephant conservation in the AMP area. As the most important wild animal in Sri Lanka, for both positive and negative values, the elephant requires special management attention. The requisite expertise is provided by the DWLC's Elephant Conservation Unit, which has demonstrated its capacity to deal with problem elephants both by immobilization-cum-transportation and by driving.

The Unit which is in the charge of the Assistant Director (Elephant Conservation) presently has no headquarters base, and is deployed in only one priority problem area at a time. It is manifestly understaffed and underequipped to deal with even the existing situation (currently over 80 elephant herds causing problems outside protected areas have been documented), and as first noted in the TAMS reports, this situation can be expected to worsen exponentially as development of the AMP proceeds. It is estimated that as many as 400 elephants within the AMP, but outside the proposed protected area network could become displaced.

It is essential therefore to strengthen the capacity of the DWLC to deal with problem elephants. This project will provide a permanent Headquarters for the Unit at Kegalle, where it will be co-located with the GSL's elephant orphanage and experimental breeding complex. Needed facilities for holding sick animals, or animals in transit, will therefore be available. The Headquarters Unit will be small, and designed so as to be able to join any of the planned sub-units around the country at short notice.

In view of the scale of problems anticipated there, one Elephant Conservation Sub-Unit will be within the AMP area, and is to be co-located with the DWLC's proposed Regional Headquarters at Welikande. This Sub-Unit is also to be established under this project. The Welikande Elephant Conservation Sub-Unit will not only be involved with managing pocketed and troublesome elephants in the AMP area, but will also be actively involved in the local elephant research programme, with particular regard to immobilization and radio-collaring.

One item of specialised equipment needed by the Unit which would enhance its effectiveness without compromising its mobility, is Quick-Tower Scaffolding. This would enable the Unit to assemble or dismantle a tower in a theatre of operations very quickly. The tower would be useful for directly sighting elephants and beaters (where cover is fairly sparse - as is often the case - tall trees

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are rare); for taking bearings on radio-collared elephants (see 2.2.4); and for improving the range of the radios and walkie-talkies used by the Unit for communication, which are all hand held and therefore lack permanent antenna masts etc.

The whole question of displaced elephants is problematic. Research must address the question as to what extent more elephants can go on being artificially introduced into given areas, especially if they are already holding stable resident elephant populations that may or may not represent full carrying capacity. Habitat enrichment measures may confer some elasticity to this dilemma, but it seems likely that the whole question of developing the demand for tame elephants needs review. Apart from traditional uses such as in temples and timber operations, new uses for tame elephants such as carrying tourists in the parks and reserves, as well as the possibility of a profitable export market should be debated. Such uses would provide managers with alternatives and complements to translocation operations, perhaps thus easing the burden thereof, should the problems persist in exceeding the capacity to deal with them.

2.4 Education and Public Awareness

Lack of awareness of the benefits of conservation and of its relevance to everyday concerns prevents policy makers, development agents, and the general public from seeing the urgent need to achieve conservation objectives. Ultimately, ecosystems and species are being destroyed because people do not see that it is in their own interests not to destroy them. The benefits accruing to people from natural ecosystems and their component plants and animals are regarded by all but a few as trivial and dispensable compared with the benefits from those activities that entail their destruction or degradation. Until people understand why they should safeguard ecosystems and species they will not do so.

Thus a strong concerted effort must be made to educate the local people if the protected areas system in the Mahaweli is to be effective in attaining its objectives. The DWLC is aware of this need and has already obtained one Mobile Education Unit. This project will provide one more, as well as one full time Education Officer associated with each. One will be based at the National HQ , and will probably be more concerned with the production of materials that can be used in the rest of the country as well as in Mahaweli. The other officer will be based in the DWLC's proposed Regional HQ at Welikande, and will be concerned with the use of such materials among the communities most affected by this project, as well as the production of materials relevant to Mahaweli and nowhere else.

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Education should be of two general types: non-formal (for adults) and formal (primarily for school children). As far as this project is concerned, the non-formal education programme would be aimed at informing the people of the AMP area what the protected area system is all about, what are the objectives of the various areas, how the areas are being managed to bring benefits to the local people, what are the regulations of the various areas, etc.

The formal education programme would include school visits by the Education Officers, special training courses for school teachers, posters, and scheduled visits to the protected areas for school children. This will require a serious commitment and a relatively formal structure; the Wildlife Clubs of Kenya might provide one very pertinent example. The DWLC will have to ensure that its activities in this field are integrated with any other national environmental education programmes such as the one planned by the Central Environment Authority with UNDP assistance. Slide programmes, booklets, nature trails, etc. should be aimed not so much at the love of nature (though this is a value of Sri Lankan culture which should not be under-estimated), but rather at the value of nature: the goods and services that nature is providing to the people living in Mahaweli. This should be presented in clear, visual, and explicit terms, perhaps (when using slide programmes) somewhat tailored to each village situation. A high level of expertise will be required to prepare the education programme, but once it is established and GSL personnel are trained, it should be relatively self-sustaining (though, like all education, it will require a regular budget).

2.5 Tourism

The DWLC's plans for the development of their own tourist facilities under this project are relatively modest, unless one includes the proposal to build a bridge or causeway over the Amban Ganga (see 3.1.3), and are confined to one Bungalow in each of the three major proposed National Parks. It is suggested that these Bungalows need not be set aside for visitor use only, as they could usefully double as Circuit Bungalows for use by staff and others visiting the park on official business. Either way use will be at the discretion of the Director, and will be coordinated through the Booking Office at National HQ.

In view of the proximity of existing tourist centres to the AMP area (ancient cities and east coast beaches), the private sector is expected to take up most of the tourism development load in terms of infrastructure, except for roads and nature trails, and will be encouraged to do so. Tourist lodges should be built

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by private enterprise in villages adjacent to the particular (relatively small), areas zoned for tourism development, thus bringing some of the economic benefits of the protected area to local people. However, under a new regulation, such developments must be a minimum of five miles outside any Park. The DWLC will benefit from fees levied on visitors and vehicles.

A very limited number of private sector opportunities for managing DWLC-owned lodges within the parks may also emerge, depending on the decision regarding a recent application to develop such an arrangement in the Gal Oya National Park.

The potential economic benefits of tourism development in the project area, based on figures relating to the existing national parks, have been considered in the Economic Analysis undertaken by USAID in preparing their Project Paper, and are substantial.

2.6. Aerial Support

The TAMS studies first identified the need to provide the DWLC with an aerial support programme in the form of aircraft services, and there are a number of independent technical reasons to justify this. While problems of economic and/or administrative feasibility may prove intractable, these reasons together nonetheless provide a compelling case for such a programme on purely technical grounds. This analysis first examines the technical background, and then briefly considers associated administrative matters.

The use of light aircraft by parks and wildlife services as a tool in management, research, and law enforcement activities is commonplace throughout America, Africa and Australia. Countries in Asia, with the exception of Malaysia, have been slow to exploit the advantages to be gained from the use of aircraft in wildlife management activities partly because of lack of funds, and partly because of the lack of an institutionalized management and research programme that would guarantee such expenditure be cost-effective.

This project will help DWLC establish just such a programme, and a light aircraft could play the following important roles therein:

a. Planning. Aerial survey can make an important contribution to the gathering of basic background information and field inventory stages of the park management planning process (see 2.1.2), particularly in landscape classification and in the production of habitat maps.

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b. Ecological monitoring (see 2.2.2). Photo-ecological plots and transects, for monitoring changes in grassland and woodland are best photographed from the air. Aerial photographs are compared at yearly intervals in order to detect what changes, if any, have occurred.

Oblique or near-vertical photographs are also suitable for counting animals, and even for the age and sex structure of populations. Trials carried out under the Smithsonian Project proved that elephants and other large mammals could be counted in open areas (e.g. grasslands around tanks, villus etc.) in the evenings. If properly designed, systematic monitoring of this kind, although unable to produce accurate estimates of total population sizes, could nonetheless provide extremely valuable information on seasonal movements, by examining relative numbers using an area at different times of the year, as well as overall population trends, by examining relative numbers using the same area at the same times in different years. Information on group sizes and proportion of young also have management value.

Finally fire maps are best prepared from the air.

c. Research. Aerial support is probably essential for a meaningful rate of data acquisition in most radio-tracking programmes, but particularly where one is dealing with wide-ranging animals, in forested/inaccessible habitats, and where time is short. These points have been considered more fully in 2.2.4. Aircraft are also of use in support of automatic programmes, as even there it is necessary to actually directly contact your subjects in the field from time to time.

d. Management. The aircraft will be particularly valuable in support of the activities of the Elephant Conservation Unit. It is no coincidence that the Unit frequently operates in disturbed, relatively open habitats, in which elephants can be spotted from the air (they have even been filmed). Experience in Africa has shown that under such conditions aircraft can play a key role in elephant drives. This can be passive, where the aircraft coordinates the movements of the ground team relative to the elephants by walkie-talkie, or active, where by diving over the animals, the aircraft actually moves them in the desired direction or prevents them breaking back.

The role of radio-tracking in the management of problem elephants is mentioned elsewhere (2.2.4). Should the ground team ever completely "lose" a radio-tagged herd, the aircraft would again prove invaluable.

e. Law enforcement. Regular air patrols can check boundary incursion and illegal settlements, spot cannabis, tobacco, or other plantations, and detect gemmers', and animal and timber poachers' activities far more efficiently and frequently than through any existing means, and can ensure the rapid and precise despatch of a ground force to deal with the problem. In certain cases such ground forces can be guided into an exact location by walkie-talkie from the aircraft overhead.

f. Miscellaneous. Once obtained for the more pressing needs above, aircraft services are also useful for the rapid positioning of staff, supplies, or spare parts, in the variety of emergencies that could (and do) affect either animal, man, or equipment in the course of the DWLC's work. A lot of other important work, such as inspections by senior staff or VIP's, that would otherwise not be undertaken for lack of time, would also become possible, thus enhancing the efficiency and credibility of the DWLC.

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The American made Cessna 185 or 206 are the best suited aircraft for the above multi-role. They can seat four and six respectively plus a substantial load. They have an appropriate range, high wings allowing unobstructed views downwards, and wing struts allowing attachment of radio-tracking antennae. They can be given STOL performance capabilities (STOL not only enables safer use of short strips, but the low stalling speed is useful for radio-tracking and surveying), and can be fitted with floats for amphibious operations which would greatly increase their utility in the AMP area where tanks abound but airstrips are confined to Trincomalee, Batticaloa, and Amparai. (The Piper Supercub, also American, is also suitable, as it has STOL capabilities and high wings and struts, but as a two-seater fabric aircraft with a small payload and no amphibious potential, it is probably impractical for use in Sri Lanka even though it is considerably cheaper).

There are a number of options for providing aerial support to DWLC activities (1) Purchase a new aircraft (2) Purchase a second-hand aircraft on the market locally (3) Hire aircraft locally.

Assuming a minimum of 250 hrs flying per annum to fulfill the aircraft's envisioned roles (this in turn assumes the aircraft could spend overnight time in the field: if this is impossible the estimate is probably low), and allowing for inflation at 12% per annum, the costs over 5 years of options two and three are very nearly the same.

Option two was used in initial budget preparation (no allowance was made for STOL or amphibious conversions which would cost a further $6,000 and $59,000 respectively), partly because the useful life of the aircraft in DWLC service should extend <u>beyond</u> 5 years anyhow, but chiefly because technically it is the preferable option. Experience elsewhere has shown that dependence on someone else's aircraft can be extremely counter-productive. User rights are non-existent and the plane is often unavailable when it is most urgently needed. The owner's priorities would not mirror those of the DWLC, thus endangering the regularity and continuity, as well as the spontaneity, vital to some envisioned DWLC activities.

On the other hand hiring would allow greater economic flexibility, although the less money allocated for aircraft hire, the lower the technical performance of the aerial support programme. If this fell too low, its whole justification would be called into question. The technical justification is indisputable.

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At the very least therefore, sufficient project funds must be set aside for a useful level of hiring. Preferably these should be substantial enough to allow purchase and running of the DWLC's own aircraft for reasons outlined above.

In this case certain administrative threats intrude. It has to be admitted that the performance record of aircraft previously provided to the GSL has fallen far short of expectations. Problems relating to their status as Government owned craft, including availability of pilots, are implicated. It is probable that any aircraft simply handed over to the DWLC would suffer a similar fate.

However, if the aircraft could become the property of the Wildlife Preservation Fund (which is administered by the Ministry of State and Director DWLC), a formal Joint User Service Agreement could be signed between the Fund and one of Sri Lanka's newly established private sector air operators. Such agreements presently exist with several international organisations. The advantages are that the DWLC no longer would be compelled to employ its own pilot (although this would in no way preclude the training of one of its own officers to fly), and would be able to tap the country's private sector pilot resource. Furthermore, the plane could be chartered commercially during idle time (the operator would take a 15% commission), thus allowing the plane to earn money, either to extend its own operational capability in DWLC service, or to boost the coffers of the Fund (all revenue to the fund is fully tax-deductable under section 31 (2) of the Finance Act No. 28, 1979). However, under the Agreement, DWLC would have priority use at any time without notice. Since aviation fuel is now freely available in Sri Lanka, such an arrangement would ensure that the plane was never idle, permanently available, and possibly profitable.

Two further options deserve consideration. The first concerns the possibility of GSL transferring a suitable aircraft currently lying redundant with another Department to the Fund for use as above. The second would have USAID use its influence to secure a donation of a new aircraft to the Fund from another international organization, preferably on the understanding that operating expenses from this project would guarantee its performance at least for 5 years. From the project point of view, these are the two cheapest options for providing aerial support to DWLC and should be explored actively before any final decisions are made.

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2.7 Technical Assistance

While DWLC is carrying out its current tasks in an effective and efficient manner, the greatly expanded responsibilities integral to this project will require new categories of staff and new levels of expertise. Little problem is anticipated in recruiting Sri Lankan graduates to any of the technical positions, save perhaps those of Park Planner and Ecologist as explained below, but they will all require technical assistance in establishing the various management, research, education, and construction/maintenance programmes.

It is proposed that all of the technical assistance should be provided for establishing programmes that subsequently will be carried out by Sri Lankan staff. The expatriate individuals involved should therefore be practical, field-level people with sufficient experience in developing countries to know what is possible. They should come not as a team (which might tend to isolate them), but rather as an integral part of DWLC; they should report directly to the Director DWLC, and he should be responsible for the final selection of the individuals. Depending on the availability of Sri Lankan counterparts and the extent and timing of the overseas training they require (if any), technical assistance should aim at being short-term, so that dependency is not established; likely exceptions to this general rule are the Park Planner and Ecologist.

The original TAMS (1980) report suggested the provision of technical assistance in wildlife management biology (36 months); wildlife ecology (36 months); park planning (24 months); and range management (6 months). The TAMS (1981) Environmental Plan of Action only retained a Park Planner (6 months). The McNeely (1982) analysis proposed eight individuals: Park Planner (14 months); Ecologist (4 months); Park Engineer (4 months); Wildlife Biologist (4 months); Protected Area Legislation Specialist (2 months); Training Specialist (4 months); Education Officer (6 months); Rural Sociologist/Economist (4 months).

A fuller technical analysis has since been undertaken, and after paying particular attention to the availability of Sri Lankan candidates suitable for the counterpart posts and their overall training requirements, as well as the precise nature of the expertise to be transferred and how long that might reasonably take, technical assistance requirements are now perceived as follows: Park Planner (18 months); Ecologist (24 months); Education Officer (6 months); Park Engineer (4 months); Training Officer (4 months); Rural Sociologist/ Economist (4 months); Legislation Specialist (2 months); Radio-telemetry Technician (2 months); Electric Fencing Consultant (1 month); Automatic Tracking Consultant (1 month).

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Job descriptions, qualifications, and recommended timing for these individuals are presented in Annex III.

Thus perceptions have shifted towards those of the original TAMS report, which first noted that park planning and wildlife ecology are the two fields in which technical expertise is most urgently needed. The technical rationale behind the need for 18 months and up to 24 months assistance respectively in these two key fields is given below.

a. Park Planning. The fact that the fundamental problems being addressed by this project (and the most relevant to its success or otherwise) are primarily social and economic, requires the Park Planner to be the dominant influence in the whole programme. The planning process is of top priority and should go ahead as early as possible, as it identifies, and guides the development of, virtually all other needed project components including research and monitoring (see 2.1).

Sri Lankans with the calibre required for a position of such responsibility, and keen to take the job, are few: only one man stands head and shoulders above the rest, but questions of his availability remain to be resolved. However, neither he, nor anyone else in Sri Lanka, has prior experience in park planning. A fairly lengthy on-the-job training period working with an expatriate park planner, combined with carefully designed training overseas (see 2.8), therefore seems appropriate. Since the latter will entail the Sri Lankan's absence in the USA for up to 6 months, the expatriate will have to remain in the field "holding the fort" over that period. For these reasons 18 months is judged ideal; it may be deemed beneficial to provide this level of assistance in more than one discrete period at intervals over the life of the project. As explained in 2.1.2, the expatriate park planner will still have a team to work with during his counterpart's absence.

As noted above, the Park Planner should assume duties as early as possible, so that the area Management Plans are in place as far in advance of infrastructural developments and other irreversible management decisions as possible.

b. Ecology. The support given to the planning effort by appropriate ecological research and monitoring is a key factor in the project's overall technical soundness. It is recommended for this and other reasons given below, that the Ecologist and Wildlife Biologist positions be extended as far as budgetary considerations allow, preferably to a minimum of 6 months, and a maximum of 12 months, each.

Since the two positions have overlapping terms of reference, and since both theoretically would involve the same main counterpart (the DWLC Ecologist), it is recommended further that the two consultancies run immediately consecutively under the same expert (since this would provide optimal continuity and anyway be cheaper), provided one suitably qualified could be found. If not, the two positions can, from an administrative point of view, be reseparated easily.

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The other reasons for lengthening Ecologist/Wildlife Biologist presence involve the interplay between the following considerations. An ecologist has several roles to play early on in the project. Firstly in contributing to the park planning process (particularly in regard to habitat mapping, field inventory, and identification of area research needs), which itself needs to be initiated as soon as possible (see above). Secondly in setting up the ecological monitoring programme, which should also commence very early so as to establish proper base-line data against which future change can be detected and assessed. Similarly, urgent studies aimed at acquiring data relevant to resolving corridor disputes must commence without delay (see 3.3). On the other hand many phenomena to which an ecologist could usefully demonstrate appropriate research responses may not emerge until development has been underway for sometime. Finally, the Sri Lankan expected to take up the post of DWLC Ecologist, and perhaps the only one both of sufficient calibre and keen to take the job, will be absent in the USA obtaining a PhD in Wildlife Management from September 1982 - September 1984 (see 2.8.2).

In other words an expatriate ecologist needs to be in position early to initiate priority ecological monitoring and research programmes. He/she should also be available to help interpret the results and so ensure that important recommendations to management are justifiable according to sound technical criteria; and one year is the minimum period over which meaningful data could be obtained. As it will take sometime for various management problems to emerge, particularly those that may require experimental management of buffer zones for their solution (see 3.2), the presence of an ecologist is also needed some way into the project so that he/she can assist design and as before, interpret, such experiments.

For all these reasons 24 months is ideal, and would probably involve only 4 months counterpart overlap, hardly likely to create "dependency," but sufficient for the necessary tasks of handing over the research programmes and experiments to the returning Sri Lankan Ecologist. Until then the three Ecological Field Assistants (one of whom could be appointed DWLC's Acting Ecologist) as well as staff from the Elephant Conservation Unit, can act as counterpart staff.

It is recommended that the entire technical assistance and overseas training component of this project be sub-contracted to a suitable international environmental organization, as administratively this would be the most convenient arrangement. IUCN would seem a logical and deserving candidate in that it undoubtedly has the capability, has contributed to the technical analysis of this project, is incorporated in the USA, has other existing contracts with USAID (in association with IIED), and has already expressed its willingness to take on the task at competitive overhead rates.

2.8 Training

By introducing a new institutionalised planning and management process, this project requires new categories of staff. By taking place in a development area where the rates of change and threats to the environment are expected

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to exceed anything previously experienced in Sri Lanka, this project requires new levels of competence and efficiency amongst all categories of staff. It is probable therefore, that the success of this project in the long-term depends on the provision of sufficient appropriate training at all levels.

2.8.1 In-country training

At present, all guards are given on-the-job training in a national park for a period of about one year before they are given permanent status; they are then sent to Colombo for training in natural history, bird identification, and the other necessary tasks for guards. Range Assistants are generally of a higher education standing (at least 12 years of schooling) and are given more extensive training in Colombo; range assistants are expected to eventually work up to Ranger level, beginning at Grade III and eventually moving to Grade I. Higher positions can also be attained, but such opportunities are limited.

In order to effectively implement the management plans to be prepared, and to deal in a competent and sensitive manner with the problems that are sure to arise both with the wildlife and with the local people, more intensive training will be required.

A detailed in-country training program should be developed by a Training Specialist as a matter of high priority (see Annex III). The composition of the program would have to be developed in consultation with the Director DWLC, his Training Officer and other senior staff, and should take into account (in both qualitative and quantitative terms), any opportunities for training overseas.

Appropriately qualified staff from the Universities, particularly those from Colombo and Peradeniya who have already volunteered to help with both the design and teaching of training courses, should also be co-opted. Furthermore, all expatriate individuals participating under the technical assistance programme should be expected not only to provide appropriate training materials that can be used repetitively over the years, but also to teach tailored courses (e.g. ways and means of handling problem elephants) during their consultancies.

This is in addition, of course, to the in-country training all counterpart staff will obtain from these individuals during the time they work together in the field. As one example of on-the-job training, the preparation of management plans can take place in a "workshop" setting, where the individuals involved in preparing the plan are guided by an experienced park planner; "learning by doing"

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is often the most effective way to develop personnel quickly, particularly when there is a series of management plans to be prepared.

2.8.2 Overseas training

An overseas training programme could include the following elements (some are relevant to in-country training also):

- Workshops. Workshops are aimed at producing a real output, such as a management plan or a policy document, with the participants all playing an active role in the process. They have the advantage of providing immediate reinforcement of training.
- Seminars. Seminars tend to be more structured, formal, and "academic." Some, such as the annual International Seminar of National Park Management given by the University of Michigan, the US National Park Service, and Parks Canada, are very useful and can help keep DWLC staff in contact with peers around the world.
- Professional meetings. Professional meetings provide opportunities for senior management and professional staff to meet with their peers to discuss common problems, exchange information, and develop new solutions to evolving problems. IUCN's various commissions have meetings in South Asia on a fairly regular basis, as do various scientific organisations of interest (International Primatological Society, INTECOL, and many others). Major international meetings such as the World Biosphere Reserve Congress (1983) or the IUCN General Assembly (1984) also provide important opportunities for DWLC staff to meet their peers.
- Study tours. Study tours involve relatively small groups of individuals visiting areas away from their usual park to study new or different approaches to problems which may be common to both areas. There should be opportunities for study tours to nearby countries for outstanding staff, but care should be taken to ensure that such tours have a thoughtfully designed agenda which will lead to real staff development.
- Short courses. These tend to be fairly intensive, formal learning situations for relatively large groups of people for dealing with a specific topic.
- Staff exchanges. In addition to normal staff rotations to fill new positions with more responsibility or for other reasons, it is also useful for more structured staff exchanges to take place, particularly between countries.
- Diploma/Degree Courses. For field staff, more academic training must be practical if it is to result in personnel development which can be applied to real problems on the ground. Specialized training courses may also be appropriate for the Ecologist, Education Officers, Park Planner and other professional staff; these should be specially designed to meet the needs of the individual involved and the needs of DWLC.

Considering project staffing requirements with the above points in mind, some specific training recommendations relevant to particular positions are given below. It is assumed that staff not mentioned below will obtain adequate training in-country, either under the technical assistance programme or the DWLC's own training programme to be developed under this project (see 2.8.1 above).

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a. Senior staff. Provision should be made to enable at least one senior staff member to attend (a) World Biosphere Reserve Congress (1983) (b) IUCN General Assembly (1984).

b. Field staff. One Assistant-Director and 25 Rangers in Grades 1 and 2 are to be recruited during the project. Two of the world's foremost training institutions for Parks' staff of this level, namely the College of Wildlife Management at Mweka, Tanzania, and the School of Environmental Management at Ciawi (near Bogor), Indonesia, have expressed a willingness to accept Sri Lankan students. These remarkable opportunities must be taken up. Since the Mweka course is much longer (2 years), it is suggested that the majority of staff be sent to Ciawi (10 months). Both institutions conduct their courses in the English language. Consideration should also be given to securing places in India, such as at the Forest Research Institute, Dehra Dun, or the school run by FAO/UNDP in Hyderabad.

c. Elephant Conservation Unit staff. One member would benefit from a tour to various countries in the region to study their methods of elephant management (India, Burma, Thailand, Malaysia).

d. Ecologist/Ecological Field Assistants. The individual currently expected to take up the post of Ecologist will be studying for a PhD at the Dept. of Fisheries and Wildlife at Michigan State University from September 1982 - September 1984 under a Fulbright Scholarship (Thesis: "Management of Reserves in the Accelerated Mahaweli Development Programme area, with special emphasis on the conservation of elephant populations "). While this takes care of his academic training, both the Ecologist and his Assistants would each benefit by attending at least one relevant meeting in the region (e.g. meetings of CITES, or IUCN's Species Survival and Ecology Commissions).

e. Education Officers/Ecological Field Assistants. While in-country training will be provided through technical assistance, provision should be made to enable one officer to attend any relevant meeting in the area (e.g. IUCN's Education Commission). One officer would also benefit from a study-tour of the region (India, Nepal, Malaysia, Indonesia). He would consider Wildlife Clubs, educational activities of GO's and NGO's, as well as in situ park interpretive activities (e.g. visitor centres, museums, nature trails etc.).

f. Training Officer. In-country training through technical assistance should be supplemented by a tour to study the structure and syllabi of other training institutions for Parks' staff in the region (Dehra Dun, India; Hyderabad, India; Kuala Lumpur, Malaysia; Ciawi, Indonesia).

g. Park Planning Officer. The Park Planner is a key individual in the new-look DWLC. His training is therefore a matter for careful thought. It is suggested that the U.S. National Park Service, perhaps in collaboration with the U.S. Fish and Wildlife Service, be asked to tailor a special course (5 months) to be given either before or after the annual International Seminar on National Parks Management held at the University of Michigan, which the Planning Officer should also attend.

In this case on-the-job training under technical assistance will be a very important feature. Provision should be made to allow the Planning Officer to attend at least one relevant meeting within the region, in addition to the above (e.g. IUCN's Commission on National Parks and Protected Areas).

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h. Park Engineer and Programme Officer. Training of these individuals will be almost entirely in-country. Attendance at the annual Michigan Seminar one year would be beneficial and appropriate supplements.

f. Legal Officer. The Legal Officer should attend at least one CITES Conference (and take the opportunity so provided to visit IUCN's Centre on Environmental Law in Bonn).

2.9 Staff Requirements

2.9.1 Functions

In order for the protected areas in the AMP area to be managed in the way envisaged in the foregoing sections, so that they will bring maximum benefits to the region, they must have a staff structure specifically designed to do so. The following functions will need to be carried out:

a. Management. The Manager (also called "Park Warden;" usually a Ranger Grade I) is the Director of a given protected area unit; he is the leader of the team charged with implementing the management plan of the area, ensuring that his personnel, equipment, and other management resources are being used effectively to attain the objectives for the area. He must deal with other agency directors as well as local leaders, and must present and defend the image and programs of the protected area. It will be necessary to have an Assistant Director stationed in the AMP area in order to coordinate the managers of the various protected areas and to provide a stronger link to DWLC headquarters and to provide appropriate high level supervision of field activities.

The Manager is also responsible for administration and accounting, and for the overall operational aspects of the protected area as specified in the system plan and the management plans. He would report to the Assistant Director on the progress of all physical, institutional, and personnel development activities, who in turn would monitor the overall personnel and budgetary status of each protected area.

b. Protection and Resource Management. The lower grade Rangers, Range Assistants, and Guards are responsible for managing and protecting the area resources and visitors to the area. They work with managers and scientists to design and implement the necessary resource management activities. Some guards deal directly with the public (when they are generally known as "Trackers"), introducing them to the park and guiding them to enjoy their activities in ways compatible with overall area policy. Others spend most of their time in remote areas or trouble spots, implementing protective legislation and dealing with boundary problems. This function dominates DWLC staffing at present, and will continue to be of primary importance during the "frontier" period of Mahaweli development.

c. Ecology. The Ecologist is responsible for the investigations related to management problems and interpretation programmes, representing the natural resources found in the protected areas and guiding management programmes in relation to the appropriate treatment of the areas' natural resources. He spends a great deal of time in the field analysing resource problems, consulting other members of staff, and advising managers on aspects related to overall resource management, with a special emphasis on mitigating possible crop damage by elephants, pigs, and birds; in order to carry out his field tasks, he will require

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several Ecological Field Assistants. The Ecologist will be based at the Regional HQ Welikande, with one Field Assistant for each of the first three areas to be developed (Somawathie, Maduru Oya, and Wasgomuwa). It is recommended that this position (rather than that of Programme Officer), be funded initially under the IUCN/WWF Project (for project description see Annex II in McNeely's report).

d. Interpretation. The Education Officer is reponsible for the interpretive and educational aspects of the protected area programme. He "interprets" the values and features of the protected areas for presentation to the visitor in formal and informal ways and in a language and manner which can be understood and appreciated at all levels. It is advisable to have one Education Officer based at the National HQ, as well as one based at the Regional HQ (see 2.4). Since private enterprise will also be involved in bringing visitors into the protected areas, the latter may also arrange training courses for the private guides. He will also require resident assistance in each of the first three areas to be developed, to help establish nature trails and exhibits in visitor centres, and to ensure these are functioning well, and that local school children are given appropriate attention by the protected area staff, etc. It is envisaged that the resident Ecological Field Assistants (see above) can also double up as assistants to the Education Officer for the above purposes.

e. Maintenance. The Technical Assistant (Maintenance) is responsible for the proper functioning and upkeep of the various vehicles, buildings, grounds, roads, trails, and other installations and facilities of the area. One Technical Assistant will be needed in each of the three major proposed Parks. During periods when physical developments are designed and constructed in the area, the Technical Assistant works in close collaboration with the contractors involved. He supervises a work force which includes carpenters, mechanics, masons, and handymen. It will probably prove most economic to have a central "maintenance pool" with full facilities in one area for the entire AMP area (i.e. Welikande); the individual areas would have smaller maintenance staffs to deal with recurrent maintenance problems.

f. Rural sociology. The Rural Sociologist/Economist is responsible for ensuring that the interests of the local people are being fairly represented in the management of each area, that project benefits are appropriately distributed, that economic benefits are well documented, that buffer zone developments are bringing appropriate benefits, that the education programme is effectively attaining its objectives, that the people in the surrounding areas are fully informed about the objectives and management of the protected areas, etc. He will also gather and analyse information on park resources, user behaviour and preferences, economic constraints and budgets, and will guide the managers on alternative plans of action to meet the goals of the protected area. A single Rural Sociologist/Economist should be sufficient to service all protected areas within the AMP area.

These six "field functions" are supported by a number of "head-quarter functions." In addition to the Director of DWLC, who is in overall control of the entire programme, and other existing officers, there are also several other important new positions which should be filled, and which might have as their initial assignments the implementation of Mahaweli management plans.

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a. Planning. The functions of the Park Planner have been mentioned earlier, he is responsible for the preparation and periodic updating of management development plans for each area, and for the national systems plan. Working under the direct supervision of the Director DWLC, he works with managers and scientists in the preparation of management plans for the areas, and works with engineers and architects in the design and control of physical development. He is responsible for coordinating the park system and strategy plans and advising the Director and area managers on progress and problems, and suggesting alternative courses of action. This position will be funded initially under the IUCN/WWF Project.

b. Programming. Working directly under the Director DWLC, the Programme Officer will be responsible for project administration and coordination, liaising directly and frequently with the Secretary (Ministry of State); Environmental Officer (MASL); and Project Officer (USAID) . The Programme Officer will be responsible for seeing that the implementation schedules agreed on are adhered to, and as one aspect of this will play a key role in servicing project technical assistance and overseas training elements. As such the Programme Officer, together with the Project Officer (USAID) will provide a focus of contact with the international environmental organisation contracted to provide these elements. He/she will also maintain relations with international organisations interested in the project and Sri Lankan nature generally (World Wildlife Fund, IUCN, UNEP, UNESCO, the World Heritage Committee etc.).

In coordination with the Assistant Director (Publicity) the Programme Officer will also draft and issue information to the general public, primarily outside of protected areas, on the overall protected area programme. He/she prepares materials for publications for general distribution, helps prepare speeches and materials which project the image of the protected area system to other agencies, the media and the public; in close cooperation with the Education Officers, he/she will provide technical support for programs for local education.

c. Maintenance. The Park Engineer is responsible for ensuring that all maintenance programs are carried out appropriately, for ensuring that contractors carry out their agreed tasks, that designs of buildings are appropriate for their functions and the image of the DWLC, that equipment is appropriate for the tasks, and other related duties.

d. Legislation. The Legal Officer is responsible for the various legal matters that are likely to crop up, particularly in regard to possible conflicts with other government agencies, land encroachment, and law enforcement. He also helps develop appropriate regulations for the different types of protected areas, and for the zones within the protected areas. Working closely with the Director DWLC, he helps develop policy aspects of area management, and works directly on controvesial issues related to the overall protected area program. It will also be necessary for the Legal Officer to spend a considerable time in court, representing the DWLC in cases brought by them under the Fauna and Flora Protection Ordinance. The Legal Officer will ensure that all the legal obligations pertinent to the various international treaties and conventions signed and ratified by Sri Lanka are in place and being enforced. As such the Legal Officer will act directly under the Director as the CITES Licensing Authority for Sri Lanka.

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e. Training. The Training Officer will be responsible for the content, duration, and frequency of the various courses to achieve necessary in-country training for DWLC staff at all levels. The Training Officer will handle all relevant administration, including preparation and duplication of course materials and aids, as well as coordination with co-opted teachers, whether they be other DWLC staff, university lecturers, expatriate advisors, or others. In addition to his administrative duties, the Training Officer is also expected to shoulder a considerable proportion of the less technical, repetitive, teaching load himself.

2.9.2 Staffing projection

The numerical details of the DWLC's minimal staffing requirements for implementing this project fully and effectively, over a five year life-span, are summarised in Table 2.1. The detailed breakdown in geographical terms may be found in Annex IV. A detailed breakdown in chronological terms is not yet available. The phasing of staff requirements will be dependent on priorities to be established by the DWLC, which in turn are dependent on the overall financial resources available in any given year (the relative availability of funds between the five years is still uncertain at the time of writing); technical urgency or importance relative to other project components competing for funds at any given time; and, after the project is underway, the extent to which preceding recruitment targets have been met.

A total of 273 new personnel in 29 positions are required.

3. SUPPORT REQUIREMENTS

The staff and programmes to be employed and implemented under this project obviously require adequate back-up in the form of appropriate equipment and materials if it is to be successful. Detailed requirements for vehicles and equipment on a location by location basis are given in Table 3.1, and Annexes IV and V.

By cross-reference to the technical analyses given in the previous section of this report, these requirements are mostly self-explanatory. However, there are other infrastructural and management activities needed that are crucial for the success of the project in both the short and long-term, that require further analysis. These are considered below. The comments made in 2.9.2 regarding phasing of requirements, apply throughout this section also.

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Table 2.1 Total staffing requirements

	National HQ	Regional HQ	Research	Education	Elephants	Somawathie	Maduru Oya	Wasgamuwa	Knuckles	E-M Corr	TOTAL
Park Planner *	1										1
Ecologist *			1								1
Park Engineer	1										1
Legal Officer	1										1
Training Officer	1										1
Programme Officer	1										1
Rural Sociologist/Economist		1									1
Assistant Director		1									1
Educational Officer	1			1							2
Ecological Field Assistant						1	1	1			3
Technical Assistant (Maintenance)						1	1	1			3
Ranger (Grade 1)					1	2	1	1			5
Ranger (Grade 2)					1	2	2	1	1		7
Ranger (Grade 3)						6	4	3			13
Clerk/Typist	4	2	1	1		2	1	1			12
Foreman		1									1
Carpenter		3									3
Mechanic		3									3
Bricklayer/Mason		3									3
Painter/Spray Painter		2									2
Range Assistant					2	8	3	5	3	1	22
Cinema Operator - cum-Driver	1			1							2
Storeman		1	1	1		1	1	1			6
Driver/Tractor Operator	6	4	1		5	10	9	7	1		43
Guard					14	32	26	24	12	4	112
Radioman-Guard						1	1	1			3
Handyman/Labourer		4				1	1	1			7
Nightwatchman		1				2	2	2			7
Bungalow Keeper						2	2	2			6
GRAND TOTAL	17	26	4	4	23	71	55	51	17	5	273

* Paid for by WWF/IUCN

Table 3.1 Total vehicle requirements

	National HQ	Regional HQ	Research	Education	Elephants	Somawathie	Maduru Oya	Wasgamuwa	Knuckles	TOTALS
Aircraft	1									1
Bus		1								1
Pickup Truck		1			1					2
Jeep	6	2	1		3	5	6	5	1	29
Education Van				1						1
Outboard motor (25hp)			1				4			5
Outboard motor (9hp)							4			4
Fibreglass boat (17ft)							4			4
Inflable dinghy			1							1
4-wheel tractor (+trailer)					1	3	2	2		8
2-wheel tractor (+trailer)						6	2	1		9
Jeep trailer					2					2
Trailer-Bowser					1	1	1	1		4
Motorcycle (+ accessories)					1	4	1	2		8

3.1 Physical and Infrastructural Requirements

3.1.1 Boundaries

With the large influx of people into the Mahaweli region that is increasing monthly, measures must be implemented to prevent settler encroachment, poaching, and timber operations, within and along the borders of reserves and corridors. The first of these, and one which should be afforded top-priority, is the physical marking, in a highly visible, unambiguous and lasting manner, of all protected area boundaries. This marking should be undertaken as soon as possible after Cabinet approval is confirmed for all the areas proposed under this project.

Boundary marking will involve three sequential and complementary components. Firstly a boundary trace (or path) will be professionally surveyed, cut and marked at intervals with small, pyramidal concrete boundary markers. Secondly, permanent concrete signposts, announcing the name and status of each area will be placed at regular intervals along their boundaries. Thirdly, along those stretches where there are especially heavy threats of human invasion, a strip of eight trees spaced ten feet apart will be planted astride the boundary. The tree species to be used has not yet been decided, and may anyway vary, but it

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should stand out in an extremely clear and obvious manner from the surrounding vegetation, and it should not be attractive or palatable to any animals likely to be pests in the areas outside the reserves and corridors (see 3.2 below).

The proposed Somawathie Complex of Reserves, which (with the arm extending west to Hurullu and other additions) represents a considerable enlargement over the existing sanctuary, requires that 133 miles of boundary be surveyed and signposted. Of this, it is expected that some 30 miles on the northern and eastern boundaries will require strip planting also.

The boundary survey of the proposed Maduru Oya National Park has already been completed with financial assistance from MASL. The boundary to be maintained totals 60 miles, of which half may require strip planting. The 65 mile boundary of the reserve proposed to link Maduru Oya and Gal Oya is to be surveyed during a later phase of this project.

The Proposed Wasgamuwa National Park is bounded on three sides by rivers; most of the 25 mile long southern boundary runs along stream, leaving only a section of about 8 miles to be opened up. Although a jeepable road (as opposed to trace) will be established along this stretch, it probably will require strip planting.

The other areas requiring boundary surveys and signposts are the Elahera - Minneriya Corridor area (145 miles); the Floodplains area along the Mahaweli (147 miles); the extension to the Nelugala Corridor (65 miles); and the Kuda Oya Corridor (21 miles). The boundary to the latter corridor will probably need strip planting. As an existing Forest/Biosphere Reserve, Hurullu has already been surveyed and the boundary marked. Establishment of boundaries to the Knuckles area is considered neither feasible nor necessary.

Thus a total of 576 miles of boundary are to be surveyed and signposted under this project, and approximately 89 miles will require strip planting.

3.1.2 Roads

A good network of roads is necessary for purposes of law enforcement communications, supply, and tourism. Most of the new roads to be provided by this project will be built in medium jungle, and all will be gravelled. They will be approximately 15 feet wide, bordered on both sides by a drain 2 feet and 1½ feet wide at the top and bottom respectively, and 1½ feet deep. The spoil and other earth will be used to provide the road with a suitable camber. It will then be surfaced

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with an approximately 3 inch layer of gravel (or suitable alternative). The entire strip cleared of jungle will be about 23 feet wide. It is estimated that one 2 x 8 ft culvert will be needed approximately every 2 miles.

The new enlarged conservation area to be encompassed by the Somawathie Complex will require at least 150 miles of new road for it to be fully developed and properly managed. The existing roads in the area are, and will continue to be, maintained by either the Livestock Development Board or the Department of Animal Production. They are therefore of no concern to this project.

A total of 49 miles of road exist in the proposed Maduru Oya National Park, and no new roads are envisaged. However all those existing roads need to be improved, involving better drainage, gravelling etc.

Similarly the 35 miles of existing road in Wasgamuwa need to be improved by cutting side drains, filling, gravelling and the installation of culverts. In addition some 27 miles of new road to run between Kadurupitiya and Angamedilla (13 miles), between Wasgamu Oya and Kotawella (6 miles), and along the portion of the southern boundary to be demarcated (8 miles), are needed.

No other requirements for road building or maintenance under this project have been identified. A total of 177 miles of new road are needed for the full development of the proposed AMP protected area system.

3.1.3 Buildings and structures

The following are the types of buildings and other structures which will be required.

Bridge/Causeway. Some sort of bridge or ford across the Amban Ganga is needed if the tourist potential represented by the existing trade in and around Polonnaruwa is to be fully exploited. This would make the Wasgamuwa National Park accessible to tourists coming from the 600 hotel beds within 30 kilometres. Detailed specifications of the structure have yet to be determined.

National Headquarters and Training Centre. The existing Head-quarters of the DWLC in Dehiwela are already cramped and overcrowded. There is no question of building on to accomodate the 17 new headquarters personnel (6 of them senior staff officers), so a new building is required. A DWLC Training Centre is also needed, and it is proposed to combine the two into a new National Headquarters and Training Centre building at the GSL's new complex at Sri Jayawardenapura.

Detailed specifications have yet to be worked out but the design will have to incorporate a large office and briefing area for the Director, a large office for use by visiting field officers and foreign experts;

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a large office for the DWLC's two Draughtsman-Artists; smaller offices for ten resident Deputy and Assistant Directors and other senior staff; a Booking Office; a lecture hall to seat 24 at tables plus a projection room; a large typing pool area; as well as toilets, pantries, and storerooms as necessary.

Workshop and Common Garage. 6,000 sq. ft. To include mechanic shop, carpentry shop, masonry shop, storeroom, and garage for all vehicles.

The workshop and common garage at the Regional/Somawathie headquarters complex will be relatively much better equipped than those at Maduru Oya and Wasgamuwa. It will serve as a central facility for certain reserves beyond, as well as all those within, the AMP area.

Circuit Bungalow. Initially one fully equipped and staffed circuit/tourist bungalow will be established in each of the three major proposed protected areas. Detailed specifications have not yet been determined, and may anyway vary, but the bungalows are likely to have at least 3 bedrooms with attached bathrooms; large verandah/sitting room; dining area; servant's quarters; kitchen; and garage.

Entrance Gate. These structures will consist of an ornately roofed arch spanning the full width of the road entering the park. Within the arch, barriers will block each lane. Two rooms, one on either side, and a toilet, will be provided for guards on duty.

Road Barrier/Guard Room. These will be much less elaborate than Entrance Gates, and will consist of a simple pivoted-pole road barrier, with a small one room house adjacent for guards on duty. Duty will probably be only during daylight, with the guards sleeping in the common quarters of nearby ranges or beats.

Park Headquarters. 2,000 sq. ft. plinth area. Includes offices for Park Warden and Deputy Park Warden; reception room with office counter for issuing permits and controlling visitor flow; casual accommodation for visitors; visitor centre (including publications, guidebooks, relevant exhibits); and toilets.

Office/Laboratory. 500 sq. ft. For ecologist and elephant holding centre.

Senior Staff Office. 400 sq. ft. Office for a senior staff officer, clerks; toilet.

Range Headquarters. 2,000 sq. ft. To include office , garage, and storeroom.

Accommodation Grade I. 1,400 sq. ft. Two bedrooms, sitting and dining room, attached toilet/bathroom, kitchen, servant's quarters, garage. For assistant directors, ecologist, rural sociologist, and education officer.

Accommodation Grade II. 1,350 sq. ft. Two bedrooms, attached toilet/bathroom, kitchen, sitting, dining room, open veranda, garage, for Park Warden.

Accommodation Grade III. 1,300 sq. ft. Two bedrooms, attached bathroom, sitting and dining room, servant's quarters, kitchen, open veranda. Common garage at office site. For technical assistants (maintenance) and ecological field assistants.

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Accommodation Grade IV. 900 sq. ft. Two bedrooms, attached bathroom, sitting/dining room, kitchen, open veranda. For rangers grade 2 and 3 and Foreman.

Accommodation Grade V. 600 sq. ft. One bedroom, attached bathroom, kitchen, lounge, open veranda. For Range Assistant.

Common quarters. 400 sq. ft. per person. Combined quarters with common sitting room, common veranda, separate bedrooms. Bathroom/toilet separated. In units of 3 to 6 bedrooms. For Guards, Drivers, Maintenance men, etc.

Where possible designs and materials should be used that harmonise as far as possible with the natural surroundings. Destruction of trees during construction should be kept to a minimum. It may be desirable for designs to be consistent in all the different areas. These matters will be the concern of the Park Engineer and his foreign counterpart.

It is planned to provide only the Regional/Somawathie, Maduru Oya and Wasgamuwa headquarters complexes with a proper water-supply and fully plumbed facilities. This proposal, as well as the fact that it will be a relatively far greater exercise at Welikande than either Kadupahara Ella or Hettipola, must be reflected in the budget. (Estimated at Rs. 400,000 and Rs. 300,000 x 2 respectively).

A detailed summary of requirements for buildings and other structures over the project period may be found in Table 3.2.

3.2 Habitat Management and Buffer Zones

3.2.1 Background principles

No amount of careful planning can remove entirely potential human/animal conflict at the interface between a protected area and its surrounds. Once the boundary to an area is etablished, the potential for conflict in its vicinity will be present. Boundary zones should of course be managed to remove or minimise actual or potential conflict, but the present state of the art is such that it is more theoretical than practical, the basic principles fairly broad, and the tools available relatively few. It is possible that the science of boundary zone management will never become more precise than it is now, as almost every "boundary" will have different characteristics and management objectives to any other. Therefore management should seek to establish its own formulae through trial and error experimentation with the various tools, or combinations thereof, available. These range from various types of physical barriers (fences; ditches); "psychological" tactics (patrols; use of noise,

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Table 3.2 Total building requirements

	National HQ	Regional HQ	Research	Education	Elephants	Somawathie	Maduru Oya	Wasgamuwa	Knuckles	E - M Corr	TOTALS
Bridge/Causeway								1			1
National HQ and Training Centre	1										1
Workshop and Common Garage		1					1	1			3
Circuit Bungalow						1	1	1			3
Park Headquarters						1	1	1			3
Range Headquarters					1	3	4	2	1		11
Accommodation Grade I		2	1	1	1						5
" Grade II					1	2	1	1			5
" Grade III						2	2	2			6
" Grade IV		1			1	8	6	4	1		21
" Grade V					2	8	3	5	3	1	22
Entrance Gate						2	1	2			5
Office/Laboratory			1		1						2
Road Barrier/Guardroom							2				2
Senior Staff Office		2		1	1						4
Common Quarters		23	3	3	20	49	41	37	13	4	193
T O T A L S	1	29	5	5	28	76	63	57	18	5	287

lights etc); and various forms of habitat manipulation (enrichment and impoverishment).

Before expanding on the theoretical aspects of habitat management, some basic principles of boundary management are noteworthy.

a. Intensive cultivation at the jungle-edge of plants that are analagous (similar or related) to any preferred plant in the natural diet of any animal likely to become an agricultural pest (e.g. elephants) should be avoided. Invariably human food crops fall into this category (but some inedible-to-human crops do also).

b. As a corollary to the above, land-use immediately outside the borders of a protected area should be dominated where possible by plants analagous to those little-eaten or avoided as food by potential pests in their natural range.

c. Any cultivation or plantation bordering a protected area should be well maintained. Poorly-weeded, overgrown schemes are relatively much more attractive to herbivores.

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d. The cost-effectiveness of the boundary management tools available varies. Some of them may not be available if they run contrary to a protected area's overall management policy, according to the area's type or category. Therefore, within the context of each given problem situation, management should select intelligently the method or combination of methods most likely to succeed. Monitoring of conditions before and after is essential for evaluating cost effectiveness.

It is clear that advice from the Ecologist will be necessary for the adoption of all four principles.

The rationale behind the use of habitat management as a tool in boundary management is that one can create ecological deterrents to discourage potential pests from leaving an area, as well as ecological attractions to encourage them to stay within it. As the overall management prescriptions of an area often prevent one from doing one, or the other (or both), of the above, the concept of a surrounding buffer zone, in which such activities are permitted, emerged. In Sri Lanka the concept has been put into practice in the sense that a mile-deep "buffer zone" beyond the borders of all national parks is now statutory. However, their management potential remains unexploited.

The basic theoretical principle behind buffer zone management is to influence its ecology so that as far as potential pests are concerned, it becomes relatively more impoverished and unsuitable than the habitat within the reserve itself. In this way the land beyond their range is intended to appear less attractive than that within it - where crops are planted right up to the boundary the opposite is usually the case.

A second major objective of a buffer zone is to manage it in such a way that, without compromising the above principle at all, it nevertheless provides maximum benefits to people at the same time.

This is most particularly true for this project with its established aim of bringing the benefits of nature conservation to the people. In many areas of the AMP, settlers will expect to be able to harvest some of the goods of nature (trees, fodder, wildlife) as well as benefit from nature's services (watershed protection etc.).

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Buffer zones would be managed by the DWLC in cooperation with other agencies (e.g. Forest Department) as part of the protected area. While annual crops or permanent dwellings would not be permitted, buffer zones might include (even quite large) areas of perennial tree crops, fuelwood or exotic timber plantations; and harvest of indiginous timber for non-commercial use; grazing; collection of dead firewood, fruit, rattan, beedi leaves, honey, ayurvedic medical plants; and (where appropriate) exploitation of some species of wildlife, might be allowed. Most traditional uses would be permissible to the people who have traditionally lived in the project area. A major problem to be addressed by the Rural Sociologist, in close cooperation with his other professional colleagues (particularly the Ecologist), will be devising formulae for bringing benefits to the local farmers in an equitable way that does not lead to degradation of the buffer zones.

While the above concepts of a buffer zone are technically sound in theory, it is not a well tried and tested management tool. Carefully monitored experimentation with various forms of ecological buffer is an urgent requirement for further development of problem elephant management in particular, for while the theory is simple (principle b. above), practical application and success may prove more difficult.

More thought needs to be given to forms of agriculture, agro-forestry, and sylviculture that would also represent impoverishment as elephant habitat. Considering the species throughout its global range the Asian Elephant rarely eats teak. Despite the very recent elephant attacks on teak in Sri Lanka (which probably reflect a severe reduction of, or impoverishment within, their natural range), teak remains a potential candidate for a suitable buffer zone plantation around very rich habitats - especially if the understorey grasses could, through appropriate management, be of the coarser, less preferred varieties (long stem Illuk, Imperata etc.). Fire breaks and control would also be necessary - this would limit green flushing (attractive even in Imperata to elephants) and damage to the trees.

Other forest plantations worth considering are the following. Eucalyptus plantations, especially where an undergrowth of the little-browsed shrub Lantana becomes established, are reported in India to have extremely negative influences on elephant occupance. Another tree-crop worth investigating (and there is no

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information on their relationship with elephants) are conifers suited to the tropics. Conifers are full of anti-herbivore chemicals, and are not browsed at all as far as is known (although there is some evidence that the extinct mammoth ate larch). Conifers are also renowned for their ability to shade (or poison) out undergrowth - all in all they could make a suitably impoverished buffer zone plantation.

Another imaginary possibility might be the identification of a heavy flowering tree species unattractive to elephants. Intensive planting in the buffer zone might then discourage the outward passage of elephants, while providing new bee-keeping and honey producing opportunities for local people. There is now an extensive agro-forestry literature, and the Programme Officer should liaise with organisations like FAO and UNDP to ensure that the Ecologist and Rural Sociologist have access to appropriate background publications and reports.

While buffer zones can be managed to discourage animals from leaving a reserve, habitats within reserves can also be managed to encourage them to stay, although in this case management is not directly influenced by considerations regarding benefits to people. One example is selective forestry - the resultant secondary growth improves carrying capacity and the net flora shifts to a fuller complement of preferred herbivore foods - i.e. habitat enrichment.

However, by their very nature, which involves alteration of the natural status quo, habitat enrichment techniques may not be viable options in certain protected areas such as National Parks, where such activities would run contrary to the legal statutes governing their use and management.

Be that as it may, habitat enrichment should preferably take place well within the boundaries of a reserve - not near the edge. Enrichment can be applied to water supplies as well as food. It can be passive (as in the example of selective forestry or artificial cutting) - or even active (i.e. actual planting of preferred foods or pasture within the range; or appropriate fire management).

3.2.2 Project requirements

The DWLC should anticipate having to use any combination of the four basic boundary management tools - physical barriers, psychological tactics, buffer zones, habitat enrichment - if they are to successfully mitigate the adverse impacts of man and animal upon one another in the AMP area. As this need may arise in relation to particularly urgent, local situations in the near future, it should

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be reflected in the planning and budgeting of this project.

Recent development trials with electric fencing against elephants in Malaysia and Kenya, using modern high-energy shockers (one per wire); sophisticated designs; intelligent wire spacing; and proper earthing measures; have proved highly successful. A major attraction is the method's relatively very low establishment and maintenance costs ($1,090 per mile; $330 per mile per annum respectively) and versatility (streams and roads can be crossed; climate has little effect), making the electric fence the most cost-effective physical elephant barrier available.

On the basis that roughly half of the 89 miles of boundary where the confrontation between man and wildlife is expected to be particularly intense (see 3.1.1.), would benefit from the additional application of electric fencing, appropriate provision has been made in project design and budget.

Night patrols and benign harrassment aimed at crop protection in surrounding agricultural areas, must be a integral part of the duties of protected area, and Elephant Conservation Unit, staff.

While it seems reasonable to expect that any large scale, ecologically appropriate developments in the buffer zones for the benefit of people will be financed by other organisations and projects, the DWLC should nevertheless have an independent capability to implement smaller scale habitat management activities in response to particular and urgent requirements that inevitably will occur.

It is estimated that a provision in this project enabling the intensive management (planting "unattractive" items in buffer zones, and/or "attractive" items in reserves; artificial cutting etc.) of an area of 416 acres (which is equivalent to 0.1% of the total area of the three major proposed parks), would confer the DWLC with a realistic capability in this regard during the life of the project. Budgeting should assume the most expensive activity (i.e. monoculture tree planting at Rs. 3,720 per acre).

Another way of retarding vegetational succession and maintaining higher carrying capacities is through fire management (as opposed to artificial cutting). This deserves trial, and as the inability to create firebreaks would forego any experimentation with this potentially invaluable management tool, project

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design and budget must reflect a modest requirement (40 miles by 23 feet) for making firebreaks. Fire control is also crucial to some other aspects of habitat management (see 3.2.1 above) as well as ecological monitoring (see 2.2).

Finally, provision must be made for the restoration of waterholes. In Wasgamuwa waterholes will be restored to prevent concentration of elephants and other large animals along the rivers during the dry months. Three fairly large tanks and about 10 small tanks have been identified for restoration, with the work involving clearing behind and building up the bunds, either by hand or using a hired D4 bulldozer.

3.3 Corridors

The technical soundness of interlinking reserves (especially small ones) with so called corridors as a means of conferring ecological and genetic resilience on them was referred to in section 1.2. As such the establishment of "corridors" represents a valuable and feasible management technique. Where such a linkage corridor can be made to correspond exactly with the migration route of an endangered species of key management, economic, and cultural importance, the argument in favour of such establishment becomes very powerful indeed. However, where the economic and social costs of establishing and maintaining such a corridor were known to be extremely high, it would be essential to provide solid, objective, scientific data to prove the corridor's importance to that species.

One area of controversy relevant to this topic and this project concerns the corridors which are proposed to link Wasgamuwa with Maduru Oya (Kudu Oya Corridor) and Somawathie with Maduru Oya (Nelugala Corridor). It is felt by DWLC that these corridors are of great importance to the long-term viability of elephant populations in the AMP area, and this feeling is supported by a considerable body of evidence. A recently completed 2-year study sponsored by WWF has shown that the area proposed for the Kuda Oya Corridor in particular, is presently an area of relatively high elephant activity. Unfortunately, what is still unclear is the relationship between that area and the seasonal movements of the local elephant populations in precise geographical terms. Until this is fully understood, it is impossible to make scientifically sound assessments of the consequences of the with-corridor or without-corridor options.

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While the corridors are intrinsically important to the overall viability of the protected area system in Mahaweli, the DWLC will need some time - a minimum of two years - to demonstrate scientifically the long-term importance of the corridors to elephants, the costs of managing the corridors, and the impacts on local people. Since this project can (and will) provide the expertise and equipment to do this (see 2.2 and 2.3), the DWLC should (if the corridors are not granted outright on present evidence), press strongly for a moratorium on the whole issue for an equivalent period (i.e. a minimum of two years).

Technically this is a sounder option for GSL than outright refusal to grant the corridors, as all future options are retained. If the areas are proved subsequently not to be vital, they can be released secure in the knowledge that no major problems to agriculture or elephants will ensue as a direct result. If it is proved subsequently that the areas are indeed vital, both settlers and elephants will be grateful that they were not developed without first checking, because immense problems would have ensued unavoidably, irreversibly, and of course unnecessarily.

The final decision on the corridors should be made by the GSL after all the data are collected and presented. Apart from providing a technical analysis of initial options, as well as offering and providing appropriate support, it would probably be counter-productive for USAID to attempt to influence this decision. Project viability is not linked to this decision, either way. If there is a moratorium, corridor development funds can be diverted to intensified research, and vice versa.

3.4 Maintenance Programmes

Project budgeting must make adequate allowance for the servicing, maintenance, and running of all the project requirements identified in this technical analysis. The following is a list of the recurrent expenditures involved.

Staff:	Salaries and travel allowances; uniforms.
Vehicles:	Spare parts; tyres; fuel; service and repairs; aircraft hangarage, insurance, licencing and pilot/engineer services.
Buildings:	Maintenance and repairs.
Roads and Boundaries:	Maintenance and repairs (at end of project a total of 261 miles or roads, and 636 miles of boundary will require maintenance).

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Habitat Management:	Maintenance of fences/ditches; buffer/habitat development zones; firebreaks; and waterhole bunds.
Miscellaneous:	Maintenance and repairs of all radio equipment (both telemetry and communications); fuel for water pumps, generators, fridges, cookers, lanterns and lamps (kerosene and diesel); office expenses (stationery etc.); drugs; batteries for radios and torches; educational support materials; other consumable hardware.

Provisions for maintenance should increase annually, even where stocks remain the same. The older an item gets, the more maintenance it will require.

Costs of all capital and recurrent expenditures envisaged under this project design have been submitted separately to the USAID Project Development and Support Office by the IUCN/IIED Consultant responsible for this technical analysis. These are all 1982 prices and the Office should ensure that appropriate allowance for yearly inflation is made in the project's administrative and economic feasibility studies and analyses.

4. PROJECT GUIDANCE

4.1 Co-ordination

Some aspects of routine project co-ordination have been touched on in the description of the Programme Officer's duties (see 2.9.1; page 31).

While it is understood that overall project co-ordination will be supervised by the Secretary, Ministry of State, it is suggested that technical co-ordination can be provided by the MASL's existing Sub-Committee on Environment. A role has already been suggested for this body in the review of area Management Plans (see 2.1.2; step (j) on page 8). The Sub-Committee also seems ideally pre-adapted for integrating development and management activities in the Buffer Zones (see 3.2; pages 41 and 43).

However, it may prove necessary to increase the existing diversity of representation on the Sub-Committee, so as to reflect all parties with interests in, or with potentially supportive or contradictory roles in relation to, any project activity.

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4.2 Evaluation

It is recommended that evaluation missions, mounted in order to review project performance in relation to achieving objectives, be carried out at 20 months, 40 months and at the end of the project (60 months). Apart from reviewing past performance, the evaluation team should submit recommendations for correcting shortcomings and improving performance where necessary. It is suggested that the team consists of at least one nominee from each of USAID, GSL, and the international environmental organisation contracted to handle technical assistance and overseas training. It is suggested further that while these individuals should have a background expertise appropriate to the review of a project of this nature, they should nonetheless each represent differing areas of specialisation.

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ANNEX I

CONSULTANCY TERMS OF REFERENCE

A. Objective

To assist USAID Colombo and the Government of Sri Lanka Department of Wildlife Conservation (GSL/DWLC) in preparing the technical analysis required for design of the Five-Year Mahaweli Environment Project (383-0075).

B. Scope of Work

The Contractor shall complete the scope of work outlined in Colombo 2614, namely to:

1. Identify infrastructure, manpower and equipment needs for the five national parks to be developed (type, categories and siting of buildings; skill categories and number of personnel).
2. Cost out the resource requirements identified in (1), including operating expenses.
3. Prepare implementation schedules based on (1) and (2).
4. Plan the phasing of USAID and GSL/DWLC expenditure over the project period.
5. Prepare scope of work for a comprehensive park development and management plan.
6. Identify and prepare scope of work (job description) for follow-on technical assistance required during project development and implementation.
7. Define training requirements within GSL/DWLC.
8. Assist USAID to incorporate (1-7) into the technical analysis required for project design and preparation.

C. Reports

The Contractor shall produce a final technical report which will address the scope of work outlined above. The report should be submitted in draft to USAID and the GSL/DWLC prior to the consultant's departure from Colombo. The final report should be submitted to USAID, with a copy to ADI/W (Asia/TR/EFE) no later than August 27th.

N.B. While number 2 above was carried out by the consultant in regard to a project with the "ideal" design considered in this technical analysis, he was not asked to participate in the process of retaining/discarding components from this "ideal" treatment so as to accommodate the final financial scenario which only emerged very late in the consultancy. This included GSL imposed ceilings to total USAID/GSL combined expenditures of Rs. 13 million and Rs. 15 million for 1983 and 1984 respectively, as well as a USAID ceiling of $5.0 million for the full five year project. Consequently the consultant was no longer required to consider either numbers 3 or 4 above.

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ANNEX II

MEMORANDUM TO: VITUS FERNANDO FROM: MIKE PHILLEY RE: ROBERT OLIVIER CONSULTANCY

1. After reviewing the draft PP materials and talking to Robert Olivier, I recommend that the report to be prepared by the consultant should focus specifically and fairly concisely on the following items:

   (a) Technical Feasibility component of the Project Paper roughly in accordance with the written outline attached to this memo;

   (b) Costing and phasing of USAID and DWLC inputs as the basis for preparing the Financial Plan of the PP;

   (c) Detailed identification and timing of technical assistance and training requirements for incorporation into (a) and (b) above, as well as the description of the DWLC institution-building plan of action;

   (d) Detailed identification of DWLC requirements and methods for a "built-in" program of applied research, monitoring and evaluation linked to their management objectives for national parks.

2. In terms of the consultant's reporting requirements through IIED/IUCN, I believe that a report which is formulated on the above items, and which allows ready application to PP preparation, will suffice. The scope of work fits well with this approach to report writing. The consultant can develop the report in the context of assistance provided to USAID, specifically addressing the items of para 1.

A. TECHNICAL FEASIBILITY

1. Technical Soundness-Summary Assessment

   a. TAMS Environmental Assessment and Plan of Action
   b. IUCN (McNeely) Report
   c. DWLC Experience and Present Capability

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2. DWLC Institution-Building Requirements

   a. Planning and Management System
   b. Applied Research, Monitoring and Evaluation
   c. Education and Public Awareness
   d. Training
   e. Personnel/Staffing Projection
   f. Technical Assistance

3. Park Infrastructure Construction, Development and Maintenance

   a. Boundaries
   b. Physical Facilities, Buildings, Roads, Paths
   c. Buffer Zones
   d. Corridors
   e. Maintenance Program

4. Mechanism for Intersectoral Coordination

   a. Role of DWLC
   b. Role of MEA and MASL
   c. Relationship to Other GSL and Donor-Assisted Projects

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ANNEX III

SPECIFICATIONS FOR TECHNICAL ASSISTANCE

1. PARK PLANNER

Job Description

This individual will be responsible for working with the DWLC Park Planner to prepare a system plan for the entire Mahaweli Project Area; and with the DWLC Park Planner and relevant park wardens in preparing management plans for the first three national parks (Somawathie, Maduru Oya, and Wasgomuwa), with his involvement progressively decreasing and DWLC expertise increasing. The Park Planner would also help the Director DWLC in developing his national wildlife management and protected area policies. The Park Planner would also ensure that each management plan includes appropriate mechanisms which would allow the success of the Plan to be assessed, and facilitate any changes that might be required.

The Park Planner will prepare appropriate training materials on the function and role of park planning, so that all rangers, range assistants, and guards will be aware of the critical role of park planning, and the contribution that each of them can make to the planning process.

Qualifications

- At least 5 years experience in park planning, with at least two years in a developing country; other relevant experience or demonstrated capability could compensate for either of the foregoing.
- Proven ability to work with local people.
- Firm commitment to protected areas as an important part of social and economic development.

Length and timing of consultancy

Eighteen months; commencing simultaneous to project initiation, and independent of counterpart availability at that time. Depending on the cost/benefit perception of those managing the project, it may be deemed beneficial to divide this level of assistance into an extended initial period, followed by one or two short follow-up missions later into the project.

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2. ECOLOGIST

Job Description

The Ecologist will in fact be a management research specialist. This individual will have three overlapping (in both technical and chronological senses), areas of responsibility.

Firstly, he/she will make an integral contribution to the park planning process, particularly in regard to habitat mapping, field inventory, and identification of area research needs.

Secondly, he/she will be responsible for setting up the ecological monitoring and priority management-oriented research programmes on which management will be based (as outlined in technical analysis section 2.2), and will specify the types of data required and develop the ways and means to acquire it.

Thirdly, the Ecologist will establish regular research programmes dealing with crop damage and wildlife tourism. He/she will therefore be responsible for advising the DWLC on ways and means of mitigating crop-damage, for assisting the DWLC to develop the capacity to respond to problems as they arise, and for developing long-term strategies for controlling problem animals. He/she will also advise on the ways and means to control the distribution of key species for the benefit of tourism, and for ensuring that particular areas are not overutilized.

The Ecologist will work closely with the GSL Ecologist and the three Ecological Field Assistants in Somawathie, Maduru Oya, and Wasgomuwa. Overall objectives and responsibilities will also involve working with local universities, the Natural Resources, Energy, and Science Authority, and DWLC field staff such as Rangers and Guards.

The Ecologist will design training materials which will demonstrate to Rangers, Range Assistants and Guards, the role and function of research in the effective management of protected areas, and the ways and means of managing wildlife to avoid conflicts with humans and to enhance wildlife attractions for tourists.

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The Ecologist will work with the DWLC Programme Officer to devise ways and means of funding requisite research programmes (including UNESCO, UNEP, Smithsonian, IUCN, WWF, and other aid organisations) should support under this project fall short.

Qualifications

- PhD in ecology or wildlife management, plus considerable field experience in designing and implementing management-oriented research programmes in developing countries; additional experience on the ground can compensate for lack of PhD.
- Experience in elephant management, particularly controlling crop damage, coupled with a demonstrated aptitude and willingness for work in the field.
- Sufficiently broad experience to be able to cover the entire range of responsibilities.

Length and timing of consultancy

Minimum twelve months, maximum twenty four months: at discretion Director DWLC, and according to availability of funds. To commence simultaneous to project initiation, and independent of counterpart availability at that time. If a person of sufficiently broad experience is not available, this consultancy could be split into two consecutive Ecology and Wildlife Biology consultancies with terms of reference as originally proposed in the McNeely report.

3. EDUCATION OFFICER

Job Description

This individual will be responsible for establishing the education programs at both national and AMP area levels. Working in close cooperation with the two Education Officers as well as the Ecological Field Assistants in Somawathie, Maduru Oya, and Wasgomuwa, the Education Officer will define the needs and approaches, stressing the benefits that environmental conservation and protected areas bring to the people. He/she will help design slide programmes, leaflets, posters, and other material for both formal and non-formal applications. He/she will also help design the exhibits for the visitor centres at the headquarters, as well as nature trails, in the three parks.

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The Education Officer will design training materials for Rangers, Range Assistants, and Guards to demonstrate the importance of education for the management programmes they are carrying out, and to suggest ways that each of them can help to support the education programme.

Working closely with the DWLC Programme Officer, the Education Officer would help devise a national education strategy in order to inform the general public about the work of the DWLC and its contribution to human welfare. He/she would also help establish the ways and means of funding specific parts of the programme, assisting the Programme Officer to establish links with UNESCO, UNEP, IUCN, WWF, and the various bi-lateral organisations which may be relevant.

Qualifications

- Bachelor's degree or higher in education or conservation.
- Considerable experience in establishing education programmes in developing countries.
- Demonstrated willingness to work in the field.
- Clear understanding of the role of protected areas in bringing benefits to the region.

Length and timing of consultancy

Six months; following counterpart availability, at discretion of Director, DWLC.

4. PARK ENGINEER

Job Description

This individual will be responsible for advising on design of buildings and roads, and for helping to set up the regular maintenance programme for the Mahaweli Project Area. Working closely with the DWLC Park Engineer (a headquarters position) and with the Technical Assistants (Maintenance) in Somawathie, Maduru Oya, and Wasgomuwa, the Park Engineer will first advise on the design of park headquarters buildings and ancillary structures so that the DWLC will have a distinctive, consistent, and appropriate architectural style. He/she will also advise on the establishment of regular procedures for maintenance of buildings and roads, stressing the use of local labour whenever possible; he/she will also advise on the Maintenance sections of the management plan.

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The Park Engineer will design training materials which will demonstrate to Rangers, Range Assistants, and Guards their role in maintenance.

Qualifications

- Degree in engineering
- Considerable experience in national parks engineering, including design of buildings, maintenance, and liaison with architects and civil engineers.
- Sufficient experience in developing countries to be able to suggest programmes that are practical and attainable.

Length and timing of consultancy

Four months; at discretion of Director, DWLC.

5. PROTECTED AREA LEGISLATION SPECIALIST

Job Description

This individual will work closely with the DWLC Legal Officer to develop the appropriate regulations for the different types of protected areas, and for the zones within the protected areas. He/she will advise the DWLC on the various legal options which have been used to control buffer zones. He/she will review existing legislation dealing with protected areas and suggest modifications which may be necessary to deal with evolving needs of protected area management. The Legislation Specialist will also work with the DWLC Legal Officer to develop regulations for controlling the activities of concessionnaires in order to ensure that appropriate benefits accrue to DWLC.

The Protected Area Legislation Specialist will work with the DWLC Legal Officer to prepare training materials for Rangers, Range Assistants, and Guards so that they are well informed of their legal status and rights. He/she should also review legal aspects of Sri Lanka's participation in international treaties and conventions.

Qualifications

- Barrister or Attorney with considerable experience with protected areas legislation.
- Experience in developing countries, particularly in South Asia.

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Length and timing of consultancy

Two months; following counterpart availability, at discretion of Director, DWLC.

6. TRAINING SPECIALIST

Job Description

This individual will work closely with the DWLC Training Officer on establishing new and expanded training courses for all personnel. He/she will advise on the various ways and means of training, provide information on international opportunities for appropriate training, and coordinate the preparation of training materials by the other expatriate technical advisors. Working closely with the Programme Officer, the Training Specialist will help identify sources of funding for training programmes. In cooperation with the Natural Resources, Energy, and Science Authority and appropriate universities, he/she will suggest appropriate changes to university curricula for developing higher level personnel for DWLC.

Qualifications

- Degree in education, training, or a related field.
- At least 10 years experience in training protected areas personnel.
- Experience in training protected areas personnel in developing countries.

Length and timing of consultancy

Four months; following counterpart availability, at discretion of Director, DWLC.

7. RURAL SOCIOLOGIST/ECONOMIST

Job Description

This individual will work closely with the DWLC Rural Sociologist/Economist to develop programs for ensuring that the local people receive appropriate benefits from the various protected areas. They will develop ways and means of ensuring that products from buffer zones are appropriately distributed, and grievances are addressed, and that the education programs are appropriate for the requirements. The Sociologist/Economist will also develop research programs which will document the economic benefits of

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various protected areas. Working closely with the Park Planner, he/she will ensure that there is appropriate public participation in the various management plans.

The Rural Sociologist/Economist will work closely with his DWLC counterpart to develop training materials for rangers, range assistants, and guards which will make them sensitive to the needs of the local people.

Qualifications

- Advanced degree in sociology, economics, or a related field.
- At least five years experience in the problems of rural development.
- Familiar with the problems and objectives of protected areas.
- Proven capacity to produce the required results.

Length and timing of consultancy

Four months; following counterpart availability, at discretion of Director, DWLC.

8. RADIO-TELEMETRY TECHNICIAN

Job Description

The technician will accompany all the radio-telemetry equipment into the field to check its performance, tune the receivers, and adjust paired antennae for aerial tracking.

Qualifications

To be determined by contracting supplier.

Length and timing of consultancy

One month, followed by one month; both at discretion of Director, DWLC.

9. ELECTRIC FENCING CONSULTANT

Job Description

The Consultant will advise on the design, construction and maintenance of electric fencing suited to the specific management requirements of the AMP.

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Qualifications

- Electrical Engineer/Agriculturalist with considerable experience of electric fencing against large mammals.
- Experience in the tropics, and with elephants, would be desirable additional qualifications.

Length and timing of consultancy

One month; at discretion Director, DWLC.

10. AUTOMATIC TRACKING CONSULTANT

Job Description

The Consultant will undertake a technical analysis and feasibility study for the establishment within the AMP area of a fully automated radio-tracking programme, to be designed primarily, but not exclusively, to fulfill elephant research requirements. The study will also identify installation, verification, and maintenance requirements, as well as those for technical assistance if any.

Qualifications

- Comprehensive theoretical and technical knowledge of all systems components.
- Considerable practical experience in establishing and managing automatic radio-tracking programmes addressing free-ranging animals.

Length and timing of consultancy

One month; at discretion of Director, DWLC.

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ANNEX IV

DEVELOPMENT PLAN FOR DWLC AND PROTECTED AREAS IN THE AMP AREA

(Numerical annotations 1-14 provide cross-reference to Annex V)

1. NATIONAL HEADQUARTERS AND TRAINING CENTRE
(at Sri Jayawardenapura)

Personnel Categories and Numbers

- Park Planner (1)
- Park Engineer (1)
- Training Officer (1)
- Legal Officer (1)
- Education Officer (1)
- Drivers (6)
- Cinema Operator-cum-Driver (1)
- Clerk/Typist (4)

Vehicles

- Aircraft (1)
- Jeeps (6)

Buildings & Structures

- National Headquarters and Training Centre Building (1)

Equipment

- Officer's tent (+ extra poles) (USA) (1)
- Camping accessories[1] (1)
- Tarpaulin (24 x 24) (1)
- Pressure lantern (1)
- Hurricane Lamps (2)
- Telemetry Receiving Equipment[5] (1)
- Training Equipment[10] (1)
- Drawing Office Equipment[8] (1)
- Refrigerator (1)
- Pedestal Fans (7)
- Typewriters (4)
- Steel Cupboards (6)

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- Filing cabinets (6)
- Maps/Photos[9] (1)
- Photocopy machine (1)
- Office tables (24)
- Office Chairs (48)

2. REGIONAL HEADQUARTERS (at Welikande)

Personnel Categories and Numbers

- Assistant Director (1)
- Rural Sociologist/Economist (1)
- Drivers (4)
- Clerk/Typist (2)
- Storeman (1)
- Central Workshop Foreman (1)
- Carpenters (3)
- Mechanics/Welders (3)
- Bricklayers/Masons (3)
- Painter/Spray-painter (2)
- Handyman/Labourer (4)
- Nightwatchman (1)

Vehicles

- Bus (1)
- Pickup Truck (1)
- Jeep (2)

Buildings and Structures

- Central Workshop and Common Garage (1)
- Accommodation (Grade 1) (2)
- Accommodation (Grade IV) (1)
- Senior Staff Office (2)
- Common Quarters (23)

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Equipment

- Manpack Radio (1)
- Nightvision scope (1)
- Torch (1)
- Uniform sets[13] (17)
- Refrigerator (1)
- Pedestal fans (2)
- Typewriters (2)
- Steel Cupboards (2)
- Filing Cabinets (2)
- Photocopy machine (1)
- Office tables (4)
- Office chairs (8)
- Central Workshop Tools and Equipment[3] (1)

3. RESEARCH (at Welikande)

Personnel categories and numbers

- Ecologist (1)
- Driver (1)
- Clerk/Typist (1)
- Storeman (1)

Vehicles

- Jeep (1)
- Inflatable dinghy (1)
- Outboard Motor (25 hp) (1)

Buildings and Structures

- Office/Laboratory (1)
- Accommodation (Grade I) (1)
- Common Quarters (3)

Equipment*

- Walkie Talkies (4)
- Officer's tent (+ extra poles) (USA) (1)

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- Camping accessories[1] (1)
- Tarpaulins (24 x 24) (1)
- Binoculars (4)
- Torches (4)
- Nightvision scope (1)
- Camera + Lenses (1)
- Pressure Lanterns (1)
- Hurricane Lamp (2)
- Pedometers (4)
- Compasses (4)
- Animal Transmitter collars (20)
- Telemetry Receiving Equipment[5] (4)
- Waterbottles (4)
- Uniform sets[13] (2)
- Refrigerator (1)
- Pedestal Fan (1)
- Typewriter (1)
- Steel cupboard (1)
- Filing cabinet (1)
- Office tables (3)
- Office chairs (6)
- Other research equipment[11]

* Includes provisions for Ecological Field Assistants in Somawathie, Maduru Oya, and Wasgomuwa.

4. EDUCATION (at Welikande)

Personnel categories and numbers

- Education Officer (1)
- Cinema Operator-cum-Driver (1)
- Clerk/Typist (1)
- Storeman (1)

Vehicles

- Mobile Education Unit Van (1)

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Building and Structures

- Accommodation (Grade I) (1)
- Senior Staff Office (1)
- Common Quarters (3)

Equipment

- Binoculars (1)
- Torch (1)
- Uniform sets[13] (2)
- Educational Equipment and Accessories[6] (1)
- Generator (2 kw) (1)
- Refrigerator (1)
- Pedestal Fan (1)
- Typewriter (1)
- Steel Cupboard (1)
- Filing Cabinet (1)
- Office tables (2)
- Office chairs (4)

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5. ELEPHANT CONSERVATION

Table 5.1 Personnel Categories and Numbers

	HQ Pinnewela	Sub-Unit Welikande	Total
Ranger(Grade 1)	1		1
Ranger(Grade 2)		1	1
Range Assistant	1	1	2
Guard	2	12	14
Driver	1	4	5
Total	5	18	23

Table 5.2 Vehicles

Pickup Truck		1	1
Jeep	1	2	3
Jeep trailers	1	1	2
4-wheel tractors with trailer		1	1
Trailer Bowser		1	1
Motorcycle[14]	1		1
Total	3	6	9

Table 5.3 Buildings

Range Headquarters	1		1
Accomodation(Grade I)	1		1
Accomodation(Grade II)	1		1
Accomodation(Grade IV)		1	1
Accomodation(Grade V)	1	1	2
Office/Laboratory	1		1
Senior Staff Office	1		1
Common Quarters	4	16	20
Total	10	18	28

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Table 5.4 Equipment

	H.Q. Pinnewela	Sub-Unit Welikande	Total
Manpack Radios	1	1	2
Walkie Talkies	2	6	8
Officer's tents(+ extra poles(USA)	1	1	2
Camping accessories[1]	1	1	2
Tarpaulins (24 x 24)	1	2	3
Tarpaulins (16 x 16)	1	2	3
Groundsheets (7 x 3)	6	18	24
Haversacks	5	14	19
Waterbottles	6	18	24
Binoculars	1	6	7
Torches	1	6	7
Nightvision scope	1	1	2
Thunderflashes		400	400
Pressure Lanterns	1	6	7
Hurricane Lamps	2	12	14
Nel-Spot Marking Equipment	1		1
Compasses	1	2	3
Immobilization Equipment[2]	1		1
Telemetry receiving Equipment[5]	1		1
Animal Transmitter Collars	10		10
Quick-Tower Scaffolding	1		1
Uniform Sets[13]	4	18	22
Generators (2 kw)	1	1	2
Refrigerators	1		1
Typewriters	2	1	3
Steel Cupboards	1	1	2
Filing Cabinets	1	1	2
Office Table	3		3
Office Chairs	6		6
Tools for Guards[7]		1	1
Total	64	519	583

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6. SOMAWATHIE COMPLEX OF RESERVES

Table 6.1 Personnel Categories and Numbers

	PHASE I						PHASE II				
	HQ Welikande	Kantalai	Seruwila	Polonnaruwa	Sungawila	Tirikonamadu	Kandakadu	Werugal	Allai		TOTAL
Ranger (Grade 1)	1	1									2
Ranger (Grade 2)				1		1					2
Ranger (Grade 3)	1	1	1	1	1	1					6
Range Assistant		1	1	1	1	1	1	1	1		8
Guard		4	4	4	4	4	4	4	4		32
Ecological Field Assistant	1										1
Driver/Tractor Operator	4	2	1	1	1	1					10
Clerk/Typist	1	1									2
Radioman-Guard	1										1
Storeman	1										1
Technical Assistant (Maintenance)	1										1
Handyman/Laborer	1										1
Nightwatchman	2										2
Bungalow Keepers	2										2
TOTAL											71

Table 6.2 Vehicles

Jeep	1	1	1		1	1					5
Motorcycle(&accessories)[14]	2			1					1		4
4 wheel tractors with trailer	3										3
2 wheel tractors with trailer	6										6
Trailer Bowser	1										1
TOTAL	13	1	1	1	1	1			1		19

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Table 6.3 Buildings and Structures

	HQ Welikande	Kantalai	Seruwila	Polonnaruwa	Sungawila	Tirikonamadu	Kandakadu	Werugal	Allai		Total
Circuit Bungalow[12]	1										1
Park Headquarters	1										1
Range Headquarters		1		1		1					3
Accommodation (Grade II)	1	1									2
Accommodation (Grade III)	2										2
Entrance Gate					1	1					2
Accommodation (Grade IV)	1	1	1	2	1	2					8
Accommodation (Grade V)		1	1	1	1	1	1	1	1		8
Common Quarters	10	7	5	5	5	5	4	4	4		49

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Table 6.4 Equipment

	HG Welikande	Kantalai	Seruwila	Polonnaruwa	Sungawila	Tirikonamadu	Kandakadu	Werugal	Allai		TOTAL
SSB Transceiver (& antennae)	1	1	1	1		1	1	1			7
Solar Panel (30 watt)	1	1									2
Solar Panel (10 watt)			1	1		1	1	1			5
Walkie Talkie	2	2	2	2	2	2	2	2			16
Officer's Tents (& extra poles) (USA)	1	1									2
Camping accessories	1	1									2
Tarpaulins (24' x 24')	1	1	1	1	1	1	1	1			8
Tarpaulins (16 X 16)	1	1	1	1	1	1	1	1			8
Groundsheets (7 X 3)	1	6	6	7	6	7	5	5	5		48
Haversacks	1	6	6	7	6	7	5	5	5		48
Waterbottles	2	7	6	7	6	7	5	5	5		50
Binoculars	1	1	1	1	1	1	1	1			8
Torches	1	1	1	1	1	1	1	1			8
Pressure Lanterns	1	1	1	1	1	1	1	1			8
HurricaneLamps	2	2	2	2	2	2	2	2			16
Uniform sets[13]	7	9	7	8	7	8	5	5	5		61
Water Pumps (2 ins)		1	1	1	1	1	1	1			7
Generators (5 kw)	1										1
Generators (2 kw)	1										1
Refrigerators	1										1
Pedestal fans	1										1
Typewriters	2	2									4
Steel cupboards	2	2									4
Filing cabinets	2	2									4
Iron safes	1										1
Office tables	4	4									8
Office chairs	8	8									16
Tools for Maintenance Gangs/ Guards[7]	1										1

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7. MADURU OYA NATIONAL PARK

Table 7.1 Personnel Categories and Numbers

	HQ Kadupahara Ella	Hannanegala	Keragoda/ Kandeganwila	Dambana	Omuna	Pimburuttewa	Girandurukotte	TOTAL
Ranger (Grade 1)	1							1
Ranger (Grade 2)	1						1	2
Ranger (Grade 3)	1			1	1	1		4
Range Assistant			1			1	1	3
Guard	8	2	4	2	2	4	4	26
Ecological Field Assistant	1							1
Driver/Tractor Operator	5			1	1	1	1	9
Clerk/Typist	1							1
Radioman-Guard	1							1
Storeman	1							1
Technical Assistant (Maintenance)	1							1
Handyman/Laborer	1							1
Nightwatchman	2							2
Bungalow Keeper	2							2
	26	2	5	4	4	7	7	55

Table 7.2. Vehicles

Jeep	3			1	1		1	6
Motorcycle (& accessories)[14]							1	1
4 wheel Tractor with trailer	2							2
2 wheel Tractor with trailer	2							2
Fibreglass boat (17 ft)	4							4
Outboard motor (25 hp)	4							4
Outboard motor (9 hp)	4							4
Trailer Bowser	1							1
	20	0	0	1	1	0	2	24

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Table 7.3. Buildings and Structures

	HQ Kadupahara Ella	Hannanegala	Keragoda/ Kandeganwila	Dambana	Omuna	Pimburuttewa	Girandurukotte		TOTAL
Workshop & Common Garage	1								1
Circuit Bungalow[12]	1								1
Park Headquarters	1								1
Range Headquarters				1	1	1	1		4
Accommodation (Grade II)	1								1
Accommodation (Grade III)	2								2
Entrance Gate						1			1
Accommodation (Grade IV)	2			1	1	1	1		6
Accommodation(Grade V)			1			1	1		3
Road Barrier/Guard Room				1	1				2
Common Quarters	19	2	4	3	3	5	5		41

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Table 7.4 Equipment

	HQ Kadupahara Ella	Hannanegala	Keragoda/ Kandeganwila	Dambana	Omuna	Pimburuttewa	Girandurukotte		TOTAL
SSB Transceiver (& antennae)	1	1	1			1	1		5
Solar Panel (30 watt)	1								1
Solar Panel (10 watt)		1	1			1	1		4
Walkie Talkie	2	2	2	2	2	2	2		14
Officer's Tents (& extra poles)(USA)	1								1
Camping accessories	1								1
Tarpaulins (24 X 24)	1	1	1	1	1	1	1		7
Tarpaulins (16 X 16)	1	1	1	1	1	1	1		7
Groundsheets (7 X 3)	15	7	5	8	8	6	6		55
Haversacks	15	7	5	8	8	6	6		55
Waterbottles	16	7	5	8	8	6	6		56
Binoculars	1	1	1	1	1	1	1		7
Torches	1	1	1	1	1	1	1		7
Pressure Lanterns	1	1	1	1	1	1	1		7
Hurricane Lamps	2	2	2	2	2	2	2		14
Uniform sets[13]	17	2	5	4	4	7	7		46
Water pumps (2 ins)		1	1	1	1	1	1		6
Generators (5 kw)	1								1
Generators (2 kw)	1								1
Refrigerators	1								1
Pedestal fans	1								1
Typewriters	2								2
Steel cupboards	2								2
Filing cabinets	2								2
Iron safes	1								1
Office tables	4								4
Office chairs	8								8
Workshop Tools and quipment[3]	1								1
Tools for Maintenance Gangs/Guards[7]	1								1

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8. WASGOMUWA NATIONAL PARK

Table 8.1 Personnel Categories and Numbers

	HQ Hettipola	Medaulpotha/ Mukkarugala	Kathurupitiya	Attaragollewa	Anganedilla	Kotawella	Total
Ranger (Grade 1)	1						1
Ranger (Grade 2)					1		1
Ranger (Grade 3)	1			1		1	3
Range Assistant		1	1	1	1	1	5
Guard	4	4	4	4	4	4	24
Ecological Field Assistant	1						1
Driver/Tractor Operator	4			1	1	1	7
Clerk/Typist	1						1
Radioman-Guard	1						1
Storeman	1						1
Technical Assistant(Maintenance)	1						1
Handyman/Laborer	1						1
Nightwatchman	2						2
Bungalow Keeper	2						2
Total	20	5	5	7	7	7	51

Table 8.2 Vehicles

Jeep	2			1	1	1	5
Motorcycle(+ accessories)[14]	1				1		2
4-wheel tractor,with trailer	2						2
2-wheel tractor,with trailer		1					1
Trailer Bowser	1						1
Total	6	1		1	2	1	11

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Table 8.3 Buildings and Structures

	HQ Hettipola	Medaulpotha/ Mukkarugala	Kathurupitiya	Attaragollewa	Angamedilla	Korawella		Total
Workshop & Common Garage	1							1
Circuit Bungalow[12]	1							1
Park Headquarters	1							1
Range Headquarters					1	1		2
Accomodation(Grade II)	1							1
Accomodation(Grade III)	2							2
Entrance Gate			1		1			2
Accomodation(Grade IV)	1			1	1	1		4
Accomodation(Grade V)		1	1	1	1	1		5
Common Quarters	14	4	4	5	5	5		37
Bridge/Causeway				1				1
Total	21	5	6	8	9	8		57

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Table 8.4 Equipment

	HQ Hettipola	Medaulpotha/ Mukkarugala	Kathurupitiya	Attaragollewa	Angamedilla	Kotawella	Totals
SSB Transceiver(+ antennae)	1	1	1	1	1	1	6
Solar Panel (30 watt)	1						1
Solar Panel (10 watt)		1	1	1	1	1	5
Walkie Talkie	2	2	2	2	2	2	12
Officer's tents(+ extra poles) (USA)	1						1
Camping accessories[1]	1						1
Tarpaulins (24 x 24)	1	1	1	1	1	1	6
Tarpaulins (16 x 16)	1	1	1	1	1	1	6
Groundsheets(7 x 3)	5	5	5	6	6	6	33
Haversacks	5	5	5	6	6	6	33
Waterbottles	6	5	5	6	6	6	34
Binoculars	1	1	1	1	1	1	6
Torches	1	1	1	1	1	1	6
Pressure Lanterns	1	1	1	1	1	1	6
Hurricane Lamps	2	2	2	2	2	2	12
Uniform Sets[13]	11	5	5	7	7	7	42
Waterpump (2ins)		1	1	1	1	1	5
Generator (5 kw)	1						1
Generator (2 kw)	1						1
Refrigerators	1						1
Pedestal fans	1						1
Typewriters	2						2
Steel Cupboards	2						2
Filing Cabinets	2						2
Iron Safes	1						1
Office Tables	4						4
Office Chairs	8						8
Workshop Tools & Equipment[3]	1						1
Tools for Maintenance Gangs/Guards[7]	1						1
Totals	65	32	32	37	37	37	240

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9. KNUCKLES RANGE NATURE RESERVE (PHASE I)

9.1 Personnel categories and numbers

	Mimure	Madulkele/ Kabaragala	Illukumbura	Total
Ranger (Grade 2)	1			1
Range Assistant	1	1	1	3
Guard	4	4	4	12
Driver	1			1

9.2 Vehicles

Jeep	1			1

9.3 Buildings and Structures

Range Headquarters	1			1
Accommodation (Grade IV)	1			1
Accommodation (Grade V)	1	1	1	3
Common Quarters	5	4	4	13

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9.4 Equipment

	Mimure	Madulkele/ Kabaragala	Illukumbara	Total
SSB Transceiver (& antenna)	1	1	1	3
Solar Panel (30 watt)	1			1
Solar Panel (10 watt)		1	1	2
Walkie Talkie	2	2	2	6
Tarpaulins (24 X 24)	1	1	1	3
Tarpaulins (16 x 16)	1	1	1	3
Groundsheets (7 x 3)	6	5	5	16
Haversacks	6	5	5	16
Waterbottles	6	5	5	16
Binoculars	1	1	1	3
Torches	1	1	1	3
Pressure lanterns	1	1	1	3
Hurricane lamps	2	2	2	6
Uniform sets[13]	7	5	5	17
Water pumps	1	1	1	3
Typewriter	1			1
Steel cabinet	1			1
Filing cabinet	1			1
Office tables	2			2
Office chairs	4			4
Tools for Maintenance Gangs/Guards[7]	1			1

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10. ELAHERA-MINNERIYA CORRIDOR

(a) Elahera Range (Phase II)

Personnel categories and numbers

- Range Assistant (1)
- Guard (4)

Vehicles

- None

Buildings and Structures

- Accommodation (Grade V) (1)
- Common Quarters (4)

Equipment

- SSB Transceiver (& antenna) (1)
- Solar Panel (10 watt) (1)
- Walkie Talkie (2)
- Tarpaulins (24 x 24) (1)
- Tarpaulins (16 x 16) (1)
- Groundsheets (7 x 3) (5)
- Haversacks (5)
- Binoculars (1)
- Pressure lantern (1)
- Hurricane lamp (2)
- Torch (1)
- Waterbottles (5)
- Uniform sets[13] (5)
- Waterpump (2 ins) (1)

Notes on development of areas of major importance

SOMAWATHIE COMPLEX OF RESERVES (Number 6 above)

Phase 1:

Welikande - Upgrading existing facilities.

Kantalai - Will cover Hurullu. One jeep already provided by USAID.

Seruwila - To be supervised from Kantalai.

Polonnaruwa - Upgrading existing facilities. One jeep already provided by USAID.

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Sungawila - Upgrading existing facilities. To be supervised from Polonnaruwa. One radio already provided by USAID.

Tirikonamadu .

Phase II:

Kandakadu - To be supervised from Tirikonamadu.

Werugal - To be supervised from Tirikonamadu.

Allai - To be linked to Seruwila.

MADURU OYA NATIONAL PARK (Number 7 above).

Phase I

Kadupahara Ella - Upgrading existing facilities. Quarters for one Range Assistant and four Guards already provided by USAID.

Hannanegala - Upgrading existing facilities. To be supervised from Kadupahara Ella. Quarters for one Range Assistant and four guards already provided by USAID.

Keragoda/Kandeganwila - To be supervised from Kadupahara Ella.

Dambana - Upgrading existing facilities. One radio and quarters for one Range Assistant and four guards already provided by USAID.

Omuna - Upgrading existing facilities. One radio and quarters for one Range Assistant and four guards already provided by USAID.

Phase II

Pimburattewa - Upgrading existing facilities. One jeep already provided by USAID.

Girandurukotte.

WASGOMUWA NATIONAL PARK (Number 8 above).

Phase I

Hettipola.

Medaulpotha/Mukkarugala - To be supervised from Hettipola

Kathurupitiya - Upgrading existing facilities. To be supervised from Hettipola.

Attaragollewa - Will cover Elahera - Minneriya Corridor also.

Angamedilla - Upgrading existing facilities

Kotawella.

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ANNEX V
SETS OF EQUIPMENT

1. Camping accessories

- Camp table, folding (1)
- Camp chairs, folding canvas (6)
- Camp stools, folding canvas (2)
- Camp beds, folding canvas (4)
- Camp bedding: light quilts (4), pillows (4)
- Pots, pans, sovens, kettle, cutlery etc. (for 6)
- Plastic jerry-cans and food containers.

2. Immobilisation equipment

- Palmer "Capchur-gun" with telescopic sight (1)
- Darts (large; elephant, buffalo)
- Darts (medium; deer, bear, leopard)
- Plunger charges
- Plungers
- Silicone grease
- 0.22 blank shells (high; medium; low charges)
- Immobilon and Revivon Kits
- Penicillen/antibiotics; water for injection
- Syringes
- Immobilon antidote (humans)
- Specimen jars; glass slides
- Rectal thermometer (veterinary)
- Plastic bucket
- Carrying case

3. Workshop Tools and Equipment

a. Vehicle service and maintenance

- Inspection pit
- Hoist
- Compressor
- Water pump
- Welding tools and accessories
- Spray painting tools and accessories

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- Hydraulic and mechanical jacks
- Work benches with vices
- Electric drills and accessories
- Complete tool sets: spanners, pliers, hack-saws, hammers, screw drivers, guages etc. (all sizes and types).
- Volt-amp meters
- Battery chargers
- Puncture repair equipment
- Fuel storage tanks with hand operated pumps
- Grease guns

b. Carpentry

- Work benches with vices
- Complete tool sets: augers, chisels, drills, files, saws, hack-saws, hammers, screw drivers, pliers, planes, rasps, etc.
- Spirit levels
- Measuring tapes (50 ft)
- Rulers
- Sandpaperer

c. Masonry

- Complete tool sets: bricklayers trowels, hammers, paint brushes, etc.
- Spirit levels
- Plumb lines
- Measuring tapes (50 ft)
- Rulers

NB. The central workshop and common garage may require more sophisticated equipment also e.g. Lathe, special testing apparatus, reboring and valve servicing equipment etc. etc. It will anyway possess relatively more of all types of tools and equipment than the other two workshops.

4. Automatic Tracking Equipment

- Transmitter collars
- Master receiving station
- Slave receiving stations
- Transmitters + collars

5. Telemetry receiving equipment

- Multi-channel receiving sets (1)
- Antennae (2)
- Leads and jackplugs
- Earphones (2)

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6. Educational Equipment and Accessories

- Generator (5 kw)
- Public address system
- Film projector
- Slide projector (Pandamatic)
- Film screen
- Films and slide programmes

7. Tools for Maintenance Gangs/Guards

- Axes, catties, pruning knives, sickles, scythes and shears
- Adzes, alavangoes, mammoties, pick axes
- Shovels, trowels
- Buckets
- Rakes
- Wheelbarrows
- Hoses
- Saws

8. Drawing Office Equipment

- Stereoscope (for air photo interpretation)
- Adjustable drawing tables with stand
- Traverse theodolite with accessories including surveying umberella
- Surveyor's engineering level
- Plan chest, steel
- Steel tape
- Mariner's compass
- Postable drawing table
- Pen stencils
- Bomastes compass
- Anglepoise lamps
- Frenel and yacht curves
- Rulers
- Set squares
- "Rotring" pen sets
- Slide rule
- Rotometer
- Rolling ruler (brass)
- Pantograph machine

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- Planimeter
- Beam compass
- Print trimming machine
- Large tables (12 x 6 ft)

9. Maps and Photos

- Air navigation charts of Sri Lanka (USA)
- Survey Department maps
- Survey Department aerial photos
- Satellite photos (USA/Europe)

10. Training Equipment

- Film projector
- Slide projector
- Overhead projector
- Blackboard/Magic-marker board
- Film screen
- Epidiascope
- Microphone
- Lecture stand and light
- Perspex squares
- Transparent overlays
- Chalk/pens

11. Other Research Equipment

- Spectro-radiometer
- Storage rain guages (13 x 100 cm)
- Concrete and fencing materials for marking permanent sample plots and setting up exclosure experiments.

12. Circuit Bungalow Contents

- Generator and/or water pump
- Furniture: tables, chairs, wardrobes, dressing tables, beds, meatsafes, stools, racks, filter stands, chests of drawers etc. etc.
- Mattresses
- Pillows
- Linen: towels, pillow cases, mosquito nets, bedsheets, cloths, napkins
- Water filters
- Refrigerators
- Cookers

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- Fire extinguishers
- Clocks
- Lamps
- Mirrors
- Pots, pans, sovens, bowls, buckets, kettles etc.
- Crockery; dining and kitchen etc.
- Glasses etc.
- Cutlery; dining and kitchen etc.
- Ash trays; trays
- Irons
- Lavatory brushes; paper roll holders
- Dust bins, door mats, table mats
- Coconut scrapers, hopper accessories, openers, curry stone, etc. etc.

13. Staff Uniforms

- Trousers (3)
- Long sleeve shirts/coats (3)
- Shoes (1)
- Socks (1)
- Hat (1)

14. Motorcycle Accessories

- Crash helmets (2)
- Crash bars (2)
- Saddle bags (2)