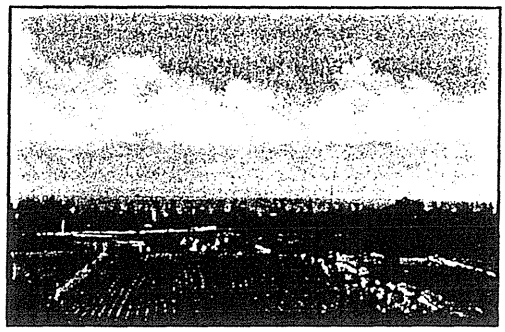
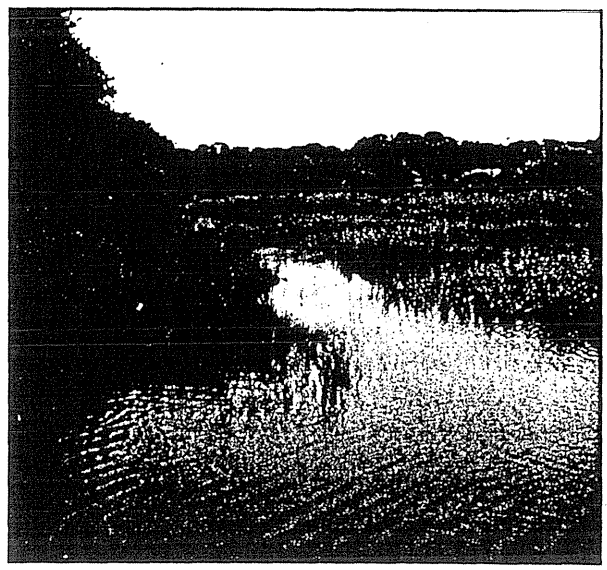


Working Draft
Revision 2

Barbados Tourism Development Programme Subprogramme C

Part II:
Graeme Hall Swamp's Future



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7. Objectives For Graeme Hall Swamp

7.1 Background

Graeme Hall Swamp is a unique natural characteristic of the landscape of Barbados. The island became an agricultural and urban environment long ago. Its forests were essentially cleared by the mid-1600's; with the only remaining parcel maintained at Turner Hall Woods. Coastal wetlands, once widespread, have been gradually converted to agriculture, commercial and residential use. Graeme Hall Swamp is the last major example of these extensive coastal wetlands.

Graeme Hall Swamp has been a working plantation since shortly after European settlement, and most of it has been modified for one purpose or another during this history. The causeway constructed in 1947 essentially divided the swamp into two functional units. The East Unit has been modified for various agricultural ventures, and the West Unit was dredged for an aborted development project in 1972. This dredging created the lake that exists today as one of the most distinctive features in the swamp. Artificial ponds were also created throughout the swamp for the shooting club that operated throughout much of this century.

The swamp today is, therefore, far from the popular perception of a "natural" area. Its natural hydrological characteristics have been significantly altered, as has its pre-settlement vegetation. Because Barbados is so highly developed and urbanised, however, Graeme Hall Swamp remains a highly significant national resource because it is one of the few remaining natural areas in the country. This significance is even more noteworthy because the location of the swamp on the South Coast, one of the most highly developed tourism areas on the island.

Graeme Hall Swamp has also been the subject of a range of preservation/development approaches over the last two decades. Recent ownership changes and developments in the West Unit have precipitated the need for immediate government actions to evaluate realistic long-term options for Graeme Hall Swamp. Development of the Sewage Treatment Plant has precipitated the need for a similar assessment of the future of the East Unit. It is, therefore, imperative that comprehensive plans are developed and implemented to ensure the highest and best use for the last remaining coastal wetland area in the country.

7.2 Definitions

The Graeme Hall Swamp Management Unit was defined in Part I, Section 2 of this report (Figure 2.1). The following definitions are used to facilitate an evaluation of the options for future development and management of Graeme Hall Swamp:

- **Graeme Hall Swamp Management Unit.** This encompasses the entirety of the swamp area including both the East and West Units. The phrase "Graeme Hall Swamp Management Unit" was adopted in Section 2 of this report to define the essential biophysical extent of the swamp.

- **East Unit.** The East Unit comprises the government-owned lands in the eastern area of Graeme Hall Swamp. It is bounded generally by the causeway and private properties on its western edge and the sewage treatment plant and residential area on the southeast borders.
- **West Unit.** The West Unit comprises the majority of the western area of the swamp, all in private ownership, bounded by the causeway on its eastern border and residential and mixed developments on its northern, western and southern borders.

7.3 Objectives to Guide Future Use and Management

Three objectives were developed to guide the evaluation of future use and management considerations for Graeme Hall Swamp. These objectives are based on the Terms of Reference prepared for this project.

Objective I: Preserve and enhance the essential ecological, recreational, educational and scientific values of Graeme Hall Swamp within a nature reserve.

Graeme Hall Swamp remains a pre-eminently significant national resource in Barbados because it is the last significant coastal wetland area, and one of the few remaining areas of natural history in the country. The extensive ecological, recreational, educational and scientific values of Graeme Hall Swamp have been documented in Part I of this report. These values transcend the potential monetary value of the swamp for any form of traditional urban development.

Because of its national significance therefore, Graeme Hall Swamp forms an important part of the natural and cultural heritage of the Nation. It has provided enjoyment for the country's residents for many years and can serve as a source of nature appreciation and education for the future. Preservation and enhancement of these characteristics will be accomplished within a nature reserve created within the East Unit of Graeme Hall Swamp.

Objective 2: Preserve and enhance the biophysical integrity of Graeme Hall Swamp.

Graeme Hall Swamp is now effectively separated into West and East Units, from both an ownership and a management perspective. The swamp is a very small area in which to sustain a complex natural system, particularly when it is located within one of the most urbanised portions of the island. The plant and animal populations within the swamp are relatively small and, therefore, particularly vulnerable to even minor adverse impacts. For some species, the swamp is one of the few locations on the island with suitable habitat.

Within the small physical area of the swamp, however, there is significant interdependence between some biophysical parameters. For example, freshwater and saltwater flows throughout the interconnected waterways of the swamp are critical to maintain the mangrove and freshwater sedge environments. The sustainability of the nature reserve in the East Unit is, therefore, dependent upon the overall integrity of the Graeme Hall Swamp Management Unit. This, in turn, requires that the entire swamp be planned and coordinated as a cohesive unit from a biophysical perspective.

With integrated planning and management of the East and West Units, resource protection, rehabilitation and enhancement, human interaction and security can all be coordinated to ensure that the swamp continues to function as one of the country's premiere nature sites.

Objective 3: Ensure the economic viability of a Graeme Hall Swamp nature reserve.

Significant financial and management resources will be required to develop and implement a nature reserve in the East Unit of Graeme Hall Swamp. These resources will be required to develop a management plan and implement the physical works necessary to maintain and enhance appropriate biophysical conditions and provide maintenance and security.

Preserving the essential natural characteristics of Graeme Hall Swamp can be accomplished in the absence of any human use of the area. Some species in fact, may require protection from human interaction during sensitive portions of their life cycles. This can be accomplished with an appropriate management regime. However, protection of the essential natural characteristics of the swamp does not need to preclude human use.

The existing character of Graeme Hall Swamp is, in fact, a priceless reminder of the natural and historic heritage of the island that will benefit from appropriate interaction with residents and visitors to the island. Planning for the Graeme Hall Swamp nature reserve therefore, should include appropriate access for residents of Barbados. Public access will require additional resources for interpretive, recreational, educational and other visitor programs. Public visitation will require additional facilities, maintenance and security.

These costs inevitably raise the question of economic viability of the nature reserve for capital expenditures and operations and maintenance. Introducing high quality and compatible nature tourism into the East Unit of Graeme Hall Swamp offers the potential for adequate revenues to ensure economically viability of the nature reserve. High quality, nature tourism, sensitively designed and implemented, can in fact complement the objectives to preserve and enhance the values of the swamp and its biophysical integrity.

7.4 Vision Statement for Graeme Hall Swamp

Based on the above objectives, therefore, we propose the following Vision Statement for Graeme Hall Swamp:

> *"Graeme Hall Swamp will be managed and maintained as a nature reserve to provide a high quality natural experience for ecologically sustainable and safe nature tourism, environmental education and research suitable for residents and visitors of all ages".*

8. Options for Future Use and Management

The objectives and proposed Vision Statement provide the framework for considering the future of Graeme Hall Swamp. This Vision Statement requires an integrated planning and management approach for the East and West Units of Graeme Hall Swamp. Because the two units are currently under separate ownership, several factors must be considered in determining how a feasible and economically viable nature reserve can be developed and managed in Graeme Hall Swamp. Expressed in the form of options, these include:

Land Use Options

- ❑ East Unit nature reserve — West Unit nature tourism and bird sanctuary
- ❑ East Unit nature reserve and independent nature tourism—West Unit nature tourism and bird sanctuary
- ❑ East Unit nature tourism integrated with West Unit nature tourism and bird sanctuary

Ownership and Control Options

- ❑ Public Sector Ownership & Control
- ❑ Private West/Private Lease East
- ❑ Private Sector Ownership & Control
- ❑ Maintain Public East/Private West Ownership

Management Options

- ❑ NGO
- ❑ Dedicated, Semi-autonomous Government Authority
- ❑ Multiple Government Line Agencies
- ❑ Single Government Line Agency
- ❑ Private Sector Contract.

Land use options are evaluated based on compatibility with the objectives and The Vision Statement for Graeme Hall Swamp. Ownership and control options are evaluated primarily based on compatibility with the preferred land use option. Evaluation of management options flows from the decision on Ownership and Control. It should be recognised however; that there are substantial overlapping factors across these three types of options.

8.1 Land Use Options

The West Unit and the East Unit of the swamp have developed significantly different land use characteristics over the years because of human interventions. These differences require examination of the overall land use of the swamp from the perspective of its respective components.

The West Unit of Graeme Hall Swamp has historically been subjected to the most human intervention. The lake, which is the most prominent feature of the West Unit, was created in 1972 for

an aborted residential development. The fill from the lake was used to increase the elevation of the land area South and West of the lake for the development. The egret population, nesting in the mangrove surrounding the lake, arrived after the lake was created. Graeme Hall Swamp Bird Sanctuary, Inc. has recently proposed an ambitious development plan for a nature attraction and bird sanctuary in the West Unit. The earthworks, dredging of new ponds and the alterations of water flow patterns constructed in April 1997 have already significantly changed the vegetation and hydrological patterns in the West Unit.

These changes, combined with the previous developments, limit the suitability of the West Unit as a nature reserve, and we do not recommend considering any additional options for the West Unit. Current plans for the West Unit as a nature tourism attraction are broadly consistent with the proposed vision for Graeme Hall Swamp as a nature tourism attraction espousing ecological, recreational, educational and scientific values.

The East Unit of the swamp remains relatively undisturbed, and either exhibits, or could exhibit, the essential characteristics of a coastal wetland nature reserve. In this regard, we recommend consideration of the following options for the East Unit:

- East Unit nature reserve only
- East Unit nature reserve with independent nature tourism
- East Unit nature reserve with nature tourism integrated with West Unit nature tourism.

The proposed nature reserve in the East Unit will require significant financial and management resources to prepare a management plan, implement the physical works necessary to maintain and enhance appropriate biophysical conditions, and to provide maintenance and security. Public access will require additional funding and management for facilities, maintenance and security.

This nature reserve, with limited resident and tourist visitation, would not generate significant revenues for operations and maintenance. Capital investment and operations and maintenance costs would necessarily be financed from Government budgets and outside funding sources. Although the nature reserve would meet objectives to preserve the essential values and integrity of the swamp, it will not be economically viable without a stable revenue source.

Creation of a nature reserve in the East Unit would enhance the value of a nature tourism attraction in the West Unit. It would essentially double the perceived size and quality of the natural area, and would provide substantial protection from unsuitable encroachment on the private nature attraction. These significant benefits would accrue at no additional cost to the private attraction.

The addition of a nature tourism attraction to the nature reserve in the East Unit would generate increased revenues. Although Graeme Hall Swamp is potentially a significant nature attraction, it is neither marketable nor sustainable without substantial rehabilitation and facility development. The tourism development would require resources for interpretive, recreational, and educational programs; additional facilities; maintenance and security.

An independently operated East Unit nature attraction would duplicate some facilities proposed for the West Unit. This proximity to another similar nature tourism attraction would make it difficult to define a distinct marketing identity and competitive product for an East Unit nature attraction, and

would constrain future revenues. These factors limit the probability of an economically viable independent nature attraction within the East Unit.

A quality, nature tourism attraction within Graeme Hall Swamp that incorporates the best nature features of both the West and East Units, however, could accomplish all project objectives identified for the swamp. Graeme Hall Swamp has the potential to be the premier nature tourism attraction on the island. It provides an excellent opportunity to interpret an important aspect of Barbados' natural environment and history, it will diversify the Barbados tourism product and it is well situated in terms of visitor markets. The nature tourism site will also strengthen ongoing and planned tourism investments on the South Coast, including:

- the Gems of Barbados project
- Carlisle Bay redevelopment
- Saint Lawrence Gap upgrading
- Hilton Hotel upgrade and expansion
- Garrison World Heritage designation.

A successful Graeme Hall Swamp nature attraction must, however, be planned and operated as an integrated nature site from both a preservation and tourism market perspective. An integrated tourism attraction will strengthen the nature tourism potential of the swamp, and provide financial incentives for both public and private sector participants to enhance facilities and experiences for both visitors and residents. Finally, a coordinated nature tourism attraction that is intimately dependent upon the natural resources of the swamp will actually reinforce the importance of preserving essential biophysical, recreational, educational and scientific values.

> *We recommend, therefore that the third land use option, Integrated East & West Unit nature tourism attraction and nature reserve, be adopted to meet the overall objectives for Graeme Hall Swamp.*

Ownership and Control Options

Graeme Hall Swamp now contains two ownership parcels. The Graeme Hall Bird Sanctuary, Inc. owns most of the property West of the existing causeway [West Unit], and the Government of Barbados owns the portion of the swamp East of the causeway [East Unit]. Graeme Hall Bird Sanctuary, Inc. has an application pending before Town & Country Planning for development of a nature attraction on the West Unit. The Government of Barbados has no development plans pending for the East Unit.

Preserving the swamp's essential biophysical characteristics and integrity requires an integrated approach to the preservation and tourism activities within the swamp. Four basic ownership and control options are available to integrate preservation and tourism activities in the swamp:

- Public Sector Ownership & Control
- Private Sector Ownership & Control
- Private West/Private Lease East
- Maintain Private West/Public East Ownership.

The most straightforward way to integrate control and management is for the entire Graeme Hall Swamp Management Unit to be brought under a single ownership. The control and management of Graeme Hall Swamp could be integrated by bringing the entire swamp under public ownership and assigning an appropriate regulatory and management authority. This would require Government purchase of the Graeme Hall Swamp Bird Sanctuary, Inc. property, a significant capital expenditure. Additional capital and operating expenditures will be required to preserve and maintain the biophysical integrity of both the East and West Units. Developing provisions for public access to both Units would also require significant additional capital and operating expenditures.

Graeme Hall Swamp Bird Sanctuary, Inc. purchase of the Government-owned portion of Graeme Hall Swamp would also integrate control and management of the entire Graeme Hall Swamp Management Unit. Previously recommended objectives for Graeme Hall Swamp emphasised the significance of Graeme Hall Swamp as part of the country's natural and cultural heritage. The significance of this heritage, and the public's perception of this heritage, obliges the Government of Barbados to ensure that the East Unit is retained under Government control. This precludes consideration of sale of the property.

A third option is to maintain government ownership and negotiate a long-term lease with Graeme Hall Bird Sanctuary, Inc. to operate the East Unit. This lease agreement could provide for integrated management of Graeme Hall Swamp. Such a lease would need to be long-term to provide Graeme Hall Bird Sanctuary, Inc. with the business confidence to make the investments necessary to accomplish the agreed long-term objectives for Graeme Hall Swamp. Moreover, it may be difficult to develop lease conditions that provide both owners with the operational flexibility necessary to meet the dual objectives of preservation and appropriate tourism use for the East Unit of Graeme Hall Swamp. This flexibility is required because tourism use requires constant monitoring of impacts and adjustment of visitor policies to mitigate negative impacts and ensure biophysical sustainability. Finally, and perhaps most importantly, a long-term lease of the East Unit may be perceived as removing the area from public access and control. In our view, this effectively precludes consideration of leasing the East Unit.

The final option, maintaining private ownership of the West Unit and public ownership of the East Unit, on the surface, may appear to be incompatible with the previously recommended land use option. However, maintaining existing ownership may be the most realistic and acceptable option, if an agreement for integrated tourism development and operation in the East Unit can be developed between the Government of Barbados and Graeme Hall Bird Sanctuary, Inc.

Such an agreement would enable the Government of Barbados to meet its objectives to protect the long-term public interest in preserving Graeme Hall Swamp. It would also provide the ecological, recreational, educational and scientific benefits of the swamp to the people of Barbados, while minimising Government's capital expenditure requirements to preserve and maintain the integrity of the swamp. Finally, it provides a mechanism for ongoing revenue generation that can be re-invested into swamp preservation, development and maintenance to ensure that the swamp is an economically viable nature reserve.

The proposed Tourism Development and Operating Agreement also would provide Graeme Hall Bird Sanctuary, Inc. with a mechanism to participate in the protection and tourism development of

the East Unit. The overall integrity of the swamp is equally significant to the successful operation of facilities planned by Graeme Hall Bird Sanctuary, Inc. in the West Unit. Actions taken in the East Unit, particularly related to the freshwater sources, could significantly affect hydrological and biological characteristics on the West Unit. Most importantly, a Tourism Agreement would significantly enhance the overall strength of the nature tourism product offered at Graeme Hall Swamp, and enhance Government initiatives to encourage tourism product diversification on the South Coast.

> *We recommend, therefore, that a Tourism Development and Operating Agreement be developed between Graeme Hall Bird Sanctuary, Inc. and the Government of Barbados. This Tourism Agreement should be specifically structured to provide the benefits of integrated biophysical and tourism management of Graeme Hall Swamp, while maintaining the respective ownership positions and long term objectives.*

8.2 East Unit Management Options

The Government has two distinct functional responsibilities in creating a nature reserve and operating a nature tourism attraction within the East Unit of Graeme Hall Swamp. First, Government must provide policy direction for the nature reserve and nature tourism attraction in the East Unit. Secondly, The Government must ensure that day-to-day management and operation of the East Unit meets its long-term policy objectives.

Government's policy and management participation must protect the long-term public interest and objectives in the swamp. At the same time, successful implementation of the dual objectives of preservation and nature tourism development requires a clear mandate, the authority to make decisions on behalf of the Government of Barbados, and a clear and decisive chain of command. Government representation for management of Graeme Hall Swamp must also include an understanding and appreciation of the ecological, recreational, educational and scientific values; and their preservation and incorporation into a successful nature tourism attraction.

There are a number of Government agencies with direct or indirect responsibility or interest in Graeme Hall Swamp. These include the Ministry of Health and Environment, The National Conservation Commission, the Ministry of Tourism, and Town and Country Planning. There is, however, no existing government authority with the experience and expertise to represent the diverse issues necessary to manage the nature reserve and nature tourism attraction within the East Unit of Graeme Hall Swamp.

The Government of Barbados currently has initiatives underway to evaluate the form and structure of a national system of protected areas and a National Park System. The East Unit of Graeme Hall Swamp, standing alone, is not a realistic biophysical unit for a National Park. The previous recommendation to manage nature tourism at Graeme Hall Swamp as an integrated attraction is premised on a dual mandate of preservation and nature tourism to develop an economically viable nature reserve in the East Unit. We do not anticipate that an agency or authority for protected areas and national parks will have the mandate or the expertise necessary to successfully implement the nature tourism component of Graeme Hall Swamp's objectives.

The operation of a nature reserve and nature tourism attraction in the East Unit of Graeme Hall Swamp will require a clear and decisive chain of command. Realistically therefore, multiple agency participation is not an acceptable option. We recommend, therefore, that:

> *A single Agency be vested with the responsibility and authority to represent the Government's interest in the East Unit of Graeme Hall Swamp, and that*
>
> *Management responsibility and authority for Graeme Hall Swamp be vested in the Ministry of Tourism.*

Finally, to ensure preservation and sustainability of the ecological, recreational, educational and scientific values of the East Unit and their incorporation into a successful nature tourism attraction, we recommend that:

> *The Advisory Committee on Nature Tourism, proposed in the Nature Tourism Section of the Subprogramme C recommendations, be designated to provide advisory services to the Ministry of Tourism with respect to Graeme Hall Swamp.*

This Advisory Committee has a designated role for the development of other nature tourism attractions, and contains the expertise to advise the Ministry of Tourism on biophysical considerations related to development and ongoing operations of the swamp.

Day-to-day management of the East Unit of Graeme Hall Swamp as a nature reserve and a nature tourism attraction requires a unique set of skills and expertise. Potential options to provide these services include:

- ❑ Government Line Agency
- ❑ Local NGO
- ❑ Private Sector Contract.

No existing Government agency in Barbados currently combines the necessary skills, expertise and resources necessary to provide day-to-day management of the East Unit. The Ministry of Tourism does not have strong operations management experience, and has no experience or expertise with the biophysical considerations of a nature reserve. The National Conservation Commission has some experience with resource and tourism issues, but does not have the breadth of institutional strengths necessary to manage the biophysical issues in Graeme Hall Swamp. Other government agencies currently involved with other aspects of Graeme Hall Swamp do not have operational mandates or experience.

Barbados has a successful history of NGO participation in resource protection and tourism. The National Trust is a prominent example. However, there are no NGO's in Barbados that currently contain the breadth of experience and expertise or the financial and staff resources to manage the Government's nature reserve and nature tourism attraction at Graeme Hall Swamp.

We recommend therefore, that the Ministry of Tourism, on behalf of the Government of Barbados develop a long-term operating contract with the private sector to manage the East Unit of Graeme Hall Swamp. Specifically, we recommend that:

> *The Ministry of Tourism contract with Graeme Hall Bird Sanctuary, Inc. to operate the East Unit of Graeme Hall Swamp as a nature reserve and nature tourism attraction under terms of the Tourism Development and Operating Agreement.*

This operating contract with Graeme Hall Bird Sanctuary, Inc. will integrate operational aspects of the Tourism Development and Operating Agreement. In addition, Graeme Hall Bird Sanctuary, Inc. will possess the requisite experience and resources available from their tourism operations in the West Unit, and this experience and resources will provide significant economies of scale for operations on the East Unit. Finally, Graeme Hall Bird Sanctuary, Inc. has an incentive to ensure successful management of the East Unit to enhance the overall attractiveness of the Graeme Hall Swamp nature tourism product.

8.3 Nature Reserve Capital Improvements Trust Fund

The East Unit nature reserve and tourism attraction will require initial capital investments for biophysical restorations and improvements. It will also require capital investments for basic visitor facilities, and interpretation and educational exhibits and facilities. As it matures, it will have additional ongoing need for capital investments and improvements.

These capital investments should be actively pursued from a number of sources, including private and corporate donations, foundations and international NGO's and funding sources. In addition, the operational budget should include provisions for setting aside a portion of facility revenues for future capital improvements.

A **Capital Improvements Trust Fund** should be established for the Graeme Hall Swamp nature reserve to serve as a central, identifiable, and ongoing mechanism for the acquisition and disbursement of monies for capital improvements and enhancements within the nature reserve. The Board of the Trust Fund should include Government Representation from the Ministry of Tourism and the Ministry of Environment, the National Trust, the local business community, and the public. The mandate for the Trust Fund should be to acquire and manage the financial resources necessary for the capital investments to:

- preserve and enhance essential ecological, recreational, educational and scientific values of the nature reserve
- preserve and enhance the biophysical integrity of the nature reserve
- enhance the educational and scientific value of the nature reserve.

The Trust Fund, upon request of the managing authority and following appropriate review and approval, should authorise expenditures for capital improvements at the East Unit nature reserve, consistent with the objectives and Vision Statement for Graeme Hall Swamp. Authorised

expenditures should also be compatible with the Tourism Development and Operating Agreement for Graeme Hall Swamp.

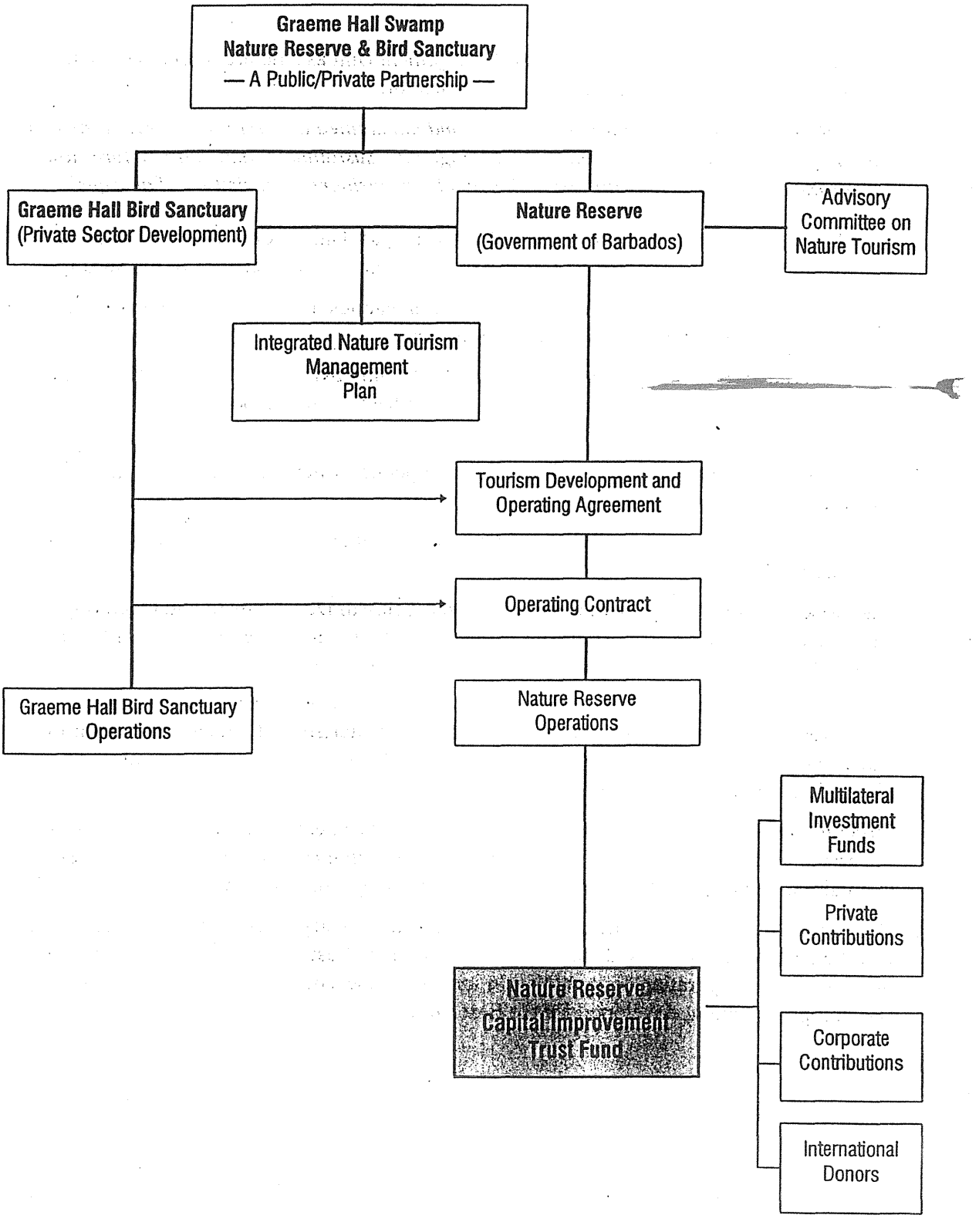
The Capital Improvements Trust Fund provides a focused structure for long-term funding stability for the Graeme Hall Swamp nature reserve. This Trust Fund also provides a recognisable focus for fund raising and donations to the nature reserve. Ultimately, the Trust Fund provides a mechanism to integrate activities at Graeme Hall Swamp in the event that private sector property in the swamp is converted to a long-term trust property.

8.4 Summary of Graeme Hall Swamp Recommendations

The overall recommendations for the structure and organisation of the nature reserve and nature attraction at Graeme Hall Swamp are summarised in Exhibit 8.1. This structure was developed to preserve the interests and future of the respective property owners at the swamp, while at the same time enhancing the quality and economic viability of the nature reserve. The primary components of the recommended structure are:

- Distinct and clear lines of responsibility for the private and public properties
- An integrated Tourism Management Plan for Graeme Hall Swamp to enhance overall attractiveness of the tourism attraction while maximising economies of scale
- A Tourism Development and Operating Agreement for the nature tourism attraction in the East Unit to implement the integrated Tourism Management Plan
- A private sector contract to manage operations in the East Unit.

Exhibit 8.1 Organizational Structure for a Public/Private Partnership Nature Tourism Attraction at Graeme Hall Swamp



Specific recommendations to accomplish this structure include:

1. Assign the East Unit of Graeme Hall Swamp protected status in perpetuity as a national nature reserve.
2. Develop the entire Graeme Hall Swamp Management Unit as a nature reserve and nature tourism attraction with an overall vision statement of:

   "Graeme Hall Swamp should be managed and maintained as a nature reserve to provide a high quality natural experience for ecologically sustainable and safe nature tourism, environmental education and research suitable for residents and visitors of all ages".

3. Develop a comprehensive management plan for the East Unit of Graeme Hall Swamp to sustain and, where appropriate, to enhance the biophysical characteristics of the swamp.
4. Develop a comprehensive management plan that integrates the biophysical management plans of the East and West Units of Graeme Hall Swamp.
5. Develop a Tourism Master Plan for Graeme Hall Swamp that integrates the nature tourism strengths of the West and East Units and is compatible with the respective biophysical management plan.
6. Maintain private ownership of the West Unit and public ownership of the East Unit of Graeme Hall Swamp.
7. Vest the management responsibility and authority for Graeme Hall Swamp with the Ministry of Tourism.
8. Authorise the Ministry of Tourism to enter into a Tourism Development and Operating Agreement between Graeme Hall Bird Sanctuary, Inc. and the Government of Barbados for the tourism attractions of the East Unit of Graeme Hall.
9. Structure the Tourism Development and Operating Agreement to enhance government initiatives to preserve and sustain the biophysical characteristics of Graeme Hall Swamp, enhance overall strength of the nature tourism product, and encourage tourism product diversification on the South Coast.
10. Structure the Tourism Development and Operating Agreement to provide the benefits of integrated biophysical and tourism management of Graeme Hall Swamp to both parties, while maintaining the respective ownership positions and long-term objectives.
11. Develop a long-term operating contract between The Ministry of Tourism and Graeme Hall Bird Sanctuary, Inc. to provide day-to-day operation the East Unit of Graeme Hall Swamp. Specifically, the operating contract should implement the Tourism Development and Operating Agreement developed for the East Unit.

9. Management Structure

9.1 Graeme Hall Swamp Management Coordination

The Ministry of Tourism should immediately initiate discussions with Graeme Hall Bird Sanctuary Inc. regarding the development of an integrated Tourism Management Plan for Graeme Hall Swamp. This Plan should focus on developing an integrated nature reserve and nature tourism attraction for Graeme Hall Swamp utilising the best characteristics of both the West and East Units.

Successful integration of tourism management of Graeme Hall Swamp will require a decisive decision process. The Tourism Management Plan should clearly define the responsibilities and authority of each party for the planning and implementation of the Graeme Hall Swamp as a tourism attraction. The Tourism Management Plan should be compatible with, and build on, the respective biophysical management plans for the East and West Units of the swamp. The focus of the plan should be to integrate the nature tourism strengths of each component of the swamp to develop the premier nature attraction on the island.

9.2 Tourism Development and Operating Agreement

After the Tourism Management Plan is completed, the Ministry of Tourism and Graeme Hall Bird Sanctuary Inc. should negotiate a Tourism Development and Operating Agreement for the East Unit. This Agreement should provide the development and operating framework for the nature reserve and nature tourism attractions within the East Unit. Two development issues should receive priority attention.

First, Graeme Hall Bird Sanctuary, Inc. should be offered to purchase of the portion of the Government property in the West Unit that lies directly North of the Graeme Hall Bird Sanctuary, Inc. property. This parcel, of approximately 5-6 acres, contains a fresh water spring. The Graeme Hall Bird Sanctuary, Inc. plan includes development of a shallow, fresh water pond of about 2 acres that would lie partially on Government property and partially on Graeme Hall Bird Sanctuary, Inc. property. This property is not critical to the integrity of the East Unit, and the revenues generated from the sale of this property could be used to offset the costs of appropriate developments in the East Unit.

Secondly, Graeme Hall Swamp's role as a nature reserve and tourism site should be secured as soon as possible. The Tourism Development and Operating Agreement should therefore, investigate interim financing mechanisms that would enable immediate development of the East Unit security fence, ponds, walkways, boardwalks and visitor facilities. The security fence will preserve the integrity of the nature reserve, and the visitor facilities will identify Graeme Hall Swamp's as a major nature attraction. Making this nature attraction operational will provide significant mutual tourism benefits when the major tourism and hotel construction and renovation initiatives are completed in the area.

In addition to these two major issues, The Tourism Development and Operating Agreement should address, but not be limited to:

- Development Principles and Guidelines for Graeme Hall Swamp
- A ten-year Operating Contract that defines project objectives and performance measures for facilities and attractions on the East Unit
- An integrated biophysical plan and monitoring programme for Graeme Hall Swamp
- An integrated interpretive plan and programs to ensure a cohesive nature tourism product for Graeme Hall Swamp
- Development of appropriate public recreational, educational and research programs and access to the East Unit
- A business plan that includes capital investment requirements and operating revenues and costs for East Unit operations and maintenance.

9.3 Management Responsibilities

The Integrated Tourism Management Plan, and the Tourism Development and Operating Agreement for the East Unit will provide a responsive and flexible framework for the owners of Graeme Hall Swamp. This will allow them to mutually develop and manage their properties in their long-term best interests, and the success of the integrated nature tourism product at Graeme Hall Swamp will directly benefit both owners.

Graeme Hall Bird Sanctuary, Inc. will develop their bird sanctuary and nature attraction in the West Unit under development permits from Town & Country Planning. It will manage this property under the provisions of existing regulations. Tourism planning will be coodinated with the East Unit under provisions of the integrated Tourism Management Plan.

The Ministry of Tourism will have the direct responsibility and authority for ensuring the public interest and, specifically, the preservation and sustainability of the essential biophysical characteristics of the nature reserve. In this role, it will utilise the Advisory Committee on Nature Tourism, as required.

The Tourism Development and Operating Agreement will provide the framework for the planning, development and operations of the nature tourism product in the East Unit. Revenues from this attraction will support the operating and maintenance costs of the East Unit, and directly affect the ability to offer additional recreational, educational, and scientific opportunities within the nature reserve to both residents and tourists.

Day-to-day operations on the East Unit will be conducted by a private contractor to the Ministry of Tourism, under the provisions of the Tourism Development and Operating Agreement. We have recommended that the Ministry of Tourism negotiate a long-term Operating Contract for East Unit operations with Graeme Hall Bird Sanctuary, Inc. This Operating Agreement will specify the terms of a ten-year contractual agreement to manage operations on the East Unit, will make the contractor directly responsible to the Ministry of Tourism, and will include performance-based standards and incentives.

9.4 Nature Reserve Operating Contract

An Operating Contract for the East Unit should be negotiated between the Ministry of Tourism and Graeme Hall Bird Sanctuary, Inc. after the Tourism Development and Operating Agreement is completed. This contract should address, but not be limited to:

Term of the contract. The Operating Contract will be for a term of ten years, with annual reviews and exit clauses as appropriate based on performance. A third-party arbitration process will be developed as part of the Contract that includes provision for arbitration in the event of issues that cannot be reconciled by the parties.

Annual budgeting. The Operating Contract will include provisions for annual operating and capital budgeting for the East Unit. The annual budget, developed by the Ministry of Tourism and the contractor, will become the framework for contract monitoring and performance review. The annual budget will include revenue sources and forecasts, capital investments and operations and maintenance for the East Unit. It will also include revenues and expenditures for integrated tourism development, marketing and operations approved by the Tourism Development and Operating Agreement. It will not include the budget for the private sector operations on the West Unit.

Programming. The programming plan will be specifically prepared for tourism activities in the East Unit, but will be consistent with the integrated tourism plan for Graeme Hall Swamp. Activity programming will including provision for independent visits and tour groups as well as educational tours, for example, with the school system. Underlying the programming is an interpretation plan for all types of visitors. The interpretation facilities will be designed to maintain interest and relevance over a extended period of time. Programming, however, will be refined on an annual basis and perhaps even on a six-month basis.

Capacity. The Operating Contract will specify anticipated capacity demands and capabilities. In that regard, the operating plan will include a monitoring program for Limits of Acceptable Change within the East Unit to ensure that key biophysical parameters are not adversely affected by facility operations.

Operational considerations. The Operating Contract will specify the hours of operation, and the pricing for admission. There will be special consideration for Barbados residents, which could be addressed through a family pass approach. This would include an annual fee for admission, enabling families to visit the site at any time throughout the year. Other visitors would be charged an admission fee per visit. Tour groups would be charged according to the fee schedules negotiated with each tour company.

Security. The Operating Contract will specify the types of security and the hours of operation for security.

Events and special activities. This category, a subset of programming, will cover items such as site availability for special events by groups, special activities related to interpretation in particular seasons, and any other events. Certainly, wedding receptions are an increasingly important tourism component that would benefit from access to a natural setting.

Review and monitoring. The Operating Contract will clearly designate authorised representatives from the Ministry of Tourism and the contractor to deal with ongoing management issues. The Operating Contract will also include provision for a regular review process, likely on an annual basis but with the review meetings on a more frequent basis, say quarterly, to review activities and deal with issues which may arise. The annual review process will include submission of an annual audited statement by the operator. The audited statement would deal specifically with the revenues and expenditures related to the East Unit.

Scientific Research. The Operating Contract will include provision for scientific research within the East Unit. This research will be coordinated in a manner that allows educational and research organisations to use the swamp as a learning tool consistent with tourism programmes. The scientific research will also be contribute with ongoing research and monitoring of Limits of Acceptable Change to provide data as benchmarks for the environmental state of the swamp.

10. Development Recommendations

This Section presents the recommended development concept for Graeme Hall Swamp. The recommendations address Graeme Hall Swamp as a bird sanctuary, nature reserve, and integrated nature tourism attraction.

Most of the facilities included in this development concept are located in the West Unit, and have been proposed in the most recent version of the Graeme Hall Bird Sanctuary, Inc. development plan (see Appendix). The development recommendations included in this Section incorporate our modified recommendations for the facilities included in the Graeme Hall Birds Sanctuary, Inc. plan. These recommendations are based on the concept described in Section 8 to treat the development and management of the swamp as a integrated unit.

Town and Country Planning approvals will be required for the construction of these facilities. We recommend that Town & Country Planning initiate and expedite the regulatory review of the specifics of the Graeme Hall Bird Sanctuary, Inc. application within the context of this integrated approach.

The recommended tourism strategy and tourism concepts described in this section were developed within the context of Graeme Hall Swamp as a combination bird sanctuary, nature reserve and nature tourism attraction. The recommended development principles are designed to provide the context for the implementation of the tourism strategy consistent with the objectives of enhancing ecological, recreational, educational and scientific values and ensuring biophysical integrity. The development concept provides the overall land use plan for the swamp and the development components describes the site plan and the proposed location of physical infrastructure, facilities and amenities.

Additional recommendations to protect and sustain the physical and biological resources of Graeme Hall Swamp are included in Sections 12. Recommendations related to the financial and operational considerations necessary for an economically and environmentally viable and sustainable nature reserve and nature tourism attraction in Graeme Hall Swamp are included in Section **13 (?)**.

10.1 Tourism Strategy

The Graeme Hall Swamp nature tourism attraction will be the pre-eminent nature attraction on the South Coast. Development of this major tourism attraction requires adherence to several basic development principles and objectives to ensure a sustainable, quality product, including:

- **Image**: Create awareness and understanding of the ecological value, uniqueness and beauty of coastal wetlands and tropical mangrove systems
- **Experience**: Provide a unique environment that instils a sense of discovery and appreciation for the resources that encourages return visits
- **Education**: Develop an understanding for the need to support conservation and protection of tropical wetland habitat, species and landscapes

- **Promotion**: Enhance the market position of the attraction within the overall diversity and richness of the Barbados tourism experience.

10.2 Tourism Development Concept

Tourists are interested in the unusual, the outstanding, the historic, the cultural or artistic, and the beautiful. They are willing to pay to see the best representative examples of a country, ecosystem, culture, historic period, artistic style or species. In that context, a nature tourism attraction at Graeme Hall Swamp should capitalise on its:

- Significance as the last remaining mangrove swamp in Barbados and the historic uses of the area (bird hunting, growing grasses for feeding mules, etc.)
- Current and potential wildlife viewing opportunities for nesting areas of cattle egrets and other wading birds, nesting areas for the indigenous yellow warbler, and the potential for attracting additional migrating birds
- Educational and research opportunities to investigate the enhancement of flora and fauna historically present at Graeme Hall Swamp
- Educational opportunities to view both freshwater and estuarine species of wetland plants
- Educational opportunities to observe and learn about ecological principles including the functions of natural wetlands, the water cycle, erosion, competition, water quality issues, home range, territory, trophic webs and pyramids, identification and taxonomy of plant and animal species
- Information and interpretation programs emphasising the swamp's special features to provide visitors with a deeper understanding and appreciation for the swamp's environment, history and purpose
- Educational opportunities to teach or carry out photography or media interpretation (painting, drawing, water colours, leaf printing) of the various landforms or species
- Opportunities to actively participate in on-going monitoring research on the water quality, plants, insects, birds and other animals
- Opportunities to use the senses for nature interpretation, including hearing, smell and touch (particularly appropriate for handicapped individuals)
- Opportunities for quiet reflection and meditation amid the bustle of southern Barbados coastal life.

Potential tourism themes and activities at Graeme Hall Swamp that could incorporate the above opportunities include:

- **Island Environments** - Use trails and displays to illustrate the various species found on this island; and interpret how this mixture of plant and animal species might have come to Barbados. Feature geologic history, Amerindian pre-history, sailors and English colonisation, and the sugar cane plantations.
- **Wildlife Viewing and Nature Photography** - Use animal viewing blinds, special trails only for guided experiences, feeders and proper plantings of food species to provide a unique

experience on the island for wildlife viewing and nature photography. Feature the variety of birds that visit the island, and explore opportunities to photograph insects, invertebrates and unusual species of plants.

- **Environments, species and ecology** - Introduce visitors to the habitats, flora and fauna of Barbados; focusing on the mangrove and freshwater sedge ecosystems of Graeme Hall Swamp and the associated ocean environment. Use guided programs, hands-on opportunities to see and touch, participatory research opportunities, exhibits, and trails.
- **Unusual and "Only Known" Display** - Introduce visitors to the unusual flora, fauna and physical features of Graeme Hall Swamp through exhibits, guided programs and signage. Place particular emphasis on the "rare or only known" location of certain plants like the sedge and mangrove, and birds such as the yellow warbler.
- **Walk Through Time** - Take visitors on a walk through the natural Barbados of the past using a boardwalk and trail system. Explore a wild Barbados mangrove swamp through the eyes of early residents canoeing through the mangroves to a fishing village. Explore the swamp through the eyes of explorers landing and discovering a dwelling at the edge of the swamp as it may have existed three centuries ago.
- **Wilderness Survival** - Exploit the "Swiss Family Robinson" theme of a shipwreck, and teach visitors how early inhabitants or stranded sailors might have utilised Barbados' natural resources including edible and medicinal plants, fishing and hunting.

10.3 Development Principles

Graeme Hall Swamp's vision is to create a nature reserve with a complimentary and supportive nature tourism attraction to allow residents and visitors to enjoy its unique character. First and foremost, the East Unit of Graeme Hall Swamp is a nature reserve—any nature tourism attraction must be developed and operated in manner compatible with the overriding objectives of the nature reserve.

Nature tourism development in the East Unit therefore, must adhere to a comprehensive set of development principles that include:

- Preserve and enhance the natural and cultural heritage of the swamp for the long-term benefit of both residents and visitors
- Promote an appreciation of the natural environment and the inspirational enjoyment of nature
- Preserve significant and unusual natural features
- Support sustainable management of the swamp's resources
- Encourage appropriate scientific research opportunities
- Provide quality outdoor recreation opportunities in an environment that fosters an appreciation of Barbados' natural resources
- Encourage stakeholder, local resident and interest group consultation during development planning

- Ensure Barbados residents have convenient access to the public resources of the swamp
- Provide facilities and activities compatible with the swamp's character and the physical capacity of the land
- Provide adequate revenue generation to support preservation and maintenance of the swamp's resource
- Optimise economic benefits, employment and income opportunities for the people of Barbados
- Provide fencing and security to limit access and egress to a single gate
- Provide facilities and attractions limited to pedestrian access with handicap accessibility
- Provide facilities and activities with a range of involvement and sophistication
- Provide adequate facilities for the safety and well being of the visitors.

10.4 Development Concept

The conceptual site plan recommended for Graeme Hall Swamp is premised upon developing Graeme Hall Swamp as a combination nature reserve and nature tourism attraction (Exhibit 10.1). This nature tourism attraction, a combination public/private partnership, utilises the East Unit that is primarily a nature reserve, to supplement the bird sanctuary and natural attractions of the West Unit attractions. The nature tourism attractions proposed for the East Unit are designed to balance swamp habitat restoration and preservation objectives with a tourism development that can generate revenues for preservation and maintenance, and provide public access to the resources.

Developments in Graeme Hall Swamp are planned to increase biodiversity and enhance the natural ecosystems whenever possible. Infrastructure developments are also designed to accommodate how the target tourism audience can observe the natural environment without damage and without initiating behavioural changes in wildlife. Visitor induced changes could cause a decline of some populations reproductive success, or cause them to move away from the viewing areas.

The concept plan is designed to bring people and nature together in a way that optimises observation in a sustainable manner. The plan includes significant modifications to some natural features of the swamp, and includes significant rehabilitation of disturbed natural areas. The concept plan also envisages additional plantings to maintain and enhance the existing and historical floral and faunal species diversity. These additional plantings will avoid invasive and non-native species.

Visitors to Graeme Hall Swamp will all enter through a single main entrance off Highway 7. Visitors to the major, private-sector tourism attractions in the West Unit will be directed to the Visitor Centre and from there will have access to all attractions on the West Unit and the East Unit.

Visitors to the nature reserve facilities and attractions in the East Unit will enter through the main gate. They will be directed right to a walkway and footbridge over the causeway channel that leads to the main walkways of the East Unit attractions and facilities. Visitors to the East Unit will be restricted from entering the West Unit unless they pay appropriate admission fees. Visitor management personnel in combination with careful location of walkways, access, extensive plantings and landscaping will maintain proper circulation of visitors in the facility.

The West Unit will be the focus of the nature attraction activities at Graeme Hall Swamp. It will serve as the main entrance from Highway 7 to Graeme Hall Swamp. It will be the focal point for all attractions and it will have appropriate, functional and high quality facilities and infrastructure. An entrance fee will be required for this portion of the swamp, and people visiting the West Unit attractions will also have access to the facilities and attractions in the East Unit.

The entire West Unit will be operated as a Bird Sanctuary. The mangrove and egret habitats will be protected and enlarged. Newly created shallow ponds South and West of the lake will provide additional waterfowl and shorebird habitat. Aviary facilities will be created on the southern margin of the facility to provide research, rehabilitative and educational capabilities. Visitor circulation will be constrained and directed by trails and boardwalks to link attractions and facilities. These walkways will provide adequate directional and informational signage and, where appropriate, will include interpretative signage. Research facilities will be located in the far Northwest portion of the property, and will have a separate entrance.

The East Unit will remain the nature reserve component of the Graeme Hall Swamp Management Unit. Public access to this portion of the swamp will be through the main swamp entrance and along a walkway and footbridge over the causeway channel to the East Unit facilities. Self-guided visits to this portion of the swamp will require a daily fee for non-residents, and a nominally priced single entrance ticket or season pass for resident families. Self-guided access for children and school tours will be at no charge. Public circulation through this area will be strictly controlled on walkways and boardwalks, with the major area access along the southern perimeter using a modified Marl Road constructed for the sewage project. Provisions for guided tours through the East Unit will be available.

The East Unit will contain extensive treed plantings to screen the Sewage Treatment Facility from views within the public access areas of the swamp. The old shooting trays constructed in the Northwest corner for the previous shooting club will be restored, and the history of this era of the swamp will be interpreted. In addition, a large new pond of approximately 9 acres with numerous vegetated islands will be created to provide additional wildlife habitat.

Figure 10-1 Conceptual Development Plan for Graeme Hall Swamp.

10.5 Development Components

This concept plan includes a number of major components, all of which must be sensitively incorporated to produce a cohesive and sustainable tourism product for Graeme Hall Swamp. These components are described in the following Sections.

10.5.1 Land Use Zones

Nature tourism development of Graeme Hall Swamp must recognise the inherent characteristics, sensitivities and tourism potential of the land use components of the swamp. The development concept proposed for the swamp is designed to accommodate to, and enhance these characteristics.

In general, the development concept proposes that the entrance, parking, visitor centre and the majority of the tourism facilities should be located in the previously disturbed portions of the West Unit. The northern portions of the West Unit will be set aside as a bird sanctuary. The entire East Unit is proposed as a nature reserve, with most of the area set aside for low-impact visitor access and observation areas. Major components of the development are described below.

10.5.2 Access and Car Park

The entrance and car park should be located immediately off Highway 7. The existing driveway to the swamp at this point should be developed as the main entrance to Graeme Hall Swamp. The car park should contain parking space for approximately 50 cars and 5 tour buses. The properties immediately East of this entrance should be acquired as part of the project to provide space for the parking lot. Extensive landscaping should disguise the parking lot from Highway 7 view, and the entire view and the approach from the highway to the swamp attraction should be of extensive and lush tropical vegetation. Drainage from the car park will be directed to a containment pond for appropriate disposal of any potentially hazardous materials.

This entrance area will provide parking and access to both the major nature attraction in the West Unit and to the nature reserve in the East Unit. A single controlled main facility entrance will direct visitors to the West Unit or the East Unit attractions. Visitors to the East Unit will be directed through the main entrance right to a walkway and footbridge over the causeway channel to the main walkways to the East Unit attractions and facilities.

10.5.3 Visitor Centre, Gift Shop and Restaurant

Access to the West Unit attractions and facilities will be controlled through the Visitor Centre. The Visitor Centre, gift shop and restaurant will be directly available from the main entrance. It will orient the visitor and introduce attractions, facilities, resources, activities and programs. The Centre will include a multipurpose room. This room will provide a sit-down program for 150, or it can be divided into smaller "break-out" rooms for special programs and meetings. The facility will also be designed to provide rental space for seminars and workshops.

The Centre will contain interpretative exhibits to explain the natural and human history of the swamp and the special adaptations of the plants and animals that occur there. The Centre will also

contain a gift shop, and 80-seat restaurant that will provide snacks and service for afternoon and evening dining.

The Visitor Centre will be designed to blend into the environment, and the architecture will represent the Caribbean vernacular. It will be constructed from tropical wood and, wherever appropriate, incorporate recycled materials. The design will emphasise shading and free airflow to the extent possible to reduce the need for air conditioning (which will be required in some areas). Facility design will emphasise environmentally "friendly" technologies and products such as solar power and water conservation devices.

10.5.4 Research and Maintenance Facility

A research and maintenance facility will be located in the Northwest corner of the West Unit. This facility will house research, breeding and maintenance activities. It will be located in an area removed from general public access, and separated from displays and the swamp. These facilities will contain quarantine facilities where new birds and sick birds can be separated from the captive and wild populations. This separation will include wastes, waste water and other methods of potential contamination. Access to the facility will be via a dedicated road off Amity Lodge Road.

10.5.5 Aviary and Wildlife Exhibits

Two aviaries will be located West of the parking lot and Visitor Centre between the ponds and the South property margin. Birds will be housed in flight cages (walk-through aviaries) with sufficient space for natural movement and behaviour. Recent trends and interest in ecotourism has indicated that visitors do not like to see caged animals, but if they do they should be provided sufficient room for movement.

The aviaries will contain interpretive and educational exhibits about the types of birds included in aviaries and their unique characteristics such as food habits or feeding adaptations, behavioural adaptations, etc. These aviaries will also be used for rehabilitation and research functions.

10.5.6 Trails, Viewing Towers and Blinds

Walkways leading from the Visitor Centre will be designed to maximise opportunities for wildlife observation, yet at the same time ensure that wildlife species behaviour will not be affected. These walkways will be handicapped accessible, and will be designed for use either by self-guided tours or by tour guides.

The actual locations of the trails and boardwalks will be determined by the final layout of the new ponds and canal rehabilitation. These trails and boardwalks will be laid out by professional biologists familiar with the behaviour of the wildlife in the swamp, and knowledgeable about the wildlife, vegetation and history interpretation that can be offered in the swamp.

Wherever possible, these walkways and boardwalks will be located to provide visitors with natural viewing opportunities without disturbing the wildlife. Trail and boardwalk design will anticipate seasonal requirements to close portions of the walkways to visitors to avoid disturbing wildlife during critical stages of their life cycle. This will require trail design that accommodates a variety of traffic flows. Where appropriate, these walkways will be supplemented with wildlife viewing blinds

near nesting and feeding areas. Blinds and viewing areas will be designed to cover or camouflage visitors from the wildlife being viewed. Viewing towers will be constructed at two strategic locations with an overview of the surrounding vegetation to facilitate wildlife viewing through binoculars, spotting scopes and cameras. The boardwalks will be constructed of sustainable hardwoods selected for durability and a life cycle of at least 50 years.

The trails in the nature reserve will include two boardwalk loops, three wildlife viewing shelters/blinds, a viewing tower, four major sign kiosks, twenty interpretive signs, and up to 150 identification and directional signs.

Appropriate directional and interpretative signage will be installed so those visitors without guides can develop an understanding and appreciation of the wildlife, vegetation, ecological processes and wetland conservation. Informational signage will be designed to educate visitors about the types of flora and fauna encountered—its characteristics, adaptations, conservation and other appropriate topics.

10.5.7 Open Water Ponds

Several ponds have already been constructed in the West Unit. Additional ponds will be created in the West and East Units by restoring the trays constructed for the shooting club. A 10-acre irregularly shaped new pond with vegetated islands will be created in the Northwest portion of the East Unit. This pond will be designed to provide habitat for migratory birds; and will be specifically designed to attract migratory birds that historically visited Barbados. It will also be designed to encourage some species of plants that historically occurred in the swamp, as well as fresh and brackish water aquatic life.

This large pond will be constructed so the depth can be changed from several inches to 2-3 feet during the course of the year. This flexibility will optimise the ability to attract wildlife and stimulate growth of certain plant species. One portion of the lake would contain water lilies and other aquatic vegetation. The deeper portion of the lake would attract ducks and wading birds while the shallower one would attract shorebirds and dabblers who prefer shallow mud flats on which to feed. Grit trays will be placed near observation decks and between the ponds and canals to attract ducks and other migratory birds.

10.5.8 Fresh Water Canals

The freshwater canals that remain after the shallow ponds are constructed will be cleaned of silt deposition and restored as wildlife habitat and drainage channels.

10.5.9 Causeway

The causeway will not change in function and will continue to act as a partial barrier between the red mangrove area and the fresh water ponds and canals. The causeway also contains its own special microhabitats that will be continued and encouraged.

10.5.10 Security

The entire perimeter of the swamp (both East and West Units) will be enclosed by a 2-meter, heavy gauge, chain link fence. This fence will prevent uncontrolled access to the site, and direct all access and egress through the main gate for both Units. The security fence will provide the control necessary to ensure the protection of the flora and fauna of the swamp, and control use of the facilities.

Access to the research facility will be strictly limited to authorised personnel only. Vehicle traffic and pedestrian movements will be controlled and directed at the main gate. The perimeter of the swamp will be patrolled by security personnel on a regular basis, including night-time patrols.

10.5.11 Landscaping

Several areas within Graeme Hall Swamp will be heavily landscaped to improve the visitor experience. The Sewage Treatment Plant area will be completely landscaped in a manner that will essentially remove its presence from the nature reserve. The entire periphery of the North and Northwest portion of the swamp will be landscaped to provide a more natural viewshed to visitors, and to provide a more secluded presence for wildlife species in the area.

The entrance area in the West Unit will be heavily landscaped to provide the visitor and people travelling past on Highway 7 with the perception of a lush, tropical landscape in the swamp. Additional landscaping will be installed between the aviaries and the ponds on the South side of the West Unit to provide a more natural feel for visitors travelling by the ponds.

10.5.12 Marl Access Road

The Sewage Treatment Plant outflow pipe was buried on the south border of the nature reserve. When installation is complete, this road will be reduced. The South Coast Sewerage Authority intends to reduce this road to a pedestrian walkway. This walkway will provide the major access to the boardwalk system in the nature reserve.

II. Biophysical Recommendations

A successful nature reserve and nature tourism attraction for Graeme Hall Swamp is premised upon maintaining the biophysical sustainability of the swamp. Underlying all of the development concepts described in the previous Section, therefore, is the basic objective to:

> *maintain and, where necessary and appropriate, enhance the biological and physical sustainability of Graeme Hall Swamp and its integral and associated habitats for future generations of residents and visitors*

The biophysical recommendations in this Section are designed to enhance and be consistent with the development plan described in the previous Section. The recommendations are based on our review of historical studies, consultations with local and international experts, and on the field investigations conducted in Graeme Hall Swamp during 1996 and 1997.

The overall intent of these recommendations is to provide a framework from which the management teams from the East and West Units can co-operatively develop an integrated biophysical plan to rehabilitate and enhance Graeme Hall Swamp. This biophysical plan will, in turn, provide the framework on which the integrated Tourism Management Plan can be developed and implemented within the East and West Units. Additional detailed operational recommendations for the East Unit, where appropriate, are included in the Resource Management Policies of the Implementation Section.

II.I Buffer Zone Land Use

The Graeme Hall Swamp project area outlined in Figure 2-1 (Part I: Graeme Hall Swamp Today) included a substantial buffer zone surrounding the biophysical unit of the swamp designated as the Graeme Hall Swamp Management Unit. This buffer zone includes the Ministry of Agricultural lands to the North, housing between Rendezvous Road and the swamp, and concentrated housing and commercial development South of the swamp.

This buffer zone will play a critical part in the future of Graeme Hall Swamp, because many of the activities undertaken in this area will directly affect the environmental health of the swamp. Activities affecting water drainage to the swamp are particularly important.

The biophysical management plans for the two units of the swamp should recognise this buffer area and identify specific components of the swamp environment that can be affected by activities in the buffer zone. The integrated Tourism Management Plan for Graeme Hall Swamp should incorporate the biophysical concerns and develop a pro-active program to monitor and influence activities in the buffer zone.

The Advisory Committee for Nature Tourism membership contains most of the government agencies relevant to actions within the buffer zone. Graeme Hall Bird Sanctuary, Inc. and the Ministry of Tourism should establish a direct ongoing contact with the Advisory Committee and the Ministry of Agriculture to monitor and review activities occurring in the buffer zone.

These government agencies should be encouraged to establish and enforce regulations and policies within the buffer zone designed to maintain the long-term sustainability of Graeme Hall Swamp. Specific recommendations for the buffer zone include:

Town and Country Planning and other relevant agencies should designate the Graeme Hall Swamp buffer zone as a unique area necessary for the preservation of the Graeme Hall Swamp nature reserve. As such, they should enforce current land use restrictions in the buffer zone, locate and cite non-compliance with regulations on land use, waste disposal, and infringement on the boundaries of the Graeme Hall Swamp Management Unit.

The Ministry of Health and Environment should investigate if any homes or businesses within the buffer zone have inadequate sewerage systems that adversely affect the water quality in Grame Hall Swamp. A program to upgrade these non-compliant systems should be developed.

Ministry of Agriculture lands within the buffer zone should be operated in a manner that does not adversely affect the sustainability of the swamp ecosystem. The hydrology studies demonstrated that runoff from the agricultural fields flows directly into the swamp. Pesticide and fertiliser use on these test plots should careful consider the effects of these chemicals on the swamp. Non-chemical techniques for pest control and nutrient enhancement in crops should be encouraged, which would benefit both Graeme Hall Swamp and other environments in Barbados.

Town and Country Planning should carefully review applications for all new or modified land use in the buffer zone for actions that could adversely affect Graeme Hall Swamp. Adequate sewage treatment is essential for any developments. Any developments that involve manufacturing processes, service industries with potentially pollutants, and businesses with petroleum products should be strictly reviewed and discouraged in the buffer zone. Any such businesses that are permitted should undergo regular monitoring for compliance with applicable regulations.

Land use and aesthetic considerations within the buffer zone are also important. As the swamp is restored and trash is cleared, a program should be developed to clean the properties adjacent to the swamp; particularly those properties that can be seen from the trails, boardwalks and facilities. Waste disposal regulations should be strictly enforced in the buffer zone.

A public information and community outreach program should be developed for residents of the buffer zone. The local landowners should be encouraged to take pride in their property and their association with the Graeme Hall Swamp nature reserve. The fact that the swamp will become a safe and positive addition to their neighbourhood should be well advertised to the residents.

II.2 Land Use Restoration and Rehabilitation

The long-term viability of the swamp, consistent with the objectives and vision recommended for the nature reserve and nature tourism attraction, requires that the swamp be planned and managed as a

cohesive unit from both a biophysical and tourism perspective. Maintenance of the status quo of either the East or West Unit land use is not an acceptable option to achieving swamp objectives.

Graeme Hall Swamp Bird Sanctuary, Inc. initiated earthworks, dredged new ponds and altered water flow patterns in April 1997. In addition, the Sewage Treatment Plant construction included a substantial work pad and storage area on the South of the lake. These works effectively removed the entire terrestrial habitat south and west of the lake.

The development concept described in the previous Section addresses the restoration of this area as a nature tourism attraction. It is imperative that Town and Country Planning expedite the review of the pending application by Grame Hall Bird Sanctuary, Inc. for the West Unit, within the context of the overall development concept presented in this report. These facilities will make a significant contribution to the tourism product on the South Coast, and are important for the economic viability of the nature reserve and nature tourism attraction on the East Unit.

Construction plans should be finalised and facilities started as quickly as possible so that the land area in the West Unit can be revegetated to minimise sedimentation and water quality degradation throughout the swamp.

Development of the Sewage Treatment Plant in 1996 and 1997 created significant short-term and, possibly, long-term alterations of the surface and subsurface freshwater flow patterns in the East Unit, and potentially the West Unit of the swamp. Dewatering and creation of the outflow work pad/road altered surface and subsurface flow patterns, which are critical to maintaining the biophysical characteristics of both the East and West Units of the swamp. It also adversely affected surface flow patterns between the swamp and private properties along the South side. Construction of the work pad also contributed substantial silt deposits to extensive areas of the East Unit. Restoration of the work pad will be required when construction is completed, and this restoration must be carefully designed not to repeat the siltation process in the East Unit. Work pad restoration work must also include the careful installation of culverts to recreate water flow patterns that existed in the East Unit prior to Sewage Treatment Plant construction.

Maintenance of subsurface saltwater flows into of the swamp is equally important to freshwater flows for maintaining the biophysical characteristics of the swamp. Construction activities on both the East and West Units must be designed to prevent any alterations to these saltwater flows.

The East Unit of Graeme Hall Swamp has effectively been under a management philosophy of "no action" since the government acquired the property. This has allowed the existing biological communities to gradually develop with a minimum of disturbance. Continuation of this "no Action" management strategy is clearly no longer appropriate. Human intervention will be required to restore, sustain and, where appropriate, enhance the biophysical characteristics of the East Unit.

This rehabilitation and restoration, however, should not include plans to attempt to restore the biophysical environment of the swamp to pre-settlement conditions. There is no compelling research, educational, or tourism imperative that would justify the financial and institutional resources that would be required to attempt this level of restoration to the swamp. Graeme Hall Swamp, as a coastal wetland, was always a creation of change—its primary feature probably was its dynamic ability to accommodate the constantly changing conditions provided by external forces.

Settlement in the 17th Century provided a new series of external changes to the swamp, that cumulatively have been the dominant factor creating the swamp that exists today. Those changes, rather than being undone, should be used to provide a valuable template for understanding the dynamics of this coastal wetland.

II.3 Sustainability

Sustainability, in the context of this report, is the long-term survival of Graeme Hall Swamp as a viable coastal wetland/mangrove swamp system. This requires that use of the swamp and its natural resources, either directly or indirectly, should be conducted in a manner that does not jeopardise that long-term viability.

The designation of the East Unit as a nature reserve, the biophysical plans recommended for the East and West Unit, the integrated Tourism Management Plan and the Tourism Development and Operating Agreement for the East Unit are all designed to ensure the long-term sustainability of Graeme Hall Swamp.

The historic documentation and the baseline studies carried out in the swamp during this project were designed to provide a base for evaluating and planning for sustainable management. Construction activities related to the Sewage Treatment Plant and the landform modifications in the West Unit significantly compromised the original intent of establishing baseline resource data. This construction activity eliminated transects for vegetation and wildlife habitat, and they significantly altered both the quality and quantity of water in the swamp.

Notwithstanding these constraints, we believe that the current and historical data gathered during this study, together with the local expertise available, provide an adequate reference point from which to develop preliminary recommendations for the future management of the swamp. This information is summarised in Part I of this report. The following biophysical recommendations include Limits of Acceptable Change monitoring throughout the operation of the facilities. The results of this monitoring can be used to adjust biophysical monitoring programs, as required.

II.4 Biodiversity

Graeme Hall Swamp is a very small area in which to sustain a complex natural system. This is particularly true when it is located within one of the most urbanised portions of the island. The plant and wildlife populations within the swamp are relatively small and, therefore, particularly vulnerable to even minor adverse impacts. Graeme Hall Swamp is also one of the few locations on the island that provides habitat for many of these species. The limited numbers of individuals, coupled with limited critical habitats elsewhere on the island, may create a situation where species are on the verge falling below population numbers required for species survival.

Maintenance of the swamp's biodiversity is key to maintaining the swamp's sustainability. This objective, together with the constraints imposed by the swamp's size and location, makes it particularly important that any development and management plans for the swamp recognise the importance of maintaining the essential biological units. By some standards, many of the plant and animal species, including the mangrove swamp itself, should be considered endangered in Barbados.

These realities provide an overlying constraint on all future development, management and monitoring programs implemented for the swamp.

Concurrent with this reality of low population numbers in Graeme Hall Swamp, is the tourism development reality that small population numbers of a particular wildlife species also often means limited visibility opportunities for human visitors. For example, a very rare bird may be seen only once a trip or perhaps only once in a season, while an uncommon bird may be seen 10-20 times per trip. Very common birds, on the other hand, have population numbers that allow sightings of 100 or more during an excursion. The opportunity to view a diversity of wildlife species in reasonable numbers is an important component of the tourism potential of Graeme Hall Swamp.

II.5 Hydrology and Water Exchange

The hydrology of Graeme Hall Swamp is unique to the island. Its position contiguous to the ocean provides the opportunity for strong ocean influences to the swamp. At the same time, these ocean influences are tempered by a continual source of fresh water from runoff and, more importantly, from underground springs and streams.

The major hydrologic consideration during development and operation within the swamp are:

- protecting and maintaining the source and quality of the freshwater flows from the uplands
- maintaining the interchange of surface water flows within the swamp to prevent stagnation
- maintaining contributions of saline water to the swamp from the ground water and the sea
- developing cost-effective and reliable method(s) to optimise water exchange between the swamp and the sea
- eliminating or reducing discharge of coloured water to the beaches
- providing sufficient discharge capacity from the swamp to avoid unplanned and undesirable flooding.

Graeme Hall Swamp is the recipient of significant fresh water resources flowing from springs and underground streams, and as runoff from associated lands. This fresh water moderates the influence of saline water entering the swamp via ground water seepage and tidal actions through the canal when it is open to the sea. This fresh water provides a clear gradation of water and biological characteristics from the ocean to the uplands. The fresh water outflow is a major contributor to the well being of the sedge communities in the swamp. Many other plants, such as the water lilies, are extremely sensitive to saline conditions, and owe their survival to the constant supply of fresh water.

Some springs have recently been rehabilitated, but these springs need additional protection from pollution and contamination by saline swamp water from the lake. Some underground streams, located primarily in the East Unit, have been adversely affected by the construction of the Sewage Treatment Plant, which resulted in the significant de-watering efforts that were required during plant construction. The plant location may have changed the flow patterns of these streams. These springs and underground streams must to be adequately protected and maintained so that they continue to serve as a quality source of fresh water for the swamp.

Flows within the swamp, particularly along the cut channels, are important to maintain water quality and prevent stagnation. Water quality sampling indicated generally good dissolved oxygen concentrations in the swamp. The extensive de-watering associated with plant construction resulted in substantial sediment deposition in many of the cut channels. These channels must be cleaned and their natural flows restored to alleviate potential stagnation problems.

The major single issue related to the hydrology of the swamp is the interaction of the swamp with the sea, and the operation of the existing sluice gate. This sluice gate has been operated as both a water control structure and a mechanism for water interchange with the sea since it was constructed early in this century.

The existing discharge channel structure and sluice gate has two major constraints to providing adequate drainage and interchange with the sea. The channel structure and sluice gate is currently located on the beach well up from the normal high tide level. This location, combined with normal beach dynamics, means that a channel must be regularly excavated through the sand to provide for discharge flow to the sea. Chronic shortages or unavailability of equipment often means that the sluice gate is not operated in an acceptable manner.

The beach area has been rapidly increasing in size in recent years due to coastal developments East of the outlet area. The discharge channel and sluice gate have, in fact, been extended three times in the last 50 years. This continual beach build-up places increasing demands for machinery and staff to clear sand for swamp discharges. The irregular discharge patterns from the swamp in recent years has also exacerbated the perceived problems with coloured water on the beaches.

The discharge channel should, therefore, be extended to near the normal high tide level of the beach. This relocation will minimise the amount of sand clearing required and allow for regular discharges from the swamp. More importantly, it will provide a means to improve interchange of waters between the sea and the swamp. Extension of the discharge channel to the normal high water mark may interfere with normal beach activities and access to the most East portion of the beach. A simple and attractive footbridge over the discharge channel would alleviate these concerns.

The sluice gate mechanism is old, difficult to operate, and requires manual operation that is usually not available at the optimum times, or during emergency situations, for its operation. The gate provides the mechanism to control water levels in the swamp. To perform this function adequately, the gate should be upgraded and configured with a remotely controlled, electric control mechanism so that it can be easily and quickly operated when needed.

A simpler and more cost-effective solution (if the discharge channel structure is moved to the high water level) would be to remove the sluice gate mechanism entirely. Water levels in the swamp could be controlled by a series of flashcard risers installed in the discharge channel that can be easily adjusted as required. These flashcard risers would be installed to control water at a fixed elevation. Any excess water would be spilled continuously over the top, alleviating any need to operate a sluice gate. Fluctuations of swamp water levels for management purposes could be accomplished by raising or lowering the level of the flashcard risers. A major advantage of this mechanism is that water will be spilled continuously from the discharge channel and this continuous and relatively low volume discharge will probably eliminate the existing concerns regarding discoloured water at the

beach. The other major constraint is that this system eliminates the need for a sophisticated and expensive control structure on the existing sluice gate.

The major potential constraint to a system of flashcard risers is that their presence in the discharge channel during periods of high tide may constrain the interchange of freshwater and seawater. This would affect swamp salinity and discouraging the exchange of biological organisms. However, scheduling the lowering or the removal of the flashcard risers during periods of high tide events can eliminate this constraint, and sea and swamp waters and aquatic organisms can move between the sea and the swamp. Experience from past tidal events indicate that there is not enough tidal "head" for extension of sea water much beyond the location of the Highway 7 bridge.

II.6 Water Quality

The major potential issues of Graeme Hall Swamp water quality are salinity of the swamp waters, the quality of the water (particularly nutrients), and the potential for pesticide contamination for upland activities on the Ministry of Agriculture lands.

Salinity levels measured at Graeme Hall Swamp during the 1996 field investigations were atypical because of the extensive de-watering program being conducted as part of the Sewage Treatment Plant construction. Historical data for Graeme Hall Swamp salinity indicates that Graeme Hall Swamp salinity was comparable to a natural mangrove ecosystem at Rookery Bay Florida, and is acceptable for mangrove sustainability. There are no indications that the subsurface source of the salinity will be altered by developments at Graeme Hall Swamp. Salinity levels in the swamp therefore, will be maintained at acceptable levels if the fresh water sources are properly maintained.

The water quality sampling during 1996 also measured nutrient and faecal coliform concentrations in swamp waters; these values generally exceeded acceptable ranges set by the USEPA for recreational waters. These relatively high levels of nutrients and faecal coliforms could be attributable to:

- Direct discharge of urban runoff
- Seepage from septic systems in surrounding residential developments
- Local bird populations
- Pumping for of the sewage treatment plant de-watering.

The levels of nutrients and coliforms must continue to be monitored as the swamp is being developed as a nature reserve and developed as a tourism attraction. Water quality monitoring should be designed to determine sources of excess nutrients and coliforms in the swamp's waters, and management, enforcement, and rehabilitation programs must be developed to control and/or eliminate these pollutants. Nutrients and coliforms must be particularly monitored on waters of the West Unit to ensure that the aviary and the increased bird populations at the new ponds do not adversely affect overall water quality in the swamp.

Walkways, trails and maintenance roadways will be located and designed so as not to modify the existing hydrology and water flows, and constructed in a manner to prevent siltation

Fresh water spring outlets should be identified and clearly marked to avoid pollution or destruction. Outlets should be protected from inadvertent pollution or brackish water exposure from the swamp waters

Motorised boating should not be permitted on the lake to prevent disrupting bird populations and prevent shoreline erosion damage.

Physical and chemical weathering processes, including soil profile development and erosion from natural forces will be allowed to continue within the swamp unless such processes cause a health or safety problem or damage facilities.

II.7 Vegetation

Graeme Hall Swamp was probably typical West Indian estuarine bay and mangrove swamp vegetation prior to European settlement. The island's vegetative was undergoing relatively dynamic changes, even prior to settlement. The mangrove appear to be one constant in the Barbados vegetation panorama throughout this period of change, however, Graeme Hall Swamp is now the last major brackish water area still remaining in Barbados.

Most of Graeme Hall Swamp is not true "swamp". Rather, it is an assemblage of highly diverse and disturbed land parcels containing a hodgepodge of semi-natural vegetation; including native and exotic species, dry upland weedy species, freshwater marsh and estuarine mangrove species. Some parcels, containing standing water or year-round wet soil, are remnants of what was once the natural tidal mangrove community. The freshwater sedge marsh backing the mangroves appears to be one of the most natural and long-duration plant communities in the swamp.

Long term management of Graeme Hall Swamp vegetation should recognise the dynamic history and current reality of the swamp; i.e., it has a long history of natural influences but an even more dominant history of human influence and change. The swamp provides an opportunity to demonstrate the more than 300 years of vegetation history and change that have occurred since British settlement. These changes include not only vegetation, but also the habitat it provided for the wildlife species that have occurred on the island.

The focus of Graeme Hall Swamp vegetation management therefore, should be to preserve the natural vegetation that characterises a brackish swamp in Barbados, while celebrating the dynamic history of change in the swamp. In general, cutting vegetation should be limited to maintaining trails and tourism areas. The importance of vegetative cover to wildlife cannot be over-emphasised, because a park-like atmosphere does not encourage wildlife. Thickets, shrub-tangles and dense areas of vegetation are necessary to maintain healthy wildlife populations. Diverse ground cover of herbaceous (weedy) species is vital to wildlife species diversity; providing food for numerous insects, small mammals and birds. Dead trees should be allowed to remain in some areas to serve as wildlife "hotels" that are also very useful for the educational programme.

Vegetation management at Graeme Hall Swamp should therefore, include:

- preserving the red mangrove and sedge communities as the basis of the natural vegetation communities in the swamp

- preserving the white mangrove community and allowing it to expand to the property boundary
- preserving and expanding vegetation that typifies a mangrove swamp in Barbados for educational and historical purposes
- providing a diversity of vegetation communities that illustrates the history of vegetation changes in the swamp
- re-introducing certain species known to have previously occurred in Graeme Hall Swamp or other Barbados wetlands
- providing a diversity of vegetation communities that provide habitat for the wildlife, primarily birds, that lived in or visited Barbados
- encouraging a scattering of native tree species in the upland grass and scrub habitats
- strictly controlling introduction of plant species exotic to Barbados; particularly those with the potential to adversely affect the long term sustainability of the "natural" swamp vegetation
- providing adequate intrusion of salt water from the bay to maintain saline conditions conducive to mangrove growth
- providing adequate fresh water flow into the upper marshy area to support the diversity of freshwater marsh species
- maintaining a consistent connection between the mangrove areas and the bay
- encourage a diversity of upland and old-field weedy and flowering species to occupy open ground for wildlife habitat
- renovating some shallow trays in the East Unit to increase diversity of freshwater species and reduce stagnant water in ditches
- monitoring plant community density and diversity to ensure that unwanted exotic species do not "take over" existing plant communities
- traditional fruit gathering from trees by residents only should be permitted and encouraged. Commercial fruit gathering should not be permitted. Fruits may also be gathered by guides for use in interpretive programming.
- removing sources of pollution, excess nutrients, herbicide or pesticide run-off from the drainage basin.

II.8 Wildlife

Barbados never had an extensive land-based fauna, and what did exist generally mirrored the arrival of plants. The now extinct Barbados Racoon probably occurred in the swamp and the rice rat may have been Barbados' only prehistoric native land mammal. It appears that the diversity of nesting and migratory birds in Barbados has remained fairly constant since European colonisation, and up to 100 species of birds may have used Graeme Hall Swamp for nesting, feeding, or as a temporary stopover. Few, if any, wildlife species appear to have been totally eliminated from the swamp.

Barbados has a long history of wildlife species intentionally introduced by humans. All mammal species currently residing in Barbados, with the possible exception of bats, were introduced over the last 300 years. There may, in fact, be more exotic species of wildlife in Barbados now than native species.

II.8.1 Displays and Introductions

Graeme Hall Bird Sanctuary, Inc. and the Ministry of Tourism, with the cooperation of the Advisory Committee on Nature Tourism should develop a clear and enforceable policy on the introduction of exotic species to Graeme Hall Swamp. This policy should also include appropriate conditions for the display and handling of captive birds and other wildlife in Graeme Hall Swamp nature facilities. This policy should specifically address the potential health risks to the animals and to humans of such actions. The policy should require that highest international standards are adopted and maintained.

Caging and maintenance of any captive wildlife (caged, pinioned, or tame) should follow guidelines developed by the American Association of Zoos, Parks and Aquariums (AAZPA) or the American Zoo and Aquarium Association (AZA). The maintenance and health of caged wildlife should be reviewed quarterly by a certified veterinarian, and these reviews should be provided to Graeme Hall Bird Sanctuary, Inc., the Ministry of Tourism and the Advisory Committee on Nature Tourism. The ministry will require that high standards are maintained or the displays removed.

II.8.2 Management

The primary focus of wildlife management in the swamp should be directed toward non-consumptive tourism, nature interpretation, education and promotion of sound conservation principles. Consideration of traditional resident use of wildlife in the nature reserve should be considered only if it is strictly controlled and monitored to ensure resource sustainability and compatibility with overall nature reserve and nature tourism objectives. A precondition of all wildlife management programs is strictly controlled access and visitations by residents and tourists.

Wildlife management in the swamp, like vegetation management, should preserve and enhance the natural species that characterise a brackish swamp in Barbados, and encourage species that demonstrate the dynamic history of change in the swamp. Wildlife management must work together with vegetation management to encourage the development of adequate, suitable habitat to protect existing species and foster attraction of appropriate new species.

Wildlife management at Graeme Hall Swamp should therefore, include:

- Establishing and enforcing nature reserve and bird sanctuary regulations for the entire Graeme Hall Swamp Management Unit
- Prohibiting the introduction or release of new wildlife species to the swamp without appropriate approvals of the Advisory Committee on Nature Tourism and other relevant government agencies
- Strictly regulating the harvest or live capture of any plants or animals within the swamp

- Monitoring habitat and wildlife populations and, as appropriate, modify management strategies to sustain or increase wildlife populations and diversity
- Encouraging scientific research and regular biological surveys of wildlife populations
- Monitoring population levels and the impacts of predatory species on birds and other animals. Control methods for exotic predatory species, such as mongoose, should be established and implemented, as appropriate
- Encouraging development and enforcement of national regulations regarding hunting of migratory birds, release of exotics, and raising of captive wildlife
- Establishing a plan for selective re-introductions of wildlife historically reported in Barbados, and particularly in Graeme Hall Swamp. Encouraging waterfowl and shorebird species previously reported for Barbados should be particularly encouraged
- Establishing educational programs in conjunction with local conservation organisations that emphasise the wildlife heritage of Barbados. Encourage efforts to establish and enforce wildlife regulations
- All aspects of facility planning and development, activity programming, maintenance and operations must include potential effects on wildlife populations in the swamp
- Emphasising the aesthetic, ecological, recreational, scientific and historical values of wildlife to visitors in a natural setting
- Providing special protection for areas or habitats that support species that are rare or unique in Barbados
- Emphasising natural measures for wildlife habitat development, minimising the use of structures such as waterfowl nesting boxes, and designing artificial structures to blend with the natural habitat
- Permitting wildlife populations in the swamp to interact naturally, and instituting measures to protect threatened species only after consultation with appropriate scientists
- Monitoring and controlling visitor numbers, timing and spatial access to the facility to minimise disturbances to wildlife species during critical and sensitive stages of their life cycle
- Managing the lake and the artificial ponds for natural production of fish and aquatic organisms, and limiting stocking to restoration of species typical of an original Barbados coastal wetland
- Emphasising visitor management over animal management in any potential conflicts between visitors and wildlife species
- Emphasising wildlife diversity and numbers that represent an original Barbados coastal wetland, and introducing species only to re-establish previously present populations
- Assessing all implications of re-introductions to the existing plant and animal life in the swamp
- Monitoring and managing bird watching activities to ensure that they are limited to times, places and methods that do not cause changes in bird behaviour or distribution in the swamp

- ❑ Removing wildlife species that were accidentally released or introduced and are not compatible with an original Barbados coastal
- ❑ Encouraging regulations to prohibit shooting or trapping of wildlife within the buffer zone.

II.8.3 Species Recommendation

Some wildlife species, because of their uniqueness or contribution to the overall ecological stability of the swamp, need additional attention during the development of the biophysical and nature tourism plans.

Yellow Warbler

Scientific data on the Barbados Yellow Warbler is very limited. Their population in the swamp appears to be dependent on access to dense mangrove stands, and is sensitive to disruptive activities during critical stages of its life cycle. The following management recommendations, which are purposely conservative to protect this unique Barbados bird species, should remain in effect until additional data allows management adjustments.

- ❑ Maintain and expand the dense mangrove areas of the swamp
- ❑ Develop specific public use guidelines to minimise disturbing Yellow Warblers during nesting season
- ❑ Encourage research on Yellow Warblers, with special focus on diet and breeding biology
- ❑ Vigorously enforce prohibition of firearms and bird collecting in the swamp
- ❑ Prohibit use of insecticides in the swamp
- ❑ Develop and distribute educational information about the Yellow Warbler and its unique role in Barbados

Other Warblers

- ❑ Encourage vegetative diversity favoured by traditional warbler migrants
- ❑ Monitor stop-over population numbers by species

Wading Birds

- ❑ Cattle Egret: monitor population numbers, nesting and behaviour during the period that the solid waste site is moved to Greenlands
- ❑ Other Egrets, Little Blue, Green, Great Blue, and Night Herons: monitor population numbers, nesting and behaviour during the development and operation of the nature attraction

Gallinules and Rails

- ❑ Sustain grass-covered nesting areas around the canals

Shorebirds

- ❑ Monitor water depth and shorebird numbers during migration to evaluate success of pond creation and management for shorebird utilisation

- Encourage nation-wide hunting moratorium on all migratory birds

Osprey

- Build a nesting platform in the West Unit, possibly on the island in the lake
- Enhance water exchange between the bay and the swamp to increase fish diversity in the swamp and encourage fish eating birds such as Osprey

Mongoose

- Monitor mongoose population numbers in the swamp to determine if population controls are required do reduce predation on ground nesting birds, reptiles and other species

Other species-to be determined

- Monitor new wildlife species diversity and numbers as the swamp rejuvenates and new species become more important in the swamp's environment.

II.8.4 Wildlife Management Plan

An integrated Wildlife Habitat Management Plan (WHMP) for the entire Graeme Hall Swamp Management Unit should be a major component of biophysical planning and nature tourism development. This plan will direct measures for protecting and improving the wildlife in the swamp, but it will also guide acceptable nature tourism activities. Key elements of the WHMP include:

- Goals and Objectives to Meet the Management Philosophy for GHS
- Baseline Data and Monitoring Plan: Biological and Physical Surveys
- Data Analysis and Responsive Management Evaluation System
- Species Specific Management Guidelines.

The framework of a Wildlife Habitat Management Plan for Graeme Hall Swamp would include the following components. As the biophysical plans are being completed, this plan can be expanded. It should be considered a living document, in that it can be modified as information in the swamp increases.

II.8.4.1 Goals and Objectives to Meet the Management Plan

The goals of the Wildlife Habitat Management Plan could be:

- to protect and enhance the wetland ecosystem
- to enhance its biodiversity and sustainability
- to establish an environmentally and economically sustainable nature tourism attractions.

The specific objectives of the Wildlife Habitat Management Plan could be:

- to mitigate for previous habitat degradation caused by sewage, silt, dumping, digging, and vegetation removal
- to develop a series of open water areas to encourage vegetation and wildlife representative of a Barbados wetland

- to enhance natural flow of water and organisms between the swamp and the bay
- to develop a public and private partnership to encourage and support wildlife conservation and management programmes at the swamp
- to develop an on-going monitoring program that allows management practices to be adjusted in a timely manner to enhance wildlife populations.

II.8.4.2 Baseline Data and Monitoring Plan: Biological and Physical Surveys

Comprehensive baseline data is the key to an effective management plan. This baseline data requires initial and systematic follow-up studies on wildlife populations and their critical habitats. A summary of historical data can only be considered the first step. In some cases, there may be the need to conduct observations daily and to record and store information in a form easily and quickly available to operating and research personnel. Observational information considerations include:

- species documentation (including specimens and photographs maintained in a systematics museum)
- qualitative data: what is there and its distribution, mapping where things occur
- quantitative data: population information, habitat quality
- change documentation: record species and habitat changes and incidents
- consistent data collection methodologies: type of measurement systems and equipment, length of observations, data recording format
- data collection location: set methods for selecting and marking observation locations
- data collection schedule: frequency, times of day for wildlife and human activities.

Data should be collected in a consistent format, recorded in both electronic and hard-copy format, and stored in a safe manner. Such data, after on a few short years, is worth a considerable amount of money and should be treated appropriately.

II.8.4.3 Data Analysis and Responsive Management Evaluation System

Wildlife data, no matter how relevant, only has value if a management system exists to adequately use the data. The wildlife management plan should include provision for a formal review of the status of the wildlife "system" at least twice a year. This systematic review will give managers an opportunity to be responsive to needed changes and adjust management practices consistent with the WHMP.

Wildlife management areas that should be evaluated for management responses include:

- water quality and pollution sources
- hydrological changes
- soil conditions (pH, salinity, saturation - porosity, compaction, fertility, erosion)
- exotic incursions and population levels
- population levels and health of key indicator species

- plant community species diversity and density
- key plant species reproductive success (particularly diversity of Red and White Mangrove size classes).

A major wildlife inventory should be conducted every 2-3 years; oftener if there have been substantial increases in visitation to the nature reserve. These Inventories should include:

- species present
- general population status and distribution
- general habitat conditions
- identification of critical areas; nesting, feeding etc.)
- critical habitat status for uncommon or unique species
- identification of prime areas for wildlife observation in the natural setting.

II.9 Aquatic Fauna and Flora

The aquatic fauna of Graeme Hall Swamp includes insects, crustaceans, amphibians and fish. Most of this aquatic fauna has been dependent on the interconnection between the swamp and the ocean. Because of the significant changes that have occurred within and surrounding the swamp during the last two centuries, the fish populations and the aquatic fauna of the swamp are depauperate compared to other natural, Caribbean mangrove ecosystems. Nonetheless, Graeme Hall Swamp provides the only opportunity for residents and visitors to experience a Barbadian coastal wetland system.

The aquatic flora and fauna are an integral component of the swamp ecosystem, and aquatic primary and secondary production may account for much of the total productivity of the swamp. This production will likely provide the trophic base for many of the wildlife species that will be a major component of the nature attraction in the swamp.

Effective rehabilitation and management of the fisheries and aquatic fauna of the swamp will require that an improved interaction between the sea and the swamp is created. Other rehabilitation and restoration measures include improving the swamp water quality and careful consideration to which the fisheries and aquatic populations are used—with an emphasis on non-consumptive use.

II.9.1 Hydrological Conditions Affecting Fish

The flora and fauna of the swamp is influenced, if not determined, by the salinity gradient that exists due to the subsurface saline migration and the connection to the sea. More importantly, the connection to the sea strongly influences the marine species that enter the swamp. This interconnection is particularly important because of the seagrass beds that are still prevalent in St. Lawrence Bay.

Improvements to the sea-swamp connection could result in significant increases in fish diversity in the swamp. There are many more marine species in the inshore waters of Barbados known to enter mangrove swamps but have not been reported in the swamp; including several species of mullets,

snappers, jacks and barracuda. There are at least 51 marine species in Barbados that are known to inhabit estuaries and, if appropriate conditions were available, the diversity of fish in Graeme Hall Swamp could be substantially increased.

II.9.2 Potential Tourism Activities

II.9.2.1 Observational and Educational Tours

Aquatic fauna presents an interesting variety of life histories and biology, and those that are indigenous are of particular interest to illustrate the biogeographical linkages of Barbados with adjacent insular and continental land areas. Providing interpretive information on the aquatic fauna will enhance the natural history experience for visitors and compliment the more obvious wildlife species.

Several of the aquatic species can be observed from carefully chosen trails and boardwalks that are located to allow visitors viewing opportunities of the aquatic environment. The fish species are best seen by day. Fish species that could have observational and educational value in the swamp include the tarpon, the snook, and tilapia.

Tarpon are coastal marine pelagic predators that reach lengths of 240 Construction Manager and weights of 130 kg. They are a favourite among anglers because of their energetic flight when hooked. They are not good eating.

The snook is also a coastal marine predator that averages 2-3 kg in weight. They are popular sport fish throughout their range, are considered good eating and are usually kept by anglers. Tilapia were introduced to the Caribbean from Africa, and are found in slow rivers, ponds and coastal lagoons. They can withstand a wide range of salinity, quickly increase in numbers, and become overcrowded and stunted. They are considered good eating and are caught by recreational fishers wherever they occur.

Many of the crustacean species are best seen at night. The eyes of the nocturnal crustaceans display bright red when illuminated in the dark. Carefully controlled night tours with subdued torches therefore, can provide an exhilarating experience for visitors. The enormous "land" crab(the swampy) and the freshwater shrimp of the genus *Macrobrachium* are best seen at night, but the fiddler crab can be seen during both day and night.

The swampy crab is the largest crab in the eastern Caribbean and it is heavily harvested throughout the region. They occupy conspicuous burrows in low-lying swampy coastal areas, seldom go far from their burrows in day but are active at night.

The fiddler crab is widely distributed throughout the Caribbean and is abundant in the flatter mud areas scattered throughout the swamp. Juveniles and adults are essentially terrestrial, and a quiet observer can readily witness foraging, courtship and mate choice behaviour by the males with the unique fiddle shaped claw.

The common crayfish *Macrobrachium faustinum* are freshwater shrimp with larval development occurring in the sea or in very saline water. They are inhabitants of quieter reaches of streams and swamps. They rest submerged on the bottom by day but become active at night when a beam of light

can readily detect them swimming and crawling on the bottom. The much larger freshwater shrimp *Macrobrachium acanthurus,* which is much larger and more impressive than the existing freshwater shrimp in the swamp, could easily be established.

II.9.2.2 Recreational Fishing

A few fish species in the swamp could provide enjoyable recreational fishing opportunities. The lake has historically been a recreational fishing source for residents of the South Coast. The greatest potential is for children fishing for tilapia, which are abundant in the lake and canals. Although more experienced anglers may prefer tarpon or snook, casting for these species would probably not be compatible with an active nature tourism program. These larger predatory species may also be important in maintaining healthy populations of tilapia.

Fishing if it occurred, should probably be located in one designated fishing area at the lake or at the new pond in the East Unit. It should be limited to a fun, recreational experience for young adults, and it should include a interpretive and aquatic conservation component. Participants must register at the Visitor Centre to receive their permit and their equipment, and they must check in before leaving to record their catch.

II.9.2.3 Aquarium Specimen Collection

Several species of fish in the swamp are suitable for aquariums, and residents have been taking advantage of the resource for some time. Most of the species collected are readily available in aquarium shops, and would not be attractive to serious collectors.

Graeme Hall Swamp does provide an opportunity for children and novice aquarists to collect their own specimens, and to see the conditions in which the fish live in the wild. Hobby collecting could be consistent with the nature attraction if it was restricted to a shallow pond or system of canals that could provide easy access in a restricted space. The collecting area should be connected to the rest of the aquatic system to allow for natural replenishment.

Collectors must register at the Visitor Centre to receive their permit, buckets and a dip net, and a plastic bag to take their catch home. They must check in before leaving to record their catch. They can also be provided with information material on species present in the swamp, on their care and feeding, and on their conservation and management.

II.10 St. Lawrence Bay

The St. Lawrence Bay is the ocean companion to Graeme Hall Swamp. This bay is the home of the most extensive remaining seagrass beds in Barbados, and these seagrass beds are the dominant coastal marine community in St. Lawrence Bay. The seagrass beds are affected by the discharge water from the swamp, but the beds can contribute to the diversity of the aquatic fauna if there is adequate water exchange between the sea and the swamp.

Seagrasses are flowering plants with extensive root and rhizome systems. They exhibit dense leaf development and high growth rates, and rank among the most productive natural ecosystems. They are widely distributed in shallow subtidal areas from the Arctic to the tip of Africa.

The high productivity of seagrasses makes them important in four major coastal food chains:

- Direct grazing of seagrass blades
- Grazing of epiphytes that grow on seagrass blades
- Detrital food chains within the seagrass beds
- Food chains based on detrital material exported from seagrass beds.

Seagrass beds are important to coastal fisheries because of their high productivity. Adults of many species of commercially harvested fish migrate from coral reefs to seagrass beds at night to feed. A number of studies have shown that coral reefs close to seagrass beds have larger and more diverse reef fish populations than those in areas without seagrass beds. Seagrass beds are also important nursery grounds for commercially harvested fish and marine invertebrates such as crabs, spiny lobsters and shrimp. The beds provide abundant detrital matter as well as micro-shelter from predators, both factors critical to small early life history stages. Seagrass beds in the Caribbean also provide an important habitat for endangered species such as the green turtle.

As a consequence of their shallow, nearshore locations, seagrass beds are particularly vulnerable to coastal activities and land-based pollution. Dredging, filling, land reclamation and accompanying sedimentation, eutrophication, agricultural run-off and industrial pollution are particularly detrimental to seagrass beds.

The seagrass beds in St. Lawrence Bay have undergone a 40 percent reduction in cover between 1969 and 1994, with an accelerated loss in recent years. Construction of the Sewage Treatment Plant at Graeme Hall Swamp resulted in significantly increased flushing of swamp water into the bay. This increased flushing of swamp water produced a strong negative effect on seagrass viability in the bay. This adverse effect of the artificial discharge indicated that management measures to improve water quality in Graeme Hall Swamp would have a positive effect on seagrass beds in St. Lawrence Bay. This, in turn, could contribute to increased faunal abundance and diversity in the swamp if the swamp water quality is improved and if the water exchange between the swamp and the bay is improved.

The entire St. Lawrence Bay, and particularly the Seagrass beds within the bay will play an increasingly important role in the successful development of Graeme Hall Swamp when the water exchange is improved. The bay should therefore, be designated as a protected area under provisions of the proposed "Coastal Zone Management Plan".

II.II Mosquito Control

The mosquito population of Graeme Hall Swamp should be monitored and, where necessary, controlled if they present a potential public health hazard to residents and visitors. Control methods should be customised to identified target species of mosquitoes, and implemented in a manner that prevents undesirable impacts to the flora and fauna of the swamp.

The mosquito control program comprises two important components; 1) a trapping and population monitoring program; and, 2) preventative, control and treatment protocol.

A regularly conducted and statistically valid sampling program of mosquito populations in Graeme Hall Swamp is the key to eliminating mosquito nuisance and disease problems. The Ministry of Health should undertake systematic mosquito sampling in Graeme Hall Swamp that is consistent with World Health Organisation guidelines, and that provides statistically reliable mosquito numbers by species.

Biological controls and prevention should be the mosquito control method of choice. Control should focus on preventive programmes throughout the Graeme Hall Swamp property as a regularly scheduled maintenance procedure. Major components of mosquito prevention should include enhancing populations of insectivorous fish and birds, maintaining good water quality, preventing stagnant ponds or water storage areas, and planting of appropriate native vegetation. A moratorium should be placed on harvesting land crabs by digging out burrows, because the digs leave small stagnant ponds that are prime mosquito breeding sites.

General vegetation cutting as a mosquito control measure should not be used for mosquito control in Graeme Hall Swamp. This clearing may actually enhance breeding opportunities for some species of mosquitoes.

Control and treatment protocols should only be used when disease vector species are present in numbers that indicate potential risk to the human population. Only chemicals approved for use by the Ministry of Health and Environment should be used in the swamp. If chemical control is required, chemicals targeted to the problem species should be used whenever possible. Chemicals should be applied in a manner that minimises undesirable effects to flora and fauna.

Residential areas surrounding the swamp may provide significant sources of mosquitoes in the area. These areas should be checked, and water holding trash cleanup programs initiated as required.

11.12 Monitoring

The institutional strengthening recommendations included in Section 9.4 of the Heritage, Nature & Community Tourism report for Subprogramme C include provision for a Nature Tourism Specialist and an Environmental Specialist to prepare model development standards for the National Trail System. These specialists were also designated to prepare operating standards for operation of the National Trail System.

Their expertise is also appropriate for development and operating standards for a Graeme Hall Swamp nature attraction. Their duties therefore, should include assisting in the preparation of development and operating standards within the context of the Tourism Development and Operating Agreement for the Graeme Hall nature reserve.

Their duties should also include assisting in the preparation of a Limits of Acceptable Change Program for the Graeme Hall nature reserve. The development and operating standards will provide a sound base from which to develop an operational programme for Limits of Acceptable Change.

II.12.1 Development Standards

Development standards, and the companion operating standards, are the keys to a successful and sustainable nature tourism attraction at Graeme Hall Swamp. The most important consideration of these standards is the maintenance of an international quality product that will provide a satisfactory experience for both residents and tourist alike. Considerations that will be important facility and program components of the nature attraction include:

- What are the product inclusion criteria regarding location, features and attractions
- What are the product development quality standards regarding facilities and services
- What are the security and maintenance considerations required for development
- What are the revenue and cost considerations associated with development
- What are the organisational and management requirements that will ensure consistency with established operating standards.

It is important also to incorporate the Limits of Acceptable Change concepts into all the decision-making process for development standards.

II.12.2 Operating Standards

Once development considerations are completed and the nature attraction is being established, the maintenance of established operating standards will be the next important consideration for the nature attraction. The most important of these operating considerations is the compliance with an established program of Limits of Acceptable Change which will be the most important factor governing maintenance of product quality standards.

Other important operating standards include maintenance of adequate revenues and cost control, and adequate provision of security and maintenance during trail operation. Provision of adequate reserve funds to maintain and upgrade product quality will be a critical consideration in maintaining product sustainability.

II.12.3 Limits of Acceptable Change

Development of a nature tourism attraction at Graeme Hall Swamp will entail biophysical limitations to maintain environmental sustainability in the swamp and social limitations to maintain economic sustainability. These limitations depend upon a realistic and practical development and operating system that manages use within these limitations.

This question of managing capacity and use has been the subject of intense research world-wide over the last decade. Initial research efforts focused was on a concept called "carrying capacity", which was derived from a biological concept that defined the number of animals of a particular species that could be sustained on a given area of land. This concept was gradually incorporated into outdoor recreation planning and tourism development because it provided a seemingly objective and scientific process for making politically contentious decisions.

The concept of carrying capacity has come under criticism in recent years. These criticisms include:

- an emphasise on physical and biological properties at the exclusion of social considerations
- inadequate distinction between scientific issues and value issues
- the assumption of fixed and determinate limits to use
- an undue focus on level of use while ignoring types and timing of use.

These limitations of carrying capacity generated an evolving body of literature that developed a framework for managing recreational use and its associated impacts that attempted to incorporate a broader spectrum of considerations into recreational planning. The major evaluation and management systems that have evolved from this research include the concept of Visitor Impact Management (VIM), Visitor Experience and Resource Protection (VERP), and Limits of Acceptable Change (LAC). The concept of Limits of Acceptable Change has recently been expanded beyond the area of recreational use to the management of protected areas and land use planning. This concept has been proposed, for example, as a framework to manage parks in Latin America and the Dutch Antilles.

The important distinction between Limits of Acceptable Change and Carrying Capacity is that Limits of Acceptable Change focuses on management of conditions rather than use levels. It is designed to establish a clear and explicit measure of what constitutes acceptable change and develop management techniques to ensure that the levels of acceptable change are maintained or restored. The Limits of Acceptable Change process consists of the following nine steps, all of which may not be required under all circumstances:

- Identify an areas special values, issues and concerns
- Identify and describe recreation or use opportunity classes or zones
- Select indicators of physical, biological, or social conditions
- Inventory appropriate existing physical, biological and social conditions
- Specify standards for physical, biological and social conditions in each opportunity class
- Identify alternative opportunity class allocations reflecting existing conditions and use issues
- Identify management actions for each alternative
- Evaluate and select a preferred alternative
- Implement actions and monitor conditions.

Once development and management plans for the swamp are completed, it will be important to encourage people to use the swamp; and to recognise the natural, economic, and societal contributions that the swamp makes to the character of Barbados. An ongoing Limits of Acceptable Change system will ensure that the types and levels of use of the swamp are maintained within the limits of the essential biophysical parameters of the swamp that are considered desirable and sustainability.

A permanent monitoring program should be simple and low-cost. It should be developed to systematically collect baseline and comparative data to measure changes in visitor use and sensitive biophysical parameters. The monitoring parameters will essentially be a systematic and on-going

extension of the baseline data parameters set out in the integrated biophysical plan for the swamp, with periodic additions to accommodate changing conditions in the swamp.

These monitoring efforts should be co-ordinated with all other research being conducted in the swamp. Monitoring and research can be consumptive and harmful if not properly managed. Non-consumptive data collection should be emphasised for research and monitoring due to the fragile nature of some Graeme Hall Swamp constituents. Populations can be damaged by over-collection and species trapping and excessive observations can disrupt normal territories and behaviour patterns if not carefully managed. Trapping and consistent removal of mammals, insects or fish within the same seasons may also be harmful, and collections should be distributed throughout the year. Collections during breeding and nesting seasons should be minimised; particularly for species with low populations that could be jeopardised harvesting.

II.12.4 Visitor Management Parameters

Current and accurate information on the numbers and characteristics of attraction clients is an ongoing necessity for almost all aspects of attraction management and administration. This information is required to understand user needs and desires, detect trends and accurately plan for future use, develop capital and staff budgets, establish user fees, allocate personnel, and schedule construction and maintenance.

Contemporary information on how the attraction is performing relative to long-term plans is necessary for attraction management. The attraction's operating plan should include monitoring systems and regular reporting requirements for all significant aspects of its operations. This reporting will ensure adequate information is available to evaluate attraction performance, update operating procedures, and regularly revision the business plan.

The attraction's visitor information system should collect basic data on visitor characteristics. The distribution of visitor number over time and the characteristics of the visitors are important for basic attraction planning. They are also important information for the Limits of Acceptable Change system for visitor management changes to minimise adverse impacts to the swamp.

Basic characteristics that should be included in a visitor information system include:

- Basic entry figures
- Arrival modes
- Visitor origins
- Socio-demographic characteristics
- Attraction activity patterns
- Peak usage periods
- Length of stay
- Visitor satisfaction information
- Visitor suggestions.

II.12.5 Biophysical Parameters

The biophysical parameters of the Limits of Acceptable Change system should be designed to monitor the essential environmental characteristics of Graeme Hall Swamp. These parameters should focus on parameters that have significance in their own right (e.g., because they are rare or unique, they are important to the attraction drawing power, or because they are unique indicator species). Parameters that are important to large numbers of other components of the swamps system should also be included.

The final set of biophysical parameters will be established when the biophysical plans and the integrated Tourism Management Plan are completed. Where appropriate, these parameters should also be monitored in the buffer zone. The following biophysical parameters should be included for consideration in the Limits of Acceptable Change system:

- Water quality
- Nutrients and pathogens
- Pollution sources
- Salinity
- Hydrology and water flow changes
- Water exchange and marine species exchange between sea and swamp
- Soil conditions in selected areas (pH, salinity, saturation - porosity, compaction, fertility, erosion)
- Exotic incursions and population levels
- Key animal indicator species, including distribution and abundance
- Key aquatic indicator species, including distribution and abundance
- Common wildlife species tourism attraction characteristics (ease of viewing, movements, home range)
- Plant community species diversity, density, reproductive success (Red and White Mangrove particularly).
- Animal and plant diseases
- Mosquito monitoring and control
- Resource harvesting and collections.

II.12.6 Water Quality

Four permanent, water quality monitoring stations are recommended to represent critical flow pathways within the major hydrological systems within the swamp. These stations are designed to monitor the following characteristics:

- Water quality within the lake (LTM-02)
- Water quality within the primary drainage channel (LTM-01)

- Water quality at the point of flow from the eastern swamp to the lake (LTM-03)
- Water quality within the dug channels near the sewage treatment plant (LTM-04).

The water quality station within the lake should consist of a composite sample taken at the surface and bottom at the four corners of the lake. All other samples can be single grab samples.

The parameters to be sampled should be the same as the baseline parameters used for this study (see Part I: Graeme Hall Swamp Today). Samples should be taken on a quarterly basis with two samples during the wet season and two samples during the dry conditions.

II.12.7 Vegetation Parameters

Four to eight permanent transects were originally planned as a baseline for swamp vegetation. These same transects were designed to be continued at least twice a year to monitor vegetation changes once in the wet season and once in the dry season. An index of similarity could then be developed to determine necessary changes to management strategies.

Two of the four vegetation transects established for baseline data were destroyed during landscaping and pond development on the West Unit during the spring of 1997. Vegetation on the area traversed by these transects was also eliminated; negating any value or long-term use of the baseline information collected on those transects. When the development plans in the West Unit have stabilised, these transects should be replaced to provide a comprehensive picture of overall vegetation changes on the swamp.

Permanent vegetation transects do not require extensive botanical knowledge to monitor, and they can be checked as part of a visitor education program. Guides can be trained to recognise the known species using pressed or photocopied plant materials. Unknown species can be sent to the University of the West Indies for identification.

The same methodology used to gather baseline data should be used to create an ongoing monitoring program. This monitoring program should include:

- Train guides to carry out the monitoring program
- Collect data in a consistent manner and store as hard copy and in a computer database
- Have data evaluated by scientists who can prescribe responsive management
- Put a responsive management plan into place
- Establish the objectives for species diversity and mangrove revitalisation
- Establish limitations for acceptable change
- Implement methods for protection or enhancement of certain species when conditions warrant.

12. Implementation

12.1 Legislation and Policy

There where a number of Barbados Statutes prior to 1997 with application to the protection of coastal resources. The most directly relevant to Graeme Hall Swamp include:

Beach Protection Act – primarily concerns the taking of prohibited material from (e.g., sand mining), and the depositing of waste matter on, the foreshore.

Fisheries Regulation Act – deals with four specific areas of fisheries regulation; prohibits the capture of turtles, emphasises preservation of sea eggs, prohibits use of explosives and noxious substances to take fish, and regulates whale fishing.

Marine Areas (Preservation and Enhancement) Act – primarily concerns the conservation and protection of marine life in the submarine area. Addresses the establishment of underwater parks; restricted areas may be designated for the preservation and enhancement of natural beauty, protection of flora and fauna, enjoyment of the public and scientific study and research.

Marine Boundaries and Jurisdiction Act – defines the legal marine boundaries of the country and specifies the extent of jurisdiction within the Exclusive Economic Zone. Includes the exploration, exploitation, conservation, protection or management of the natural living and non-living resources of the seabed, subsoil and adjacent waters.

Barbados Territorial Waters Act – sets the limits of territorial waters and allows the making of regulations related to preservation of the marine environment, the prevention of pollution and control of fishing.

National Conservation Commission Act – primarily concerns NCC responsibilities to conserve the natural beauty, topographic features, historic buildings, sites and monuments of Barbados.

Shipping (Oil Pollution) Act, 1994 – generally concerns the discharge of oil, oil residues and ballast water from ships into the sea, the overall intent being the prevention of oil pollution of territorial waters.

Because Barbados is a small island country there is a direct interface between land and sea; terrestrial activity (even that which is relatively far inland) rapidly impinges upon the coastal zone. Thus, there are many other Statutes related to use of the land that could also be included in the above list.

Low priority was placed upon sound environmental management prior to the 1990's, and there had been progressive deterioration of the coastal environment due to untreated effluent discharge, sand mining of beaches, poor waste management practices, deforestation and increasing building development. In the early 1990's, there was growing recognition that most of the existing

environmental legislation was somewhat dated and implementing regulations had not kept pace with the reality of contemporary society. It was determined to draft a new comprehensive environmental-specific legislation to overcome the problems of uncoordinated institutional focus and uncertain enforcement.

The new Act, which is at the draft bill stage, is referred to as the *Coastal Zone Management Act, 1997*. This Act "makes provision for a more effective management of the coastal resources of Barbados, for the conservation and enhancement of those resources and for matters related thereto." The Act contains several parts which are intended to group together, in a comprehensive manner, sections contained in some of the above mentioned Acts which pertain directly to the coastal zone.

Part II of the Act, The Coastal Zone Management Plan and Management Area, calls for the preparation of a coastal zone management plan and an order delineating a coastal zone management area. Within that area, the management plan may include several policies, strategies and standards concerning development and maintenance of structures, environmental impact assessment, water quality, public access, exploitation activities, underwater parks, etc. Of note is the fact the provisions of the *Fisheries Act* and the *Town and Country Planning Act* take precedence over the Coastal Zone Management Act.

Part III contains three subsections. Preservation and Enhancement of Marine Areas deals with the designation of portions of the marine areas of Barbados as restricted areas for purposes of preservation, enhancement and protection of activities as described above for the *Marine Areas (Preservation and Enhancement) Act.* Coral Reef Protection concerns the harvesting and scientific study and research of coral in territorial waters and the EEZ. Beach Protection concerns primarily the removal of material and fouling of the foreshore.

The *Coastal Zone Management Act, 1997* in conjunction with the *Marine Pollution Control Act, 1997*, which makes provisions to prevent, reduce and control pollution of the marine environment of Barbados from whatever source, provides the Government of Barbados with broad legislative powers to ensure the preservation and protection of the island's coastal resources. These Acts are presently in the form of draft bills and are only in the final stages of preparation before being submitted to Parliament. It is assumed that appropriate regulations will be put in place to allow the effective implementation of this legislation.

To demonstrate its commitment to addressing the complex management issues of the coastal zone in an integrated, coordinated and sustainable manner, the Government of Barbados has launched a nation-wide Coastal Conservation Programme. The first phase of this programme comprises the development of a coastal zone management plan for the north, east and south-east coasts.

A review of existing legislation and regulations coupled with discussions with the Ministry of Health and the Environment and the Environmental Management and Land Use Planning project office indicates that there are, presently, no provisions for the designation of a "nature reserve" *per se* and the protection of associated natural resources in Barbados. Currently, the *Marine Areas (Preservation and Enhancement) Act* contains some measures of relevance regarding restricted areas, but these deal specifically with marine resources and underwater parks. As well, the *Wild Birds Protection Act* concerns the protection of scheduled wild birds, but makes no reference to

specific place, such as for example, a bird sanctuary. An attempt could be made to circumvent the specific absence of reference to a nature reserve in the legislation by designating an appropriate type of land use. The use of land is generally governed by the *Town and Country Planning Act*, and it might be possible to make interpretations of that Act to allow uses similar to that which is to be desired in a nature reserve to take place in GHS. However, the Act falls short on measures to conserve and protect natural resources.

There is also no specific mention of a "nature reserve" in the draft bills mentioned in the previous section. However, there is provision for the designation of a coastal management area and strategies, policies and standards regarding the resources in that area. GHS is, in large measure, a coastal resource and could be delimited as a coastal zone management area under the *Coastal Zone Management Act, 1997*, if and when this Act is proclaimed. Subsequently, the appropriate supporting regulations and policies could be prepared which would in effect accomplish the objectives of designation of a nature reserve and conservation and protection of the resources contained therein.

Activities in the catchment area and on the land side periphery are currently controlled by the Town and Country Planning Act and other planning related legislation. The Act primarily concerns development of land in both urban and rural areas and to preserve the amenities thereof. The definition given to development is wide and general and includes: " the carrying out of building, engineering, mining or other operations in, on, over or under any land, the making of any material change in the use of any building or other land or the subdivision of land". The Act contains several provisions dealing with the powers of the Chief Town Planner, the procedures to make planning applications, and details enforcement, penalties and compensation and appeals processes. Of relevance to GHS is that it is a material change to deposit refuse or waste on land. Also of importance to GHS, the Act contains provisions for tree preservation orders when there is a need to preserve trees or woodlands in the interest of amenity.

Other legislation that could possibly come into play in the catchment area includes the *Trees (Preservation) Act*, the *Public Works Act*, the *Highways Act*, the *Prevention of Floods Act* and the *Land Acquisition Act.* All of this legislation, while somewhat old (dating from mid- to late-eighties) if broadly interpreted and effectively enforced is considered to be adequate to control activities in the catchment area such that the sustainability and viability of Graeme Hall Swamp would be assured.

12.2 Capital Investment

Management of the East Unit nature reserve and tourism attraction is recommended to be a public/private partnership between Graeme Hall Swamp, Inc. and the Ministry of Tourism. This partnership will prepare an integrated Tourism Management Plan for all Graeme Hall nature tourism attractions, followed development of a Tourism Development and Operating Agreement for the operation of the East Unit.

The Tourism Management Plan and the Tourism Development and Operating Agreement will include the components and phasing of capital improvements for the nature attraction within the East Unit. The recommended capital investment described below describes the capital investment recommendations to implement the development concept presented in Section 9.

12.2.1 Capital Investment Program

The development concept (Figure 10.1) for the East Unit of Graeme Hall Swamp encompasses a series of site interventions; all designed to provide a nature tourism experience that enhances the visitor's understanding of the swamp ecosystem. It includes:

- an environmentally friendly boardwalk and trail system along which covered viewing and interpretive stations are placed at strategic points
- Interpretive and directional signage along the boardwalk and walking trail routes
- creation of about 10 acres of new ponds in two components
- a viewing tower for shore birds and waterfowl overlooking the new pond
- landscaping at the northern periphery to better define the site and between the new pond system and the sewage treatment plant — to reduce the visual impact of the treatment plant structure
- a perimeter fence for security purposes
- provision of visitor parking including property purchase for the parking area.

These interventions will produce a comprehensive nature product with sound infrastructure for both independent and guided tour interpretation of the East Unit of the swamp. Capital costs for this investment program are shown in Table 10.1 and summarized below:

Investment Program Component	Capital Cost (US $)
Construction	$1,570,600
Start-up Activities	274,884
Total Capital Cost	$2,081,074

The start-up activities include securing project approvals, budgets for start-up marketing (e.g., brochure preparation) and an interpretive plan, and planning, design and construction management services. The interpretive plan will provide the specifications, content and story line for the covered viewing/interpretive stations and plant identification signage.

Exhibit 12.1

omponent	Description/Material	Quantity	Size	Unit	Unit Cost	Total
Perimeter Fence	2m high Perimeter Fence	1	1,400	metres	100	140,000
Sluice Gate Enhancement		1	1		35,000	35,000
Parking Property Purchase (Cost Shared)		1	1		200,000	200,000
Visitor Parking	chip-seal quality	1	4,000	sq. m	90	360,000
Eastern Ponds	new excavation	3	35,000	sq. m		100,000
East Boardwalk	tropical hardwood on posts	1	1,800	metres	300	540,000
East Trails	crushed cinder/marl surface	1	200	metres	150	30,000
Interpretive Signage	weather-proof enameltec	15		sign	2,000	30,000
Marl Road Planting	landscape borders	1	600	sq. m	11	6,600
Viewing Tower	wood, approx. 10 m high	1			8,000	8,000
Plant Identification Signage	weather-proof enamel	50		sign	500	25,000
Perimeter Landscaping	large Tree Plantings	1	800	metres	100	80,000
Wildlife Viewing/Interpretive Station	tropical hardwood	4			4,000	16,000
Construction Total						1,570,600
Contingency @ 15%						*235,590*
Site Intervention Total						*1,806,190*
Project Approvals and Start-up						*5,000*
Start-up Marketing						*10,000*
Marketing						*20,000*
Interpretive Plan						*20,000*
Planning and Design 8%/Construction						*125,648*
Construction Management 6%/Construction						*94,236*
Start-up Activities						*274,884*
Overall Project Cost						*2,081,074*

12.2.2 Investment Program Management

Under the provisions of the proposed public/private partnership, we recommend that the Ministry of Tourism assume responsibility for initiating this investment program. Graeme Hall Bird Sanctuary, Inc. will be a party to the Tourism Development and Operating Agreement for the East Unit. They will also be contracted to operate East Unit facilities when they become operational.

Graeme Hall Bird Sanctuary, Inc. will be developing facilities on the West Unit concurrently with proposed facilities on the East Unit. The partnership should look at taking advantage of the obvious economies of scale available from simultaneous construction. These economies of scale are particularly apparent for construction of new ponds, boardwalks, viewing areas, and interpretive signage (which can be very expensive).

12.2.3 Capital Investment Funding Sources

Capital funding for the Graeme Hall nature reserve is partially required for preservation of the nature reserve and providing access to this reserve to the people of Barbados, and partially as a financial investment in a nature tourism attraction. The nature reserve and public access is an investment in the public heritage of the country. The nature tourism attraction is an investment that is expected to

eventually repay a portion of the original capital investment but, more importantly, to provide a revenue stream that will defray the costs of maintaining and operating the nature reserve. The integrated nature attraction at Graeme Hall Swamp will be a significant addition to the tourism product of Barbados and, as such, will attract tourism revenues to the country.

Capital funding for the Graeme Hall nature reserve will be the responsibility of the owner, the Government of Barbados. Funds could come from a variety of national and international sources. Potential funding from internal sources include:

- **Land Tax.** This tax is currently 1% of assessed property value with a minimum $50 payment. This tax collected an estimated Bds $60 million in 1997. A 3.5% surcharge on this tax for one year for natural heritage preservation would generate enough revenues to pay for the proposed capital investment in Graeme Hall Swamp nature reserve. This action would likely be met with substantial opposition because property valuations and taxes are generally a sensitive issue. It would also place the burden for nature reserve improvements on property owners, rather than Barbadian society in general.
- **Income Tax.** Personal income taxes are currently 25% for the first Bds $24,200 and 40% thereafter. Increasing this tax may be a more equitable distribution of burden, but is also likely to be fiercely opposed. Also, there is no precedent for allocating a specific portion of income taxes for a dedicated purpose.
- **Special green or tourism tax.** Such a "special tax" would contradict establishment of the VAT, which was initiated to replace the many different, small taxes and to streamline tax collection procedures in the country. A tourism related tax would be, in effect, double charging because the business plan anticipates that most of the annual revenues for operations and maintenance for the nature attraction are derived from tourism visits.
- **A Philanthropic Trust.** This would allow Barbadian residents and corporations to make tax-deductible donations to a trust with the explicit allocation of the funds raised to Graeme Hall Swamp. This approach has been used with considerable success in many jurisdictions. It is difficult to estimate the total funds this might generate on an annual basis. For illustration purposes, if each of the 75,170 household (1990) in the country contribute Bds $5, the total fund would be $375,850. The corporate sector could be invited to match these donations, increasing the fund to $750,000. There would be fund-raising and administrative expenses. This type of funding requires continual effort and the year-to-year contribution level is always uncertain. This would however, allow Barbarians to take a direct involvement in the preservation and management of the swamp. The Capital Improvements Trust Fund recommended in Section 8 incorporates this approach, but also provides for international donations.

A large number of international organisations can provide grants and soft loans for Graeme Hall Swamp capital improvements. Many of the constituencies supporting these international organisations will benefit from, and actively support, the biological resource of the tropics. These potential sources of funding can be accessed via international conventions that provide financial support, direct assistance from international conservation institutions and foundations, and existing relationships with similar operations in other areas.

An example of potential funding sources that financially support biodiversity strategies, environmental sustainability, ecosystem conservation and habitat protection includes:

International Organizations/Conventions

Convention on Biological Diversity
Global Environment Facility
United Nations Environment Programme
United Nations Development Programme
United Nations Educational, Scientific and Cultural Organization
Food and Agriculture Organization of the United Nations
World Bank
Inter-American Development Bank
Canadian International Development Agency

Non-Governmental Organizations

World Wide Fund for Nature
World Conservation Union
World Resource Institute
Ducks Unlimited
Conservation International
Earth Island Institute

Private and Corporate Foundations

Turner Foundation Inc.
John D. and Catherine T. MacArthur Foundation
Ford Foundation
W.K. Kellog Foundation
American Express

An officer of prime responsibility should be either be hired or designated from within government resources. Initially at least, this function will require a full-time effort. Telephone discussions and written correspondence introduce the project to the various funding sources. These organisations should be assigned priorities (in terms of a ranked order of solicitations) based upon the best "fit" between the funding organisation's mission statement and the development objectives for Graeme Hall Swamp. Each individual organisation has a specific, grant application process that is based upon criteria varying from the general to the prescribed.

Applications, in the form of proposals meeting the requirements must then be submitted for review. Some organisations accept, review and approve applications on a continual basis. Others meet on a predetermined schedule (e.g., quarterly, annually, etc.) to consider proposals. Additionally, some

organisations provide multi-year funding for projects, while annual re-submissions for the same project are required by other organisations. The key to success lies in preparing a succinct proposal that directly addresses the funding criteria of the donor, and tenacious follow-up.

12.3 Institutional Strengthening

The institutional strengthening recommendations included in Section 9.4 of the Heritage, Nature & Community Tourism report for Subprogramme C include provision for a Nature Tourism Specialist and an Environmental Specialist to prepare model development standards for the National Trail System. These specialists were also designated to prepare operating standards for operation of the National Trail System.

Their expertise is also appropriate for development and operating standards for a Graeme Hall Swamp nature attraction. Their duties therefore, should include assisting in the preparation of development and operating standards within the context of the Tourism Development and Operating Agreement for the Graeme Hall nature reserve.

Their duties should also include assisting in the preparation of a Limits of Acceptable Change Program for the Graeme Hall nature reserve. The development and operating standards will provide a sound base from which to develop an operational programme for Limits of Acceptable Change.

12.4 Public Awareness and Community Involvement

Community involvement is including the public in the decision-making process. This can be accomplished by a series of approaches or techniques ranging from consultation to participation. The key difference is the degree to which those involved in the process are able to influence, share in, or control the decision making process.

Consultation includes education and information sharing with the public, with the goal being better decision making. Participation brings the public directly into the decision making process. Community involvement in Graeme Hall Swamp could involve a continuum of degrees of possible involvement, including:

- Persuasion - changing public attitudes without raising the expectations of involvement
- Education – distribution of information to create awareness about the project and issues
- Information sharing and feedback – distribution of information with the intent of receiving and considering public comments
- Consultation – two-way communication between the nature attraction operator and the public based on established mutually accepted objectives
- Joint planning or shared decision making – public representation in the decision making process through voting and decision making authority
- Delegated authority – transfer to the public of responsibilities normally associated with the operator
- Self-determination – process initiated by the public with the operator accepting the outcome.

Public/community involvement in planning matters in Barbados currently occurs primarily through a "town-hall" meeting whereby residents are presented with the parameters of a plan of action and invited to make comments (e.g., sanitary landfill, sewage treatment plant). These interventions are considered to varying degrees when decisions are rendered through the political process.

A public involvement program for Graeme Hall Swamp may involve several of these steps depending on the stage of the project at the time. For obvious reasons, some of the above mentioned techniques are unsuitable for GHS. The most appropriate process may involve a mix of education, consultation and joint planning. Considerations with respect to an education programme are presented elsewhere in this report. The involvement process also includes the Advisory Committee on Nature Tourism.

There are two levels of consultation to be considered for Graeme Hall Swamp. On one dimension, the swamp is a National resource and the people of Barbados have an overall concern for the preservation and good maintenance of the swamp. Thus, they should be kept informed about developments and activities. They should remain abreast of activities so they can take advantage of the unique experiences offered. They should also have a general voice in the operation and planning of future development, such as, for example, expansion of certain elements contained in both the East and West Units as demand warrants.

Informal research indicates that most Barbarians obtain their information from the two national newspapers and CBC-TV, rather than, for example, public meetings. These media should be used to disseminate information about Graeme Hall Swamp. Feedback to swamp operations could take several forms. These include general public debate such as petitions to political representatives and government ministries, letters to the editor, and informal discussions with operators and staff. They also include direct input to Ministry of Tourism or the Advisory Committee on Nature Tourism.

On another dimension, the swamp is a local resource whose operation has the potential to create both positive and negative effects on residents and businesses on the periphery of its boundaries. Positive benefits include the tranquillity and beauty of an ecological treasure, literally at their doorstep. Negative effects could possibly include traffic congestion created by tourist vehicles and tour buses, perceived reduced access to the East Unit, and potentially reduced parking availability at Worthing Beach.

To handle these issues a local committee should be formed with broad representation of residents, business owners and tourism sector operators from the neighbourhood surrounding the swamp. This committee would provide input directly to the operator, by convening "bilateral" meetings, and indirectly to the Advisory Committee on Nature Tourism. In both cases, the basis of mechanisms must be mutually agreed upon (perhaps through facilitated dialogue).

The key to successful community involvement will not hinge upon the prevention of conflict, but rather, upon the recognition of the importance of the resource as a National asset that will benefit all communities in the country. The challenge is to create a dynamic link between the people and the operator that results in the development of continually enhanced programming that is relevant and accessible to the people of Barbados.

12.5 Economic Development Linkages

Tourism attractions and activities at Graeme Hall Swamp have the potential to create meaningful economic development opportunities for the people of Barbados. In many businesses and industries, entry to the marketplace requires substantial capital investment. However, this is generally not the case for nature based tourism where entry to the sector is relatively inexpensive. Local guiding and interpretation is a concrete example - visitors will enjoy a far more satisfactory experience if it is provided through the eyes and interpretive descriptions of Barbarians. Interpretation requires only local knowledge and a flair for telling a story – no capital equipment is involved.

The tourism attractions at Graeme Hall Swamp will generate direct employment opportunities. But beyond that, it will be necessary to evolve a more comprehensive diversification strategy that explicitly incorporates communities and the Barbadian public as part of the experiences offered to GHS clients. This strategy would also include tourists visiting the South West Coast and the Island in general.

Graeme Hall Swamp occupies a commanding location on the South Coast. Economic opportunities associated with the development of the swamp are boundless, and include:

- creation of community-based crafts and other products
- expanded retail and arts and crafts outlets
- guided tours of local points of heritage and culture interest that tie into the swamp
- community/expert involvement in resource management at the reserve
- tie-ins with related community projects such as walking trails
- joint ventures between communities and swamp operations on provision of related services
- community events and activities coordinated with special events at the swamp
- joint marketing with local products or tourism services
- provision of goods and services.

Graeme Hall Swamp will be a major magnet for tourism visitation to the local area and will thus provide the opportunities for jobs, new businesses and community activities. However, for these opportunities to bear fruit the linkage between swamp operations and potential product development in the region must be created and nurtured. There is a superb opportunity to increase value-added activity and involve local communities and individuals in the benefits of increased tourism traffic. The development of the swamp will lead to greater local marketing and promotion that will lead to more tourism visitation which, in turn, should stimulate further investment in tourism products and services. Because of the increased infrastructure and activity-mix, overall tourism expenditures will increase.

The public/private partnership at Graeme Hall Swamp should therefore:

- Identify specific potential swamp related tourism products, as outlined above
- Develop specific mechanisms to facilitate community participation and involvement, as outlined in the Community Involvement section

- Ensure that local citizens and entrepreneurs are aware of meaningful opportunities for participation in the tourism sector
- Develop the potential for community and local entrepreneur management of tourism resources in Graeme Hall Swamp, where appropriate.

12.6 Scientific Research

One of the most effective investments in the long-term sustainability of the mangrove ecosystem and associated habitats of the Graeme Hall Swamp drainage basin is in research. However, the information gathered in the past, and research activities conducted for the present study demonstrate the lack of information about Graeme Hall Swamp.

Despite hundreds of hours spent annually by bird watchers in the swamp, there is limited documentation about the resident and migratory bird life utilising the area. Very little is known about the other vertebrate or invertebrate groups. The mix of introduced fish species make it difficult to determine what was there originally, what was introduced, and what actual "species names" should be given to what exists at present. The plant surveys provided new information about plants thought rare or not previously found in Barbados. Virtually no information was available about the original herbaceous vegetation in the swamp. All of these points demonstrate the need for research to continue in Graeme Hall Swamp.

The scientific value of the Graeme Hall Swamp as a natural outdoor laboratory should be recognised and encouraged in the integrated Tourism Management Plan. The biophysical and Tourism Management Plans for the swamp should include a section on long-term research needs at the swamp. Outside research should be coordinated with in-house research and monitoring, and incorporated into management and operating plans. This will provide a framework to guide long-term research needs at the swamp, and to evaluate the appropriateness of outside research requests.

Research on the biodiversity, ecological complexity and sustainable use of the swamp should be encouraged in the swamp and the buffer zone and drainage of the swamp. Only research projects that will not adversely modify the physical or biological resources, the natural processes of the swamp, and the aesthetic, recreational and tourism values of the area should be approved. Research and educational activities could be conducted by government agencies, private individuals, international and local universities, NGO's, and nature tourism researchers.

All research proposals must be approved by Graeme Hall Bird Sanctuary, Inc., the Ministry of Tourism and the Advisory Committee on Nature Tourism. A committee of scientists may also be formed to screen and evaluate research proposals that have been submitted for approval. Swamp facilities should be made available to qualified researchers if they agree to provide a copy of the results immediately following completion of the research. Publication of the results in scientific journals should be encouraged.

Graeme Hall Swamp can become a laboratory for understanding tropical mangrove systems, and thus provide a valuable resource for educational institutions in Barbados. Graeme Hall Swamp should establish formal relationships with the University of the West Indies and the public school

system to facilitate information exchange about the swamp. Researchers could "mentor" tourist volunteers to assist with their work, and researchers could provide valuable resources for developing programs, providing lectures, and staff training. Training and Education Services

12.7 Education

The best investment in the long-term sustainability of Graeme Hall Swamp is a proactive education and research programme. These programmes must involve and utilise a diversity of private and public resources for swamp educational and research purposes.

The Visitor Centre will be the focus for providing educational programs and activities to visitors. It should be planned in a way that encourages visitors to seek out the opportunities to participate in various types of educational and interpretive programmes. This emphasis should be carried throughout the facilities to discourage an attitude that the attraction is a passive experience of simply viewing birds and plants. The Centre should have open space where groups can receive lectures and participate in audio-visual programs, the trails should have ample instructional signs, and the tours should be established to teach people about the natural history of the swamp and its importance as its plant and animals life.

Other programs that should be offered to tourists include hands-on programs and classes where participants learn by doing. These should include close-up study of the swamp wildlife and plant communities whenever possible. These programs could originate as part of the swamp education and interpretation programmes, or they could be run by the university, the school system, or by outside tour operators.

The attraction programmes and activities should also include well thought out passive educational programs such as signs, audio-visual programming and lectures by staff and experts for visitors that want to take their time and poke around. These programmes and infrastructure should predominate in the nature reserve.

The Visitor Centre should be responsible for providing informational and educational publications and brochures on the swamp, as well as providing specific publications about the flora and fauna in the swamp.

An informational public service campaign and educational materials on the vital ecosystems of Graeme Hall Swamp and the importance of its drainage basin should be produced by a consortium of Government Ministries such as Tourism, Education and Health and Environment for distribution within the schools and to communities. Developing an understanding and respect among the residents of Barbados for this national treasure is absolutely essential for its long-term conservation.

12.7.1 Staff Training

The development of a marketable and economically viable attraction at Graeme Hall Swamp will require a product that both entertains and educates. Developing educational offerings for visitors is both a science and an art that requires an over-all view of the ecological considerations, a thorough

understanding of specific concepts and an understanding of the expectations and needs (educational and entertainment) of the specific target audiences.

This will require professionals capable of designing and overseeing such a program, well trained professional staff with a dedication to working with the public and with interested community members who wish to participate in the swamp's educational programmes.

A professionally trained manager must be in charge of the educational programs and staff to insure that the quality and standards meet the expectations of today's modern traveller. Staff must be provided with adequate initial training, and with incentives and chances to continue on-going training. This training should include guides as well as all staff who greet, transport, or otherwise encounter the public on-site. All staff training should include the basic philosophy of sustainable management and the natural and cultural history of the swamp and its surrounding environment.

The staff management structure should be organised to encourage advancement from within the organisation based on experience and training. This will provide significant incentives for staff, and particularly guide staff, to feel a part of the organisation and strive for advancement in positions and salary.

At least one professional staff member needs to be knowledgeable about and responsible for on-site quality control of all research projects undertaken on the property. This provides co-ordination between educational programming and on-going research so guided groups do not accidentally interfere with research projects.

12.7.2 Public Education

Graeme Hall Swamp nature attraction can provide an invaluable service to public education in the communities. The staff, programs, and materials developed there can be extremely important for teacher and student training in the natural sciences and conservation. It will also provide an outdoor classroom where both students and teachers can learn from well-trained staff and be guided into the swamp to learn about their natural heritage.

The operational plan for the Graeme Hall Swamp nature attraction should include a comprehensive programme for public schools, teachers, and universities to use the facilities and visit the swamp. Such agreements must be developed in a way that will help, not hinder, tourist operations and economic viability. Because of the proposed entrance policy for students, it is important that scheduling be done so as not to interfere with paying programs. Teaching student groups and teachers is an excellent way in which novice guides can gain experience in working with groups and learning the site. Schools and universities can cooperate as well by providing expertise to the attraction.

12.7.3 Education Components

The most basic requirement for the preservation of a natural or historical resource is the acknowledgement of the value of that resource by those responsible for the funding and regulation creation and enforcement necessary to protect that resource. This acknowledgement of value can be

derived from an educational appreciation of the intrinsic value of the resource to the history and ecology of Barbados.

An appreciation of the intrinsic value of the resource must begin with a basic understanding of the principles of ecology, an appreciation of the importance of history and heritage, and an acceptance of the concept that limitations are necessary to insure sustainability of such valuable resources. Thus, education and understanding is the key. This means education for decision-makers, education for the general public, education for commercial interests, and education for tourists and education for the children who will become the decision-makers and business people. The education programme should not be a propaganda campaign, it must reflect the values of the community and the best, current information of the scientific community. An educational programme is dynamic, it must continually change as the knowledge (scientific, historical, cultural) on which it is based continues to grow and change.

This education programme should include the following components:

- Identify the specific goals and objectives
- Design strategies for meeting these goals and objectives
- Identify the conceptual material to be taught
- Identify the philosophy of the stakeholders and the points of agreement as well as conflicting views
- Establish needed curriculum, infrastructure and staff training programs
- Adapt curriculum and methodology to the multi-cultural tourism audience
- Establish on-going evaluation programme to up-date the body of knowledge and operating philosophy upon which the educational programme is based
- Design sustainable fee capture and budgets.

12.7.3.1 Specific goals and objectives

Goals

The educational programme should provide:

- a foundation for understanding and evaluating the functioning of the biological and physical systems of the swamp and drainage basin
- a basis for identifying the natural, historic and cultural resources of the swamp and for monitoring the status of and impacts to those resources
- a framework for identifying the historical, scientific, regulatory and cultural issues pertinent to the swamp and the drainage basin, and a system for considering and resolving those issues
- an understanding of and appreciation for the value of the natural, historic, and cultural resources f the GHS drainage basin.

Objectives

The educational programme participants should:

- gain an understanding of the importance and functioning of the mangrove ecosystem
- develop a working knowledge of basic environmental principals that affect and influence the physical and biological aspects of the swamp, the drainage basin, and the bay
- experience the wonder of the resources of the swamp and be able to identify the various components of the resource
- gain an understanding of the monitoring and management practices needed to maintain the each component of the resource
- identify the stakeholders in the swamp's resource and recognise the varying viewpoints
- develop a framework for resolving differences and making decisions on swamp issues
- verbalise and internalise the value of the swamp resources to Barbados as a whole
- develop a personal understanding of the swamp and its issues and resources, and identify a personal position within the framework of the decision making process.

12.7.3.2 Design strategies for meeting goals and objectives

Effective strategies to meet the objectives will be dependent upon the specific direction that is selected for the swamp. Some possible strategies include:

- on-site well-planned guided tour programs for local adults and families, for school children and for tourists
- carefully designed on-site self-guided walks with appropriate written maps and guides, and on-site signage
- passive interpretative signage and displays
- museum-like exhibits, both passive and inter-active
- on-line website with information and opportunities for interaction
- create computer and other multi-media curricula that can be used in the schools by teachers to help educate students about the swamp drainage basin and its specific resources
- an educational forum or support organisation to continue passing along the information gained from monitoring studies of the swamp drainage basin and maintain an active community educational effort
- special classes designed for pre-school aged children and school children that provide a hands-on experience with the resources of the swamp
- special adventures for tourists that go beyond the usual tour and incorporate hands-on, in-depth experiences in the swamp drainage basin
- a lecture series designed to bring together interested citizens with the front-line researchers and decision makers on the swamp management plans
- a series of special events held at or featuring the swamp and its resources

- special training classes for school teachers on the swamp resources and curricula available for them to use with their classes
- special training programs for tour operators and guides on the resources of swamp and how they can incorporate these into their programming
- creation of a handout or newsletter for cruise ships to interest them in the swamp, supporting it and to encourage visitation and incorporation into their regular shore visits.

12.7.3.3 Conceptual Materials

Conceptual material to be taught by guides and to be incorporated into the handouts and on signs should be carefully developed and reviewed by experts. Materials must be developed with the following in mind:

- scientific accuracy
- historical accuracy
- appropriate cultural understanding
- ability to be interpreted by tourist from a variety of cultures
- language is clear and promotes accuracy
- material is presented in an interesting manner
- varying age and levels of understanding are addressed
- all senses are incorporated where appropriate into the learning experience
- material is updated to maintain accuracy
- presentations are interactive, using questioning behaviours to involve the audience.

Concepts to be taught should include basic information in the major disciplines as well as more specific thematic areas. These should include:

- Geology and developmental history, fossil history, soils, erosion
- Barbados climate and relationship to past and present ecosystems
- Topography, hydrology and general physical principles affecting the terrain
- Marine and estuarine biology, mangrove ecosystems, fish nursery areas
- Freshwater ecology and resources
- Botany, distribution of plant species, diversity, introduced and exotic species
- Species of particular concern such as sedges, mangroves, yellow warbler, shore birds, wading birds, ducks, fish, land crabs, etc.
- Species of historical or cultural interest such as medicinal plants, edible plants, wildlife used historically.
- Archaeological and anthropological topics

- Historical and current cultural information
- General outdoor recreation topics such as fishing, canoeing, hiking, map reading.

12.7.3.4 Philosophy of stakeholders

Guided programmes and interpretative materials should fairly reflect the various philosophical viewpoints of the stakeholders. Some probable areas of concern might include:

- Consumptive vs. Non-consumptive use of the swamp drainage basin
- Methods for mosquito control and concerns of surrounding residents
- Use of exotic plant species in landscaping and control of exotics
- Exchange of water between the swamp and the bay; beach concerns
- Residents perception of tourism use of traditional areas
- Desire by some for swamp to be eliminated and additional building to make use of land
- Desire for strictly recreational uses of swamp areas with no regard for species protection
- Value of mangrove ecosystem to Barbados as a whole
- Concerns about safety of resident's property bordering the swamp development
- Concerns about management and control of monetary gains from use of swamp area
- Traffic concerns as cruise ship visitors and buses invade swamp area.

12.7.3.5 Curriculum, infrastructure and staff training

The establishment of well-planned curriculum for use with the staff training programs is extremely important for the long-term sustainability of the GHS tourism development programme. Any and all staff contacting the public need specialised training to work with the various aspects of tourism and public education programming.

Staff should be pre-selected for suitability to the type of position for which they are being trained. Guides need to be out-going, have an excellent memory, be dedicated to learning the necessary information and be well practised in delivering that information to visitors in an interesting manner. Habitat management staff should be well versed in biological and ecological principles as well as in the needs of tourism. All staff should be trained in the philosophy of sustainability of the swamp resource.

Some topics that should be included in all training programmes include:

- public safety and first aide, dealing with catastrophes
- communications and organisation
- natural history - ecology, biology, botany, geology, etc.
- cultural history - anthropology, archaeology, architecture, current arts and crafts

- ethics, conservation and business practices
- methods of interpretation - drama, storytelling, characterisations, lectures, presentations
- working with volunteers
- hospitality, manners and visitor expectations
- handling conflicts
- publicity, marketing and public image
- family, gender issues, humour, relationships.

Facilities should plan ahead to allow for a staff training area with space for a resource library, bulletin board space for informational materials and sufficient space for private staff training outside of public areas.

The quality of the overall programme and the guides and other staff to teach it is often directly related to the space devoted up-front to staff training and management.

12.7.3.6 Curriculum for multi-cultural tourism audience

The training programme must take into account the cultural premises of the guides to be effective. Also, the programme being presented by the guides and through interpretative materials must not only reflect the culture of Barbados, it must also be understandable and acceptable to the visitors paying for the experience. Appropriateness for a multi-cultural audience is a very important criterion for any exhibits or presentations. Methodologies are not necessarily the same for all cultural groups.

Americans like multi-media presentations that are fast moving. Some English audiences tend towards more even paced traditional tours. Japanese groups like predictable experiences and some Germans like opportunities to test physical limits. Each group of expected visitors to Barbados needs to be analysed and curriculum considered in respect to that group and their needs. This will result in a more marketable program and in greater visitor satisfaction.

Language translations are particularly sensitive areas. Expressions and naming in one culture or language may have unusual or unexpected connotations in another. Have an expert make translations and discourage guides from attempting to speak in languages with which they are only vaguely familiar to avoid embarrassing or even dangerous mistakes. Efforts at simple phrases are certainly appreciated by visitors but great care should be exercised.

Guides need to be very careful of using humour in their presentations. Not all humour translates well from one culture to another. Gender and sexual issues are very sensitive, particularly among American audiences. Religious and political issues are very dangerous areas of conversation and should not be addressed in interpretative programs except in a historical context if such is pertinent to some aspect of the program.

12.7.3.7 On-going evaluation

Guide training program and curriculum on which all programmes are based should be reviewed and up-date regularly to incorporate the most recent findings in the various disciplines and to include the information gained from the swamp monitoring programs.

12.7.3.8 Sustainable education framework

Fee capture is vital for a sustainable programme that will have sufficient budget to maintain a quality product and keep visitor and tourist interest high. Some minimal equipment will be needed by guides, and infrastructure and management can be costly. Fees should be set at what ever the market will support. Programs priced too low frequently have less visitation than more costly programs due to perceived value by the consumer. Fees need to be set in a way that encourages school children and local use of the swamp as well as tourist use of the area.

12.8 Schedule

Because the Graeme Hall nature reserve is proposed to enter into a public/private partnership with Graeme Hall Bird Sanctuary, Inc. to develop an integrated nature tourism attraction, there are special constraints on implementation.

Graeme Hall Bird Sanctuary, Inc. has a development application pending with Town and Country Planning for their tourism facilities in the West Unit. The overall development concept presented in this report addresses an integrated nature tourism development for Graeme Hall Swamp. The development recommendations incorporate aspects of the integrated development proposed in the Graeme Hall Bird Sanctuary, Inc. application to Town and Country Planning. Pending Government approval of the overall development concepts presented in this report, Town and County Planning should expedite the review and approval process for the Graeme Hall Bird Sanctuary, Inc. application, based on the comprehensive development concept presented in this report.

Graeme Hall Bird Sanctuary, Inc. is also recommending an aggressive development and implementation schedule for the West Unit facilities. As was noted in the capital cost estimates, there are significant economies of scale available if the West and East Unit facilities are development on a relatively comparable time schedule. It would be advantageous therefore, if the Government of Barbados would accelerate the implementation schedule for the Graeme Hall nature reserve and nature attraction to coincide with the development schedule for the West Unit.

Finally, the proposed nature tourism attraction at Graeme Hall Swamp will make a significant contribution to the overall tourism product available on the South Coast. Timely implementation of that facility can only improve the overall tourism climate in Barbados.

13. Economic Viability

The growing trend worldwide is to recognise the economic value of conservation areas. This recognition means that these areas should generate revenues to offset their development and operation costs, and that the facility will provide jobs and economic benefits to their associated communities.

The following Sections provide projected revenues, costs and net cash flow for the Graeme Hall Swamp nature reserve and tourism attraction. These projections assume that the facility operations will be integrated with the Graeme Hall Bird Sanctuary, Inc., and that the operations of the East Unit facilities will be contracted to Graeme Hall Bird Sanctuary, Inc.

The economic projections are based on visitor number projections developed in Subprogramme C. The underlying assumptions for visitor projections are described in the baseline information from the *Subprogramme C Market Analysis Technical Background Report*. Assumptions and methodology to derive revenues and costs are included in the following discussion.

13.1 Visitor Projections

The projected number of visitors to Graeme Hall Swamp Nature includes both tourists and residents. Tourists include visitors arriving by cruise ship and by air (stayover passengers). The visitor number projections assume variable capture rates for all visitor components and represent the percentage of total tourists and residents likely to visit the nature reserve. The basis for these estimates (i.e. total projected number of stayover and cruise tourists and number of residents). A complete explanation of the market analysis methodology is found in the *Subprogramme C Market Analysis Technical Background Report.*

Capture rates for cruise and stayover visitors to Graeme Hall Swamp are expected to increase to 6 and 6.5 percent, respectively by the year 2006 (Exhibit 13.1). These capture rates represent projected percentage of total Barbados tourists that visit Graeme Hall Swamp. Because the site currently has effectively no visitors, visitor number projections are all considered incremental to project improvements.

Exhibit 13.1 Projected Cruise and Stayover Capture Rates for Graeme Hall nature reserve.

	Year							
	1999	2000	2001	2002	2003	2004	2005	2006
Stayover Capture Rate	2.5%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%
Cruise Capture Rate	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%

The number of tourist visits to Graeme Hall Swamp is calculated by multiplying anticipated capture rate by total stayover or cruise tourists. Increased tourist visits over the years is attributable to both

increases in tourism arrivals and increases in tourist capture rates. Exhibit 13.2 illustrates Approximately 45,000 stayover tourist are expected to visit Graeme Hall Swamp nature reserve by the year 2006.

Exhibit 13.2. Projected Stayover Visitors to Graeme Hall Swamp Nature Reserve

Year	Estimated Capture Rate (%)	Estimated Stayover Visitors	Estimated Nature Reserve Site Visits
1999	2.5%	486,175	12,154
2000	3.5%	505,622	17,697
2001	4.0%	528,375	21,135
2002	4.5%	554,794	24,966
2003	5.0%	585,307	29,265
2004	5.5%	617,499	33,962
2005	6.0%	651,462	39,088
2006	6.5%	687,292	44,674

An estimated 50,000 cruise tourists are expected to visit the Graeme Hall Swamp nature reserve in the year 2006 (Exhibit 13.3).

Exhibit 13.3 Projected Cruise Visitors to Graeme Hall Swamp Nature Reserve

Year	Estimated Capture Rate (%)	Estimated of Cruise Visitors	Estimated Nature Reserve Site Visits
1999	2.5%	590,360	14,759
2000	3.0%	619,878	18,596
2001	3.5%	650,872	22,781
2002	4.0%	683,415	27,337
2003	4.5%	717,586	32,291
2004	5.0%	753,465	37,673
2005	5.5%	791,138	43,513
2006	6.0%	830,695	49,842

The number of residents projected to visit the nature reserve was also estimated from the market analysis model of the *Subprogramme C Market Analysis*. This model estimated the incremental capture of residents visiting the project sites and apportioning these incremental visits among all sites.

Approximately 3,200 residents are projected to visit Graeme Hall Swamp nature reserve by the year 2006 (Exhibit 13.4).

Exhibit 13.4 Projected Resident Visitors to Graeme Hall Swamp Nature Reserve

	1999	2000	2001	2002	2003	2004	2005	2006
Resident Increment Due to All Projects	5,791	11,930	21,505	28,478	29,333	30,212	31,119	32,052
Graeme Hall Resident Visitors	579	1,193	2,150	2,848	2,933	3,021	3,112	3,205

13.2 Revenues

Revenues at the Graeme Hall Swamp nature reserve will include visitor gate fees, annual pass fees, donations, special guided tours, and site rentals (i.e. weddings, special events, etc.).

Visitor Gate Fees

Visitors to Graeme Hall Swamp will be given their choice of ticket options:

- entry to nature reserve only
- entry to west unit attractions only
- entry to both nature reserve and west unit attractions.

Approximately 15% of all visitors to Graeme Hall Swamp are projected to only visit the nature reserve. The remaining 85% are projected to visit both the nature reserve and the West Unit attractions. Estimated revenues from visitor gate fees are based on this proportion.

The recommended admission fees were developed to provide adequate revenues for Graeme Hall Swamp nature reserve and, at the same time, reflect a financial incentive to visit all the facilities. This is reflected in the reduced nature reserve proceeds from an admission to visit all facilities. The admission fees used in the order of magnitude cash flow calculations are:

- Nature reserve only (residents and tourists) $10.00 (Bds)
- Nature reserve proceeds from tickets to both facilities $ 5.00 (Bds).

The total admission price to both facilities is dependent upon the final admission price to the Bird Sanctuary only. Assuming a $15.00 admission to fee to the West Unit, a ticket for both attractions of $20.00 would represent 20% savings for the visitor to visit both facilities simultaneously.

The total estimated number of tourist and resident visitors to the nature reserve includes both adults and children. Revenue generated from admission fees has been adjusted to reflect the reduction in overall revenue by assuming 96% of total visitation will be adults and 4% will be children.

Revenue estimates assume that approximately 60% of all tourist visitors to both facilities are generated by tour operators. Total tourist admission revenue has been adjusted downward by 20% to account for the tour operator discount.

Revenues from Other Sources

Resident Annual Passes	An annual family pass for residents of Barbados will be developed to encourage local use of the nature reserve facility. We recommend that this pass be $25.00, and project 500 annual passes will be sold when the nature reserve facilities are completed.
Donations	Donation boxes will be located at both the Visitors Centre and the main exit. We project that visitors donations will average $0.50.
Site Rentals	The nature reserve will be available, by reservation, for special activities such as weddings, conference cocktail parties, etc.). The rental rate during the initial year will be $200.00. We project 75 site rentals will be requested per annum.
Special Guidd Tours	Special guided interpretative tours will be available to visitors to the nature reserve. These special guided tours will be available to visitors in a variety of specific interests such as photography, ornithology and botany. Projected revenue from special guided tours assumed approximately 15 people per tour (at $3.00 per person) and 600 tours per year.
School Programmes	There will be no admission for school programmes.

13.3 Operating Costs

Operating costs have been estimated for salaries, general overhead and administrative expenses. The operating costs have been developed based on the assumption that operating services will be contracted to Graeme Hall Swamp Bird Sanctuary Inc. As such, these costs reflect significant economies of scale based on the simultaneous operation of both facilities.

All operating costs were increased at 4% per annum to account for inflation.

Salaries

The following costs, presented as salary equivalents, are incorporated in the order of magnitude cash flow.

Position	Number of Person Years	Annual Salary
Management	0.5	$80,000
Exhibit Technical Specialist	0.25	$32,000
Marketing and Communications	0.5	$25,000
Accountant/Administrator	0.25	$25,000
Senior Tour Guide (Supervisor)	0.5	$20,000
Junior Tour Guide	3.0	$16,000
Maintenance Manager	0.25	$25,000
Groundsperson	2.0	$16,000
Ecologist	0.25	$60,000
Environmental Assistant	1.0	$16,000
Security Guard	2.0	$20,000

Operating and Administrative Costs

First years cost estimates have been provided for all aspects of general operations and administration. These costs are increased at 4% per annum for the cash flow analysis.

A management fee of 5% of gross revenues to the nature reserve has been included as a cost of the operating contract. The first year estimates for operating and administrative costs are:

Marketing	$20,000
Maintenance (including utilities, equipment)	$20,000
Landscape Supplies	$15,000
Administration (office supplies)	$5,000
Programming	$20,000
Exhibit Upgrade and Maintenance	$15,000
Management Fee	5% of gross revenues

13.4 Economic Viability and Revenue Retention

A 10-year order of magnitude cash flow analysis for the Graeme Hall Swamp nature reserve projects an expected loss in the first two years of operation followed by gradual increases in net revenues (Exhibit 13.5). The cumulative cash flow to the end of the 10-year analysis is approximately $250,000 with a project payback period of 6.2 years (excluding capital costs).

Net revenues beyond the payback period should be submitted to the Nature Reserve Capital Improvement Trust Fund. This dedicated fund will be used for ongoing capital improvements and enhancements within the nature reserve. A description of the fund may be found in Section 7 of this report.

Exhibit I3.5 Order of Magnitude Cash Flow

Site: Graeme Hall Swamp Nature Reserve ($ Bds)

	1999 (Est.)	2000 (Est.)	2001 (Est.)	2002 (Est.)	2003 (Est.)	2004 (Est.)	2005 (Est.)	2006 (Est.)
Tourist Visitation:	**34,727**	**44,449**	**55,708**	**58,493**	**68,071**	**71,636**	**82,600**	**94,516**
Resident Visitation:	**579**	**1,193**	**2,150**	**2,848**	**2,933**	**3,021**	**3,112**	**3,205**
Total Visitation:	**35,306**	**45,642**	**57,858**	**61,341**	**71,004**	**74,657**	**85,712**	**97,721**
Revenues:								
Visitor Gate Fees								
Tourists to Graeme Hall Swamp Only	40,005	51,205	64,176	67,384	78,418	82,524	95,156	108,882
Tourists to Both Facilities	147,589	188,907	236,759	248,597	289,303	304,452	351,051	401,692
Residents to Graeme Hall Swamp Only	834	1,718	3,097	4,101	4,224	4,351	4,481	4,616
Residents to Both Facilities	2,461	5,070	9,139	12,103	12,466	12,840	13,226	13,622
Total Visitor Gate Fees	190,890	246,900	313,171	332,185	384,411	404,167	463,914	528,812
Membership Fees	6,891	7,235	7,597	7,977	8,376	8,794	9,234	9,696
Special Guided Tours	27,000	28,350	29,768	31,256	32,819	34,460	36,183	37,992
Gift Shop Revenue	0	0	0	0	0	0	0	0
Donations	17,653	22,821	28,929	30,671	35,502	37,328	42,856	48,860
Site Rentals	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Total Revenues	***257,434***	***320,306***	***394,464***	***417,089***	***476,107***	***499,749***	***567,186***	***640,360***
Operating Costs:								
Labour Costs	234,000	243,360	253,094	263,218	273,747	284,697	296,085	307,928
Marketing	20,000	20,800	21,632	22,497	23,397	24,333	25,306	26,319
Maintenance	20,000	20,800	21,632	22,497	23,397	24,333	25,306	26,319
Landscaping Supplies	15,000	15,600	16,224	16,873	17,548	18,250	18,980	19,739
Administration	5,000	5,200	5,408	5,624	5,849	6,083	6,327	6,580
Programming	20,000	20,800	21,632	22,497	23,397	24,333	25,306	26,319
Exhibit Upgrade and Maintenance	15,000	15,600	16,224	16,873	17,548	18,250	18,980	19,739
Management Fees	12,872	16,015	19,723	20,854	23,805	24,987	28,359	32,018
Total Costs	***341,872***	***358,175***	***375,570***	***390,935***	***408,689***	***425,266***	***444,649***	***464,960***
Net Revenues	**-84,438**	**-37,869**	**18,895**	**26,154**	**67,418**	**74,483**	**122,537**	**175,400**