

*MANGROVE AND COASTAL WETLANDS
PROTECTION DRAFT POLICY AND REGULATION*

October 1997



U.S. Agency for International Development
Development of Environmental Management Organizations Project
USAID Contract No. 532-0173-C-00-3188-00



Natural Resources Conservation Authority

Technical Support Services, Inc.
Technical Assistance and Training Contractor



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MANGROVE AND COASTAL WETLANDS PROTECTION

DRAFT POLICY AND REGULATION

NEGRIL CASE STUDY

NATURAL RESOURCES CONSERVATION AUTHORITY
COASTAL ZONE MANAGEMENT DIVISION

April 1996

EXECUTIVE SUMMARY

Wetlands commonly called morass represent less than two percent of Jamaica's total surface area, and occur for the most part in the coastal zone. These areas are among the most biologically productive ecosystems, and play a great part in ensuring coastal stability. Coastal wetlands that support mangrove growth are particularly important as marine nurseries and as sources for the harvesting of shellfish.

In addition to the national significance, government has a wider responsibility to conserve wetlands (especially those which are waterfowl habitats) as a signatory to the Ramsar Convention on Wetlands of International Importance.

Government has adopted the mangrove and coastal wetlands protection policy and regulation in order to promote the management of coastal wetlands to ensure that the many benefits they provide are sustained.

The policy sets the following five goals in support of the overall aim of sustainable use of wetlands:

- (i) Establish the guidelines by which wetlands can be developed in order to ensure their continued existence;
- (ii) Bring to an end all activities carried on in wetlands which cause damage to these resources;
- (iii) Maintain the natural diversity of the animals and plants found in wetlands;
- (iv) Maintain the functions and values of Jamaica's wetland resources;
- (v) Integration of wetland functions in planning and development of other resource sectors such as agriculture, forestry, fisheries, ecotourism, and waste management;

In pursuing the goals of the mangrove and coastal wetlands protection policy, government will be guided by the following established principles:

- (a) Wetlands are an important part of Jamaica's coastal resources and their preservation is a key component of coastal area management.
- (b) Wetlands protection can only be achieved by the combined and coordinated effort of individuals, organisations, and communities having an interest in these areas.

- (c) Improved public awareness of the vital functions of wetlands is necessary to ensure conservation of wetlands.

Twenty five specific policy statements are made on how the goals will be achieved, and general information on Jamaica's wetlands as well as recommended regulatory provisions are annexed.

Specifically the policy seeks to:

- * Provide protection against dredging, filling, and other development;
- * Designate wetlands as protected areas;
- * Protect wetlands from pollution particularly industrial effluent sewage, and sediment;
- * Ensure that all developments planned for wetlands are subject to an Environmental Impact Assessment (EIA);
- * Ensure that traditional uses of wetlands are maintained;

OVERVIEW

Wetlands, commonly called morass are among the most biologically productive of all Caribbean ecosystems. Low lying coastal wetlands that support mangrove growth are particularly important as marine nurseries and as sources for the harvesting of shellfish.

The term "Wetlands" refers to a site where plants and animals have become adapted to temporary permanent flooding by saline brackish or fresh water. This document focuses on coastal wetlands and includes permanently or temporary flooded lands with sedge or grass morass, swamp forest or mangroves.

Wetlands represent less than two percent of Jamaica's total surface area, and occur for the most part in the coastal zone.

Awareness of the role played by wetlands in contributing to coastal resource productivity is relatively new, and formerly these areas were regarded as a source of disease, particularly malaria, and a menace to public health. Wetlands destruction was also hastened by draining in an attempt to create agricultural lands particularly for the planting of rice and other moisture-tolerant crops. Extensive marshlands in Jamaica, and elsewhere in the Caribbean, were also drained for crop cultivation including sugar cane.

More recently, the filling of wetlands, particularly coastal wetlands, has resulted from expanding tourism development, as well as from urban growth extending outward from congested central areas.

Marine terminals and warehouses, Freeport sites for industry, and residential subdivisions have replaced coastal wetlands, particularly in estuarine locations. The greatest destruction has occurred in the larger estuaries now used for harbor facilities such as along Hunt's Bay and the Kingston waterfront.

Several attempts to convert wetlands to farmlands have been unsuccessful, and housing developments on drained wetlands are regarded as highly vulnerable to the effects of natural disasters.

The net result has been a major depletion of Jamaica's wetlands, and the degradation of other wetlands near urban areas. The management of these areas must be undertaken with urgency in order to ensure that we will continue to benefit from their many uses.

1. FUNCTION AND USES OF WETLANDS

Despite representing less than two percent of Jamaica's total surface area, wetlands perform invaluable ecological functions in their natural state. The role of coastal wetland ecosystems in maintaining shoreline stability and preserving biodiversity is well established. In addition these areas provide direct socio economic benefits, through human exploitation.

1.1 NATURAL FUNCTIONS OF WETLANDS

(i) Shoreline Protection

Coastal wetlands protect the shoreline from erosion by acting as a buffer against wave action as in the case of coastal mangroves.

(ii) Flood Protection

Wetlands reduce the effect of floods on coastal areas by acting as a sponge and slowing down floodwaters as in the case of coastal marshlands. In the absence of wetlands the full force of floodwaters would cause erosion of river banks, and also kill coral reefs.

(iii) Sediment Trap

Sediment produced by erosion from upland areas settles out when the water flow slows upon entering wetlands. This helps in preventing silting up of rivers, thus preventing flooding of adjoining areas. As a sediment trap, wetlands also protect marine resources such as coral reefs and sea grass beds from being smothered by silt brought down by rivers and streams.

(iv) Wildlife Habitat And Nursery Area

Jamaica's coastal wetlands support a rich indigenous flora, and fauna, with several of the species being endemic. These include, *Grias cauliflora*, the only native representative of the Brazil nut family Lecythidaceae, the swamp palm (*Roystonea princeps*), the thatch palm (*Sabal jamaicensis*), and the naseberry bullet (*Manilkara sideroxylon*).

Wetlands support various species of birds, crabs, fish, shrimps, and the American crocodile. The Black River Morass for example has been described as the best area in Jamaica for all water birds, and is known to be the only area where the flamingo still nests occasionally. Commercially important species using the wetland as a breeding and nursery area include snapper, snook, tarpon, jack, and several species of fresh and brackish water shrimps.

(v) Land Building

Mangrove wetlands are regarded as land builders. Because of their submerged root system, mangroves retard water movement and trap suspended materials and the remains of organisms associated with the mangroves. The accumulation of this organic material contributes to raise the soil level. Continued accumulation of soil, particularly by sea-fringing mangrove stands, builds the shoreline seaward.

1.2 HUMAN EXPLOITATION OF WETLANDS

(i) Timber cutting

Wetland areas provide wood for the making of charcoal, fish pots, and to a lesser extent, racks for oyster farming.

(ii) Fishing/Shrimping

As a habitat for many species of fish and shellfish wetlands are important to Jamaica's fishing industry. The sustainability of Jamaica's fishery is directly dependant upon the habitat provided by wetlands and other coastal systems such as coral reefs. The Black River Lower Morass has traditionally supported an important local shrimp industry.

(iii) Recreation/Tourism

If properly managed, mangrove wetlands can be important in generating ecotourism. Wetlands offer recreational opportunities such as sightseeing, boating, swimming, and sport fishing. Boat excursions into wetlands is gaining increasing popularity as a tourist attraction.

(iv) Scientific/Educational

Mangrove and coastal wetlands can serve as a living laboratory providing opportunity for education and research concerning the ecological, and possibly medicinal value of various species of plants and animals.

(v) Agriculture/Building

Fringe wetland areas may be used successfully for the cultivation of certain crops e.g. sugar cane, and vegetables. It is possible to do some construction in wetlands provided that it does not result in restriction of water flows.

2.0 ISSUES AFFECTING WETLANDS

The major issues affecting wetlands generally result from a lack of recognition of the wide range of benefits -- ecological, economic and scientific --, which they provide. This has led to the conversion of large tracts of coastal wetlands, particularly mangrove communities with no attempt to replace these resources at other sites.

The following are among the major issues affecting wetlands:

(i) Pollution

Pollutants directly affecting wetlands include garbage, sewage, industrial waste (mainly from sugar factories), and oil spills. In addition wetlands are subject to the indirect effects of:

- Contamination by substances that are transported by run-off of storm waters in urban areas;
- Non-point source pollution by agro-chemicals, nutrients, and other materials used in agriculture that are released to streams and rivers and eventually into wetland areas;
- Large scale pumping from coastal aquifers, which affects the water balance inducing saltwater intrusion;

Mangroves tend to trap and concentrate pollutants. The extent to which various types of pollutants, other than oil and sediments, contribute to mangrove destruction is uncertain. However, it is known that in mangrove-fringed estuaries, pollutants, and/or temperature and salinity changes, tends to upset the delicate balance of microscopic life, drastically altering the entire coastal ecosystem.

(ii) Land reclamation (Draining and filling)

Formerly, swamps were regarded mainly as a source of disease, particularly malaria, and a menace to public health. In an era when malaria posed a major threat, such a policy was clearly in the public interest.

More recently, the spiraling cost of land, and the ever increasing demand for dwelling space, has led to the building of extensive communities on cheaper "dumped up" land as one means of providing affordable housing.

Wetlands destruction has also been caused by draining of land for agriculture. Extensive tracts of wetlands in Jamaica have been drained for the planting of rice and other moisture-tolerant crops, as well as for the cultivation of sugar cane.

Wetlands destruction has been shown to result in loss of fishery resources e.g. in the Hunts Bay/Kingston Harbour system. Wetlands destruction is also known to result in the loss of unique species such as the phosphorescent algae, the source of Falmouth's once famous "Glistening Waters".

(iii) Reduced flood control

The draining of wetlands by widening and deepening of wetland rivers has reduced the value of these areas in slowing the run-off of flood waters. This has resulted in the increase of peak fresh water flows to coastal areas contributing to the die-off of coral reefs.

(iv) Fires

Wetlands are destroyed by fires some of which are spontaneous, while some are deliberately set by humans.

(v) Disruption of wildlife habitat

The operation of recreational (guided) tours in wetlands like those being carried out in the Black River lower morass, can have a disruptive effect on local wildlife if not properly controlled;

3.0 GOVERNMENTS ROLE/RESPONSIBILITY AND RESPONSE

The conservation of wetlands can only be achieved by the combined effort of individuals, communities, and government. Nevertheless government must play a leading role in the proper management of these areas. An understanding of the functions and uses of wetlands, as well as the issues affecting wetlands is necessary in order to ensure the sustainable use of these resources.

Government also has a wider responsibility to conserve wetlands (especially those which are waterfowl habitats) as a signatory to the Ramsar Convention on Wetlands of International Importance.

To fulfill these responsibilities with respect to wetlands conservation, government has stated broad aims, to be achieved by accomplishing certain specific goals. Also presented are the key principles guiding the development of the specific policy strategies.

The mangrove and coastal wetlands protection draft policy and regulation complements other coastal zone management initiatives concerning coral reefs, mariculture, pipelines and conduits, marinas, and protected areas.

The policy supports the Draft "Green Paper" Proposals for a System of Protected Areas, which identifies coastal habitats and wetlands as among those resources and areas

requiring protection. In addition the policy supports the objectives of the National Environment Policy, which include providing for the protection and conservation of plants and animal species, particularly endemic species.

4.0 AIM OF THE POLICY

The aim of this policy is to promote the management of coastal wetlands to ensure that the many benefits they provide are sustained.

5.0 GOALS

This overall aim will be achieved by pursuing the following five goals :

- (i) Establish the guidelines by which wetlands can be developed in order to ensure their continued existence;
- (ii) Bring to an end all activities carried on in wetlands which cause damage to these resources;
- (iii) Maintain the natural diversity of the animals and plants found in wetlands;
- (iv) Maintain the functions and values of Jamaica's wetland resources;
- (v) Integration of wetland functions in planning and development of other resource sectors such as agriculture, forestry, fisheries, ecotourism, and waste management;

6.0 KEY PRINCIPLES

In pursuing the goals of the mangrove and coastal wetlands protection policy, government will be guided by the following well-established principles:

- (a) Wetlands are an important part of Jamaica's coastal resources and their preservation is a key component of coastal area management.
- (b) Wetlands protection can only be achieved by the combined and coordinated effort of individuals, organisations, and communities having an interest in these areas.
- (c) Improved public awareness of the vital functions of wetlands is necessary to ensure conservation of wetlands.

7.0 SPECIFIC POLICY STRATEGIES

The stated goals of the policy will be pursued by developing specific strategies to address the main issues and problems affecting Jamaica's wetlands.

7.1 Protection Against Dredging, Filling, and Land Development

Large tracts of coastal wetlands have been drained and filled for agriculture, and urban development. The effect of this on wetland productivity, as well as on the productivity of associated ecosystems has been well documented noticeable.

Strategy

- (i) Any activities which alter the surface hydrology, drainage, tidal ebb and flow or any activities affecting the vegetation, topography, or soil characteristics of coastal wetlands shall be prohibited except by permit certified jointly by NRCA and the local Planning Authority.
- (ii) Issuance of a permit shall be contingent upon the preparation by the applicant of a mitigation plan approved by the permitting authority.

Explanation: *Activities subject to regulation include dredging, excavating or removing soil, silt or sand, flora, fauna or any type of aggregate from coastal wetlands; the filling or depositing of dredged material, marl, aggregates or any type of sewage sludge, garbage or solid waste either directly or indirectly in any coastal wetlands; materially affecting mangrove or other wetlands flora or fauna; or the construction of any structure which directly or indirectly affects the quality or quantity of surface and/or ground water in wetlands.*

7.2 Special Protection Status

Presently there is no specific legislation or mechanism which protects wetlands from indiscriminate and inappropriate exploitation.

Strategy

- (i) All mangrove and coastal wetlands in Jamaica are deemed to be of national interest and are to be accorded protected status.
- (ii) An island-wide wetland management plan designating priority areas for which site specific management and operational plans shall be prepared NRCA.
- (iii) Site specific management and operational plans shall be prepared by NRCA jointly with local planning authorities and environmental NGOs.

Explanation: *The Government of Jamaica has limited resources available for mangrove protection and management, and so it is necessary to concentrate those resources on mangrove wetlands that are deemed to be of priority concern. Although the most important mangrove and coastal wetlands shall be designated as priority protected areas, other mangrove and coastal wetland ecosystems are of sufficient importance to warrant protection against avoidable destruction or degradation.*

7.3 Minimizing Sedimentation from Construction Activities

Significant sediment loads are transported to wetlands areas in gullies, rivers and streams, particularly during periods of heavy rain.

Strategy

- (i) Mangrove and coastal wetlands will be protected from excessive sediment flow from uplands by imposing protective conditions on construction projects.
- (ii) All development on sites of two or more acres must follow prescribed conditions for controlling and minimizing erosion and sedimentation.
- (iii) Periodic monitoring at the building site during construction will be carried out to ensure that prescribed controls and conditions are not ignored.

Explanation: *NRCA can protect some mangrove and coastal wetlands from excessive uplands sediment flow by imposing protective conditions during construction. In the past, controls often recommended in the review of environmental impact statements are frequently ignored during construction.*

7.4 Sustainable Use Of Wetlands

Long term national prosperity depends on the maintenance of good environmental quality. Sustainable development depends therefore on being able to balance development with protection of the environment.

Strategy:

- (i) To the extent practical, and in keeping with best management practices, the multiple use of wetland resources will be encouraged in the interests of sustainable development.
- (ii) Any proposal to use wetlands must give consideration to traditional users.
- (iii) Wetlands will be used in such a way that traditional values and benefits are preserved.

Explanation: While mangrove and other coastal wetlands are to be protected as "areas of national interest", it is recognized that such areas traditionally provide food and fiber to the inhabitants of adjacent communities.

7.5 Effluent Discharge

Wetlands receive industrial wastewaters and sewage directly and indirectly. Some effluent discharges have been occurring for several decades. There are distinct signs that the environment is being overloaded by these discharges.

Strategy:

- (i) No part of a surface or subsurface sewage system including septic tanks, tile fields, soak-away, settling basins or lagoons can be located within 150 feet of a mangrove ecosystem or coastal wetland.
- (ii) The use of dry toilets will be encouraged as well as small scale community systems that provide for maximum removal of nutrients.
- (iii) Discharge standards for industrial effluent will be developed to ensure that assimilative capacity of the environment is not exceeded.

Explanation: Mangrove and coastal wetlands are important habitat for fish and shellfish, so it is essential that sewage and industrial waste inflow into these areas be reduced to the absolute minimum. In the case of preexisting development, measures will be taken to provide technical assistance and other support to mitigate conditions that result in nutrient enrichment in wetlands and near shore coastal waters.

7.6 Innovative Strategies To Protect Wetlands

The providing of incentives can have a positive influence on wetlands conservation.

Strategy

- (i) Financial/Tax incentives will, be provided to private individuals and developers who undertake programs or activities which are deemed to significantly restore, enhance or create wetlands.

Explanation: These measures shall include, but not be limited to: reduced land or other taxes, building bonuses, technical assistance, reduced fees and charges.

7.7 Public Ownership and Custody

Several agencies of the Government, through the Commissioner of Lands (including the Ministry of Agriculture, the Urban Development Corporation, and the PCJ) own or exercise custody over significant mangrove and coastal wetland holdings that are of strategic importance to long-term sustainable development. It is important that these resources be protected bearing in mind the development mandate of these agencies.

Strategies

- (i) Wetlands controlled by government agencies are deemed to be public trust holdings that cannot be alienated except through Cabinet decision following public hearings in the affected parishes.
- (ii) Activities conducted by any agency of the Government of Jamaica involving significant alteration and/or any action involving the transfer of ownership or custody of Crown owned mangrove or coastal wetlands must be reviewed and certified by NRCA as being consistent with national mangrove and wetlands protection policy.

Explanation: *An activity is considered to result in significant alteration of a wetland if it affects either habitat, vegetation or hydrology.*

7.8 Development in Coastal High Hazard Areas

Construction in coastal high hazard areas, including coastal wetlands, increases the risk of property damage and personal injury.

Strategy:

- (i) Hazard mitigation techniques shall be incorporated in the site plan and structural design of developments approved for wetlands and/or adjacent areas.

7.8 Environmental Impact Assessment And Monitoring

Development activities can have a negative effect on the environment. Assessment of such impacts as a part of the planning process can minimize the social and economic costs by preventing damage. This compares to the more expensive alternative of taking corrective action after carrying out the development, or restoring degraded wetland areas.

Strategy

- (i) All proposed modifications, and restoration of wetlands will be subject to an Environmental Impact Assessment (EIA) the result of which will determine whether the proposed action takes place and if so, to what extent.
- (ii) All new development projects planned for wetlands, or adjacent to wetlands will be subject to an EIA to determine the kind of controls necessary.
- (iii) Projects subject to an EIA will be monitored periodically after implementation to assess actual impact, and make a determination as to the continuance of the development.

Explanation: *An EIA is a technical document used as the basis for determining the legally binding environmental management measures to be included into a development plan. The EIA is now recognized as an essential tool in achieving sustainable development.*

7.9 Improving Public Awareness

Increasing understanding of the benefits derived from wetlands, will contribute to a change in attitude towards these areas which continue to be regarded as wastelands by most individuals.

Strategy

- (i) Design and implement a National Public Awareness programme on the values and benefits derived from wetlands, focussing on wetland users, and adjacent communities.
- (ii) Integrate public awareness campaign on wetlands with awareness programmes which target users of other resources.
- (iii) Multimedia dissemination of information on the importance of wetlands.
- (iv) Ensure wide distribution of development guidelines, and regulations for wetland developers.
- (v) Develop and implement pilot demonstration project aimed at improving the management capability of local communities.

ANNEXES

ANNEX 1: GENERAL INFORMATION ON JAMAICA'S MANGROVE WETLAND RESOURCES.

Background

With the growth of Kingston on the south coast, and Montego Bay, Ocho Rios and Port Antonio on the north coast -- and associated harbour and infrastructure development -- much of Jamaica's original mangroves and coastal wetlands have been destroyed. Many of the remaining ones, particularly in rapidly urbanizing tourist areas, are threatened or severely degraded. Marine terminals and warehouses, freeport sites for industry, and residential subdivisions have replaced coastal wetlands, particularly in estuarine locations. The greatest destruction has occurred in the larger estuaries now used for harbor facilities such as along Hunt's Bay and the Kingston waterfront.

Mangrove and coastal wetlands provide a wide range of benefits -- ecological, economic and scientific -- which are generally not recognized. If properly managed, mangrove wetlands can be important in generating ecotourism. They can also serve as a living laboratory for education and research. Despite multiple benefits, mangroves continue to be viewed as areas of low economic productivity, principally supplying wood for charcoal and the construction of fish pots. Economic valuations of mangrove wetlands fail to take account of their value in acting as buffers against natural catastrophes, refuges for wildlife, nurseries for marine life, fishing and shellfishing areas, sources of organic detritus, and as natural filters for improving water quality.

Because of their submerged root system, mangroves retard water movement and trap suspended materials and the remains of organisms associated with the mangroves. The accumulation of this organic material contributes to raise the soil level. Continued accumulation of soil, particularly by sea-fringing mangrove stands, builds the shoreline seaward. In the course of this process, the rich protected substrata provide a habitat for a large variety of organisms that serve as food for marine fauna, including oysters and crabs, which are a harvestable source of protein.

Many fish, including those of commercial importance, spend part of their life cycle in wetlands during breeding and spawning. The sustainability of Jamaica's fishery is directly dependant upon the habitat provided by reef and mangrove systems. If an objective of public policy is to protect and develop the fisheries resource, to permit the destruction of wetlands, particularly mangrove wetlands, clearly undermines such a policy.

Mangroves can be harmed or destroyed by dredging, filling, sedimentation, oil spills, and sometimes by other pollutants as well. Land reclamation through filling is the most serious and direct threat to mangroves. Land reclamation of adjacent areas may also

affect mangroves indirectly by altering the hydrology and changing salinity levels. Other major threats are burning, over-cutting, and garbage dumping.

Mangroves tend to trap and concentrate pollutants. The extent to which various types of pollutants, other than oil and sediments, contribute to mangrove destruction is uncertain. However, it is known that in mangrove-fringed estuaries, the concentration of pollutants, and/or temperature and salinity changes, tends to upset the delicate balance of microscopic life, drastically altering the entire coastal ecosystem.

Indirect Threats to Mangrove and Coastal Wetlands

Jamaica's coastal wetlands also remain subject to indirect damages from a number of sources, including:

- Contamination by substances that are transported by run-off of storm waters in urban areas;
- Non-point source pollution by agro-chemicals, nutrients, and other materials used in agriculture that are released to streams and rivers and thence into wetland areas;
- Large scale pumping from coastal aquifers which affects the water balance inducing saltwater intrusion.

Extent of Jamaica's Mangrove and Coastal Wetlands

Unfortunately, no authoritative inventory of mangrove and coastal wetlands has been conducted in Jamaica. Hence, there is no reliable tabulation of wetlands, nor are there systematic records documenting the loss of wetlands. No GOJ agency uses standard procedures for recording the loss of wetlands. No statistical data exist for rates of wetland conversion, past or present. Some aerial photo data on wetlands has been compiled from black-and-white photography, but it is incomplete and outdated. A USAID-funded study of freshwater and coastal wetlands was initiated in the late 1980's but was never completed (and the funding is believed to have been withdrawn).

Current data for mangrove wetlands are not available. It is possible that work carried out by NRCD's Aquatic Resources Division, and by students and faculty at UWI might add to the current information base, but this remains to be verified. Maps prepared by the Ecological Survey fail to distinguish mangrove wetlands from other coastal wetlands, nor does the survey incorporate systematic measurements of those wetland areas. Newly assembled NRCA material on wetlands is still in preliminary form. In the future, data based on aerial photos needs to be field verified. To facilitate updating, and to improve analytical capabilities, the data should be integrated into the Geographic Information System (GIS) being established.

Governmental Support for Wetlands Protection

Despite avowed concerns with the protection of bio-diversity, water quality management, and natural hazard mitigation, wetlands protection has received little active government support. This, despite the symbiotic relationship that exists between coastal wetlands and deepwater habitats that support coral reef growth. Indeed, in assessing wetlands nationally, five major systems need to be considered: marine, estuarine, riverine, lacustrine, and palustrine. Of these five major systems, all except palustrine include both wetland and deep water habitats.

Types of Mangrove Wetlands

Three types of mangroves are found in Jamaica -- the red (Rhizophora mangle), black (Aricennia germinans), and white mangroves (Laguncularia racemosa). They occur in a wide range of wetlands settings, each with different characteristics and special values.. The coastal zone includes both tidal and non-tidal wetlands. The tidal wetlands consist primarily of a mangrove fringe along the shoreline, and off-shore cays, some of which are ringed by mangroves. Some near-shore inland areas have a basic flow of fresh water, but are also subject to intermittent tidal inundation or overwash. Other areas, such as basin wetlands, are transitional between salt and freshwater wetlands, but support mangroves as a result of inundation during exceptionally high tides. Although all mangroves require protection against willful destruction through filling, other needs vary. One type, for example, is suitable for recreational facilities or houses (on stilts, to prevent interference with water flows and with suitable protection against raw sewage and solid waste) but others are not. Some mangroves regenerate rapidly and can tolerate selective cutting; others can survive only if left completely alone.

A brief description of types of mangrove wetland habitats follows.

- o Overwash wetlands: Predominantly red mangroves; these are overwashed by daily tides and are the most marine oriented mangroves.
- o Fringe wetlands: Red mangroves predominate along rivers, lagoons and canal shorelines; highly productive in nutrient output; excellent habitat for wildlife and for shellfish production; susceptible to management for controlled timber harvesting, recreation and other multiple uses; high regeneration rate even after clear cutting.
- o Scrub wetlands: Red and black mangroves predominate; found on hypersaline soils which are devoid of all other plant life; they stabilize the soil and

should not be disturbed since regeneration is very slow; if destroyed nothing will grow in its place.

- o Riverine wetlands: Red mangroves predominate, but white and black also occur; flourish in saline portions of river flood plains; very high resource values relative to controlling water quality, protecting against flooding and providing wildlife habitat; multiple use potential includes tannin production, timber, and sewage recycling; should receive priority protection to maintain productivity.
- o Basin wetlands: Are the most inland of mangroves reached only by exceptionally high tides; black mangroves predominate; basin mangroves are effective nutrient traps; any interference with tidal flows or overland sheet flows represent threats; as long as water levels are maintained timber production as well as sewage recycling is possible.

The foregoing wetland types have decidedly different characteristics, values and locational proclivities. In order to design site-specific management programmes for mangrove and coastal wetlands, information on vegetative types, condition, and current use is needed. However, given present knowledge, certain broad policy options and regulatory measures can be adopted despite an acknowledged need for more complete information and a stronger analytical base.

ANNEX 2: WETLAND RESOURCES OF JAMAICA.

The Negril Great Morass

The Negril Great Morass covers an area of 2,289 hectares (5,657 acres), and accounts for approximately one fifth of all wetland areas in Jamaica. It is separated from the sea by a narrow sandy spit forming the famous Negril beach at Long Bay and Bloody Bay. A map of the coastal resources of the Negril Great Morass and adjacent areas was prepared in 1981 for the Peat Resources Utilization Project, Environmental Feasibility Study. The map (Figure 1) identifies the major plant communities.

The wetland consists of herbaceous marshlands, mangrove forests, swamp forests, others lowland forests, and waterways. The dominant vegetation is saw grass (*C. jamaicense*), occupying approximately 80 percent of the total surface area. The eastern edge of the morass is fringed by a diverse lowland forest.

The area suitable for growth of mangroves in the Great Morass is limited by the presence of dykes along the canals and rivers that deny these plants the necessary shallow water to enable their propagation. Two species of mangroves predominate, the red mangrove (*Rhizophora mangle*), and the white mangrove (*Avicennia germinans*). The largest tract of mangrove, *R. mangle*, is located at Orange Bay near the old mouth of the Orange River.

The Great Morass has been shown to support several species of animals, including tree crabs, birds, and several species of fish. Species of fish known to enter the mangrove area include *Diapterus rhombeus* (shad), *Strongylura timuca* (piper), *Lutjanus griseus* (snapper), and *Gambusia affinis* (mosquito fish). (The shrimp fishery in Negril is not considered commercially viable.)

Other Wetland Areas

The other wetland areas within the boundaries of the NEPP, namely those at Green Island, Samuels Bay, Salmon Point, Homers Cove, and Little Bay, are in need of detailed study to determine their extent and ecological status. The general vegetative cover in these wetlands consists of herbaceous marshlands and mangrove forests. The herbaceous marshlands consists of salt tolerant species mixed with fresh water species.

At Salmon Point an extensive wetland drains to the New Savanna River. This wetland is predominantly vegetated by fresh water species such as cat tails (*Sagittaria*

lanciofolia), and *Typha domingensis* (*Plate 1*). The wetland is fringed by a sandy area covered mainly with various trees including mangroves and sea grape.

Homer's Cove is a shallow semi-enclosed water body fringed by a fairly large stand of red mangrove.

At Green Island there are two relatively small wetland areas located in the eastern section of the Bay and at the mouth of the Green Island River. Dominant coastal vegetation is the red mangrove.

Little Bay, approximately one km in length, contains patches of mangrove along its coastline. The coast line is covered by stands of coconut trees and other tall trees. Field inspection revealed that the roots of many of these trees are as much as 1m above the surface of the soil at the base of the trunks as the result of illegal sand extraction and erosion (*Plate 2*).

EXTENT OF DESTRUCTION AND DETERIORATION IN THE GREATER NEGRIL AREA:

In the absence of a national policy relating specifically to the management of wetland areas, there have been numerous instances where these ecosystems have been filled to provide land for construction and farming. There are also several instances where these areas are, or have been, used for the disposal of solid waste. The Negril Great Morass has been subjected in the past to major man-made changes which have influenced its hydrological function as well as its role as a wildlife habitat. In addition, surveys carried out by local NGOs, such as the Negril Coral Reef Preservation Society, have pinpointed other areas where mangrove areas have been destroyed or degraded by filling, dumping of solid waste, effluent disposal, cutting, and burning.

Negril Great Morass

The Negril Great Morass was drained during the late 1950s by the Ministry of Works in order to improve the agricultural potential of adjacent lands. This modification resulted in the South Negril River being straightened and deepened, and the Orange River diverted into the new North Canal, which discharged at the coast north of Bloody Bay. Another canal (the Cut-Off Canal), drained the eastern section of the wetland. Spoil was dumped on the banks of the canals. The result has been incursion of sea water along the deepened river channels, some ponding behind levees, and elsewhere, on slight elevations, a seasonal drying out.

Extensive damage to the Negril swamp forest at the south-eastern section of the wetland as a result of fires, timber extraction, and drainage has been documented. The lowland forest fringing the eastern edge of the morass is being impacted by felling for development and timber.

The construction of the North Canal quite likely resulted in the destruction of mangrove communities to the north of Bloody Bay. However, red mangroves in this area appear to have overgrown a lagoon which was situated on the north bank of the North Canal near its mouth.

The uncontrolled development of the banks of the South Negril River (*Plate 3*) has quite likely placed further stress on the existing stands of mangrove in this area due to the disposal of domestic waste. High fecal coliform levels measured at the mouth of the South Negril River give an indication of the magnitude of the problem. Available data indicates values for coliform at the mouth of the river, approximately 1km above the main road bridge, to be 10 - 20 times above acceptable levels. The artificial straightening of the South Negril River and the creation of dykes discourage the growth of mangrove in most areas along this waterway.

The Royal Palm Reserve, in the south-eastern section of the morass, initiated by the Petroleum Corporation of Jamaica (PCJ) (*Plate 4*) is presently not in operation. However, it was observed that the site was freely accessible. Livestock (goats and cows) (*Plate 5*) could be seen roaming in the forest. There was also evidence of recent channellization. A casual observation was made of the visibly small numbers of young Royal Palms in the Reserve. Based on this observation, the possibility that the palms may be dying out would appear to merit investigation.

Orange Bay

The area of greatest impact to mangrove forests has occurred at Orange Bay, where clearing has been done to facilitate the operation of a solid waste dump. There is evidence to suggest that this dump site was being used for some time after it was declared officially closed. At this site, solid waste from the surrounding area was dumped precariously close to the water's edge. Periodically, solid waste piles have been burned to reduce volume. The dump continues to be a health hazard, and it may be assumed that leachate from the site is adversely impacting coastal water quality resulting in the massive destruction of the bay's reef system. The site now appears to be inaccessible as a result of the blocking of the access road with a mound of marl (*Plate 6*).

Samuels Bay

At Samuels Bay, just north of Orange Bay, there has been extensive clearing of coastal vegetation and filling to provide access roads into the wetland (*Plates 7-10*). This has involved the removal of a large tract of mangrove woodland ostensibly to provide a horseback riding trail along the beach. The clearing of the coastal vegetation has denuded a mangrove area approximately 300m by 30m. Mangrove can be observed repopulating the shallow areas along the coastline. This action is believed to be the cause of coastal instability now being experienced, resulting in the loss of as much as 8ft. of beach front.

There are a number of upwellings believed to be in this bay, and signs of eutrophication are evident as witnessed by the proliferation of algae.

Green Island

Green Island Bay is regarded as one of the prime areas suitable for culture of oysters. Presently, a group of citizens from the area are pursuing this activity in collaboration with the Fisheries Division, and the National Development Foundation of Jamaica (NDFJ).

The major impact to mangroves at this location appears to be uncontrolled cutting for a variety of reasons. These include the use of mangrove sticks as the main source of timber for the construction of racks used in the culture of oysters.

Salmon Point

There has been some clearing at this site allegedly to make way for private development. Some amount of erosion of the coastline is noticeable in this area. This wetland is under threat from parcelization. It is alleged that parcels of land extend from the coastline up to 1,600 ft. into the wetland.

Homer's Cove

The mangrove and other coastal vegetation around Homer's Cove and adjoining areas have been impacted by clearing for the construction of private dwellings. There has even been an attempt at construction on a sandy spit that extends into the sea (*Plate 11*). The water of Homer's Cove also showed signs of eutrophication, evidenced by the proliferation of several types of algae.

Little Bay

Little Bay has been severely denuded of its coastal vegetation in several sections. This has evidently been due to the extensive removal of large amounts of sea sand. In many locations deep depressions have been created and large rocks have become exposed (*Plate 12*).

Conclusions

Continued depredation of Negril's mangrove forests and coastal wetlands is a serious concern. The piecemeal clearing of mangroves and filling of wetlands will, over time, significantly alter the quality of Negril's marine resources, contributing further to accelerated erosion and deteriorating water quality. Destruction of the reef system protecting the shoreline can be expected to alter the sand supply available to replenish the Negril beaches which increasingly will be exposed to erosional forces.

Continued wetland destruction will also further diminish the importance of the Negril area as a wildlife refuge, negatively impacting on biodiversity and devaluing the natural resource base and aesthetic quality. Directions for future work should include an evaluation of the impact of the altered hydrological regime on the ecology of the Great Morass.

Black River Lower Morass

The Black River Lower Morass lies to the south of the Lacovia Gorge, extending down to the sea. Its eastern boundary lies near the Santa Cruz Mountains. Its western boundary is close to the Black River and to the Santa Cruz main road. The wetland is owned by both Government and private individuals.

The Black River passes through the wetland and enters the sea at the capital town of Black River. The main tributaries are the Broad and Punches River to the east, and the Middle Quarters, and YS Rivers to the west. On the southern section of the wetland area two large ponds, namely, the Parotee Great Salt Pond which is hyper saline, and the Wally Wash Pond, which is a fresh water body. Several blue holes have been identified in the eastern section of the morass. The main activities occurring in the wetland are shrimping and fishing, and farming on marginal swamp areas.

**TABLE 1
THE MAJOR WETLANDS OF JAMAICA**

		NAME		LOCATION		(Ha)
Black River		Lower Morass		St. Elizabeth		
	Negril Great	Hanover	2,400	Morass		Estuarine;
Cabarita Swamp	St. Catherine	1,600		Marine/Estuarine;		
The Great Morass	St. Thomas	1,600		Marine; Mangal		
		West Harbour		Clarendon	1,600	
Canoe Valley	Manchester	1,200		Estuarine/Riverine;		
	Falmouth &	Trelawny	1,070			
		Saltmarsh		Marine/Estuarine;		
		Amity Hall		St. Catherine		
		Great Salt Pond		St. Catherine		
		Manatee Bay		St. Catherine		
		Cabarita		Westmoreland		

NAME	LOCATION	SIZE	DESCRIPTION (Ha)
			Kingston Harbour Kingston & St. Andrew
			Cockpit-Salt River Clarendon
			Cow Bay St. Thomas
			Mason River Clarendon
			Peartree Bottom St. Ann

The wetland supports a rich indigenous flora, and fauna, with several of the species being endemic to Jamaica. These include, *Grias cauliflora*, the only native representative of the Brazil nut family *Lecythidaceae*, the swamp palm (*Roystonea princeps*), the thatch palm (*Sabal jamaicensis*), and the naseberry bullet (*Manilkara sideroxylon*). The thatch palm is used extensively by local people in the making of baskets, and as a roofing material. The southern section of the lower morass contains relatively large stands of red mangrove (*R. mangle*) which supports various species of birds, crabs, fish, shrimps, and the American crocodile.

It has been described as the best area in Jamaica for all water birds, and is known to be the only area where the flamingo still nests occasionally.

Commercially important species using the wetland as a breeding and nursery area include snapper, snook, tarpon, jack, and several species of fresh and brackish water shrimps.

The Black River Morass has been the subject of much previous study which was aimed at exploiting this resource base on a large scale for agriculture, and peat mining. Other current issues affecting the lower morass are as follows:

- The pollution of the lower morass as a result of industrial/agricultural activity in the upper morass;
- The operation of recreational (guided) tours in the wetland (mainly on the Broad River), an activity which may have a disruptive effect on local wildlife;
- The destruction of wetland vegetation by spontaneous as well as anthropogenic fires.

The Cabarita Swamp - St. Catherine

The Cabarita swamp is situated on the western side of Hellshire Hills adjacent to the Galleon Harbour. The wetland is registered as Crown lands.

The Cabarita is mostly a marine wetland as there are no fresh water rivers or springs running through it, rain being the only source of fresh water.

The swamp is composed of three distinct types of habitats: shallow lagoons, mud flats which are flooded at high tide, and mangrove forests mainly *R. mangle*. Some of the lagoons present in the swamp are connected to the sea by narrow channels. At high tide sea water enters through these channels and floods the lagoons and mud flats.

A section of this wetland has been used for rice cultivation. Further plans for its use have included draining to provide additional agricultural lands.

The Great Salt Pond And Flashes - St. Catherine

The Great Salt Pond is bounded on the north by the Port Henderson Hills, on the south by the Hellshire Hills, on the west by a mangrove forest, and on the east by the sea. It comprises approximately 448 acres in area, and is registered as Crown lands, vested in the Urban Development Corporation.

One river flows through the swamp to the pond. Originally the pond was separated from the sea by a permanent sand bar which was breached during periods of heavy rainfall. The pond was permanently opened by the construction of a channel during the 1970's.

The mangrove forest surrounding the pond is dominated by *R. mangle*. Other species of mangrove occur in a forest to the west of the pond, mixed with the bullrush (*Typha domingensis*).

Plans for utilisation of this wetland have included the establishment of a nature reserve, and shrimp farming. The salinity of the pond is variable depending on rainfall and evaporation.

The Cockpit - Salt River Wetland - Clarendon

The Cockpit - Salt River wetland is situated between the communities of Freetown and Salt River in the south eastern section of the parish of Clarendon. It is bounded on the north between the village of Cockpit and the sea, on the west by the Salt River main road, on the south by the Salt River estuary, and on the east by the sea. It comprises 400 acres, and up to the early 1980s very little activity activity was reported for the area. The area is government owned.

The wetland consists of two distinct ecological zones, namely, The Cockpit River Drainage Basin and Irrigation Biota, and mangrove forests.

Vegetation of the Cockpit River Drainage Basin and Irrigation Biota is dominated by freshwater plants which include the bullrush (*T. domingensis*) water cress (*Nasturtium officinale*). The fauna here is reported to be very diverse particularly with respect to bird life. Birds include the Baldplate, the Jacana, and the Cattle Egret. Fish include mullet, Perch, and Snook.

Mangroves are present throughout the swamp where conditions are saline or brackish, hence, they are thickest south of the Cockpit River Basin. The animals in this area are dominated by the tree climbing crabs, *Aratus* and *Goniopsis*, and the land crabs *Cardiosoma* and *Gecarcinus*.

The Salt River was known to support a small amount of fishing, and provides a habitat for the crocodile.

The McCarry Base Swamp - Clarendon

The McCarry Bay Swamp is situated in south-western Clarendon, just west of the Carlisle Bay swamp. The wetland comprises approximately 3,000 acres, and is Government owned.

The wetland is separated from the sea along its entire length by a narrow sand bar. No rivers flow through the eastern section of the swamp, but maps indicate a number of blue holes in that area. One main river, the Milk River, runs through the western section of the wetland. Silt brought down by this river has created a permanent sand bar, completely enclosing a section of the sea in front of Farquahar's Beach forming a salt pond.

On the eastern side of the wetland, the flora may be divided into three main zones. On the seaward side, the vegetation consists of a dense strip of mangroves running parallel to the sand bar. On the landward side of the swamp, a zone of *Typha domingensis* is present, corroborating the presence of blue holes in this section.

The western section of the wetland beside Farquahar's Beach is dominated by mangroves, but other species such as the wild cinamon (*Canella winterana*) are also present. The flora on the sand bar is also dominated by red mangrove. Mangroves are also dominant along the side of the road leading to Milk River. The fauna is reportedly dominated by birds and crabs. Crocodiles are reported to be present in this wetland, and species of fish and shrimp inhabit the Milk River.

The West Harbour Swamp - Clarendon

The West Harbour Swamp is situated on the Northeastern area of Portland Ridge, on the south coast. The total area of mangrove swamps, lagoons and channels in West Harbour and its environs is approximately 5,000 acres. This wetland is Government owned.

It is bounded on the west by the community of Portland Cottage and the east by the sea, on the north by the Sandy Bay to Salt River Road, and on the south by the Portland Ridge Mountains. West Harbour is comprised of a system of mangrove islands, *Thalassia* beds, lagoons, large ponds and channels. The northern section of West Harbour connects with a similar system of mangrove islands, lagoons and channels, known as Peake Bay. West Harbour has access to the sea through several openings of varying width on the eastern side.

The mainland surrounding the northern, western and southern sections of West Harbour is swampland and stretches inland for approximately a half mile to one mile. The southeastern section of the swamp is called Mahoe Gardens and here the swamp abuts directly on the sea.

The flora is dominated by red mangroves and all the mangrove islands in the harbour are comprised of this species. The swamps on the mainland consist of a mixture of black and white mangroves in the water logged area, and button mangrove on the harder ground. The undergrowth is dominated by rice grass (*Batis maritima*).

The fauna include several species of fish -- mullet, snapper, snook, tarpon, jack, and mackerel. Shrimps are also numerous in the lagoons and ponds. Crocodiles and crabs are also numerous. However, a decline in the once large numbers of oysters once found on the roots of red mangrove in the area has been observed. The many birds in the area include, baldpate, peadove and white wing.

Major activities supported by this wetland include fishing and farming. West Harbour, in the past has been the base for approximately 150 fishermen, but fishing is also carried out by numerous fishermen from other areas. The fish catch per boat with three fishermen has been known to be around 160 pounds on each outing.

The Great Morass - St. Thomas

The Great Morass is situated at the extreme eastern end of the island with its south-western boundary at Rocky Point, the eastern boundary at Morant Point, the north-eastern boundary at Holland Bay, and the south-eastern boundary towards the sea. A large section of the wetland is privately owned.

The Morass is separated from the sea at Mammee Bay by sand bars and white sandy beaches. There are three streams running through the morass in the Belgium District which originate from blue holes. These empty into the main drain which flows to the sea.

The flora is dominated by mangroves. Mangrove thickets have been observed lining the main stream down to the sea. These mainly comprise red mangrove and button mangrove. On surrounding higher land, the vegetation is typical of strand woodland association, particularly in the north-eastern section of the wetland around Quaco Point and Morant Point.

The fauna is comprised mainly of birds and crabs, crocodiles are also known to be present in the area. Turtles are known to nest on the beaches around the Great Morass but these animals have been hunted almost to the point of extinction. A portion of the swamp is used for agriculture, including crops such as bananas, yams, and a small amount of rice. Shrimps are known to be present in the drainage canals but not in sufficient quantities to support a viable industry.

Carlisle Bay - Jackson Bay Swamps

These swamps are situated on the south coast to the west of Portland Ridge. They are partially owned by the Government.

The Carlisle Bay swamp extends along the coast and has one river running through it, locally known as "Old River". A sand bar separates a large part of the swamp from the sea. The Jackson Bay swamp is separated from the sea by a sand bar and there is no sign of a fresh water source.

In both wetlands the vegetation is comprised mainly of the black and white mangroves. The undergrowth is dominated by rice grass. The animals found here are mainly crabs and several species of birds.

These wetlands have been observed to be in a state of degradation.

Swamps around the Kingston Harbour

The Kingston Harbour is divided into three zones: the inner harbour, the outer harbour and Hunts Bay. The major wetlands around the harbour are situated in the region of Hunts Bay, Dawkins Pond, and Port Royal. They are owned by Government and private parties.

The wetlands in the Hunts Bay/Dawkins Pond area have been extensively reduced by urban development. The dominant vegetation is mangroves. Fauna supported includes fish, oysters and shrimps. The Kingston Harbour/Hunts Bay/Dawkins Pond system is known to once have been the site of a flourishing fishery.

Frontier Swamp - St. Mary

Frontier is situated adjacent to the town of Port Maria, just south of the main road leading to Annotto Bay. Originally the entire area was privately owned but the northern section was acquired by Government.

The area is landlocked and has no connection to the sea. It is a low lying area and is flooded during the rainy seasons. Flooding is also enhanced by two small springs situated at the northern end of the swamp.

A section of this swamp was drained and used for the cultivation of bananas and coconuts.

Cow Bay Swamps - St. Thomas

This wetland is situated on the south-eastern section of the island and is bordered on the north by limestone hills and on the south by the sea. The wetland is privately owned.

The swamp is separated from the sea by a high berm, comprised of black sands, probably terrigenous in origin and transported by littoral drift. Two fresh water lagoons are located in the middle of the wetland. There are no obvious waterways leading into the wetland and it may be assumed that the two lagoons are supplied by underground springs.

The vegetation of the wetland is mixed, the landward side being dominated by *T. domingensis* and sawgrass. The freshwater lagoons are surrounded by red mangroves.

The open water surrounded by the mangroves provides good habitat and refuge for various species water fowl and could provide suitable breeding and nursery grounds for marine species of fish. However, the lagoons have also been known to support only fresh water species of fish when the connection to the sea is occluded.

Plans have been put forward in the past which would involve subdivision of the area for residential purposes.

Turtle Crawle Swamp - Portland

This small wetland is situated on the northern coast of the island halfway between Port Antonio and San San Bay. It is privately owned.

Turtle Crawle consists of an enclosed bay with the wetland on its southern shore. Three main rivers pass through the swamp, mainly Turtle Crawle River on the south-eastern end, Banana River to the south and West River to the west. Several other springs and streams are present in the area.

The vegetation has two main zones, namely a mangrove zone and an open bog zone. The mangrove zone consists of white mangrove mainly around the lagoon and red mangrove in the shallow, muddy inshore. Other fresh to brackish species occur in this zone. The open bog zone consists mainly of grasses, sedges, herbs and occasional clumps of bullrush (Typha and Lilies).

Fauna is reported to consist mainly of shrimps, fish, crabs and birds.

Orange Bay Swamp - Portland

This swamp is located a few miles west of St. Margaret's Bay is divided by the main road. The wetland is privately owned. A substantial portion of the wetland has been reclaimed and is under rice cultivation by small farmers.

St. Margaret's Bay Swamp - Portland

This small wetland is located on the north-eastern coast of the island and is also divided by the main road into two sections: a landward side and a seaward side. It is in private ownership.

One small stream runs through the wetland and empties into the sea. The flora is dominated by *Aplinia allughas* on the landward side. The bullrush is present on the river bank and water hyacinth is present in the river. The area is not known to support any significant wildlife communities.

Hart Hill & Windsor Castle Swamps - Portland

This wetland is located to the west of Orange Bay and extends from the main road to the sea. It is owned by Government and private individuals.

The Windsor Castle Swamp is separated from the sea by a sand bar. The Boging River runs through this swamp and empties into the sea. A few drainage canals are present in a section which is under cane cultivation.

Flora is dominated by the bull rush with patches of crab thatch (*Acrostichum aureum*). A few trees of seaside mahoe (*Thespesia populnea*) and *Dalbergia ecastaphyllum* occur on the seaward side of the swamp along with red mangrove.

The fauna is dominated by birds. This wetland is being used for agriculture and is known to support some fishery.

Canoe Valley (Long Bay Morass) - Manchester

The wetland is situated on the south coast of Jamaica. Is bounded on the north and west by the road leading from Alligator Pond to Milk Pen District, and the south by the sea, and on the east by Round Hill. The wetland is state owned.

This is a linear swamp which runs parallel to the parochial road which is at the foot of a limestone hill called Marley Hill. Several rivers which originate at the foot of this escarpment traverse the wetland. These rivers include the Swift River, Two Rivers, Alligator Hole River, Gut River and Granbre River. Several blue holes have been observed in the morass. The morass is separated from the sea by a narrow sand bar.

The morass is dominated by freshwater type vegetation such as bull rush, but there are large areas which are brackish to saline, dominated by red mangrove, black mangrove and button mangrove.

The wetland is known to support several species of water fowl, and a variety of shore birds. Other fauna known to occur include, manatees, crocodiles and sea turtles. The area is used for fishing and reed cutting for basket making. This wetland has been proposed as a national park.

Cabarita Swamp - Westmoreland

The Cabarita is a coastal swamp which extends from Salmon Point in the west to Cabarita Point in the east. It extends as far north as George's Plain. It is owned, for the most part, by Government and, to a lesser extent, by private individuals.

The wetland is separated from the sea by a sand bar. There are three main water channels, namely, the Cabarita, the Styx River and the Eastern Catchment Canal that drains the Potts, Ricketts, and Three Miles Rivers.

South of the main road the vegetation is dominated by mangroves. Before drainage, the entire area, north of the main road was dominated by bull rush but most of this has disappeared.

Fishing and shrimping activities are carried out in the lower section of the wetland and the eastern catchment canal. Fishing is restricted to mainly perch and god-a-me. Shrimping involves the species *M. faustinum* and *M. carcinus*.

Effluent from the Frome Sugar Estate discharges to the Cabarita River resulting in septic conditions in this waterway.

Pear Tree River Swamp - St. Ann

This swamp is situated just west of Runaway Bay, on the southern side of the main road leading to Falmouth. It is Government owned.

The swamp is separated from the sea by a sand bar. It is drained by the Pear Tree River and there are numerous blue holes in the interior.

The flora is dominated by bull rush and crab thatch. There is fringing mangrove along the coastline. Fauna consists of fishes, birds and large amounts of shrimps. The area is believed to be a small nursery ground for fish and shrimps and is also a habitat for several species of birds.

Fishing is the main activity in the area, but there are plans for physical development.

Bush Cay - Florida Land Swamps - Trelawny

This wetland is located on the north coast, to the east of Falmouth on the northern side of the main road. It is presently in private ownership. The wetland features a peninsula partially enclosing a lagoon which was once famous for its phosphorescence (glistening waters). This phosphorescence was due to an uncommon combination of topography, climate, soils, ocean currents and nutrients that permit the proliferation of dinoflagellates.

The phosphorescence was lost subsequent to indiscriminate clearing of mangroves around the lagoon. Currently, the fauna is dominated by birds.

The Swamps around Falmouth

The swamps are situated to the south and west of Falmouth and are divided into three sections. To the extreme west is the Salt Marsh Swamp which is in the form of a peninsula bounded on the south and east by the main road, on the north by the sea and on the west by the bay. A second swamp, which exists on the Half Moon property between the main road on the west and north, the district of Maxfield on the south and the road from Martha Brae to Falmouth on the east. The Hague Swamp lies adjacent to the Half Moon property. The Hague swamp is government owned while the Half Moon property is in private ownership. The ownership of the Salt Marsh Swamp needs to be established.

The Half Moon Bay and Hague Swamps are separated by the sea by the main road. The wetland is drained in the south-eastern section by the Martha Brae River. The swamp is also drained by a network of canals which includes two main canals that run parallel to the Martha Brae on either side. The Salt Marsh Bay Swamp is a peninsula with one small stream originating from a blue hole passing through its south-western section.

The flora is dominated by mangroves in all three swamps and, all mangrove types occur in different areas. Large tracts of bull rush and crab thatch are present in the Hague and Half Moon Bay Swamps.

ANNEX 3: SPECIFIC REGULATORY PROVISIONS.

Development Guidance

Tourism Projects:

Proposals for the construction of tourism hotel and resort developments that are adjacent to a mangrove ecosystem or coastal wetland must provide a detailed design scheme and operation and maintenance plan for sewage treatment that incorporates waste treatment and sewerage design standards promulgated by relevant agencies of the Government of Jamaica, and of Development Orders adopted by local Planning Authorities. In addition to waste treatment specifications, the plans must be consistent with room density, setback, height, and other standards that are in force.

Small Lot Residential Development:

Development of one to three residential units on small lots present special problems when such development occurs on sites that are bounded by the sea on one side and by a wetland on the other, a condition that is prevalent in many locations. In general, this type of development is done without permit, using family labour, and proceeds incrementally as funds are available. Special design criteria and education material relative to construction in or adjacent to wetlands including elevating and building on stilts, waste disposal techniques, and protection against natural hazards will be developed by NRCA in cooperation with local authorities and NGOs.

Wetlands Filling

The filling of mangrove and coastal wetlands is expressly prohibited other than by permit reviewed and endorsed by the local planning authority and issued by NRCA.

Where approval is granted, fill material shall be of non-toxic material. Garbage or solid waste is not acceptable fill material, nor is any other type of fill where there is the potential for degrading water quality.

Where filling necessitates the destruction of wetlands flora, appropriate mitigation shall be undertaken in conformance with a mitigation plan and schedule and at the expense of the applicant or developer.

Waste Generation

Whereas mangrove and coastal wetlands are important habitat for fish and shellfish, it is essential that sewage inflow into wetlands be reduced to the absolute minimum. The use of

dry toilets is to be encouraged by all available means, as are small scale community systems that provide for maximum removal of nutrients.

No part of a surface or subsurface sewage system including septic tanks, tile fields, soak-aways, settling basins or lagoons can be located within 150 feet of a mangrove ecosystem or coastal wetland. In the case of preexisting development, measures will be taken to provide technical assistance and other support to mitigate conditions that are resulting in nutrient enrichment in wetlands and near shore coastal waters.

Financial and Tax Incentives to Protect Wetlands

In order to encourage minimum impacts to mangrove and coastal wetlands, and to encourage wetlands restoration, including artificial wetlands development, various innovations will be provided to private individuals and developers who undertake programs or activities which are deemed to significantly enhance or create wetlands.

These measures shall include, but not be limited to:

- Reduced land taxes;
- Reduced taxes on imported building materials;
- Building bonuses;
- Technical assistance;
- Reduced fees and charges;
- Others as appropriate.

Permit Applications and Review Requirements

Permit applications for construction on or adjacent to mangrove ecosystems and coastal wetlands shall be submitted to both NRCA and the local planning authority. The application shall include the following:

- Name and address of applicant and of owners of record;
- Map, drawn to scale, showing the location of any structure in relation to adjoining wetland; description of the proposed activity and expected effects;
- Excavation and filling including type of fill and building design elevation;
- Measures for treating sewage and for the disposal of solid waste;
- Description of mitigation measures to reduce expected on-site and off-site impacts on coastal wetlands.

An EIA and/or EIS will be required if NRCA determines that the effects of the proposed project have the potential for generating significant negative impacts on the wetland and/or on the receiving water bodies into which the wetland drains.

Enforcement

For projects deemed to be potentially damaging to mangrove and coastal wetlands, a performance bond will be required of the developer. The monies are to be deposited in an escrow account, and will be repaid, with interest, at the completion of the project providing that all conditions of permit approval have been satisfied.

To ensure that project conditions are being followed during the construction phase, the local environmental officer (and/or other appropriate officials) shall regularly inspect the site and report on activities observed.

Fines and penalties shall be levied in accordance with prevailing norms.

Administrative hearings shall be held for violations. Every effort shall be made to resolve disputes through negotiation. In the event that a settlement cannot be achieved, the matter shall be referred to the courts for adjudication.