PROJECT EXECUTIVE SUMMARY

A study of Environmentally Sensitive Areas in Mauritius and Rodrigues was commissioned by the Ministry of Environment and National Development Unit, Government of Mauritius in December, 2008. The contracted party, a consortium formed by NWFS Consultancy of Portland, Oregon, USA, Stem Consulting Ltd., Port Louis, Mauritius and the Watershed Company of Kirkland, Washington, USA commenced activities in mid-January, 2009, continuing through to presentation of final deliverables in mid-July, 2009. More than a dozen professional staff were variously engaged towards achieving the objectives of the study. The original duration of the project was scheduled for 15 months.

The study consisted of three parts or phases. Part A focused on the demarcation and inventory of wetlands in Mauritius and Rodrigues. Part B directed effort towards identifying and demarcating Environmentally Sensitive Areas (henceforth, ESAs) other than wetlands. Part C engaged the consultants towards the development of a comprehensive policy, legal and management framework that can support ESA protection and maintenance well into the future. A series of outputs were delivered to the client in the form of five major reports, a draft ESA bill, numerous map products, two training short courses, resource personnel support for a national ESA workshop, an extensive GIS and geodatabase, and a complete equipment package for ESA geospatial information and data management.

Study Background

The study on ESAs was identified as a priority project in the National Environmental Strategies (NES) prepared in 1999. The 2003 National Development Strategy (NDS) provided a strategic framework for development that integrates the use of natural resources in a sensitive and sustainable manner. A preliminary system of ESAs was identified and formed the initial base for the present ESA study. Subsequent examination of development planning through the District Council Outline Planning Schemes (OPS) further resolved a preliminary distribution of various ESAs and guidance on how these areas should be approached in the milieu of private and public-sector driven development on Mauritius and Rodrigues. These three documents, the NES, NDS and OPSs formed the primary foundation for study of ESAs, along with numerous legal acts and regulations governing natural resource-related issues, technical reports, guides and scientific studies. A wide range of representative bodies and individuals were engaged in the study of policy, legal and management aspects of ESA maintenance.

Rapid economic development in Mauritius over the past 25 years has seen increasing pressures on the islands' natural environment. Economic success, particularly in the development of manufacturing and tourism sectors, has required considerable improvements in national infrastructure. Natural resource use needed to feed this development has increasingly encroached

on areas believed to provide important societal benefits through a range of environmental services. The conservation of these benefits underpins the need to develop a network of environmentally sensitive areas (ESAs) for the country. This is of particular importance to Small Island Developing States (SIDS), where land area is extremely limited and often very susceptible to changes in the marine environment. ESA designation, when supported by adequate legal and institutional support, can act as an important mechanism in the conservation of public goods and wider environmental benefits while allowing development of physical infrastructure that internalizes environmental costs otherwise passed on to future generations. In other words, ESAs can contribute significantly to the maintenance of inter-generational equity, considered a key component of a sustainable economy.

Study Outcomes

Part A- Demarcation and Inventory of Wetlands in Mauritius and Rodrigues

The Ramsar Convention, an intergovernmental accord established in 1971 to protect and foster wise management of wetlands worldwide, classifies areas of prospective international significance across 42 different classes, including freshwater, marine and many man-made features, such wastewater treatment facilitiies, irrigation ditches and salt exploitation sites, among others . The purpose behind this wide and varied system is to provide maximum flexibility when an area of critical *international significance* is identified.

At the national level, the Fisheries Act and draft Wetlands Bill also provide legal definitions of wetlands in Mauritius and Rodrigues to include man-made features and areas of marine water for the specific purposes of interpreting the binding conditions imparted through these documents In addition, the recommendations of the final report of a "Study of Environment Risks in the Grand Baie Area" are to act as a framework for an element of the study, viz. "…carry out a complete survey of [Grand Baie] wetlands identified and identify their owners to declare wetlands as protected areas…will constitute one of the tasks in the project". The wetlands addressed in the Environmental Risks study were limited to land-based freshwater systems. Considering marine or man-made areas in defining wetlands in the Grand Baie area with the *a priori* view to declaring them as protected areas, as stated in the TOR, also clearly presented an unworkable definition for the purposes of Part A of this project. Thus, for the purposes of carrying out Part A activities, wetlands were defined as:

> " areas of fresh or brackish water to varying depth, not actively attached to the marine environment via surface natural or manmade channels or flows, and characterised by soils, plants and animals whose attributes and distributions are affected by or adapted to permanent or frequent inundation and/or complete saturation"

This definition appeared most in line with the intention and scope of the project, as detailed in the

project TOR and consultant proposal descriptions. It is also proved the most workable in relation to the activities.

The main project objectives achieved in Part A included:

1. Identification and delineation of wetlands showing boundaries, buffer zones, land tenure and administrative authority
2. Characterisation of bio-physical attributes, pressures and adjoining land use
3. Training of officers in wetland inventory techniques
4. Three-point alowable use categorisation of wetlands

The study of freshwater wetlands was conducted through three phases: 1. Grand Baie coastal wetlands, 2. Other wetlands and 3. Upland marsh. The sequence and completion of each phase depended on the availability of various data sources and time needed to undertake field surveys. Ground-truthing, aerial photography and maps were the main tools employed in the delineation of coastal wetlands, lakes and reservoirs. Upland marsh areas were primarily delimited using SPOT-5 imagery combined with field validation.

1. <u>Grand Baie coastal wetlands</u>

The delineation of 12 Grand Baie wetlands revealed historic and ongoing pressures from backfilling and other disturbance. Evidence of the effects of this disturbance is present in the largely non-native and invasive plant and animal communities, and in area flooding and associated damages. Comparison to previous work also showed recent and past fragmentation of what were previously large, contiguous wetlands.

Wetland hydrology, soils, and habitat functions were found to be of generally poor or decreasing value in Grand Baie. This is due in most part to reductions in wetland size from backfilling, loss of functional buffers from backfilling and development, and vegetative cover made up primarily of non-native species. Ten wetlands are dominated by *Typha domingensis*, often in near-monospecific stands, and two are open-water-dominated. All wetlands function to store water, and most have had additional stormwater flooding pressure exerted on them due to decreases in wetland size and increasing impervious surface in surrounding areas. Habitat functions of wetlands are limited by the generally low vegetative structural and composition diversity and by buffers that are commonly disturbed and developed. Wetland buffers also tend to function poorly because of their common use for dumping construction materials and other debris, as well as their increasing urbanization.

A comparison of wetland area in Grand Baie over time reveals an estimated 23 percent decrease from 2000 to 2008. Previous inventories approximate that the wetlands decreased in area by 10 percent and 30 percent in the periods from 1980 to 1990 and from 1990 to 2000, respectively.

Backfilling of the Grand Baie wetlands has impacted and continues to impact wetland functions. Detrimental effects are likely to continue and increase in intensity if consideration is not given to wetlands in matters of development. It is therefore important that a framework for wetland management be implemented to avoid further wetland loss and degradation in Grand Baie.

2. Other wetlands

Over 200 coastal marshlands were identified in Mauritius covering an approximate area of 406 ha. Approximately half of these were habitat fragments of once-contiguous wetlands. Coastal marshland is generally found in areas less than 20 metres above sea level (asl), with around 13% of the total documented area falling below sea level, based on an interpolation of the base 10-metre topographic contour data made available to the project. The bulk of these sub-zero marshlands are located in the Grand Baie, Post Lafayette/Roches Noire, Wolmar and Belle Mare/Palmar areas.

Coastal Marshland appears to aggregate along margins where normal riparian drainage has failed to form through natural means or been removed through historic land use change. Consequently, coastal marshland appears to be acting as the main surface hydrological system in the Riviere du Rempart and Flacq districts.

Based on standardised vegetation surveys and mapping of each site, we characterised these wetlands into four structural and community types: (1) Open-water and grass-dominated wetlands; (2) Open-water and *Acrostichum*-dominated wetlands (with *Rhizophora*); (3) Vegetated wetlands dominated by *Typha* and grass; and (4) Vegetated wetlands dominated by *Typha* and *Acrostichum*. We examined biological diversity across these wetland types and found that wetlands dominated by *Acrostichum* of either open-water or vegetated structure supported the following: 1) more total biodiversity, 2) more plant diversity and 3) more terrestrial plant diversity, than the wetland types (1 & 3) dominated by grass and *Typha*. Aquatic plant diversity, alternatively, was found to be significantly higher in vegetated wetlands (3 & 4) compared to open-water wetlands. There was no effect of wetland type on fauna diversity. In summary, ***it appears that wetlands have acted as important refuges for plant species in the coastal lowlands of Mauritius. The low-lying and frequently rocky features of these wetland habitats has made them unsuitable for agriculture and ensured the protection of many native plant species, particularly immediately adjacent to and within the buffering ecotone.***

Twenty-seven percent of coastal marshlands (54 of 204) were allocated to a High Conservation Value Category, based on biophysical attributes. Of these, twelve marshlands appear to be of particularly elevated conservation significance.

Continued urbanisation and expansion of residential housing was identified as the key contemporary threat to Mauritian wetlands, exacerbating earlier losses of wetlands from centuries of farming in the lowlands. The process of backfilling and fragmenting wetlands has markedly reduced the area of wetlands within most major Defined Settlement Boundaries and disturbed most wetland edges. ***The***

construction of homes in these low-lying areas has also significantly elevated the risk of major flooding to surrounding houses and infrastructure, particularly during intense cyclonic activity.

Ground surveys and classification of remotely-sensed SPOT and IKONOS satellite imagery of Rodrigues indicates that there are no significant freshwater marshlands, lakes or reservoirs on the island that met the study criteria as applied to the island of Mauritius.

3. Upland marsh

More than 600 individual upland marsh features, covering approximately 65 ha, were identified through classification of remotely-sensed imagery (SPOT panchromatic, 10m resolution) combined with a basic net of field-collected, data control points. A filter was applied to remove areas less than 100 m^2. Upland marsh is principally found in the Plaines Wilhelms district, particularly within the Black River Gorges National Park and adjoining State Forest Lands between 500 and 720m above sea level (asl). They are characterised by localised, flat topography and slow drainage. Highly clustered, upland marsh features are relatively small (900 m^2 on average) as small-scale, topographic relief shapes presence of marsh-like conditions. Vegetation consists primarily of sedges, grasses and a variety of endemic *Pandanus* spp. (Vacoas). They are intermixed with endemic heath and exotic plantation forest (mainly *Pinus* spp.) in the main areas.

Upland marsh, lakes and reservoirs are almost exclusively found on State Land in some of the more remote areas of the island. Consequently, while they represent important ESAs and rank highly in terms of conservation value, they are presently subject to few of the pressures currently being exerted on coastal marshland. All upland marsh features have been assigned to High or Moderate Conservation Value categories due to their limited distribution, hydrological role attached to reservoir function and repository of endemic Mauritian biota. Few of the most significant upland marsh areas appear under threat with virtually all of the remaining area located within areas of State Land. Most lakes and reservoirs have been assigned a Moderate Conservation Value. Bassin Blanc has been assigned High Conservation Value due to its relatively undisturbed condition and repository of endemic Mauritian biota.

Part B- Identification and Demarcation of ESAs other than Wetlands

ESAs were selected using an ecosystem approach, a strategy recommended by the international programs associated with the Convention of Biological Diversity and the Millennium Ecosystem Assessment. Selection of ESAs were informed through focus group meetings and consultations and structured on a set of provisional ESA types outlined in the NDS, NES and various OPSs. Their delimitation made best use of remotely-sensed imagery, existing GIS coverages, maps, and substantive field validation and collection of GPS data. Information was rolled up as it became available and structured within a GIS-geodatabase.

The main project objectives achieved in Part B included:

1. Establishment of a formal list of ESA types within a classification system
2. Description of ESA identification criteria based on ecosystem services (environmental functions)
3. Baseline delimitation and mapping of designated ESA types
4. Training of officers in ESA GIS and GPS use
5. Delivery of ESA GIS equipment package

A hiearchical classification system was developed to provide management flexibility with the ESA system. ***At the centre of the classification are fourteen main ESA Types covering terrestrial and lagoon environments:***

1. ***Coral Reefs***
2. ***Islets***
3. ***Sea Grass Beds***
4. ***Mangroves***
5. ***Inter-tidal Mudflats***
6. ***Sand Beach and Dune***
7. ***Coastal Freshwater Marshlands***
8. ***Boreholes (Wells)***
9. ***Caves (and other geological features)***
10. ***Rivers and Creeks***
11. ***Lakes and Reservoirs***
12. ***Upland Marsh***
13. ***Steep Slopes***
14. ***Forests with High Native Content***

Profiles of the fourteen ESA Types were created in fact-sheet formats. A fifteenth identified type, ***Native Fauna Habitat***, lacked the necessary spatial information to adequately resolve a baseline distribution and requires further work before accession into the system.

Combined, the fourteen ESA Types are estimated to cover more than 112,000 hectares. This represents more than a third of the land and lagoon area in Mauritius and more than three-quarters of these areas in Rodrigues, ***after accounting for type overlap.*** Steep Slopes (greater than 10% slope) have the largest areal representation among the identified ESA Types, particularly on Rodrigues. This is followed by Sea Grass (and Algal) Beds (of varying density), Coral Reefs (of varying density), Rivers & Creeks (including buffer zone) and Forests with High Native Content.

Most of the described ESA area is concentrated in areas containing several, overlapping ESA Types. This is most pronounced in the south-west Le Morne-Black River Gorges region, the Bambous Mountains-Mahebourg Bay region in the south-east, the Northern Islets archipelago, and the Poudre D'Or-Ile d'Ambre-Ilot Bernache area in the northeast of Mauritius. On Rodrigues, this is concentrated in the south lagoon and vicinity of the Plaines Cavernes-Plaines Corail region.

Identified and delimited ESAs were accessioned into a GIS-geodatabase that will allow personnel to revise ESA Type coverages within an adaptive management framework.

Part C- Study of ESAs legislation and policy for protection and management

Part C of the ESA Study aimed to assess the relative importance of different ESAs and develop a comprehensive framework that would pave the way towards the long-term maintenance of their integrity. The key to achieving this outcome rests with a framework that affords sufficient flexibility in the way ESAs are integrated into national development processes.

The main project objectives achieved in Part C included:

1. Categorisation of ESAs based on relative value criteria
2. Assessment of ESA Type conditions
3. Determination of threats and pressures impacting ESA integrity
4. Evaluation of ESA vulnerabiilty
5. Ranking of ESAs based on priorities for engagement
6. Drafting of policy guidance for ESAs
7. Review of laws and statutes for their applicability to ESA protection
8. Drafting of ESA Bill
9. Development of strategic ESA management plan

ESA Categorisation

ESAs within each type required categorisation based on their relative value (sensitivity) in maintaining environmental functions. This categorisation provides sufficient flexibility in proposed land uses to strike a balance between environmental protection and sustainable development needs.

The ESA project developed a ranking system of three categories for the categorisation and management of ESAs.

> ***Category 1 ESAs*** ***have the principal objective of protecting sites with high ecosystem service value through strict control on land use.***
>
> ***Category 2 ESAs*** ***have moderate service values and can be managed to allow some permitted alteration, as long as sites are maintained in a healthy state.***
>
> ***Category 3 ESAs*** ***will be managed to allow their sustainable use for a wider range of activities, such as fishing, tourism, aquaculture and facility development through application of appropriate technologies and more stringent design criteria and site management than otherwise permitted under existing regulations.*** Category 3 ESA may be subject to some further degradation, but with a view to maintaining representative examples and compensating for loss of service provision.

A risk assessment was undertaken to identify general trends in the pressures and threats weighing on ESA integrity and how these are related to relative value (vulnerability). Pressures drive impacts

over the near term that afford little opportunity for socio-economic adaptation. They are best addressed through mitigative action while threats describe longer-term drivers of change to ESA function delivered through larger-scale processes. These will primarily require an adaptive approach in responding to environmental change.

Expansion of the urban-suburban boundary into adjoining areas was considered to integrate the main factors placing pressure on ESAs in Mauritius. This is due to its association with both domestic and industrial resource use, the production of degrading pollutants and point source for release of invasive alien species. Pressure on each ESA Type was explored through the use of proximity and designation-based analyses. Proximity analysis examined the distribution of all ESA area in relation to the nearest Built-Up Area (BUA). BUAs form the core of Defined Settlement Boundaries (DSB) and their subset of Strategic Growth Zones (SGZ). Combined, DSB and SGZs provide a view into the likely future pressure areas. Designation-based analysis examined the incidence of each ESA Type under various land classes. The results of categorisation under proximity and designation-based analyses were crossed to identify those types under most extreme pressure.

Results of the pressure analysis indicate that a number of ESA Types are under extreme pressure from expansion of the built environment, either due to a clustering of sites near BUAs, a relatively small area covered by any ESA Type, poor representation in conservation areas, or combination thereof. These include Caves, Coastal Marshlands, Sand Beach and Dune Systems, Tidal Mudflats, Mangroves and Boreholes (wells). Field survey data on incidence of solid-waste contamination and material alteration support these conclusions. Results indicate that River and Creek and Coral Reef ESA Types are under moderate pressure, while Reservoirs & Lakes, Forests with High Native Content, Steep Slopes, Upland Marsh, Sea Grass Bed and Offshore Islet types are under relatively low pressure. ***This categorisation doesn't preclude individual features (sites) within types from being under different pressure levels***.

Assessment of the spatial distribution of ESAs in relation to BUAs, identify ***a Critical Risk Zone (CRZ) extending up to 500 metres from the edge of most BUAs. ESAs with Category 1 status located within the BUA or CRZ are considered the Most Vulnerable and have been allocated Highest Priority in implementing recommended policy and management measures.***

Threat analysis focused on Forests with High Native Content and Coral Reefs as two key ESA Types that are subject to longer-term degradation due to invasive species, global warming and the interaction of these. Analyses were limited by the poor coverage for Mauritius within global datasets needed to adequately detect spatial patterns at the scale embraced by Mauritius and Rodrigues. Assessment of forest isolation identified areas on the eastern-most fringe of native forest distribution that are most likely to degrade due to mass effects. Examination of sea surface temperature data provided by the Fisheries Division, indicates that coral reefs distributed across the northernmost lagoon in Mauritius are most vulnerable to decline due to sea temperature rises.

ESA Policy Guidance

The main Policy Principle required to underpin ESA maintenance is sustainable development, defined as:

> ***meeting the needs of the current generation without sacrificing the needs of future generations – is a powerful concept that reflects the principle of intergenerational equity.***

This leads to a simple vision statement for ESAS, being:

> ***Intact, healthy and functioning ESAs producing economic, social and cultural benefits for current and future generations of Mauritian society, as well as overseas visitors***

Placed in the three-tier ESA categorisation system, the ***long-term outcomes desired for ESAs*** are as follows:

- ***Category 1 ESAs are protected intact and, where needed, restored to health and resiliency***
- ***Category 2 ESAs are protected in a viable and healthy state, with restoration considered on a case-by-case basis and any mitigation for adverse impacts on ESAs provided on-site***
- ***Category 3 ESAs are protected, with an emphasis on conserving a viable number of features (instances of an ESA type) within an individual ESA type, and any loss is compensated.***

The ***overarching policy prescription*** proposed (in conjunction with the legal review) applies to land use development and ESAs. The policies elaborated below are designed to restrict development in the following manner so as to meet the outcomes specified above:

- ***For Category 1 ESAs:***
  - ***All development in or on an ESA is prohibited.***
  - ***Development outside an ESA that will adversely affect the ESA is prohibited; development outside the ESA may proceed provided that mitigation measures will prevent adverse affects on the ESA.***
- ***For Category 2 ESAs—Any development that may adversely affect an ESA must be offset by projects on the same property that provides environmental benefits.***

- ***For Category 3 ESAs—Any development that causes significant adverse impacts is prohibited. Development is permitted and may degrade the ESA provided that mitigation measures prevent significant impacts and any net impacts are compensated.***

In terms of the determination of compensation for impacts that cannot be mitigated it is recommended that economic valuation of these residual impacts be undertaken according to standard valuation methods. The key question is whether certain levels of compensation can be prescribed before the fact. It would be generally desirable to avoid case-by-case negotiation on these matters. On the other hand the range of different impacts that would need to be foreseen and valued is rather larger, making such an exercise unwieldy. It might be best to instead to develop a committee to oversee individual cases and ensure that the appropriate methods are employed. Perhaps then after some time the more frequent types of impacts could yield themselves to a standardized compensation schedule.

The intent is that compensation be paid only when it is not possible to fully offset impacts on ESAs or when the ESA in question is not of critical importance. ***Monetizing the loss of ESA services in this fashion is effective only if these funds are then held in an ESA fund for reinvestment in ESA that are close substitutes*** (i.e. ESAs of the same type but in another location) or ,if not possible, in other ESAs. ***It is imperative that the compensation be reinvested in ESAs and not spent on other budgetary items in order to follow the policy principles.***

The most relevant short and medium-term desirable outcomes for ESAs were identified as being:

- Control of access, development and use of ESAs in the commons (uncommitted state lands-forests, caves, etc, streams and rivers, public waters)
- Creation of additional protected areas (national parks, reserves and boreholes)
- Restoration of existing protected areas (national parks, reserves and boreholes)
- Protection and management of ESAs on private and leased state land (forests, wetlands and other ESA types)
- Elimination of subsidies for productive agricultural activities (rivers and streams; marine areas)
- Marginal cost pricing of public services and resources (water, wastewater, etc)

A series of policy instruments that can be prospectively employed towards achieving short and medium-term outcomes are outlined in Table 1.

Table 1. Policy instruments for achieving desirable outcomes

Policy Instruments and Financing Mechansims	Short- and Medium-term Outcomes					
	Access, development and use controlled in the commons	PAs protected or created	Restoration of PAs	Protection and restoration of ESAs on private and leased lands	Subsidies for production eliminated	Marginal cost pricing of services and resources
A. Regulatory						
Centralized Management						
Public Ownership						
Public Investment						
Enhancing Public Assets						
ICDPs						
Sensitization*						
Micro-credit*						
Command and Control						
Decentralized and Polycentric Partnerships						
Co-Management						
Common Property Management *						
Public-Private Partnerships						
Market-Based Instruments						
Fiscal Instruments						
Taxes on Pollution						
User Fee and Charges						
Subsidies and Payments						
Regulated Markets						
Privatization						
Cap & Trade						
Product Certification*						
B. Non-Regulatory						
Self-Regulation						
Market-Based Approaches						
Voluntary Contractual Arrangments						
Private and Voluntary Sector Investment						

Notes: * indicates mechanisms that could also be provided by regulatory program

Perhaps the most innovative of the policy instruments recommended here is the use of positive incentive programs to induce better management of ESAs that are located on private (and state lands). While a range of instruments are presented, ***the use of direct payments to landowners to protect and manage ESAs probably holds the most attraction in terms of simplicity and tractability in the Mauritian context.*** Akin to payments for ecosystem services, ***such arrangements would be voluntary contractual arrangements that clearly specify the roles and responsibilities of the government and the landowner, and clearly proscribe compliance, monitoring activities and the payments and any other consequences/inducements associated with performance under the contracts.*** Adaptation of these arrangements to work with local groups is highly advisable in order to better sensitize communities to the importance of ESA protection and to enable wider benefit sharing with regard to actions taken and costs incurred.

ESA Legal Review

This review assessed the laws and institutions of Mauritius to identify its strengths and weaknesses for protecting and managing ESAs. Together with a complementary Policy Guidance and Strategic Management Plan—serve as the basis for making recommendations for conserving and managing ESAs.

CONCLUSIONS ON EXISTING LEGISLATION. The report concludes that the laws and institutions of Mauritius are, in many respects, effective for accomplishing the goals of sector-specific laws (e.g., nature reserves, water pollution, etc.). Many aspects of Mauritian law are well tailored to protect and manage ESAs, and in many cases the laws of Mauritius are quite progressive. For example, the establishment of river and stream reserves has no doubt protected rivers and streams from sedimentation, pollution from fertilizers and other agricultural inputs, and other harms. An outright ban on sand removal in lagoons also demonstrates a commitment to protecting one of the more valuable resources in Mauritius.

Taken as a whole, however, the laws of Mauritius are inadequate to protect ESAs. There are several reasons.

1. **Gaps in Legal Protection.** Some ESA types receive inadequate legal protection. Wetlands provide a good example. Although filling or draining of a wetland requires an Environmental Impact Assessment (EIA) licence, no law prevents or regulates the filling or draining of a wetland or otherwise determines the type of information that a developer should provide prior to developing a wetland. In addition, because EIA law only applies to new undertakings, the EIA provisions of the Environment Protection Act 2002 do not apply to ongoing activities that may harm wetlands. Similarly, no specific laws are designed to protect caves.

2. **Lack of Thresholds for Ministerial Decisions/Too Much Discretion.** For a number of laws that could afford protection to a variety of ESA types, the laws establish no environmental threshold for decisionmaking. For example, the Fisheries and Marine Resources Act 2007 does not include a duty to ensure that fish quotas are set at a sustainable level or at maximum sustainable yield. The Central Water Authority Act 1971 does not prohibit water use beyond the capacity of a river or stream. The Pas Géométriques Act 1982 does not establish a limit for development within the Pas Géométriques.

3. **Inadequate Environmental Impact Assessment.** The provisions on EIA of the Environment Protection Act 2002 apply to a large number of undertakings that may affect ESAs. Nonetheless, they do not require any specific substantive outcome. Provided that the project proponent adequately analyzes the impacts of the project, suggests alternatives, and proposes mitigation measures, nothing prevents the Minister of Environment from approving a project that will significantly harm an ESA. Moreover, the EIA provisions do not require the implementation of measures to mitigate harm caused by an undertaking.

4. **Inadequate Environmental Planning.** A wide range of stakeholders believe that the consideration of ESAs and other environmental issues comes too late in the development process. The EIA process includes an early warning system that requires project proponents to provide information to the Director of Environment concerning the proposed undertaking prior to seeking an EIA licence. Nonetheless, many governmental and private sector stakeholders commented that the EIA process, the most significant mechanism for protecting ESAs and ecosystem services values, is triggered only after all the design work for a project has been completed. As a consequence, project proponents have already committed substantial financial resources to their project, only to be told near the end of the process that design changes must be made. There was fairly universal agreement among stakeholders that, despite the existing early warning system, project proponents must be made aware of ESAs much earlier in the development process. Moreover, it appears that some types of projects, such as Integrated Resort Schemes, may be subject to expedited approval processes that make implementation of EIA impossible.

5. **Inadequate Enforcement.** Enforcement remains inadequate due, in many instances, to a lack of political will to enforce the law. Various stakeholders from the governmental, private, and nongovernmental sectors all provided examples indicating a lack of political will. In some cases, for example, the government initiated an enforcement action and, when confronted with political pressure, stopped the enforcement action. In other cases where more than one ministry has enforcement authority, neither ministry would take enforcement action because it believed that the other should. In yet other cases, it appears that authorities have turned a blind eye to obvious violations of law. Blue Bay, for example, is littered with jetties despite the prohibition against the construction of such physical structures. Moreover, despite having the authority to establish a prosecutorial unit within the Ministry of Environment, the Ministry has not done so. As a consequence, it must rely on the State Law Office for bringing its cases. The State Law Office, however, is charged with bringing a large number of cases and an environmental case becomes just one of many on its docket.

   Inadequate enforcement also results from a lack of capacity. Thus, even where the political will exists, ministries are under-staffed and under-resourced. For example, a staff of four people is charged with conducting post-monitoring of PERs and EIAs, an almost insignificant staff to review implementation of more than 1000 EIAs prepared since EIA became a requirement.

SUMMARY RECOMMENDATIONS FOR LEGISLATIVE CHANGE. To overcome these problems, a number of recommendations for improving the conservation and management of ESAs have been made. The recommendations begin by designing an overarching legal framework for protecting ESAs deriving from the three-tiered categorization of ESAs described above. Those categories provide the basis for determining the types of activities that may or may not be permitted in an ESA. Consistent with the relative value of an ESA, as well as the goal of Mauritius to balance environmental protection with development, these recommendations do not attempt to prohibit all development in all ESAs or prohibit all harm to all ESAs. Rather, these recommendations propose the following framework in which increasingly strict standards for development apply as the ecosystem services value of an ESA increases:

- **Category 1 ESAs—**
  - ***All development in or on an ESA is prohibited.*** This standard is very clear and rigorous enough to be enforceable. It also recognizes that some ESAs are simply too valuable to degrade. The rigidity of this rule is offset by the more flexible rules for development affecting Category 2 and 3 ESAs. To the extent that this rule is viewed as too rigid, the following proposal provides an alternative threshold: All development in or on an ESA that may adversely affect the ESA is prohibited.
  - ***Development outside an ESA that will adversely affect the ESA is prohibited; development may proceed provided that mitigation measures will prevent adverse effects.***

- C**ategory 2 ESAs—*Any development that may adversely affect an ESA must be offset by projects that provide environmental benefits on the same property.*** For example, if development of an industrial facility will result in degradation of a wetland, then other wetlands must be restored or built or a stream reserve expanded on the same property.

- **Category 3 ESAs**—***Any development that causes significant adverse effects is prohibited. Development is permitted and may degrade the ESA provided that mitigation measures prevent significant impacts.***

Numerous ways to integrate these legal standards into the environmental laws and regulations of Mauritius are identified. For future activities, that challenge is met by including these standards into the EIA process of the Environment Protection Act 2002. This project also seeks ways to include these standards into sector-specific laws, such as the Forests and Reserves Act 1983 and Ground Water Act 1969, to ensure that existing activities are managed effectively to safeguard ESAs from adverse impacts. Section 5 of this report suggests immediate, short-term, and long-term strategies for making these laws better able to protect and manage ESAs.

Perhaps the most challenging component of this project is finding ways to protect and manage ESAs from the adverse effects of existing activities on private lands. Because private landowners have certain rights to develop their property, those rights, in general, cannot be taken away without compensation. To overcome this financial barrier, ***this project explores the use of conservation easements—legally binding, voluntary agreements between a landowner and the government or other eligible organization that restricts the type or amount of development on the landowner's property.*** Landowners are sometimes willing to enter into such agreements because they receive a tax credit that lowers the amount of tax they must pay. While governments still pay for these easements through lost tax revenue, the impact is generally less than direct cash payments to buy development rights outright or to compensate landowners the fair market value of the land as part of a condemnation/eminent domain action. The report also proposes other incentives in which the government provides funding for the conservation of ESAs on private land.

The incorporation of incentives into conservation planning reaches across different laws and resources. That is, conservation easements and other incentives are valuable tools not only for conserving wetlands but also for conserving streams, forests, and other ESAs. ***To implement and enforce easements across a variety of resources, it would be valuable to have new legislation that adopts uniform standards for their use.*** For that reason, ***the Draft Environmentally Sensitive Areas Conservation and Management Act (2009) (hereinafter Draft ESA Act) submitted as part of this project proposes a number of uniform rules for the valuation of lands, enforcement of easements, and the development of other types of incentives for conserving and managing ESAs***..

A central component of these recommendations is, of course, identifying ESAs and ensuring that a proper development framework exists to conserve and manage them. As a result, this report recommends that two critical proposals be adopted on a priority basis. First, the **ESA Map** that accompanies this project is absolutely essential for planning purposes. The ESA Map not only identifies ESAs by type, but also categorizes them as Category 1, 2, or 3 ESAs. ***The ESA Map thus provides the fundamental basis for planning where development may occur consistent with the three-tiered development framework***. ***It is recommended that the Hon. Minister of Environment & NDU promulgate a regulation that makes the ESA Map a binding feature of EIA.***

Second, recognizing that the early warning system embodied in the Environment Protect Act 2002 has failed to provide sufficient notice to developers of the requirements of environmental law, ***this report recommends the adoption of an ESA Clearance***. The ESA Clearance will inform the project proponent as to whether the proposed project may harm an ESA. Project proponents will also be told which laws and other planning requirements apply to development at the proposed site. To ensure that project proponents do not invest significant resources before learning that the presence of an ESA may impose certain development and design requirements, project proponents must

obtain the ESA Clearance *before* receiving any development permits. The process for obtaining an ESA Clearance is described in Section 5.1.3 and in the Draft ESA Act.

SUMMARY RECOMMENDATIONS FOR IMPLEMENTING LEGISLATIVE CHANGE. The Legal Review provides options for implementing the recommendations for legislative change. ***Many of these recommendations could be implemented through regulations***, because most ministers have substantial authority to promulgate a wide range of regulations. Because not all of the proposed changes could be adopted by regulation, ***a hybrid regulations-amendments approach through which most changes would be made by regulation but others would be adopted through amendments to existing law is offered as an option***. ***A third option proposes the adoption of the Draft ESA Act,*** which would provide the general framework for protecting ESAs and establish incentives for the protection of ESAs on private lands, including the use of conservation easements and payments for environmental services.

It is concluded that over the long term adoption of an ESA Act is the better choice, because it would provide a unified and coherent structure and binding legal obligations that could not be reversed through the adoption of regulations. Moreover, because the hybrid regulations-amendments approach requires significant amendments to existing laws—and thus Parliamentary approval—it would be worthwhile to pursue the full range of legislative changes needed to provide a unified, coherent legislative framework for protecting and managing ESAs.

Nonetheless, ***if Parliamentary approval of an ESA Act is expected to take even a moderate amount of time, the Minister of Environment & NDU should take immediate action to adopt regulations to implement EIA as proposed in Section 5.1, as well as adopt additional regulations, also included in Section 5.1, to make the ESA Map and ESA Clearance legally binding tools for EIA and other law use planning.***

SUMMARY RECOMMENDATIONS FOR INSTITUTIONAL CHANGE. The findings of this report concerning the appropriate institutional arrangements for protection and management of ESAs are more ambiguous. In many respects, Mauritius has found a way to overcome a lack of integration among agencies with environmental responsibilities—a problem that plagues many countries—through meetings of inter-ministerial boards and committees. Given the heavy reliance on this mechanism, this report suggests that a review be done to ascertain whether there is *too much* coordination which perhaps has allowed a kind of "integration fatigue" to set in for some ministry officials who may need to attend meetings of two or more committees.

It also suggests that Mauritius review the placement of the Forestry Service and the National Parks and Conservation Service (NPCS) in the Ministry of Agro Industry, Food Production and Security. The Forestry Service, because it has both conservation and exploitation mandates, has an inherent conflict as it tries to juggle these two different mandates. The NPCS may also find difficulty in achieving its full mandate as an institutional sub-associate within the Ministry of Agro-Industry and Forestry Services. As such, it may be more appropriate to put the conservation duties of these

departments in the Ministry of Environment where the main missions are more consonant with a singular focus on environmental protection and conservation. Regardless of any transfer of duties to the Ministry of Environment, it may be useful to concentrate resources and expertise for management of nature reserves and other protected areas within the NPCS.

Lastly, concerns have been raised relating to monitoring and enforcement. The overlapping authority of the Ministry of Environment and the "enforcing agencies"—those agencies with a mandate to implement laws concerning specific resources—appears to be causing significant breakdowns in enforcement, with both the Ministry of Environment and the enforcing agencies claiming that the other ministry should be undertaking an enforcement action. This report suggests that this issue be reviewed to determine whether all enforcement authority be placed within the Ministry of Environment & NDU or delegate that responsibility to the relevant enforcing agency only.

ESA Strategic Management

The main goal of ESA management is to implement activities and apply resources towards striking and maintaining this balance. This goal can be achieved by managing towards:

- sustainable economic development,
- protection of fragile habitats,
- ensuring a healthy supply of freshwater,
- conserving endemic flora and fauna,
- minimising lagoon degradation
- retaining landscape features contributing to scenic beauty and socio-cultural heritage
- maintenance of natural coastal defences, and
- maintenance of outdoor recreational and educational venues

This plan is structured to extend over a five-year period running parallel to the timeframe established for the District Council Outline Planning Schemes. It follows a four-step process that has been employed to link a three-tier system of categorising relative ESA value to policy, legal and management instruments.

Three management categories form the core of the management framwork, viz.

1. ***Category 1 Management - Protection***
2. ***Category 2 Management - Conservation & Mitigation***
3. ***Category 3 Management - Sustainable Use***

Management categories are consonant with the three-point system for assigning relative value, establishing ESA policy and establishing a legal mandate for future ESA identification and management.

A series of permitted activities are linked to ESA Type and Management category in line with the main management focus. ***A series of seven management measures are broadly prescribed to deliver effective action in ensuring protection and long-term integrity of ESAs.*** These include:

1. ***Buffers zones***
2. ***Access***
3. ***Amelioration and Improvement***
4. ***Mitigation***
5. ***Development Design***
6. ***Information, and***
7. ***Public Awareness***

Not all measures are necessarily employed across all ESA Types and/or Management Categories.

The Ministry of Environment & NDU should act as the de facto secretariat for ESA management coordination given the current mixed model employed in Mauritius for managing natural resources and ensuing alignment of managerial responsibilities across a wide range of government agencies. Establishment of a secretariat is critical to the long-term success of any programme for management of ESAs. It is likely that additional personnel will be required for the Ministry of Environment to fulfill their necessary obligations under this arrangement.

It is expected that implementation could commence in 2010 and follow through a five-year timeframe. An implementation schedule outlines a basis for proceeding with facilitatory arrangements and subsequent deployment of management measures. ***Activities would, in the first instance, focus on those ESA Types and Features (sites) that have been identified for priority action through the vulnerability analysis***. A new management plan will require drafting at the end of the five year term. More detailed site management plans may be required to advance activities at some ESAs, particularly those now inter-mixed with the built environment.

Monitoring of ESA integrity will play a central role in advancing towards the long-term management objectives. ***A detailed programme for monitoring ESA integrity focuses on individual ESA Types and methods to collect the time series data needed to detect degradation to the state condition of ESAs in Mauritius and Rodrigues.***

Effective management of ESAs will only occur where a sound financial footing has been established. ***While government funding may play an active role in supporting ESA management, significant efforts to source support from non-governmental sources should be undertaken***. Support

could occur through grants, volunteering, sponsorship and other, innovative approaches to development of public-private partnerships towards retention of ESAs in the country.