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**Government of Saint Lucia**

**Ministry of Planning, Development and the Environment**

**WATERSHED AND ENVIRONMENTAL  
MANAGEMENT PROJECT - PHASE II**

**INTERIM REPORT**

**February 1997**

**VOLUME I**

**Executive Summary**

**Institutions, Socio Economics and Draft**

**Watershed and Environmental Management Plan**

**Hunting Technical Services,  
Hemel Hempstead,  
England.**

**IN ASSOCIATION WITH**

**Mott MacDonald  
Cambridge,  
England.**

**Under assignment by the Overseas Development Administration**

7088

**St. Lucia Watershed and Environmental Management Project**

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19 February, 1997

The Permanent Secretary  
Ministry of Planning, Development  
and Environment  
Government Buildings  
CASTRIES

Dear Sir

**Watershed and Environmental Management Project - Interim Report**

I have pleasure in submitting this Interim Report, in ten copies.

The report is in addition to those required under the Project Memorandum, but consistent with the proposed reporting structure set out in the consultants Inception Report (October 1996). Our rationale for this, is to study the issues raised and to discuss and comment on the direction of the consultancy, and we trust that by so doing, the value of final documents produced and the prospects for successful implementation will be enhanced.

A series of technical inputs have been completed during the period October 1996 to February 1997. As consultants completed their inputs, reports were produced and circulated in draft form.

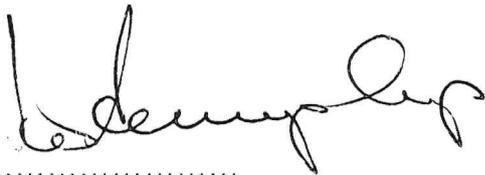
A series of meetings were then convened in order to give the consultants essential feedback, and comments raised during these sessions have, as far as in practicable, been incorporated in this final version.

Guidance was sought on the crucial issue of community participation, and the strong support given by government has allowed exciting developments in this field.

The report is presented in two volumes; Volume I covering Institutions - Socio Economics and includes first draft of a Watershed and Environmental Management Plan, and Volume II covers Land Use, Environmental Issues, River Engineering and Hydrometeorology.

I trust that you will find the report informative and that it meets with your approval.

Yours faithfully

A handwritten signature in black ink, appearing to read "P. W. Humphreys", written in a cursive style.

.....  
Peter W Humphreys  
**TEAM LEADER**

# SECTION A

## CONTENTS LIST

<b>1. Introduction</b>	<b>1</b>
1.1. Inputs and Timing	1
1.2. Work Programme	1
1.3. Layout of the Report	1
<b>2. Environmental Legislation</b>	<b>3</b>
2.1. General	3
2.2. Watershed Legislation	4
2.3. Environmental Legislation	9
2.4. Disused Legislation	15
2.5. Need for New Legislation / Amendments to Existing Legislation	16
<b>3. Institutions Responsible for Watershed Management Legislation</b>	<b>18</b>
3.1. Watersheds and Coastal Zone Management	18
3.2. Agricultural Department	19
3.3. St Lucia Banana Growers Association	20
3.4. Forestry Department	21
3.5. Water and Sewerage Authority	22
3.6. Ministry of Communications, Works and Transport	23
<b>4. Institutions with an Environmental Interest</b>	<b>25</b>
4.1. Government Institutions	25
4.2. Regional Organisations	28
4.3. Non-Governmental Organisations	30
4.4. Community Based Organisations	32
<b>5. Government, Community Based and Other Organisations in the Dennery and Cul de Sac Watersheds Field Trials</b>	<b>33</b>
5.1. Approach	33
5.2. The Danger of an Unsuccessful LCDC Campaign	33
5.3. Future Work Programme	33
5.4. Some Initial Responses to the Survey	34
<b>6. Towards an Integrated Institutional Framework for Watershed and Environmental Management Programme</b>	<b>35</b>
6.1. Statement	35
6.2. Problems	35
6.3. National Environmental Management	36
6.4. Watershed Management	37
6.5. Five Year Watershed and Environmental Plan	40

## LIST OF FIGURES

<b>Figure 3.1</b>	<b>Establishment, Agricultural Engineering Services Division</b>	<b>19</b>
<b>Figure 3.2</b>	<b>Establishment, Forestry Department</b>	<b>21</b>
<b>Figure 3.3</b>	<b>Establishment, Works Department</b>	<b>23</b>
<b>Figure 3.4</b>	<b>Establishment, Meteorological Services</b>	<b>24</b>
<b>Figure 4.1</b>	<b>Establishment of the St Lucia National Trust</b>	<b>31</b>
<b>Figure 6.1</b>	<b>Proposed Structure for Environmental Management</b>	<b>36</b>
<b>Figure 6.2</b>	<b>Proposed Administrative Regions</b>	<b>38</b>

## **LIST OF TABLES**

<b>Table 6.1</b>	<b>Administrative Regions Based on Watersheds</b>	<b>39</b>
------------------	---	-----------

## **APPENDICES.**

<b>Appendix A</b>	<b>Itinerary, Programme and Persons Contacted</b>
<b>Appendix B</b>	<b>Terms of Reference, Institutions/Legislation Specialist.</b>
<b>Appendix C</b>	<b>Government Community Based and Other Organisations in the Dennery and Cul de Sac Watersheds</b>

## Table of Contents

	<b><u>Executive Summary</u></b>	2
1.	<b><u>Introduction</u></b>	6
2.	<b><u>The Starting Point: Economic Impact of Tropical Storm Debbie</u></b>	6
3.	<b><u>Critical Socio-Economic Features for Watershed Management</u></b>	9
3.1	<u>People's Perception on Land Conservation and Drainage</u>	9
3.2	<u>The Apparent Profitability and Risky Path of Banana Dominance</u>	10
3.3	<u>Constraints to Economic Transformation</u>	14
3.3.1	Limitations for Land-Use Enforcement and Alternative Income Generation	14
3.3.2	Impediments to Agricultural Diversification	14
3.4	<u>Towards Sustainable Watershed Management: Action Priorities</u>	19
4.	<b><u>The Community Participation Programme for Watershed Management</u></b>	22
	List of Figures. Figure 1. WMAF General Institutional Setting	24
	List of Tables. 3.1 Banana Production Model	
	3.2 Estimates of Crop Production	
	Appendices:	
	Appendix A: Reconnaissance Survey Details	
	Appendix B: WMAF - Establishment and Annual Operating Budget	



## CONTENTS

## SECTION B

Introduction	1
Preamble	3
1. Population, Demography and Socio Issues	3
2. Land Use and Soil Conservation	4
3. Coastal Zone	7
4. Agriculture	8
5. Land Tenure and Farm Tenancy	11
6. River Systems, Drainage and Maintenance	12
7. Water Requirements and Water Supply	14
8. Liquid Waste	16
9. Solid Waste	17
10. Institutions and Legislation	18
11. Disaster Preparedness	20
12. Local Level Participation	20
13. Environmental Monitoring Programmes	20
14. Overall Programme Activities	20



## SECTION C

### CONTENTS

#### SUMMARY

<b>1. AGRO-ECOLOGICAL ZONING</b>	<b>1</b>
1.1. Agro Climatic Analysis	1
1.2. Soil Conditions	5
<b>2. LAND USE AND AGRICULTURE</b>	<b>11</b>
2.1. Existing Land Use Mapping	11
2.2. Slope Analysis	15
2.3. Land Suitability	17
2.4. Potential Land Use Options and Implications for Land and Water Management	18
<b>3. FIELD TRIALS</b>	<b>21</b>
3.1 Introduction and Objectives	21
3.2 Design of the erosion and Run-off Control Trials	21
3.3 Location of the Trials	23
3.4 Erosion and Run-off measurements from natural forest, as a comparison to data from banana cultivated areas	23
3.5 Progress of Trials as of 27 Nov 1996	23
3.6 Investigation of banana yield and profitability with respect to slope gradient	24
<b>4. ENVIRONMENTAL ASSESSMENT AND MANAGEMENT</b>	<b>26</b>
4.1 Environmental Assessment	26
4.2 Environmental Input of Phase I Civil Engineering Works	30
4.3 Prescriptions for Improved Watershed Management	30

#### LIST OF TABLES

1.1 Mean Monthly Rainfall to 1995 (mm)	1
1.2 Mean Monthly Deficit / Surplus of Rainfall minus Potential Evapo-transpiration (mm)	1
1.3 Analysis of Wet and Dry Months based on Monthly Averages over 10-20 Year Period	3
1.4 Maximum Rainfall Intensities for Union Agricultural Station	4
1.5 Characterisation of the Soil Series Mapped at 1:25,000 scale	5
1.6 Infiltration Experiments: Soil Conservation and Runoff Control Trials	8
1.7 Union Agr.: Comparison in Rainfall / Runoff / Soil Water balances under Bananas and Forest for the Period 1980-95	9

1.8 Crop/Soil Water Balance for Roseau, under Rainfed Bananas, and deep Silty Clay Soil	9
1.9 Union Agr.: Banana Cultivation: Ratio of ETa/ETc for each pentade for the Years 1980-95	10
1.10 Watershed Statistics and Characterisation	10
2.1 Areas of Landuse (Acres) within each Watershed	12
2.2 Intensity of Banana Cultivation in Different Land Use Units	14
2.3 Land Use Options and Implications: Land of 30 <sup>0</sup> slope	18
4.1 Environmental Issues	26
4.2 Environmental Physical Issues, Relative Importance, and Possible Solutions	27
4.3 Fertilizer Mixtures and Scheduling for Crops of the Humid Tropics	28

## LIST OF FIGURES

1.1 St. Lucia: Agro-Ecological Zones, Scale 1:100,00	2
1.2 Mean Monthly Rainfall in relation to Potential Evapo-transpiration: Differences in Accumulated Rainfall Deficits between Stations	3
1.3 Sprinkler Infiltrometer Investigations	8
2.1 Cul de Sac Sample Area: 1:12,500 Map: Land Use (Roche Itee, 1992)	12
2.2 Cul de Sac Sample Area: 1:12,500 Map: Land Use (HTS 1984)	12
2.3 Cul de Sac Sample Area: 1:12,500 Map: Land Use (HTS 1996)	14
2.4 Cul de Sac Sample Area: 1:12,500 Map: Slope Analysis (HTS 1996)	16
3.1 General Plan of Soil Conservation Trials	21

## APPENDICES

Appendix 1: Daily Soil Water Balance Model (DI.YSLWB9.wk3)
Appendix 2: Annotated Bibliography: Environment and Land Use Planning
Appendix 3: Terms of Reference

## SECTION D

### Watershed and Environmental Management Project - Phase II

#### River Engineering and Hydrometeorology Contents

	Page Nr
<b>1. Introduction</b>	1-1
<b>2. Review of Phase I Works</b>	
2.1 World Bank Rapid Deployment Force	2-1
2.2 Phase I Design and Implementation of Emergency Works	2-2
2.3 River Surveys and Benchmark Establishment	2-10
2.4 Environmental Assessment (to come)	
2.5 Recommendations for Improvements of Existing and Potential Future Works	2-11
<b>3. Review of Hydrometry</b>	
3.1 Introduction	3-1
3.2 Historical Perspective	3-2
3.3 Equipment Purchased and Installed under Phase I	3-9
3.4 Prioritisation of Watersheds and Instrumentation Needs	3-10
3.5 Equipment to be purchased under Phase 2	3-12
3.6 Proposals for Operation and Management of the Networks	3-13
3.7 Training Programme	3-14
<b>4. Flood Plain Hazard Mapping</b>	
4.1 Introduction	4-1
4.2 Flooding Resulting from TSD	4-3
4.3 Flooding of 26th of October 1996	4-6
4.4 Experience from TSD and the event of 26th October	4-8
4.5 Flood Plain Hazard Zoning Mapping	4-10
4.6 Flood Hazard Warning	4-11
4.4 Surveys Required to Support Flood Hazard Mapping	4-12
<b>5. Field Trials</b>	
5.1 Objective and Scope	5-1
5.2 Structural Trials	5-1
5.3 Implementation and Monitoring Issues	5-5
5.4 List of Proposed Field Trials	5-5
<b>6. Watershed and Environmental Planning (Outline Considerations) (from a river engineering and water resources perspective)</b>	
6.1 Water Requirements	6-1
6.2 Liquid Waste	6-1
6.3 River Systems, Drainage and Water Supply	6-2
6.4 Coastal Zones	6-2
6.5 Solid Waste	6-3
6.6 Institutions and Legislation	6-3

## **Appendices**

### **A Existing Networks and Data in Relation to Water Resources Issues**

A.1 Flood Estimation

A.2 Dry Season Flow Estimation and Water Sector Demands

A.3 Rainfall Runoff Relationships

A.4 Sediment Transport Estimation

A.5 Water Intakes and Water Qualities

### **B River Bed and Bank Material Sample Analyses**

### **C Photographs**

## ACRONYMS AND ABBRAVIATIONS

AESD	Agriculture Engineering Services Division (of MALF&F)
ADUC	Agricultural Diversification Coordinating Unit
API	Aerial Photography Interpretation
CAHMA	Canaries and Anse La Raye Marine Management Area
CANARI	Caribbean Natural Resources Institute
CAP	Chapter of GoSL Legislation
CARDI	Caribbean Agricultural Research and Development Institute
CBO	Caribbean Based Organisation
CEHI	Caribbean Environmental Health Institute
CIDA	Canadian International Development Agency
CRM	Coastal Resource Management
CZM	Coastal Zone Management
CZMU	Coastal Zone Management Unit
DCA	Development Control Authority (of MPD&E)
ECS	Eastern Caribbean Dollars
EEZ	Exclusive Economic Zone
EH	Environmental Health
EIA	Environmental Impact Assessment
ENCORE	Environmental and Coastal Resources Project
FAO	Food and Agricultural Organisation (of UN)
GIS	Geographic Information System
GoSL	Government of St. Lucia
GTZ	German Technical Mission for Co-operation
HTS	Hunting Technical Services Ltd
ICZM	Integrated Coastal Zone Management
IoH	Institute of Hydrology (UK)
ISM	Island System Management
LCB	Land Conservation Board
LCDC	Land Development and Drainage Committee
MALF&F	Ministry of Agriculture, Lands, Fisheries & Forestry
MCW&T	Ministry of Communications Works & Transport
MHI&B	Ministry of Health Information and Broadcasting
MPD&E	Ministry of Planning Development and Environment
NEAP	National Environmental Action pLAN
NEC	National Environmental Commission
NEMO	National Emergency Management Organisation
NGO	Non-Governmental Organisation
NRMU	Natural Resource Management Unit (of OECS)
OAS	Organisaiton of American States
ODA	Overseas Development Administration (UK)
OECS	Organisation of Eastern Caribbean States
PM	Prime Minister
PPU	Physical Planning Unit (of MPD&E)
PS	Permanent Secretary of A GoSL Ministry
SFAP	Small Format Aerial Photography
SI	Statutory Instrument of GoSL Legislation
SLBGA	St. Lucia Banana Growers Association
SLNT	St. Lucia National Trust
SMMA	Soufriere Marine Management Area
TDB	Tourist Industry Development Board
ToR	Terms of Reference
TSD	Tropical Storm Debbie

TDB	Tourist Industry Development Board.
ToR	Terms of Reference.
TSD	Tropical Storm Debbie.
USAID	United States Agency for International Development.
USDA	United States Department of Agriculture
WASA	Water and Sewerage Authority.
WIBDECO	Successor to WINBAN
WINBAN	Winward Island Banana Growers Association
WMO	World Meteorological Organisation
WWF	World Wildlife Fund.





## EXECUTIVE SUMMARY

### CONTENTS

Chapter 1	-	Introduction	1
Chapter 2	-	Background	2
Chapter 3	-	Phase I	4
Chapter 4	-	Background to Phase II	5
Chapter 5	-	Selection of Pilot Areas	6
Chapter 6	-	Main features of Technical Inputs	8
Chapter 7	-	The Trials Programme	22
Chapter 8	-	The Watershed and Environmental Management Plan	28

#### List of Figures:

Figure 1.: Activities and Staffing Programme

Figure 2.: Map of St. Lucia showing Pilot Watersheds and Trials Activities

Figure 3.: Policy and Coordination Organogram

#### List of Tables:

Table 3.1.: Phase I Priority Works

Table 6.1.: Results of Infiltration Tests

Table 6.2.: Environmental Physical Issues

Table 7.1.: Details of Alternative Crops

## **2. Background**

### **2.1 St. Lucia**

St. Lucia is one of the group known as the Windward Islands. It lies approximately between 13° 43' and 14° 06' North, and 60° 53' and 61° 05' West. The island is small, 42km in length and 22km wide, and covers an area of 616 km<sup>2</sup>. Rainfall, brought by predominantly the NE trade winds, fall mainly between June and December and averages between 1250 - 1500 mm near the coast to more than 3000 mm in the mountains. Rain can fall in any month and the climate is characterised by wet and dry years.

Being of volcanic origin, the island is dominated by steep slopes, the highest being Mt. Gimie at 950m. The high rainfall gives rise to numerous rivers with associated tributary systems. Rivers are short and steep, and respond rapidly to rain storms, giving rise to short duration flooding. The island divides into 37 watersheds which vary in size from Roseau at 49.1 km<sup>2</sup> to Mt. Bellevue at only 4.8 km<sup>2</sup>.

The island is heavily forested, but driven by high banana prices in the eighties, forest has been progressively cleared to make way for banana cultivation, much of it on land with slopes in excess of 30°. Estimates put this amount of land as high as 20%, but existing maps and aerial photography are not sufficiently accurate to validate this. What is clear however, is that forest clearing and changes in land use have given rise to an increase in soil erosion, which has increased sediment loads in the river system causing problems of siltation, restricted drainage and a greater propensity to flooding.

### **2.2 Tropical Storm Debbie**

On the 9<sup>th</sup>/10<sup>th</sup> September 1994, Tropical Storm Debbie (TSD) hit St. Lucia. It followed a period of heavy rain, and it deposited an estimated 500mm of rain over a matter of hours on the island already saturated. The resulting flooding caused substantial damage to infrastructure, agricultural crops and the environment. Four people died, and hundreds were made homeless. It was the most severe storm within living memory and caught most islanders unaware.

Losses to the agricultural sector were largest. Valley areas were most severely affected with heavy flooding and deposition of sediment and debris, brought down from the upper catchments and from river bank erosion. Solid waste blocked drains, choked culverts and built up on bridges, causing flood waters to back up. There were 400 landslides reported, predominantly in higher areas, both under cultivated and forest areas. Much of the sediment was deposited in the flood plains, blocking drainage channels in banana plantations, the rest found its way to the sea, where marine environment damage was caused. The cost to the agricultural sector was initially put at EC \$ 133 million and recovery took almost two years. Later estimates were reduced by around 30 per cent.

Damage to infrastructure and the river system was estimated at EC \$60 million. WASA water intakes and pipeline sustained damage, six bridges were swept away and four others suffered severe damage. The main road system was blocked by many small landslips and some roads collapsed. The feeder road system which supports the agricultural sector was also extensively damaged. In the housing sector, around 233 houses were damaged, some 100 being totally destroyed. Private losses of possessions was considerable but difficult to quantify.

The storm left the island devastated, and with large quantities of disturbed sediment remaining in the watersheds, posing additional hazards for future wet seasons.

### **2.3 The World Bank Mission**

Following the storm, government responded quickly in providing shelters for the homeless, restoring domestic water supplies and making emergency repairs to transport infrastructure, but the sheer enormity of the task, led government to request emergency assistance from the World Bank. A team visited the island between 30<sup>th</sup> October and 2<sup>nd</sup> November, and this was followed by the fielding of a team of Consultants supported by British Development Division Caribbean. The Consultants were in St. Lucia from 29<sup>th</sup> November to 23<sup>rd</sup> December and their main objectives were to prepare a reconstruction programme and a programme of longer term measure for sustainable management of the island's watersheds comprising:

- priority works to rehabilitate storm damage caused by flooding and landslides
- a medium term plan to redesign hydraulic infrastructure to minimise damage and disruption from future storm events.
- a longer term plan to fully integrate land and water management into the framework of a National Environmental Action Plan.

In their comprehensive report "Watershed and Environmental Management" (December 1994) after examining and analysing in all pertinent information and issues, the consultants proposed a two phase strategy.

- Phase I comprised a priority works programme to effect repairs to the rivers and drainage systems
- Phase II - a longer term view of environmental management aimed at achieving sustainable development of land and water resources through watershed management.

### 3. Phase I

Phase I was supported by a loan from the World Bank of EC \$ 14.3 million, and the British Government, Overseas Development Administration ( ODA) agreed to fund the Technical Assistance component by providing engineering supervision. The contract was awarded to Crown Agents/Halcrow and they mobilized in February 1995.

The World Bank Consultants, had in their report, listed and prioritised works. They were:

- clearing TSD debris from river courses, bridges and culverts so as to prevent further flooding of adjacent land;
- desilting river channels affected by sedimentation from TSD through landslides in upper catchments and general erosion, in order to prevent flooding and to improve drainage of agriculture land on the flood plains;
- resectioning some river channels that had been subjected to undue widening of the river bed caused by TSD sedimentation so as to reclaim lost land.
- bank stabilization and minor river training works which was needed to ensure that the interventions in the river bed will have sufficient durability, and to provide protection to adjoining properties, and
- where unavoidable, works on both bank to train the river to follow a pre-designed channel.

In their report , the Consultants were careful to point out the dangers of forcing drastic changes on a destabilized river system and recommended the inclusion of bioengineering techniques. They assessed probable environment impact and called for the involvement of the people, likely to be directly affected by emergency works, in the planning process.

Based on a table of priority works set out in the World Bank report ( table 2.1), the Phase 1 Consultants drew up a programme which, in addition to work already identified, included river resectioning, loop cutting and flood protection works. Local contractors were used extensively and works were largely completed between February 1995 and the end of April 1996. Works are summarized in Table 3.1, taken from Section D of this report, and Crown Agents/ Halcrow submitted a final report in May 1996. In addition the Consultants left plans and as built drawings to facilitate a review. Phase I has been surrounded by some controversy and works are reviewed by the River Engineer in Volume 11, Section D of this report.

## **EXECUTIVE SUMMARY**

### **1. Introduction**

During the period October 1996 to February 1997, the first series of Consultants inputs was completed. As the various specialist completed their inputs, a series of Draft Interim Reports were produced. They were:

- Institutions and Legalisation
- Land Use and Environment
- River Engineering and Hydrometeorology

The reports were circulated on 9<sup>th</sup> December 1996, to give government staff and others time to study the contents. In January 1997, a further draft was submitted following the completion of an input by the Socio Economist.

During January and early February a series of meetings were held, organised by the Project Coordinator, at which reports were reviewed individually and comments made. These comments have been taken into account, original documents modified and added to, and now become the Final Interim Report.

In order to accommodate the mass of information and for ease of handling, the report is presented in two volumes:

Volume I: Executive Summary - Institutions - Draft Pilot Watershed and Environmental Management Plan

*Socio-Economics.*

Volume II: Land Use and Environment, River Engineering and Hydrometeorology.

The report is consistent with the BDDC Project Memorandum and the Consultants Inception Report (October 1996).

This summary reviews events leading up to the Phase II Consultancy. It describes the main features of the Technical inputs and shows their inter relationship and how findings link together in the formulation of a Watershed and Environmental Management Plan.

Full texts of the individual reports have been reproduced, to ensure that all data collected and analysed is published, thus providing adequate background to the conclusions drawn and a permanent record.

The Project Final Report, due to be published October/November will contain only key extracts from technical consultancy inputs.

#### 4. Background to Phase 11

The World Bank report (December 1994) included a detailed strategy for phase 11, discussed the major issues and set out terms of reference for a consultancy. This was subsequently scrutinised in detail and refined by both BDDC and GoSL, and in response to a request from GoSL, BDDC agreed to fund the consultancy under technical assistance. A detailed Project Memorandum was prepared.

The contract for Phase II was awarded in mid 1996 to Hunting Technical Services Ltd. (HTS) in association with Mott MacDonald Ltd. (MML). It provided for a core team of five specialists and a total of 28.5 months of consultancy. Post were:

- Team Leader 7 months
- Socio Economist 4 months
- River Engineer 4 months
- Land Use/Environmentalist 5 months
- Institutions 2.5 months
- Project Adviser 0.5 months
- Geotechnical Adviser 0.5 months
- Geotechnical Engineer 2.7 months
- Landslide Hazard Expert 0.8 months

By agreement, a scheduled 1.5 month input by a Sociologist, was deleted, and supervisory staff to assist in the development of a community participation programme were employed, using funds saved.<sup>d</sup>

Inputs were planned to cover an elapsed time of 12 months, but in two stages, leaving a six month gap.

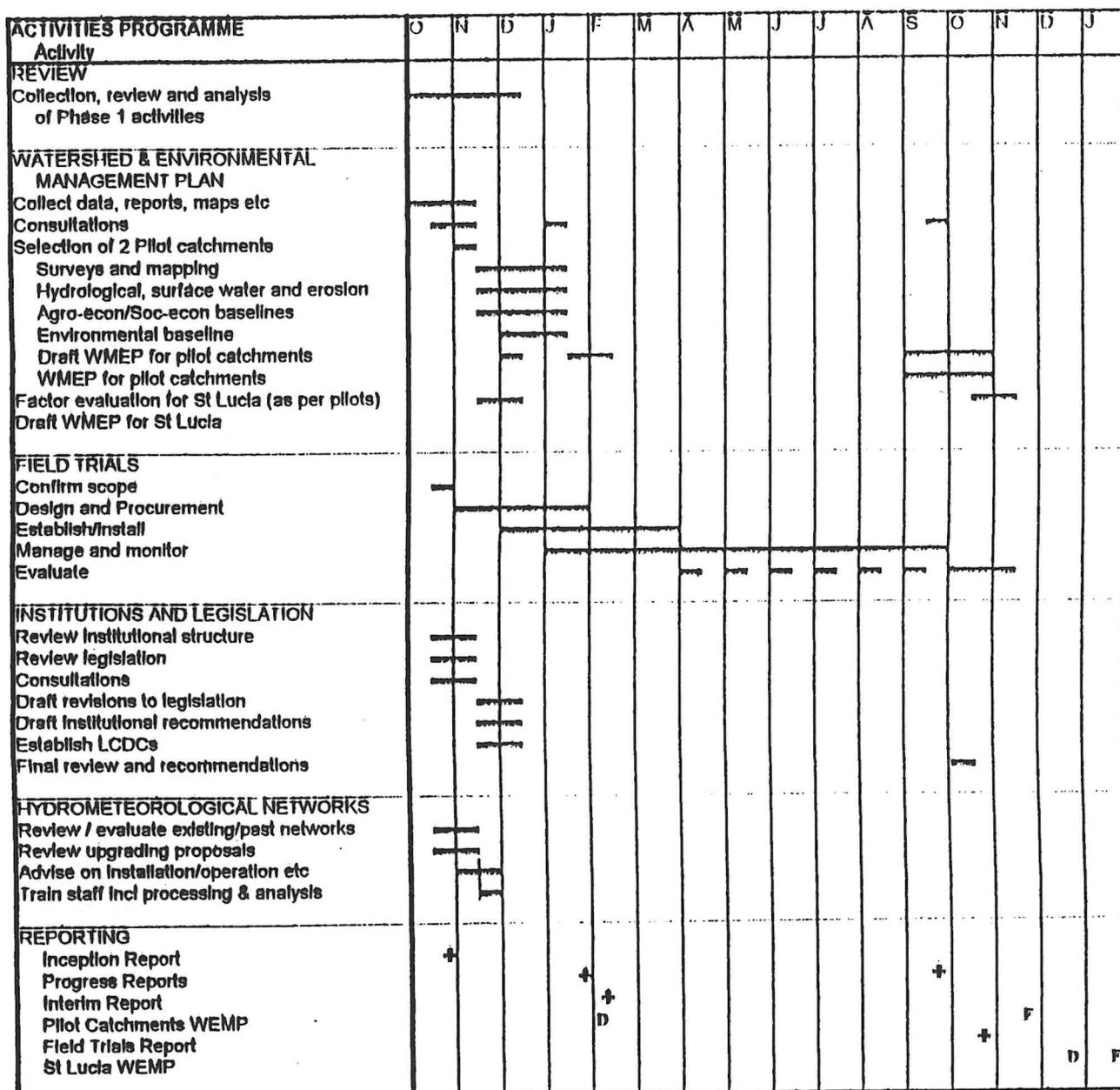
Detailed terms of reference were included in the 1994 World Bank Report, and the project approach involved:

- Collation of existing data on watershed management programmes in St. Lucia, identification of problems experienced and solutions applied and their relative degrees of success
- identification and field testing of solutions to unsolved problems (e.g. Flood hazard planning, landslide/slope stabilisation, sustainable land use, river stabilisation, social impact, conservation of biodiversity and environment), disaster preparedness and management.
- review of existing institutional infrastructure and legislation for integrated watershed management; participatory design of an improved institutional structure, identifying necessary human resource development; recommendation of legislative reform to enhance effectiveness and efficiency, including powers and means of enforcement.

Figure 1

**Saint Lucia Watershed and Environmental Management Project**

**Activities and Staffing Programmes**



**Future Staff Inputs:**

<b>P. Humphreys</b>	<b>Team Leader</b>	<b>10 September</b>	-	<b>22 November</b>
<b>A. Lieberg</b>	<b>Socio Ecoomist</b>	<b>22 July</b>	-	<b>17 September</b>
<b>D. Moore</b>	<b>River Engineer</b>	<b>29 September</b>	-	<b>21 November</b>
<b>C. Hatten</b>	<b>Land Use/Eniron.</b>	<b>14 May</b>	-	<b>18 June</b>
		<b>22 September</b>	-	<b>21 November</b>
<b>R. Isaac</b>		<b>As required</b>		
<b>C. Rogers</b>		<b>As required</b>		
<b>P. Thomspn</b>	<b>Institutions</b>	<b>1 November</b>	-	<b>17 November</b>

- on the basis of the above, design and implementation of pilot watershed management plans for two selected sites; design of a strategy for extrapolating pilot site results to the whole system on a watershed basis.

In the Interim Report a note of caution was sounded. Phase I works were in response to the emergency rehabilitation of the river system and associated structures damaged as a result of TSD and although Phase II is seen as a continuation of Phase I, it's focus is significantly different. Phase I works will certainly be reviewed and recommendations made for improving the emergency response programme, but the main purpose of Phase II is the development of a sustainable Watershed and Environment Management Plan. It must be appreciated that the resulting plan, will for reasons of history and project concept, be slanted towards drainage and soil conservation issues and other elements of a comprehensive Management Plan, such as the dry season management of water resources will inevitably receive less attention.

What must also be appreciated is that environmental degradation is a slow and insidious process, and the incidence of TSD served to illustrate in dramatic fashion, an existing problem. Measures designed to improve the environment, however well thought out and applied, will take some years to become evidently effective.

The Consultants mobilised in October 1996 and the first series of inputs was completed by February 1997.

A bar chart of activities and inputs is given at Figure 1.

## 5. Selection of Pilot Areas

In the ToR, the Consultant team were asked to select two Pilot Areas for detailed study. St. Lucia is subdivided into 37 watersheds, of widely varying size and complexity and no watershed could be described as "typical". As the selection had far reaching implications for the long term success of the consultancy and the development of a meaningful watershed and Environmental Management Plan, the decision was taken in close consultation with government staff. The watersheds selected were:

Dennery 5,234 acres

Cul de Sac 10,097 acres

*BOLD*  
The **Dennery** watershed is on the Eastern side of the island and is rurally based. There are four main settlements and population totals 2918. According to SLBGA figures, there are 250 banana farmers, many on steep slopes in the upper catchment. The Forest Management Plan 1992-2002 gives areas of land use conflict within the watershed as moderate 1567 acres (30%), high 315 acres (7%) and very high 20 acres (0.4%).

This Act provides for the conservation of land in St. Lucia and for the establishment of a Land Conservation Board, responsible for advising the Minister on the following matters:

- general supervision of land and water resources;
- stimulating public interest in the improvement and conservation of land/water resources;
- recommending legislation;
- coordinating the efforts of other conservation bodies/Government agencies;
- implementation of the Act and drafting Regulations;
- advising the Development Control Authority on matters concerning land conservation and improvement.

The Board has a wide ranging mandate, including responsibility for making Protection Orders to:

- prohibit, regulate and control the clearing of land for cultivation, the grazing/watering of livestock and the lighting of fires;
- prohibit or restrict the cultivation of specific crops;
- regulate the method of cultivating land;
- destroy without payment of compensation, crops planted in contravention of the Act.

No regulations have been formulated and at present, the Board has no access to funds, other than those which might be provided by Government. This piece of legislation has had a long gestation period and there appears to be a lack of political will to implement the Act. The legislation was first proposed by the Consultants in 1984 and the draft Bill became available by the end of 1987. The Act finally reached the statute books in April 1992, <sup>but</sup> nothing happened until after TSD, when the Board was finally appointed in 1995. It then met for the first time and only time in November 1995.

x  
? HTS  
x

In commenting on the need for amendments to legislation, the Consultant suggested that priority be given to making existing legislation work effectively. He drew attention to deficiencies in some acts:

- the Proposed Coastal Zone Management Act (draft)
- the Proposed Water Resources Act (draft)
- the Wildlife Protection Act (9/80)
- the Land Development (Interim Control) Act (8/71)

He concluded that legislative improvements are always possible and the Consultants will propose a method for constantly reviewing and where necessary up-dating the environmental legislation. In general, the Consultants believe that the existing legislative base is adequate, but there is a pressing need for co-operation and collaboration amongst the various agencies involved in the protection and improvement of the environment. There is also an urgent need, at the national level, to recognise the cost of undesirable environmental practices.

2 A

The river flows in a deeply incised valley and there is very little flood plain. The main urban settlement is prone to flooding and extensive protection works, part of Phase I activities, are almost complete.

**SOLD**  
x  
Cul de Sac at 10, 097 acres is much larger, and the population of 12 806 live in around 20 settlements. The proximity to Castries distorts the northern side of the watershed. There are a reported 600 banana growers and land use conflict areas have been set at moderate 3 961 acres (39%), high 170 acres (<2%) and very high 7 acres. The watershed has a wide flood plain and drainage is a major problem.

To allow the Consultants to focus early on the Pilot Area watersheds, the selection was made by week 4 of the Consultancy, in time for the publication of the Inception Report (October 1996). A map showing Pilot Areas and other detail is presented at Figure 2.

## **6. Main Features of Technical Input**

### **6.1 Institutions and Community Participation**

Section A (Volume I) of the Report, comprises essentially two reports, those of the Legalisation/Institutions Specialist and the Socio Economist. During the period October 1996 to January 1997 a community participation programme has evolved. This dynamic process, will continue to develop over the coming months and represents an important trial in the involvement of stakeholders in the broad field of environmental management.

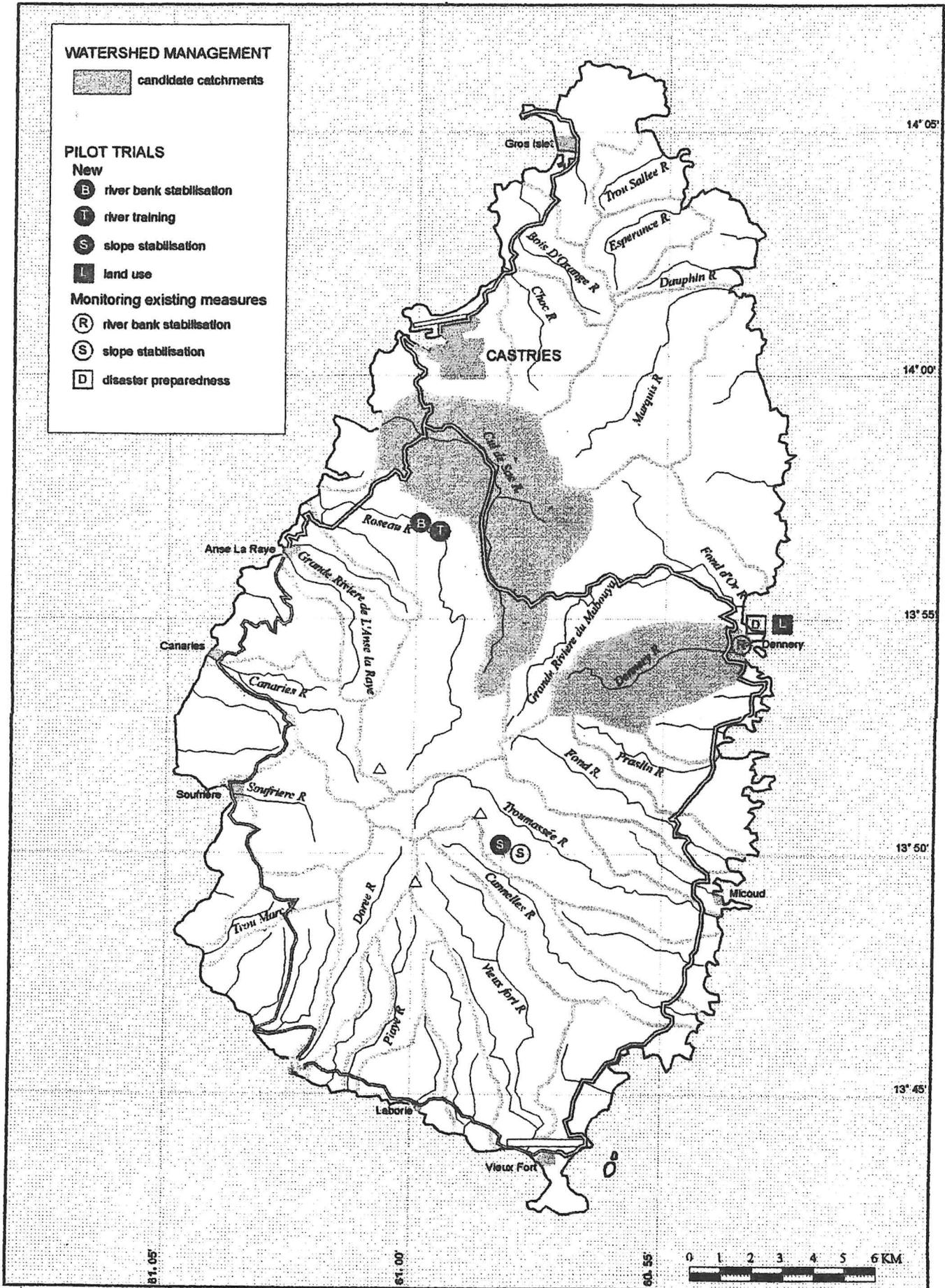
The ToR called for an involvement of both government and non-government stakeholders in the planning of watershed management plans. This concept is relatively new to St. Lucia and has required much time, thought, discussion and patience. In theory at least, the participation of the community at whom interventions are targeted, in the planning, prioritisations and development of watershed plans, invokes a sense of ownership which greatly enhances the prospects for successful implementation. Used correctly, essential changes in attitude can be brought about, thus achieving goals of sustainability.

The Consultants started with a review of legislation and institutions, under three broad categories:

- environmental legislation
- institutions responsible for watershed management legislation
- institutions with an environmental interest.

Some 29 Acts were reviewed, the most important in watershed management terms being the Land Conservation and Improvement Act (10/92).

Figure 2



The World Bank report (1994), drew attention to the institutional complexity likely to be involved in watershed management and stated that one of the important tasks for Phase II will be to resolve these difficulties and design a suitable organisation structure. An obvious starting point is that there must be overall control, and execution of the various measures should be the responsibility of existing organisations. Creating a new organisation is generally a dangerous and impractical option. Key issues in watershed management will be the coordination of efforts between involved government agencies and NGO's and arrangements for public participation. In considering institutions charged with the administration of legislation, particular attention was drawn to the issue of coastal zone management. Here the inter-relationship of Integrated Coastal Zone Management (ICZM) with watershed management was recognised and the Consultant endorsed the view that there is a need to adopt a holistic philosophy.

The key institutions for which the Watershed Management Project would have to accommodate within it's institutional framework were seen as:

**COASTAL ZONE MANAGEMENT:**

- The Coastal Conservation project - covering an area from the south of Roseau to the northern end of Cap Estate and is administered by Fisheries Department.
- The Soufriere Marine Management Area-covers all the coastal zone from just north of Choiseul Bay to Anse Marine also administered through Fisheries Department.
- The Canaries and Anse La Raye Marine Management Area - a project being developed by Fisheries Department.

**GOVERNMENT DEPARTMENT:**

- Agricultural Engineering Service Division
- Agricultural Extension Services
- Crop Protection Unit
- Forestry Department
- The Water and Sewage Authority
- The Ministry of Communications, Transport and Works
- The St. Lucia Banana Growers Association

Institutions with an environmental interest were then considered.

The key to successful coordination of a multitude of government ministries, regional organisations, specific projects, NGO's and CBO's, lies with the Ministry of Planning. By Cabinet Conclusion in March 1995, in response to a submission from Ministry of Planning Development and Environment commencing on the perilous state of the environment following TSD, it was agreed that the National Environment Commission would provide an appropriate basis for sustainable management through the implementation of activities contained in a proposed National Environmental Action Plan (NEAP).

# Proposed Structure for Environmental Management

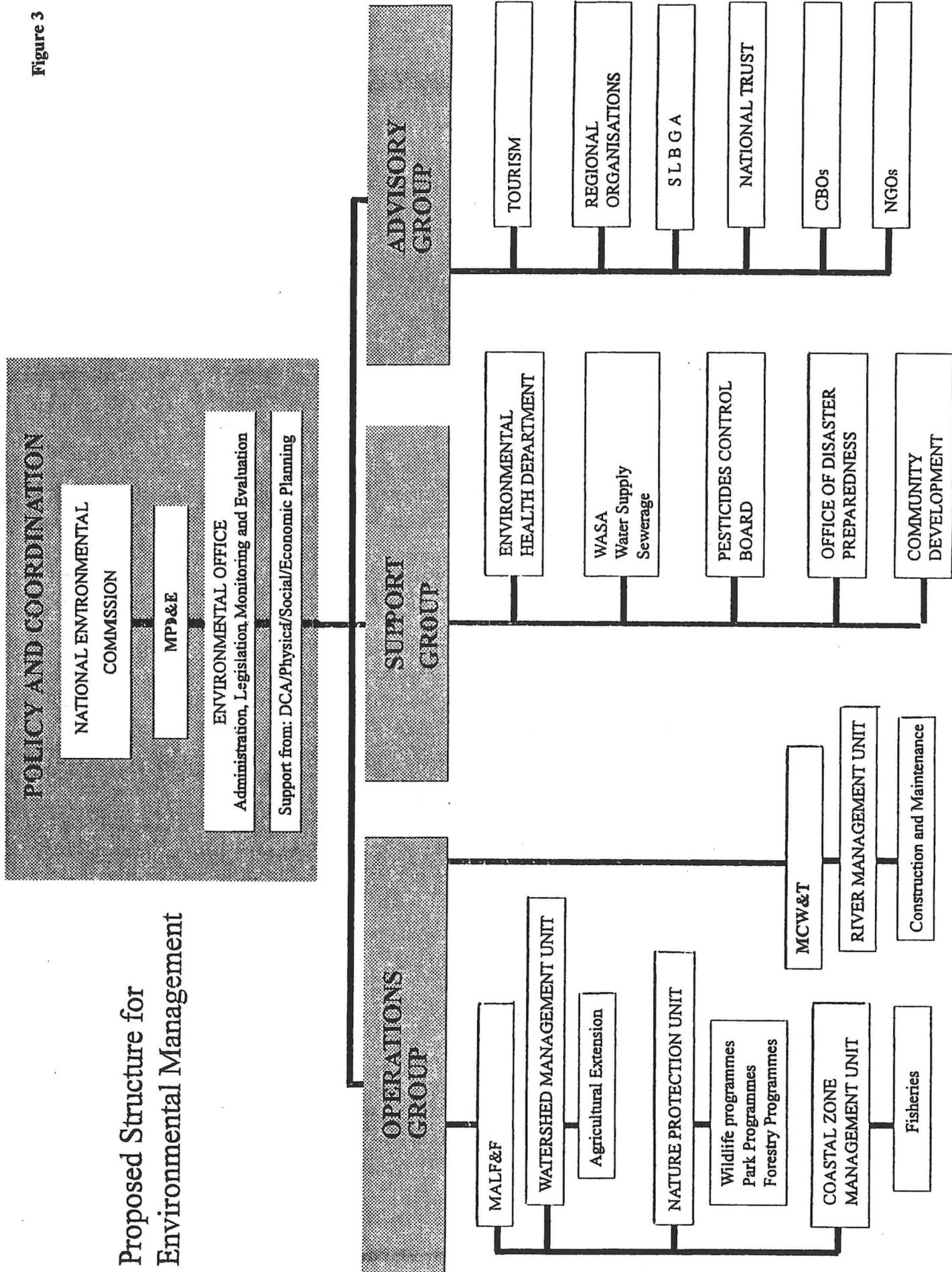


Figure 3

The broad functions of the NEC are as follows:

- to provide guidance and advice to Cabinet, para-statal and non-governmental organisations NGO's on environmental matters;
- to co-ordinate the inputs of Government and NGO's as well as private sector agencies/interests in the implementation of the NEAP;
- to mobilise financial and technical resources in support of environmental projects and activities, especially at the community level;
- to monitor and evaluate the implementation of the NEAP;
- to assist with the design and delivery of training programmes/workshops in environmental management and sustainable development;
- to organise and or supervise applied research in accordance with the NEAP.

Action has been slow, and only recently was it reported that a final draft of the NEAP was currently being considered as a matter of priority, and that a meeting of the NEC was likely to be held in the first half of 1997.

An Organogram showing how ministries, institutions and other projects can be coordinated for the purposes of environmental management, taken from the Legalisation/Institution Specialist report is presented at Figure 3.

From there, the Consultant went on to outline an approach to community participation, made recommendations on the employment of staff to supervise and organise surveys to identify community based organisations in both Pilot Watersheds and individuals within them, who could be considered as influential and potential community motivators. He also proposed some administrative changes within the Ministry of Agriculture, Lands, Fisheries and Forestry and the Ministry of Communications, Works and Transport, and the creation of Watershed Management Unit and River Management Units to support any community based organisations formed.

The dangers of an unsuccessful campaign were recognised, but some initial survey work in both Dennery and Cul de Sac Watershed proved promising. The Project was thus faced with a choice, either to go forward and develop a participatory programme, or to limit activities to a general sensitisation campaign.

The proper management of the Country's watersheds and of the associated river/coastal system is the responsibility of GoSL and ultimately of everyone who lives on the Island. Non-governmental organisations, community groups, aid agencies and others can certainly help, but the Government, irrespective of the political party in power must put in place and operate the necessary management framework.

To proceed on the best course of full participation, government commitment was essential. The issue was raised at a meeting on 11<sup>th</sup> December and the desired commitment was given by the two principal Ministries involved, Planning and Agriculture. This opened the way for further development of a community participation programme.

This aspect was picked up the Socio Economist, who during his two month input, carried out informal surveys in both pilot watersheds to assess perception to conservation and drainage issues, constraints to economic transformation and impediments to agricultural diversification with its inherent benefits of improved land use and reduced erosion.

Far reaching proposals were made to redress marketing and other problems in the non-traditional crop sector and poor performance of the agricultural extension and advisory system. Recommendations were made, namely:

- the formation of a National Agricultural Diversification and Marketing Campaign
- a reform of the Agricultural Advisory and Information System
- the training of staff in land conservation, drainage and production of non-traditional crops.
- the establishment of an on-farm trial and demonstration programme
- determined action against praedial larceny

The implementation of these proposals would support and facilitate improvements in land use and a reduction of erosion and therefore, fall well within the scope of the Project, but further development and implementation rests with government and might will from the basis of future projects.

The main focus of the Consultancy was the development of the central theme of community participation. Concepts were discussed with government in an on-going dialogue. This had the advantages of pooling information and knowledge and ensuring that proposals put forward by the Consultants, were acceptable to government and would attract the necessary support.

Contact with the communities in the two Pilot Watersheds was intensified, and preparations made to approach the Dennery community with a view to forming a watershed Management Action Force.

In late January, just prior to the departure of the Socio Economist, a meeting was held at Dennery attended by some 40 invitees representing the various clubs and groups, officials, church leaders, farmers and fishermen; a good cross section of responsible opinion. After outlining Project proposals for involving the community, the people were asked if they were willing to participate and if so, how they wished to proceed.

The issue gave rise to much interest and discussion and the group at length decided:

- that they wished to participate in the trial
- an Interim Steering Committee be elected from within those present
- that preparations be made to hold a public meeting
- that at the meeting a Watershed Management Action Force be formed

The Project Community Participation Advisor and Coordinator are in continuing dialogue with the Steering Committee and Government of St. Lucia, particularly AESD, within which a Watershed Management Unit is to be formed.

Thus the first, hesitant steps towards full community participation have been taken. Strong government support to this group is essential, and must include assistance in designing and implementing educational programmes, the formation of a River Management Unit within Ministry of Communications, Works and Transport, and access to finance to implement programmes identified and prioritised by the residents of Dennery Watershed through their newly formed Watershed Management Action Force. Much supporting assistance to this process is anticipated and Project Community Participation staff will provide this.

With regard to staffing during this trial period, maximum use will be made of existing government staff, and likewise, office facilities and services, already in place, in Dennery will be made available.

Much depends on the outcome of this trial, and its evaluation will provide good indicators for the development of a final Watershed and Environmental Management Plan.

In the Cul de Sac watershed preliminary studies were completed but time was not sufficient to develop a full programme. The watershed is much larger than Dennery, has many centres of population and apparently poor compatibility between the many community based organisations. It is also much more important agriculturally and suffers extensive drainage problems in the flood plain. However, as educational programmes are developed, some further preparatory work in sensitising the community will be included in the programme.

## **6.2 River Engineering and Hydrometeorology**

### **6.2.1 Introduction**

The main focus of the engineering aspects of the Interim Report is the "Review of the Phase I Works", the Review of the Hydrometeorological Networks and as assessment of the current level of information in relation to water resources and flooding issues on the land. The document has also been used to provide a degree of reporting of the floods which took place on October 26<sup>th</sup> 1996 and the subsequent less severe floods in November.

The main tasks related to the river engineering and hydrometeorological components of the study are defined in the Terms of Reference for the Project.

Some of the problems which have been encountered in relation to undertaking these tasks are:

- information on flood levels <sup>is</sup> in almost non-existent; this impacts on the production of the flood hazard zoning map for St. Lucia;
- topographic survey information which was collected as part of Phase I has been made available but relates almost entirely to those reaches of the river system for which Phase I construction works have been undertaken.

- 1996
- the review of the Phase I works is being hampered by the fact that damage to these works took place during the October storm event.
  - considerable time has been spent analysing the impact of the storm of October 26<sup>th</sup> <sup>96</sup> and comparing with TSD. Not to have done so would have been unfortunate since it has been a good opportunity of study the mechanics of the storm and the functioning of the new rainfall data loggers that have been in place (from Phase I). However, the analysis and reporting is really outside the scope of the ToR for the Phase II Studies. Nonetheless the occurrence of the floods has provided valuable information for the assessment of flood risks.

The River Engineering and Hydrometeorological Report comprises three main chapters:

- The Review of the Phase I Works;
- The Review of the Hydrometeorology;
- Background and Basis for Flood Hazard Mapping, and
- Notes related to the proposed engineering field trials.

Only a brief introduction is presented in the River Engineering and Hydrometeorological part of the Interim Report related to aspects of the development of Watershed and Environmental Management Planning. However, the outline approach is given in the WEMP proposed contents given in Section B, Volume I of this report.

In addition, there are three appendices in the River Engineering & Hydrometeorological part of the Interim Report containing supporting information.

### **6.2.2 Phase I Works: Review of Engineering Aspects**

Following Tropical Storm Debbie in September 1994, a two-phase programme was formulated for the rehabilitation and future management of the Island's watersheds. Phase I comprised a reconstruction programme involving priority works. It started in May 1995 and was substantially complete by mid 1996.

The works which were funded by the World Bank and GoSL, were carried out by the Ministry of Communications, Works and Transport. A supervising engineer and supporting design group was funded by ODA.

Most of the works proposed in the December 1994 Report were for desilting and river training.

In relation to river training, it was stated in the World Bank December 1994 Report that: 'When intervening in the natural behaviour of a river, it should be realised that there is a relationship between the amount of water and sediment that is loaded on a river, and the longitudinal and cross section it adopts in the process; also that improper interventions could have unexpected negative effects. Without much data regarding 'design' discharges, one should be prudent so as not to force too drastic changes upon a river otherwise, in the next wet season, the river could undo much of the work, choosing its own course.' (P 13 *ibid.*).

It was also stated "However, in St. Lucia, relevant hydrological data are often inadequate, which makes it difficult to make a reliable assessment of the probability of higher-than-design discharges occurring and the extent of associated damage that could occur. In these circumstances, it might be better to allow rivers a certain degree of freedom of movement using land zoning regulations to keep adjoining land construction and used instead for parks etc."

Desilting of the channel system was important since much debris and large boulders were carried down the main river system by the usually high flows. Most of the works originally identified related to debris clearance with proposals for more structural interventions at Dennery and Soufriere in particular.

The Phase I works were expanded beyond what was originally conceived with a larger budget apparently being made available. Broad categories of work have been:

- river bank protection through rip rap or gabions;
- river resectioning;
- river clearance and desilting; and
- river realignment.

Where possible, a review of these works has been undertaken together with an assessment of the preparations made for the works.

In general, the design work contained in the files made available to the Consultants can be considered at best to be outline designs. Design/preparation documentation was not available for all works. Additional preparations/design work would need to have been undertaken at field level during construction - it is presumed this was done.

Design criteria, data and information was and is relatively sparse. The design information on file which has been made available to the Consultants has in the most part been design sketches for river training works and re-alignments or loop cutting.

Design flood flows in the river system has been based on an estimated 1:5 year return period event. Sometimes increased where deemed necessary. The values for the 1:5 year flow have been derived from the 1984 Report by Hunting Technical Services. The Roseau, Dennery and Cul de Sac Drainage and Conservation Project. Recent analysis

have indicated that these estimates can seriously underestimate the scale of flood facilities should be expected to withstand.

*Factors emanating from the Review:*

Some of the important aspects to take into account when dealing with flood flows and designing facilities to pass or protect against such flows are:

- ensure that major infrastructure is designed to accommodate a 1:50 or 1:100 year flood (not a 1:5 year event). The flood information is such, in relation to flood discharge estimates and flood levels, that in all probability it will be necessary to design against the worst recorded flood if this is considered to be an extreme event.
- minimise the degree of channel re-alignment particularly if it is purely to protect or create new agricultural land in the flood plain.

Possible improvements included:

- the introduction of palisading using natural materials for bank protection;
- the greater use of gabion mattresses at key infrastructure points;
- the combined use of selected vegetation with gabions and rip rap to create a more permanent and effective structure;
- the need to link loop cutting, where such is seen as the only solution, to channel profile control measures (small cross weirs or channel steps);
- the importance of establishing a system for the regular inspection of the river system particular at key infrastructure locations (e.g. roads, service lines, main buildings);
- the importance of regular maintenance tied to regular inspection of the channel and contact with local landowners or farmers;
- keeping the channel clear of obstacles which will affect the flow regime;
- reducing the danger of tall or overhanging trees from falling into or across the river channel by a defined system of top looping;
- the identification of drainage system re-habilitation needs in the flood plain areas with the assessment of the efficiency of the whole drainage system to the sea with considerations given to tidal level fluctuations in the lower areas. The re-excavation of field drainage ditches is an important factor in maintaining banana yield and quality in the face of potential waterlogging.

The above will be elaborated in the course of the development of the Watershed Management Plan.

The Review of Phase I works indicated that a series of design guidelines would be useful. The Phase I works were by necessity carried out quickly and hence greater emphasis was placed in undertaking construction works.

Any river engineering intervention needs a good appreciation of the natural condition of the river and of the potential impacts on the behaviour of the river of the measures being proposed. There is little point in solving one problem only to create another which might have more adverse impact.

General considerations should always be made covering:

- deciding when and where to implement the works;
- deciding what options exist, which will be the optimum solution in terms of ease of construction, cost effectiveness and subsequent maintenance requirements;
- knowing the major pitfalls in the particular intervention proposed;
- awareness of environmental factors particularly that of the aquatic ecology;
- awareness of the impact on land loss and appropriation and crop loss compensation factors and hence the socio-economic acceptability of the possible interventions;

### **6.2.3 Review of Hydrometry**

The approach adopted for the review of the hydrometry has been multi-faceted, assessments have been made of:

- the historic development and changes experienced in the coverage of the various networks;
- the quality and accessibility of the existing data bases. It is important to not only look at the station year coverages but also at the integrity of that data;
- the use currently made of the data;
- the identified needs of data currently and in the foreseeable future;
- previous upgrading programmes and equipment supplies and their impact;
- the institutional involvement in data gathering, processing, storage, analysis and end use.

The gathering of data should not be seen as an exercise in itself. It should have a number of definable end uses as well as the general need for a hydrological perspective of the Island. Hence, the main focus of the review has been on 'current data base scope and quality' in the context of current and likely future issues.

The data gathering process being addressed is primarily related to:

- rainfall;
- water level and discharge data within the river network. However, other factors covered includes;
- sediment transport (within river waters);
- evaporation;
- relative humidities, temperatures, insolation, wind speed.

Issues related to water quality have only been tentatively addressed since this introduces a far broader number of issues. However, the coverage given is believed to address the main components and identified the shortcomings that exist.

Some of the current hydrologically based problems encountered on the Island have been identified and the network and existing data investigated and analysed in order to identify the support that data gives to the problem quantification and solution.

These problems have been:

- the evaluation of the hydrological significance of TSD and the storm of October 26<sup>th</sup>;
- the estimation of sediment transport from the river system into the various estuaries (in the context of increasing soil loss from catchments and the damage to coral);
- the estimation of dry season surface water resources associated with the positioning of the WASA water supply intake points and other strategic abstraction points which may be developed;
- the design of river training works and other hydraulic infrastructure (which requires hydrological data);
- the potential development of a new reservoir in the south or south east of the Island;
- assistance to flood warning procedures.

Most of the above issues have a direct bearing in any 'Watershed Management' process.

Instead of purely listing the requirements for the above issues, the problems have been rapidly addressed based on the data currently available in order to highlight the shortcomings where they exist and also to provide examples of the shortcomings which are created in the problem solving process. Background information on these aspects is given in Appendix A of the River Engineering and Hydrometeorological part of the Interim Report (Section D).

At the moment two organisations are involved in hydromet data gathering and analysis. The Meteorological Services Department under the Ministry of Communications, Works and Transport (MCW&T) and the Agricultural Engineering Service Division of the Ministry of Agriculture, Lands, Fisheries and Forestry (MALF&F). The former is primarily responsible for the operation of the climatological stations at the two airports, Vigie and Hewanorra. The organisation is more concerned with synoptic forecasts and providing information for the two airport control units and the radio and television broadcasts. The Meteorological Services Department providing information for shipping etc.

The AESD is currently responsible for the collection of data from the other rain gauge and climate stations over most of the Island. The main interest of AESD is in agrometeorological data. Monthly 'Agromet Bulletins' are produced summarising the data of that month and for the preceding months of the year. Mean values over the period 1982 to 1995 are also presented for information. Isohyet plots are also incorporated. The document is quite useful giving guidelines for farming activities. An Annual Agromet Bulletin is planned to be produced in February 1997.

From the above, the agrometeorological data gathering system would appear to be reasonably well actioned, especially with the introduction of the new rainfall data loggers and tipping bucket devices installed under Phase I. However, the hydrometric system (river gauging) is in very poor status and needs to be re-activated and updated. Proposals have been made to action this.

The relationship between data gatherers and data users is summarised by data type in Table 3.9 Section D. The table lists the type of data in a hydrometeorological and hydrometric nature and identifies the use to which each type of data is or should be put. The uses of data are based on the currently seen issues in St. Lucia and are generally non-project related. Project related data would include the data requirements associated with the development of a new storage reservoir in the south of the Island.

As indicated by the table, there would appear to be a deficiency of data to meet the requirements of many analyses. Use has to be made in many instances of a very limited data set which impacts on the integrity of detailed analysis and of conclusions thereby drawn. However, it should be pointed out that the 'users' defined in the table are not necessarily being 'undertaken' as tasks by the relevant organisations.

The major equipment needs are therefore:

- Water level discharge recorders (with data loggers);
- Sediment sampling equipment;
- Staff gauges and crest level gauges.

It is important to consider the different problems associated with monitoring flood flows where level is a key factor and low flows where quantity and quality are more important. The establishment of reliable low flow is variable between flood events. During flood flows, large proportions of the flow will be across the flood plain making discharge measurement problematic. Hence, stage discharge relationships need to be addressed carefully at each proposed gauging site.

The proposed siting of this equipment is presented in Figure 3.8, Section D. Ideally the whole network should be brought into operation at the earliest, however, it is appreciated that this may not be possible without technical assistance bearing in mind the limitations imposed by manpower availabilities within AESD, the organisation currently presumed to be the best organisation to initiate the establishment or re-establishment of the network.

In addition, it is recommended that standby rainfall loggers are provided to act as an immediate replacement for malfunctioning units.

The need for a training programme has also been outlined in the Report.

#### **6.2.4 Flood Plain Hazard Zoning Mapping**

The main information required for the flood plain hazard mapping which is to be undertaken is normally:

- historic water level information at several locations in each river system covering many flood events. Ideally a record length of about 50 years is desirable;
- flood reports associated with the historic floods, reporting the properties damaged, the flood levels at the properties or infrastructure and the duration of flooding;
- socio-economic surveys of the affected populations, be they household surveys or sample group interviews;
- good topographic information in the main flood prone areas with contour intervals of about 0.3m (1ft).

Unfortunately, in St. Lucia very little of the above data is available. Although subject to serious flooding on a relatively regular basis, water level records in the river system is at best sparse. Water level recorders operational in the past have been primarily related to gauging dry season flows. Stage discharge relationships have been derived for low flows with uncertain extrapolations used to relate stage to flood discharges. During serious flood events, gauges have often been damaged or washed away.

The peakiness of flood flows is such that normal staff gauges read manually once or twice a day would not necessarily produce peak flow water levels unless the staff gauge reader was exceptionally diligent and was willing to record levels on a ½ hourly basis during a flood event, day or night.

Flood Reports have not been produced, hence this source of valuable information is not available. This situation should be rectified in the future with the automatic production of a well structured flood report document following each serious flood event. Even after TSD, there is not known to be any structured watershed by watershed quantified statement of peak flood levels and flooding extents. Flood marks based on trash marks were painted on various trees and power/telephone poles, but only several weeks after the event when trash marks could have been disturbed. The impact of channel blockages on trash marks is also difficult to ascertain if flood reports are unavailable.

In terms of topographic information, several map series do exist. The 1:25,000 and the 1:10,000 series have contours shown but only at a minimum interval of 25 feet (7.6m). This is inadequate for reliable flood plain or hazard zone mapping. There is a limited coverage of 1:2,500 maps with contours at 10 feet (3m). Some additional flood plain topographic surveys are being undertaken to check the 1:2,500 mapping (contour details) and to provide information in some areas with no 1:2,500 coverage. This will build upon the river surveys undertaken in Phase I.

### **6.2.5 Flood flows and Flooding of October 26<sup>th</sup> (and TSD)**

An analysis of the flood events of TSD and of the 26<sup>th</sup> October has been carried out in considerably more detail than is warranted by the Terms of Reference for the Phase II Consultancy Contract for several reasons:

- I. To provide a more detailed comprehensive assessment to TSD bringing together individual, small, papers and notes on the incident {the flood mark summary is also recorded}.
- II. To similarly provide a quantified assessment of the flood of the 26<sup>th</sup> October to put the event in the context of TSD and in the context of frequency of occurrence;
- III. To provide an example for the use of the information now available from the new data loggers which have been installed under Phase I;
- IV. To provide an example for the assessment of the value of the existing hydrometric data base and the need for new or expanded hydromet networks.

The main factors emanating from the assessment, in relation to the flooding of the 26<sup>th</sup> of October, have been:

Cause of flood flows:

- high intensity rainfalls on small steeply sloping catchments;
- possible impact on flood flows of changing land use in the catchments.

Cause of flood damage:

- agriculture encroaching onto the flood plain;
- infrastructure and buildings encroaching onto the flood plain;
- throttling of the flood way through the construction of 'economic' small cross drainage structures;
- possible imprudent re-alignment of the natural river channel or resectioning of the channel;
- lack of river channel maintenance resulting in reduced flow capacities within the channel section and potential destabilisation of flows;

The above situation is aggravated by poor agricultural practices in terms of soil conservation, poor farm waste management and poor household waste management in general.

Natural processes which should be appreciated;

- the inevitability that flood flows will occur;
- the fact that a 'normal' river channel is the regime condition for normal flows which also accommodates low flows;
- almost all rivers in their natural state require a relatively clear flood plain for extreme flow events;
- sediment discharges increase by a power factor with flow discharges ( $Q^{2.5}$  approximately);
- flood plains are naturally vegetated with resilient plants and provide the location for the deposition of sediment during high flow events. This adds to the fertility of the flood plain and helps reduce the quantity of soil lost to the sea.

Human intervention factors and their impact:

- poor hydrological, hydraulic and engineering design can both throttle river flows and destabilise rivers during flood events;
- changes in land use in the upper catchments can increase the runoff rate for a particular rainfall event thus aggravating flooding downstream;
- cultivation of bananas in the upper catchments and in the lower catchment near to the main channel of a river increases the risk of bananas being damaged and washed away. When washed away they increase the debris flow in the river system which can block cross drainage structures (road bridges, culverts etc) downstream. They can also accumulate against trees which have fallen across the river channel through undercutting or storm winds;
- the existence of bananas and deep drainage ditches over most of the flood plain increases the frictional resistance of the flood plain over what it would naturally be. This increased roughness impairs flood plain flow increasing water levels and hence flood extent and damage extent. The increased water level can increase the pressure head against a structure (possibly already clogged with debris) causing it to fail/collapse
- the poor waste management related to banana cultivation, especially the protective plastic covering used on the bananas, aggravates the level of debris passing down the river system into the coastal areas.

The flood hazard level of a particular location will therefore depend upon external factors, not just rainfall intensity (recurrence frequency etc) and topographic characteristics. Factors which could be addressed through prudent catchment management include:

- controlling upper catchment development and land use practices;
- controlling and undertaking proper design of cross drainage structures;
- controlling and where possible preventing infrastructure and building development on the flood plain if negative impacts can be proven;
- controlling agriculture use of the flood plain, reducing the encroachment towards the river channel and making sure that drainage systems are comparable with flood plain flooding;

- most rivers possess active and passive flood plain areas, these need to be identified in the control process;
- maintaining river channels and identifying and removing potential vegetation or other material which could fall or be swept into a channel during a storm event;
- establishment of a river berm both for increased conveyance capacity, improved bank stability following rapid draw down of river water levels at the end of a flood and to assist in providing at least a small buffer zone with no banana cultivation;
- maintaining cross drainage structures for a clear flow way;
- undertaking river engineering work only where essential and where economically justified i.e. to protect major infrastructure. Where modifications to a channel is undertaken, careful consideration needs to be given to ecological issues.

### 6.2.6 Field Trials

A series of field trials have been devised to examine some possible alternative river bank protection and conservation measures. The trials which will also include landsliple/slope stabilisation, sustainable land use, river stabilisation etc. Will provide guidelines and criteria for the watershed management plans.

Some of the pilot works will be undertaken to address shortcomings encountered in the Phase I works. These include:

- Cul de Sac River: Gabion protection work adjacent to house, modification to gabion length and alignment (vegetal cover to be established);
- Cul de Sac River: Protection of main road, water supply pipeline and electricity pole by gabion work or palisading;
- Roseau River: Introduction of weir formation at location of loop cut;
- Cul de Sac River: Introduction of hard nibs and/or palisading at location of severe erosion in banana plantation near Marc Marc junction;
- Cul de Sac River: Creation of timber frame as crib for river bed stones to be cemented with vegetation/ creeper;

A pilot study will also be undertaken in an estimation of river maintenance requirements. This will be assessed in terms of estimates per km of channel length and relate to tree lopping, bank trimming, toe protection and debris removal.

Monitoring of the field trials will include:

- Careful work and material estimation for the construction of the works;
- sources used for materials;
- labor requirements and construction difficulties encountered;
- photographic records and level and dimensioning of the works and nearby r river system prior to the following wet season;
- monitoring of the flood flows impacting on the trial works;

- surveys and post flood assessments of the condition of the works including the performance of any bio-engineering provisions;
- assessment of costs for rehabilitation, post flood season, if required.

Monitoring of the bioengineering works will include the regular measuring of plant stem and leaf growth and soil moisture measurements.

### **6.3 Land Use and Environment**

#### **6.3.1 Summary**

The consultants made his first input in October/November 1996 and completed 7 weeks (30%) out of a total allowance of 5 months. Further inputs are scheduled for mid day season 1997 (May/June) and towards the end of the project in September to November to complete studies and participate in the preparation of the Final Report and the Watershed and Environmental Management Plan.

The Consultant started with a review of literature relating to Agriculture, Land Use Planning and the Environment and agro-ecological zones were defined by the entire island, based on agro-climatic zoning, on soil characteristics (notably clay mineralogy and depth), and on slope gradient ranges. Six major agro-climatic zones were defined (A to F) based on average accumulated deficits of rainfall minus evapo-transpiration (which varied from 0 to nearly 800mm across the island), month of 'very dry', 'dry', 'wet', and 'very wet' conditions (varying from 0,0,4,8 to 6,2,4,0 respectively), as well as mean annual rainfall deficits (varying from 3430 mm to 1330 mm).

Soils were grouped according to mineralogy and depth ranges, with allophanic, kaolinitic, montmorillonitic (commonly shallow), alluvium (mixed) and rock and debris being the main grouping (denoted h, k, m, a, and r respectively).

Daily water balances were then analyzed for Union Station for the period 1980-95 using the Daily Soil Water Balance model running on a Lotus 123 spread sheet (DLYSLWB9.wk3). Stimulations for bananas and for primary forest were run, based on measured and assumed values for available water holding capacities and infiltration rates of soils. Values for surface and subsurface run-off and deep leaching were obtained for the two vegetation types for each year. the model was also run using the rainfall data from Mr. Peter Norville's run-off experiment at Roseau in 1988, and very close correlation between observed and predicted surface and subsurface runoff values were obtained.

Actual to potential evapo-transpiration ratios were then worked out for banana, showing enormous differences in severity of dry season from year to year over the 1980-95 period.

The 37 Watersheds were then characterized according to proportions of the 20 agro-ecological zones in each watershed. Land Suitability Ratings (according to FAO Framework for land evaluation methodology) were assigned to each of the 20 agro-ecological zones for the 10 defined Land Utilization Types.

Existing Land Use Mapping and aerial photography was reviewed, revealing that the recent (1992) photography covered only half the island, leaving out the upper watershed areas. The Land Use Mapping of 1993 was largely based on satellite imagery which produced only very generalized land use classes; these are far from satisfactory for the present stud. the consultants are thus planning to acquire their own Small format Air Photography which will be obtained from a short term helicopter hire during the coming dry season, and this will form the basis for the routine land use mapping. Detailed (1:12,500 scale) land use analysis was undertaken for 2200-acre trial area in the Cul de Sac Valley, and land use classed showing different promotions of banana cultivated land was worked out.

Slope mapping was reviewed, and the Consultants undertook analysis on the 2200-acre trial area for comparison with the computer-generated slope mapping. Land use options were reviewed for the steep land classed, an expected amounts of surface wash and mass movements were quantified for each option.

Maximum rainfall intensity rates experienced during Tropical Storm Debbie and during other events were reviewed, and compared to measured soil infiltration rates obtained with a simple sprinkler infiltrometer.

Sprinkler infiltrometer measurements were undertaken for bare soil surfaces, soil under trash cover, soil under forest cover (thick forest litter), and preliminary results demonstrate massive differences (15mm, 45mm and 80mm infiltration respectively over a 30 minute period). Both forest litter surfaces and banana trash surfaces can cope adequately with maximum rainfall intensities expected in most years, and thus good trash management will make a crucial difference to watershed management.

A program of soil conservation field trials were started on steep banana land in four areas covering the two trial watersheds, and these will run until the end of 1997. These trials are under the supervision of the Government Extension Staff from three of the regional offices. the trials will assess trash management required to improve infiltration and cut run-off and soil losses on banana land on sloped of 20-35°. The Consultants consider that it will be extremely difficult to prevent banana cultivation on this steep land, and that may alternative crops will be considerably worse than bananas in soil conservation terms. Improved soil conservation in banana land is thus vital for improved watershed management. Further trials using tree crops are being considered.

Environmental Issues and current Environmental Projects were reviewed, showing that existing information and projects had covered marine, aquatic, pollution and biodiversity issues fairly well, but there were severe deficiencies on the terrestrial side, including land use, soil conservation and agronomic practices. Some key areas are further elaborated in the following sections.

### **6.3.2 Soil Infiltration Rates**

Much of the flooding and damage during flood events such as Debbie and the October 26<sup>th</sup>, 1996 event, are caused by excessive runoff and a failure of the soil to absorb the intensive rainfall. In his literature and data review the Consultant was unable to find any references to measurements of soil infiltration rates, and in order to establish relationships between rainfall intensity, infiltration rates, and in order to establish relationships between rainfall intensity, infiltration and differing soil cover conditions a series of tests was conducted.

The sprinkler infiltrometer, rather than the double ring infiltrometer, was chosen in that it stimulates rainfall more closely; water is applied by means of a sprinkler rose. For the double ring infiltrometer, which more closely simulates flood irrigation, damage to the soil surface driving in the ring and by flooding creates very artificial; conditions. the measured rates are thus quite different from those observed from the sprinkler infiltrometer of those measured from lysimeters and run-off plots.

In the experiments representative 0.75 x 1 meter rectangular areas are selected, and corners of the rectangle with small sticks or thin pegs. On the downward side of the slope soil is cut away from the lower edge for a depth of 10cm, the face being angled into the slope, and a collector tray placed so that it can collect any run-off from the plot. Three catch can are placed within the rectangle in order to record depths of water applied. Water is then syphoned from 5 gallon drums through a hose connected to the sprinkler rose, the flow rate of which has been adjusted to deliver a maximum of 3mm/minute over the 0.75 sq m area. The rose is passed the rectangle, evenly delivering water which wets the surface and enters the can as it passes. Water application is continued until run-off commences, after which a break of 4 minutes is taken for the surface to drain. The times of start and finish of each wetting period (hours: minutes: seconds) are carefully recorded, and the levels of water in the 3 catch cans are then measured. The process is repeated several times for a duration of 1 hour, water levels in the cans being recorded each time. Water running into the collector tray is measured with a measuring cylinder at the end of the experiment. Data is recorded onto field sheets and entered into a Lotus 123 spreadsheet for calculation .

At the end of the experiment a `post mortem` is undertaken on the rectangular plot to records the depth and evenness of wetting, and the presence of root channels cavities worms and other fauna. Distance banana mats, features of micro-topography large stones and rocks outcrop etc, are all recorded. The time and date of the experiments is noted, and compared with rainfall data from nearby gauges.

Preliminary results from infiltration test demonstrates the enormous variability of infiltration rates over short distances, and the strong correction of high infiltration rate with presence of trash cover, earthworm presence and worm channel density. Infiltration rates average 90mm/hour for the 30 minutes for the trash-covered sites.

Areas of exposed soil, by constant, invariably show very low infiltration rates averaging less than 30mm/hour over the same 30 minute period. Well-established secondary forest at Barre D'Isle, with a deep litter and humus layer, shows a average infiltration rate of more than 160mm over 30 minutes.

Limits for required soil infiltration rates sloping upland cultivation have been tentatively placed at >50, 49-35, 34-20 mm/hour for 1 hour for classes S1, S2 and S3 respectively. Corresponding short-term infiltration rates are >2.5, 2.4-1.5, and 1.4-1.0 mm/minute for a duration of 5 minutes respectively. Soils not meeting these criteria should not be under cultivation to seasonal crops, nor bananas, but should be planted to permanent treecrops or to forestry plantations.

Results of the tests are given in the Table 6.1, taken from the Land Use/ Environmentalist report.

Table 6.1

## INFILTRATION EXPERIMENTS: SOIL CONSERVATION &amp; RUN-OFF CONTROL TRIALS

Time Start	Time Stop	Mins	Depth Measurements(mm)				Sprinkler Intensity (mm/min) (mm/hr)	Surface Run-off (ml/sq m) (mm)			Net Infiltration (mm) (mm/min) (mm/hr)			
			Rep1	Rep2	Rep3	Mean		**** (accumulatd)						
*****														
<b>RAVINE POISSON</b>														
10:37:00 AM	10:38:40 AM	1.67	1.0	0.4	1.0	11.0	6.6	396	0	0	0.0	11.0	6.6	396
10:42:35 AM	10:43:25 AM	6.42	1.2	0.7	1.2	13.3	2.1	125	0	0	0.0	13.3	2.1	125
10:51:20 AM	10:53:00 AM	16.00	1.3	0.9	1.3	14.7	0.9	55	0	0	0.0	14.7	0.9	55
10:57:55 AM	10:57:55 AM	20.92	1.4	1.2	1.5	16.7	0.8	48	0	0	0.0	16.7	0.8	48
11:03:00 AM	11:03:00 AM	26.00	1.6	1.5	1.7	19.0	0.7	44	0	0	0.0	19.0	0.7	44
11:18:00 AM	11:18:00 AM	35.42	1.7	1.8	2.0	20.7	0.6	35	0	0	0.0	20.7	0.6	35
11:27:00 AM	11:27:00 AM	35.67	2.1	2.0	2.4	24.7	0.7	41	0	0	0.0	24.7	0.7	41
<b>DENNERY: GLAVIER</b>														
12-Nov-96														
bare soil surface														
12:19:40 PM	12:20:20 PM	0.67	0.4	0.2		6.0	9.0	540				6.0	9.0	540
12:22:20 PM	12:22:30 PM	2.83	0.6	0.4		8.0	2.8	169				8.0	2.8	169
12:25:40 PM	12:25:45 PM	6.08	0.8	0.5		9.5	1.6	94				9.5	1.6	94
15-Nov-96														
33deg slope bare soil surface														
11:52:00 AM	11:53:10 AM	1.17	0.2	0.2	0.2	5.0	4.3	257	48	48	0.1	4.9	4.2	254
11:59:01 AM	11:59:40 AM	7.67	0.5	0.4	0.4	7.3	1.0	57	60	108	0.1	7.2	0.9	56
12:07:26 PM	12:07:52 PM	15.87	1.0	0.8	0.6	11.0	0.7	42	70	178	0.2	10.8	0.7	41
12:21:03 PM	12:22:00 PM	30.00	1.2	1.0	0.9	13.3	0.4	27	140	318	0.4	12.9	0.4	26
12:39:36 PM	12:39:55 PM	47.92	1.5	1.4		12.7	0.3	16	100	418	0.6	12.1	0.3	15
12:47:29 PM	12:47:54 PM	55.90	1.8	1.6		14.3	0.3	15	192	610	0.8	13.5	0.2	15
15-Nov-96														
28deg slope 95% bare soil surface														
01:02:04 PM	01:02:32 PM	0.47	0.2	0.2	0.3	5.3	11.4	686	42	42	0.1	5.3	11.3	679
01:05:26 PM	01:05:42 PM	3.63	0.5	0.8	0.6	9.3	2.6	154	358	400	0.5	8.8	2.4	145
01:13:10 PM	01:13:26 PM	11.37	1.0	1.0	1.2	13.7	1.2	72	218	618	0.8	12.8	1.1	68
01:20:34 PM	01:20:50 PM	18.77	1.3	1.1	1.5	16.0	0.9	51	210	828	1.1	14.9	0.8	48
01:28:22 PM	01:28:40 PM	26.60	1.6	1.4	1.5	18.0	0.7	41	316	1144	1.5	16.5	0.6	37
<b>DENNERY: GLAVIER</b>														
12-Nov-96														
thick banana trash cover														
12:35:00 PM	12:40:00 PM	5.00	2.0	1.9	2.1	23.0	4.6	276				23.0	4.6	276
12:48:00 PM	12:57:00 PM	22.00	5.6	5.5	6.3	61.0	2.8	166				61.0	2.8	166
15-Nov-96														
35deg slope mod thick banana trash														
09:30:00 AM	09:35:20 AM	5.33	2.1	2.1	2.2	24.3	4.6	274	0	0	0.0	24.3	4.6	274
09:41:00 AM	09:42:15 AM	12.25	2.8	2.4	2.7	29.3	2.4	144	0	0	0.0	29.3	2.4	144
09:49:55 AM	09:51:55 AM	21.92	4.0	3.5	3.9	41.0	1.9	112	0	0	0.0	41.0	1.9	112
09:58:00 AM	09:59:30 AM	29.50	4.7	4.0	4.5	47.0	1.6	96	384	384	0.5	46.5	1.6	95
10:05:00 AM	10:06:20 AM	36.33	5.8	4.4	5.1	54.0	1.5	89	68	452	0.6	53.4	1.5	88
15-Nov-96														
29deg slope thin cover of banana trash														
10:41:15 AM	10:42:15 AM	1.00	0.8	0.5	0.2	8.0	4.80	480	228	228	0.3	7.7	7.7	462
10:45:01 AM	10:46:30 AM	5.25	1.1	1.0	0.5	11.7	2.2	133	454	682	0.9	10.8	2.0	123
10:54:45 AM	10:55:45 AM	14.50	1.9	1.4	0.8	16.7	1.1	69	248	930	1.2	15.4	1.1	64
11:06:30 AM	11:07:10 AM	25.92	2.6	2.1	1.1	22.3	0.9	52	34	964	1.3	21.0	0.8	49
11:14:22 AM	11:15:02 AM	33.78	3.1	2.5	1.5	26.7	0.8	47	362	1326	1.8	24.9	0.7	44
11:26:11 AM	11:26:44 AM	45.48	3.5	3.0	1.8	30.7	0.7	40	134	1460	1.9	28.7	0.6	38
11:36:00 AM	11:36:28 AM	55.22	3.6	3.2	2.0	32.3	0.6	35	90	1550	2.1	30.3	0.5	33
<b>BARRE DE'ISLE</b>														
15-Nov-96														
23deg slope 2cm layer of pine, mahogany & bamboo litter														
02:37:30 PM	02:39:39 PM	2.15	2.0	2.3	2.0	24.0	11.2	670	0	0	0.0	24.0	11.2	670
02:47:30 PM	02:49:55 PM	12.42	3.9	4.6	4.9	47.7	3.8	230	29	29	0.0	47.6	3.8	230
02:57:59 PM	03:00:00 PM	22.50	6.4	6.9	7.2	71.3	3.2	190	26	55	0.1	71.3	3.2	190
03:09:00 PM	03:10:10 PM	32.67	7.3	8.1	8.9	84.0	2.6	154	96	151	0.2	83.8	2.6	154
03:16:50 PM	03:18:15 PM	40.75	8.9	9.5	10.1	98.0	2.4	144	73	224	0.3	97.7	2.4	144
15-Nov-96														
c.32deg slope thin but continuous litter layer: secondary forest, c 12 yrs growth														
04:07:00 PM	04:07:35 PM	0.58	0.0	0.0	0.5	6.7	14.9	891	318	318	0.4	8.2	14.1	848
04:13:16 PM	04:13:42 PM	6.70	0.4	0.3	0.7	11.7	1.7	104	290	608	0.8	10.9	1.6	97
04:22:30 PM	04:22:57 PM	15.95	1.0	0.8	1.4	17.7	1.1	66	760	1368	1.8	15.8	1.0	60
04:29:00 PM	04:29:22 PM	22.37	1.2	1.1	2.1	21.7	1.0	58	640	2008	2.7	19.0	0.8	51
04:35:00 PM	04:35:22 PM	28.37	1.6	1.5	3.0	27.3	1.0	58	740	2748	3.7	23.7	0.8	50

### 6.3.3 Land Use and Agriculture

Changes in land use, particularly in the upper catchments on steep slopes have been blamed for increases in soil erosion and associated problems. Almost without exception, this land has gone into bananas. Estimates of land use change have been put at 20%, and the increase in banana planting, using figures taken from the Agricultural Census 1996, was 3368 acres.

By reviewing past mapping, it is possible to map change from as early as 1996 to 1984. Most recent exercises, the Roche Itee, group conseil maps of 1992 using satellite imagery, was insufficiently precise, and stereoscopic Air Photography of 1992 did not cover the whole island and was of poor quality due to cloud in the upper catchment.

A sample area of the cul-de-sac watershed of 2200 acres was examined, and an exercise of aerial photo interpretation and mapping, allowed a comparison of current and 1984 land use to be made.

Quantifying land use change is important in the context of watershed planning, and the data is also essential for producing land hazard maps.

To get over these problems the Consultants are proposing to use Small Format Aerial Photography (SFAP). SFAP was used by our staff under very similar conditions to St Lucia, In Palawan, the Philippines. Here mountainous terrain, intense cloud cover over most of the time, and remoteness from major contrast where survey aircraft are based all made conventional photography extremely difficult and expensive. SFAP has big advantages of flexibility (a helicopter will hire at short notice when the weather is clear), and the production of stereoscopic color photos giving sufficient detail to differentiate bananas, seasonal crops, and interplanted treecrops. Some 240 color prints at a normal standard scale of 1:12,500 would be acquired at a conventional 3.5 x 5 inch print size.

### 6.3.4 Slope Analysis

With most of St Lucians agricultural land on slopes of  $> 20^{\circ}$  and a significant portion in the  $25.35^{\circ}$  range, slope analysis is very relevant to watershed planning.

Maps are available at 1:25000 scale and on file at 1:10,000 with contours at 25 foot intervals below 250 feet and 50 feet above 250 feet. This information is also available on GIS and is useful for analysis at a general island level.

As a check on the DEM GIS data, a conventional analysis on a 900ha sample area in Cul-de-Sac was undertaken. Results show a high percentage of the total area degrees slope (21.7%), with 5.7% over  $35^{\circ}$  slope. This land should not be in banana cultivation, and land over  $35^{\circ}$  should be planted to deep-rooting permanent trees as a matter of urgency. A very high percentage of the land is of slopes of  $20-30^{\circ}$  (42%), the vast majority of this being under banana cultivation. This use can continue, but soil conservation measures

( trash cover is of  $<5^{\circ}$  slope, representing the valley bottom land, most of which has a high flood risk, but otherwise would be highly suitable for bananas. Surprising only 10.8% of the land is in the gently sloping categories, ( $5-20^{\circ}$  slope), which would show a low flood risk and high suitable rating for banana cultivation.

### 6.3.3 Land Utilisation Types

Many of the current problems of erosion, heavy run off and flooding, can be attributed to wrong land use.

A review of alternative crops, suited to St. Lucia conditions was undertaken, and issues such as mass movements, landslides and surface wash risk were assessed. Concentrating on the critical  $30^{\circ}$  slope land the Consultants concluded:

- **Natural Forest** is by far the best land use for land  $30^{\circ}$  slopes and above, retaining soil and water better than competing land use. Thus any further deforestation of this land need resisted with great vigor.
- **Forest Plantation, Permanent Treecrops, ( and VP tea)** are all excellent crops for soil conservation on steep land. if under good management. Young stands of trees, however, will not anchor unconsolidated soil into the bedrock, and hence landslide risk in these areas continues to be high until the trees are established. Similarly, although tea is good for reducing surface wash erosion, its relatively shallow roots do not provide much protection from mass movements. ( Tea although ecologically very well suited to upper catchment areas of St. Lucia is not recommended here because of its high labor demand, requirement for a central factory for processing, and requirement for good marking links.)
- **Bananas** under average ( i.e poor trash ) management are clearly not a sustainable land use on  $30^{\circ}$  slopes. Good trash management ( covering the ground surface with an even coverage of trash, or installing closely-spaced trash lines) will cut down soil losses through surface wash considerably. However, tied contour drains with the above good trash management will be required to reduce the problem to a sustainable level. For landslides-risk areas, however, the latter practice would not be advocated, as retaining water on the contour during the latter part of the wet season would further promote mass movements.
- **Seasonal cultivation (taro, yams, Sweet potato, peppers),** are clearly not suited to steep land. With the decline in banana prices, there is a grave danger that banana land would be converted to these crops which would exacerbate the erosion problem.

### 6.3.6 Field Trails - As part of the Projects Field Trail Program

Cultivating of bananas on steep lands had been identified by the project as the single most important misuse of land contributing to the erosion problem; both surface wash erosion, and a greater risk of mass movements, ( landslides, debris flows etc.) being involved. Much of the steep land now cultivated has been cleared from forest over the high banana prices during the period 1980-92. The worsening of the erosion and flooding problems can thus closely correlated with the expansion of the bananas steeply sloping land at the expense of the cover.

Erosion and Run-off Control Trials have been started by the project, with the following objectives:

- To obtain measurements on infiltration and run-off on steeply-sloping banana land under different practices of trash cover and trash lines to verify the hypothesis that trash cover can improve infiltration by a large factor as well as protecting the soil surface from raindrop impact.
- To obtain measurements on yield increases that would results from better soil and water conservation.
- To obtain cost of soil conservation measures in term of labor and any materials used.
- To assess the relative costs and benefits of the different treatments being considered ,ie even spread of trash over the soil surface orientation of trash in the lines held down by stakes along the contour and tied contour drains.
- To demonstrate to extension staff and farmers the benefits obtained and the methods used in these trails.

It is hoped that on the basis of these trials a simple extension leaflet would be produced, which would be circulated to extension staff and farmers.

Four sites, all under banana cultivation in the 25 - 30<sup>0</sup> slope range were chosen.

At each field experiment site the following parameters would be measured:

- composite topsoil analysis: exchangeable cations, CEC, total and available P, organic C and N;
- sprinkler infiltrometer measurements;
- fresh banana root density;
- soil run-off;
- banana fresh-trash weight;
- Leaf Area Index (LAI)
- nematode courts

## ST LUCIA: ENVIRONMENTAL PHYSICAL ISSUES, RELATIVE IMPORTANCE, AND POSSIBLE SOLUTIONS

File:ENVSOLNS.wk3

GROUPING	SPECIFIC ISSUE	IMPORTANCE	POSSIBLE SOLUTIONS
Soil Erosion	1 Surface Wash	<<<<	a)Major campaign to install trash lines & maintain trash cover in banana lands: Extension Service to be strengthened; b)Steeper lands (some >25, all >30deg) to be underplanted with perennial trees c)Steepest land (>35deg), and land above water intakes, to be acquired by govt for forestry plantations. a)Highest risk areas (>35deg, more concave) to be identified and planted to perennial trees b)Surface Drainage in high risk areas to be improved; c)Areas threatening infrastructure to have compulsory acquisition orders
	2 Mass Movements(Landslides)	<<<<	
Soil Degradation	3 Loss of Plant Nutrients	<<<	a)Solutions 1 a,b,c to be implemented; b)Balanced nutrients to be applied to all crops.
	4 Nutrient Imbalances	<<<	a)Study to be implemented covering macro & micro elements*.
	5 Acidification	<<<	a)Soil testing programme to be implemented*; b)Lime to be applied to balance N—fertilizer additions
	6 Pesticide Accumulation	<	a)Study to concentrate on potential hot spots(banana sheds etc)
	7 Adverse Pesticide Affects	<<<	a)Break crops to be promoted of nematicide use; b)Research on biological control (nematode—trapping fungi) to be promoted; c)Alternate use of different nematicides; {a)Maintain even trash cover; b)Not too rigorous weed control c)Promote earthworm activity (lime application {reduce nematicide use) d)improve soil drainage
	8 Soil Surface Exposure	<<<<	Spoil to be used to improve shallow soil areas (small homegardens) [Flat alluvial areas]
	9 Decreasing Soil Infiltration	<<<<	Small, localised problems only, particularly on Windward coast;
	10 Spoil Disposal	<	
	11 Soil Waterlogging	<<	
	12 Salinity & Sodicity Increase	<<	
	13 Inappropriate Agric.Land Use	<<<<	Promote perennial treecrops in steeper banana areas; don't grow seasonal crops
	Land Suitability	14 Land Lost to Construction	<<
15 Surface Run-off		<<<<	a)Solutions 1 a,b,c to be implemented
Rivers	16 Surface drainage	<	b)Attention to be focussed also on agric.drains, and drainage of farm tracks & paths; Farmers to be advised in design & layout of drains
	17 Sediment Load	<<<<	Solutions 1 a,b,c to be implemented (solution lies more in land upstream, less so in rivers)
	18 River bank Erosion	<<<<	a)Maintenance of 20m river reserves (permanent trees); b)Planting of cover plants; c)Avoidance of River straightening d)Promotion of 1 a, b, c, above.
	19 Solid debris load	<<<<	a)Better rubbish collection & public education; b)Farmers to clear debris from farm drains; Promote perennial tree cover over larger proportion of watershed
River Water Quality	20 Dry Season Flow	<<<<	a)Better upstream water management b)Grow dasheen & Terminalia arjuna in lowest areas
	21 Flooding	<<<<	
Groundwater	22 Nutrient Loads	<	Unlikely to be major problem, except in freak rainstorms in dry season – Monitor river nutrient contents (incl K, N, and P2O5)
	23 Pesticide Loads	<	Unlikely to be major problem in rivers, but needs study.
	24 Groundwater Recharge	<<<<	[A massive problem, but solutions lie upstream in better land management] Temporary solutions (vacuum cleaning of reefs etc) needs further study.
Marine	25 Groundwater Quality	<<<<	[A problem in Rodney Bay Marina, and in Castries Harbour] Needs further study: particularly pesticide adsorbed onto colloidal material, deposited in sea.
	26 Siltation	<<<<	
CLIMATE	27 Nutrient loads	<<<	
	28 Pesticide Affects	<<<	
CLIMATE	29 Decreasing wind Protection	<	Ridgetops require permanent treecover for >100m width.
		<	

Note Relative importance assessed in terms of annual financial losses represented by each issue: <<< massive costs, >EC\$10m/yr; << large costs, >\$1m/yr; sig.costs, >\$100k/yr.

At each site the following treatment would be investigated:

- I. Control Conditions: involving some shallow surface drainage and
- II. banana trash left at random in piles;
- III. Even coverage of banana trash would be place over the entire surface, pseudostems being cut into strips, and this would be orientated along the contour; the trash would be obtained from production in situ.
- IV. Even coverage of the banana trash, but at the density; further trash would be brought from production from flatter areas.
- V. Banana trash placed in lines on contour, and held by short stakes. Trash obtained from production in situ.
- VI. as (iv) above, but with installation of tied contour drains ( silt traps);
- VII.as (v) above, but with banana trash also brought in from flatter areas to give double the standard application rate; of the trash would be used to cover the ground surface, the other half placed in lines on the contour held by short stakes.

Sprinkles infiltrometer and soil run off measurements will be made and the Consultants will be able to give adequate supervision during his May/ June input, In the measure, Extension Staff are making observations and ensuring that fertilizes lime and trash are all applied as planned.

### **6.3.7 Environmental Assessments and Management**

The most useful single source of information in the Environmental Field is the Country Environmental Profile, produced for St. Lucia by the Caribbean Conservation Association in 1991. This reviews all existing information in the Environmental sector, including Physical, Biological and Human Issues, the Institutional Framework, and gives a list of recommendations for environmental management.

In reviewing existing information and projects the Consultants have become increasingly aware that these have been focussing more on the symptoms of the environmental problems. Thus the all-important soil conservation problems have received little attention, while the studies in the marine and freshwater ecology fields have been well covered. The consultants are thus intending to redress this imbalance.

A long list of environmental issues applying to St.Lucia was tabulated, showing relative importance and cost. From this a further table derived, showing physical issues, relative importance and possible solutions. The results is reproduced here at table 6.2.

The consultants concluded by making a series of recommendations which would lead to improved watershed management. These focused on such issues as conservation, better land use and regulations on road construction and forest clearing. Similar recommendations have been made by the other specialist and requirement of the pool of ideas will form part of the watershed and Environmental management Plan.

## **7. The Trials Programme**

In the projects Memorandum, the consultants are asked through the collation of existing data and a review of Phase I, to identify and arrange for the field testing of possible solutions to problems remaining unsolved.

A series of field trials was devised to examine the various protection and conservation measures. The trials which cover landslide/slope stabilization, sustainable land use, river stabilization etc. will provide guidelines and criteria for the watershed management plans. The field activities are not restricted to the two selected pilot catchments.

A Field Trials program was first tabled in late November 1996 as a basis for discussion, the intention being that government would choose what was considered most relevant and important and agree a final program for which funds were sufficient.

This has now evolved and trials are covered in detail in the Technical Reports. They fall into three categories:

- Engineering and Bioengineering
- Agricultural
- Social

### **7.1 Engineering and Bioengineering**

During Phase I, the majority of works carried were, of necessity "hard" measures, featuring extensive use of gabions, rip rap and revetments. The works were reviewed by the River Engineer and details can be found in Volume 2 section D, of this report. Being costly it is considered that continued use of such measures cannot be justified or sustained in St. Lucia, except where protection of property or infrastructure is involved. The Engineering Trials Program has used the experience gained during the short Bioengineering Specialist input, trials have been kept relatively simple employing local materials wherever possible and adopting designs which can be replicated without the need for heavy engineering or high cost. However, during the flooding which occurred on 26th October 1996, some shortcomings of Phase I works became apparent and damage to works, rivers and infrastructure resulted. Some pilot works are necessary to redress this situation.

Altogether eight trial types have been defined, using a combination of hard and soft measures, and additional three bioengineering trials are included.

The trials are designed to test various options from the source of erosion through to river protection using both hard and soft measures or combination of both.

At the source of erosion such issues as on farm contour drains, with or without bioengineering have been identified. Measures could include vegetative filter strips and buffer strips.

As a next line of defence, minor channel controls using porous check dams and filter fences will be tested using vegetative materials to trap sediment before it enters the main river system. these techniques will, if practicable, be used in conjunction with sediment detention basins or ponds, although topography may well limit the application of such measures.

Most emphasis will be given to river training and bank protection, and here 7 trial types, which can easily be replaced have been developed. Full details including sketches descriptions, specifications cost estimates and forms of contract for the works are to be found in Volume 2, Section D (Chapter 5).

Particular attention is given to the flood plains, which are of considerable importance to the banana industry, with some building also encroaching. The coastal towns of St. Lucia are almost exclusively on flood plains close to river estuaries, and therefore vulnerable.

Much can be done by the regular removal of debris, fallen trees etc. and through ensuring that cross channel structures do no impede flood flows.

Measures to be tested include:

- gabion (boxes or mattresses) protection work to prevent lateral movement of the channel and erosion of the outer banks of a bend.
- revetments with the same objective;
- palisading with the same objective;
- gabion work to provide a hard nib to provide a degree of stability to the alignment;
- palisading or gabions to create a groyne to redirect flows;
- loop cutting with associated mini weir construction if a head loss is to be created to match that lost in the cut. Care has to be taken with such weir design.

More of these measures will include a level of bioengineering.

One trial, ENG 1, involving river patrolling to provide the basis of maintenance program including tree lopping, bank trimming, toe protection and removal of debris, has been prepared in full detail. This trial, which will be conducted on the Dennery river, will be important, as it will fall within the scope of the Watershed Management Action Force currently under formation. This will test not only the validity of the trial methodology but the institutional capacity of the Watershed Management Action Force and essential linkage with the River Management Unit.

## 7.2 Agriculture

With the increased area of banana plantations and with their development on the steeper slopes in many of the river catchments, it is reported that the rate of erosion of soil from the catchments has increased in recent times. The number of banana plants reported in 1996 was about 15 million, an increase of about 25% from 1986. Other trees have much lower numbers with coconuts declining in popularity at about 650,000 units although plantains are of rapidly growing importance. The increase in banana plants in the 10 year period is considered to be indicative of the increase in cultivated area, being located on the more steeply sloping land with high erosivity indices. {Information source: 1996 St. Lucia Census of Agriculture, Portrait of the Main Findings, June 1996}.

Topsoil, once removed from the land and passed into the drainage system, either has to be removed at considerable expense or alternatively the sediment passes to the estuaries and marine environment affecting marine life. Deposition is also likely to occur in the lower flood plains raising bed levels and increasing flood risk and destabilising the meandering river network on the plains.

Having established that a main cause of erosion was the increase in banana cultivation on steep land in the upper reaches of the watersheds, and reasoned that a rapid reversal of this trend was unlikely, a trial was devised to establish cheap and effective control. Four trials of common design were established, all in areas under existing banana cultivation and on slopes in the range of 20-35°. Treatments, using banana trash available on site at no cost, other than labor were devised, they were;

- control, trash left at random
- even coverage of trash
- even coverage of trash but at double density
- trash placed in lines on contour and held by stakes
- as above but with tied contour drains
- as above, but with additional trash brought in to cover ground surface

Early tests using an infiltrometer under varying conditions gave positive results under heavily mulched conditions, and showed that infiltration capacity was sufficient to absorb all but the highest rainfall intensities.

Lessons learned from these trials will form the basis of recommendations which will be embodied in the Watershed and Environmental Management Plan. Full details will be found in Volume II, Section C.

The Land Use Report also discusses Land Suitability and options on steep land and concludes that either forest or permanent tree crops would considerably reduce erosion. While agronomically desirable, all efforts to date at diversification have achieved little. There are many perceived reasons for this and these were investigated by the Socio Economist, who found the key issues to be:

- lack of markets and marketing infrastructure
- lack of technical skills and field demonstration plots
- preadial larceny
- an underlying belief that the banana industry will continue to bring benefits.

Despite a considerable investments in studies, data is hard to find and it would seem that government has failed to devise a package, that it can demonstrate to farmers and which is supported by establishment and production costs, output and profitability.

Pure stands or mixture of species could bring benefits of both conservation and income and some data has been collated and is presented at Table 7.1

It is considered worthwhile to investigate these issues further and while any trial/demonstration established would take many years to yield results, the project could well consider sponsoring some initiative, possibly jointly with Ministry of Agriculture, Lands, Fisheries and Forestry.

### 7.3 Social Development

Consistent with the Project Memorandum, which call for the involvement of both government and non government stakeholders, a trial was originally proposed as part of the project Field Trial Program. As conceived at the time, both Pilot Watershed, Dennery and Cul de Sac were to be involved. taking heed of experience of the ENCORE Project at Soufriere and bearing in mind the capacity if the Project to develop and supervise adequate programmes, it was deemed prudent to proceed with:

- a full participatory program for Dennery Watershed
- a sensitization exercise in Cul de Sac Watershed

The trials contrast around the establishment of a Watershed Management Action Force (WMAF) in the Dennery Watershed, the main function of which would be;

- implementation of works
- monitoring and communication
- education and training

Governments commitment to the philosophy of community participation and its' ability to provide support is essential. Main indicators of this will be:

- the resuscitation of the Land Conservation Board and the holding of regular meetings
- the establishment of the National Environmental Commission and adoption of a National Plan
- the establishment of a Watershed Management Unit within AESD
- the establishment of a River Management Unit within Ministry of Communication Works and Transport
- the provision of support staff
- the backing of education and training programmes

Table 7.1

NAME	LATIN	ROOTING DEPTH	SPACING	YIELD	HARVEST PERIOD
Soursop	<i>Annona muricata</i>	medium	?	?	December - June
Avocado	<i>Persea americana</i>	shallow	20 - 40 feet	100 - 500 per tree	July - November
Breadfruit	<i>Artocarpus altilis</i>	medium	30 - 40 feet	up to 700 per tree	February - October
Mango	<i>Magnifera indica</i>	deep	30 - 35 feet	up to 400 per tree	April - July
Grapefruit	<i>Citrus paradisi</i>	deep	25 feet	160 per tree	June - November
Cocunut	<i>Cocos nucifera</i>				
Cocoa	<i>Theobroma cacao</i>	deep 2 inches	12 x 12 feet	200-600 lbs dry cocoa per acre	November - February
Cashew	<i>Anacardium occidentale</i>	deep	30 x 30 feet	850-1000 lbs per acre	June - July

Source: J. W. Purseglove  
 Cost of Production Data Base (CARDI)  
 Prix Produit

- providing finance
- providing logistical support

The main responsibilities if the WMAF are see to include:

- implementation of participation in land conservation programmes to prevent erosion and subsequent river siltation; provision of technical assistance to adopt agricultural practices less damaging to the flow of rivers (including use of agro-chemicals);
- monitoring of drainage system/soil movements and organisation of works to be implemented;
- communicating needs for capital intensive works to be carried out by higher authorities;
- workshops/educational programmes and public awareness campaigns with respect to proper watershed management (including solid waste management);
- river bank protection;
- reforestation and other forestry activities;
- promotion of improved housing design, road infrastructure, and appropriate in-house water storage facilities to reduce risks of damage by run-off and flooding
- dry season issues, river base flow, water intake management and catchment conservation
- water quality and water use efficiency.

There are several aspects to the trial which is testing the Project concept of community participation and the ability of government to support the initiative.

From the Project perspective, what is on trial are;

- community sensitization techniques
- community acceptance of the Project proposals
- success in formation of Watershed Management Action Force
- the implementation of an education program
- the identification of watershed priorities as seen by the people
- the establishment of a realistic program
- the implementation of the program including the handling of finance and accounting.

Although the programme in Cul de Sac is relatively modest, it should yield some useful information which could help in the formation of final plans.

## **8. The outline Watershed and Environmental Management Plan.**

### **8.1 General Plan**

An outline plan has been prepared, and forms Section B of Volume 1 of this report. This has not been previously circulated, but is presented to provide an indication of the anticipated structure. Publication at this stage of project development will serve three main functions:

- to promote early discussions with government with a view to refining the model and agreeing on the final format for the plan.
- to focus the remaining technical inputs so as to ensure that all aspects of the plan are properly covered.
- to guide community participation staff in their ongoing dialogue.

In the form presented, the plan is very much an outline, with some introductory material. The structure, set out as a series of headings and sub-headings serves as a framework, into which technical data will be progressively inserted. To date, some of these data are available, at least in outline, and are contained in the technical reports. Much remains to be done in refining these data, exploring important areas in greater depth and drawing sound conclusions and making workable recommendations.

The WEMP is presented in ten chapters, covering all important issues, they are:

- Population, demography and social issues
- Land use and soil conservation
- Coastal zone
- Agriculture
- River systems and drainage
- Water requirements and water supply
- Liquid waste
- Solid waste
- Institutions and legislation

Of these the two most important aspects and those on which success will largely depend are land use and conservation and agriculture.

### **8.2 Land Use and Conservation**

In most of the watersheds in St Lucia, the main activity is generally agriculture. The pilot WEMP's will therefore tend to focus on the agricultural sector. Water Plan is developed, it will be the farmers who finally decide what will and will not be done on agricultural land. It is therefore important that the WMAF have close liaison with the farming community with important farmers being within the WMAF.

Both the Land Use Planner and the Socio Economist have drawn attention to the misuse of land.

Soil erosion is regarded as one of a number of forms of soil degradation, including the deterioration of physical, chemical and biological properties, all of which normally require attention as fragile young soils are intensively cultivated.

Further advantages can be gained if links can be shown to exist between improved soil cover and water conservation. This could prove very beneficial to both the needs of agriculture but for the well being of the catchment as a whole. Reducing flood flows and increasing dry season river base flows. The trials established by the Land Use Specialist aims at providing more adequate data to guide recommendations. Options other than heavy mulching which will be considered are:

- afforestation, reforestation, revegetation of bare slopes
- vegetative barriers on contours;
- check dams, silt traps;
- trail, rural road and forest road treatments;
- earthen or rock barriers;
- reducing potential for landslides in high risk areas;
- controlling land-use change rates and avoidance of bare surface exposure for long periods;
- area closures (or development control).

Another key to success will depend upon the development and promotion of tree crops as an alternative to bananas.

This topic is well elaborated by the Socio Economist who concluded that much data is already available and that a concerted effort by GOSL is needed.

Land Use will also include the definition of landslide hazard areas and causes, be it misuse of land, road or building construction.

Erosion issues, which include slope, soil type, ground cover and land use, rainfall and the impact of tropical storms will also be included.

Much of the base data required has already been collected.

### **8.3 Agriculture**

The farming community have the biggest impact on most watershed in St Lucia. Any Watershed and Environmental Management Plan will naturally include an emphasis on improved agricultural practices, farm management and perhaps crop diversification. The active co-operation of farmers and farmer groups in both the design and implementation of the Plan is therefore vital.

Whatever Plan is developed, it will be the farmers who finally decide what will and will not be done on agricultural land. It is therefore important that the WMAF have close liaison with the farming community with important farmers being within the WMAF.

The WMAF program of community participation has been devised to allow the community to identify problem areas. However, no program can entirely bottom-up as rural people are often not aware of available technology and generally need help in assessing the economic viability of solutions. Much development work is needed in this area and over the summer period of about 6 months, the WMAF and other organizations will be identifying key catchment issues and in some cases identifying potential solutions from their own perspective. The socio-economic field team will maintain regular contact with the various groups to monitor the progress of 'issue perception'. The Team would 'seed' potential issues to the groups in a gentle fashion in case these issues had been considered by the WMAF or other organizations to be outside the remit of a prospective 'Watershed and Environmental Management Plan' and subsequent execution and management of the Plan.

Agricultural considerations would include:

- diversification
- contour farming
- contouring with vertiver grass separators;
- improved terracing;
- earth banks on field boundaries;
- better ridging or ridge tying;
- better tillage practices;
- vegetative ground cover, mulching and manuring;
- grass cover, grass strips, grass barriers;
- improved farming systems;
- agroforestry;
- better use of fertilizer.

Drainage issues would include:

- grassing artificial waterways;
- channel check structures, silt traps, gully control;
- diversion drains and longer drainage paths.

#### **8.4 River Systems, Drainage and Maintenance**

Failure to maintain the river and drainage system has been shown to exacerbate flooding during storm events. Soil and vegetative trash dislodged during storms cause blockages and solid waste, mostly plastic add to the problem. In some cases cross drainage structures are badly designed and have inadequate clearance, and this aggravates back p of water and flooding.

systems are being developed and tested to improve;

- clearing of drains and removal of debris on a regular basis
- river patrolling to identify minor and major problems, and rectify.

These measures are aimed at reducing the need for river training and channel alignment control and will be supported by

- gabion (boxes or mattresses) protection work to prevent lateral movement of the channel and erosion of the outer banks of a bend;
- revetments with the same objective;
- palisading with the same objective;
- gabion work to provide a hard nib to provide a degree of stability to the alignment;
- palisading or gabions to create a groyne to redirect flows;
- loop cutting with associated mini weir construction if a head loss is to be created to match that lost in the cut. Care has to be taken with such weir design.

Bioengineering, also being tested, will be included where appropriate.

Other major components of the plan will be flood hazard mapping, and for this purpose adequate maps of the river network exist with the 1:50,000 map (Rainfall and Drainage System, Land and Water Use Unit, Ministry of Agriculture, 1984) providing an adequate base map of the main channel network. Other map series at 1:25,000, 1:10,000 and 1:2,500 also exist.

Topographic maps at a scale of 1: 10,000 provide a general contour and hence level information of the channel system from which channel slopes can be interpreted. River surveys carried out as part of the Phase 1 program provide additional detailed information in relation to the lower sections of the river network. This is supplemented by the 1:2,500 maps in most parts of the basins.

If successfully completed, SFAP photography will also be of use.

Flood protection and flood proofing will be included with an emphasis on property and infrastructure.

**SECTION A**

**INSTITUTIONS AND LEGISLATION**  
**&**  
**SOCIO ECONOMICS**



## **1. INTRODUCTION**

### **1.1. Inputs and Timing**

The Institutions and Legislation Specialist's contribution to the project is split into two parts:

- an initial input from 10 October to 6 December 1996;
- a second 17 day input to be carried out during October 1997.

Appendix A details the Itinerary, Programme and Persons contacted during the first input.

### **1.2. Work Programme.**

The team member's terms of reference (ToR) are reproduced in Appendix B and the ten month gap between the two inputs will have a considerable impact on the work programme. The approach adopted has therefore been, to consider the present legislation, national/local institutions involved in the broad environmental field and the Government of St Lucia's (GoSL) plans for land and water resource development and management in the Interim Report. The Final Report would then recommend the institutions needed to manage the watershed and environmental programme including cost estimates for the first five years of implementation.

General elections are scheduled to be held soon after the end of April 1997, which could have a significant impact on the way in which the project develops. With this in mind discussions, were held with Government officials on 3rd December 1996 to consider possible institutional changes. It is hoped that common ground might be found and that some changes could be put in hand prior to September 1997.

### **1.3. Layout of the Report**

Following this Introduction, Chapter 2 reviews the environmental legislation on the St Lucian statute books and divides the enactments broadly by sectors, such as agriculture, forestry and tourism.

Chapter 3 discusses the institutions responsible for administering the laws which relate specifically to watershed management and suggests that the project should take only a limited interest in Coastal Zone Management (CZM), in view of the fact that the Fisheries Department, with assistance from a number of aid agencies, is undertaking a considerable CRM programme. Chapter 4 follows a similar pattern to Chapter 3 and evaluates the Government and non-government institutions involved in environmental management as a whole.

The project ToR require the Consultants to give considerable attention to the the part that communities could play in preserving the environment and managing natural resources in the watersheds. A first step in this process is to determine the Community based Organisations (CBO) which exist at Dennery and Cul de Sac, the watersheds chosen for detailed study. A summary of the findings appears in Chapter 5 with a detailed description in Appendix C.

For the reasons set out in Section 1.2 above, Chapter 6 proposes a framework for the management of the environment as a whole with special attention being given to watershed management . These proposals will be refined and a development programme prepared and costed in time for the Final Report. The extent to which the proposals are acceptable to GoSL and the changes which might be put in place during the first nine months of 1997, will be a good indication of Government's commitment to the aims and objectives of the project

## 2. ENVIRONMENTAL LEGISLATION

### 2.1. General

The presentation makes a subjective distinction between:

- watershed legislation; those laws most closely involved in the watershed management project;
- environmental legislation; laws which impact on the wider environmental field;
- disused legislation: laws which are still on the statute books, but which are not used for a variety of reasons..

The following sections detail the existing environmental legislation, with comparatively less attention being paid to the laws and regulations dealing with the built environment. The division into various sectors such as agriculture and forestry is a matter of convenience and some overlap is inevitable. There are number of instances where legislation cuts across sectoral boundaries, for example it is probable that the forthcoming Disaster Prevention and Preparedness Act will affect most, if not all, sectors. The latter legislation is being drafted by the Caribbean Law Institute in Barbados<sup>1</sup> and is one of a series of "Harmonised Legislation" to be adopted, presumably with some local variation, throughout the Commonwealth Caribbean in response to common problems.

### 2.2 Watershed Legislation

#### 2.2.1 Agriculture

##### *a). Land Conservation and Improvement Act (10/92)<sup>2</sup>*

The Act provides for the conservation of land in St Lucia and for the establishment of a Land Conservation Board, responsible for advising the Minister on the following matters:

- the general supervision of land and water resources;
- stimulating public interest in the improvement and conservation of land/water resources;
- recommending legislation;
- co-ordinating the efforts of other conservation bodies/Government agencies;
- implementation of the Act and drafting Regulations;
- advising the Development Control Authority on matters concerning land conservation and improvement.

The Board has a wide ranging mandate, including responsibility for making Protection Orders to:

- prohibit, regulate and control the clearing of land for cultivation, the grazing/watering of livestock and the lighting of fires.;

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<sup>1</sup> To avoid repetition, frequent reference is made to the Institute's publication "The Environmental Laws of the Commonwealth Caribbean (1991)". Information on more recent legislation was obtained from the Attorney General's office and the cooperation of the Director of Legal Drafting is gratefully acknowledged.

<sup>2</sup> Act 10 of 1992

- prohibit or restrict the cultivation of specific crops;
- regulate the method of cultivating land;
- destroy without payment of compensation, crops planted in contravention of the Act.

The Minister may, with advice from the Board, make General/Specific Protection Orders or declare Conservation Areas. and the Act provides for the right of appeal against such orders.

The Board may make such Regulations as appear to be necessary and there is provision for the appointment of Conservation Officers, for the acquisition of land by private treaty or compulsory purchase and for the imposition of penalties for offences.

The Board comprises the Permanent Secretary, MALF&F (Chair), Director of Agricultural Services, Chief Engineer, WASA, Chief Technical Officer, Planning, MPD&E, Chief Engineer, MCW&T, Senior Agricultural Engineer, MALF&F (Executive Secretary), Four non-government members appointed by the Minister

Any 6 members shall form a quorum and members serve for 3 years unless they resign or are removed. All members may be re-appointed.

No regulations have been formulated and at present, the Board has no access to funds, other than those which might be provided by Government. This piece of legislation has had a long gestation period and there appears to be a lack of political will to implement the Act. The legislation was first proposed by the Consultants in 1984 and the draft Bill became available by the end of 1987. The Act finally reached the statute books in April 1992, nothing happened until after TSD, when the Board was finally appointed in 1995. It then met for the first time and only time in November 1995.

***b). The Pesticides Control Act (7/75)***

The Pesticides Act regulates and controls the use of pesticides, provides for the establishment of the Pesticide Control Board and the appointment of inspectors with powers to inspect and seize unauthorised pesticides. The effectiveness of the legislation has been enhanced by the enactment of regulations (SI 70 and 71 of 1987<sup>3</sup>) to control the labelling storage and distribution of pesticides. In addition, an amendment to the Act (27/88), increased the fines/penalties which may be imposed and enlarged the membership of the Board from five to eight members. Finally protection for employees engaged in the trade is provided by the Employees (Occupational Health and Safety) Act (10/85) administered by the Ministry of Education, Culture and Labour.

The Board meets every 2 months and executive powers are entrusted to the Plant Protection and Quarantine Unit in MALF&F which operates effectively. The Pesticide Control Board and the OECS have also been effective in promoting public awareness of the dangers inherent in pesticide use. Dumps of old and/or banned pesticides are known to exist and approaches could be made for international assistance to destroy these stocks and the Consultants have suggested an appropriate course of action.

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<sup>3</sup> Up to 1978 subsidiary legislation was published in the form of Statutory Rules and Orders in Supplements to the Gazette. Thereafter these were entitled Statutory Instruments (SI)

**c). *St Lucia Banana Growers Association Act (6/67)***

Provides for the repeal and replacement of the St Lucia Banana Growers Ordinance (Cap 35) and the establishment of the St Lucia Banana Growers Association (SLBGA). The Act transfers all of the assets and liabilities of SLBGA Limited a public corporation to the Authority. The original SLBGA was established in 1934, became SLBGA Limited in 1953 and reverted to the status of a statutory corporation by the 1967 Act.

Three Dissolution of the Board Orders were enacted in 1988, 1993 and 1994 which gives a good indication of the often troubled relationship between GoSL and SLBGA (The Minister of Agriculture has powers under Section 44 of the Act to direct the Board to regulate its affairs. If the Board fails to comply, it is lawful for the Minister, after obtaining the approval of Cabinet, to dissolve the Board). Regulations 43/81 and 55/90 respectively establish the categories of growers (large, medium and small) and make arrangements for the supervision of Branch elections.

**d) *The Praedial Larceny Act (13/78)***

The Act provides powers to prosecute those who cause damage to crops or who steal produce from others. It is said that inability to enforce the Act is a major factor in preventing farmers from diversifying away from bananas i.e. thieves tend not to steal bananas, but will take vegetables, root crops and anything else that can be sold.

The Police are responsible for enforcing the legislation, but admit that the breakdown in the Rural Constable system and the increased complexity of the Courts makes it difficult to secure a conviction. (**Note** drug addicts are said to be the main offenders and that none of the constraints which would normally apply in rural areas are effective).

In an attempt to address the problem the Extension Division (MALF&F) employs two Produce Inspectors (one in the north and one in the south of the Island) to check on those who might be involved in selling stolen produce. Exporters are listed and there is provision to licence farmers/vendors who are known to the local extension officer. Inspectors have been successful in prosecuting a number of unlicensed vendors, mainly those selling coconuts. However there are problems

- inspectors are frequently threatened and have asked if they could be issued with firearms (refused);
- there is a lack of transport.

Community watch schemes have been effective, but there are difficulties with vigilantes taking the law into their own hands. There is no obvious way of enforcing the legislation except by continued support to the Produce Inspectors and possibly some improvement in the licensing system.

### **2.2.2. Forestry**

**a) *Forest, Soil and Water Conservation Ordinance<sup>A</sup> (CAP 25, 7/198<sup>5</sup>)***

The controlling legislation is the above, pre-independence Ordinance which was updated in 1983 by the Forest, Soil and Water Conservation (Amendment) Act. It

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<sup>4</sup> Up to 1/3/67 the statutes of St. Lucia were entitled Ordinances and thereafter Acts.

<sup>5</sup> Refers to the Laws of St. Lucia (up to 30/6/57) Chapter 25, Vol 7, page 198.

provides for the appointment of a Chief Forestry Officer charged with the management of Crown Land and with the general administration of the enactment. The Ordinance empowers the Governor-in-Council to declare any Crown Lands a forest reserve and there are wide ranging powers for the prevention of soil erosion/landslips, the maintenance of water supplies and the protection of roads and bridges. In 1983, a number of forest reserves were declared including the Castries Water Works Reserve, and the Barre de L'Isle reserves.

Other (non-Crown) lands may be designated as protected forests with powers for the Governor-in-Council to regulate or prevent the felling of timber, the clearing of land for cultivation, the trespassing of livestock, the setting of fires or other prejudicial acts. Again in 1983 using the Statutory Instrument process, several protected forests were declared including Marquis Estate Areas, the Monier Plateau and others.

As an incentive to forest production provision is made for the owners of protected forests to be remitted the land tax that may be in force at the time, subject to compliance with the applicable rules. In addition there is provision to regulate timber dealers/producers and both measures should encourage responsible exploitation of resources and help to reduce the incidence of illegal harvesting of forests from both public and private land. The illegal clearing of both Crown and forest land for drug growing involves the Police and 122,000 marijuana plants were destroyed between January and October 1996. (all sites are identified using GPS and can be re-visited if necessary)

***b). Wildlife Protection Act (9/80)***

The Act repealed the Wild Birds Protection Ordinance and the Turtle and Fish Protection Ordinance and establishes three categories of wild fauna

- those that are absolutely protected which must not be caught, owned or offered for sale
- those that are partially protected which may only be hunted in the open season
- those that are unprotected.

The Act does not afford protection to wild flora, but the Forestry Department maintain that there are adequate provisions under the Forest, Soil and Water Conservation Ordinance to achieve this objective.

**2.2.3. Fisheries**

***Fisheries Act (10/84)***

The Act is concerned with the environmental management of maritime areas and of their resources. It charges the Minister with the management and development of fisheries to ensure their optimum utilisation and in order to regulate/conservate the resource there are powers to licence foreign fishing vessels and to declare local fisheries management areas

In addition the Minister has the power to declare marine reserves for the protection of marine flora/fauna, to promote scientific research as well as to preserve and enhance the natural beauty of such areas. In general the Act makes provision for various conservation and enforcement measures, which are further refined in the Fisheries Regulations (SI 9/94)

The implementing regulations makes provision for the appointment of a Fisheries Advisory Committee consisting of: the PS (Chair), the Chief Fisheries Officer (Secretary), 3 persons appointed by the Minister from the fishing industry and 2 other persons also appointed by the Minister. The regulations include; licensing of foreign fishing vessels, local fishing licences/registration, sports fishing and fish processing. Conservation aspects of the regulations prohibit the removal of lobsters, turtles, corals, sponges, conch and sea urchins except with the permission of the Chief Fisheries Officer.

A Fisheries Advisory Committee has not yet been created, but might be considered desirable after the 1997 elections

#### **2.2.4. Water**

Previous sections have discussed the following enactments which have a bearing on water resources

Forest Soil and Water Conservation Ordinance  
Land Conservation and Improvement Act

##### ***a). The Water and Sewerage Authority Act (18/84)***

This is the principal legislation for the sector and replaces the Public Health (Sewerage and Drainage) Ordinance whose assets were absorbed by provisions of the Act. The legislation imposes on government the obligation to promote a national water policy which appears to devolve on the Water and Sewerage Authority (WASA) established by the Act and requires WASA to:

- establish a hydrological network and carry out periodic water surveys;
- prepare estimates of future demand for the issue of water;
- prepare plans for securing more efficient management of water;

Although not specifically stated, the powers conferred on WASA imply that water is a public resource over which the state enjoys an unimpeachable right of access and that there are no private rights over water which the state can only alienate on payment of compensation. There is a view that this supposition should be clearly stated in the enactment to prevent future miss-understanding.

The composition of the Authority was amended by the Water and Sewerage Authority (Amendment) Act 13/96 and now consists of: Chairman appointed by the Prime Minister, Director of Finance or representative, Chief Engineer MCW&T, not less than three and not more than seven other persons appointed by the Minister with expertise in business, finance, engineering, planning, law, housing, medicine etc.

The Authority aims to be self-sufficient, but there is provision for government to underwrite the operating costs. In the discharge of its functions the Authority enjoys wide discretion to:

- prohibit or regulate the placement of materials which may impair or reduce the capacity within a catchment;
- prohibit or regulate acts considered conducive to the pollution or diminution of the supply of water in any river or watercourse;
- conserve water and prevent waste /misuse or contamination of supplies;
- cope with existing or threatened water shortages;
- require the Chief Forest Officer under the Forest Soil and Water Conservation Ordinance to take action to stop de-afforestation.

The Act is supported by comprehensive regulations (SI 47/95) which are thought to have replaced earlier and hastily prepared regulations (Wessex Water Authority Consultant, September 1989) formulated in order to comply with financial obligations for the Roseau Dam.

***b) Other Water Legislation.***

Other legislation relevant to the Water and Sewerage Act, is the Public Health Act (8/75) and the Public Health (Water Quality Control) Regulations (SI 14/78), established under the Act. These regulations set standards for the purity of the water supply and address issues such as the construction of water supply systems, the construction and location of wells, the quality of domestic and industrial water supplies and penalties for infringement of the regulations.

**2.2.5. Mining**

***The Beach Protection Act (2/67)***

This Act governs sand mining on beaches, is administered by the Ministry of Communications Works and Transport and establishes the need for a licence to dig and remove sand/other materials from beaches. The illegal mining of sand continues apace in response to the demands of the construction industry and is serious problem in spite of severe penalties introduced by amendments to the Act in 1984 and 1987.

Pumice deposits in the south of the island are being exploited to supply a small proportion of the demand for building material. Short of barging building sand into St Lucia, pumice presents the only real alternative to illegal mining and consideration should be given to an expansion of the industry by a commercial contractor.

**2.2.6. Planning Land Use and Development.**

The Ministry of Planning have been designated as the custodians, or at least co-ordinators of the environment and mention must be made of the following

***Land Development (Interim Control) Act (8/71)***

This is the controlling legislation for land use and development in St Lucia and provides for the establishment of a Development Control Authority (DCA). The Act requires written permission from the Authority to develop any land in the country and details the procedures for making development applications. The Authority does not enjoy uncontrolled discretion to grant or refuse development permission and certain classes of development are exempt from the need to obtain Authority approval and the Minister may refer particular applications to Cabinet for a decision.

The Consultants engaged on the NW Coastal Zone Management Project suggested that the DCA should take responsibility for new Coastal Zone Management legislation in addition to the administration of the Land Development (Interim Control) Act. This proposal is contained in the Phase I Final Report dated January 1995 and should be reconsidered in the light of more recent events including the work of the Watershed and Environmental Management Project

## **2.3. Environmental Legislation**

### **2.3.1. Agriculture**

#### ***a) Plant Protection Act (21/88)***

Gives the Minister of Agriculture the authority to prohibit or restrict the importation or movement of fruit, planting material, soil etc., in order to protect the agricultural resources of the country. It establishes the need to obtain a permit to import plant material and the requirement to produce a phytosanitary certificate from competent authorities in the country of origin. The Act gives the Minister wide powers to prevent the spread or otherwise control plant pests in the country and provides for compensation to farmers and others whose plants/planting material have been destroyed in order to eradicate or prevent the spread of pests/diseases.

In addition there is provision to establish a plant quarantine service and whilst the Act repealed the Plant Protection Ordinance it retained the relevant regulations until such time as these could be up-dated. The Act is now supported by comprehensive Plant Protection Regulations (Statutory Instrument (SI) 66/95) which take into account, for example, the possible entry of in-vivo and in-vitro planting material. The legislation appears to be supported by an effective administrative machine, in the form of the Officers in the Crop Protection and Quarantine Section of the Research and Development Division (MALF&F)

There is provision for the Minister to establish a Plant Protection Board and a five person Board (Chief Plant Protection Officer, Plant Pathologist, Legal Officer, Forestry representative and a Secretary), has been in existence since 1990 and meets regularly.

#### ***b). The Animals (Diseases and Importation) Ordinance (CAP 41, 1/341)***

The Ordinance requires owners to segregate diseased animals and notify the proper authorities of disease in herds/flocks. There is provision to destroy diseased animals and to compensate owners. It also establishes the need to obtain a licence for the importation of birds, reptiles/insects, animal carcasses or animal by-products. The need for legislation of this sort is clearly very desirable and appears to be properly enforced by the Veterinary Division of MALF&F.

Animal Health Regulations under the provisions of the Ordinance were drafted in 1993 and additional Animals (Diseases and Relocation) Regulations were drafted in 1996. These two sets of regulations, have so far, failed to reach the statute books. The definition of bees as animals in the regulations will make the Importation of Bees Ordinance (CAP 42, 1/378) redundant.

#### ***c). Animals Trespass Ordinance (CAP 39, 1/318)***

The Ordinance empowers owner/occupiers of land to seize and impound animals found trespassing and to kill certain categories of straying livestock and at least in theory, prevents the destruction of land occasioned by un-tethered or straying livestock.

At present the Police are responsible for enforcing the legislation and have in the past shot cattle/pigs under the provisions of the Ordinance. There is, on occasion, a problem with straying cattle and the Police would like to transfer responsibility for

the Act to MALF&F, but neither the Police nor the Department of Agriculture have a pound in which to hold stray livestock.

***d). Co-operative Societies Ordinance (CAP 82, 1/746)***

Provides for the formation, regulation and operation of Co-operative Societies, with the Registrar of Co-operative and Friendly Societies being responsible for the Ordinance. The 22 Credit Unions in St Lucia continue to prosper, but the other 20 co-operative organisations are generally less successful (e.g. only 2 of the 7 agricultural Co-ops are active). There is a Credit Union and a Fishing Co-operative in Dennery, but apparently no co-operative activity in Cul de Sac. All Co-operative Department staff are based in Castries.

***e). Other Agriculture Related Legislation.***

Brief mention should be made of the following enactments:

- Marketing Board Act (18/67) - provides for the establishment of a Marketing Board charged with promoting the proper and effective marketing of agricultural produce;
- Model Farms Act (1982) - provides for GoSL to guarantee loans from CDC and Geest (Estates) Limited to Model Farms Limited;
- Livestock Meat Marketing Board Ordinance (17/64).

### **2.3.2 Forestry**

***Water and Sewerage Authority Act (18/84)***

This Act is discussed in more detail in Section 2.2.4, but places a responsibility on the authorities to establish and protect water catchment areas and adequate legislative arrangements are in place to co-ordinate activities between WASA and the Forestry Department. In practice it appears necessary to acquire the lands needed to protect water supplies and a number of parcels of land have recently been purchased.

### **2.3.3. Fisheries**

***The Maritime Areas Act (6/84)***

The Act is primarily concerned with establishing the maritime jurisdiction of the state and incorporates various provisions of the United Nations Convention on the Law of the Sea (1982) including a definition of:

- the limits of St Lucia's territorial sea, where the country has complete sovereignty over fisheries;
- the extent of the continental shelf with the rights of exploration, exploitation, management and conservation in respect of the living resources;
- the exclusive economic zone (EEZ) with similar powers over the sea-bed and subsoil

The enactment governs activities in the Fisheries sector and also has a bearing on marine pollution as discussed in Section 2.3.6.

### **2.3.4. Mining**

Apart from ilmenite in some beach sand, there are no known deposits of valuable minerals in St Lucia and the mining of industrial minerals, largely for the construction industry, is controlled by the following legislation

**a). *The Minerals (Vesting) Act (7/66).***

***The Radio-active Minerals Ordinance (CAP 118, 3/322).***

The first of these two Acts, vests ownership of minerals in the State and it is unlawful to explore for, or mine minerals except with the authority of and in accordance with, the conditions of a government licence. Similar conditions apply to the exploration and winning of radio-active minerals. There are no regulations in existence for either the Act or the Ordinance.

**b). *Crown Lands Ordinance (CAP 108, 2/252)***

The Act entitles the Minister to establish conditions for the exploration and mining of minerals on State lands leased for that purpose, but no leases appear to have been granted.

### **2.3.5. Tourism**

The quality of a country's tourist industry is, in the final analysis, dependent on the environmental health of several related sectors of the economy and inevitably involves a number of Ministries including:

- Ministry of Tourism, Public Utilities, National Mobilisation and Civil Aviation, which is concerned with natural resources, parks and beaches;
- Ministry of Health, Information and Broadcasting responsible for water supplies;
- Ministry of Communications Works and Transport whose responsibilities include sand mining and beach control;
- Ministry of Agriculture Lands Fisheries and Forests;
- Ministry of Planning Development and the Environment which regulates building in coastal and other areas.

Specific tourist legislation or legislation which has a considerable bearing on the tourist industry is discussed in the following sections

**a) *The Tourist Industry Development Act (4/81)***

This Act is administered by the Ministry of Tourism, Public Utilities, National Mobilisation and Civil Aviation and provides for the establishment of the Tourist Industry Development Board, (TDB) with wide powers to promote and develop all aspects of tourism. In addition the Board is charged with the administration of tourist facilities and the promotion of amenities for the industry.

The TDB is very active (meets at least monthly), has a non-Government Chair and sub-committees for Finance, Special Events, Marketing/Promotions etc. At present all funds come from GoSL, but the Board is considering a structure similar to that of the Barbados Tourism Development Corporation and would like to be able to raise funds direct from the tourist industry. The TDB has 28 paid employees and promotional offices in US, France, Canada, Germany and UK

**b). *The Parks and Beach Commission Act (4/83)***

Other than this Act, which is of considerable interest to the tourist industry, St Lucia has no other beach control legislation on the statute books. Activities in the coastal zone are controlled by the Parks and Beach Commission which is charged with the responsibility for maintaining facilities in parks, gardens, and beaches and for prescribing sanitary conditions in these areas.

In addition, the Commission may also advise the Minister on measures to protect coastal zones from environmental degradation. At present the Commission is a single person, but the Ministry propose to re-constitute the Commission after the 1997 elections, to include of representatives from the Ministry, Police, Tourist Industry, Forestry, Hotel and Tourism Association etc.

***c). St. Lucia National Trust Act (16/75)***

The Trust is responsible for the management of national parks designated for this purpose by the government and to date three such parks have been created ( Pigeon Island National Landmark, Frigate Island Nature Reserve and Maria Islands Nature Reserve). The Act does not give the Trust powers to prevent the destruction of buildings of historical or cultural significance, but it may acquire such sites/buildings and preserve these as a public trust. It appears that the DCA may have sufficient powers to prevent the demolition or alteration of buildings of historical or cultural significance by withholding planning permission in appropriate circumstances.

***d). Other Tourism Legislation***

Other legislation which has a bearing on the tourist industry includes

- Forest, Soil and Water Conservation Amendment Act - see Section 2.2.2 a).
- Wildlife Protection Act (9/80) - see Section 2.2.2 b).
- The Fisheries Act - see Section 2.2.3 which empowers the Minister to declare marine reserves for the protection of flora and fauna and to promote scientific research

### **2.3.6. Marine Pollution**

The applicable enactments on the statute books relating to marine pollution are not numerous but their collective scope is quite extensive. As discussed in Section ---, the Fisheries Act, empowers the Minister to take a variety of measures for the conservation of the marine environment, its flora and fauna, but the principal legislation in this area is the Merchant Shipping Act.

***a). Merchant Shipping Act (3/81)***

A section of this Act, in effect, incorporates the provisions of two wide ranging pieces of English legislation relating to pollution of the marine environment (The Merchant Shipping (Oil Pollution) Act of 1971 and the Dumping at Sea Act of 1974) into the laws of St Lucia:

***b). Oil in Navigable Waters Act (2/84)***

***Maritime Areas Act (6/84)***

The first of these Acts makes it an offence to discharge oil from any vessel or apparatus on the sea or on land into the territorial waters of the state, whilst the second Act confers upon the state the right to protect and preserve the marine environment of the EEZ

### **2.3.7. Waste Management**

***a) The Litter Act (24/83)***

The Act, which is the responsibility of the Minister for Health, Information and Broadcasting, makes it an offence to litter public places, or private places without the consent of the owner or to aid or abet such activities. Provision is made for

enforcement of the Act, for the removal of abandoned vehicles and for the appointment of litter wardens.

By amendments in 1985 and 1993 the effectiveness of the Act was considerably enhanced and the legislation addresses the problem adequately. The difficulty is that the applicable legislation is not, or can not, be enforced and there is a need for the public to be conscious of the litter problem. This and other environmental issues might be solved in the longer term by an educational programme, on both a formal and informal basis.

***b). Solid Waste Management Act (20/96)***

This Act provides for the establishment of a Solid Waste Management (SWM) Authority charged with providing a co-ordinated and integrated system for the collection, treatment and recycling of waste including hazardous waste. The Authority acquires the assets, liabilities and functions of the Castries Corporation in relation to SW collection/disposal and is responsible for the management of sanitary landfills (required to consult WASA prior to establishing such landfills)

A quorum of 6 persons is required, the membership of the Authority being; PS Ministry of Planning (Chair), PS Ministry of Health (Deputy), Director of Finance or nominee, PS Ministry of Community Development, Attorney General or nominee and the Clerk of the Castries Council. In addition representatives from, St Lucia Chamber of Commerce, Association of Professional Engineers and the St Lucia Tourism Association and three other suitable persons appointed by the Minister.

Members serve for a 3 year term and may be re-appointed, whilst those who absent themselves from three consecutive meetings will cease to be members of the Authority.

There is provision to raise funds from haulage and tipping fees and from an Environmental levy imposed on all visitors to St Lucia. This levy will be collected by the Air and Sea Ports Authority and paid over monthly to the SWM Authority. A Manager has been appointed, but Regulations have not yet been formulated.

The project in St Lucia is one of a number of SWM projects in the Caribbean to be funded by the World Bank.

***c). Public Health Act (8/75)***

The Act focuses on promoting and protecting the health of the population and addresses the problem of waste disposal as an aspect of public health management, rather than an environmental issue. The Act establishes the Public Health Board and authorises the Minister to delegate any of his statutory functions to the Board. There are a large number of Regulations relating to the Act including:

- Public Health (Nuisances ) Regulations (SI 10/78)
- Public Health (Offensive Trade) Regulations (SI 11/78)
- Public Health (Water Quality) Regulations (SI 14/78)
- Public Health (Disposal of Offensive Matter) Regulations (SI 21/78)
- Public Health (Sewage and Disposal of Sewage and Liquid Industrial Waste Works) Regulations (SI 22/78)
- Public Health (Slaughter House) Regulations (SI 69/80)
- Public Health (Food Legislation) Regulations (SI 70/80)

### **2.3.8. The Built Environment**

In addition to the Land Development (Interim Control) Act - see Section 2.2.6 and for the sake of completeness, mention is made of the following planning, land use and development legislation.

**a). *The Town and Country Planning Ordinance (CAP 175, 3/125).  
The Housing Ordinance (11/66).***

The Town and Country Planning Ordinance vests responsibility for carrying out its provisions in the Central Planning and Housing Authority which was subsequently dissolved by the Housing Ordinance and its powers / functions transferred to the St Lucia Housing Authority.

The Housing Authority is charged with carrying out the Government's housing policy subject to the Minister's direction and enjoys wide powers, including:

- investigation into improved methods of house construction, standards and design;
- construction of housing units on state land;
- acquire houses/land by purchase or lease;
- participate in housing projects;
- guarantee house improvement loans and requires the Treasury to establish a Home Improvement Insurance Fund.

Although the enactments provide the framework for sound environmental management, implementation is said to be impaired by financial and human resource constraints (ref. footnote 1)

**b). *Other Land Use and Development Legislation***

Mention is made in Section 2.3.5 b) of the Parks and Beaches Commission Act, which empowers the Commission to develop public amenity areas. Other relevant legislation includes:

- National Development Corporation Act (9/71) which confers on the Corporation the functions of a Planning Authority under the provisions of the Town and Country Planning Ordinance;
- The Rodney Bay Development Act (8/70), authorisation for Rodney Bay Limited to carry out land improvement works.
- The Housing and Urban Development Corporation Act (14/71) which empowers the Corporation to develop designated areas and charges it with administering the Slum Clearance and Housing Ordinance (CAP 174, 3/86);
- The Aliens (Land holding Regulations) Act (10/73) allows the Cabinet to grant aliens permission to own land;
- The Public Works and Roads Ordinance (CAP 178, 3/208) confers on the National Development Corporation the power to make temporary roads or to regulate the course of rivers in order to preserve or maintain any road;
- Control of Advertisements Ordinance (25/60) provides controls relating to the display or exhibition of advertisements in the interests of amenity, public morality or public safety;
- Crown Lands Ordinance see Section 2.3.4 b).

## **2.4. Disused Legislation**

There is provision for repealing laws which have become "spent" and for removal from the statute books. The following laws are not used and thus in effect "spent".

### **2.4.1. Agriculture**

#### ***a). Board of Agriculture Ordinance (CAP 24, 1/196)***

This Ordinance establishes the Board of Agriculture and charges it with advisory and consultative functions which are wide enough to allow it to advise on agricultural land use and conservation. Staff in MALF&F can not remember the last time a Board was appointed, although a casual check in the St. Lucia Archives, provides information on the planters and others who served on the Board in the past. The Department of Agriculture would appear to consult agriculturists/farmers less frequently than it should and a revival of the Board of Agriculture might not be a bad idea.

#### ***b). The Government Pasturage Lands Ordinance (CAP 212, 1/378)***

The Ordinance allows for lands owned or controlled by the state to be declared as government pasturage and permits those holding licences to graze tethered livestock on such land. Livestock Division staff in MALF&F appear not to make use of the provisions of this Ordinance.

#### ***c). The Agricultural Small Tenancies Act (22/75)***

The Agricultural Small Tenancies Act provides, in theory, a mechanism for persuading tenants of holdings of not more than five acres to observe sound and environmentally friendly cultivation practices. Failure to comply with the provisions of the Act permits the landlord to terminate the tenancy on production of a certificate from the competent authority that the tenant is failing to employ good husbandry practices. Department of Agriculture staff appear to be unaware of the legislation and certainly have no knowledge of the law being applied.

#### ***d). Old Agricultural Industries***

Legislation which applies to agricultural industries which are now defunct or struggling to survive include:

St Lucia Limes Association Ordinance (CAP 37, 1/307);

Cotton Ordinance (CAP 34, 1/310);

Coconut Industries Fund Ordinance (CAP 34, 1/297) and regulations of 1959.

### **2.4.2 Forestry**

#### ***a) Timber Industry Development Board Ordinance (24/63)***

In 1983, the provisions of this Ordinance were incorporated into the Timber Industry Board Ordinance (Amendment) Act (12/83) and the Board so established is charged with the development, preservation and maintenance of the timber industry.

There were two sawmills in St Lucia in 1970 (Timber Industry Sawmill at Castries and the St Lucia Fine Timbers Sawmill at Patience Estate near Micoud). Both mills subsequently closed down and at present all timber conversion is by chain saws and "Alaskan guides". Chain saws must be licensed (annual fee between EC\$30 and \$50) and it is assumed that this legislation is, in effect, redundant

## **2.5. Need for New Legislation or for Amendments to Existing Legislation.**

In the past, Consultants and others have identified weaknesses in existing environmental legislation and have spent considerable time and effort in drafting new laws, or in proposing suitable amendments to existing Acts or Statutory Instruments. There is a tendency for such legislation not to be "owned" by the institution responsible for implementation and in consequence little effort has been made to have the legislation adopted. In general, it is easier to have amendments to existing legislation approved rather than entirely new legislation.

The Consultants will be suggesting an answer to the problem and in the meantime believe that priority must be given to making the existing legislation work effectively. The following Sections detail some of the areas where inadequacies are said to exist.

### **2.5.1. The Pesticides Control Act (7/75)**

There is some concern that the present Act does not provide powers to control the movement, storage, and distribution of toxic chemicals. To this end the OECS Legal Unit prepared a Draft Pesticides and Chemical Control Act in 1994, as one of a series of "harmonised" laws which might be adopted throughout the region.

The Consultants are not aware of any degree of urgency in having this legislation adopted.

### **2.5.2. Proposed Coastal Zone Management Act**

The Consultants working on the NW Coastal Zone Management Project state that there is a need for specific legislation and presumably take the view that amendments to the Fisheries Act of 1984 will not suffice.

A draft Coastal Zone Management Act (and Regulations) was prepared in January 1993 as part of an OECS/NRMU and GTZ project. This seeks to provide OECS countries with a legislative and regulatory basis for ensuring a sustainable use of resources within their coastal zones. The stated approach is to enable states to adopt regulations without drastic alteration to their enabling legislation and if adopted would lead to the repeal of the Beach Protection Act and in so doing transfer responsibility for beach protection from MCW&T to MALF&F

The Fisheries Department, as the concerned authority, will presumably be reviewing the need for new legislation and will be aware that, where appropriate, amendments to existing legislation is an easier option.

### **2.5.3. Proposed Water Resources Act and Selected Regulations**

This draft legislation, prepared in January 1990 by a FAO consultant, was intended to supersede the Water and Sewerage Authority Act, 1984 and incorporate the major provisions of the Land Conservation and Improvement Bill, 1987 (now the Land Conservation and Improvement Act 10/92)

Whilst the proposed legislation never eventuated and was to an extent overtaken by events, it pointed out a number of deficiencies in both the WASA and LCB legislation including:

- how the LCB would be funded (no provision to raise drainage rates) and how it would gain access to Crown Land to offer in lieu of compensation;
- public rights in water (the right to investigate, use, control, protect, manage and administer the water of St Lucia).

The pragmatic approach would be to establish or improve the institutions responsible for administering the existing legislation and then progressively make amendments to the Acts in question. In due course, it would be useful to re-consult the draft Water Resources Act of 1990 for the form of words needed to make the necessary amendments.

#### **2.5.4. The Wildlife Protection Act (9/80)**

The Act does not afford protection for wild flora and there is a suggestion that the provisions of the Act may need to be enlarged to accommodate the obligations assumed by the GoSL under the CITES Convention. The Forestry Department state that there are sufficient powers under the Forest Soil and Water Conservation (Amendment) Act of 1983 to protect wild flora and there may be little incentive to amend the Act.

#### **2.5.6. Land Development (Interim Control) Act (8/71)**

There is no requirement for environmental impact assessments (EIA) to accompany applications for significant land use and development, or that environmental considerations should be taken into account when the Development Control Authority (DCA) makes its decisions. Whilst EIAs are not required by statute, the DCA does routinely require EIA on "large development projects undertaken by the private sector" but this does not comprise "...an efficient, uniform, multi-disciplinary vetting process for all major development projects and plans -- whether public or private"<sup>6</sup>.

In practice extensive use is made of the 1988 GoSL "Manual for Developers" prepared by the Physical Planning Section in the Ministry of Planning with OAS assistance. In addition the Medium Term Strategy Paper<sup>7</sup> states that the Government is committed to "establish procedures and guidelines for environmental impact assessments and ensure their implementation".

### **2.6. Conclusions**

Legislative improvements are always possible and the Consultants will propose a method for constantly reviewing and where necessary up-dating the environmental legislation. In general, the Consultants believe that the existing legislative base is adequate, but there is a pressing need for co-operation and collaboration amongst the various agencies involved in the protection and improvement of the environment. There is also an urgent need, at the national level, to recognise the cost of undesirable environmental practices and in general, there appears to be a surprising lack of interest in the environment at the political level.

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<sup>6</sup> USAID 1991. St Lucia Environmental Profile. USAID document produced by Island Resources Foundation, Red Hook, St. Thomas, Virgin Islands 332 pp.

<sup>7</sup> CPU 1994. St. Lucia Medium Term Economic Strategy Paper 1993-96. Central Planning Unit GoSL March 1994

### **3. INSTITUTIONS RESPONSIBLE FOR WATERSHED MANAGEMENT LEGISLATION**

#### **3.1. Watershed and Coastal Zone Management**

This Chapter considers the existing institutions charged with the administration of the legislation listed in Section 2.2 and referred to as the "Watershed Legislation". However before pursuing this issue it is important to define the Consultants interpretation of their areas of responsibility, particularly as the ToR place some emphasis on the Coastal Zone Management (CZM) aspects of the project

The inter-relationship of CZM (or Integrated Coastal Zone Management ICZM) with Watershed Management is recognised and the Consultant's endorse the view that for small islands there is a need to adapt CZM principals to accommodate the holistic Island Systems Management (ISM) philosophy. Never-the-less the agencies responsible for CRM and Watershed Management are different and provided there is co-operation and co-ordination at the policy level (see Chapter 6) it should not be necessary to do more than briefly review the present CZM activities and plans.

##### **3.1.1. The Coastal Conservation Project**

Also called the NW Coastal Zone Management Project (funded by CIDA), was carried out by the Fisheries Department and Atria Engineering Consultants and covers the area from the south of Roseau beach to the top of Cap Estate. Phase I, the Pre-feasibility Study, took from late 1993 to January 1995 with a second phase due to start early in 1997. The project includes, seven watersheds, one of which is Cul de Sac.

On the Institutions front, the Project envisaged a Coastal Zone Management Unit (CZMU) as part of the Ministry of Planning, but answering to the DCA. Sector Advisory Panels would ensure that other agencies co-operated with the CZMU. A new Coastal Zone Management Act would be formulated and the DCA would be responsible for both this and the Land Development (Interim Control) Act. Amongst other preliminary recommendations the project proposes an Environmental Ombudsman.

In preparation for Phase II of the project, the Fisheries Division have created a CZM Section headed by the Deputy Chief Fisheries Officer and the Consultants anticipate that the project initiative will be translated into a permanent CRM institution.

##### **3.1.2. Soufriere Marine Management Area (SMMA)**

The SMMA covers the coastal area from just north of Choiseul Bay to Anse Mamin, north of Soufriere. This is largely a self-funded project, administered through the Fisheries Department with some external assistance. A recent contribution from France of FF1.5 million, will be spent on watershed management in the Soufriere area. The project involves a high degree of participatory management by the stakeholders and is a good example of both the success and the frustrations of this type of development.

### 3.1.3. Canaries and Anse La Raye Marine Management Area (CAMMA)

The Fisheries Department and other are just beginning to talk about the CAMMA to fill the "gap" between SMMA and the NW Project Area. In due course a series of Marine Management Areas will probably encircle the Island and will relate to/be influenced by, the equivalent Watershed Management Area.

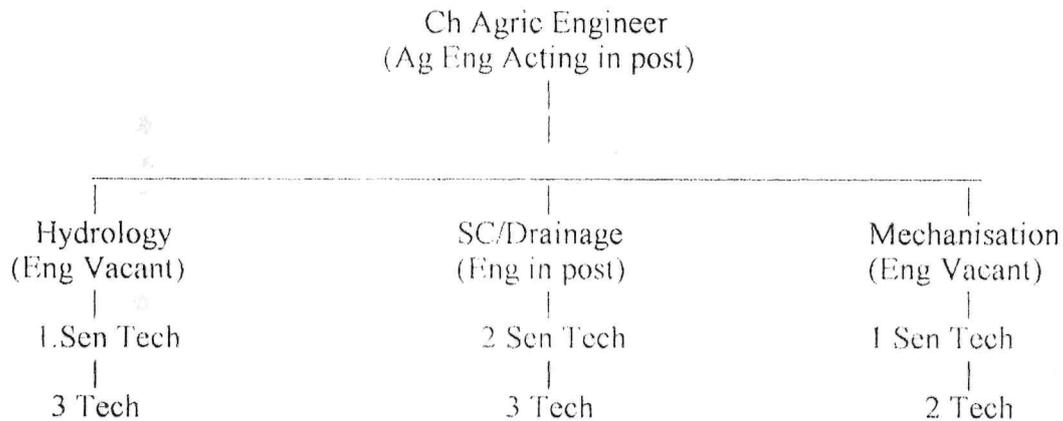
## 3.2. Agricultural Department

### 3.2.1. Agricultural Engineering Services

The Agricultural Engineering Services Division of the Agricultural Department is, or should be, the implementing agency for the Land Conservation and Improvement Act. The present organisation of the Division is shown in Figure 3.1.

Figure 3.1

#### Establishment, Agricultural Engineering Services Division



Of the 4 Senior Technicians, one has been suspended for a year, one post is vacant and two posts are filled by experienced staff.

Of the 8 Technician posts, two are vacant, one is on secondment to Mabouya Valley Development Project and five staff are in post. Other staff include 2 Clerk/Typists and all staff are based in Castries.

Out of a total complement of 16 engineers and technicians only 9 posts are occupied.

### 3.2.2. Agricultural Extension

A comparatively large staff resource which hardly impacts on watershed management at present is the Extension Division of the Department of Agriculture which consists of a Chief Agricultural Extension Officer, and the following staff

- 11 Co-ordinators (Subject Matter Specialists)
- 2 Produce Inspectors (see Section 2.2.1d)
- 30 Extension Officers of various grades based in the 8 Regions
- 8 Support staff

Extension staff cover the eight Regions and are based at Union Agricultural Station.(# 1), Babonneau.(# 2), Dennery.(# 3), Micoud.(# 4), Beausejour.(# 5), Soufriere.(# 6),

Roseau (# 7). and Bexon (# 8). Each Region is staffed by a Senior Agricultural Assistant (mostly diplomates trained in Jamaica, Trinidad or Guyana) and two or three Agricultural Assistants. The latter are either diplomates or older experienced officers. The Division is responsible for all extension services, other than the banana crop. An Extension Officer should know most farmers in his/her area.

Extension, Engineering Services and the Forestry Department have worked together in the past on joint projects, but much more could be done in this regard.

### 3.2.3. Crop Protection and Plant Quarantine

The Crop Protection Unit in the Research and Development Division is responsible for the administration of The Plant Protection Act (21/88) and the The Pesticides Control Act of (7/75). The respective Boards meet regularly and the Unit appears to operate satisfactorily.

### 3.3. St Lucia Banana Growers Association (SLBGA)

Established under the Act (6/67), the SLBGA is charged with marketing and control of all bananas produced, has a responsibility to promote, finance and assist the industry and is the sole exporter. The nine person Management Board is made up of 6 members elected at the Annual SLBGA Conference of Delegates and 3 members nominated by GoSL.

#### 3.3.1. Organisation of the Association

All banana growers are eligible to join the Association and are organised into 46 Branches throughout the Island. Each Branch has a Management Committee of seven persons, including a Chairman and Secretary. Branches return delegates to the Annual Conference of Delegates in the ratio of one delegate for every fifty farmer members (110 delegates were eligible to attend the 25th Conference, with two Branches either failing, or not being eligible to return delegates). The Association's income is derived from a levy of 4.6 cents/lb on all bananas handled

#### 3.3.2. SLBGA Branches in the Pilot Watersheds

Watershed	Branch	No of Delegates
Dennery	Dennery	5
Cul de Sac	Crownland/Marc	2
	Forestierre	2
	Odsen	2
	Ravine Poisson	1
	<b>Total</b>	<b>17</b>

The two watersheds contain approximately 15.5% of the banana growers in the country, (i.e. 17 out of the 110 delegates). Appendix C lists the current Chairmen and Secretaries of the Branches listed above.

### 3.3.3. SLBGA Advisory Services

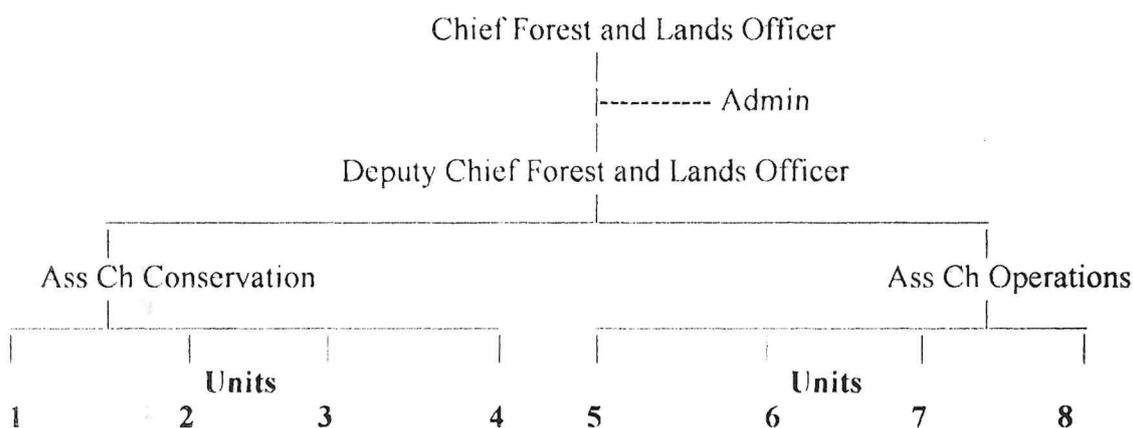
The Island is divided into five Regions (Northern, West Central - includes Cul de Sac, East Central - includes Dennery, Eastern and Southern) with a Regional Manager and six or seven Technical Service Assistants in each Region

### 3.4. Forestry Department

The Department is responsible for administering the Forest Soil and Water Conservation (Amendment) Act of 1983 and for the Wildlife Protection Act of 1980. The main organisational structure of the Department is shown in Figure 3.2

Figure 3.2

#### Establishment Forestry Department



#### Units

1. Protection and Patrol Unit - 1 Patrol Officer and 3 Assistant Patrol Officers.
2. Education and Information Unit - 1 Environmental Education Officer, an Assistant Environmental Education Officer, 3 Naturalists and 4 Trail Guides.
3. Wildlife Unit - 1 Wildlife Officer and an Assistant Wildlife Officer.
4. Research Unit - 1 Research Officer and an Assistant Research Officer.
5. Nursery Unit - 1 Nursery Officer and an Assistant.
6. Survey and Mapping Unit - 2 Surveyors and 2 Draftsmen.
7. Crown Lands Unit- 2 Lands Officers and 6 Lands Assistants.
8. Forest Operations Unit - 5 Range Officers, 5 Extension Officers and 12 Forest Officers.

A number of the units are of special interest to the project including:

- the 5 Range Officers responsible for the areas of Forest Reserve - North, Dennery, Quillesse, Millet and Soufriere - about 30% of the country is forested of which 16% is in private hands and 14% Crown;
- the 5 Extension Officers (3 posts are vacant) responsible for working with Community groups;
- the Education/Information Unit which includes Eco-tourism (the largest source of Forestry Department revenue). This Unit, could with minor assistance, provide publications and other material for use in the watershed management campaigns;
- the Protection and Wildlife Units.

The Forestry Department leads the country in conservation education, a programme which started in 1979 with a campaign to save the St Lucian parrot. It then extended into other subjects such as forest, wetlands, bio-diversity protection and the recent River Conservation Project. A pleasing feature is the Department's genuine interest in conservation, the legacy of the late Gabriel Charles MBE, formerly the Chief Forest and Lands Officer

### **3.5. Water and Sewerage Authority (WASA).**

The Water and Sewerage Authority Act of 1984 imposes on government the obligation to promote a national water policy which appears to devolve on WASA.

The controlling authority is the WASA Board which comprises a non-Government Chairman, the Director of Finance, the Chief Engineer MCW&T, the Chief Medical Officer, the PS in the Ministry of Tourism and two non-Government nominees. The Board meets at least every month. Cash flow is a severe problem, caused at least in part by the fact that GoSL is said to owe WASA EC\$ 5.0 million. This is an accumulated debt and relates to the supply of water to schools and other government institutions

#### **3.5.1. Water Supply and Billing.**

WASA have an image problem in some areas, partly caused by the previous government policy of providing free water to small communities. Despite this, there are 32,000 connections, seventy percent of which have metres (sold to householders at approximately half price). The balance of households are charged on estimated consumption, WASA eventually plan to put everyone on a meter.

The current price of water is \$5.00 per 1000 gallons and meters are read every month (used to be quarterly). Two years ago WASA asked GoSL for approval to increase prices and are still waiting for approval.

Defaulting on paying water rates is not regarded as a severe problem and the first priority is to get WASA's invoicing system operating properly. WASA are prepared to cut off those who default - for example a number of hotels were poor payers in the past, but now pay on time.

#### **3.5.2. Water Catchments and Hydrology.**

Although there would appear to be sufficient provisions in various existing legislation to protect catchment areas, in practice WASA find that unless GoSL owns the area there is no control (see Section 2.3.2 for reference to recent purchases)

The WASA Act requires the Authority to establish a hydrological network and carry out periodic surveys. There a difference of opinion within WASA regarding this obligation - the technically correct view that WASA should have control over its raw material and the pragmatic belief that it is better to continue to co-operate with Agricultural Engineering Services who have better trained staff and equipment.

The Consultants are of the opinion that WASA are struggling to maintain an adequate water and sewerage service to St. Lucia and that taking over responsibility for the hydrological network would mean additional recurrent costs with no prospect of a

financial return. The need for AESD to provide an improved service is discussed elsewhere in the Interim Report.

### 3.5.3 Water Sources and Sewerage

WASA divide the Island into three zones, the North East, North West and South with superintendents responsible for the supply and distribution of water in each of the zones. These zones do not physically match the eight regions used by MALF&F and other government agencies and there is no reason why they should do so.

There are three main sources of supply Roseau Dam, Hill 20, and Grace (Vieux Fort), in addition there are 26 minor intake sites which are costly to maintain. There is a need for a dam in the south to supply what could be an important area for future development and two possible sites are being investigated. In addition some form of water grid with low head pumping would be practical for much of the east of the Island.

There are two main sewerage treatment plants, one at Castries and a new one to serve the north of the Island. Two small plants are located at Vieux Fort and Micoud. All other areas operate on septic tanks or pit latrines.

### 3.6. Ministry of Communications Works and Transport (MCW&T)

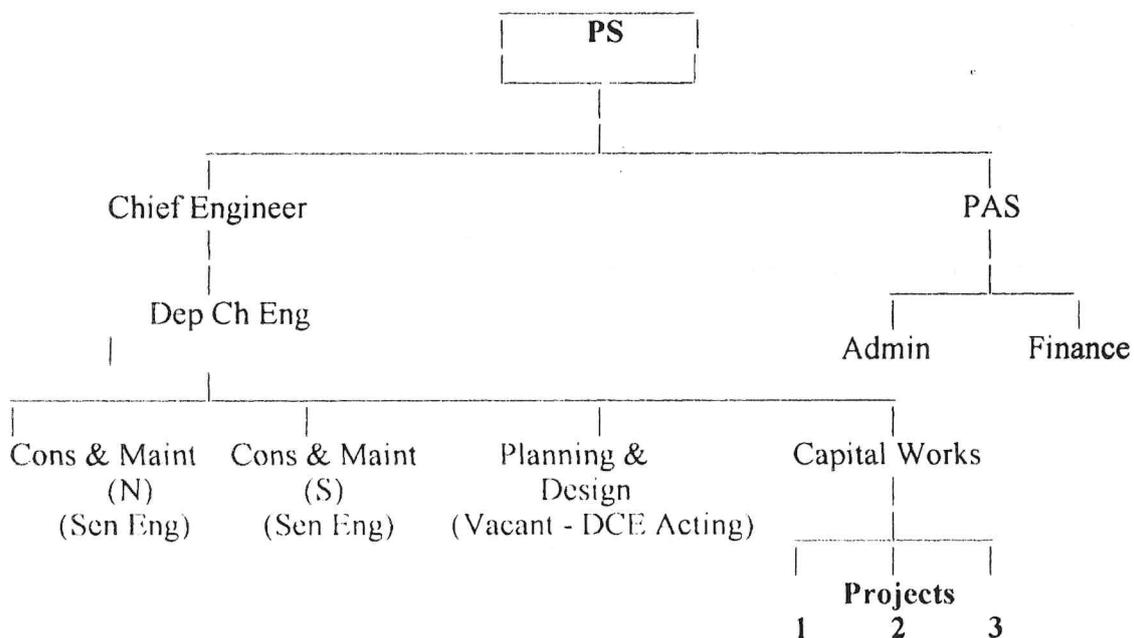
Two Departments of MCW&T have important environmental responsibilities, namely the Works Department and the National Meteorological Office.

#### 3.6.1. Works

Figure 3.3 shows the organisation and establishment of the Works Department.

Figure 3.3

#### Establishment, Works Department



### Capital Projects

1. Castries / Cul de Sac Highway
2. Water and Environmental Management Project
3. Rehabilitation and Road Improvement and Maintenance Project (RIMP). Cost EC\$23 million, now coming to an end.

Section 6.4.4c) suggests attaching a River Management Unit to each of the Construction and Maintenance Sections. These units would be responsible for the identification of problems in the rivers and the main drains and would also administer the Beach Protection Act - note that this responsibility could eventually be transferred to a CZM Unit - if there is a change in the legislation.

### 3.6.2. Meteorological Services

The Government Meteorological Service is part of MCW&T with a small office in Castries and all other staff are based at the two Airports as shown in Figure 3.4.

Figure 3.4.

#### Establishment Meteorological Services

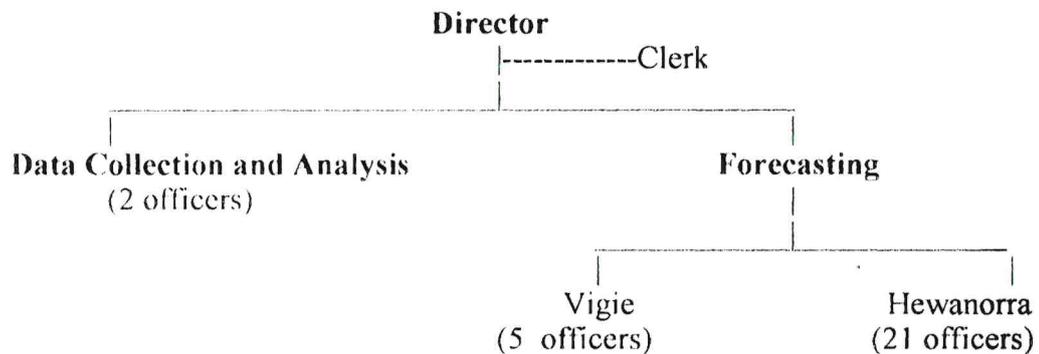


Figure 3.4 shows the existing establishment, but it is not clear which posts are occupied. There has been a long running campaign to have the hydromet work presently carried out by Agricultural Engineering Services (AESD) transferred to MCW&T. The head of the Meteorological Service stated that if Agricultural Department staff were transferred to his Department, an improved service would result as MCW&T staff tend to be better trained.

The Consultants believe that the cost effective course of action would be to ensure that the service currently provided by AESD is as efficient as possible and will be making suggestions for the facilities need by the Meteorological Service in order to improve weather forecasting.

## **4. INSTITUTIONS WITH AN ENVIRONMENTAL INTEREST**

This Chapter considers the organisations and institutions with an interest in the St. Lucian environment and in general covers those responsible for "Environmental Legislation" (see Section 2.3). The division between the agencies considered in Chapters 3 and 4 and is largely arbitrary, as there is overlap between agencies/areas of interest and in the final analysis the approach has been adopted for ease of reporting

### **4.1 Government Institutions**

#### **4.1.1. Environmental Unit (MPD&E)**

The Environmental Unit in the Ministry of Planning Development and the Environment (MPD&E) is responsible for policy issues in the fields of: Environment, Energy, Science and Technology. Amongst other duties, the Unit is required to act as the Secretariat for the National Environment Commission (NEC) which in turn should be St. Lucia's principal environmental authority

The decision to establish a the NEC was confirmed by Cabinet in March 1995 (Cabinet Conclusion 450 of 23/3/95) in response to a submission from MPD&E, which drew attention to the perilous state of the environment following TSD. Cabinet agreed that the NEC would provide an appropriate basis for sustainable management through the implementation of activities contained in a proposed National Environmental Action Plan (NEAP)

The broad functions of the NEC are as follows:

- to provide guidance and advice to Cabinet, para-statal and non-governmental organisations (NGOs) on environmental matters;
- to co-ordinate the inputs of Governmental and NGOs as well as private sector agencies /interests in the implementation of the NEAP;
- to mobilise financial and technical resources in support of environmental projects and activities, especially at the community level;
- to monitor and evaluate the implementation of the NEAP;
- to assist with the design and delivery of training programmes/workshops in environmental management and sustainable development;
- to organise and or supervise applied research in accordance with the NEAP.

Membership of the NEC is wide, but the Commission has not yet met, because MPD&E would like to have an agreed NEAP in place prior to the first meeting. NEAPs are required by the World Bank for its clientele and with Bank assistance GoSL produced a draft plan in May 1994 (basically an instruction as to how GoSL should prepare the final document). The Environmental Unit hopes to finalise the NEAP by the end of the year, but a the 30 month gap between the draft and final plans gives the Consultants the impression that the GoSL's environmental machinery moves slowly.

In passing, it should be noted that environmental issues in St. Lucia tend to have a long gestation period - an Environmental Commission was first established by the late Gabriel Charles and others in 1981, but faded away for lack of political support only to be re-launched in June 1995.

#### 4.1.2. Physical Planning Unit (MPD&E)

The Physical Planning Unit (PPU) services the DCA which is, in turn, responsible for the Land Development (Interim Control) Act of 1971. The Unit includes a GIS Section which is well equipped with human / other resources and would need little additional assistance, in order to meet the demands of a future Watershed and Environmental Management Programme.

The Consultant's ToR require attention to the roles, functions and responsibilities of central and local institutions regarding settlements in flood plain and coastal areas including building regulations in hazard zones. The Manual for Developers (1988) in Section 3.4, Disaster Prone Areas states:

*"If an area possesses characteristics and is located in an area where life and property may be in constant threat (then) if the area is developed, a Development Order may be issued to prevent development of the area".*

The PPU state that, as hazard areas have not been designated, there has been no attempt to progress beyond the statement quoted above. However, when dealing with individual planning applications, in a hazard-prone area, the DCA may grant approval for the proposed development, provided the developer complies with special conditions. In practice there is, unfortunately, no legal mechanism to force developers to adhere to the conditions of approval.

A comparison can be drawn between the approach adopted for the Queen's Chain and the approach which might be adopted for hazard-prone areas in the future. The DCA commissioned a report on procedures for granting leases within the Queen's Chain (the area encircling the Island, which lies within 187.5 feet of high water mark) and the resulting policy document was adopted on 10/2/88 and for example, specifies:

- the procedure for granting leases in the Queen's Chain and notes that Cabinet have granted leases without ascertaining if the proposed land use is acceptable to DCA;
- the development policy (e.g. maximum leases 25 years, renewable);
- the types of development to be permitted in each of the three zones of the Chain and adjacent coastal environment;
- that public access should be available to all developments adjoining or on the Queen's Chain.

Enquiries in a village like Dennery, indicate that people build where they can find land and that in practice the planning process tends to be extremely casual. Because of limited land, a significant percentage of houses might be in flood or landslide areas and the true position could only be ascertained by a detailed housing survey, along with the identification of alternative housing plots for those who might be relocated.

#### 4.1.3. Office of Disaster Preparedness (ODP)

In 1979 the UN funded a Pan-Caribbean meeting of Ministers of Health to discuss disaster preparedness in the Region. This led to the formation of a Unit in St Lucia, with a former Cabinet Secretary (Stanislaus James) acting as the Disaster Co-ordinator until his appointment as Governor General in 1989.

The Office of Disaster Preparedness (ODP) answers to the Office of the Prime Minister, is regarded both in St. Lucia and in the wider Caribbean as an effective

organisation and employs three full time staff (Disaster Co-ordinator, one staff member and a Secretary). The original National Emergency Advisory Council, changed its name to the National Emergency Management Organisation (NEMO) and meets once a year to decide on actions needed in the event of a hurricane or other disaster

Regional DP Committees were planned to cover the same areas as Regional Councils, but in the recent past, local elected representation has been replaced by nominated Councils. Under the circumstances the DP Office has organised local Emergency Committees at Gros Islet, Dennery, Micoud, Vieux Fort, Choiseul, Soufriere, Canaries, Anse La Raye and Laborie. Each of these Committees is made up of all the Civil Servants in the area, plus others such as the Priest, Schoolmaster, Representatives from the Tourist Industry and others. In some cases there may be Sub-Committees for example to represent Rural as opposed to Urban areas. Funds are limited, but the DP Office will pay transportation costs and projects/workshops are often sponsored. The DP Committee Secretaries, who are also the local Town or Village Clerks and receive a salary from the Office of Local Government.

At the national level the NEMO is divided into 6 smaller committees responsible for - Information and Evaluation - Transportation - Telecom - Management of Supplies - Health and Welfare - Emergency Works (divided into Immediate, Intermediate and Long Term). In an emergency, there are 3 tiers of involvement:

- Decision Makers - PM, Cabinet, Police
- Managers - The 6 Committees set out above - for example the membership of the Health Committee includes, Chief Engineer MCW&T, PS Planning, Clerk to the Castries Council, Planning Officer Min of Health, Local Government Officer in Ministry of Community Development and representatives from WASA, LUCELEC and the Tourist Industry.
- Communities - i.e. the 9 local Emergency Committees. Emergency Operation Centres are designated, and the local member of the house of representatives should also be involved.

The DP Local Committees have much in common with the community based organisations which the project seeks to establish in the Pilot Watersheds. The ODP state that, the most important thing the project can do is to map the areas prone to landslides, flooding and the coastal areas most prone to storm surges.

#### **4.1.4. Environmental Health Department (MHI&B)**

The Environmental Health Department in the Ministry of Health is responsible for the administration of the Litter Act (24/83) and the Public Health Act (8/75) and its associated regulations. In addition the Chief Environmental Health Officer is responsible for many of the solid waste management (SWM) functions which will in time be taken over by the SWM Authority to be established under the Solid Waste Management Act of 1996

##### **a) Litter Act (24/83)**

It will be at least 5 years before implementation of the Litter Act becomes the responsibility of the SWM Authority, although this is the ultimate intention. Following amendments to the Act in 1985, efforts were made to enforce regulations with the appointment of Litter Wardens. Their effectiveness was greatly reduced

following a court ruling which demonstrated that wardens are relatively powerless and the Police are said not to take littering seriously.

About three years ago, the French funded a campaign to clean up old vehicles which resulted in a temporary improvement to the environment. It is however difficult to judge when a vehicle is "litter" - there are powers to remove vehicles which appear to be derelict to a pound - held for a period and then scrapped if not reclaimed - However the Chief Environmental Health Officer does not have access to a pound.

#### ***b) The Public Health Act (8/75)***

The Public Health Board (Chief Medical Officer is the Chair) established under the Act, has not met for at least three years and one must assume that the Department automatically carries out the wishes of the non-existent Board.

Public Health Officers were re-designated as Environmental Health (EH) Officers some time ago and EH Inspectors are based in each of the 8 Regions responsible for the inspection and improvement of the environment. There is a total Inspectorate staff of 25, but with some 235 other employees, many of whom are EH Aids (Assistant EH Officers) or sanitary workers responsible for clearing up rubbish. One staff member is responsible for testing water quality at both the intake and at the tap. The analysis of samples is done at the Caribbean Environmental Health Institute (CEHI).

There is a land fill site at Cul de Sac which does not have a proper access road and is difficult to use in wet weather. An important job for the SWM Authority will be the establishment of a proper landfill site to serve the Castries area.

#### **4.1.5. Veterinary Division (MALF&F)**

The Chief Veterinary Officer is responsible for the administration of the Animal (Diseases and Importation) Ordinance. Importers of livestock of any description are required to obtain a licence and strict limits are placed on the areas which may export stock to St. Lucia. The Veterinary Division does not have an Animal Quarantine Station and a system of farm quarantine is used until stock can be shown to be free of disease. A similar licensing system applies to the importation of animal products.

St Lucia does not have a central slaughter house and there is apparently little need for such a facility. Animals are killed in make-shift abattoirs and when necessary veterinary officers co-operate with Public Health officials on an informal basis to enforce the Public Health (Slaughter House) Regulations (SI 69/80).

### **4.2. Regional Organisations**

#### **4.2.1. Natural Resources Management Unit (NRMU) of the Organisation of Eastern Caribbean States (OECS).**

The Central Secretariat of OECS is located in St Lucia with an Economic Affairs Division in Antigua. Until January 1996, there was also a Fisheries Unit in St Vincent, which has now merged with the St. Lucia based NRMU.

The NRMU receives assistance from USAID, WWF and GTZ. In addition ODA has a commitment to support the following programmes -

- a Regional Coastal Resources Management (CRM) initiative

- a Watershed Management component which will come on-stream after the Watershed and Environmental Management Project has been completed
- a water quality project - see Section 4.2.3.

**a) Programmes**

The following three programmes with which NRMU and/or Fisheries Department are involved have a high degree of public participation and are of environmental interest:

- NMRU are running a Public Awareness campaign on Pesticide use which involves the Pesticides Control Board and the Caribbean Environmental Health Institute (CEHI). Plans are in hand to expand this work under the CRM programme.
- Soufriere Marine Management Area (SMMA) was established in 1992 and became operational in 1995. The Fisheries Dept. acts as the Chair of the Technical Advisory Committee which draws representatives from a wide range of stakeholders including the fishing community, water taxi owners, tourist industry, the Soufriere Foundation, Customs and hotels in the area. The SMMA has attracted aid funds from both the French and the ENCORE project, but is said to cover recurrent costs from income earned from mooring fees, diving permits etc. Staff comprises a Manager and 4 Wardens and there are apparently no plans to change the present, "Government, but with Autonomy" structure of SMMA.
- Sea Urchin Programme - In the past the harvesting of sea urchins in the Vieux Fort area seemed to be reasonably well self-regulated. Following Hurricane David in 1989/90, sea urchins disappeared for 4 years - when they eventually re-appeared there was indiscriminate harvesting which resulted in Government imposing a moratorium. Harvesters asked for this to be lifted and CANARI/Fisheries worked together to explain the biology of the urchin and helped to form a group of those interested in harvesting and cleaning. This group decides who will be involved in the industry and the size of urchins which may be taken. The normal harvesting season is from September to December, but last year the Group asked that the season be closed after only 3 days as there was an insufficient crop

**b) The Environmental and Coastal Resources Project (ENCORE).**

The project started in 1992, is due to end in September 1997, but with the possibility of a one year extension and is funded by USAID through WWF and OECS

The Local Site Management component of the project is managed by GoSL staff members with a similar local Government team involved in Dominica (training, public awareness, institution building etc.)

Work is concentrated in the Canaries, Soufriere and Anse La Raye areas and excluding the SMMA and SWM work, trials have been established at Font St Jacques where farmers are being encouraged to plant trees between dasheen on steep slopes to aid soil stabilisation. Similar work is being undertaken at Zenon, plus a sustainable charcoal production project at Canaries in conjunction with the National Trust.

**4.2.2. Caribbean Natural Resources Institute (CANARI)**

CANARI was established 20 years ago as a charitable foundation and has been at Vieux Fort for about 11 years. Also in the US Virgin Islands (St Croix) The organisation concentrates on the following a fairly narrow band of issues and is heavily committed to participatory management

- Applied Research
- Analysis - learning from applied research
- Advocacy - dissemination of information

CANARI has a total staff of twelve (7 in St Lucia and 5 in St Croix) and an annual budget of US\$700,000. The organisation obtains funds from:

- Programme grants - US Foundations, ODA, etc.
- Specific project grants - UN etc.
- Training fees, which account for 15 percent of income

Previous mention has been made of CANARI's work with the sea urchin project. In addition the organisation is involved in the sustainable development of sea grass beds, in the production of charcoal from mangroves and is working with a group of farmers in the Millet, Praslin and Pelouse areas.

CANARI have, with assistance from ODA, recently produced a video "People are Trees, Trees are People" which features areas on the edge of the Dennery watershed.

#### **4.2.3. Caribbean Environmental Health Organisation (CEHI)**

CEHI was established 10 years ago and provides expertise in water related subjects for the smaller Caribbean Islands and has received assistance from a number of aid projects including:

- GTZ has provided consistent support to the Institute (capital for the well appointed building and continuing technical assistance);
- CEHI is the base for ODA funded work, which is of considerable interest to the Watershed and Environmental Management Project (The Development and Integration of Biotic and Chemical Monitoring with Land Use Assessment and Tropical River Resource Management);
- the Caribbean Basin Water Management project which is responsible for the co-ordination of training for all the member countries Water Authorities.

Staff consists of a director and four professional staff from the Region in addition to expatriate staff. It would appear that WASA and other Water Authorities in the Region could, or should make greater use of CEHI for water quality monitoring.

### **4.3. Non-Government Organisation (NGOs)**

#### **4.3.1. St Lucia National Trust (SLNT)**

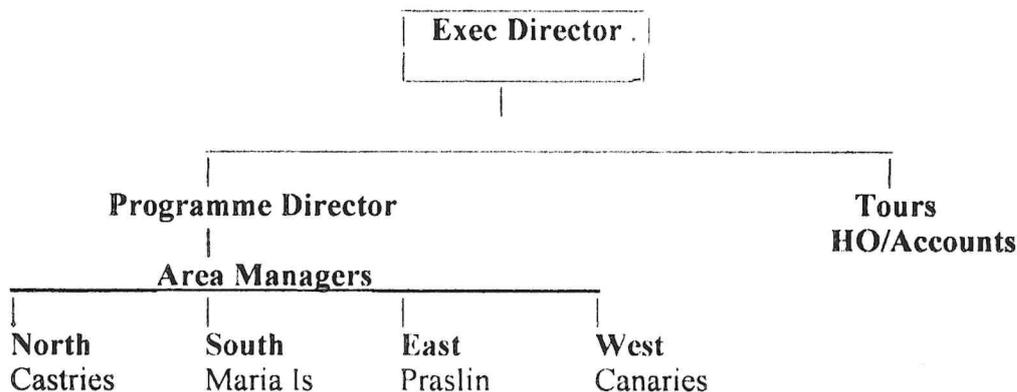
The SLNT was established in 1975 by the National Trust Act and control is vested in a Council consisting of 7 people elected from the membership, 2 nominated by Govt and 2 by the Archaeological and Historical Society. Council meetings are held at least every two months. An Architectural Heritage Committee has recently been established consisting of SLNT, a representative from MPD&E and the private sector. Income comes from entrance fees, money raised by members and from a government grant which started at EC\$1.0 million in 1993, declining by \$100,000 per year (ie. \$700,000 in 1996). The SLNT has a total of 45 staff organised as shown in Figure 4.1

At present three SLNT properties have been developed - Pigeon Is, Frigate Is and Maria Islands. A property (130 acres) at Canaries is in the process of being developed

as a Camp site and in addition there are a number of properties/sites which have been donated to the trust including five on the Morne.

**Figure 4.1**

**Establishment of the St. Lucia National Trust**



The SLNT would like to acquire a 20 acre wetland site at Bois d'Orange which is a site for migrating birds. The area is privately owned with a lot of houses and so far it has been impossible to protect the area from further development. In this regard the SLNT made a submission to GoSL at the end of 1992 for the designation of a number of "Protected Areas". Government did not reject the proposals, but have asked the Trust to work on one scheme at a time.

Although appointed as the custodians of national heritage, the Trust is vulnerable to political pressure and a case in point is the Savannes Bay area (518 hectares) which was placed under the legal protection of SLNT in 1982. It was then divested by GoSL ten years later, against protests from all conservation interests, so that it could be developed as a tourist resort.

**4.3.2. World Wildlife Fund (WWF)**

The WWF provided an initial 2 year technical assistance input to the ENCORE project and now acts on behalf of USAID as the project's funding agent (the money passes from USAID to WWF to OECS + CEHI and the participating Governments, St Lucia and Dominica). The project has a budget of US\$8 million over 5 years and the routing of funds through WWF came about when USAID closed down its office in Barbados.

It is probable that WWF will not stay in St Lucia after the end of the ENCORE project (1998 if extended), but there are some other local organisations with similar interests to WWF.

**4.3.3. Other NGOs with an Environmental Interest**

- RARE Centre for Tropical Conservation - a USA-based funding agency with a small staff, but able to position funds to maximum effect (e.g. provided assistance for nature trails, the "save Jacquot project" and a family planning campaign in St Lucia.).

- The Folk Research Centre - have or could be helpful in Public Awareness Campaigns.
- St Lucia Whale and Dolphin Watching Association - which is affiliated to the Eastern Caribbean Coalition for Environmental Awareness.
- St Lucia Naturalist Society - started in 1878 and funded by subscriptions from the 180 members plus donations. Current campaigns include:
  - study and documentation of mangroves;
  - identification and documentation of waterfalls;
  - bird watching and recording migratory patterns of certain species;
  - turtle watching, tagging and recording;
  - beach cleaning and recording of garbage accumulation on beaches.

There would be advantages in the NGOs and others forming an environmental pressure group ("Friends of St Lucia") The Consultants would be happy to subscribe to such an organisation.

#### **4.4. Community Based Organisations (CBOs)**

Following a political decision, local elected representation has been replaced by nominated Councils in the towns and villages. This is said to have resulted in a weakening of community activities.<sup>8</sup> GoSL have made some efforts to redress the situation, through:

- Ministry of Community Development - with responsibility for decentralisation and the administration of local government;
- Office of Women's Affairs - first established in 1986 within the Ministry of Community Development but transferred to the AGs Office in 1994 as was thought appropriate that the Unit should answer to a woman Minister.

There has been a long tradition of community and self help in St Lucia<sup>8</sup> and there was a "grass roots" expansion in the 1970s of CBOs which are collectively called Mothers and Fathers Groups. These have developed in various ways and in response to various situations - some single sex, some for married couples, some for younger people etc. - most of which are involved with the church in some way. There is now a National Association of Mothers and Fathers Groups which receives assistance from Government.

There are many examples of successful CBOs and frequent mention of the Soufriere Foundation and of the Canaries Ambulance and Development Association (this CBO with assistance from St Lucians living in UK and USA, raised money for an ambulance and are now working to build a community centre)

An important part of the Consultant's work is to identify and involve the CBOs at Dennery and Cul de Sac in watershed management and the proposed approach is covered in more detail in Chapter 5.

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<sup>8</sup> Reported in a Seminar (November 1996) following an ENCORE funded review of CBOs in the Soufriere, Canaries and Anse La Raye areas - carried out by St Lucia Consultants, Creative Solutions.

## **5. GOVERNMENT, COMMUNITY BASED AND OTHER ORGANISATIONS IN THE DENNERY AND CUL DE SAC WATERSHEDS**

### **5.1. Approach**

The Land Conservation and Improvement Act of 1992 provides an appropriate legislative vehicle for the institutions/socio-economic development of the two watersheds. Unfortunately the Land Conservation Board (LCB), which should spearhead land conservation and improvement work has only met once (on 14th November 1995) and is unlikely to be of much help during the current phase of the Project. It is however, interesting to note that the minutes of the first LCB meeting discussed, in general terms, a similar programme of work to the one set out in this report.

A possible way of taking "the project" to the people" is provided by the following extract from the Consultant's (Hunting Technical Services Limited) Drainage and Land Conservation Programme, Final Report dated 1987:

*"The Steering Committee for the formation of the Land Conservation Board did not completely agree with the Consultant's proposals for Drainage Boards with boundaries drawn up around the lower river basins. Rather a complete watershed was preferred which could be designated a Conservation Area. Within this area a Land Conservation and Drainage Committee (LCDC) could be formed consisting of representatives drawn from throughout the complete catchment. In this way it was felt that any action carried out on the upper slopes that would affect land lower down, would be properly considered. Whilst such LCDC's are not specifically mentioned in the Act there is general provision for delegating the work of the LCB to committees, thereby allowing LCDC's to be formed and modified as the need arises".*

The possibility of establishing LCDCs in the Dennery and Cul de Sac watersheds has been agreed by Chairman of the LCB (Permanent Secretary, Ministry of Agriculture, Lands, Fisheries and Forests), but needs to be ratified by the whole Board at the earliest opportunity.

### **5.2. The Danger of an Unsuccessful LCDC Campaign.**

The undertaking will require a very serious commitment from GoSL (discussed in Chapter 6) and the level of government resources devoted to the campaign will in turn determine the Consultant's effort and approach. Unlike the physical trials programme, community participatory programmes such as that envisaged, can not be simply started and stopped (the catastrophic results of an early withdrawal of support are well documented as are the difficulties of re-starting programmes amongst discouraged and cynical communities). The ENCORE project, has been involved in participatory management work in the Soufriere, Anse La Raye and Canaries areas since 1992, and would be the first to emphasise the difficulties involved.

### **5.3. Future Work Programme.**

In order to start the programme and allow GoSL to make decisions, the Consultants engaged a full time LCDC Co-ordinator (Ms J Raynold) and a part-time LCDC Adviser (Mr M P Toussaint MBE) on 11 November 1996. The initial work programme has been straightforward and involves the identification of all of the

organisations in the two watersheds - a task which was nearing completion at the end of November. The social and to an extent, the economic characteristics of the watersheds, are set out in Appendix C and some of the significant differences between the two are summarised in Table 5.1

Table 5.1.

#### Some Characteristics of the Watersheds

	Dennery	Cul de Sac
Area (1)	21.4 sq km	40.9 sq km
Population (2)	2,918	12,806
Centres with population > 300	2	13
Approx no. of banana farmers (3)	250	600

- Notes (1) See Table 6.1  
 (2) 1991 Census  
 (3) Estimated from the number of delegates eligible to attend the SLBGA Conference of Delegates.

The information collected, provides a good indication of where to target the LCDC campaign and the Consultant's Socio-economist will assist the LCDC team (the locally engaged Consultants plus GoSL staff) during December 1996 and January 1997. There are two development alternatives:

- a strong GoSL commitment will enable the full LCDC programme to be developed and will mean that important management lessons could be gained and the Watershed and Environmental Management Programme would have started by the time the project ends at the end of 1997;
- a weak commitment by GoSL will result in the Consultants mounting a general environmental awareness campaign which will do little good, but at least would not expose the project to the dangers set out in Section 5.2 above.

#### 5.4. Some Initial Responses to the Survey.

In conclusion, the following extracts from the LCDC Co-ordinator's Report (see Appendix C) should be noted:

*The prospect of a programme which would address the issues of watershed management and the negative consequences of mis-management was generally well received. The impact of TSD in 1994 and the more recent/frequent heavy rains on the social and economic livelihoods of people has generated an increased awareness of issues such as deforestation, construction and cultivation on hill slopes, as well as poor drainage systems in both residential and agricultural areas. As such many people expressed an interest in seeing the objectives of the LCDC programme implemented.*

*Community members and government personnel working in the watersheds indicated that mobilising individuals and groups is a particularly challenging exercise. The feeling is that people are wary of government, community, or other projects which have typically promised relief from one form of hardship or the other, but have shown no continuity or tangible results*

## 6. TOWARDS AN INTEGRATED INSTITUTIONAL FRAMEWORK FOR WATERSHED AND ENVIRONMENTAL MANAGEMENT

This Chapter sets out the mechanisms for the management of the environment in general and of the watershed in particular, in the hope that at least some of the proposals will have been adopted prior to the Consultant's return in September 1997.

### 6.1. Statement

The proper management of the Country's watershed and of the associated river/coastal systems is the responsibility of GoSL and ultimately of everyone who lives on the Island. Non-governmental organisations, community groups, aid agencies and others can certainly help, but the Government, irrespective of the political party in power must put in place and operate the necessary management framework.

The solution to the problem, which everyone recognises, particularly after torrential or even heavy rain, requires a long term commitment, does not respond to a "quick fix" and requires a multi-agency approach.

### 6.2 Problems

#### 6.2.1 Structures and Staff

*"Integration of multiple agency interests into a single programme is difficult. Without exception, institutions will defend their turf and only yield authority and prerogative grudgingly. Getting institutions to co-operate in multi-sectoral activities towards integrated common goals - those that no institution can accomplish alone - is certainly one of the toughest jobs for natural resource authorities"*<sup>1</sup>

The above task is exacerbated in St. Lucia for a number of reasons, which although outside the Consultant's ToR, have a very real bearing on the difficulty of instituting change and hence of formulation solutions. These problems include:

- the divisions sections and units of Government Departments often lack "critical mass" and are very vulnerable to small changes in human or other resources;
- the country is small and characterised by close relationships sometimes creating difficulties in enforcing legislation and exerting line discipline in government departments.
- the comparatively small number of senior staff with limited opportunities to delegate work, results in "institutional paralysis" on the frequent occasions when staff are out of the country, at conferences, attending courses or on study/sick/annual leave;
- the decision making process is frequently characterised by "extensive consultation, intensive debate and very little action"

There is a GoSL commitment to reform of the Civil Service, when no doubt the above issues will be addressed, **but** this is unlikely to occur until after the next General election. St. Lucia does, (at least in most fields) have an adequate number of capable, well trained, civil servants and there are sufficient examples of well motivated units and individuals to support the view that change is possible.

#### 6.2.2 Policy and Direction

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<sup>1</sup>GoSL, Watershed and Environmental Management Project - Consultants Report December 1994.

### 6.2.2 Policy and Direction

Even a casual reading of the previous Chapters will indicate that advisory or executive Boards established under various pieces of legislation do not always function as they should, in many cases because they have never been formed, or if established seldom meet. There are lessons to be learned from a comparison of successful Boards in St. Lucia:

- a good non-government Chair is preferable to a good government Chair (Senior Civil Servants frequently complain of "committee fatigue")
- a good government to non-government mix is needed, with if possible, a balance in favour of non-government members
- successful Boards have a degree of control over finances and have a defined end product (eg attract more visitors to St. Lucia).

### 6.3 National Environmental Management

Figure 6.1 shows an organisational structure which could be put in place without inventing new organisations, or requiring initial increases in staff or expenditure. Implementation of the work would however require co-operation amongst the agencies involved and a determination to make progress. The following Sections discuss the components of the structure in more detail.

#### 6.3.1 National Environmental Commission (NEC)

Immediate steps should be taken to appoint the members of the NEC and Cabinet should be invited to consider the appointment of a non-public servant Chair - someone known to have a strong commitment to preserving and enhancing the environment.

The Commission should meet every second month, in the first instance and the meeting schedule should be set out a year in advance. Initial tasks should be:

- agree the National Environmental Action Plan (NEAP) and any suggestion that NEAP should be finalised before appointment of the Commission is unacceptable;
- consider and if possible endorse this Report.

Every financial year, the commission should check and agree all Government funds allocated for the protection/enhancement of the environment prior to the announcement of the budget. In addition it would be appropriate for the NEC to allocate and require agencies to be accountable for the expenditure of such funds.

At this stage the Environment Unit in MPD&E (referred to in Figure 6.1 as the Environmental Office) does not require enlargement, although its future role, (acting as the Secretariat for the NEC, monitoring/evaluating programmes, co-ordinating environmental legislation and involvement in international treaty obligations) will involve additional staff.

#### 6.3.2 Operations Group

The units making up the Operations Group (see Figure 6.1) are mainly considered in Section 6.4, as they are fundamental to the management of the watersheds. The exception is the Coastal Zone Management Unit and it would be proper for the NEC to ask MALF&F (Fisheries Department) to prepare a position paper regarding long term CZM plans. The Consultants take the view, (see Section 6.1) that just like the

# Proposed Structure for Environmental Management

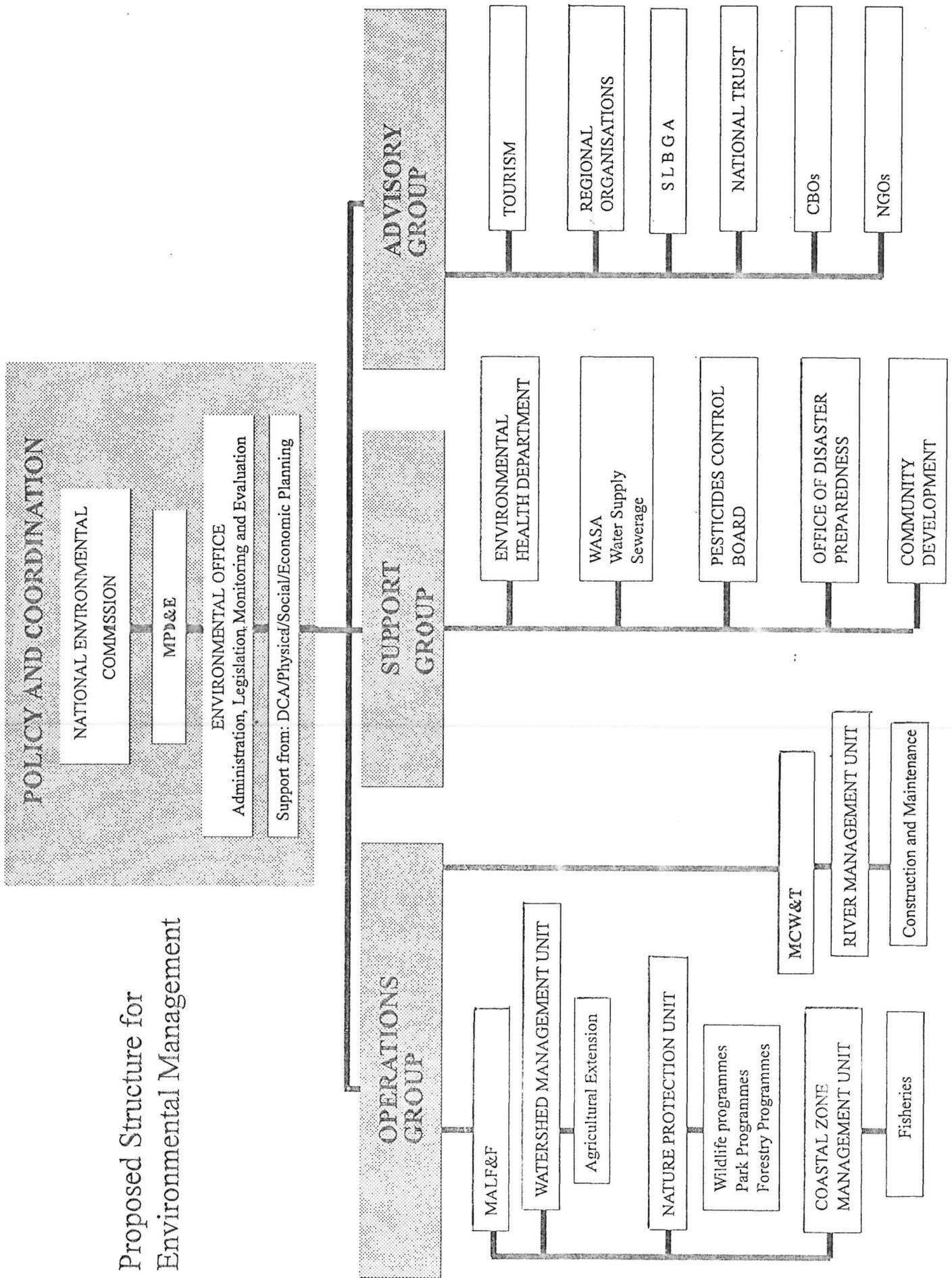


Figure 6.1



watersheds, the coastal zone must be a GoSL responsibility; projects can certainly assist, but the management process must be driven and co-ordinated by Government.

### **6.3.3. Support Group**

The Support Group will have an indirect role in the watersheds and will include a number of government and quasi-government agencies some of which are shown in Figure 6.1. These organisations will usually receive public funds and should be required to prepare annual environmental plans which relate to the NEAP and the watersheds. The plans should record progress against set objectives and the submission dates should be staggered throughout the year to enable the NEC to give proper consideration to individual statements.

### **6.3.4. Advisory Group**

The NEC should invite the organisations, which have a wide environmental interest shown as the Advisory Group in Figure 6.1. (not necessarily a comprehensive list) to an annual seminar to discuss important environmental issues. Papers for presentation should be available prior to the meeting and the NEC should encourage an active exchange of views. St Lucia has organisations with sectoral environmental interests (wildlife, archaeology, marine resources etc.), but appears to lack an active environmental pressure group. Far from discouraging a pressure group of this nature, the NEC has an obligation to encourage healthy debate, particularly if it leads to action.

## **6.4. Watershed Management**

### **6.4.1. Land Conservation Board (LCB)**

The membership of the present Board is noticeably short of farmer or SLBGA representation and this issue should be addressed in the future. As with the NEC, consideration should be given to the appointment of a non-government Chair and the Secretary to the Board should be a non-voting member. Starting at the earliest possible date, the LCB should meet every second month, with the meetings scheduled on alternate months to the NEC.

Despite the LCB resolutions of 14 November 1995, no progress has been made towards formulating Regulations. The Consultants believe that the drafting process should now be deferred until 1998, at which time the issue of what Regulations are required will have more meaning.

### **6.4.2. Land Conservation and Drainage Committees**

In addition to considering/endorsing this report, the LCB must decide on the membership and structure of the LCDCs in the pilot watersheds, an issue that will be influenced both by the community survey and by the geography of the watersheds, which may be broadly sub-divided as follows;

- |         |   |
|---------|---|
| Dennery | i) Land east of the main road which includes the town and almost all of the population. |
|         | ii) The agricultural areas west of the road.  |

- Cul de Sac
- i) Land west of the main road which includes the Hess Terminal, the industrial developments and the tidal areas.
  - ii) Area from the road to the Marc River.
  - iii) The Marc River catchment.
  - iv) The Bexon to Ravine Poisson ribbon development.
  - v) Land south of Ravine Poisson.

Each of the above areas have their own set of environmental problems which the composition and areas of responsibility of the LCDCs must address

#### 6.4.3. Administrative Regions and the Watersheds.

MALF&F and preferably other Ministries should match the boundaries of the eight Administrative Regions to the thirty seven Watersheds in the Island, as shown in Figure 6.2 and Table 6.1. In practice this would involve only minor changes in areas of responsibility and apart from being a logical development, the change would be a good opportunity for GoSL to demonstrate its commitment to watershed management.

Figure 6.1, shows that when re configured the Regions are not all the same size (e.g. Region 5 is nearly twice the size of Region 1). These differences are not important as staff should be deployed in response to need rather than simply land area.

#### 6.4.4. Watershed/River Management and Nature Protection Units

The Environmental Operations Group (Figure 6.1) involves both MALF&F and MCW&T and the land based responsibilities of the two Ministries are discussed in the following sections.

##### *a). Watershed Management Unit*

The present AESD would form the Watershed Management Unit and will need to:

- improve the hydromet service it provides (covered elsewhere in the project);
- abandon any agricultural mechanisation ambitions it may still retain;
- recognise that there is a limit to the civil engineering services it can provide (qualified civil engineers will not regard AESD as providing good career prospects);
- concentrate on meeting the technical needs of soil conservation, drainage and irrigation (where appropriate) requirements in the watersheds;
- meet the administrative demands of the LCB and LCDCs and in particular help to prepare the 1997/98 estimates for the Dennery/Cul de Sac LCDCs (note that the LCDCs must have access to funds for which they are responsible and accountable).

There is an immediate requirement, if the LCDC programme is to proceed, to post two AESD Technical Assistants to Cul de Sac and one to Dennery in the dual role of Secretary/Technical Advisers to the LCDCs. In addition the Agricultural Extension Division must decide the extent to which it can support the watershed management effort and the Consultants will hope to find a co-operative programme in place for Dennery/Cul de Sac by September 1997.

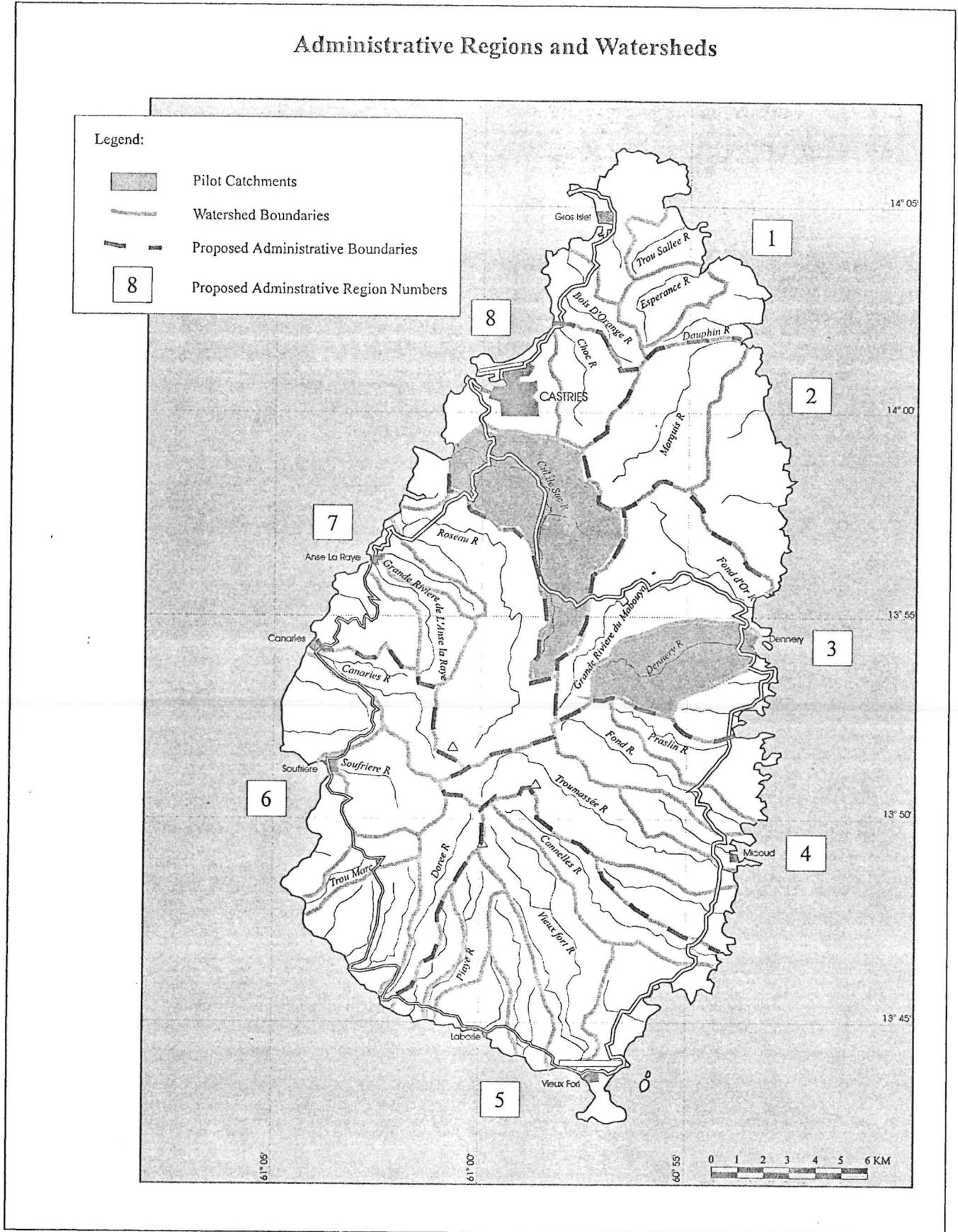




Table 6.1

## Administrative Regions Based on Watersheds

Region	W/sh no	Name	Sq km
1	1	Salle / Lapins	6.7
	2	Esperance	9.7
	3	Trou Grauval / Dauphin	10.0
	36	Bois d'Orange	11.3
	37	Cap	15.4
		<b>Total</b>	<b>53.1</b>
2	4	Maquis	31.0
	5	Grande Anse / Louvet	29.2
		<b>Total</b>	<b>60.2</b>
3	6	Fond d'Or	41.0
	7	Denmery	21.4
	8	Riviere Gadet / Trois Islet	11.0
		<b>Total</b>	<b>73.4</b>
4	9	Mamiku / Patience	16.0
	10	Fond	18.1
	11	Volet	8.6
	12	Troumassee	31.7
	13	Micoud / Ravine Bethel	13.1
		<b>Total</b>	<b>87.5</b>
5	14	Canelles	17.3
	15	Roarne / Rugeine / Palmiste / St. Urban	22.8
	16	Vieux Fort	28.8
	17	Black Bay	15.2
	18	Laborie	5.5
	19	Piaye	9.6
	20	Balembouche	5.2
		<b>Total</b>	<b>104.4</b>
6	21	Doree	11.1
	22	Choiseul / Trou Barbet / Trou Marc	18.1
	23	L'Ivrogne	6.5
	24	Pitons	7.1
	25	Soufriere	17.2
	26	Mamin / Mahout	13.7
	27	Canaries	14.6
		<b>Total</b>	<b>88.3</b>
7	28	Anse la Verdure / Cochon / Galet	13.1
	29	Grande Riviere de Anse-la-Raye	8.9
	30	Petit Riviere de Anse-la-Raye	5.7
	31	Roseau	49.1
	32	Mt. Bellevue	4.8
		<b>Total</b>	<b>81.6</b>
8	33	Cul de Sac	40.9
	34	Castries	14.3
	35	Choc	12.2
		<b>Total</b>	<b>67.9</b>

**Total all Regions/Watersheds - 616.4 sq km**



## APPENDICES

**Appendix A** Institutions/Legislation Specialist: Itinerary, Programme and Persons Contacted.

**Appendix B** Terms of Reference: Institutions/Legislation Specialist.

**Appendix C** Government, Community Based and Other Organisations in the Dennery and Cul de Sac Watersheds.

***b). Wildlife Protection Unit***

The Forestry Department must decide if and how it can improve the service they currently provided in the two watersheds and a first step might be to post one of the Extension Officers to work exclusively in Dennery/Cul de Sac.

***c). River Management Unit***

In time the LCDCs should take an increasing responsibility for all of the drainage works in their respective areas, but the responsibility for rivers must remain with GoSL which means MCW&T.

Section 3.6.2 proposes that River Management Units be assigned to the Northern and Southern Construction/Maintenance Divisions of the Works Department. A first step would be the creation of the Northern Unit - perhaps two officers and a vehicle concentrating in the two watersheds. The Unit would be expected to work closely with the LCDCs, determine the river and main drainage works and either carry out the necessary work by contract or seek funds, from the 1997/98 allocations in order to put the work in hand.

**6.5. Five Year Watershed and Environmental Plan.**

At the end of 1997, the Consultants are required to prepare a Watershed and Environmental Management Strategy for St Lucia and in addition, estimate the capital and recurrent costs for the first five years. In so doing, they will expect to hold discussions with all of the existing or proposed agencies in order to formulate and cost a realistic programme. Clearly, the Consultant's views and hence the resulting plan, will be greatly influenced by progress made in the Dennery/Cul de Sac watersheds during the first nine months of 1997.

## Appendix A

### ITINERARY, PROGRAMME AND PERSONS CONTACTED

10th Oct	Depart UK and arrive St Lucia.
11th Oct	Logistical affairs. Visit future office and introductory meeting with the Project Co-ordinator (Mr Martin Satney).
12th Oct	Preliminary meeting of team members to discuss the work programme. Travel round the island via Soufriere, to become acquainted with the geography and inspect some of the Phase I civil engineering works.
13th Oct	Report reading and visit to the Mabouya Valley. Meeting with Mr Ferdinand Henry, a former Minister of Agriculture.
14th Oct	Meeting with Director of Legal Drafting (Mr V Appeah) in the Attorney General's (AG) Office. Consultant team meet in MPD&E with Govt. representatives - Ms R Charlery (Chair), Mr G Fontenard (Chief Engineer, MCW&T) and Mr M Satney ( Sen. Eng. MALF&F) as well as BDDC representatives Dr B Blake (Outgoing Environment and Marine Resources Adviser) and M R Beales (Incoming Adviser).
15th Oct	Meeting with Ms D Bushell and Mr P Murray of the Natural Resources Management Unit of OECS. Return to Attorney General's Office.
16th Oct	Working on legislation in AG's Office. Meeting at MALF&F with Co-operators: Ms D French (Office of Disaster Preparedness), Ms C Nathaniel (St Lucia National Trust), Ms M Lesmond (Director Women's Affairs), Mr K Nichols (Deputy Chief Fisheries Officer) Mr B James (Chief Forest Officer) and Mr M Satney (Chair). Discussions with Mr K Nichols re Fisheries Department.
17th Oct	Working in the AG's Office. Meetings with Ms E Charles (GIS Specialist) and with Mr C Corbin (Environmental Engineer) both in MPD&E.
18th Oct	Completed most of the work on legislation. Moved into offices at the Forestry Department. Start reporting.
19/20th Oct	Report writing. Meeting with Sir Keith Gordon.
21st Oct	In the Office, reading and report writing.
22nd Oct	Meeting with National Trust (Ms C Nathaniel) and initial meetings with Forestry (Mr M Andrew) and Research and Development of MALF&F (Ms J Norville).
23rd Oct	Attended meeting at MPD&E. Meeting with Office of Disaster Preparedness (Mr T James and Ms D French)
24th Oct	Field visit to the Mabouya Valley Development Project, met with the Programme Officer (Mr P Norville) and staff.
25th Oct	Meeting with the Meteorological Service, part of MCW&T (Mr B Lamontagne) Heavy night rain
26/27th Oct	Working on the Inception Report. Rained all day (26th)- extensive flooding
28th Oct	Meeting at NRMU/OECS (Dr V Chase) Continued working on the Inception Report
29th Oct	First draft of Inception Report
30th Oct	Inception Report completed and delivered to MPD&E (10 copies). Visit to Mabouya Valley Project.

31st Oct Meeting with PS Agriculture (Mr C Robinson) followed by brief meetings in MPD&E (Mr R Soomer) and with the Local Government Officer (Mr A Gaspard). Further discussions with Disaster Preparedness Office. Courtesy visit to PAS Community Development (Mr L Long)

1st Nov Visit to Mabouya Project to meet with Mr Damian Greaves. Meeting in MPD&E with staff involved in the ENCORE project (Mr Crispin d'Auvergne and Mr Vaughn Charles). Meeting with Acting Assistant Secretary for Decentralisation (Mr Lucian Isidore) Interviews with potential LCDC staff members (Mr Michael Toussaint and Ms Joanna Raynold)

2/3 Nov Reporting and work on a submission to ODA. Agree contract with Ms Raynold (3 Nov)

4th Nov Meeting with Mr Toussaint re post of LCDC Adviser. Work in Office

5th Nov Meeting with the Head of the Environmental Unit (Ms Marie-Ange Louis) followed by meeting with WASA (Messrs Hobson-Garcia - Chief Engineer and Eudovique, Ass Operations Manager). Meeting in afternoon with WWF (Mr Michelet Fontaine)

6th Nov Meeting with staff at Dept of Agriculture Division, of Research and Development. Afternoon to Vieux Forte, meeting with CANARI (Messrs Yves Renard - Exec Director, Allan Smith - Research Scientist and - Mathias Burt Rural Development Co-ordinator)

7th Nov Meeting with Chief Environmental Health Officer (Mr Marcel Fevrier) Worked on application for additional funds to BDDC.

8th Nov Meeting with PS Tourism (Mr Percy McDonald). Afternoon meeting with Agriculture (Mr Dudley Auguste - DDAS, Dr Michael Montrose Sen Vet. and Mr Kenny Daniel - Sen Livestock Officer)

9/10 Nov Visit the north of the Island

11th Nov Ms Joanna Raynold started work. Make initial contacts in Dennery.

12th Nov Meeting with Project Co-ordinator, followed by meetings in AG's Office (Mr Victor Appeah) and with the Police (Super. Ausbert Regis)

13th Nov Agree contract with Mr Michael Toussaint. Work in Office

14th Nov Meeting with Fisheries (Messrs Walters and Nichols) also with the Environmental Unit to obtain a copy of the Atria Project Report.

15th Nov CBO Seminar at MPD&EP followed by meeting at AESD

16/17 Nov Visit Soufriere

18th Nov Meetings with Forestry (Messrs James and Andrew)

19th Nov Meeting with Chief Extension Officer (Mr R Leandre). Work in Office

20th Nov Meeting of the Technical Committee

21st Nov Heavy rain. Inspect flooding in the Choc, Cul de Sac ad Roseau rivers. Work in Office

22nd Nov Meeting with National Trust (Mr G Romulus)

23/24 Nov Reporting

25th Nov Meetings at CEHI (Dr Barry Lloyd and Ms Theresa Thorpe) and with Forestry - Education and Information Section (Ms Anita James) and with MCW&T (Mr G Fontenard Chief Engineer)

26th Nov Meetings with RARE Centre (Mr Alleyne Regis) and with SLWDWA (Ms Jane Tipson)

27th Nov Meeting with BDDC (Mr Andrew Tainsh)

28th Nov Meeting with GoSL staff and World Bank (Messrs S Wedderburn and S Miquel). Meeting with Chairman SLBGA (Mr Rupert Gajadha)

29th Nov Work in AG's Office and further meeting with World Bank. Meeting with Registrar of Cooperative Societies (Mr John Baptiste Wilson) followed by a meeting with SLBGA's Senior Technical Officer (Mr Cuthbert Joseph).

30th Nov Reporting

1st Dec Reporting

2nd Dec Meeting with Chair, St Lucia Naturalists' Society (Ms M-L Felix). Project Socio-economist arrived.

3rd Dec Project Presentation at MPD&E. Meeting with Manager of SWM Authority (Mrs A King-Joseph). Reporting.

4th Dec Complete reporting.

5th Dec Present draft Interim Report.

6th Dec Depart St Lucia for UK.

## TERMS OF REFERENCE

### INSTITUTIONS / LEGISLATION SPECIALIST

1. Confirm Government of St. Lucia's strategy for rationalising institutional arrangements for land and water resource development and management, particularly water management, both quantitative and qualitative.
2. Consider the existing institutional framework, design an appropriate structure and organisation for the institution(s) responsible for watershed and environmental management, together with proposed powers and linkages with other agencies and local groups.
3. Define the roles, functions and responsibilities of central and local institutions concerned with natural resource and environmental management including:
  - water use/disposal, quality, quantity and distribution;
  - land use quality and zoning;
  - river management, including reserves and maintenance in riverine and coastal areas;
  - settlements in flood plain and coastal areas, including building regulations in hazard zones;
  - disaster preparedness and management;
  - forestry conservation protection and management;
  - public awareness education and participation.
4. Propose modifications or additions to existing legislative instruments governing the development and management of natural resources and the environment. In addition examine powers and mechanisms for enforcement, making appropriate recommendations to enhance effectiveness. Particular attention should be given to existing institutional capabilities and related aspects affecting effectiveness of enforcement.
5. Develop a programme for establishing the institutional framework which should include:
  - offices and related physical infrastructure and facilities island wide (equipment transport etc.);
  - appropriate GIS system for monitoring and evaluating watershed management activities;
  - Human Resource Development programmes including the public awareness and educational component;
  - cost estimates (Capital and recurrent for the first five years).
6. Consult with the environmentalist for the legislative framework for environmental management.
7. Report findings to the Team Leader who will be responsible for the collation of all specialist inputs into the management plan.

## Appendix C

### GOVERNMENT, COMMUNITY BASED AND OTHER ORGANISATIONS IN THE DENNERY AND CUL DE SAC WATERSHEDS

A summary of preliminary field investigations in the Dennery and Cul-de-Sac watershed.

#### C 1. POPULATION<sup>1</sup>

##### a) Dennery.

Community	Population
Anse Canot	384
Bazile	1
Bois Joli	52
Dennery Village	<u>2481</u>
Total	2918

##### b) Cul de Sac.

Community	Population	Community	Population
Barre Duchaussee	245	La Croix Maingot	422
Ti Colon	494	Cicéron	2128
Soucis	205	Odsan	808
Morne Fortune	1843	Goodland	660
Ravin Poisson	655	Trois Pitons	483
Ferrand	18	L'Abbayee	757
Barre St Joseph	-	Dubrassay	-
Barre Denis	592	Crown Lands	298
Deglos	-	Marc	920
Bexon	1352	Forestierre	646
Floissac	46	Guesneau	<u>234</u>
		Total	12806

#### C 2. APPROACH

Preliminary field investigations were conducted by the locally appointed Land Conservation and Drainage Committees (LCDC) Co-ordinator, Miss Joanna Raynold and the locally appointed LCDC Adviser Mr Michael Toussaint.

Visits are made to the various communities which fall within the two pilot areas to identify and where possible locate the government officials, SLBGA Branches, community organizations/groups and influential individuals. Having established contact, the aim was to conduct informal discussions to familiarize them with the objectives of the project and to gather information regarding the existence and status of community organizations and to get a feel of the general atmosphere which exist in the

<sup>1</sup> Population figures taken from the 1991 census

communities re: participation in community development activities. This exercise is conducted with a view to co-opting the assistance and resources of the institutions they represent in the consultation and participatory process of the LCDC programme.

The prospect of a programme which would address the issues of watershed management and the negative consequences of mismanagement was generally well received. The impact of TSD in 1994 and the more recent and frequent heavy rains on the social and economic livelihoods of people has generated an increased awareness of issues such as deforestation, construction and cultivation on hill slopes and poor drainage systems in both residential and agricultural areas. As such, many of the persons approached, expressed an interest in seeing the objectives of the LCDC programme implemented.

Although the programme is timely, as it provides a response to the problems of mismanagement in watershed areas, December is a bad month to start the campaign in view of the cultural tradition for all work to "slow down" during the weeks approaching Christmas.

The following points arose in discussions with Community members

- The use of the 'screen' is an important means of attracting an audience and maintaining interest.
- It is important for anyone working with the communities to keep to their word and be on time for planned activities. Observing these courtesies is important to the people in the community.
- The mobilization of community members is most effective through group/organization leaders.

### **C 3. DENNERY WATERSHED**

The two visits to Dennery on 11 and 12 November, 1996 were conducted, on Monday 11 by Mr Peter Thompson (Institutions Specialist) and Miss Joanna Raynold (LCDC Co-ordinator) and on Tuesday 12 by Miss Joanna Raynold. The first point of contact was established at the Dennery Regional Office from which the following government ministries/divisions provide services:

- Ministry of Agriculture (Departments of Agriculture and Forestry)
- Ministry of Health
- Ministry of Community Development, Youth, Social Services and Sports
- The Dennery Village Council

The Regional Office at Dennery proved to be a useful starting point for contact with government officials. Several of the officers operating from the office also live in the community and were able to provide additional information particularly with regards to key community groups and community leaders.

From all indications, while several community organizations/groups exist, the most vibrant is the Dennery Disaster Preparedness Committee, chaired by Mr Ivan Gaspard, who is also the Village Clerk, an active community member and reputed to be an effective community mobilizer. The general opinion of the persons contacted is that this group is perhaps the most successful at mobilizing the efforts of community members as it deals with matters which have a direct and tangible impact on the lives of the people.

Community members and government personnel working in the watersheds have indicated that mobilizing individuals and groups is a particularly challenging exercise. The feeling is that people are wary of government, community or other projects which have typically promised relief from one form of hardship or the other, but have shown no continuity or tangible results.

*GOVERNMENT PERSONNEL RESPONSIBLE FOR DENNERY WATERSHED AREA:*

1. Alfred Prospere (Range Officer)  
Peter Vidal (Assistant Forest Officer)  
Forestry Division, Phone No.: 453-4016
2. Fermin Faucher (Agricultural Assistant) Resides in Dennery  
Dennery Regional Office, Phone No.: 453-4016 (work), 453-4347 (home)
3. Ms. E Joseph (District Health Team Leader, Health Educator)  
Wayne Williams (Environmental Health Aid)  
S Vidal (Vector Control Officer, Secretary Disaster Preparedness Committee, Health Team PRO)  
Dennery Regional Office Phone No.: 453-4016 (work)
4. Ivan Gaspard (Village Clerk)  
Dennery Regional Office, Phone No.: 453-4016
5. Marinus Pascal (Community Development Officer)  
c/o Ministry of Community Development, Phone No.: 452-4880 (work)
6. Franklin Bray (Family Case Worker)  
c/o Social Services Division, Ministry of Community Development.

*SLBGA*

Dennery Branch (Gills Arthur, Chairman, Roseline Felix, Secretary) Returns five delegates to the Annual Conference of Delegates

*COMMUNITY GROUPS/ORGANIZATIONS*

1. Dennery Disaster Preparedness Committee (Chairman: Mr Ivan Gaspard, also Village Clerk)  
Phone No.: 453-4153 (Home), 453-3325 (Post Office), 453-4016 (Regional Office)
2. Married Couple's Group (President: Ms. A Stanislaus, also member of 1 above)  
Active member: Ms. M Skelly, c/o Dennery Girl's Primary
3. Dennery Youth Council (President: Mr Felix Eudovic, Principal Aux-Lyon Combined School)
4. All Black Sports Club. (Contact: Alfred Prospere)
5. Dennery Fisherman's Co-operative (Secretary: Oliver Williams Phone No.: 453-3414,  
Treasurer: Kenneth President, Phone No.: 454-3334)
6. Dennery Mother's and Father's Group

*SCHOOLS*

1. Clendon Mason Secondary School (Principal: Mr Egbert James, Phone No.: 453-3329)

2. Dennery Girl's Primary (Principal: Ms. A Stanislus)
3. Dennery Boy's Primary (Principal: Mr. Marcus Edward, Phone No.: 453-4263)

#### *CHURCHES*

1. Roman Catholic, 2. Seventh Day Adventist, 3. Church of God (Contact: Godwin Prospere)
4. Pentecostal Church, 5. Evangelical Church, 6. Apostelical Church

#### *POSSIBLE LOCATIONS FOR COMMUNITY MEETINGS, WORKSHOPS ETC:*

Community Center (most central location) or Dennery Regional Office or Dennery Multi-purpose Centre

#### *BEST MEDIUM FOR DISSEMINATING INFORMATION*

- through the Churches. - on the Creole radio programme - via the Schools.

#### **C 4. CUL-DE-SAC, WATERSHED**

The Cul-de-Sac watershed covers a much more extensive area than that of Dennery and comprises some 22 individual communities from Goodlands in the north to Ravine Poisson in the south. The area falls within the Agricultural Regions 7 (Anse La Raye) and Region 8, (Castries).

The reconnaissance exercise took a form similar to that conducted in Dennery. The first point of contact was with government personnel in the Cul-de-Sac watershed. From these officers some information was gathered about the community organization/groups and a listing of key informants was generated. These individuals or groups were then contacted for additional information.

##### **a) Government Personnel Responsible for the Cul de Sac Watershed**

1. Mr Methodist Faucher (Acting Senior Agricultural Assistant)  
Mr Francois Henry (Agricultural Assistant) Phone No 452-1768 - home  
Ms Antonia Felix (Agricultural Assistant)  
c/o Region 7 Office, Model Farms, Roseau, Phone No.: 451-4238
2. Mr Cyril Henry (Senior Agricultural Assistant)  
Mr Aloysius Les Flores (Agricultural Assistant)  
Ms Eurice Perineau (Agricultural Assistant)  
Mr Joseph George (Agricultural Assistant)  
c/o Region 8 Office, Marc, Phone No.: 451-2277
3. Mr David Lewis (Range Officer, Northern)  
c/o Forestry Division, Phone No.: 450-2078 (work)
4. Mr Marinus Pascal (Community Development Officer)  
Ministry of Community Development, Phone No.: 452-4880 (work)
5. Mr Lennard Montoute (Youth and Sport Officer)  
Ministry of Community Development, Phone No.: 452-4880 (work), 450-0061 (home)

**b) Communities in the Cul de Sac Watershed.**

**i) BEXON**

Bexon's sphere of influence extends beyond the central area of Bexon to the communities of Odsan, Marc, Crownlands, L' Abbaye, Ravine Poisson and Floissac.

In these communities it is reported that the churches (ie Catholic, Seventh Day Adventist, Baptiste, Pentecostal and Jehovah's Witness) play an important and influential role in the lives of community members and in community development. It is therefore suggested that any community development effort must be approached through these religious organizations.

It is also reported that there is a marked absence of community spirit as the community is divided along religious lines. This division has in the past posed a challenge to mobilizing community members as a single unit or to getting a representative group together at one location.

In the smaller communities of Crownlands, Floissac and Marc formal community organizations/groups are almost non-existent. There is a heavy dependence on Bexon for everyday activities related to religion, education, health, sport and culture.

***BEXON (CENTRAL), COMMUNITY ORGANIZATIONS/GROUPS***

1. Bexon Development Committee (Vice president: Sydney John (John John)  
Phone No.: 451-2153 (home), 452-2871/2/1583 (work), 453-1602 (work)
2. Disaster preparedness Committee (affiliation to 1 above)
3. Mother's and Father's Group ( Contact: Ms Stephen, Phone No.: 451-0080 (home)  
or Maryana Sexius, Phone No.: 451-2312 (home)
4. Sports Club ( Contact: Jean)
5. Drug Free Club (Contact: Jemma Stephens)
6. Path Finders Club - SDA affiliation (Contact: Sydney John (John John) Tel: 451-2153 (home)
7. Catholic Youth groups / Choir (Contact: Clementia Eugene Tel: 452-4880 (work)  
452-2503 (home)
8. Literary Group (Contact: Anselma Montrope,-Classes held on Monday, Tuesday and Thursday)

***CHURCHES***

1. Seventh Day Adventist, (Contact: Pastor Jariah), 2. Baptiste (Contact: Ernest Clifford)
3. Catholic (Contact: Fr Jerry Beniere), 4. Pentecostal, 5. Jehovah's Witness

***SCHOOLS***

1. Bexon Primary School (Principal: Marily Bayne)

2. Bexon Infant School (Principal: Morrison Blanchard, Phone No.: 451-2212 - work)

*BEST DAYS FOR COMMUNITY MEETINGS ETC:*

- Monday, Tuesday and Sunday afternoon and evening

*POSSIBLE VENUE FOR COMMUNITY ACTIVITY*

- Bexon Infant School

**ii) ODSAN**

*SLBGA*

Odsan Branch (Augustus Andrew, Chairman Tel 451-0453, Leonard Esnard, Secretary, Tel 453-0721)  
Returns two delegates to the Annual Conference of Delegates

*COMMUNITY ORGANIZATION/GROUPS*

1. Odsan Development Committee (Contact: Moses Charles)
2. Odsan Mother's Group (Contact: Una Charles, Phone No.: 452-7519 - home or Pamela Mathurin, Phone No.: 451-0440)
3. Netball Team (Contact: Rosemary Clement)
4. Kenton Music/Cultural Group (Contact: Mr Kenton, Phone No.: 453-0843/451-2379)

*CHURCHES*

1. Seventh Day Adventist, 2. Pentecostal (Contact: Pastor Emilaire), 3. Catholic.

*SCHOOLS*

Odsan Combined School (Principal: Catherine Albert, Phone No.: 453-0721)

*BEST MEANS OF DISSEMINATING INFORMATION:*

- Through church and school

*POSSIBLE VENUE FOR COMMUNITY MEETINGS ETC*

- Odsan Community Centre - Suggested days and times for community meetings - Sunday and Thursday evenings, or Monday and Tuesday

*OTHER INFORMATION*

Adult literacy classes held on Monday, Tuesday and Thursday evenings.

**iii) MARC**

*COMMUNITY ORGANIZATION/GROUPS*

Mother's and Father's Group (Contact: Veronica Duplesis, Phone No.: 451-0391 - home)

### *CONTACT PERSONS IN THE COMMUNITY*

1. Albert (Youth Worker), 2. Ms Raymond (c/o Forestry Division Union), 3. Mr Danny Brown

### **CROWNLANDS**

#### *SLBGA*

A single Crownlands / Marc Branch represents the two communities (Chairman, Patrick Brown, Secretary Stephen Lesforis, or Andrew Duplesis, Phone No.: 451-0174 (home). Returns five delegates to the Annual Conference of Delegates

### *COMMUNITY ORGANIZATIONS/GROUPS*

Mother's and Father's Group (Contacts: 1. Edison Charles, 2. Louisa Aubry (alias sister) Phone No.: 451-0837, 3. Rosaline, c/o Clementia Eugene, Ministry of Community Development, Youth, Sports and Social Services

### *POTENTIAL COMMUNITY MOBILIZER*

Mr Aiden Pemberton (lives near new Bexon school)

### *BEST MEDIUM FOR THE DISSEMINATION OF INFORMATION*

1. Public address system, 2. Leaders, 3. Bexon church/school

### *POSSIBLE VENUE*

- Christopher Edward's Hall (located at the gap of Bexon and Crownlands)

### *BEST DAY AND TIME FOR COMMUNITY MEETINGS ETC*

- Sundays 4:00 p.m. - preferably early December or January.

### **v) L' ABBAYE/RAVINE POISSON**

The communities of L'Abbaye and Ravine Poisson are officially regarded as two separate entities. The two communities are however integrated socially and economically. The dominant religion in the area is the Seventh Day Adventist to which most community groups are affiliated.

#### *SLBGA*

Ravine Poisson Branch (Albert Weeks, Chairman. Maria Robert, Secretary) Returns one delegate to the Annual Conference of Delegates

### *COMMUNITY GROUP/ORGANIZATIONS*

1. L' Abbaye Primary School (Principal: Mrs Vera Hunte Phone No.: 451-0528 (work) 451-4331 -home, Parent Teacher's Association, Chair Casina Emmanuel, Phone No.: 452-6058)
2. L' Abbaye SDA Church (Elder: Mr Benjamin Emmanuel, Phone No.: 452-6055 Treasurer: Joseph Cadette, Phone No.: 453-7129)

3. Path Finder's Club - SDA (Leader: Maximen Rene, Phone No.: 452-0201)
4. Community Service (Leader: Miss Lucille John, c/o Bexon Supermarket)

*BEST MEDIUM FOR DISSEMINATION OF INFORMATION*

- Through Schools, Churches, Group Leaders, Via the Radio.

*POSSIBLE LOCATIONS FOR COMMUNITY MEETINGS*

- The Seventh Day Adventist Church

*BEST DAY AND TIME FOR COMMUNITY MEETINGS*

- Sunday - 3:00 p.m.

**vi) CICERON**

There appears to be little concern for environmental matters related to watershed management in Ciceron. Unlike many other communities in the pilot area there were no serious effects on the social or economic lives of community members as a result of the events related to the mismanagement of watershed areas.

Several community groups exist and are functioning but the members interest mainly relates to sports and culture. Some division exist in the community between residents who originate from Ciceron and those who were relocated from Conway (in Castries). There is also reported to be some division created by partisan politics.

The existing churches play no real role in community development. At present the most vibrant and influential organization in the community are the Ciceron Seaquills United Sports and Cultural Club and the Ciceron Mother's and Father's Group. These groups do not, however, represent or unite a wide cross section of community members.

*COMMUNITY GROUPS/ORGANIZATION*

1. Ciceron Seaquills United Sports and Cultural Club (President: Dr George Joseph, Vice President: Felix Nathan Phone No.: 452-3676 - work)
2. Ciceron Development Committee (not currently functioning. Deals, inter alia with matters related to disaster preparedness, President: Felix Nathan)
3. Ciceron United Mother's and Father's Group ( Contact person: Josiah Regis)
4. Ciceron Mother's and Father's Group (Contacts: Mrs Victoria Reid, Miss Monica Joseph)
5. Ciceron Methodist Women's Group (Contact person: Angela Hippolyte - Group involved in community projects)
6. Ciceron Avengers (Netball group)
7. Ciceron Lawn Tennis Group (Contact: Mr Felix Nathan)
8. Ciceron Credit Union (Contact Person: Mrs Victoria Reid, Phone No.: 453-7299 - home)

### *POTENTIAL COMMUNITY MOBILIZERS*

1. Mr Felix Nathan (Teacher Ciceron Combined School, Chairman Ciceron Development Committee, Vice President Ciceron Seaquills United Sports and Cultural Club, Chairman Ciceron Lawn Tennis (group))
2. Nurse Niles (Resident Nurse, Ciceron Health Center, Phone No: 453-7934 - work)
3. Mrs Victoria Reid (Involved in Mother's and Father's Group and Credit Union - Tel: 453-7299)

### *CHURCHES*

1. Methodist Church, 2. Baptiste Church, 3. Pentecostal Church (Contact person: Pastor Claude)
4. Gospel Hall

### *SCHOOLS*

1. Ciceron Combined School (Principal: Miss Rosalene Philogene, Phone No.: 452-3676)
2. Also two Pre-schools and a Day care centre

### *BEST MEDIUMS FOR DISSEMINATING INFORMATION:*

- Through the church, - On community notice board at the Community Centre or by writing to individual groups

### *POSSIBLE VENUES FOR COMMUNITY ACTIVITY:*

1. Ciceron Combined School, 2. Ciceron Community Centre, 3. Ciceron Society Hall

### *SUGGESTED TIMES FOR COMMUNITY MEETINGS ETC:*

Weekend days or the evenings on weekdays.

### **vii) TI COLON AND BARRE ST JOSEPH**

There are no organized community groups in Ti Colon. Community members generally are involved in activities of Barre St Joseph and Cul-de-Sac.

### *POTENTIAL COMMUNITY MOBILIZER OR CONTACT PERSONS:*

1. Bernadette Sony ( Pre School Teacher, c/o Barre St Joseph Pre School - Involved in Mother's and Father's Group, Active community member)
2. Peter Emmanuel - resides at Ti Colon (President Chopper's United Sports Club, Cul-de-Sac Phone No.: 451-5570 (home))
3. Black Squad Sports Club - not an active group. (Contact Gregory Williams - lives at Barre St Joseph, c/o Radio Shark Castries, or Fancis Paul, Last Vice President. Tel : 451-5045 (home).)
4. Miss Judith Sony (Miss Shabine), Key figure in the community - President Mother's and Father's Group

### viii) LA CROIX MAINGOT

Discussion at La Croix Maingot were held with a joint group of individuals who were identified as key persons in the community, but who at present have no active representation in community organizations. They can however help to forge links with other community members and to provide information about the community. These individuals are:

1. Joseph Avril - Resides in the community. (Teacher at Anse-La-Raye, also involved in the ENCORE Anse-La-Raye Agricultural project)
2. Mr Peter Eristhee (Teacher La Croix Maingot Combined School)
3. Mr Lucius Prescott (Teacher La Croix Maingot Combined School)

The general feeling of those interviewed was that any programme which would educate or sensitize community members about watershed management / soil conservation and related issues particularly as it relates to agriculture and land use for building construction would be welcomed and appropriate given the area's susceptibility to landslips and the tendency for people to construct their homes on steep hill slopes.

#### *SLBGA*

La Croix Maingot Branch (Andrew Brown, Chairman, Audrey Frederick, Secretary) Returns two delegates to the Annual Conference of Delegates

#### *COMMUNITY GROUPS/ORGANIZATIONS*

1. Catholic Prayer Group (Contact person: Veronica Raymond, resided near La Croix Maingot Health Centre)
2. Youth Group (Contact person: Christine Joseph - regarded as key figure in the community c/o Helen's Mini Mart, La Croix Maingot, Phone No.: 451-4172 - work/home)
3. Diabetic Group c/o La Croix Maingot Health Centre.
4. La Croix Maingot Combined School (PTA President: Julian Alphonse, c/o Mrs Agath Alphonse La Croix Maingot Combined School)

#### *CHURCHES*

La Croix Maingot SDA Church (Elder: Franklin Bray) Tel: 451-5808 (home), 453-0652 (work).

#### *SCHOOL*

La Croix Maingot Combined School (Teacher in charge: Thelma Ferdinand, Tel: 451-4148)

#### *BEST MEDIUMS FOR DISSEMINATION INFORMATION:*

- through Schools, Churches and Health Centers, via a mobile public address system or by radio and television

*POSSIBLE VENUE FOR COMMUNITY ACTIVITIES:*

The old School at La Croix Maingot

*BEST DAYS/TIMES FOR COMMUNITY MEETINGS ETC:*

Evenings of Sunday, Monday and Tuesday

**ix) BARRE DUCHAUSEE**

*EXISTING COMMUNITY GROUPS*

1. CDC Mother's and Father's Group, (Contact: Hendrickson Joseph, c/o Wyndham Hotel)
2. Dynamic Youth ( Contact Dona Charlemagne, Student St Joseph's Convent)

**x) CUL-DE-SAC AND SOUCIS**

Cul-de-Sac and Soucis are officially regarded as separate communities, within the area however the residents use the two names interchangeably. The residents are united by common cultural, sporting and other community interests

*COMMUNITY GROUPS MOTHER'S AND FATHER'S GROUP*

1. Cul-de-Sac Mother's and Father's Group (Contact: Julianita Pierre, c/o La Clery Health Center Resides at Soucis, Phone No.: 453-0695 - home, 452-4303 - work)
2. Dragon 17 (President Victor Bonnette (Zex) Key community figure and community mobilizer Phone No.: 453-0695 - home)
3. Chopper's United (Contact: Peter Emmanuel c/o Government Printery)
4. Diabetic Group (Contact: Veronica Sylvester)

*SCHOOL*

George Charles Secondary School, Cul-de-Sac (Principal: Mr Bonaventure Jn Baptiste  
Phone No. 453-0252/452-7231

*POSSIBLE VENUE FOR COMMUNITY MEETING ETC:*

- Cul-de-Sac Recreation Center

**xi) BARRE DENIS**

*COMMUNITY GROUP/ORGANIZATIONS*

1. Le Jeunes de Barre Denis (Contact: Theodora Henry, c/o Central Library, Castries Phone No.: 452-2875/7053 (work)
2. Active Sports Club (Magella Prospere PRO, c/o North American Assembly Factory Odsan)

3. Barre Denis United Mother's and Father's Group (Leader: Julietta Marius, Tel: 451-5197 - home, Member: Marcia Edmund Phone No.: 451-5134 -home)

4. Catholic Prayer Group and Choir, Catholic Chapel, Barre Denis (Contact: Audrey Prescott - prayer group, Fr. Lambert St Rose (priest))

## xii) GUESNEAU

### *COMMUNITY GROUPS/ORGANIZATIONS*

1. Guesneau Evangelical Church (Contacts: Mr Joe Valcent, Miss Carol Valcent, Forestiere School, Phone No.: 452-2233 (work))

### *POTENTIAL CONTACT PERSONS*

1. Miss Euginia Greg (Co-ordinator - Day Care Centre, Ti Rocher, Phone No.: 451-9308)

2. Ti Rocher Combined School (Principal: Mrs Judy Johannes, Phone No.: 452-1587)

## xiii) FORESTIERE

### *SLBGA*

Forestiere Branch (Denis Jawahir, Chairman, Mr Canicius Mark, Field Officer, Phone No.: 450-5993 - home, 452-2551 - work) Returns two delegates to the Annual Conference of Delegates

### *COMMUNITY GROUPS/ORGANIZATIONS*

1. Path Finder's Club (Leader: Mrs Julietta Biroo, Phone No.: 451-8968)

2. Adult Literary Group (Facilitator: Mrs Marie Malaykhan, Phone No.: 451-8635)

### *SCHOOL*

Forestiere Methodist Primary School (Principal: Mr Iram Isaac, Phone No.: 452-2233 (school) 452-1117 (home))

### *CHURCHES*

1. Roman Catholic Church, (Celebrant - Parish Priest -Marchand Phone No. - 452-3724 Church Leader - Mrs Marie Malaykha). 2. Methodist Church (Steward: Rufus Khodra, Phone No.: 451-6129 - home, 453-2367 -work). 3. Seventh Day Adventist Church (Elder: John Barley Phone No.: 450-5739). 4. Community Service - SDA Church Group (Contact Mrs Lucia Auguste). 5. Gospel Hall (Pastor: Webster Gajadhar Phone No.: 453-0300)

### *POTENTIAL COMMUNITY MOBILIZERS*

1. Mrs Marie Malaykhan - Phone No.: 451-8635

2. Mr Rufus Khodra (Principal Assistant Secretary, Ministry of Education, Culture and Labour)
3. Mr and Mrs Anthony Khodra - Phone No.: 453-0445
4. Guy Joseph - Phone No.: 451-8820

*BEST MEDIUM FOR DISSEMINATION OF INFORMATION*

- School, Churches, Public Address Speaking System, Influential Persons - Mr Anthony Khodra and Mrs Marie Malaykhan.

*POSSIBLE VENUE FOR COMMUNITY ACTIVITIES*

- The school

*SUGGESTED TIME FOR COMMUNITY MEETINGS*

- Sunday - 4:00 p.m.

**xiv) TROIS PITONS, DU BROSSAY, DEGLOS**

These communities are very interrelated in various social and economic activities. Trois Pitons appears to be the centre of the three in terms of activities. These communities depend on Ti Rocher, Bexon, Odsan for educational, health, religious (R.C.) and sporting facilities. Deglos is almost a completely farm area, with few residents.

*COMMUNITY GROUPS/ORGANIZATIONS*

The following Trois Pitons group serves all the communities.

Mother's and Father's Group (Leader: Miss Christella Remy, Mr Jerry Jn Baptiste and Mr Clement)

*CHURCHES*

1. Church of God (Minister: Mr Remy Joseph, Phone No.: 452-4647).
2. Seventh Day Adventist (Leader: Mrs Dina Felix, c/o Day Care Centre, Ti Rocher, Phone No.: 451-9308)

*POTENTIAL COMMUNITY MOBILIZERS*

1. Cecil Alexander and Philippa Alexander, Phone No.: 452-5716
2. Miss Rosalie Daniel, Phone No.: 451-6120 (home) 452-5479 (work)
3. Mr Jules St Jules - Phone No.: 451-0560
4. Maggie - Phone No.: 451-0504

*BEST MEDIUM FOR DISSEMINATION OF INFORMATION*

- Through Public address system and Leaders / Influential Persons

*POSSIBLE VENUES FOR COMMUNITY MEETINGS*

Odsan Boxing Plant

*SUGGESTED DAY AND TIME FOR COMMUNITY MEETINGS*

Mondays - 5:00 p.m.

**xv) MORNE FORTUNE AND GOODLANDS**

Morne Fortune and Goodlands are suburban areas which mainly fulfil a residential function. There is no real sense of community as exists in other areas. Most residents utilize the services and facilities available in the neighboring communities. Residents appear to be socially divided and there is no one organization or group which is representative of a wide cross section of the residents.

**GOODLANDS, CONTACT PERSONS**

1. Mr Leonard Leonce - Phone No.: 453-1766, (leader of an informal group concerned with the upkeep of the upper Goodlands area. The concern of this group is mainly for the maintenance of infrastructure such as roads).
2. La Rose Group (Contact: Lisa, Phone No.: 452-4197)
3. Mr Abel C Ghirawoo - Phone No.: 453-2676
4. Mrs Catherine Albert (Principal Odsan School Phone No.: 453-0721 -work)
5. Mr E Eudovic - Eudovic Art Studio, Phone No.: 452-2747
6. Mr Timothy Charles - Phone No.: 452-7519

**MORNE FORTUNE COMMUNITY ORGANIZATIONS/GROUPS**

1. Emmeralds Sports Club (Contact: J Mitchel, c/o Central Library)
2. Morne Fortune Planning Committee, c/o St Lucia National Trust (Contact: Charmaine Nathaniel, Phone No.: 452-5005 - work)
3. Catholic Religious Groups(eg. Youth, Choir, Brownies, Cub Scouts etc.,)  
c/o St Benedict's Center Contact: Fr Clarence Watrin.

**SECTION B**

**DRAFT WATERSHED  
AND ENVIRONMENTAL  
MANAGEMENT PLAN**



## Executive Summary

St. Lucia's land surface is rugged with mountain peaks and deeply incised river channels. The entire island is topographically segregated into 37 watersheds of which four (Cul-de-Sac, Cannelles, Roseau, Dennery) account for more than 60% of St. Lucia's good agricultural land. Human settlements, social and economic infrastructure, and therefore the core of the economy is located within watershed boundaries. It is therefore imperative to view any attempt into improving current management of the island watersheds as an approach towards general social and economic sustainability of the entire island.

Although it is not possible to prove with scientific certainty the direct relationship between the disastrous consequences of Tropical Storm Debbie or similar natural hazards and the human impact on land-use and environmental management, experience and long-term observation confirm that exploitation of natural resources and general watershed mismanagement are responsible for aggravating decisively the dimension of social and economic losses, in both, the immediate and long-term basis. In order to work out a feasible action plan for watershed management it is imperative to explore and define as accurately as possible the main constraints currently hampering the efforts towards sound and sustainable watershed management.

The on-going destruction of forest cover caused by the expansion of banana cultivation onto forested lands, is dramatically altering the island's hydrology. The predominant importance of banana production for agriculture and St. Lucia's economy as a whole can easily be highlighted by just one economic indicator. In 1995 the total value of banana exports amounted to EC\$ 126.4 million, i.e. 44% of total export earnings. On a conservative basis roughly 1 in 3 inhabitants of St. Lucia is economically related to the banana industry and respective satellite sub-sectors. The importance of this "green gold" commodity to St. Lucia's economy has for years disguised the fact that the natural and physical environment to support banana production is becoming increasingly marginal. Unfortunately, this has been realized only since financial profitability of banana cultivation has started to decline. Micro-economic analysis reveals that under the current monetary input/output relationship banana production is marginally viable. However, in order to draw the desirable attention to the critical issue of the longer term economic sustainability of banana production in St. Lucia, the profitability analysis has to be viewed with the global trade environment.

The medium term future of the banana industry in St. Lucia will be determined by external factors impacting on the quota level accorded to dollar producing countries, and prices as well as the outcome of the petition filed against the European Union at the World Trade Organization by the American Government which alleges that present marketing arrangements for bananas in the European Market are discriminatory. It is not a secret that the guaranteed banana market will remain for a limited period only (2000 or 2003) after which St. Lucia and the Windward Islands will have to compete on equal terms with larger producers whose cost of production are lower and supplied quality better. Unless farmers can cut costs dramatically, which seems to be almost impossible at the already low input levels, and increase quality of produce, the industry will not be able to survive, with catastrophic effects on the island's economy and social stability.

It can't be overemphasized enough that potential social unrest as a consequence of a further substantial decline in banana profitability/prices (on a medium term basis, and particularly after 2002), would have an immediate and even more disastrous effect on the stability of the second foot of the economy, i.e. the tourism industry. As the development of the banana world market is clearly transparent, St. Lucia has no other choice but to



diversify the economy and seek with all resources available to gradually reduce banana dependency. In order to maintain social stability in the long run and soften the side-effects of economic transformation, immediate and determined action is needed.

As a consequence to the above, it is certain that the current agricultural land-use pattern and in its wake the economic base of most watersheds in St. Lucia will have to be transformed in order to keep up with the challenge of long-term sustainable economic growth, social stability and environmental protection. However, agricultural land-use enforcement as part of watershed management is currently economically and socially unacceptable. With an estimated average unemployment rate of 20% island-wide and with peaks as high as 35% in some parts of the country it becomes evident that the employment strategy must be to at least maintain current levels of occupation. It is in this light that any approach towards environmentally sound watershed management will have to incorporate economically and socially acceptable instruments for agricultural development. The transformation of the economy can only be achieved with agriculture and not against it.

Although awareness towards the need for diversification had developed in the 1980s very little has been achieved *de facto* on a large scale. When asked about their general motivation to gradually diversifying from banana to other crops, the unanimous answer of farmers is not surprising. On the one hand, farmers still believe that banana prices and returns will go up again. On the other hand, they don't see any realistic possibility (crop) to seriously engage in alternative commodities. The predominant reason is the lack of available markets and of ensured sales of crops produced. Most farmers declared that in the case of banana becoming even more unprofitable, they would rather leave their banana fields idle than engage (invest) in a crop with doubtful prospects.

In view of the paramount importance and urgency of the matter, it is recommended that a National Agricultural Diversification and Marketing Campaign be established at the institutional level of the Prime Minister's Office. It should comprise the most powerful stakeholders in the economy (private and public sector). This forum would have to investigate pragmatic ways to facilitate and stimulate private investment for the agriculture related economic transformation of the economy. The crucial issue of agricultural diversification in St. Lucia goes far beyond the mandate of the Ministry of Agriculture but impacts directly on trade, commerce, industry, transport and tourism. The ultimate objective would be to attract business and commerce in order to set up direct market linkages between the producer (farmer) and the market agent or market. This seems to be one of the few possibilities to induce the farmer to seriously engage in alternative crops. Equally important is to establish private sector marketing mechanisms such as contract farming, crop advisory service, provision of inputs and crop-credit availability, crop transport and processing arrangements.

Furthermore, there is urgent need to review the agricultural advisory system from the point of view of operational efficiency, staff needs (in numbers and in terms of training) and financial requirements. In this context there is an urgent need to train extension staff in the areas of soil conservation, drainage and the cultivation aspects of non-traditional crops. In addition, there is a need to embark as soon as possible on a programme of on-farm production trials, for tree crops in particular. This would include appropriate soil erosion prevention and drainage methods. A properly implemented on-farm trial programme combined with enhancing the potential marketing environment seem to be essential for any attempt towards agricultural diversification. On a long term basis a transformation of agricultural extension into a private sector and commodity driven system would have to be considered seriously.

The above recommended immediate action priorities call for the active responsibility of the government and of other political/ economic stakeholders from the private sector. However, in order to gradually reverse the current situation of environmental degradation and economic stagnation with respect to the resource base of the island's watersheds, the issue of wider social responsibility has to be tackled pragmatically. Peoples participation and community initiatives are increasingly recognized as indispensable parts of sustainable management of natural resources. Experience suggests that the benefits of environmental management are more likely to be achieved when the ultimate clients are actively involved in designing and implementing the work necessary. It is important to make people understand that watershed management in St. Lucia is certainly not to be seen as an activity of ecologically minded naturalists but as a paramount necessity in order to safeguard and sustain the economic well-being of the people. In this context the most serious issue in watershed management is how to prevent further expansion of cultivation into St. Lucia's remaining forest areas and persuade the farmers cultivating steep hillsides to give up practices which cause soil erosion and subsequent flash floods, river siltation, crop and properties' damage and deterioration of land and water quality in downstream areas. Furthermore, clearing works of drains need the active involvement of the local population and can only be effective if coordinated with landowners work on-farm. This will only be achieved if based on active community participation and transfer of responsibility to the local strata.

In this respect a Community Participation Programme in Watershed Management is proposed. The trial-programme will be located in the pilot watershed of the Dennery river. However, the intention is to gradually replicate the programme for all the main watersheds of St. Lucia on a medium term basis, possibly within the next five years (1997-2001) and as part of project implementation.

In view of the need for continuity it is important to institutionalize the participatory approach by setting up an appropriate group to implement the programme and to streamline all related activities on a community level. So-called local *Watershed Management Action Force* (WMAF) groups will be established as a means of ensuring community participation in watershed management. The WMAFs will be responsible for land conservation, drainage and other watershed management related activities within one watershed or 2 or more small watersheds. The composition of an WMAF, would have to be adapted according to the socio-demographic characteristics of the respective watershed. It is important to include the most influential local personalities into the Action Force. The core responsibilities of the WMAF would include:

- (a.) implementation of/participation in land conservation programmes to prevent erosion and subsequent river siltation; provision of technical assistance to adopt agricultural practices less damaging to the flow of rivers;
- (b.) cleaning and de-blocking of main and secondary drains and culverts;
- (c.) monitoring of drainage system/soil movements and organization of works to be implemented;
- (d.) communicating needs for capital-intensive works to be carried out by higher authorities;
- (e.) workshops/educational programmes and public awareness campaigns with respect to proper watershed management (including solid waste management);
- (f.) river bank protection;
- (g.) reforestation and other forestry activities;
- (h.) promotion of improved housing design, road infrastructure, and appropriate in-house water storage facilities to reduce risks of damage by run-off and flooding etc;
- (i.) water conservation;

- (j.) water abstraction;
- (k.) water quality issues.

It is important to involve farmers and the population living in the watershed in the clearing of rivers and drains, especially shortly before and during the rainy season. The WMAF would have the task to organize river and intermediate drain clearing activities, as well as the removal of debris and garbage blocking the down-flow. Where necessary, this would include aspects of solid waste disposal/collection as well as repair and construction of drains. The execution of these works would be based on the mobilization of community clearing campaigns and, if necessary, hired labour. In addition, the Action Force would act as a catalyst with respect to whatever local issue relating to sound watershed management. This would include

- (a.) the mediation in local disputes such as the responsibility of landowners in the clearing of drains,
- (b.) the swapping of eroded land for reforestation/suitable Crown land,
- (c.) inappropriate/illegal (feeder) road construction.
- (d.) the promotion of alternative crops and information on markets and marketing,

The ultimate goal of the community participation programme is to form the basis for long-term sustainability of environmental and watershed management in the *heads of the persons*. A continuous effort in educating and training people is indispensable to transform watershed management from a "highly expensive emergency programme" to a natural process deeply rooted in comprehension and personal responsibility of the individual towards the environment and the community as a whole.

## **1. Introduction**

This report summarizes the preliminary findings and recommendations by the Socio-Economist Consultant of the project. Later on, this input will be incorporated into the final project report. As this document focuses strictly on the socio-economic dimension of watershed management, technical or scientific aspects related to environmental degradation, land conservation, drainage, land-use etc. are not included but will form part of the final project report. The general concept on which the socio-economic input is built and which forms the backbone of the recommended approach are basic facts of St. Lucia's topography.

St. Lucia's land surface is rugged with mountain peaks and deeply incised river channels. Almost half the country has slopes of greater than 20% and more than 80% of the island has slopes over 10%. This indicates that there is a need to apply soil conservation measures of one type or another to the remaining 90%. A general restriction for open-land cultivation is commonly considered at about 20% slope, but, because of the limited flat land available, cultivation is carried out on lands with steeper slope. The entire island is topographically segregated into 37 watersheds of which four (Cul-de-Sac, Cannelles, Roseau, Dennery) account for more than 60% of St. Lucia's good agricultural land (GIS, 1988). Finally, human settlements, social and economic infrastructure, and therefore the core of the economy is located within watershed boundaries.

It is therefore imperative to view any attempt into improving current management of the island watersheds as an approach towards general social and economic sustainability of the entire island. In order to deal with this vital basic concept, this report goes beyond its original mandate and TOR.

## **2. The Starting Point: Economic Impact of Tropical Storm Debbie**

On September 10, 1994, Tropical Storm Debbie struck the island of St. Lucia. Incessant rain was reported as high as 15 inches over a 10 hour period. This level of precipitation contrasted sharply with the average of 12 inches for the month of September in the previous five years. Moreover, heavy rains in the preceding weeks had already resulted in extensive soil saturation. The continuous intensive rainfall led to widespread run-off, flooding, and massive landslides contributing to the washing away of soil, trees and crops and contributing to the formation of debris which choked rivers and damaged adjoining farmland. As a consequence, the storm resulted in about 600 persons having to be placed in emergency shelters, extensive inundation of agricultural land, disruption of electricity supply and telephone services, road and airport closures, and unavailability of tap water to the entire population. Furthermore, four deaths and several casualties were reported. The heaviest damage occurred in the areas of Dennery, Anse La Raye and Soufriere.

The agricultural sector bore the brunt of the damage. Valley areas were most severely affected due to flooding and deposition of materials (soil, debris etc.) stripped from along the river banks or deriving from the steep hillsides in the watershed. More than 400 severe landslides occurred all over the island but especially on cultivated land in the steep hilly areas. Apart from the evident physical damage to crops and infrastructure, non-apparent losses included leaching/washing away of residual fertilizers and the consequences of continuous waterlogging. Estimates by the MALF&F reveal that as much as 10% of productive land had been lost due to land slip, severe erosion, and river re-location.

Early estimates of losses to the agricultural sector were high. Figures were collected by MALF&F by asking farmers, but as crop insurance (bananas) and compensation were likely to be involved, inflated figures resulted. They were:

banana sector	EC \$ 76.6 m (58% of acreage)
fruit and vegetables	EC \$ 25.0 m
livestock	EC \$ 17.0 m
tree crops	EC \$ 21.3 m
<b>total</b>	<b>EC \$ 139.9 m (13-15% of GDP)</b>

Estimates from Geest for 1995 (April 1995) predicted banana exports of 10 500 - 115 000 tons, a shortfall of 12 000 - 22 000 tons. Half of this they attributed to a drought following TSD, and their calculations showed that damage caused by TSD was in the range of 8-30 per cent of acreage.

A similar overestimation may well be the case for other agricultural sector losses.

Losses in forestry were recorded in both natural and planted forests, and resulted mainly due to landslip. In fisheries, major loss was observed in terms of damage to fishing pots and facilities (buildings, boats etc.). Moreover, sediment flowing into the sea was deposited on coral reefs and marine fisheries habitats. Apart from the partial or complete destruction of crops, the siltation of drains and fields left strewn with debris, substantial damage to farming and forest infrastructure contributed to the total loss account. The economic costs of lost soil and forest resources, permanently damaged valley farmland, affected coral reefs (as well in relation to returns from tourism) and reduced fish catches have not been evaluated. In the livestock sector losses occurred through drowning of stock and destruction of pens located in the flooded areas.

Costs for the rehabilitation and reconstruction of water systems, bridges, roads and buildings/houses, i.e. general social and economic infrastructure were estimated at about EC\$ 50-60 million. Flood water and siltation caused extensive damage to all water intakes, precluding WASA from using its water catchments for water distribution to the public. The rehabilitation works comprised mainly the replacement of damaged pipelines and restoration of water intakes. The rehabilitation works for desilting and river training accounted for the bulk of the EC\$ 14 million spent under Phase I of the Saint Lucia Watershed and Environmental Management Project. The country's main reservoir project (Roseau Dam) was extensively damaged. Six bridges were totally swept away by the flood waters, while four others suffered significant damage. While the surface of most roads remained unaffected by the storm, landslides resulted in the collapse of road shoulders. Two main arteries, the Barre De L'Isle and the West Coast Road, collapsed in parts due to land slip. However, most of the road damage was recorded on feeder roads which adversely affected the transportation of agricultural produce. The housing sector together with community support facilities suffered severely. About 233 houses were damaged of which about 100 were rendered uninhabitable. No more recent estimates were available to the Consultants.

Total direct losses from agriculture and infrastructure were high, and implications for the economy was serious. However, the above damage inflicted by the storm affected the economy not only by direct income loss of the private sector and the burden of enormous rehabilitation costs for the public sector but led inevitably to reduced tax income for the Government, significant loss of foreign earnings, food shortages, increased food import bill, as well as adverse social hardships.

It is not possible to prove with scientific certainty the direct relation between the disastrous consequences of Tropical Storm Debbie or similar natural hazards and the human impact on land-use and environmental management. However, experience and observation of similar incidents elsewhere in the world confirm that over-exploitation of natural resources and general watershed mis-management are responsible for aggravating decisively the dimension of social and economic losses, in both the short and long-term. The most crucial socio-economic aspects with respect to sound watershed management in St. Lucia's are analyzed below.

### **3. Critical Socio-Economic Features for Watershed Management**

It is important to point out that the following elaboration is based on an intensive reconnaissance survey during which discussions were held with farmers, fishermen, non-farming residents, children, government officers and other people. In addition secondary literature was reviewed and discussions held with individuals, organizations, and several governmental departments operating on specific projects/programmes or island-wide.

In order to work out a feasible action plan for watershed management it is imperative to explore and define as accurately as possible the main constraints currently hampering the efforts towards sound and sustainable watershed management. Although there may be an indefinite number of socio-economic factors inhibiting watershed development and socio-economic transformation, the need for immediate action and practicability of approaches indicates that prioritization must be the ruling parameter for decision making. In the light of future prospects in watershed management three broad socio-economic areas became apparent as being strategically the most important ones, i.e. (i.) people's perception on natural hazards and their causes, (ii) the interpretation of the current and future role of banana cultivation, and (iii) the impediments hampering the socio-economic transformation needed to ensure long-term sustainability in watershed management.

#### **3.1 People's Perception on Land Conservation and Drainage**

Soil erosion represents one of the main problems in agriculture worldwide. Poor soil and water management, intensive production on young and vulnerable soils, and deforestation undermine the capacity of soils and create obstacles to increased crop, feed, and fuel production. In the past, most natural resources were considered common property, providing a productive base for crops and other basic needs. Today however, the continued dependence by an increasing number of individuals on a finite natural resource base results in the over-exploitation of the resources and a serious loss in their productivity. Furthermore, soil erosion and water run-off also increase costs to rural (agricultural) and urban communities through devastating floods and landslides (see above).

People in St. Lucia are generally aware of the potential danger of torrential rainfall and respective floodings. The reconnaissance survey revealed that asked about the **causes for the devastating flooding** resulting from Tropical Storm Debbie, the most frequent answer was *cutting of the forest* (deforestation). Not even one person mentioned agricultural land use as such. However, some farmers expressed the opinion that *god is responsible for sending the heavy rains and that mankind has no possibility to control the consequences, such as flooding and landslides*. This "explanation" is quite sensible considering the fact that people could hardly recall any similar devastating (flood) event during their entire lifetime. Furthermore, the rainfall resulting from TSD is generally believed to have been of the intensity which occurs once every 50 years.

With respect to **soil erosion**, the general understanding about the direct relationship between topsoil run-off on sloping/steep land and flooding (siltation/blockage of rivers and main drains) in the downstream areas/plains was not well understood. Nevertheless, once explained the farmers agreed that *this cause/effect explanation could be true*. Generally, farmers were not very much aware of the soil (silt) washed downstream but were almost exclusively concerned about *the masses of water that cause damage to crops, roads, bridges and houses*. In this respect the incidence of surface erosion as a consequence of flooding on plains was seen as possibly the main problem by farmers cultivating on flood-prone areas. In fact, "erosion" was normally associated with surface washing of land rather

than with top-soil run-off from steep land. Hillside farmer were much less concerned about the issue of land conservation and flooding than those cultivating in down-stream areas. A few fishermen (Dennerly) observed the incidence of "dead bottom fish" after TSD. This was due to the silt washed into the sea and suffocating the fish.

Also the risk of **landslides** deriving from heavy rainfall was considered only by some farmers in areas widely known for landslide hazards (e.g. Marc, Ravine Poisson). Here again, the impact of land use, may it be through cultivation practices, construction of (feeder) roads or enlargement of human settlements were not seen as important factors contributing to the aggravation of flood damage or land degradation. Especially the aspect of banana cultivation with its shallow rooting habit was, intentionally or not, never blamed as contributing to the problems of land degradation and drainage. The fact that flooding and heavy rains contribute substantially to the inefficiency of the fertilizer applied, especially on steep hillsides, was not always known by the farmers interviewed.

Exclusively the **need for drainage** was widely acknowledged and all farmers interviewed drained their field by maintaining simple in field drains. However, most of these drains, especially those in the hillsides, were not placed along the contour line and were not properly maintained. Reasons mentioned by farmers for the noticed negligence in drain maintenance were *expensive labour force* and *lack of technical knowledge*. All farmers asked for assistance in proper drainage on-farm. In this context disputes between neighbouring farms concerning the responsibility of clearing blocked drains leading to the main stream, was reported frequently. Finally, village residents mostly acknowledged the need for educating people not to dump waste and garbage into drains and rivers.

Summarizing, it has become apparent that the general perception on the issue of land conservation and drainage by farmers and by a large part of the residents in the watersheds is far from being adequate. The most critical aspects of this analysis are:

- Soil erosion as such is not realized as a problem;
- Flooding and landslides are often characterized as being unavoidable;
- The impact of land-use is viewed mostly from the angle of de-forestation only;
- Farmers lack the knowledge of suitable soil erosion prevention practices and proper drainage of fields (i.e. insufficient technical advisory service);
- Residents in the flood plains/flood-prone areas are aware of the dangers associated with flooding but mostly blame the government for not maintaining the main drains properly (incl. river bank stabilization and river training/ desilting);

The on-going destruction of forest cover which has coincided with the expansion banana cultivation onto erstwhile forested lands, is dramatically altering the island's hydrology. In conjunction with high sedimentation rates resulting from accelerated soil erosion in unprotected upland areas, drainage ditches fill, culverts clog, streams overflow, and flooding has now become a major problem in many prime valley bottom agricultural areas and in coastal and urban areas alike. The importance of this "green gold" for St. Lucia's economy has for years disguised the fact that the natural and physical environment to support banana production is becoming increasingly marginal. Unfortunately, realization has come only since financial profitability of banana cultivation has started to decline.

### 3.2 The Apparent Profitability and the Risky Path of Banana Dominance

The predominant importance of banana production for the economy in St. Lucia can easily be highlighted by just one economic indicator. **In 1995 the total value of banana exports amounted to EC\$ 126.4 million, i.e. 44% of total export earnings.** The industry is well structured, advice to growers and buying being undertaken by the SLBGA and export and marketing in the UK by WINBAN/GEEST (now WIBDECO). Prices are predictable and relatively stable, shipments are made weekly and payment to farmers through SLBGA are also weekly. Farmers receive around 60% of SLBGA receipts. When referring to the economic indicators of what is generally called the *banana sector*, the real importance of this commodity for employment and economic performance of the country is only partially revealed. Any analysis of the banana sector has also to include the related economic activities which are non-agricultural by definition. Excluding public and parastatal services (MALF&F, SLBGA, etc.), the sub-sectors of agricultural input supply and commercialization, e.g. fertilizer, pesticides, packaging, transportation, road construction, and port handling depend to a certain extent directly on the production and export of banana. Furthermore, the income generated (directly and through taxes, customs duties, and handling charges) contributes significantly to the purchasing power of the country's economy and to consumption. In general, this has a direct beneficial effect on the performance of all other sectors of the economy.

Being the dominant agricultural commodity in St. Lucia, banana cultivation is by far the most important farming activity. According to unofficial estimates, banana cultivation amounts to around 15,000 acres compared to the island's total cultivated area of 39,000 acres which include temporary and permanent crops as well as fallow. However, the preliminary results of the 1996 Agricultural Census estimate the area under banana at about 19,000 acres or almost 50% of the area under cultivation. Based on an average of 5.5 members per household and around 5200 registered banana farmers island-wide (SLBGA), the total number of people depending fully or partially on banana cultivation can be estimated at around 29,000. When including an average of 0.25 permanent paid farm worker per acre, the total population related to banana "cultivation" only, i.e. excluding other sub-sectors of the banana industry (see above) totals 33,000 or 22% of the island's population. One can estimate that on a conservative basis roughly **1 in 3 inhabitants of St. Lucia is economically related to the banana industry** as a whole, i.e. including the aforementioned satellite sub-sectors.

From the farming point of view, bananas are popular for a number of reasons. The crop provides a regular income, both for farmers and their workers, throughout the year whereas many other crops notably tree crops only produce a pay-off following a lag period during which labour and other inputs must be paid for. It is the only crop with an extensive export marketing system and a guaranteed market. For this reason, access to credit, either through SLBGA or local banks, is good. St. Lucia as the other islands of the Caribbean, is periodically affected by severe storms and hurricanes and banana, as a tall, shallow-rooted plant with a weak aerial structure is quite easily blown over or snapped, but is relatively easy to reestablish by ratooning and vegetative propagation with little or no land preparation. Bananas are largely immune from the ravage of theft. This is because they are shipped in the unripe state and the varieties grown are not well-suited to cooking. Furthermore, the abundance of fruit renders any losses insignificant in contrast to other crops, where theft is probably the largest category of loss.

According to the reconnaissance survey, the average farm size for banana producers within the islands' watersheds ranges between 3-8 acres. According to a WINBAN (1993) survey carried out in 1993, 65% of all banana farmers in St. Lucia depend completely on bananas as income source and another 30% derive half and more of their total income from banana cultivation. The larger the size of the farm the stronger is

the reliance on banana as a mono-crop. However, the reconnaissance exercise in the two pilot watersheds revealed that although being by far the most important income source, the household's total income was mostly composed of a variety of contributions, such as non-agricultural permanent/seasonal employment of wives/women or of other household members, consumption/sale of produced food crops (mostly root provisions) and fruits (especially oranges), remittances, part-time fishing, and other. The field survey revealed further that farm-income was used almost exclusively to cover household expenses and to pay for basic agricultural inputs. The fact that **very few resources are used for farm investments** (for farm development) may be interpreted twofold. Either the income is too small to allow for investment or farm improvement is not of high priority vis-à-vis consumption.

The reconnaissance survey and the simple production analysis presented at Table 3.1, show that banana production is still profitable. However, yields range from 5.5 tons to 12 tons, and those farmers using most inputs and with a high cost of production would have a correspondingly high output and a greater margin of profit, and conversely those using low inputs would have a low cost (perhaps 0.22 cents) and low yield, but still produce a profit. The most significant factor governing yield is the amount of inputs used, with soils having a much lesser affect and farm size no effect. Of total receipts to SLBGA, some 40% is retained to cover, marketing, transport, aerial leaf spot control, boxes, advice and a small margin. SLBGA deduct a further 6 cents from the farmer, and this is put into an account, against which he can draw inputs. If the farmer buys inputs from a source other than the BGA, he can draw cash from his account. The costs shown in the table do not therefore include any provision for working capital, and no fixed costs (depreciation on equipment, establishment costs, depreciation on pick-up etc) have been shown.

Profits from banana cultivation have fallen over the last four years. The real dimension of this has been masked by:

- a lack of understanding of the SLBGA cess mechanism, and deductions for inputs
- the broad base from which household income is derived
- bananas reputation as a strong cash crop.

However, to get a better perspective on the long term sustainability of the banana industry, it is necessary to view the St. Lucia situation in the context of the global market.

The EU banana market is going through its most difficult period for decades. The banana trade is much more volatile now than previously. Absorbing between 90% and 97% of the Windward islands bananas, the U.K. market with its lucrative and stable supermarket sector, probably one of the best developed and sophisticated in the EU, has become a major target for market predators. The market has been hit by excessive supplies from dollar banana producing countries and by a levelling off of demand. In the EU banana trading has become a buyers market where low grade/quality fruit is not only discounted, it just cannot find buyers. Other ACP states were able to respond by raising quality, but in St. Lucia the trend was in the opposite direction. With the exception of 1994 when due to Hurricanes, droughts and tropical storm the banana production of the Windward islands was substantially reduced, there is a clear trend towards declining banana prices. By December 1996 the Windwards' FOT price (green price) was down to Pound Sterling 360/ton compared to Pound Sterling 450/ton a year before. Crucial to the short-term survival of the Windward island banana industry, and the only instrument left apart from the necessary reduction of unit costs of production, is improving the current poor fruit quality.

Since the Lome Convention was signed between the EC and ACP countries in 1976, St. Lucia has been benefiting from the related **preferential trade agreement**. Entirely based on the anticipated prospects and the confidence in the subsidized access to a guaranteed buyer's market, St. Lucia's agriculture transformed rapidly into a banana dominated single commodity sector. The banana industry developed rapidly into the economy's driving force. The year 1993 was a momentous one in the history of the banana industries of St. Lucia and ACP banana exporting countries. A new banana regime was implemented by the single European Market in July 1993. As a consequence, banana exports from St. Lucia to its major market, the United Kingdom, changed from unlimited duty-free access to a situation of quantitative restrictions to the tune of 127,000 tones per year with any additional exports being subject to duty. Since then and in the wake of the General Agreement on Tariffs and Trade (GATT), it is becoming more and more apparent that the general belief in free-trading as the main instrument to develop sustainable markets will leave the European Commission little room for manoeuvre in order to restrict the import of the cheaper Dollar bananas (non-ACP) and will therefore gradually lead to a reduction and ultimately abolition of major multilateral or bilateral trade agreements. The World Bank predicted in 1993 that the ACP producers would on a medium term basis lose half of their market in a free-trade regime

With little scope to cut input costs, survival of the banana industry in St. Lucia will increasingly depend on quality and a better access to markets. Some restructuring of the industry is likely, with acreage reduced and confined to the most suited areas and emphasis put on higher yields and better quality. The new "Certified Grower" scheme and recent direct negotiations with some of UK's major supermarkets are aimed at achieving this, but success is by no means guaranteed.

The medium term future of the banana industry in St. Lucia will therefore be determined by external factors impacting on the quota level accorded to dollar producing countries, and prices as well as the outcome of the petition filed against the European Union at the World Trade Organization by the American Government which alleges that present marketing arrangements for bananas in the European Market are discriminatory. It is not a secret that the guaranteed banana market will remain for a limited period only (2000 or 2003) after which St. Lucia and the Windward Islands will have to compete on equal terms with larger producers whose cost of production are lower and supplied quality better.

**It can't be overemphasized enough that potential social unrest as a consequence of a further substantial decline in banana profitability/prices (on a medium term basis, and particularly after 2002), would have an immediate and even more disastrous effect on the stability of the second foot of the economy, i.e. the tourism industry. As the development on the banana world market is clearly transparent, St. Lucia has no other choice but to diversify the economy and seek with all resources available to gradually reduce banana dependency. In order to maintain social stability on the long run and soften the side-effects of economic transformation, immediate and determined action is needed even at high political and social costs.**

**Table 3.1: Banana Production Model**

Activity Budget: Banana (1 acre)		banana price		ECS/lb	0.32
Output		Unit	Unit Cost(ES\$)	Quantity	Total (ES\$)
Bananas		tons	705.60	7.00	4939.20
<b>Total Return</b>					<b>4939.20</b>
<b>Cost of Production (variable costs only)</b>					
NPK (fertilizer)		bag	45.00	10.00	450.00
SA (fertilizer)		bag	45.00	1.00	45.00
Lime		bag	20.00	3.00	60.00
Vydate (nematicide)		gallon	105.00	1.00	105.00
Mocap (nematicide)		15 kg	108.00	0.50	54.00
Gramoxone (weedicide)		lit	12.00	5.00	60.00
Reglone (weedicide)		lit	16.00	1.00	16.00
Round-up (weedicide)		lit	33.00	2.00	66.00
Sleeving diothrene		roll(30kg)	171.00	1.00	171.00
Twine		roll	31.00	1.00	31.00
Harvesting materials		LS	100.00	1.00	100.00
<b>TOTAL MATERIALS</b>					<b>1158.00</b>
Resupplying		md	30.00	3.00	90.00
Fertilizers		md	30.00	3.00	90.00
Nematicides		md	30.00	1.00	30.00
Other Pesticides		md	30.00	0.50	15.00
Weedicides		md	30.00	7.00	210.00
Fungicides		md	30.00	1.00	30.00
Sleeving		md	30.00	6.00	180.00
Detrashing		md	30.00	2.00	60.00
Deflowering		md	30.00	11.00	330.00
Drainage		md	30.00	2.00	60.00
Propping		md	30.00	6.00	180.00
Pruning		md	30.00	10.00	300.00
Field Sanitation		md	30.00	2.00	60.00
Misc.		md	30.00	3.00	90.00
Total Pre-harvest		md	n.a.	57.50	1725.00
Harvest		md	35.00	42.00	1470.00
<b>TOTAL LABOUR</b>		md	n.a.	<b>99.50</b>	<b>3195.00</b>
<b>Other</b>					
Transportation		LS	350.00	1.00	350.00
<b>Total Variable Cost</b>					<b>4703.00</b>
<b>Return after Labour</b>					<b>236.20</b>
<b>Return before Labour</b>					<b>3431.20</b>
<b>Return to Labour-day</b>					<b>34.48</b>
<b>Return to Family Labour-day</b>					<b>54.73</b>
Variable Cost of Production		ECS/ton			671.86
<b>Variable Cost of Production</b>		ECS/lb			<b>0.30</b>

### 3.3 Constraints to Economic Transformation

As a consequence to the above elaborations, it is certain that the current agricultural land-use pattern and in its wake the economic base of most watersheds in St. Lucia will have to be transformed in order to keep up with the challenge of long-term sustainable economic growth, social stability and environmental protection. Nevertheless, in order to do so constraints have to be defined and prioritized before proceeding to action.

#### 3.3.1 Limitations for Land-Use Enforcement and Alternative Income Generation

In order to safeguard and sustain the environmental equilibrium within the watersheds of the island, proper land-use is vital. As far as land-use enforcement is concerned, this is operationally and socially limited to economic and social infrastructure as well as the existing forest reserves, Crown land, and generally all areas which are severely endangered by the current environmental circumstances (e.g. severe risk of landslides). Generally, the construction of roads (and feeder roads), the enlargement of villages, and the illegal encroachment into the forest areas have to be severely monitored and proper land-use ultimately enforced.

Enforced changes in land use as part of a watershed management plan, however, desirable are currently both economically and socially unacceptable. Any attempt to legislate for change on land in the 25 - 30 per cent slope category would meet with rejection, and there are problems associated with promoting alternative crops. In the current tense economic situation, and also bearing in mind the poor prospects for alternative employment, any such measure would be out of the question. Average unemployment island-wide is estimated at 20%, and anything that was likely to have a detrimental effect would be wrong.

Commercial pressure may well influence the situation, particularly the implementation of the SLBGA's "Certified Grower" scheme under which the best growers of quality bananas will be rewarded, and prices paid to marginal (hillside) farmers reduced. The power of educational programmes, through the WMAF's should not be discounted.

Initial investigations into the feasibility of employment transfers between agriculture and other sectors are not encouraging. Despite some pilot activities of a number of projects (e.g. ENCORE, Mabouya Valley Development Project etc.), the reconnaissance exercise revealed clearly that so called alternative employment possibilities or potential income generating activities are currently limited. Implementation of a new project, Rural Enterprise Development (assisted by IFAD) is due to start later in 1997, and is aimed at seeking solutions to these problems. It is far too early to assess what effect this will have. This topic will be the subject of further investigations during a future input. For the bulk of farmers and agricultural labourers the only alternative is to work seasonally, e.g. in construction or sometimes go as farm worker overseas (USA Farm Workers Programme seems to be phasing out). It is in this light that any approach towards environmentally sound watershed management will have to incorporate economically and socially acceptable instruments for agricultural development. The transformation of the economy can only be achieved with agriculture and not against it.

#### 3.3.2 Impediments to Agricultural Diversification

Based on the current scenario and the evident future development with respect to the world market for banana, the need for agricultural and therefore economic diversification is more urgent than ever. Diversification has a long history in St. Lucia and

indeed the Caribbean as a whole, but when the first danger signals of possible problems with the banana industry became apparent, the heads of OECS Governments, with some support from Geest, decided on a Regional approach and the Agricultural Diversification Coordinating Unit (ADCU) was born. Initially the role of ADCU was to investigate marketing opportunities for non-traditional crops and develop a data base of prices. Because of the Geest connection this was mainly confined to the United Kingdom. With some support from BDDC, contact was made with the Natural Resources Institute (NRI) in the UK, and the data base was broadened. In 1990, an organisation established to assist ACP countries with marketing in Europe (COLE ACP) took over the data base. Importers in both Europe and USA were screened, to avoid exposing local exporters to unscrupulous operators, and market prospect information is made available to Agriculture ministries, monthly or sometimes weekly, through out OECS member states.

In 1990, a new project, TROPRO was started, funded by USAID to the tune of US \$10 million. ADCU became the implementing agency. Project objectives were:

- to increase marketable production through disease control, pruning, flower inducement, water management and orchard management.
- to improve market intelligence
- to improve post harvest techniques, including grading standards, packaging, training, trial shipments and evaluation.
- transport - introduction of new airlines and negotiation of freight rates and scheduling.

Both CARDI and IICA were heavily involved in the project.

On another front, BDDC funded a series of projects in the eighties on various islands. The Tree Crop Project started in St. Lucia in 1984 and involved mainly the planting of avocado and citrus. Plant propagation facilities were established and assistance with inputs was made available to farmers. Demonstrations in farmers fields were also featured. The project was not totally successful, the main cause being that banana was used as a nurse crop and once banana prices went up, farmers abandoned the tree crops in favour of the then more profitable banana.

ADCU remains very active and is currently in dialogue with the main supermarket chain in the UK and other prospective importers.

Despite this actual progress has been poor, but with a steady stream of exports by some 20 private operators.

Total production estimates are presented at Table 3.2.

Table 3.2

**Estimated Crop (Tonnes)  
Production 1992-1996**

Produce	1992	1993	1994	1995	1995
Banana	143,139.7	140,057.2	96,591.5	119,117.6	112,132.8
Coconut	n.a	n.a	n.a	n.a	n.a
Copra	4,098.0	5,039.5	3,583.8	2,622.5	2,389.9
Cocoa	67.8	50.0	64.4	47.1	33.2
Sweet Potato	259.0	333.4	281.6	506.8	557.8
Yams	294.9	347.1	454.0	442.0	595.6
Tannia	35.4	75.7	48.7	42.7	102.4
Tomato	153.4	116.5	182.8	147.7	152.6
Cabbage	124.8	199.8	238.3	231.7	255.5
Cucumber	209.6	208.6	245.0	223.7	260.5
Carrot	44.8	17.5	24.4	8.8	23.8
Sweet Pepper	32.7	35.6	53.0	44.8	65.0
Okra	23.4	45.2	52.4	72.0	65.8
Melon	117.7	79.8	153.2	100.8	102.9
Pumpkin	167.6	135.4	167.5	165.5	172.9
Ginger	3.6	7.2	5.5	6.0	19.8
Lime	134.6	125.5	174.0	172.8	184.6
Sweet Orange	619.0	574.2	698.0	660.4	673.8
Grapefruit	931.1	814.0	898.8	1,182.4	887.6
Avocado	205.6	238.1	234.6	250.3	488.9
Dasheen	294.2	395.8	371.3	417.0	647.4
Plantain	777.4	704.0	411.6	531.0	1,172.2
Lettuce	79.4	80.4	104.0	90.0	86.0
Breadfruit	2,644.0	2,318.4	2,045.3	1,968.8	1,999.4
Sour Sop	183.7	251.8	164.7	158.0	109.8
Hot Pepper	173.3	97.7	224.8	304.6	224.5
Mango	2,541.6	2,197.1	3,245.2	1,846.0	1,959.4
Pineapple	275.7	389.9	347.0	250.9	121.4

Source: Planning and Statistical Unit, Ministry of Agriculture

#### A. Markets and Marketing

During the reconnaissance survey farmers were asked for their views on diversification. Responses were unanimous, all believed that banana prices would return to their previous high and none saw alternative crops as a serious option. The reason cited was that lack of markets for alternative crops and guaranteed sales. Most went on to state that in the event of further reductions in the price of bananas they would abandon their land rather than plant tree crops, but went on to say that were an efficient and reliable marketing structure in place, they would consider alternative crops seriously. This suggests two things, that farmers have been spoilt by the highly organised marketing structure for bananas, where associated costs, deducted at source by the SLBGA are unseen, and the very weak development of alternative crop marketing infrastructure in St. Lucia.

There would also seem to be a failure in communications and technical advice in a form acceptable to the farmer is not getting through.

#### B. Technical Skills and Demonstration Plots

Farmers have been relying on bananas as their main crop for so long, that they reported a lack of knowledge and experience of other crops. Their knowledge and awareness of erosion control and drainage was equally sparse. Some observers doubt this, and while it is feasible to accept that farmers could grow a range of crops, improved production and management techniques, harvesting, grading and packaging would all require training. Again, farmers expressed a desire to see how alternative crops are grown, and need reliable, figures on production costs, yield and prices. Demonstration plots and a better focus by extension staff could fill this need.

#### C. Praedial Larceny

Another important impediment for a shift from banana to other crops is the incidence of praedial larceny. Without exception, all farmers interviewed feared the possible theft of crops grown, especially root crops and vegetables. As already pointed out above, due to the abundance of fruit, bananas are largely immune from ravages of theft whereas for other crops, theft is probably the largest category of loss. Despite the existence of the *Praedial Larceny Act* that provides powers to prosecute those who steal produce from others, in practice the enforcement is almost impossible. The MAFL&L has appointed two produce inspectors to monitor the incidence but no significant impact can be expected from this attempt. Farmers tend to believe that any such inspector could even himself become involved in illegal actions attracted by whatever sort of shared returns. The seriousness of praedial larceny is mirrored by the fact that some communities have considered the establishment of "watch teams". In the *Marc* community (Cul-de-Sac) for instance, such a watch team composed of three members has recently been set-up. Working in shifts these teams are supposed to patrol the community area on a 24-hours basis.

#### D. The Belief in Banana

Farmers have a deep rooted belief in the continued strength of the banana industry, and this is a disincentive to diversification. A large proportion of farmers have grown up with bananas, and admit to little experience of other crops, except traditional root crops. On average, St. Lucian farmers have been involved with banana production for around 20 years, and the reconnaissance survey revealed that most could not recall what was grown before bananas were planted. In many cases, the land was cleared from primary or secondary forest, or land was bought, rented or inherited with bananas already established. In short, two decades of guaranteed markets and high returns have spoilt farmers.

Apart from the four major issues mentioned above, there are number of other limitations inhibiting progress towards agricultural diversification. The following socio-economic features are generally considered impediments to agricultural development in St. Lucia, and to any attempt towards intra-sectoral changes. However, investigations revealed a rather different picture. Areas investigated by the Consultant are discussed below.

The prevailing pattern of land ownership and tenure is often cited as a major barrier to effective diversification, particularly where more permanent tree crops are involved. The reconnaissance survey suggested that the argument has only limited validity. Owned land has been reported at just over 30% and family land at 46%. During interviews, most farmers cultivating family land claimed that once assigned a plot by the family, decisions regarding what to grow, were theirs and theirs alone. In some cases a family concensus was necessary. However, GoSL remains convinced that family land represents a major constraint to change and the topic is worthy of further investigation.

With regard to rented land (15%) there would appear not to be any problems in changing cropping patterns. Thus change in land use would not present problems on the owned and rented land (54%) and possibly on half the family land (23%), a total of 77%. The problem may therefore not be as formidable as current thinking would suggest.

Similarly, with an average 1-2 plots per farm, land fragmentation in St. Lucia is not a major issue, and the distance of plots from homestead (on average 4.6 miles) is not of significant importance. Most farmers reside in the villages having direct access to the main road. Equally, most cultivated plots (90%, WINBAN) are located adjacent to secondary roads or feeder roads. In other words motorized access to farms is possible.

The incidence of advanced farmers age and unavailability of labour force is generally mentioned as another constraint to agricultural development and diversification. However, the reconnaissance exercise revealed that farmers are mostly around 50 years of age (47 years, WINBAN estimate). For women farmers the average age was found to be lower. It is adequate to say that the current average **farmers age** is according to general socio-demographic expectations and does not represent a major constraint as such.

More important, however, is the fact that the younger generation is generally reluctant to engage in farming being sometimes even opposed to helping out on the parents land without any direct cash payment. Mainly due to the low esteem of farming, the young people express their unwillingness to take over the farm from their parents. Underlying factors contributing to this problem are not only the declining reputation of traditional farming as a profession but the exhaustive manual work and the limited acreage and low income. Younger people see no hope of farming meeting their increasing expectations of consumer goods and comforts. It was not clear what opportunities for employment exist for them.

Contrary to most other investigations in this field, the reconnaissance exercise revealed that **shortage of labour** is not an issue, not even during harvest days. The unanimous opinion was that, although expensive, labour was continuously available throughout the year *as long as they are paid*. However, the fact that family labour is becoming scarce forces farmers to hire farm workers which contributes to increasing cost of production (financially). However, whether family or hired labour is used, it does not influence the profitability of production, in economic terms.

Another frequently cited impediment to investments in farming, in tree crop cultivation in particular, is the question of access to credit. Most farmers interviewed during the reconnaissance exercise were familiar with the procedures for obtaining agricultural credit. Many of them had previous experience, mostly to buy farm land or a pick-up. The WINBAN survey confirmed that almost 50% of all banana farmers have had experience or currently use credit. Formal sources of credit are predominant (> 90%). Although, there is a general tendency to avoid the use of credit, farmers reported a willingness to borrow money for investments into farming as long as the sale of produce could be ensured. Female farmers representing about 11% of all banana farmers in St. Lucia (WINBAN), reported no gender related problem with access to credit. In summary, **access to credit** cannot be seen to be a major impediment to changes in St. Lucia's agriculture.

### 3.4 Towards Sustainable Watershed Management: Action Priorities

Based on the above findings this chapter highlights the immediate action priorities with respect to the general socio-economic dimension of watershed management in St. Lucia. As mentioned before, these recommendations have to be seen against the background of sustainable watershed management being crucial for economic growth and social stability of the country as a whole. The following deals basically with action areas which, although of vital importance for long-term sustainability of the country's watersheds, go beyond the official mandate of the project and can therefore not directly be influenced by project activities.

#### A. National Agricultural Diversification & Marketing Campaign

Even a cursory review of the facts reveals that there has been little real progress towards agricultural diversification over the last ten years. Indeed, the Agricultural Census 1996 shows an increase in banana cultivation over the period 1986-1996, indicating yet further dependence on this crop.

With the considerable quantity of data, covering varieties, management techniques, export opportunities and marketing all available, and good propagation facilities in operation, it is hard to see why more has not been achieved. One can only conclude that Government has not shown the necessary commitment, and that the facts have not been suitably packaged for the farmers.

Bearing in mind the huge potential benefits to the economy, social stability and a reduction of soil erosion, fresh impetus is required and concerted action should be planned without delay.

Key players in such a campaign would be:

Ministry of Planning  
Ministry of Agriculture  
A.D.C.U.  
St. Lucia Marketing Board  
S.L.B.G.A.  
Private Sector representatives

Such issues as the collation of all available data, review of previous initiatives, identification of gaps in current knowledge, upgrading of marketing infrastructure must all be tackled, and an action plan prepared and ministries and persons responsible for implementation identified.

Regular meetings to review progress and problems would be essential, and monitoring against set targets would add essential focus.

There are many avenues that could be explored, some are:

- using SLBGA expertise and facilities to reduce the cost of initial marketing infrastructure
- adopting a nucleus estate/small holder regime, using estates to plant sufficient acreage to justify the establishment of markets which would then cushion small holder development
- niche cropping targeted specifically at tourists
- the need for subsidies, credit or other incentives
- direct contracts between growers and importers
- the role of Government vis-a-vis the private sector.

## **B. Reform of the Agricultural Advisory & Information System**

In order to tackle the main issues related to the inefficiencies in the current agricultural advisory and information system the implementation of the following recommendations is strongly advised:

### **i.) Streamlining of the Agricultural Advisory System.**

The current situation whereby SLBGA field officers and agricultural extension officers are responsible for giving advice related to agricultural production has revealed decisive deficiencies. For the sake of better resource use and increased efficiency it is recommended to unify the advisory system (including the current mandate of SLBGA field officers). Such a coordinated agricultural advisory service would have to incorporate a mechanism that provides up-to-date market information transferred in a "digestible" manner to the end-user (farmers). Another important issue is the mobility of the extension staff. The Government should disengage from providing extension officers special access to loans for purchase of vehicles. Extension officers tend to use this facility to purchase cars which are (i.) not appropriate for most secondary or feeder roads, (ii.) used only exceptionally for duty. Much more cost effective and substantially more appropriate would be a similar loan-scheme for cross-country motorcycles. Generally, there is an urgent need to review the advisory system from the point of view of operational effectiveness, staff needs (in numbers and in terms of training) and financial requirements. On a long term basis a transformation of the agricultural extension into a private sector and commodity driven system would have to be considered seriously.

## ii.) **Training in Land Conservation, Drainage and Production of Non-traditional Commodities.**

There is an urgent need to train extension staff (including current SLBGA field officers) in the areas of soil conservation, drainage and the cultivation aspects of non-traditional crops.

## iii.) **On-farm Trial & Demonstration Programme.**

With the apparent communication gap between ADCU/MALF&F and the farming community some serious action is required. Farmers have expressed a desire to see for themselves and for cost data. A validation trial and demonstration programme would fulfil this need and should be given urgent consideration. The planning of such a programme would have to take into account:

- marketability of produce
- agronomic factors affecting various species selected
- selection of the best varieties
- mixing species to prolong harvest periods
- mixing crops ie. trees with pepper or vegetables, to enhance profitability
- proper soil conservation techniques.

Two trials are currently being planned by a UWI based programme, and the Project is likely to add a third, but to create the necessary impact, a much larger programme would be required. Such a programme might well attract donor funding and implementation by an NGO could also be considered.

It is considered that such a programme is a pre requisite to achieving the desired degree of diversification and it would give farmers the confidence to commit themselves to change.

## **C. Determined Action against Praedial Larceny**

Based on the above findings (3.3.2) there is a need for determined action against the incidence of preadial larceny. A number of attempts have been undertaken in the past few years with little success. It is recommended to carry out as soon as possible a growers registration/licensing exercise island-wide. This could be done with the assistance of growers/producers lists of the SLBGA, Marketing Board and other organizations or groups with farmer memberships. Once registered, whoever sells agricultural produce would have, on request, to identify him/herself and reveal the name of the respective grower. No produce should be allowed for trading without a declaration of origin. In addition, and in view of the magnitude of the matter the country's legislation would have to consider to drastically increasing the punishment for violating the law (*Praedial Larceny Act 13/78*).

**It is implicit that some of the above action priorities could be tailored into a project format suitable for external donor funding.**

#### **4. Community Participation Programme in Watershed Management**

The above recommended immediate action priorities call for the responsibility of the government and of other political/economic stakeholders from the private sector. However, in order to gradually reverse the current situation of environmental degradation and economic stagnation with respect to the resource base of the island's watersheds, the issue of wider social responsibility has to be tackled pragmatically.

##### **4.1 The Concept**

Peoples participation and community initiatives are increasingly recognized as indispensable parts of sustainable management of natural resources. Experience suggests that the benefits of environmental management are more likely to be achieved when the ultimate clients are actively involved in designing and implementing the work necessary.

It is important to make people understand that watershed management in St. Lucia is certainly not to be seen as an activity of ecologically minded naturalists but as a paramount necessity in order to safeguard and sustain the economic well-being of the people. In this context the most serious issue in watershed management is how to prevent further expansion of cultivation into St. Lucia's remaining forest areas and persuade the farmers cultivating steep hillsides to give up practices which cause soil erosion and subsequent flash floods, river siltation, crop and properties' damage and deterioration of land and water quality in downstream areas. Furthermore, clearing works of drains need the active involvement of the local population and can only be effective if coordinated with landowners work on-farm.

Indeed, all the efforts of St. Lucia Government would be insufficient without the cooperation of farmers and population farming/living by the riversides and on respective sloping land of the watersheds. To change not only some agricultural but as well general behavioural/educational attitudes that have a proven negative impact on soil conservation, drainage effectiveness, and on flow of rivers will take patience and wide participation. However, the well documented and more than evident acceleration of soil erosion and soil fertility decline in large areas of the islands' watersheds and the frequent occurrence of natural disasters and consequent economic loss related to the mismanagement of watersheds in St. Lucia call for an urgent and radical change in watershed and environmental management. This will only be achieved if based on active community participation and transfer of responsibility to the local strata.

The main features of the proposed Community Participation Programme in Watershed Management are:

- A. Works Implementation
- B. Monitoring & Communication
- C. Education & Training

In order to avoid duplication of efforts and resources as well as overlapping of command areas, use will be made as much as possible of already existing initiatives and institutional structures on the island. Nevertheless, a strong and continuous commitment by the communities, the Government and the individual residents of the watersheds will determine the long-term sustainability of the programme.

The trial-programme will be located in the pilot watershed of the Dennery river. However, the intention is to gradually replicate the programme for all the main watersheds

of St. Lucia on a medium term basis, possibly within the next five years (1997-2001) and as part of project implementation.

In view of the need for continuity it is important to institutionalize the participatory approach by setting up an appropriate organization/committee/group to implement the programme and to streamline all related activities on a community level.

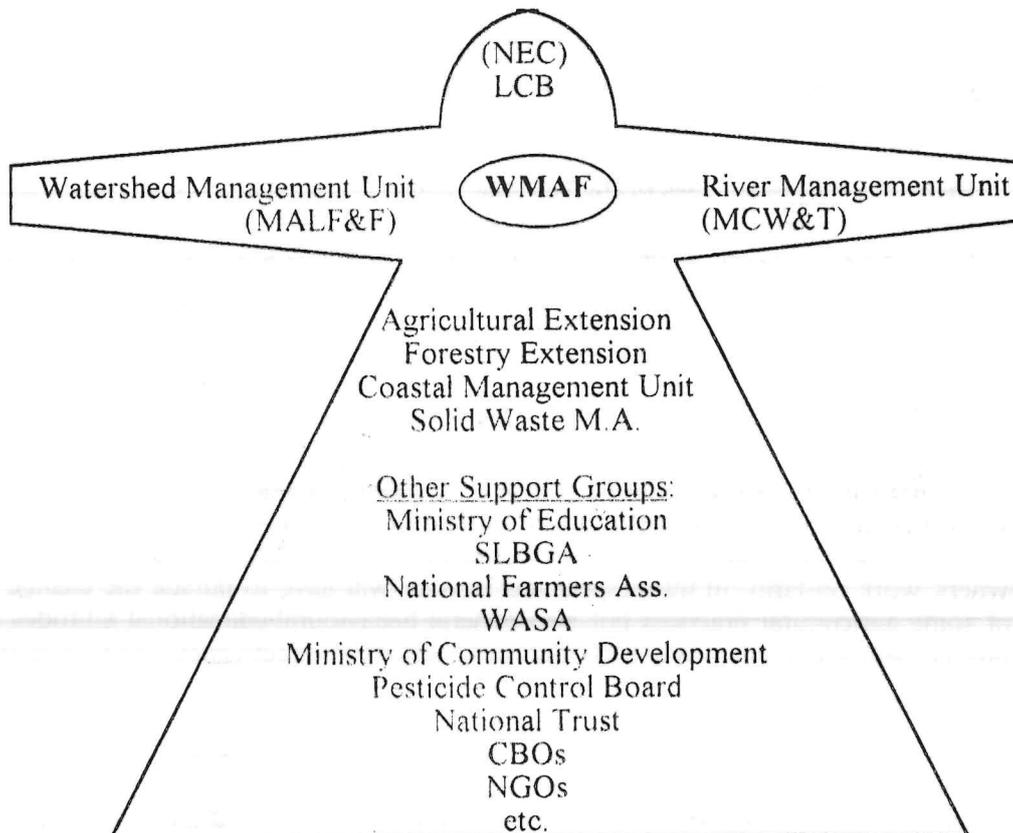
#### 4.2. Institutional Setting of the Watershed Management Action Force (WMAF)

Based on the *Land Conservation and Improvement Act of 1992*, its Board is responsible for the general supervision of land and water resources island-wide. The same Act defines a legal provision for the institutional set-up of local entities. In this respect, the GoSL has agreed with the concept of using so-called local *Watershed Management Actions Force (WMAF)* groups as a way of ensuring community participation in watershed management. The WMAFs will be institutionally headed by the *Land Conservation Board (LCB)* and will be responsible for land conservation, drainage and other watershed management related activities within one watershed or two or more small watersheds. In this context, it would be organizationally and logistically advantageous if GoSL would match the boundaries of the eight administrative regions to the thirty seven Watersheds on the island. The jurisdiction of the WMAF will extend to all parts of the watershed where an existing authority does not already have control, e.g. the Queen's Chain or in forest reserves where authority rests with DCA and Forestry Department respectively. The enforcement of the Land Conservation & Improvement Act, e.g. the declaration of Protection Orders will be the responsibility of the LCB rather than the WMAF.

Operationally, the *Watershed Management Unit* to be established in the Agricultural Engineering Division of the MALF&F will meet the administrative demands of the LCB and WMAFs and in particular help to prepare the respective annual operational and financial budgets. With respect to river related works, the LCB/WMAFs would be assisted by the *River Management Unit* to be established under the Construction/Maintenance Division of the MCW&T. The unit would be expected to work closely with the WMAFs, determine the river and main drainage works and either carry out the necessary work itself or by contract. Additional direct support in technical matters would be ensured by *Agricultural Extension, Forestry Extension, the Coastal Management Unit* and the *Solid Waste Management Authority*. Furthermore, external support would be provided by a number of organizations and groups which would have to be represented either in the LCB or/and form part of the respective local WMAF. On WMAF request, the authority of the LCB would institutionally ensure the continuous and direct assistance of the support groups, governmental in particular (e.g. Agricultural and Forest Extension). The requests for support would be processed through the Watershed Management Unit as the operational catalyst between WMAF and LCB. The figure below shows the core function of the community-based WMAF within the general institutional set-up of watershed management.

Figure: 1

WMAFs - General Institutional Setting  
(adopted from the organogram presented by  
the Institutions/Legalisation Specialist)



According to the local situation with respect to existing community groups it is possible that watershed-specific arrangements will become more appropriate for the formation of WMAFs than a rigid pre-defined institutional set-up. This means that apart from the coordinating and empowerment function of the LCB, existing and efficient community groups could be used as a vehicle for WMAF formation. In order to achieve the most fertile institutional environment a number of issues remain to be addressed:

- (i.) Unfortunately the Land Conservation Board which should spearhead land conservation and improvement work has only met once (14 November 1995). Despite the resolutions of its first meeting, no progress has been made towards formulating Regulations. Government should therefore be urged to start a resuscitation of the LCB as soon as possible.
- (ii.) With respect to the composition of the present LCB it is noticeably short of farmers, SLBGA or generally speaking of non-government representation. In view of the community participation required in watershed management it will be necessary to address this issue in the near future. Furthermore, it is proposed to include a senior official of the Ministry of Education and the Chairman of the Office of Disaster Preparedness on the LCB.

- (iii.) Establishment of a well functioning Watershed Management Unit under the MAFL&F equipped with the necessary power and resources to act as a coordinating body for the operational and budgetary aspects of the WMAFs; establishment of the River Management Unit under the MCW&T.
- (iv.) Establishment of National Environmental Commission (NEC).
- (v.) The aforementioned proposal to possibly match the boundaries of the eight administrative regions to the thirty seven watersheds will have to be discussed by the Government as early as possible.

#### 4.3. Tasks and Responsibilities of the WMAF

The tasks and responsibilities of the WMAFs are directly linked to the objectives of the Community Participation Programme. Indeed, the programme is implemented largely by or through the WMAF at the local level.

As mentioned above, the most serious issue in watershed management is how to prevent further expansion of cultivation into St. Lucia's remaining forest areas and persuade the farmers cultivating steep hillsides to give up practices which cause soil erosion and subsequent flash floods, river siltation, crop and properties' damage and deterioration of land and water quality in downstream areas. Furthermore, clean-up works of drains need the active involvement of the local population and can only be effective if coordinated with landowners' work on-farm. In this respect the WMAF will have to pursue the change not only of some agricultural practices but also general behavioural/educational attitudes and their proven negative impact on soil conservation, drainage effectiveness, and on flow of rivers.

The following domains are to be considered core responsibilities of the WMAF:

- (a.) implementation of/participation in land conservation programmes to prevent erosion and subsequent river siltation; provision of technical assistance to adopt agricultural practices less damaging to the flow of rivers (including use of agro-chemicals);
- (b.) cleaning and de-blocking of main and secondary drains and culverts;
- (c.) monitoring of drainage system/soil movements and organization of works to be implemented;
- (d.) communicating needs for capital-intensive works to be carried out by higher authorities;
- (e.) workshops/educational programmes and public awareness campaigns with respect to proper watershed management (including solid waste management);
- (f.) river bank protection;
- (g.) reforestation and other forestry activities;
- (h.) promotion of improved housing design, road infrastructure, and appropriate in-house water storage facilities to reduce risks of damage by run-off and flooding etc.;

In general, there are three main instruments which properly utilized will lead to sound watershed management, namely Implementation of Works, Monitoring & Communication, and Education including training and promotion.

#### 4.3.1. Implementation of Works

The task to carry out works related to land conservation and drainage is restricted to activities which are financially and technically feasible within the mandate and resource capacity of the WMAF. The necessity for heavy works such as river training and physical river bench stabilization will have to be communicated to the respective higher authority for implementation, e.g. River Management Unit.

One of the main causes of flooding and flood damage is lack of river channel maintenance and insufficient clearing of drains. With respect to a proper functioning of the natural and constructed drainage system in the watershed, there are generally three sections to be distinguished: (i.) the main stream or river, (ii.) smaller on-farm/private drains, (iii.) so-called intermediate drains which can, but don't have to, link the smaller drains to the main river.

It is important to involve farmers and the population living in the watershed in the clearing of rivers and drains, especially shortly before and during the rainy season. The WMAF would have the task to organize river and intermediate drains clearing activities, as well as the removal of debris and garbage blocking the down-flow. Where necessary, this would include aspects of solid waste disposal/collection as well as repair and construction of drains. The execution of these works would be based on the mobilization of community (clearing) campaigns and, if necessary, hired labour.

#### 4.3.2. Monitoring & Communication

In the long run, the implementation of works can be reduced dramatically if prevention and education are given priority. The WMAF will be responsible to constantly monitor the state of the art of the local drainage system and to observe the potential risks for the watershed arising from e.g. improper agricultural practices, areas prone to landslides, or inappropriate/ illegal (feeder) road construction etc. The WMAF would record all relevant observations and take actions as needed.

One of the first activities of a newly established WMAF would be the recording and mapping of the respective geographical area with respect to the natural and constructed drainage system, landslide hazards, flood prone areas, accelerated soil erosion, land use, and land ownership.

As mentioned above, as far as minor or intermediate works are concerned the WMAF would have the mandate to carry out the works itself or by contract. Where capital-intensive works are concerned, the respective request would be communicated to the responsible authority for execution.

#### 4.3.3. Education & Training

The third pillar of the community participation programme is to form the basis for long-term sustainability of environmental and watershed management in the *heads of the persons*. A continuous effort in educating and training people is indispensable to transform watershed management from an "highly expensive emergency programme" to a natural process deeply rooted in comprehension and personal responsibility of the individual towards the environment and the community as a whole.

The WMAF would have to streamline all educational and training efforts related to watershed management for the locally concerned communities. This would have to go far beyond the creation of general public awareness. Public awareness campaigns alone generally obtain little tangible results in terms of substantial behavioural changes. Assisted by the aforementioned support groups (see figure 1), Agricultural Extension and Forest Extension in particular, the WMAF would on a continuous basis:

- (i.) cooperate with the local schools, youth and sports clubs, to organize and carry out continuous workshops on relevant topics, such as “causes of flood flows/flood damage”, “human intervention and its impact on the environment”, “responsibility of the individual towards the community”, etc. In the longer run such continuous workshops should become institutionalized as part of the official curricula programme of schools;
- (ii.) organize and implement extension workshops/field days for farmers with respect to proper soil erosion prevention/drainage and environmentally sustainable agricultural practices (including use and management of agro-chemicals);
- (iii.) cooperate with local adult clubs and groups, e.g. Mothers & Fathers, to organize evening sessions on general environment-related behaviour, e.g. “household/solid waste management”, “river training” or “the need for community management”;
- (iv.) promote and inform about other related activities, such as river bank protection, reforestation of abandoned land, improvement of housing design to reduce risks of damage by flooding, enhancement of physical environment (beautification and landscaping) etc.

In addition to these three main areas of general WMAF responsibility (4.3.1-3), the Action Force would act as a catalyst with respect to whatever local issue relating to sound watershed management. This would include

- (a.) the mediation in local disputes such as the responsibility of landowners in the clearing of drains,**
- (b.) the swapping of eroded land for reforestation/suitable Crown land,**
- (c.) inappropriate/illegal (feeder) road construction,**
- (d.) the promotion of alternative crops and information on markets and marketing.**
- (e.) other issues will be added as inputs from other Specialist are completed.**

#### 4.4 Authority of Enforcement

Without adequate authority, the WMAF is doomed to failure. The activities of the WMAF are intended to generate desired changes in cultural practices and behavioural attitudes. This is not a simple matter and may no doubt create areas of tension within the community. Unless it is realized that the Action Force has the authority to enforce its regulations, very few people will take it seriously. The Land Conservation Board has been fully empowered under the *Land Conservation and Improvement Act* with the required level of authority to pursue its responsibilities (e.g. Protection Order, or sec. 14 para. 3 and

4 of Act). Accordingly, the Board should delegate some of its authority to the Action Force. It would be imperative to establish regulations within the by-laws of the WMAF, to assist the management of the Action Force. Important areas for enforcement are:

- Implementation and Monitoring of work which fall under the management of the watershed area, especially where delinquent farmers/residents are concerned;
- The rights to generate own funds and manage them with autonomy where appropriate.

#### 4.5. WMAF Formation and Member Composition

For the formation of the WMAF it is necessary to organize so-called community meetings to which all influential persons and representatives of community groups as well as all locally based government officers should be invited. The intention of the first (could be more than one) community meeting is to sensitize the community vis-à-vis the topic of land conservation/drainage and explain the need for community participation in watershed management.

The objectives of the initial community meetings are:

- to present the main ideas of the community participation programme;
- to highlight the need for community participation and formation of a WMAF;
- to explore the views of the community representatives regarding the formation of a WMAF for the watershed;
- to explore the view of the community on tasks, responsibilities and resources needed for the WMAF;
- to explore first possible composition of WMAF based on interest and enthusiasm shown by participants;
- to delineate the next steps towards establishment and empowerment of the WMAF.
- modus operandi vis-a-vis private and public sector organisation and NGO's.

A possible list of invitees for the inception community meeting is given below.

#### Possible List of Invitees for inception community meeting:

- Village Clerk
- AESD officer appointed to the respective WMAF/watershed
- Representative of the Construction/Maintenance Division of the Works Department (MCW&T)
- Agricultural Extension Officer
- Forestry Extension Officer
- Community Development Officer
- Farmers Representatives ( i.e. representing hillside farmers, farmers cultivating on flood-prone land, SLBGA/NFA)
- Chairman of local Disaster Committee/ sub-committee Emergency Works
- Representatives of all local churches/religious groups
- President of Adult Groups (e.g. Married Couples Group)
- President of Youth Club
- President of Sports Club
- President of Fishermen's Cooperative
- WASA local officer
- Local Police Corporal
- National Trust area officer
- Other influential persons of the community (e.g. heads of Schools, leaders in the commerce or business sector etc.)

An effective WMAF can be viewed as being pivotal to the successful and sustainable management of the respective Watershed. The WMAF should be quite manageable devoid of too large or unnecessary membership. The emphasis should be on action, and implementation of decisions rather than a theoretical talking shop.

Whenever the respective watershed is characterized by a number of organized community groups or organizations and acceptable public facilities, it would be evidently more feasible and beneficial to utilize as far as possible available resources in the formation of the WMAF. This can be advantageous in various ways, e.g. human resources, office facilities, linkages between the WMAF and various sectors of the community.

Depending on the dimension of the geographical mandate the WMAF should be composed of not more than ten to fifteen (10-15) permanent members representing the community from the point of view of potentially influencing watershed management. Ideally, an equal distribution should be reached between government officers and non-government members. With respect to the government officers, it is advisable that both the extension and the engineering officers be of senior status. Except for the village clerk, all government officers of the WMAF would be non-voting members. This is important in order to keep the prime responsibility at the community level. The composition of an WMAF, as suggested below, would have to be adapted according to the socio-demographic characteristics of the respective watershed. It is important to include the most influential local personalities into the Action Force and to have a substantial representation of women (not less than 1/3). It may happen that one person of the community is the Chairman of/or represents two or more local community groups. This is quite common in St. Lucia and beneficial for group formation in terms of keeping the number of WMAF members down.

#### WMAF - possible member composition:

- Farmers (at least 3, rep. hillside farmers and those cultivating flood-prone areas)
- Community Adult Groups representatives (at least 3, including school representative)
- Youth and Sports Club representatives (at least 2)
- Religious Groups representatives (at least 1)
- Village Clerk
  
- Agricultural Engineering Officer
- Forestry Officer
- Community Development Officer
- SLBGA
- WASA
- Police Corporal

Members of the WMAF should be elected/confirmed by an annual community meeting and appointed by the chairman of the LCB for a period of one year. A member of the Action Force may be re-appointed after the completion of her/his term. Once established, the WMAF would elect its chairman for one year with the option of three consecutive terms. In addition to the permanent members of the WMAF, non-permanent members deriving mainly from the aforementioned support groups (Figure 1) would co-opted whenever necessary. **WMAF chairman and members would not be paid any stipend for their engagement but their commitment is viewed as a voluntary service to their community and country.**

#### 4.6. Staff & Operations

In order to demonstrate the paramount importance of watershed management vis-à-vis all other social and economic activities, and in view of the necessity to institutionalize watershed management on a continuing basis it becomes imperative to equip the WMAF with a **core staff** for programme execution.

In presenting this however, the trial status of the first WMAF must be taken into account. Upon full development, considerable pooling of staff, resources and equipment, should be possible. As far as is practicable, GoSL will staff and equip the Dennery initiative from its own existing resources.

Operationally the WMAF would execute and promote its tasks and activities through the programme manager seconded by a field supervisor and supported by a secretary-cum-account clerk. Both, the programme manager and the field supervisor would be selected by the WMAF members and supervised by the chairman. The programme manager would have (i.) to ensure the proper preparation and execution of the WMAF's annual programme, and (ii.) to oversee proper handling of WMAF's finances. The programme manager should be a technically skilled person, preferably in the field of agricultural engineering with experience in community work and teaching (need for educational programmes). The field supervisor would be highly mobile in order to ensure monitoring functions and works execution. The field supervisor, a technical person by standard, would be in constant touch with farmers and residents of the watershed. He would also monitor the development in the watershed to ensure that the policies of the WMAF were respected. The field supervisor would be assisted by such members of the Action Force and level of workers necessary to carry out the programmed activities in the field, e.g. clearing of drains. Hiring and dismissal of workers would be the responsibility of the programme manager. The secretary should possess some knowledge of accounts to enable her/him besides the clerical duties to handle the administrative operations of the WMAF. Once established and after a period of two years, the programme manager and the secretary-cum-account clerk probably be put on part-time payroll (working half day) whereas the field supervisor would have to remain assigned on a full-time basis. For the project trial period of about two years the SLG will assign the adequate staff to the pilot-WMAF.

At the initial stages after formation of the WMAF, frequent **meetings** might be necessary in order to organize and set the WMAF on a sound footing. Once established the Action Force should meet on a monthly basis and in emergency cases, as the need arises. Meetings should be well planned, members timely and properly briefed and the event conducted in a business-like manner, and minuted. Most WMAF members are usually busy scheduled people and will keep away from meetings unless they feel it is something worthwhile or purposeful. Decisions arrived at should always be incorporated into a definite plan for follow up actions, to avoid uncertainty on the part of members. The meetings would have to be called on a day and time convenient to the majority of the members. General community meetings would be held on an annual or six monthly basis. At this occasion the WMAF would (i.) discuss the annual programme, (ii.) present the financial accounts, and (iii.) discuss whatever important issue with the forum.

The venue for the meetings would be in one of the community meeting places, e.g. school, multipurpose centre, the regional centre or any place which offers the best environment conducive to concentration and purposeful discussions.

The work of the WMAF would entail an established **reporting scheme**. Apart from monthly Programme Implementation and Watershed Observation reports, the WMAF would transmit on a quarterly basis financial and operations reports to the LCB (through the Watershed Management Unit at MALF&F).

#### 4.7 Resources Needed & Cost Recovery

The WMAF should be well located, preferably with an office at the regional centre of the main village of the watershed. Mostly, these centres provide office accommodation to the agricultural extension officer, forestry officer, public health officer, community development officer, social services, youth and sports, village council and others. All of these sectors will in some way be involved in the effective conservation and maintenance of the watershed. The location of the WMAF in the regional centre would, besides facilitating easy access and interaction with other stake-holders, also assist in fostering stronger ties and bring about better relationship among them. Further, it becomes more convenient for farmers and other persons to access more than one of the technical officers at the same location if necessary.

Besides the need for office space, the services of a telephone/fax and a computer/typewriter would be indispensable but could be shared with other people working in the centre. Equally, basic office facilities and office supplies for a staff of three and accommodation for clients or visitors should be made available. In order to carry out its educational and training functions basic facilities would be required, such as overhead projector and screen, flip chart and easel, TV monitor and VCR, camcorder, slide projector, basic library on the relevant educational materials. The library should be able to facilitate schools, groups and individuals who are desirous of obtaining information on watershed-related topics. It might be argued that some of the above stated facilities might be borrowed where possible. However, people are normally not very keen on lending such sensitive equipment. Furthermore, they may not be available when required by the WMAF.

It is important from the beginning to limit as much as possible the financial dependency from whatever external source of funding. It is therefore indispensable to reduce already at the time of establishment the fixed costs of the WMAF. In other words, apart from the aforementioned three core staff no additional staff should be employed on a continuous basis. Furthermore, wherever possible maximum use should be made of existing community or government facilities. **Imperative is also the voluntary engagement of WMAF members and general community participation in works and activities to be executed or promoted under the WMAF's mandate.** However, in addition to the inevitable establishment costs there is a need to have an annual operational budget based on reliable and continuous funding. Main expenditure categories are summarized below.

WMAF establishment cost categories:

- (a.) Establishment fund for basic office equipment, teaching and training equipment etc.;
- (b.) Equipment/agricultural tools and possibly small farm motor implements to facilitate drainage and soil conservation work;
- (c.) One 4WD vehicle to facilitate the difficult terrain of the area (or guaranteed utilization of existing government vehicles);

WMAF operational expenditure categories (recurrent):

- (d.) Staff salaries;
- (e.) Office running costs and supplies;

- (f.) Expenses for works execution (incl. hired labour);
- (g.) Vehicle maintenance and running costs;
- (h.) Expenses for educational and training materials, workshops, field days, meetings etc.

The appendix to this chapter shows a tentative budget for establishment and operational (annual) expenditure. However, apart from the objective to test the WMAF approach vis-à-vis its operational capability, also the dimension for a realistic operational budget will have to be assessed during the trial period (2 years) of the pilot-WMAF. The actual expenditure for conservation and drainage works (i.e. works execution) in particular will heavily depend on (i.) the scale of works, i.e. in chains, acres etc., (ii.) the capacity to mobilize voluntary labour force from the community, and (iii.) the possibilities of external fund raising and cost recovery. **In this context it is strongly recommended to approach potential donor agencies in order to seek assistance for the replication process of the pilot-WMAF.**

Although the pilot-WMAF would be financed initially (2 years) by a GoSL grant budget in order to secure sustainability of programme execution, it is expected that substantial efforts should be undertaken by the WMAFs to set up appropriate mechanisms for cost recovery. This is important in order to gradually reduce budgetary dependency from government funding and therefore to increase public acknowledgment for the community effort. The Action Force through the Land Conservation Board, should have the right and obligation to approach various local funding agencies with a view to assist in financing appropriate projects as the need arises. Fund raising in general as well as on special occasions, e.g. at workshops or when drainage clearing works need urgent implementation, would be the most common approach to cost recovery. In this respect the WMAF could subcontract local community groups, e.g. Sports Club, to execute activities like drain clearing campaigns etc. Doing so, the respective group could carry out its own fund raising activity whenever needed.

Whereas it may be a positive approach for farmers and other individuals to be offered incentives as an encouragement towards change for better development, it is equally advisable that a system of incentives does not lend itself to abuse. The client should therefore, where appropriate, be asked to contribute towards the service in the form of levies or other. Funds should therefore be raised from conservation and drainage rates. The principle must be established that those who benefit pay. Additionally, the collection of fines with respect to abuse/misuse of the community and state-owned drainage system as well as with respect to any deliberate activity having deteriorating consequences vis-à-vis the proper functioning of the watershed should become part of direct local revenue to the Action Force. In order to enhance the system and process of farm work, e.g. drainage, both with regard to standard and time utilization, it is advisable that the Action Force considers the purchasing of some small agricultural implements for on-loan-service to farmers of the watershed and nearby areas. This would add dimension to the activities and services of the WMAF in the area and also gain added revenue for the project.

## RECONNAISSANCE SURVEY

A reconnaissance survey was carried out in both Dennery and Cul de Sac watersheds. Interviews were semi-formal and centred around a semi-structured questionnaire.

The questionnaire, which covered a range of topics was:

### General aspects

- sex of head of household
- location of residence
- household composition (how many persons belong to household; out-migration)
- age profile
- availability of household members for farm work (in %)
- permanent/seasonal hired labour force (for what activities, which months)
- **main source crops** (in acres or plots)
- land use pattern, acres of land cultivated, land left idle topography of plots
- **type of tenure** (family land, own, rent, squat)
- **land problems** (erosion, flooding, stony etc.)
- **location/distance** to roads, village, river, etc.
- own vehicle/management of transportation (of banana crop)

### Soil Erosion/Flooding/Landslides

- **perception on flood rains, soil erosion (washing of land), flooding, landslides**
- **type of preparation towards flood events**
- **perception of economic losses involved, main sort of loss/damage**
- **perception/importance of prevention methods and drainage**
- **perception of cause/effect relation (which are main reasons for these problems)**
- soil erosion prevention methods applied, drainage activities
- perception on inter-cropping, contour farming, trash cover, minimum tillage, vegetative barriers, cross-slope barriers, run-off drains, simple gully control
- reasons for banana cultivation (open land cultivation) on steep/flood prone land
- implication of land tenure (family land) with respect to effective soil conservation and drainage, eg. planting of trees, intensive soil erosion control, maintenance of drains etc.
- perception on and level of diversification, tree crops production, potential alternative crops, impediments (eg. praedial larceny, all but banana)
- tree crops on the farm (mango, avocado, citrus, breadfruit, coconut, cacao, other)
- which tree crop would be preferably grown, what sort of assistance needed
- efficiency of extension towards diversification, soil erosion prevention etc.
- perception on preventive measures/ex-ante information by GoSL or community
- general knowledge/information on watershed management available
- need for community involvement in prevention/works implementation, education, training, information

### Income

- different sources of income sources (% distribution) (on/non-farm, off-farm, other members, remittances)
- level of monthly/annual income by source of income (farm income in particular)
- percentage of income by banana
- where is the money invested (in agriculture or other, and why)
- current and potential relevance of other on- and off-farm earnings/employment

### Banana crop budget

- cost of production and yield of banana crop per acre and year
- why do farmers stick to banana
- to what price has the price to drop in order to leave banana production
- banana revenue covers cost of production
- % of hired labour in banana production
- comparable hired labour rate in the area (should be less than EC \$ 35)
- different hired labour rates (harvest and non)
- fixed/imputed costs

### Other

- estimate of economic loss during TSD and 26<sup>th</sup> October 1996
- labour availability
- efficiency of marketing, price levels
- access to technical assistance, by which service/organisation
- access to credit/services (source), collateral needed, experience, gender relation

### Individual Farmers Interviews:

	<u>Dennery River Watershed</u>	<u>Cul de Sac River Watershed</u> <u>(and other)</u>	<u>Total</u>
steel hillside (mainly banana)	5	6	11
on flood prone plains	4	5	9
Total	9	11	20

Farmers selected had to be representative for the area in terms of acres cultivated (mainly small-scale), income, number of household members, and gender of head of the household. Selection procedure was based on consultation with local extension officers and on random investigations, ie. "road-side" selection.

### Interviews with people residing/working in flood prone/landslide areas:

(incl. Dennery village, Bexon, Ravine Poisson)

Carried out by driving/walking through the respective affected areas and talking to people. Special attention was given to people residing along rivers and in flood-prone landslide areas. Women and children were included. The latter in view of the educational importance of the matter investigated.

Total number of interviewees: 25 (excluding individual farmers, see above).

Appendix B:

**WMAF  
ESTABLISHMENT AND ANNUAL OPERATING BUDGET  
(Estimate)**

The following tentative budgets put forward as a basis for discussion indicate the estimated cost of establishing and operating a Watershed Management Action Force (WMAF) under two different financing scenarios. **Budget A** assumes that all equipment, vehicles and other operating costs are met entirely by the project/SLG. **Budget B** reflects a reduced estimate which envisages the possibility of establishing the proposed office at the (e.g. Dennerly) Regional Office where the premises and some equipment will be shared with the governments departments already established there. It also proposes to include the use of existing project/GoSL vehicles as an option to purchasing new ones. However, one of the main objectives of the trial period of the pilot-WMAF (Dennerly) is to accurately assess the realistic financial requirements and possibilities for cost recovery in order to give guidance for the replication process to follow.

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**Budget A**

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<b>I. ESTABLISHMENT COSTS</b>	<b>(EC \$)</b>
1. BASIC OFFICE EQUIPMENT	17,544
2. TRAINING EQUIPMENT	15,091
3. VEHICLE AND MACHINERY	133,427

**TOTAL ESTABLISHMENT COSTS :** **166,062.00**

<b>II. ANNUAL RECURRENT OPERATING COSTS.</b>	<b>(EC\$)</b>
1. STAFF SALARIES	73,256
2. VEHICLE MEINTENANCE & RUNNING COSTS	7,100
3. TRAINING AND EDUCATION	20,400
4. OFFICE SUPPLIES	2,468
5. UTILITY BILLS	15,240
6. CONSERVATION WORKS*	(25,000)
7. DRAINAGE WORKS*	(25,000)
8. Contingencies (10%)	(17,846)

**TOTAL ANNUAL RECURRENT COSTS\*** **: 196,310**

\* For the time being there is no possibility to estimate the financial requirements needed for the conservation and drainage works. The realistic dimensions of the works to be implemented will depend on the continuous needs of each individual WMAF, the size and nature of geographical areas, and the capacity of the Action Force to mobilize voluntary work contribution. It is therefore difficult to accurately estimated these costs at present.

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**Budget B**

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<b>I. ESTABLISHMENT COSTS</b>	<b>(EC \$)</b>
1. BASIC OFFICE EQUIPMENT	: 13,444
2. TRAINING EQUIPMENT	: 15,091
3. MACHINERY	: 86,356

**TOTAL ESTABLISHMENT COSTS : 114,891**

<b>II. ANNUAL RECURRENT OPERATING COSTS.</b>	<b>(EC\$)</b>
1. STAFF SALARIES	: 73,256
2. VEHICLE MEINTENANCE & RUNNING COSTS	: 7,100
3. TRAINING AND EDUCATION	: 20,400
4. OFFICE SUPPLIES	: 2,066
5. CONSERVATION WORKS*	: (25,000)
6. DRAINAGE WORKS*	: (25,000)
7. Contingencies (10%)	: (15,282)

**TOTAL ANNUAL RECURRENT COSTS\* : 168,104**

\* For the time being there is no possibility to estimate the financial requirements needed for the conservation and drainage works. The realistic dimensions of the works to be implemented will depend on the continuous needs of each individual WMAF, the size and nature of geographical areas, and the capacity of the Action Force to mobilize voluntary work contribution. It is therefore difficult to accurately estimated these costs at present.

Assumptions used and details of cost estimates:

**I. ESTABLISHMENT COSTS**

**A. BASIC OFFICE EQUIPMENT**

Equipment	approx. unit cost EC \$	Number	Total cost EC \$
secretary's chair	800.00	1	800.00
office desks	1200.00	3	3600.00
office chairs	300.00	5	1500.00
filing cabinet	1400.00	1	1400.00
fax machine/telephone	2500.00	1	2500.00
photocopier	1600.00	1	1600.00
computer/printer/ mouse	5500.00	1	5500.00
dustbins	12.00	1	12.00
filing trays	33.00	3	99.00
diskette tray	60.00	1	60.00
transformer	300.00	1	300.00
foot extension cord	150.00	1	150.00
stapling machines	16.00	1	16.00
paper punch	7.00	1	7.00
<b>TOTAL</b>			<b>17,544.00</b>

(Estimated costs of all office equipment and stationery based on prices obtained from various office equipment and stationery stores.

**B. TRAINING EQUIPMENT**

Equipment	approx. unit cost EC \$	Number	Total cost EC \$
flip charts	55.00	6	330.00
easel	200.00	1	200.00
slide projector	2300.00	1	2300.00
slide projector carousel	45.00	1	45.00
slide screen	500.00	1	500.00
overhead projector	2800.00	1	2800.00
multi system video recorder	1900.00	1	1900.00
TV monitor (20")	2500.00	1	2500.00
stand by generator	4000.00	1	4000.00
camera	300.00	1	300.00
video tapes	12.00	12	144.00
audio tapes	3.00	24	72.00
<b>Total</b>			<b>15,091.00</b>

## C. VEHICLE AND MACHINERY

### - Agricultural tools

Equipment	approx. unit cost EC \$	Number	Total cost EC \$
forks	145.00	2	290.00
trench spades	36.00	2	72.00
shovels	35.00	2	70.00
cutlasses	17.00	2	34.00
file	10.00	1	10.00
pickaxes	29.00	2	58.00
crowbar	32.00	2	64.00
wheel barrows	220.00	2	440.00
line	28.00	6 (rolls)	168.00
tapes	75.00	2	150.00
		<b>Total costs :</b>	<b>1356.00</b>

(Source : El Paso Marketing - American Drywall)

### - COSTS OF ONE 4 WHEEL DRIVE VEHICLE.

**APPROXIMATE COST : \$ 47,071.00**

Vehicle - 4x4 WD Mitsubishi - Diesel Engine - 2500cc Duty free

(Source : JQ Charles Motor Sales Department)

### - COST OF HEAVY DUTY MECHANICAL EQUIPMENT - MINI TRACTOR OR EXCAVATOR.

**APPROXIMATE COST : \$ 85,000.00**

Mini tractor or escavator recommended for drainage activity on small scale projects not requiring vast drains and very difficult operations e.g. steep terrain.

(Local agent or source of information cost - Sunset Motors)

**TOTAL COST OF VEHICLE AND MACHINERY : \$ 133,427.00**

## II. RECURRENT OPERATING COSTS.

### A. STAFF SALARIES

Staff salaries are based on discussions with Mr. Martin Satney re. (Director, Agricultural Engineering) qualifications required for each post. Salaries quoted based on relevant grades as established by the Government of St. Lucia Estimates 1996/1997.

#### 1. Programme Manager :

Grade 9

Approximate annual salary : \$29,743

#### 2. Field Supervisor :

Grade 7

Approximate annual salary : \$24,591

3. Secretary/accounts clerk :  
 Grade 5  
 Approximate annual salary : \$18,921

**TOTAL STAFF SALARIES : \$73,256**

**B. VEHICLE MAINTENANCE AND RUNNING COSTS.**

Nature of maintenance	Total Cost ECS
tyres (4 tyres @ \$350.00)	1400.00
service ( estimated cost)	2500.00
cleaning material ( estimated cost)	200.00
fuel ( estimated cost)	3000.00
<b>Total costs :</b>	<b>7,100.00</b>

(Source of information : informal discussions with garage personnel of JQ Charles Motor Sales Department)

**C. TRAINING AND EDUCATION.**

( estimated on the basis of 12 sessions - 1 session per month). Costs based on informal discussions with personnel from various government offices.)

	Approximate cost \$
-Stationery / film processing (\$300 per workshop)	3600.00
-Transport - field trips (\$350 per trip)	4200.00
-Facilitation (1 facilitator @ \$300 per workshop)	3600.00
-Refreshments/ meals (approx. 25 participants per session at \$25 per head)	7500.00
-Printing of posters, leaflets etc.	1500.00
<b>Total costs :</b>	<b>20,400.00</b>

**D. UTILITY BILLS**

Utility bills	Monthly average costs EC \$	Year total EC \$
Telephone	500.00	6000.00
Office rental	700.00	4200.00
Fax rental	300.00	3600.00
Electricity	100.00	1200.00
Water	20.00	240.00
<b>Total costs :</b>		<b>15,240.00</b>

## E. OFFICE SUPPLIES

Stationery	approx. unit cost EC \$	Number	Total cost EC \$
masking/ scotch tape	6.00	12	72.00
diskettes	55.00 per pkt.	6	330.00
rulers	1.00	3	3.00
sharpeners	1.00	3	3.00
scissors	13.00	2	39.00
legal pads	4.00	12	48.00
pencils	1.00	24	24.00
staple removers	3.00	2	6.00
push pins	3.00	6	18.00
erasers	1.00	3	3.00
steno pads	7.00	4	28.00
file suspenders	135.00 per set	1	135.00
markers	15.00 per doz.	3	45.00
paper (typing/copying)	236.00 per box	5	1180.00
post it notes pads	12.00 per doz	2	24.00
toner	90.00	4	360.00
fax paper	7.00	6	42.00
paper clips	5.00	6	30.00
pens	1.00	36	36.00
glue	7.00	6	42.00
		<b>total cost :</b>	<b>2468.00</b>

## F. CONSERVATION WORKS & DRAINAGE WORKS

For the time being there is no possibility to estimate the financial requirements needed for the conservation and drainage works. The realistic dimensions of the works to be implemented will depend on the continuous needs of each individual WMAF, the size and nature of geographical areas, and the capacity of the Action Force to mobilize voluntary work contribution. It is therefore difficult to accurately estimate these costs at present. However, discussions with various government personnel in the fields of agriculture and forestry and other persons in the commercial sector who have some experience with drainage and conservation works provided the following information :

### Cost for drainage works:

- Drains : 3 feet approx. \$40 - 60 per chain
- : 18 inches approx. \$24 - 20 per chain
- : 1 foot approx. \$12 - 15 per chain

-Mini tractor or escavator recommended for drainage operations on small scale projects Operator's fees \$10 - \$15 per hour

-Mechanical Operation of mini tractor in the Dennery Area might be in the range of \$115 - \$130 per hour,

**Cost for conservation works :**

-Planting - four chains of Khus-Khus planting materials require one man and one woman day ( $\$40 + \$30 = \$70$ )

-One truck load Khus-Khus: digging - 2 to 3 man days at \$40 per day.

-General conservation works estimated as \$5000.00 per acre for manual labour required to carry out works with an additional \$1550 for maintenance costs.

## SECTION B

### INTERIM REPORT

#### Outline Watershed and Environmental Management Plan

##### Introduction

The following pages provide an indication of the anticipated structure and content of the Watershed and Environmental Management Plans which will be produced for the Dennery and Cul de Sac Catchments.

The outline is to be used as a basis for eliciting information from the watershed areas through the WMAF in the case of Dennery and through other organisations in the case of the Cul de Sac Watershed.

It is not proposed that this structure or contents list be shown to any of the organisations, however, the Consultant's socio-economic/ people's participation field team will be aware of it and hence enable them to relate feedback to the anticipated subject matter coverage. The issues raised from the local level should link in to the sections envisaged for the overall 'Plan'.

Over the summer period, of about 6 months, the WMAF and other organisations will be identifying key catchment issues and in some cases identifying potential solutions from their own perspective. The socio-economic field team will maintain regular contact with the various groups to monitor the progress of 'issue perception'. The Team would 'seed' potential issues to the groups in a gentle fashion in case these issues had been considered by the WMAF or other organisations to be outside the remit of a prospective 'Watershed and Environmental Management Plan' and subsequent execution and management of the Plan.

In most of the watersheds in St Lucia, the main activity is generally agriculture. The pilot WEMPs will therefore tend to focus on the agricultural sector. Whatever Plan is developed, it will be the farmers who finally decide what will and will not be done on agricultural land. It is therefore important that the WMAF have close liaison with the farming community with important farmers being within the WMAF.

On the return of the main Consultant group in September/ October 1997, a series of debriefings would be undertaken between them and the socio-economic field team. A revision of the content and emphasis of the plan development would result from these sessions. It is proposed that the Consultants would then hold meetings with the WMAF and other organisations to listen to and discuss the issues which have been raised and developed from the local level. This would enable the WEMP to be formulated, for each of the watersheds, in a manner compatible with the desired emphases of the local population. The different needs and perceptions of groups from different parts of the catchments would also be taken into account in the formulation of each Pilot Plan.

In consequence, the following pages give an outline structure for the Pilot Watershed and Environmental Management Plans which will be produced later in the year.

It is envisaged that there may be a need for one plan for the WMAF or similar with a supporting document for the use of the Watershed Management Unit (MALFF/AESD) and for the River Management Unit (MCW&T). However, this will be determined at the time of producing the Pilot WEMPs.

In the development of the Pilot WEMPs, careful consideration must be given to other environmental management plans, strategies and policies which have been or are being formulated in other more specific sectors or under different projects or programmes. Duplication must be avoided and integration should be obtained. A major factor is the avoidance of the creation of unnecessary government and non-government units or committees both within the Project and between projects or programmes.

During the local level participation process, the level of local commitment to the measures which need to be included in the Plan must be elicited. The commitment of labour, materials and funds from local sources will have a bearing on the overall potential composition of the Plan.

It will be important to obtain a sensibly balanced programme of structural and non-structural activities within the plan compatible with both realistic future fundings levels, implementation capacities and sensible objectives and attainment levels in relation to the changes which are deemed necessary. In many cases the programmes will need to be based on gradual changes with continuous feedback to enable the identification of improved implementation routes/methodologies.

Publicity campaigns to alert the general public to the problems of land degradation and ways in which they can be overcome will be essential elements of the WEMP and any conservation programme. This will include publicity material, videos, education programmes with possible press and radio coverage and even television. Field days and demonstrations should be organised with conservation activities included in school curricula if possible. Many of the concepts proposed for the pilot WEMPs will be usable for other watersheds.

# **St Lucia : Watershed and Environmental Management**

## **Interim Report**

### **Watershed and Environmental Management Planning**

## **Dennery Watershed and Environmental Management Plan**

**{Outline Only}**

### **Preamble**

Will include the description of the manner in which the Plan was developed and the role of the WMAF and other local level organisations. The full role of local level participation in the development of the Plan will be described as well as references to the relative importance of different components of the Plan as perceived by the local communities.

The relationship of the Plan to central government will also be presented in outline.

A presentation of other projects and programmes and the integration expected will be presented.

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### **Chapter 1    Population, Demography and Social Issues**

#### **1.1    Introduction**

#### **1.2    Population**

#### **1.3    Employment and Earnings**

#### **1.4    Education**

#### **1.5    Health**

#### **1.6    Social Issues**

#### **1.7    Services**

## Chapter 2 Land Use and Soil Conservation

### 2.1 Introduction

The land use characteristics of each watershed needs to be evaluated whilst the sustainability of the different uses on the different soils and land slopes will need determining.

One of the key factors in the identification of the need for the development of 'Watershed and Environmental Management Plans' for the various watersheds in St Lucia has been the problem of soil erosion.

Soil erosion is regarded as one of a number of forms of soil degradation, including the deterioration of physical, chemical and biological properties, all of which normally require attention as fragile young soils are intensively cultivated.

Worldwide, it is often found that the costs of labour and materials for the physical works necessary to control run-off and reduce erosion by such means as bunds and terraces are commonly found to be excessive. Options for the introduction of mechanical means into the St Lucian situation is limited and in any case, such works are often badly maintained. There is thus a greater emphasis on the effects of soil cover as a means of controlling erosion. This can include the advantages which can be gained from mulching and minimum tillage.

Further advantages can be gained if links can be shown to exist between improved soil cover and water conservation. This could prove very beneficial to both the needs of agriculture but for the well being of the catchment as a whole. Reducing flood flows and increasing dry season river base flows.

Options can include:

- afforestation, reforestation, revegetation of bar slopes;
- vegetative barriers on contours;
- check-dams, silt traps;
- trail, rural road and forest road treatments;
- earthen or rock barriers;
- reducing potential for landslides in high risk areas;
- controlling land-use change rates and avoidance of bare surface exposure for long periods;
- area closures (or development control).

### 2.2 Land Use Characteristics within the Dennery Watershed

#### 2.2.1 Forestry

#### 2.2.2 Agriculture

#### 2.2.3 Tourism and Trails

#### 2.2.4 Urban

#### 2.2.5 Ecological Habitats

- 2.3 Soil Types within the Watershed**
  
- 2.4 Landslides in the Dennery Watershed**
  - 2.4.1 Distribution of High Risk Areas**
  
  - 2.4.2 Agriculturally Induced**
  
  - 2.4.3 Impact of Feeder Road Construction**
  
- 2.5 Erosion Issues within the Watershed**
  - 2.5.1 Land Slopes**
  
  - 2.5.2 Soil Erosivity**
  
  - 2.5.3 Groundcover**
  
  - 2.5.4 Rainfall**
  
  - 2.5.5 Tropical Storms**
  
- 2.6 Land Use Controls**
  - 2.6.1 Rural**
  
  - 2.6.2 Urban**
  
  - 2.6.3 Planning, Building Regulations and New Roads**
  
- 2.7 Proposals for the Dennery Watershed**
  - 2.7.1 Non-structural**
  
  - 2.7.2 Structural**
  
- 2.8 Potential Environmental Impacts**

**2.8.1 Social and Socio-economic**

**2.8.2 Ecological**

**2.9 Cost Implications of Proposals**

**2.9.1 Social and Environmental**

**2.9.2 Financial**

## **Chapter 3 Coastal Zone**

### **3.1 Introduction**

The assessment of the quantity of suspended sediment passing out from the river system into the marine environment should be related to the areas declared as marine reserves in the Fisheries act of 1986. Nineteen sensitive coastal areas were defined.

Impacts of sediment loads and pollution in the coastal environment can include those on fisheries, coral other marine life and tourism. The major causes of pollution are:

- agricultural chemicals and non point pollution by concentration in river estuaries;

- sewage effluent discharges

- industrial waste and petroleum discharges;

- solid waste.

Heavy sediment loading has been reported at a number of reefs along the west coast. Reefs near river mouths show higher impact levels. These are probably due to a combination of sediment impacts as well as agricultural fertilizer loadings enhancing algal growth in the areas.

(Information will be assembled on land use and effluent discharges and these will be assigned to coral reef and coastal zones. Secondary data related to the condition of the coastal zone area will be obtained from ongoing projects whilst pollution discharge levels will be obtained from WASA. Agrochemical usage will be estimated from land use analyses for each catchment whilst sediment loads will be estimated from hydrological, land use and catchment topography assessments).

(Planning and management as proposed under other projects and programmes will need to be reviewed).

### **3.2 Existing Situation in Dennery Coastal Zone**

### **3.3 Proposals for Dennery Watershed/ Coastal Zone**

#### **3.4 Impact of Proposals**

##### **3.4.1 Social Impact**

##### **3.4.2 Ecological Impact**

##### **3.4.3 Financial**

## Chapter 4 Agriculture

### 4.1 Introduction

The farming community have the biggest impact on most watersheds in St Lucia. Any Watershed and Environmental Management Plan will naturally include an emphasis on improved agricultural practices, farm management and perhaps crop diversification. The active co-operation of farmers and farmer groups in both the design and implementation of the Plan is therefore vital.

Whatever Plan is developed, it will be the farmers who finally decide what will and will not be done on agricultural land. It is therefore important that the WMAF have close liaison with the farming community with important farmers being within the WMAF.

In a recent publication, land Husbandry: A framework for soil and water conservation, the World Association of Soil and water Conservation (WASWC) emphasised six important points in relation to acceptability of plans to farmers:

- the incorporation of soil conservation as an integral part of any farming system rather than as a separate discipline or activity;
- the more important problem of soil productivity losses rather than just soil losses per se;
- the greater importance of rainwater management than of formal soil conservation;
- the greater significance of biological measures than of mechanical measures in preventing erosion and runoff;
- the importance of reducing the volume of run-off before attempting to control its flow; and
- the acknowledgement that action programmes based on bottom-up co-operation between technical staff and local communities are far more likely to succeed and last than those based on top-down planning.

In this latter context, despite the need for a bottom-up identification of issues and desired solutions, technical advice from the correct level is vitally important. It is generally agreed that in the agricultural context, 'prohibitive policies' do not usually work, and conservation must be achieved through the willing co-operation of farmers. To do this farmers must be motivated through being able to see benefits from conservation works.

What is to be **avoided** is the large scale centrally driven conservation programme where:

- ◆ erosion prevention is only seen as an end in itself;
- ◆ farmers are regarded as one of the problems to be solved;

- ◆ effects on agricultural production and farm income is ignored;
- ◆ very high unsustainable labour requirements and programme costs;
- ◆ farmers see little benefits for themselves, only costs and extra burdens and are hence far from motivated;
- ◆ not all actual problems have been analysed, e.g. the land tenure system.

Options can include, apart from crop diversification:

- contour farming;
- contouring with vertiver grass separators;
- improved terracing;
- earth banks on field boundaries;
- better ridging or ridge tying;
- better tillage practices;
- vegetative ground cover, mulching and manuring;
- grass cover, grass strips, grass barriers;
- improved farming systems;
- agroforestry;
- better use of fertilizer.

In field drainage:

- grassing artificial waterways;
- channel check structures, silt traps, gully control;
- diversion drains and longer drainage paths.

## **4.2 Current Agricultural Production in the Dennery Watershed**

### **4.2.1 Cropping Characteristics**

### **4.2.2 Farming Practices**

### **4.2.3 Agro-chemical Use**

### **4.2.4 On-farm Drainage**

### **4.2.5 Extension Services and SLBGA Assistance**

- 4.3.4 On-farm Drainage
- 4.3.5 Programme
- 4.4 Proposed Policies and Marketing Factors
- 4.5 Implications on Extension Services
- 4.6 Potential Environmental Impacts
  - 4.6.1 Social and Socio-economic
  - 4.6.2 Ecological
- 4.7 Cost Implications of Proposals
  - 4.7.1 Social and Environmental
  - 4.7.2 Financial

## **Chapter 5 Land Tenure and Farm Tenancy**

### **5.1 Introduction**

### **5.2 Existing Situation in Dennery Watershed**

#### **5.2.1 Cadastral Mapping and Data Base**

#### **5.2.2 Land Ownership Distribution**

#### **5.2.3 Tenancy**

#### **5.2.4 Land Transfer**

### **5.3 Proposals for Dennery Watershed**

### **5.4 Impact of Proposals**

#### **5.4.1 Social Impact**

#### **5.4.2 Ecological Impact**

#### **5.5.3 Implementation Implications**

## Chapter 6 River Systems, Drainage and Maintenance

### 6.1 Introduction

Adequate maps of the river network exist with the 1:50,000 map (Rainfall and Drainage System, Land and Water Use Unit, Ministry of Agriculture, 1984) providing an adequate base map of the main channel network. Other map series at 1:25,000, 1:10,000 and 1:2,500 also exist.

Topographic maps at a scale of 1:10,000 provide a general contour and hence level information of the channel system from which channel slopes can be interpreted. River surveys carried out as part of the Phase 1 Programme provide additional detailed information in relation to the lower sections of the river network. This is supplemented by the 1:2,500 maps in most parts of the basins, these being of two types, one topographic with contour information and the other Cadastral (land ownership information).

Aerial photographs at a scale of 1:10,000 have been obtained for April 1992. This is reasonably cloud free and provides useful pre-Debbie channel alignments. A similar set of aerial photographs for the post Debbie situation would be of advantage but is not believed to be available.

It is important that river maintenance and the removal of debris is regularly undertaken before the intrusion destabilises the channel through increased bank erosion etc. Such maintenance will reduce the need for river training and channel alignment control.

Measures which can be undertaken include:

- gabion (boxes or mattresses) protection work to prevent lateral movement of the channel and erosion of the outer banks of a bend;
- revetments with the same objective;
- palisading with the same objective;
- gabion work to provide a hard nib to provide a degree of stability to the alignment;
- palisading or gabions to create a groyne to redirect flows;
- loop cutting with associated mini weir construction if a head loss is to be created to match that lost in the cut. Care has to be taken with such weir design.

In almost all of the above measures it is important to introduce different levels of bio-engineering.

### 6.2 Existing Situation in Dennery Watershed

#### 6.2.1 Natural Drainage Network

#### 6.2.2 Urban Drainage Network

#### 6.2.3 Cross Drainage Structures

#### 6.2.4 Flood Hazard Mapping

- 6.3 Hydrology and River Hydraulics**
  
- 6.4 Flood Protection/Proofing Proposals for Dennery Watershed**
  - 6.4.1 Non-structural**
  
  - 6.4.2 Structural**
  
- 6.5 River Maintenance Programme for the River Dennery**
  - 6.5.1 Non-Structural**
  
  - 6.5.2 Structural**
  
- 6.6 Urban Drainage Systems Upgrading Programme**
  - 6.6.1 Non-structural**
  
  - 6.6.3 Structural**
  
- 6.7 Environmental Impact of Programme**
  - 6.7.1 Social Impact**
  
  - 6.7.2 Ecological Impact**
  
- 6.8 Cost of Programme**
  - 6.8.1 Capital Costs**
  
  - 6.8.2 Recurrent Costs**
  
  - 6.8.3 Implementation Implications**

## Chapter 7 Water Requirements and Water Supply

### 7.1 Introduction

A general statement was made of the water requirements in St Lucia in the recent report by H.V Rodriguez entitled 'Water Resources Management and Development in St Lucia Post Tropical Storm Debbie', MoA, AESD 1994.

The population in 1991 was reported to be 136,900 (Annual Statistical Digest) and with an assumed population growth rate of 2%, a population in 1994 was estimated to be 145,000. A per capital consumption of 300 litres/day was assumed yielding a total demand of 15.88 million m<sup>3</sup> per annum. Industrial demand was taken to add a further 3 Mm<sup>3</sup>.

Irrigation demands were based on an assumption that 2,200 ha were irrigated. Irrigation supply volumes of 7000 m<sup>3</sup>/ha/annum were assumed for sprinkler systems and 10,000 m<sup>3</sup>/ha/annum for surface systems. This indicating a gross irrigation demand somewhere between 15Mm<sup>3</sup>/annum and 22Mm<sup>3</sup>/annum.

Overall Island demand was thus estimated to be between 34Mm<sup>3</sup> and 41Mm<sup>3</sup>/annum. These are relatively approximate estimates since they do not consider any re-use of irrigation drainage water and are based on many assumptions.

Information on water supply systems in relation to abstraction points, abstraction volumes through the year and associated water qualities will be obtained from WASA. The ongoing ODA funded project {outlined earlier referring to the biotic classification of the river system and the use of this information to monitor river water qualities} will also be approached for information. The information would provide the basis for control locations in relation to ensuring sediment loads are kept low and effluent discharges are avoided within the management planning process.

The 1994 National Environmental Action Plan (Draft, May) states that on average 6.5 mg/d was distributed in 1987 and by 1992 this had increased to 8.5 mg/d. This latter value is equivalent to 11.7 Mm<sup>3</sup>/annum and is assumed to relate to the all but the agricultural sector. It is also reported that water shortages are common and that the figure is not equivalent to demand.

Seen problems include:

- clogging of river intakes during floods, aggravated by upstream catchment land use changes;
- recurring droughts in the dry season, with different degrees of severity in different catchments.
- main supply pipeline ruptures;
- inadequate water treatment units especially on the smaller intake and distribution systems;
- insufficient revenue to WASA to enable it to operate effectively.

There are plans to develop new sources particularly in the east and southern part of the Island to facilitate the development of tourism in these areas. The cost of the programme which should be completed in 1998 was estimated to be about EC\$137m. A National Water Conservation Plan was also deemed necessary. An increase in water catchment areas by 2,000ha was indicated as being necessary as well as an increase in supply tariffs (5 to 10c per 1,000gallons (1.3c to 2.6c per m<sup>3</sup>)) and the completion of metering on all properties.

### 7.2 Existing Situation in Dennery Watershed

#### 7.2.1 WASA Water Supply System



## **Chapter 8     Liquid Waste**

### **8.1     Introduction**

The treatment and disposal of sewage is a major problem for the Island which has not to date been adequately addressed. The use of septic tank soakaways by large sectors of the population which live in the lower river basin areas is reportedly producing contamination of coastal waters.

### **8.2     Existing Situation in Dennery Watershed**

### **8.3     Proposals for Dennery Watershed**

#### **8.3.1   Non-Structural**

#### **8.3.2   Structural**

### **8.4     Environmental Impact of Programme**

#### **8.4.1   Social Impact**

#### **8.4.2   Ecological Impact**

### **8.5     Cost of Programme**

#### **8.5.1   Capital Costs**

#### **8.5.2   Recurrent Costs**

#### **8.5.3   Implementation Implications**

## **Chapter 9 Solid Waste**

### **9.1 Introduction**

To address the issues of solid waste, there is in the process of commencing, a St Lucia Solid Waste Management Plan. This is to be part of the OECS Waste management Project and entails the construction of two new sanitary landfill sites and the closure of specific major dump sites on the island. Waste reception facilities are also proposed at ports. One of the new land fill sites is proposed for the Deglos area of the Cul de Sac watershed (as a replacement to the one at Choc originally proposed). The site at Vieux Fort is to be upgraded. Existing dump sites to be closed being Ciceron, Micoud, Dennery, Anse le Raye and Choiseul. It is also proposed that CEHI have a role in the environmental monitoring of the landfill sites.

### **9.2 Existing Situation in Dennery Watershed**

### **9.3 Proposals for Dennery Watershed**

#### **9.3.1 Non-structural**

#### **9.3.2 Structural**

### **9.4 Environmental Impact of Programme**

#### **9.4.1 Social Impact**

#### **9.4.2 Ecological Impact**

### **9.5 Cost of Programme**

#### **9.5.1 Capital Costs**

#### **9.5.2 Recurrent Costs**

#### **9.5.3 Implementation Implications**

## **Chapter 10 Institutions and Legislation**

### **10.1 Introduction**

#### **10.1.1 Land Related**

#### **10.1.2 Water Related**

The main environmental laws which relate to the water resources sector are:

- Forest, Soil and Water Conservation Ordinance (1946);
- Water and Sewerage Authority Act (1984);
- Public Health (Water Quality Control) Regulations (SI 14/78);

The responsibilities of WASA would appear to include, on the basis of the 1984 Act:

- establishment of a hydrologic network and the execution of periodic water surveys;
- prepare estimates of future water demands for the domestic, industrial and commercial sectors;
- preparation of plans for and the execution of more efficient water management;

As stated in the Institutions Report, water is perceived to be a property of the State and that there are no private rights over water.

WASA has the responsibility to manage the water resources within a watershed including the safeguarding of water qualities. It is also responsible for the management of droughts and to monitor resources to these ends.

Water qualities are covered under Public Health Regulations wherein are defined the water quality standards and penalties for their infringement are laid out.

Important aspects which must be addressed include:

- the permissible activities in the flood plains and the manner in which these are enforced;
- the control of trash ingress into the river system during flood periods;
- the regulation on the use or abstraction of water from the river systems in the dry season;
- the potential for charging systems and licenses for water abstraction and the monitoring of these abstractions;
- the control of activities which can cause pollution in the river system particularly in the dry season;
- the possibilities for the introduction of fines for pollution incidents.

The socio-economic impact of such controls and charging systems needs to be investigated. The public response to such concepts will hopefully be obtained during the course of the study to enable realistic and workable approaches to be introduced. This will form a part of the Watershed and Environmental Management Plans which are to be formulated during the course of the Project.

#### **10.2 Watershed Management Unit (Ministry of Agriculture)**

#### **10.3 River Management Unit (Ministry of Communications, Works and Transport)**

## 10.4 Land Conservancy Board

## **Chapter 11 Disaster Preparedness**

### **11.1 Introduction**

### **11.2 Situation in Dennery Watershed**

### **11.3 Recommendations**

## **Chapter 12 Local Level Participation**

### **12.1 Introduction**

### **12.2 WMAF**

### **12.3 Local Level Institutions and NGOs**

## **Chapter 13 Environmental Monitoring Programmes**

### **13.1 Introduction**

### **13.2 Agro-meteorological Network**

### **13.3 Hydrometric Network**

### **13.4 Water Quality**

### **13.5 Ecological**

### **13.6 Land Use**

### **13.7 Agricultural Practices**

### **13.8 Special Activities/Pilot Schemes**

## **Chapter 14 Overall Programme Activities**

### **14.1 Introduction**

