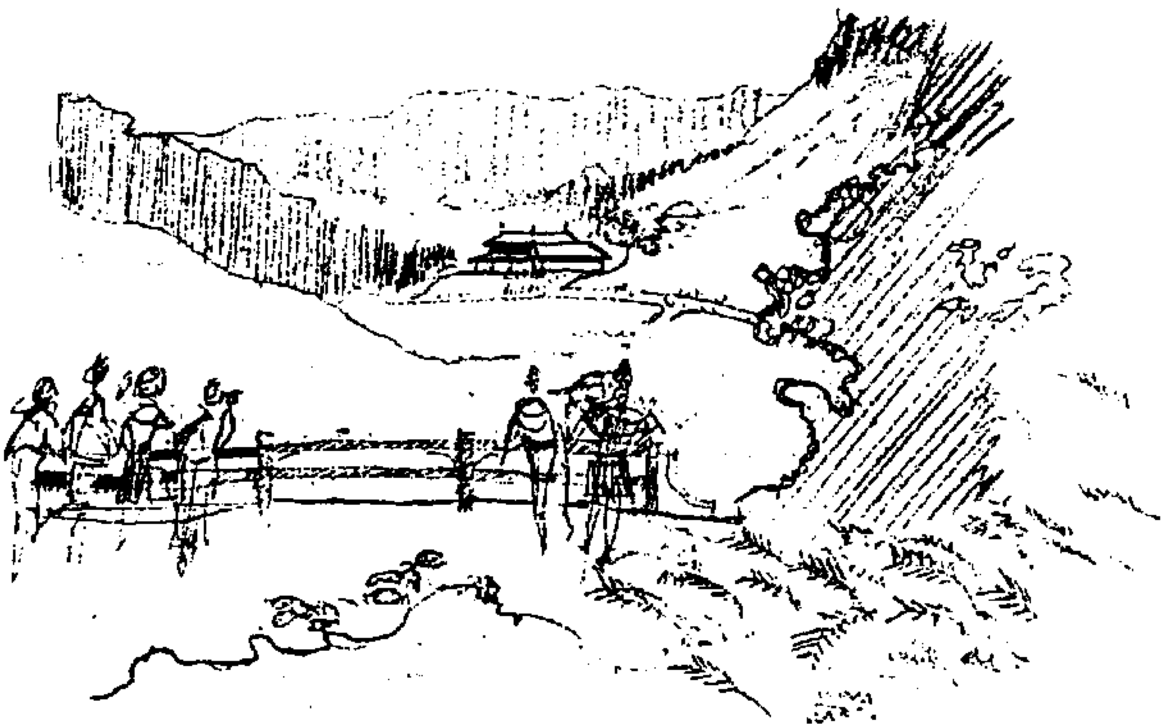
MANAGEMENT AND DEVELOPMENT PLAN
FOR THE
SULPHUR SPRINGS NATURAL LANDMARK



FEASIBILITY REPORT

MARCH 1991

GOVERNMENT OF ST. LUCIA

ST. LUCIA TOURIST BOARD

ORGANIZATION OF AMERICAN STATES

DEPARTMENT OF REGIONAL DEVELOPMENT

AND ENVIRONMENT

ACKNOWLEDGEMENTS

This report presents a draft plan for the design, construction and implementation of a Sulphur Springs Natural Landmark enhancement programme for St. Lucia. The report was written by Richard Huber and Wayne Park and received significant editorial input from Nicholas Thomas. The following list of people were instrumental in the organization and design of the report:

The St. Lucia Tourist Board

Stephen McNamara	-	Chairman
Nicholas Thomas	-	Director of Tourism
Sonia Soltibus	-	Manager Information Services
Agnes Francis	-	Product Development Manager
Roslind Robinson	-	Asst. Accountant
Angela Alphonse	-	Research Executive
Harold Dawson	-	Manager, Soufriere Information Center
Mary Ratti	-	Secretary, Soufriere Information Center
Brenda Alfred	-	Ticket Collector
Peter Simon	-	Sulphur Springs Guide

Ministry of Trade, Industry, and Tourism

George Mallet	-	Minister
Eudes Bourne	-	Ministry of Tourism

The St. Lucia National Trust

Robert Devaux	-	Director
Giles Romulus	-	Projects Coordinator\Planner
Jean Pierre Laurant	-	Botanist

Soufriere Development Programme

Clem Bobb	-	Chairman, SDP
Michael Gustav	-	Director, SDP
Nick Troobitscoof	-	Chairman, Technical Committee, SDP
Ange Emmanual	-	Chairman, Town Council
Ernest Augier	-	Representative, Chamber of Commerce
Julius Alcindor	-	Representative SW Regional Clerk
Ken Prospere	-	Rep Youth and Sports Council

Organization of American States

Todd Payne	-	Director OAS National Office
Newton Cordeiro	-	Chief of Division, OAS Washington
Wayne Park	-	OECS Coordinator
Claude Larreur	-	Tourism Specialist
George Proctor	-	Botanist Consultant
Michael Pascal	-	Architect
Robin Lovell	-	Architect

EXECUTIVE SUMMARY

The enhancement of the Sulphur Springs Natural Landmark has been discussed for several years as a means of improving the St. Lucia tourism product. Tourism planners have indicated the need for improving the attractions in the Soufriere area that are accessible to stay-over arrivals and cruise shippers during their visit to St. Lucia. With an increased interest in geological processes and natural phenomenon, the Sulphur Springs is guaranteed to continue to receive high visitation. The implementation of the Sulphur Springs enhancement and interpretive action plan outlined in this report will improve St. Lucia as a "green tourism" destination.

The report includes a review of the infrastructural, educational, and environmental projects necessary for the rehabilitation of the natural landmark. A capital investment, equipment, programming, maintenance, and personnel budget are presented with a total estimated cost of EC$1,618,572 over 12 years. The report presents architectural drawings and specifications for a visitor center, restaurant, rest room facilities, and an environmental education room with exhibits display. Revenues are envisaged from entrance fees, concessions, and sales.

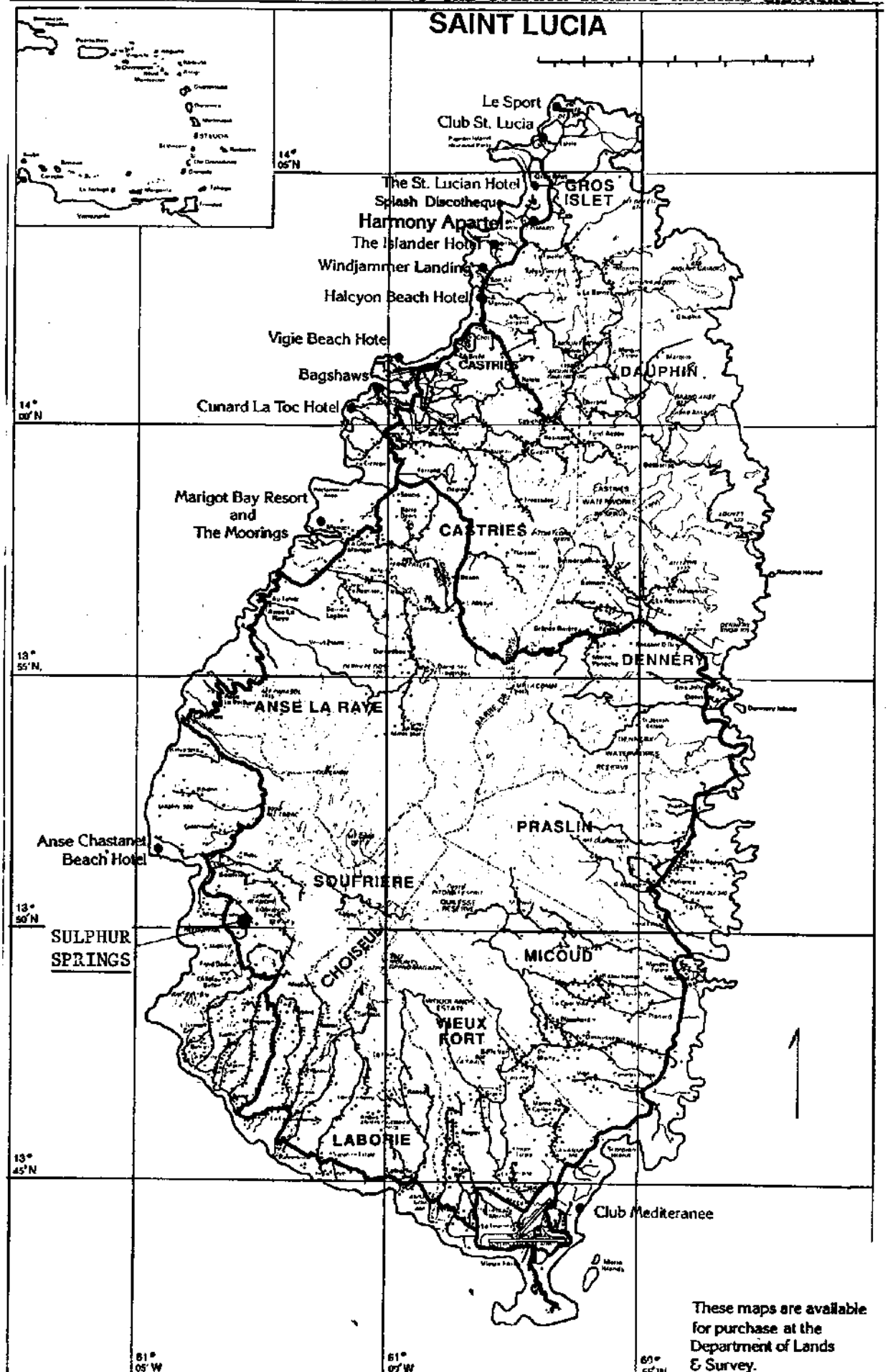
Tourism growth in St. Lucia has increased roughly 10% per year for the last 8 years. Of the total arrivals to St. Lucia, 24% visit the Sulphur Springs. Visitation to the Sulphur Springs has increased 15% per year on the average over the last 5 years. Based on this history, two approaches have been used to evaluate the financial feasibility of the proposed improvements at Sulphur Springs. The first approach tests the financial viability from the perspective of the entire operation at Sulphur Springs. Current and ongoing costs are combined with the capital and operating expenditures of the enhancements and compared against total expected income. This approach tests the soundness of the entire operation after the project has been implemented.

The second approach analyzes the viability of the enhancements by themselves, comparing the marginal costs of the enhancements alone with estimates of the additional income that they alone would generate.

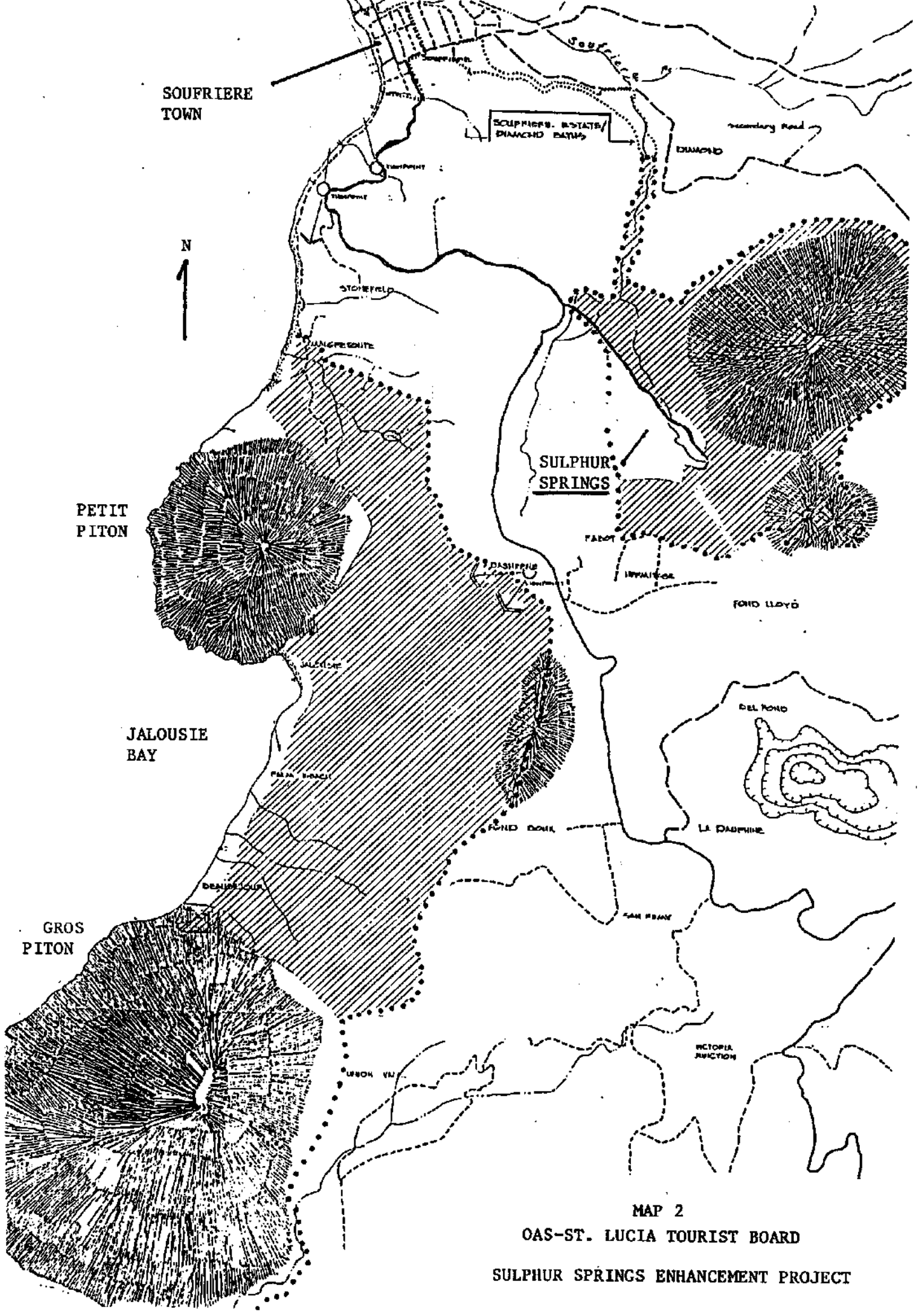
	First Approach	Second Approach
INTERNAL RATE OF RETURN	25%	22%

The analyses show that the enhancement project is highly viable. The critical assumptions to the analyses are very conservative: the five percent growth rate in overall visitation, the approximately five percent marginal improvement in visitation, a carrying capacity of 100,000 visitors, and finally the entrance fee increase from EC$3 to EC$5.

MAP 1. LOCATION MAP OF THE SULPHUR SPRINGS NATURAL LANDMARK



These maps are available for purchase at the Department of Lands & Survey.



MAP 2

OAS-ST. LUCIA TOURIST BOARD

SULPHUR SPRINGS ENHANCEMENT PROJECT

I. INTRODUCTION

1. Objectives

St. Lucia is making a concerted effort to improve its tourism product through the organized enhancement of its unique natural resource attractions. This report represents a continuation of these efforts focusing on improvements for the Sulphur Springs Natural Landmark. (See Map 1.)

This fascinating area of boiling hot springs, volcanic promitories and tropical vegetation is part of a growing tourism attraction in the region of Soufriere, a coastal town on the southwestern coast of the island. The Springs themselves are located within the Qualibou Volcano, 1.5 miles southeast of town along a paved road. (See Map 2.)

The study serves to evaluate the current conditions of the Springs, its tourism visitation and needs for improvements. It then details an integrated program of physical, administrative, educational and promotional enhancements to provide for a well-protected national heritage site and an outstanding, world-class tourism attraction. This study is completed at the level of feasibility and is oriented to rapid implementation.

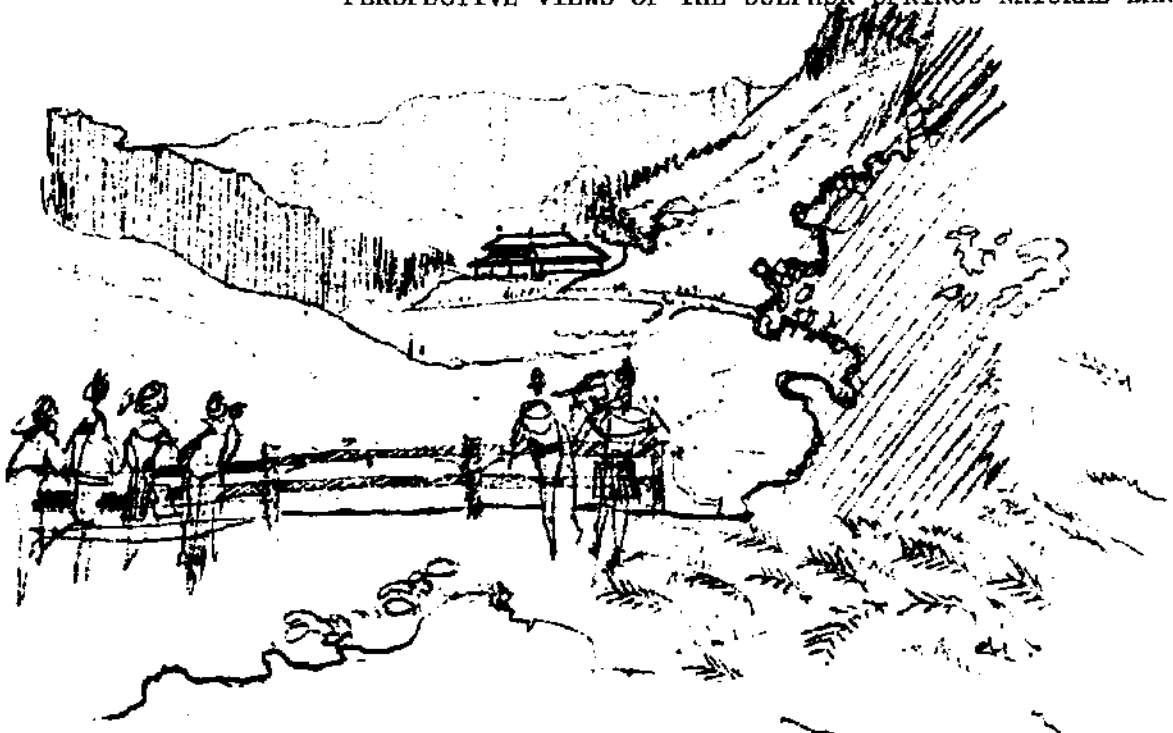
The study was prepared jointly by the St. Lucia Tourism Board and a technical team of the Department of Regional Development and Environment of the Organization of American States (OAS). The work forms a part of St. Lucia's National Program of Technical Assistance as requested of the OAS for the biennium 1990-1991. Input and collaboration in the study was also provided by the St. Lucia National Trust and the Soufriere Development Program.

2. Background

The Soufriere area with its significant attractions has become the primary day excursion destination for stay over-arrivals that reside primarily in the hotels in the north of the Island. The Sulphur Springs, the historic town of Soufriere, the mineral baths and botanic garden, old sugar mills and rum distilleries, the old colonial estate houses, and the Pitons, considered the most spectacular scenery in the Caribbean, all provide an exceptional experience.

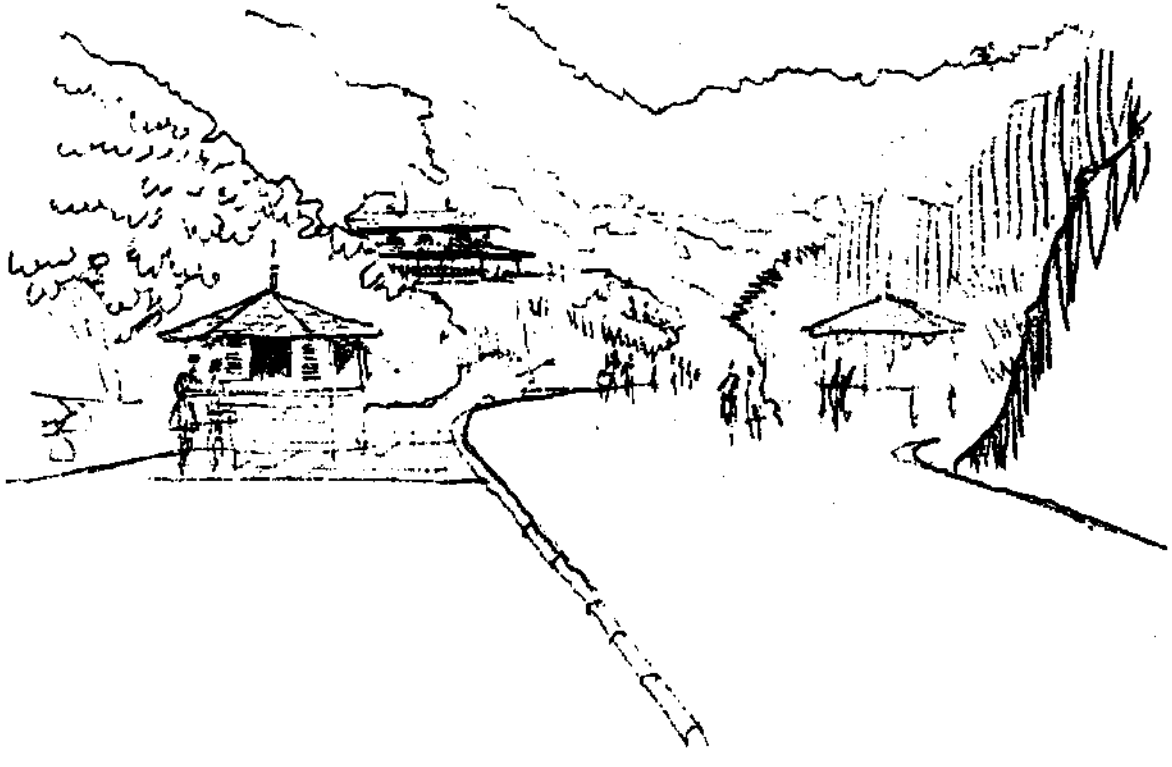
Nevertheless, the residents of Soufriere, specifically those involved in the tourism trade, have been vociferous that the Soufriere area has prospered little from tourism, and that minimal tourist dollars are left behind. Soufriere residents complain that the area has a poor road network and receives inadequate marketing in the Castries and Cap Estate areas. Tourists and tour guides complain of a lack of security for the tourists and harassment from vendors. These problems, that have

PERSPECTIVE VIEWS OF THE SULPHUR SPRINGS NATURAL LANDMARK



This view is from the shade and sun shelter overlook down onto the Sulphur Springs.

This view is from the parking area up to the visitor center. The kiosks in the foreground are the guard station and handicraft vendor booths.



hindered the economic development of the Soufriere region, were addressed in two Government of St. Lucia\OAS Department of Regional Development reports entitled "Soufriere Tourism Development Programme", of 1985, and "Tourism Development Plan for St. Lucia", of April, 1985.

These reports made concrete recommendations, that, once implemented, would assist with the comprehensive tourist development and environmental protection of the region. The study completed in 1985 addressed the following objectives:

- to improve mutual respect between Soufriere residents and visitors.
- to develop and protect the natural attractions to increase visitor appreciation.
- to expand tourism in the area (day-tour as well as stay-over).
- to increase employment opportunities, income, and net foreign exchange earnings.

The study proposed the following seven subprojects:

1. The Pitons as a park and recreation area
2. The Sulphur Springs
3. The Soufriere Town
4. Diamond Baths/Gardens
5. Rain Forest Walk and Overlooks
6. Historic and Archeological Sites
7. Lodging

The report was a preliminary plan aimed at assisting the St. Lucian authorities select and implement specific limited projects appreciating the implications and function of that action on the overall context of tourism in St. Lucia. (OAS - Tourism Development Plan for Soufriere, 1985)

II. THE SULPHUR SPRINGS NATURAL LANDMARK

1. Description

The Sulphur Springs Natural Landmark is a 25 acre land area which contains natural features of outstanding national significance. The geological formations are considered of world class, compared to those of Solfatara in Italy, Yellowstone Geysers and Hot Springs in Wyoming, U.S.A., and Onzendoki in Japan. The Sulphur Springs has hot springs of bubbling, spouting water that were formed more than 300,000 years ago which deserve protective management. The Sulphur Springs represents a geological formation called solfatara that send forth hot vapors and gases. Technically the volcano is still active, but it no longer sends forth lava. The area has plant species which either because of their uniqueness, natural beauty or because they are rare either

as individuals or a population, should be protected. (See Appendix III.)

Unfortunately, the area has been significantly altered by man over the last century for sulphur mining, and more recently for geothermal exploration. In both cases cut and fill have resulted in large exposed naked earth along the access road that is susceptible to erosion and unsightly. The first "British" geothermal exploratory project in 1974 left the original wells tapped off and in place. Corrosion has lead to leakage and a hazardous condition. The access road is of poor quality. Large trucks transporting heavy equipment to the geothermal project have caused it significant damage. Its surface is currently badly eroded and full of pot holes.

The Sulphur Springs area needs to be rehabilitated, ideally, to reflect little or no evidence of man's activities. The area has high potential for public recreation and education, but a survey indicates that several of the visitors are unimpressed with the attraction after hearing so much about it.

2. Management Objectives:

Management objectives are to protect and preserve the natural features of interest and, to the extent consistent with this, provide opportunities for recreation, environmental education and research.

Activities, which can endanger the perpetuation of species or cause damage to the natural phenomena of the landmark will not be permitted.

3. Natural Resources Management:

Management to perpetuate flora and fauna and natural geological phenomena which was a major objective for the establishment of the area as an attraction is permitted. Normally, however, the natural processes will be allowed to evolve freely.

Hunting and collection of flora, fauna, geological items, including sulphur, or other natural phenomena, except those utilized for authorized scientific purposes are prohibited.

The use of the areas for agricultural, forestry, grazing, mining, or other commercial or exploitive purpose will not be permitted unless provided for in specific non-critical sectors by the law establishing the area.

Exotic species of plants and animals will not be introduced and, where they exist, should be removed if practical. As natural landmarks will frequently be established within agricultural areas of private ownership, these agricultural uses may be

continued. It is not recommended to continue planting with the introduced Caribbean pine. If erosion control measures are to be implemented, native species found in the immediate area should be utilized.

4. Visitor Use Policy:

Visitors will be permitted in the area under the conditions established by management unless the feature or site is so fragile that visitor use endangers its preservation. Visitors are no longer permitted to enter the immediate area of the Springs and wander around. They must remain on the asphalt road, concrete trail, and other designated trails. Side trails into other areas to give different views of the Springs will be developed. While the prohibition to actually enter the Springs may detract to some minor extent from the overall experience of being right on top of the Springs and feeling the hot sulphurous gases, it is deemed necessary to protect the visitors and guides and to minimize visitor use impact upon the Springs.

Interpretation and environmental education programmes will be encouraged. A visitor center with interpretive exhibits and rest facilities is recommended. Details for the design, location and construction are included in this report.

Provision of outdoor recreation facilities such as hiking and picnicking will be permitted although they should not unduly disturb the natural character of the area. Trails to the Rabot Crater Lake and to the top of Mt. Soef will be improved and properly marked.

Visitor facilities in keeping with the character of the area may be provided. A small rest house for protection from the rain and sun is recommended from the overlook found at the end of the cement path.

Scientific research is encouraged. The Springs present churning cauldrons, sizzling basins, fumaroles of geologic importance, and plant adaptations to live within range of the sulphurous gases.

III. TOURISM CHARACTERISTICS

1. Regional Tourism Perspective

Tourism in St. Lucia is the country's fastest growing sector of the economy accounting for approximately 7%-9% of GDP. Tourism revenues and contribution to the national tax base have grown steadily over the last decade. Stay-over arrivals have increased at roughly 10% per year over an eight year period.

The performance and profitability of the St. Lucian hotel sector is highly successful. Data for 1989 for eleven major hotels

showed an average room occupancy of over 70%. This suggests that St. Lucia has one of the highest hotel occupancy rates in the Caribbean. 1989 figures indicate that tourists spent average US$103.40 daily during the winter and US$87.99 daily during the summer. Some areas of dissatisfaction specifically mentioned include:

a. Roads
b. Garbage dump and littered streets
c. Pollution of the water and the environment
d. Inconsiderate drivers
e. Lack of signage on roads

Indicated in the Tourism Action Plan prepared by the Caribbean Tourism Organization (1990) as one of the fundamental weaknesses of the tourism product is the partly unfavorable presentation of sites of historic and natural heritage.

2. The Accommodation Sector

The majority of the accommodation stock (75 percent of the rooms) is concentrated in the north-west of the island from Castries to Cap Estate. The largest establishment is the Club Med (256 rooms) which is located in the south near Vieux Fort and Hewanorra International Airport. Soufriere and Marigot Bay are isolated pockets with small hotel accommodation. Stay-over tourism in Soufriere is limited to two small hotels, several villas, and a few small guesthouses.

Accommodation in Soufriere is summarized in the Table 3.2.1.

Table 3.2.1

HOTEL	NO. OF ROOMS
Anse Chastenet	25 doubles
Diamond Cottages	5 doubles and 3 bedroom cottages
Hummingbird Beach Resort	6 doubles
Home Guest House	7 doubles
Tropical Palm	4 doubles
La Caille	1-3 bedroom
Still Beach House	1-3 bedroom cottage (under expansion)
Wayne Brown	1-4 bedroom cottage
	1-2 bedroom cottage
Total Rooms	62

This represents roughly 3% of the total accommodation in St Lucia.

3. Analysis of Visitation to the Sulphur Springs

Soufriere tourism activity today consists primarily of day-tour attractions for visitors that arrive by boat or bus tours. (See Appendix IV.) The majority of the visitors to the Sulphur Springs are tourists lodged in beach areas from Marigot Bay to Cap Estate. Most holiday makers are on organized tours arriving either by boat, overland, or on their own. Yachtsman who moor in Soufriere bay also hire taxis to carry them to the Sulphur Springs.

The majority of the visitors are tourists who travel on the day-excursion sailing ships such as the Buccaneer, Unicorn, or Flamingo. A smaller number arrive by privately-hired mini-bus or Around-the-Island tours with either Fletcher's Touring or Courtesy Taxi Service. They travel through the scenic town of Soufriere, onto the Sulphur Springs, and thereafter onto the Diamond Mineral Baths\Garden or one of the rain forest walks. They may also visit one of the beaches, view one of several scenic overlooks, or visit one of the historic or archeological sites in the Soufriere area. Thus Soufriere and environs is not a beach resort itself, but forms part of the island's tourism product.

The St. Lucia Tourism Policy as it pertains to natural and cultural attractions is to provide "adequate protection for the physical environment and in particular the scenic resources which place St. Lucia at an advantage as a tourist destination." (Draft Tourism Action Plan for St. Lucia 1990, page 8.) The overall intention is to promote St. Lucia's competitiveness and uniqueness as a prime Caribbean holiday destination and to ensure that the country develops and maintains a reputation for good quality and value. The Sulphur Springs is noted as one of the main features of the St. Lucia tourist product along with the lush, tropical vegetation, the trademark Pitons, and the attractive mountainous scenery.

4. Demand for the Sulphur Springs

The Sulphur Springs is presently the main sightseeing goal of Soufriere visitors. (See Appendix IV, question 5.) Of all visitors (air arrivals plus cruise ship passengers), 24% (yearly average) visit the Sulphur Springs. Table 3.4.1 compares total arrivals to St. Lucia vs. the number of paying visitors to the Sulphur Springs. With improved roads and visitor facilities, it is estimated that 40% of all tourists would visit the Sulphur Springs.

TABLE 3.4.1

TOTAL ARRIVALS VS. NO. OF PAYING VISITORS TO THE SULPHUR SPRINGS

Year	1985	1986	1987	1988	1989
Total Arrivals (000)	151	174	210	214	243
No. Of Paying Visitors to the Sulphur Springs (000)	35	44	41	57	61
% of total	23%	25%	20%	27%	25%
Average over 5 years	24%				

Tourists staying at the all-inclusive hotels (Couples, Club Med) are offered a trip to Soufriere as part of the all-inclusive rate. With an improvement in hotels and guest cottages in the Soufriere region, Soufriere will stand to prosper from the increased tourism. The establishment of the proposed ferry service from Castries to Soufriere and the rebuilding of the West Coast Road should dramatically increase Sunday and holiday excursions.

The number of visitors coming to the Sulphur Springs is the primary planning parameter for designing the facilities. Table 3.4.2 compares available data on the number of St. Lucia arrivals by air, cruise ship passenger arrivals, the number of Sulphur Springs entrance tickets sold, and the number of boat passengers disembarking from tour boats in Soufriere town.

Table 3.4.2

ARRIVALS TO ST. LUCIA,, SULPHUR SPRINGS, AND SOUFRIERE JETTY 1987-1990 (000,S)

Year/Month 1987	Air Arrivals (1)	Cruise ship Pass. (2)	Sulphur S. Paid Visitors (3)	Soufriere Jetty Arrivals (4)
January	11.6	14.3	5.3	2.7
February	12.3	14.4	6.6	2.7
March	11.2	13.5	6.6	2.8
April	11.0	11.1	4.6	1.6
May	9.5	1.4	2.6	1.1
June	8.6	2.9	2.9	1.0
July	10.3	2.3	2.5	1.0
August	11.6	1.3	4.3	1.3*
September	7.5	.5	.3	.9*
October	9.3	5.4	.7	1.4
November	10.1	7.3	.7	1.6
December	12.1	9.6	5.3	2.5
Total	125.0	83.8	41.1	19.0*

*estimated, no records for these months

Year/Month 1988	Air Arrivals (1)	Cruise ship Pass. (2)	Sulphur S. Paid (3)	Soufriere Jetty (4)
January	11.2	11.8	5.5	2.3
February	11.9	13.2	7.1	2.5
March	12.5	11.4	6.9	2.7
April	10.9	8.9	5.0	2.3
May	8.7	3.4	3.9	1.5
June	8.2	3.6	3.2	1.4
July	11.6	3.0	3.3	1.4*
August	11.5	3.2	4.9	3.5*
September	8.5	2.7	3.1	1.3*
October	10.8	4.4	4.1	3.0*
November	11.1	5.4	5.1	2.3*
December	13.3	8.4	5.3	2.5*
Total	130.2	79.5	57.4	28.10*

*estimated, no records for these months

ARRIVALS TO ST. LUCIA,, SULPHUR SPRINGS, AND SOUFRIERE JETTY 1987-1990 (000,S)

Year/Month 1989	Air Arrivals (1)	Cruise ship Pass. (2)	Sulphur S. Paid Visitors (3)	Soufriere Jetty Arrivals (4)
January	12.8	12.4	6.3	2.4
February	11.1	11.2	6.7	2.2
March	14.0	15.7	9.2	2.9
April	11.3	10.5	5.0	2.2
May	10.3	6.6	5.8	1.6
June	11.1	4.8	4.5	1.7
July	11.0	4.7	4.0	1.3
August	10.1	6.4	4.0	1.4
September	8.2	3.8	3.9	1.2*
October	10.5	5.4	2.8	.6
November	11.0	10.4	5.0	1.5
December	11.4	12.3	4.0	1.6
Total	132.8	104.3	61.2	19.4

Year/Month 1990	Air Arrivals (1)	Cruise ship Pass. (2)	Sulphur S. Paid Visitors (3)	Soufriere Jetty Arrivals (4)
January	11.8	17.0	2.6	
February	11.2	12.9	2.6	
March	15.3	15.3	3.4	
April	14.3	13.0		
May	11.5	3.9	Data unavailable.	
June	9.5	2.0		
July	11.3	3.3		
August	13.7	2.9		
September	7.8	1.9		
Total	106.5	72.2		

Source: (1) and (2): 1987 - Statistical Dept. Quarterly
(3) and (4): St. Lucia Tourist Board

One may note from this data that roughly half of the visitors to the Sulphur Springs arrived by way of the Soufriere Jetty in 1987 and 1988, and roughly 30% in 1989.

5. Visitor Preference Survey

A sample survey taken of 600 visitors to Soufriere in 1984 returned 62% or 385 responses. 60% responded that they liked the Sulphur Springs the best, 2nd only to the view of the Pitons. The survey was run again with similar questions in December 1989-January 1991. In this case, 93% of the questionnaires were returned. A sample of the survey may be found in Appendix IV, along with an analysis of the results. Of significance to note is the high percentage of requests for more interpretive programming and recreational activities at the Sulphur Springs. 69% of the visitors indicated that they would like to see more interpretive panels on the Sulphur Springs trails. (See questions 12 & 13.)

IV. INSTITUTIONAL ANALYSIS

The St. Lucia Tourist Board is the national statutory authority with the responsibility for the development and marketing of tourism. It was established under the Tourist Industry Development Act of 1981 - "an act to provide for the establishment of a Board for the purposes of administering and developing the tourist industry of St. Lucia and for purposes connected therewith."

The funding of the board is provided by an annual grant from Government, together with any monies received as payment for advertising or other income.

The current activities of the St. Lucia Tourist Board include the following areas:

Advertising/Publicity
Publication and Distribution of Promotional Activity
Tourist Information Services/Interpretation and Conservation
Tourism Research and Statistics
Overseas Representation (New York, Toronto, London, Frankfurt)
Product Development
Administration

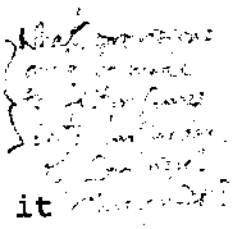
The Board has the following staff complement:

AREA	FULL-TIME	PART-TIME
Head Office and Local Tourist Information Offices	23	-
Overseas	8	1
Soufriere	18	-
	49	1

Day to day control of the Soufriere/Sulphur Springs is exercised by the Soufriere Tourist Information Center manager, who reports to the manager, Information Services at the St. Lucia Tourist Board headquarters in Castries. The specific breakdown of the staff in Soufriere is as follows:

Manager (Harold Dalson)	1
Tourism Officer (Magdalena Rattie)	1
Ticket Collector (Brenda Alfred)	1
Tour Guides	10
Tourist Wardens	4
Caretaker at Sulphur Springs	1
Total	18 full-time personnel

The Sulphur Springs has no fixed budget, rather funds are allocated from either the Sulphur Springs account in the Soufriere bank where the entrance fees are deposited, or the overall Tourist Board budget. As no overall plan for the enhancement of the site has preceded this report, no specific budget has traditionally been allocated to the Springs. It is recommended that the revenues that are generated from the entrance fees be continued to be administered by the Tourist Board or the agency designated to manage the natural landmark.



Based on several visits to the Sulphur Springs as an observer, it is the opinion of the consultant that the existing staff is adequate and the facility is well managed. While there is a definite need for site rehabilitation, the human resources are able to handle peak visitation, specifically on Wednesdays, when up to five cruise ships are harbored in Castries.

The wardens and guides are well-dressed and their presence certainly adds to the effective management of the resource. Uniforms with matching shirt and hat are recommended so that the officials are easily discernable. A patch should be designed on left sleeve of the shirt. If appropriate, a badge on the left shirt pocket of the wardens adds authority in dealing with potential problems.

A certified guide course of one month is recommended for all of the Soufriere staff. The course should include modules on visitor safety, first aid and CPR, psychological management of troublemakers, personal behavior and hygiene, and the natural and cultural history of the St. Lucia.

The St. Lucia Tourist Board may depend on input from the following national organizations which are involved with environmental issues. These include:

- Central Planning Unit - Responsible for the National Development Strategy.
- Development Control Authority - Responsible for the planning and control of projects.
- St. Lucia National Trust - Responsible for protection of national cultural and natural patrimony.
- The Parks and Beaches Commission - Responsible for the management of Parks and Beaches.

V. VISITOR USE PROGRAM

"The job of recreational engineering is not one of building trails into lovely country, but of building receptivity into the yet unloving human mind."
Aldo Leopold - Naturalist.

1. Environmental Education

The Sulphur Springs will provide an excellent field laboratory for the study of the natural sciences to include geology, botany, and ecology. An awareness program will be designed targeted towards elementary and secondary school students and entitled "enhancing a sense of national pride in our cultural and natural heritage."

Of initial importance will be the presentation of workshops for the teachers on the use of the Springs in their natural and cultural history curricula. An information package including videotapes, displays, and a series of leaflets will be available for the teachers to demonstrate to the students in order to prepare them for the Sulphur Springs visit. Likewise, post-visit activities will be included in the teacher-packets to allow follow-up.

2. Visitor Safety

Protection of the visitor is an important element of the administration of the Springs. The Visitor Protection Programme will include:

- Provision of first aid facilities at the Sulphur Springs Headquarters and Visitor Center.
- Training of tour operators, guides, and wardens in the use of safety equipment, life saving techniques and emergency procedures, and a detailed safety code for all concessionaires.
- Regular patrols through the Springs.
- Proper maintenance of facilities and trails.
- Appropriate equipment.

3. Information and Visitor Services of the Sulphur Springs

The visitor center will contain toilets, snack bar, first aid, and an exhibition. The center will provide a welcome and information area with brochures and maps on trails and activities. Souvenirs, postcards, posters and publications will be available at the retail sales area.

An exhibit area will display graphic and three-dimensional expositions on geologic formation, Amerindian culture, and floral and faunal adaptations. The exhibits will be presented within the audio-visual room, which will have the ability to be darkened for slide and video presentations. This is particularly relevant for school groups.

Self-guiding environmental education trails and guided walks departing from the visitor center will be designed around the different areas of interest. Three interpretive walks planned for the Springs are "The Geologic Formation of the Calibou Volcano", "Plant Adaptations to Survive the Effects of Hydrogen Sulfide", and the "Importance of the Sulphur Springs to the Amerindians". (See Appendix I.)

4. Interpretive Objectives and Themes for the Visitor Center

The objectives of the interpretive program will be to give the visitors an understanding of regional geology and plant life, and an appreciation of the cultural and social history.

The following themes are only a few of the ideas that can be developed:

- A discussion of geysers, hot springs, and fumaroles in the world.
- The geologic formation of St. Lucia featuring volcanism, uplift and subsidence, plate tectonics, erosion and deposition, and island biogeography.
- Plant adaptations such as seed dispersal strategy.
- Identification of flora and fauna including birds, riverine organisms and plants.
- Riverine productivity and the impact of the gases on riverine life.
- The social, economic, and cultural history of the area to include the Amerindians,and the use of mining technology representing historical methods.
- Graphic description of a geothermal power plant.

VI. CAPITAL DEVELOPMENT WORKS

1. Installations, Construction, and Groundswork

The following recommendations are made with every attempt to utilize existing structures and man-made alterations already present where appropriate. It is strongly felt that the human alteration that has occurred over the centuries should be minimized, and that only those structures that are necessary to provide a superlative tranquil and educational experience should be constructed, and within the policy guidelines that are stated in Chapter II. The phasing of the Management and Development Plan is detailed in Appendix VI.

- The parking area will remain in the same location. The cars will park in a line as they do now, and a turnaround will be constructed. This will require no new cutting or filling in this area. The kiosk area will be beautified with planting of native species found within the natural landmark.

- The Visitor Center should be constructed as an authentic replica of St. Lucia architecture. (See site plan and architectural drawings.) The building will include a welcome and orientation area, a restaurant(snack bar), rest room facilities for staff and visitors, an interpretation center, and management offices. Special attention will be given to the drainage on the slope behind the visitor center. At present, severe erosion gullies are undermining the plateau area where the visitor center will be constructed. A concrete drain running along the contour above the building will drain the water into the Sulphur Springs river to the north west. Three contour plantings of trees, shrubs, and groundcovers will be placed laterally across the slope above the visitor center. This will assist in slope stabilization and will minimize erosion.

- A picnic site for 24 people (six tables) next to the visitor center will be constructed. Picnic tables will be of the one piece table and bench, standard wooden design which seat a total of six. The tables will be permanently anchored into cement. This will protect against vandalism. Shade for the four picnic tables will be offered by flamboyant trees in the short term and a Saamon tree in the long term. If possible, trees of at least six feet in height should be transplanted in order to facilitate shade in this area as soon as possible.

- Special attention will be given to slope stabilization all around the Sulphur Springs area. Land slips will be stabilized in order to control the erosion that is occurring due to man-made influences such as tree cropping on the

slopes and fires, and natural occurrences such as earthquakes that can cause landslides. While some may argue that the landslides are natural and should be left as a part of the landscape, it should be noted that these landslips were probably started as a result of the blasting that occurred from sulphur mining operations at the turn of the century and from the fires that have occurred for centuries. Local folklore states that the slopes were burned yearly by the Amerindians for religious purposes. Vegetation burning still occurs but should be stopped. It is hazardous and repels the natural vegetation from becoming established that would ultimately minimize erosion. As a result, actions will be taken to stabilize the slopes by contour planting of appropriate trees and shrubs all over the site as indicated on the site plan drawings.

Management has the responsibility to minimize hazards from landslides. Forestry quite logically attempted to regularize this situation by planting Caribbean pine. These actions have arrested soil erosion and have begun to stabilize the slopes. This reforestation has minimized the danger from falling boulders which still continue to roll down the slopes regularly from the activity of the grazing animals, specifically goats, that are seen on the slopes from time to time. Revegetation should continue but it is recommended to utilize native species as indicated above.

- Restoration of cultural landmarks will include the Louis XVI baths (others claim the baths were built in 1902 by the owner of the Springs at the time) but for viewing purposes only. Management will decide if local residents may continue to bathe in this area, but it should not be encouraged. <u>If spa facilities are to be organized, it is recommended that they be developed in another location, but not within the Sulphur Springs Natural Landmark.</u> A logical location would be to expand the existing Diamond Mineral Baths.

  The Diamond Mineral Baths/Botanic Garden/Waterfall located within the Soufriere Estate is a very successful ecotourism venture. The Mineral Baths were built by the Baron de Laborie in 1785 and were financed by Louis XVI. They have been partially restored.

- A "rustic shelter" at the overlook at the end of the cement path will be constructed. The rustic shelter will provide a comfortable place to pause and enjoy the naturalistic vista of the Sulphur Springs. The pagoda-shaped structure will be built of local unfinished mahogany, and provide seating for 20 people. This will also be an ideal place, protected from the sun and rain, for the guides to give interpretive talks to small groups.

- Hand railing and skid proof surface will be installed on the cement walk. A small switchback alternative route will be constructed from the cement path up to the Lake Rabot trail which descends down to the overlook. This area has a good patch of forest which will be enriched. Interpretive plaques will be placed on the trees of interest. This alternative trail is important because it provides a view of the tropical forest for the short-time visitors to the Springs.

- Four other trails into the forest are planned for those with more time to spend at the Sulphur Springs Natural Landmark. (See Section 6 of this Chapter.)

- Planting for slope stabilization and erosion control on the slopes behind and facing the visitor center is recommended. Conversations with foresters at the Forestry Department indicate that **Clusia pluknettii** and **Brysonia caribaea** for overstory, and cus cus grass along with any of the **Melastomes** found on the site would be appropriate for the understory or shrub layer. Once these contour plantings are established and rill and gully erosion is arrested, the groudcovers may be introduced. Introduced species such as **Leucaena** and **Gmelina arborea** would also be effective for soil fertility improvement and stabilization. Several lines of trees and groundcovers along the slope contours will be planted as indicated on the site plan. It is recommended to utilize only native plants found in the area, except around the visitor center where more traditional plants such as bougainvillea, flamboyant, and Saamon may be utilized for color and shade. (See Appendix III.)

- Berming and smoothing of the cut and fill areas that are a result of the geothermal and road works will be required. Native grasses, sedges, and shrubs from the area will be planted along the road once the slopes have been naturally shaped.

- Several benches and trash bins are recommended as indicated on the site plan. Benches will be placed in front of the visitor center, around the kiosks, along the road, and at the waterfall overlook. Bench design details are indicated on the site plan.

- Drainage improvement and resurfacing of the main access road are essential. (Cost not included in the investment scenario. It is hoped that the Ministry of Works will absorb this expense.)

2. Sulphur Springs Headquarters and Visitor Center

The Headquarters is proposed to be located in the plateau area as indicated on the site plan. The center will serve to orient the visitor and inform them of the diversity of activities found in the natural landmark. The facility will offer a number of amenities such as information and interpretive displays, book and souvenir sales, sanitary facilities, and a restaurant\snack bar. It will provide office space for the manager and administrative and maintenance staff. The area behind the building will be used for storage sheds for equipment and tools. The Sulphur Springs Visitor Center will have around-the-clock security. The security guard (warden) will also ensure that people do not enter the Springs at night. The Springs will be open from 9 am to 6 pm.

Utilities necessary for the visitor center are:

- Water (water storage tank). Two 400-gallon water tanks will be installed for use by the visitor center. If hot water is necessary solar heaters should be installed. No irrigation system for the plantings is considered necessary because native or legume species are recommended that are hearty and should thrive under the site conditions.
- electricity connection to grid and back-up emergency generator.
- Sewage disposal (septic tank and soakaway).

Design details requiring special attention:

- Soil stability and load-bearing capacity of the proposed visitor center site should be analyzed. The geothermal well at the visitor center site drilled in 1977 by the British exploratory team indicated no geothermal activity to a depth of 800 feet. Nevertheless, a geotechnical engineer should be contracted to do a survey of the site.

- The visitor center should be of modular design so it can be moved relatively easily if geothermal activity becomes dangerous in the vicinity of the building or picnic area.

- All plumbing and electrical equipment must be resistant to the effects of local sulfuric gases. The roof material will be made of a petrochemical derivative. Galvanize or other exposed metal should not be used as the gases are highly corrosive.

- A percolation test for the septic-soakaway system must demonstrate a filtration medium of 5 feet to ensure that an adequate sewerage facility is installed.

- A land ownership study should be completed to regularize the squatting in the area if this is deemed to be a problem. At

present there are is no legal cadastre indicating the boundaries of the Sulphur Springs Natural Landmark.

- The geothermal well test project presently underway to analyze the potential of the thermal manifestation to generate a suitable amount of power should be monitored in conjunction with Sulphur Springs activity to discern if any impact occurs. (Appendix II.)

Specifications and costings for the visitor center are indicated in Appendix V.

3. Shade and Sun Deck at the Overlook

The shade and sun deck will be constructed at the overlook at the end of the concrete walkway. It will provide a rest area out of the sun and rain. It is the only shelter planned along the walkway but is felt necessary because of the frequent rain showers. The shelter will be built of rustic materials (mahogany and wooden shingles) and will harmonize with the visitor center which will be in view.

4. The Concrete Walk

The concrete walk built recently by the Soufriere Development Programme has helped minimize erosion and provides safer footing. However the guides have indicated that the lower portion is slippery when wet. A handrail should be constructed and the concrete should be grooved to provide better footing.

5. The Kiosks

The kiosks will remain. The one on the left as you enter the Springs will remain as the turnstile entrance fee kiosk unless management decides to centralize the cash center at the welcome and information center. As many of the entrance fee receipts are pre-paid and sent by the tour agencies to the Tourist Board at the end of the month, it may be more appropriate to have the unpaid visitors met at the kiosk by the guides, and then walked up to the visitor center where they will pay the entrance fee. If management decides this to be the case, the kiosk should still be maintained as the warden-guide center.

The other kiosk will be subdivided into three pie-shaped vendor booths; they will be rented for 5% of the total cost of sales. Costs to maintain the kiosk will be met by the St. Lucia Tourist Board (SLTB).

5. Side Trails

Picnicking and Camping

An improved Sulphur Springs area is expected to attract high use: day trippers, picnickers off of visiting yachts, overnight tourists, cruise shippers, and St. Lucians in general. As fire is a potential problem in the Springs area during an extended dry season, barbecues will not be permitted within the Sulphur Springs Natural Landmark. A camping area may be developed along the trail to Lake Rabot. This campsite should be designed to accommodate groups such as the Boy Scouts. A Nielsen poll in the United States listed camping as the fourth largest sport in North America with 58.1 million people involved. Camping is among the ten fastest-growing participant sports, registering a 7% growth rate per year (Appalachian Mountain Club pers. comm. 1990 & Proudman 1981). While campers do not stay in hotels for part of the time, their daily expenditure is nevertheless significant. Campers tend to spend in the outerlying rural areas which stand to prosper significantly from nature-based tourism. It is this group and the local and European markets that the ecotourism movement in St. Lucia should intend to capture.

Hiking Trails

A series of trails designed for nature observation will be provided in and around the Sulphur Springs. Trails will commence from the parking lot and from the park headquarters and visitor center.

Trail Development Programme

The following trails will serve to diversify the tourist experience and encourage the visitors to spend more time at the Springs. At present visits tend to be very short (around 30 minutes) because, apart from the walk up the concrete path, there is little to do. While the guides are informative, visitors desire more technical information and description of the natural processes. The exhibits in the visitor center and self-guiding environmental education plans will significantly improve this present deficiency.

Trail 1. This is the main concrete walk trail which leads to the overlook and the new rustic shelter. Benches will be placed along the trail at areas affording good views of the Springs as indicated on the site plan. (Appendix I provides basic information relative to an environmental education trail brochure for this and the other trails.)

Trail 2. At present, the scenic waterfall where Louis XIV bathed in the hot mineral water is degraded and out of view. A side trail should be run from the main road onto the cliff above the

waterfall and a rest area constructed with two benches as indicated on the site plan.

Trail 3. Another trail should zig zag up to Mt. Souf. A scenic overlook with a waterproof placard should indicate the significance of the view off to the Pitons and Soufriere.

Trail 4. The hike to Rabot Lake is highly scenic. A self-guiding environmental education trail and brochure to be distributed at the visitor center should be designed.

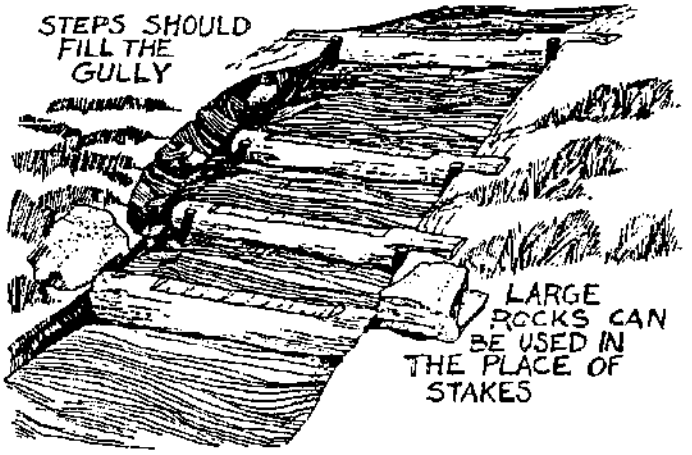
Trail 5. This will be a trail up to the geothermal project, which, if implemented, will serve as another attraction. An exhibit in the visitor center should clearly explain the processes of geothermal power. (See Appendix II.)

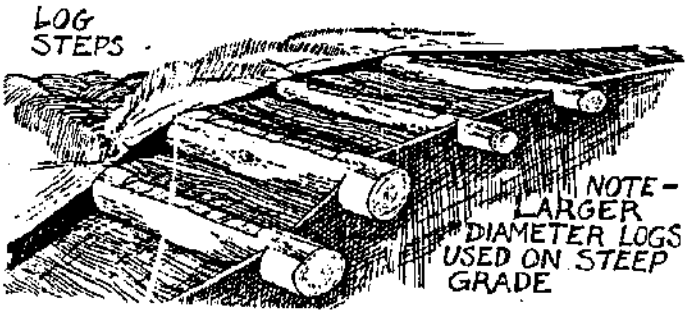
Trail 6. Trail 5 descends down towards the Diamond Mineral Baths and waterfall. It departs from the parking lot.

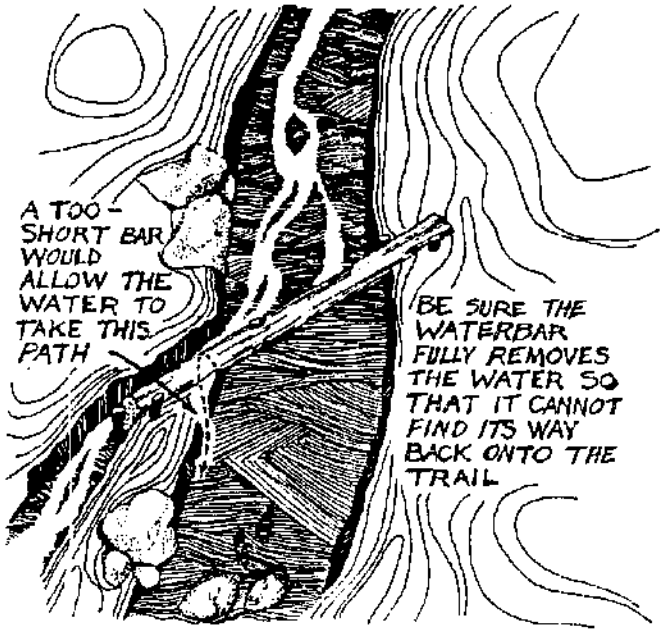
The design of the trails is critical to the success of the visitor experience. Trail layout, clearing, marking, erosion control, hardening of trails in wet areas, stream crossings, and the design of trails on private lands are tasks that should be delegated to professional engineers and recreation planners. The following drawings are examples of the kinds of engineering works that need to be done to promote safe hiking. At present, the trails within the area are in good condition. Regular maintenance is necessary after storms, and some gullies require simple bridges as presented in the following diagrams.

EROSION CONTROL TECHNIQUES ON TRAILS

Source: (Proudman et. al. 1981)

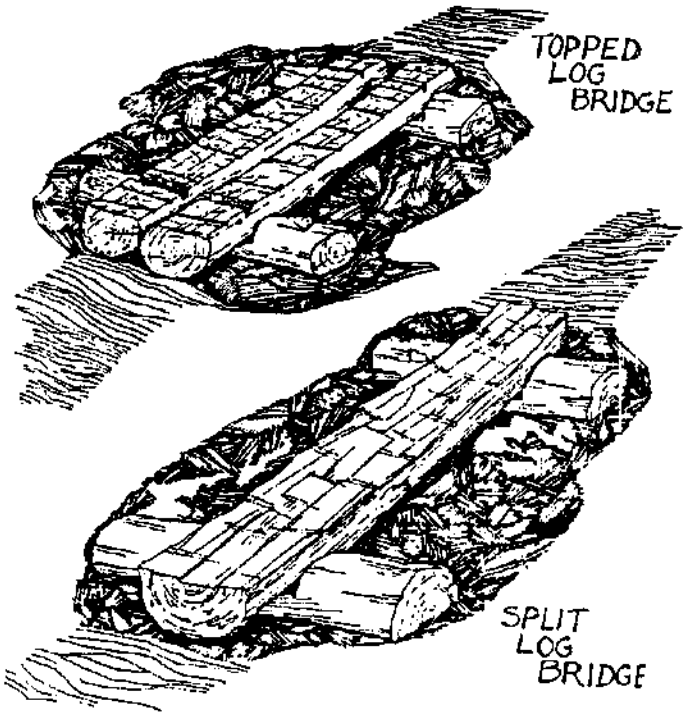


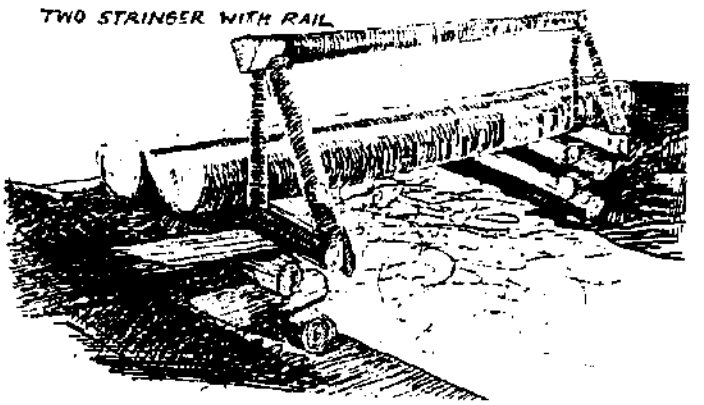




EXAMPLES OF BRIDGES TO CROSS SMALL STREAMS

Source: (Proudman et. al. 1981)





Topped Log Bridges — A sharp axe is the main tool necessary in constructing a topped log bridge. A small chainsaw, if available, can make the work easier and faster. A peeler or bark spud greatly facilitates peeling, and a sledgehammer is best for driving spikes. Digging tools such as a mattock and shovel facilitate placing base logs.

With smaller diameter logs used for topped log bridge stringers, usually two are needed side by side to provide a treadway of adequate width. Stringers should be no less than six inches in diameter; the average length should be around eight to ten feet. Logs should be peeled to retard rot.

VII. FINANCIAL ANALYSIS

1. Funding the Tourism Development and Interpretive Action Plan for the Sulphur Springs

As the Sulphur Springs has demonstrated a revenue of roughly EC$160,000 over the last few years, it is the intention of the Tourist Board to acquire a loan with a commercial bank to implement the site plan and interpretive recommendations. The Sulphur Springs can serve as an example to other attractions such as the proposed botanic garden being implemented by the National Trust, that projects can be self-financing from entrance fees. This relieves Government of the burden of financing the recurrent expenditures of the attraction. The Government, based on fiscal constraints, may be unable to allocate adequate financial resources to the project. For a detailed breakdown of the costs see Appendix V.

For the budget estimates, it is calculated that the St. Lucia Tourist Board will supply 33% of the funds and the bank 67% of the funds. Funds are defined as the capital, equipment, and programming expenditures. Recurrent expenditures such as maintenance and salaries expense will be paid with revenues from the St. Lucia Tourist Board. It is recommended that the loan be guaranteed by the Government of St. Lucia. Table 7.1.1 summarizes the figures.

TABLE 7.1.1

PROJECT FINANCIAL PLAN

ITEM	SOURCE OF FUNDS EC$			TOTAL EC$
	SLTB	Bank	Other	
1. Capital Costs				
Visitor Center				
Picnic area				
Rest Shelter				
Trash shelters				
Trails				
Furnishings				
Utilities				
Kiosk area				
Total	254,680	509,361		764,041
2. Equipment	18,150	36,850		55,000
3. Programming	21,450	43,550		65,000
4. Maintenance	45,000 per year to be paid by SLTB from project revenues.			
5. Bank Repayment	EC$111,562 per year to be paid by SLTB from project revenues.			
6. Roads	Roads expense to be paid by Ministry of Works			
7. Cut and Fill	Preparation of site for the visitor center and berming of fill deposited by previous activities should be completed by the Ministry of Works.			

2. Income

The main present source of income for the Sulphur Springs is the entrance fee, which is recommended to be raised from the present rate of EC$3 to EC$5 per person. It is projected that all visitors to Soufriere will enter the Sulphur Springs Natural Landmark. St. Lucian groups from schools, churches, and civic or community organizations may be admitted free provided prior agreement has been obtained.

Secondary sources of income would be from the concession fees collected from the sale of cold drinks, film, souvenirs and post cards, and from the bar\restaurant. The kiosk presently being used as a snack bar will be subdivided into three sections and leased out to handicraft vendors. Only these vendors will be permitted to sell their wares in the Sulphur Springs area, and it will be the job of the wardens to enforce this.

For the purposes of estimating concession revenues, it is assumed that 60% of the visitors will spend EC$20. (This is considered the cost of a light lunch, a drink, a postcard, and a brochure.) The cost of sales is estimated to be 75% of total sales and the concession fee is set at 5% of total sales. This will leave for the concessionaires the standard 20% profit ratio which should make the venture attractive. Concessions are the bar\restaurant, three pie-shaped vendor stalls in the kiosk, and the retail sales area located at the welcome and information area in the visitor center. The Tourist Board may decide to retain control of the retail sales area.

3. Internal Rate of Return

In order to determine the attractiveness of the investment opportunity, internal rates of return (IRR) have been calculated under different investment scenarios. Data on the revenue of paying tourists were analyzed over the period 1985-1989. Revenues from entrance fees soared from roughly 104,000 to 183,000 during the period. This indicates an average increase of over 15% per year.

To evaluate the financial feasibility of the proposed improvements at Sulphur Springs, two approaches have been used.

The first approach tests the financial viability from the perspective of the entire operation at Sulphur Springs. Current and ongoing costs are combined with the capital and operating expenditures of the enhancements and compared against total expected income. This approach tests the soundness of the entire operation after the project has been implemented.

The second approach analyzes the viability of the enhancements by themselves, comparing the marginal costs of the enhancements alone with estimates of the additional income that they alone would generate.

VIABILITY OF THE ENTIRE OPERATION AT SULPHUR SPRINGS WITH THE PROJECT

Table 7.3.1 found in Appendix V provides a breakdown of the costs of the entire operation at Sulphur Springs between the years 1991 and 2002. The costs include the major investment expenditures that occur in 1992 with the construction of the visitor center as well as the costs of the total labour force needed at the Springs, both existing and newly contracted. These labour costs begin in 1992 when the new entrance fee structure is introduced.

Appendix V, Table 7.3.2 provides a breakdown of the expected income over the same period. In 1989, 61,204 visitors paid entrance fees to the Springs. As this was the last year for available compiled data, it was assumed that between 1989 and 1991, visitation grew at 10 percent per year, following the trends at the Springs and recent total tourist visitation to the island. The 1991 assumed visitation of 74,057 is then calculated to grow at a conservative 5 percent per year until arriving at 100,000 total annual visitation, considered to be a natural "use limit" or carrying capacity for the Springs. The carrying capacity of the site is estimated to be the maximum visitation level that the site can accept without environmental deterioration. At this point, the project infrastructure and visitor use facilities should be reviewed with consideration for further expansion.

In 1992 the increased fee system is expected to go into effect. The total income in that year is the sum of entrance fees of 77760 x EC$5 = EC$388,880 and concession revenues estimated to be 5 percent of EC$20 times 60 percent of the number of total visitors, or EC$46,656, yielding an income of EC$435,456. Subsequent annual incomes are calculated similarly.

Comparing the costs against income over the period yields a 10 percent net present value of EC$454,105 and an internal rate of return of 24.74 percent.

Please note that the salaries expense of the manager has been included in its entirety. Another scenario is that only half of the manager's salaries expense be included, as his\her time would be split between management of the Soufriere Tourist Board Office and the Sulphur Springs.

MARGINAL VIABILITY OF THE ENHANCEMENT ALONE

Appendix V, Table 7.3.3 provides a breakdown of the costs in the period 1991 through 2002 that are assignable to just the enhancement. Comparing Tables 7.3.1 and 7.3.3 shows that the only difference is in labour costs which are EC$40,800 per year for the additional maintenance personnel required to maintain the site. At present, there are no maintenance staff.

It has been assumed that the enhancements of the Springs would attract approximately 5 percent more visitation than what would occur without the enhancement. This is a very conservative estimate, but as is seen below, even with this value, the marginal viability of the project is very positive. Additional increases in marginal visitation would simply improve this condition.

Two income scenarios have been assumed. The first assumes that the total visitation will grow at 5 percent with the enhancement against a no enhancement, 0 percent growth condition. The second assumes a visitation growth of 10 percent with the enhancement against a no enhancement, 5 percent growth condition. Tables 7.3.4 and 7.3.5 found in Appendix V describe the marginal income flows under these two scenarios respectively.

In Table 7.3.4 in year 1992 for example, there are 77,760 - 74,057 = 3703 additional visitors. At EC$5 entrance fee, this annual income is EC$18,514. In addition, in this year, entrance fees are increased from EC$3 to EC$5. The marginal benefits of this increase in 1992 are applied to all the other visitors or (5-3) * 74,057 = EC$148,114. As in the case above, the income from concessions is estimated to be EC$46,656. Total marginal income for this case in 1992 then adds to EC$213,285[1]. All entries in Tables 7.3.4 and 7.3.5 are calculated in this fashion.

In the first 5 percent over 0 percent growth scenario, the comparison of costs of Table 7.3.3 and income of Table 7.3.4 yields a 10 percent net present value of EC$460,177 and an internal rate of return of 24.95 percent.

In the second 10 percent over 5 percent growth scenario, the comparison of costs of Table 7.3.3 and income of Table 7.3.5 yields a 10 percent net present value of EC$309,377 and an internal rate of return of 22.37 percent.

---

[1] Round off error.

SUMMARY

The analyses just described show that the enhancement project is highly viable. The critical assumptions to the analyses are very conservative: the five percent growth rate in overall visitation, the approximately five percent marginal improvement in visitation, a carrying capacity of just 100,000 visitors, and finally the entrance fee increase to EC$5. This fee is currently equivalent to US$1.85, an insignificant amount for the average tourist.

APPENDIX I - GEOLOGIC DESCRIPTION OF THE SULPHUR SPRINGS

The following description forms the basic information needed for an environmental education brochure for the Sulphur Springs Natural Landmark.

Sulphur Springs Complex.-

The area of violently boiling acid springs and steam vents, Sulphur Springs is the surface manifestation of a volcano that once existed immediately southeast of the town of Soufriere. It is a reminder of the tremendous energy of the volcano that still remains, a heat source that lies perhaps two kilometers below the surface. The Sulphur Springs have remained active since the Miocene geologic period to the present. Present activity is reduced to fumaroles with emission of gas at 172 degrees C.

> "The Sulphur Springs inspire awe. Pools are filled with boiling black water. Fumes fill the air. Steam is ejected from the earth to the accompaniment of intimidating roars and hisses. Solid rock is decomposed and redeposited in bright mounds of such minerals as kaolinite. Iron oxides streak the altered deposits with orange and red stains, adding to the brilliant landscape. This world is both intimidating and exhilarating. Travelers half expect earthquakes to shake their knees and see the volcano surge to life. To professional geologists, the acid springs and fumaroles are among the most impressive in the world."
>
> Mr. Glen Kaye
> Interpretive Planner
> OAS Tourism Development
> Plan for St. Lucia, 1985

Possibly the most impressive elements of the Sulphur Springs is the diversity of the color caused by the geologic formations of the rocks and the algae that grows as a result of the higher and constant temperatures. The following table indicates the diversity of colors present and their origins.

Rock or Mineral	Color
Pumice	- white
Iron	- brown
Copper	- green
Manganese	- red
Sulphur	- yellow
Carbon\lave	- dark grey
Alkaline lead	- purple
Quartz crystal	- clear

The Sulphur Springs gives us insight into the fiery geologic past that helped to form St. Lucia and the Lesser Antilles. Volcanoes arise where structural weakness in the earth's crust allow magma to rise from the mantle in the earth. Generally, the crust is crumpled by the process of late tectonic activity, whereby, in this case, the great Atlantic Plate pushes beneath the slower moving Caribbean Plate.

The interior of St. Lucia is dominated by mountain peaks, steep ridges, and deep narrow valleys. The highest mountains are Mt. Gimie (3117 ft), Piton Canaries (3012 ft), Mt. Parasol (2011 ft), Mt. Tabac (2270 ft) and the Gros and Petit Piton (2611 and 2438 ft) respectively. Fast flowing streams emanate in a radial arc from the central volcanic ridge. Relief tends to be very high, with a 3000 foot drop over 4 mile horizontal distance in some areas.

The volcanic geology of the interior is the dominant factor that produced the rugged landscape. Shifting volcanic vents created a somewhat jumbled topography with several major peaks, each having numerous ridges radiating from them. The Qualibou caldera, which takes in the entire region around Belfon and the Sulphur Springs, is an immense crater with numerous faults. It is thought that at one time the site of the Sulphur Springs was a volcano with its own complete crater. In a period of reduced activity it filled with water, exceeding the holding strength of the crater wall. Quite possibly, an earthquake cracked the structure and the "downstream" side of the crater gave way, draining the lake, and leaving the opening where the river drains today. Today, the Sulphur Springs is not a true volcano, but rather a solfatera, a fault in the sub-stratum which permits the escape of superheated sulphurous gases. These gases bubble through the pools of rainwater giving the cauldron effect that is seen in the Sulphur Springs today.

The ridgetops around the Sulphur Springs are composed mostly of andesite and basalt lavas. Surprisingly, they have retained their narrow tops and steep sides. This is possibly due to the low permeability of the clay soils to water, the principal erosive agent of the rock.

By far the most imposing of reworked craters and worthy of more detailed description are the Gros and Petit Pitons. These peaks are well known to all travellers and are probably the most imposing of all the West Indian mountains. They owe their magnificence to their proximity to the sea, from which they rise in towering twin peaks. The more southerly Gros Piton is the less imposing of the two as its slopes are not as steep. The Petit Piton, which rises a veritable Matterhorn, has an apical angle of not less than 70 degrees. It was until the late 1800's considered unscalable due to its precipitous cliff sides. It was first climbed by Abdome Deligny in 1878.

In contrast to the volcanic craters of the interior, the coastal deposits are dominated by "reworked" volcanic rocks, including fluviatile (stream) and mudslide deposits swept down from the mountain peaks.

Travelers to the Sulphur Springs are startled to learn that they stand within the heart of an old volcano. The surface features are not all that evident, for considerable water erosion and reforestation of the volcanic rock has altered the landscape.

APPENDIX II - DESCRIPTION OF POTENTIAL IMPACTS FROM THE GEOTHERMAL PROJECT

Investigation of the geothermal energy potential of the Sulphur Springs area dates back to at least 1951. However, drilling did not begin until 1975-1976, when 7 wells were drilled at various points by the British. The wells, that ranged in depth from 116 to 725 m, were drilled in and around the Sulphur Springs area. The derelict remains of these wells are still evident from the double steel tubes that may be seen in 3 locations within the Sulphur Springs complex. Four of these wells produced a relatively small amount of dry steam at shallow depths (133 m). The other three were unproductive. (Rivera, R. J. et al 1990)

Thereafter, in the late 1980's, two geothermal wells were drilled in St. Lucia, one in Belfon called SL-1, and the other within 300 meters of the Sulphur Springs tourist attraction called SL-2. Only the Sulphur Springs well was found to be productive. SL-2 tapped a vapor-dominated geothermal resource having high gas/ steam and H2/H2S ratios. Condensed steam showed the presence of HCl (hydrochloric acid) that increased with production time, reaching a concentration higher than 300 ppm. This fact suggests the presence of a highly concentrated brine at some depth in the reservoir that started boiling shortly after production began. The presence of this chemical species is an indication of future corrosion problems in those places where steam condenses.

Based upon the interpretation of data from well tests performed by means of several models, it can be concluded that well SL-2 has tapped a naturally fractured, double porosity system. The geothermal reservoir behaved as a limited vapor-dominated system with a limited recharge. Essentially this means that the well may be productive, and further tests need to be conducted to discern whether the well will provide a relatively constant energy source for the production of electricity. Longer production tests are occurring now, and a three month test will be conducted beginning March 1991. (LUCELEC, pers. comm. 1990)

While the environmental impacts have been little studied, the instillation of a 2-3 megawatt power plant will have the following impacts:

The well will emit a high gaseous potential into the atmosphere. The gases are highly corrosive. The British tests done in the 1970's essentially found that the wells were low output with a high toxic gas output, and therefore abandoned the project.

The increased traffic from the large trucks will increase noise and alter the natural setting of the site. It is suggested to design another road into the site if the product is deemed feasible and is implemented.

The plant during production will produce noise. This can be minimized by a rock silencer which runs the pressurized gases and liquids through an underground rock encased area to minimize the sound.

The requirement of a new road and transmission lines will produce negative visual attributes on the landscape. All the power from the plant will be tied into the national grid.

The expense of the project may make the project an unnecessary burden on the Government of St. Lucia. The plant has complications due to it's location, and it's small size may not justify the environmental conflicts that may arise as a result of the project. The preliminary assessment of the resource already has a price tag of over US$6 million.

Positive attributes of the implementation of the project include the following:

The production of energy from natural sources within St. Lucia, thereby saving on the expenditure of foreign exchange.

Tourism implications of visiting the geothermal project. In New Zealand, as an example, geothermal wells are a primary tourism attraction.

Nevertheless, the Sulphur Springs tourist attraction has deteriorated over the last five years due to the development of the geothermal project. The access road was widened to accommodate large tractor trailers to bring in the heavy machinery. Any development for the geothermal project should have an adequate budget to correct any negative impacts that have occurred or are foreseen.

Discussions with experts connected with the geothermal exploratory project predict that if a thermal manifestation is encountered making the project feasible, it probably will not impact the sulphur springs. The wells will tap geothermal energy from greater than 4600 feet, while the energy which causes the boiling springs occurs from a much shallower depth (200-900 ft.). Nevertheless, a monitoring program should be established simultaneously when the well test occurs to note any changes in the sulphur springs activity. The tests should gauge changes in water and\or gas temperatures.

The economic viability of the of the geothermal well will be decided in June 1991 when the tests are completed. LUCELEC will at this time inform the appropriate agencies of the impacts and any recommendations to mitigate potential hazards.

APPENDIX III - PARTIAL LIST OF PLANTS FOR THE SULPHUR SPRINGS

(Compiled by Proctor, G., Laurent, J.P., Simon, P., and Huber, R.)

COMMON NAME	BOTANICAL NAME	ETHNOBOTANICAL INFORMATION
wild cane	Gynerium sagittatum	
	Pitcairnia angustifolia	straw hats, ornamental
wild sedge	Cyperus ligularis	straw hats
	Clusia plukenetii	parrot food
jean	Elocharis mutata	straw chairs
	E. flavens	
grass	Hymenachne amplexicaulis	
	Paspalum distichum	
jiwof glo	Ludwigia octovalvis	medicinal
	Spermacoce verticillata	
fern(capulet)	Blechnum serrulatum	
(Melastome)	Nepsera aquatica	
(Melastome)	Pterolepis glomerata	
(Melastome)	Tetrazygia discolor	
(Melastome)	Clidemia hirta	
(Melastome)	Miconia racemosa	charcoal
guinea grass	Panicum maximum	
silver fern	Pityrogramma calomelanos	
	Mikania micrantha	
cashew	Anacardium occidentale	art & craft, food
tree fern	Cyathea arborea	ornamental
club-moss	Lycopodium cernuum	
sedge	Cyperus surinamensis	
scratch coco	Alocasia macrorhiza	
arrow root	Maranta	food
wild ginger	Hedychium coronarium	
soursop	Annona muricata	medicinal, juices, jams
guava	Psidium guajava	medicinal, confectionary
sweep ovens	Flemingia strobilifera	
amaranth	Cyathula prostrata	
	Pseudelephantopis spicatus	
morning glory	Ipomoea sp.	fodder or forage
wild mint	Hyptis erubescens	
legume	Vigna sp.	
bois canoe	Cecropia schreberiana	medicinal, weather indicator
bois cabuit	Palicourea crocea	medicinal, fodder
bamboo	Bambusa vulgaris	arts and craft, soil stabilizer, construction
fern	Oleandra articulata	
job's tears	Coix lachryma-jobii	arts and craft, religion (prayer bead)

APPENDIX IV - RESULTS OF THE SULPHUR SPRINGS SURVEY

The following data reflects the results of the survey held in Soufriere between December 15 and January 15 1991. The survey was conducted by Mr. Harold Dawson and Mary Ratti of the Soufriere Tourist Board Office and the data were compiled by Angela Alphonse, Agnes Francis, Nathania Augier, and Sonia Soltibus of the St. Lucia Tourist Board, and Richard Huber, OAS consultant.
The survey is very similar to the one conducted during the same period in 1984 by the OAS. (OAS, Soufriere Tourism Development Programme, 1985.)

Note: NS means Not Stated.

1.Residence:	U.S.	U.K.	Europe	Canada	Caribbean	Other	NS
	39%	23%	15%	13%	3%	4%	4%

2. Age:	Less than 20	20-30	31-40	41-50	51-60	over 60
	5%	27%	35%	24%	8%	1%

3. How did you arrive at the Sulphur Springs?

Overland tour	Sea Safari	Private Car	Other	NS
15%	64%	8%	9%	4%

4. How much time will you spend in Soufriere?

Most tourists spent between 2 hours and 5 hours in the Soufriere region. Some tourists stated that they were there for up to three weeks.

5. Which places have you seen in Soufriere?

Sulphur Springs	Diamond Bath	Beaches	Historic Sites	View of Pitons	Other	NS
87%	72%	26%	12%	66%	4%	7%

These percentages do not add up to 100% because tourists went to more than one site.

6. Which site did you like best?

Sulphur Springs	Diamond Bath	Beaches	Historic Sites	View of Pitons	Other	NS
30%	23%	8%	4%	22%	3%	1!

7. What did you like least?
Most stated the poor condition of the roads. Next was the visible garbage on the roads, rivers, and beaches. Next was the harassment from the young boys who wanted to be guides in Soufriere. Others mentioned once or twice were: guides who do not control their emotion, the smell of the Sulphur Springs, the Diamond Baths\Botanic Garden and the overly friendly people.

8. Would you visit national parks and hiking trails?

Very Probably	Probably	Possibly	Probably not	Don't Know	NS
22%	30%	17%	18%	7%	6%

This question provides valuable information for the National Trust who are currently pioneering a systems plan of national parks and protected areas. Clearly 55% of the holiday makers would visit national parks. As an entrance fee would be charged, it is forecast that the parks program would be partially financially self-sustaining.

9. Would you be interested in visiting an estate (plantation) house historical museum?

Very Probably	Probably	Possibly	Probably not	Don't Know	NS
31%	31%	17%	14%	2%	5%

The National Trust is charged with historical and archeological research and historic site preservation and management. This data provides valuable information into the need for more educational attractions in this area.

10. Would you be interested in visiting a botanic garden?

Very Probably	Probably	Possibly	Probably not	Don't Know	NS
28%	35%	13%	8%	1%	4%

The National Trust is currently undertaking a pre-feasibility study to establish a botanic garden in the north of the island. These data assist in gauging forecasted visitation levels.

11. Would you spend 1 to 3 days of a future visit in Soufriere if more amenities or facilities were available?

Very Probably	Probably	Possibly	Probably not	Don't Know	NS
20%	26%	24%	20%	5%	5%

Clearly these data give the green light to the need for increased guest houses in the Soufriere region. The Soufriere Development Committee is currently presenting to the Government and the private sector a plan for Soufriere harbor restoration. The plan includes sites for several locally or jointly owned guest houses along the Soufriere waterfront.

12. How do you feel we could improve the Sulphur Springs?

Picnic Area	Bar\Restaurant	Brochures	Exhibits
13%	27%	20%	12%

Hiking Trails	Visitor Center	Other	NS
24%	31%	4%	16%

These percentages do not add up to 100 because some visitors chose more than one. Only three questionnaires stated that the

Sulphur Springs should be left alone. All of the above amenities will be offered at the Sulphur Springs once the current rehabilitation project is completed.

13. Would you like to see more interpretive panels on the Sulphur Spring Trails?

Yes	No	NS
69%	23%	8%

Interpretive panels and an environmental education program will be offered in the proposed visitor center. Educational brochures will also be offered.

APPENDIX V - FINANCIAL ANALYSIS OF SULPHUR SPRINGS RESTORATION

The financial analysis will be based on the revenues from the entrance fees and the capital and recurrent expenditure of running the tourist attraction.

RECEIPTS FROM ENTRANCE FEES FOR THE SULPHUR SPRINGS

Period	1985	1986	1987	1988	1989
January	13800	14844	15770	16364	19048
February	10902	16071	19650	21514	20029
March	11427	12449	19945	20784	27727
April	9640	16939	13727	15260	14906
May	7977	10647	7864	11601	17324
June	6026	6156	8683	9681	13575
July	7121	8613	7353	10035	12147
August	7268	10354	13020	14556	12119
September	7655	5930	1002	9279	11626
October	6600	8089	200	12329	8383
November	6835	7021	200	15176	14944
December	8348	13902	16021	15799	11785
TOTAL EC$	103599	131015	123435	172378	183613
% increase over previous year		26%	-6%	40%	7%

NUMBER OF PAYING VISITORS TO THE SULPHUR SPRINGS

Period	1985	1986	1987	1988	1989
January	4600	4948	5257	5455	6349
February	3634	5357	6550	7171	6676
March	3809	4150	6648	6928	9242
April	3213	5646	4576	5087	4969
May	2659	3549	2621	3867	5775
June	2009	2052	2894	3227	4525
July	2374	2871	2451	3345	4049
August	2423	3451	4340	4852	4040
September	2552	1977	334	3093	3875
October	2200	2696	67	4110	2794
November	2278	2340	67	5059	4981
December	2783	4634	5340	5266	3928
Yearly	34533	43672	41145	57459	61204
% increase over previous year		26%	-6%	40%	7%
% increase over 5 years		77%			
Average % per year increase over 5 years		15.45%			

These very favorable statistics indicate that tourist visits to the Sulphur Springs have increased roughly 15% per year.

For the purposes of this study, tourism visitation is assumed to plateau at roughly 100,000 after 1995 in the high demand scenario, and 2000 in the low demand scenario.
The carrying capacity of the site after the improvements have been made as indicated in this study should not exceed this amount until the tourism impact has been assessed.
Carrying capacity is offering a quality product w/o environmental deterioration.
The foregoing illustrative estimate is made on the basis of accepted forecasting assumptions, e.g., no war that involves the industrialized countries, maintenance of the cooperation which has characterized international monetary relations between the major economies, and no significant increase in protectionism, continuation of the Caribbean and St. Lucia as a tourism destination of attraction to world markets, and continuation of air services and cruise ship calls to the island in keeping with potential market demand.

CAPITAL AND MAINTENANCE COSTS FOR THE SULPHUR SPRINGS

ITEM	ANNUAL COSTS					
Exchange rate US$1 = EC$2.7 All figures in EC$'s	1991	1992	1993	1994	1995	1996
CAPITAL COSTS						
1. Visitor Center (Authentic construction of French Provincial Architecture						
a. Exposition Room and Audio Visual area - 640 ft. sq.						
b. Retail Sales Area 320 sq. ft.						
c. 2 Offices - 700 ft. sq.						
d. Total Dining 1,208 sq. ft. seats 56 (Bar/Restaurant 520 ft. sq. + 688 ft. sq. Verandah Dining)						
e. Staff Toilets, Storage						
f. Rest Rooms - Male/Female - 400 ft. sq.						
g. Entry Portico & Public Gallery 480 ft. sq.						
h. Kitchen/Service Entrance 400 ft. sq.						
Total 4148 ft. sq. @ EC$120/ft.sq.		497760				
2. 1 group picnic area for 20 people # 4 tables		25000				
3. 1 200 sq. ft. rustic thatch bldg. on scenic overlook			25000			
4. Trash receptacles at picnic areas		2000				
5.a. Construction of 15,500 linear feet of improved trails up to Mt. Souf,				40000		
b. 200 linear feet to waterfall trail,			1000			
100 linear feet up to Rabot Lake Trail,			1000			
and improvement of Rabot Trail and			5000			
Mineral Bath Trail.			5000			
6. Furnishing of Centre with						

office equipment furniture and exhibits			30000			
7. Utilities (water storage electricity generator)		50000				
8. Roads - Improvement of sightlines, paving, and provision of crash barrers		40000				
Straightening and bridgework			Min of Works			
9. Kiosk Area & Carpark for 10 cars		50000				
SUBTOTAL	0	664760	67000	0	0	0
EQUIPMENT YEAR	1991	1992	1993	1994	1995	1996
a. 1 Jeep	35000					
b. Audio visual equipment			5000	5000	0	0
c. Fire preventation and supression materials	5000	5000			0	0
SUB TOTAL	40000	5000	5000	5000	0	0
PROGRAMMING		ANNUAL COSTS				
YEAR	1991	1992	1993	1994	1995	1996
a. Production of environmental education, materials and exhibits		15000	10000	10000	0	0
b. Study of fire-control						

and preventation			10000		0	0
c. Implementation of environmental monitoring programme		10000	5000	5000	0	0
Sub TOTAL	0	25000	25000	15000	0	0
MAINTENANCE YEAR	1991	1992	1993	1994	1995	1996
a. 1 Carpark & Roads and Trails Maintenance		15000	15000	15000	15000	15000
b. Vehicle and equipment maintenance	3000	3000	5000	5000	5000	5000
c. Buildings and Grounds	3000	5000	25000	25000	25000	25000
Sub-TOTAL	6000	23000	45000	45000	45000	45000

SUMMARY TOTAL - ANNUAL COST - EC$

	1991	1992	1993	1994	1995	1996
Capital Cost	0	664760	67000	0		
Equipment	40000	5000	5000	5000		
Programming	0	25000	25000	15000		
Maintenance	6000	23000	45000	45000	45000	45000
TOTAL COSTS	46000	717760	142000	65000	45000	45000

Total six year budget 1060760
Total Cap,equip,&prog budget 851760

NOTE: The above calculation does not take into consideration personel expense. The staff expenses for the SLTB Soufriere Office are detailed below. The maintenance staff has been added.

POST	PERSONNEL (MONTHLY PAID STAFF)					
YEAR	1991	1992	1993	1994	1995	1996
Sulphur Spring Manager(1)	30000	30000	30000	30000	30000	30000
Tour Guides(Interpreters)(13)	124800	124800	124800	124800	124800	124800
Caretaker	6000	6000	6000	6000	6000	6000
Tourist Warden(4)	48000	48000	48000	48000	48000	48000
Tourism Asst.(1)	14400	14400	14400	14400	14400	14400
Maintenance Staff (3 labourers & 1 Supervisor)	40800	40800	40800	40800	40800	40800
TOTALS Personnel	264000	264000	264000	264000	264000	264000

TABLE 7.3.1 - TOTAL COSTS AT SULPHUR SPRINGS WITH ENHANCEMENTS

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CAPITAL		664760	67000								
EQUIPMENT	40000	5000	5000	5000							
OPERATIONS		25000	25000	15000	15000	15000	15000	15000	15000	15000	15000
MAINTENANCE	6000	23000	45000	45000	45000	45000	45000	45000	45000	45000	45000
PERSONNEL	0	264000	264000	264000	264000	264000	264000	264000	264000	264000	264000
TOTAL COSTS	46000	981760	406000	329000	324000	324000	324000	324000	324000	324000	324000
TOTAL REVENUES	0	435456	457229	480091	504095	529300	555765	560000	560000	560000	560000
COSTS-REVENUES	-46000	-546304	51229	151091	180095	205300	231765	236000	236000	236000	236000

IRR (TOTAL FACILITY) = 24.74%
Interest Rate 10%
NPV (TOTAL FACILITY) = $454,105

Internal Rate of Return (IRR) is the discount rate that equates the present value of expected cash outflows with the present value of expected inflows.
Simply, IRR is the rate of return, or profit, that an investment is expected to earn.
The NPV (Net Present Value) [illegible] the net present value of a stream of cash flows.

TABLE 7.3.2
REVENUE OF PAYING TOURISTS VISITING SULPHUR SPRINGS WITH ENHANCEMENTS

Total Revenues - Entrance Fees	0	388800	408240	428652	450085	472589	496219	500000	500000	500000
Concession Revenue:										
5% of EC$20 times 60% no. of tourists	0	46656	48989	51438	54010	56711	59546	60000	60000	60000
TOTAL REVENUE	0	435456	457229	480091	504095	529300	555765	560000	560000	560000

TABLE 7.3.3 - TOTAL COSTS AT SULPHUR SPRINGS WITH ENHANCEMENTS

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CAPITAL		664760	67000								
EQUIPMENT	40000	5000	5000	5000							
OPERATIONS		25000	25000	15000	15000	15000	15000	15000	15000	15000	15000
MAINTENANCE	6000	23000	45000	45000	45000	45000	45000	45000	45000	45000	45000
PERSONNEL	0	40800	40800	40800	40800	40800	40800	40800	40800	40800	40800
TOTAL COSTS	46000	758560	182800	105800	100800	100800	100800	100800	100800	100800	100800
TOTAL REVENUES - LOW MARGINAL	0	213285	235058	257919	281924	307128	333593	337828	337828	337828	337828
TOTAL (REVENUES-COSTS) - LOW MARG	-46000	-545275	52258	152119	181124	206328	232793	237028	237028	237028	237028
TOTAL REVENUES - HIGH MARGINAL	0	222912	256867	294801	289949	276446	262269	260000	260000	260000	260000
TOTAL (REVENUES-COSTS) - HIGH MARG	-46000	-535648	74067	189001	189149	175646	161469	159200	159200	159200	159200

IRR LOW MARG = 25%
NPV LOW MARG = $460,177

IRR HI MARG = 22%
NPV HI MARG = $309,377

SUMMARY TOTAL - ANNUAL COST - EC$

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL Capital, Maintenance, Programming	46000	717760	142000	65000	65000	65000	65000	65000	65000	65000
TOTAL Personnel		264000	264000	264000	264000	264000	264000	264000	264000	264000
TOTAL	46000	981760	406000	329000	329000	329000	329000	329000	329000	329000

DATA FOR INTERNAL RATE OF RETURN (IRR) ANALYSIS - SULPHUR SPRINGS
The following financial analysis is explained in Chapter 7, section 3 of the report. The following growth rates are different projected increases in annual visitation levels.

YEAR	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
ZERO GROWTH	61204	67325	74057	74057	74057	74057	74057	74057	74057	74057	74057	74057
FIVE % GROWTH	61204	67325	74057	77760	81648	85730	90017	94518	99244	100000	100000	100000
TEN % GROWTH	61204	67325	74057	81463	89609	98570	100000	100000	100000	100000	100000	100000
FIFTEEN % GROWTH	61204	67325	74057	85166	100000	100000	100000	100000	100000	100000	100000	100000

TABLE 7.3.4
MARGINAL REVENUE OF PAYING TOURISTS VISITING SULPHUR SPRINGS - CASE 1

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Marginal Annual Revenue - Increased Visits	0	18514	37954	58366	79799	102303	125933	129714	129714	129714
Marginal Annual Revenue - Increased Price	0	148114	148114	148114	148114	148114	148114	148114	148114	148114
Concession Revenue:										
5% of EC$20 times 60% no. of tourists	0	46656	48989	51438	54010	56711	59546	60000	60000	60000
TOTAL REVENUE	0	213285	235058	257919	281924	307128	333593	337828	337828	337828

Note: The concession revenue is calculated by assuming that 60% of the visitors will spend EC$20 each, and that the SLTB will retain 5% of this revenue as income.

TABLE 7.3.5
MARGINAL REVENUE OF PAYING TOURISTS VISITING SULPHUR SPRINGS

Marginal Annual Revenue - Increased Visits	0	18514	39806	64198	49915	27411	3781	0	0	0
Marginal Annual Revenue - Increased Price	0	155520	163296	171461	180034	189036	198487	200000	200000	200000
Concession Revenue:										
5% of EC$20 times 60% no. of tourists	0	48878	53766	59142	60000	60000	60000	60000	60000	60000
TOTAL REVENUE	0	222912	256867	294801	289949	276446	262269	260000	260000	260000

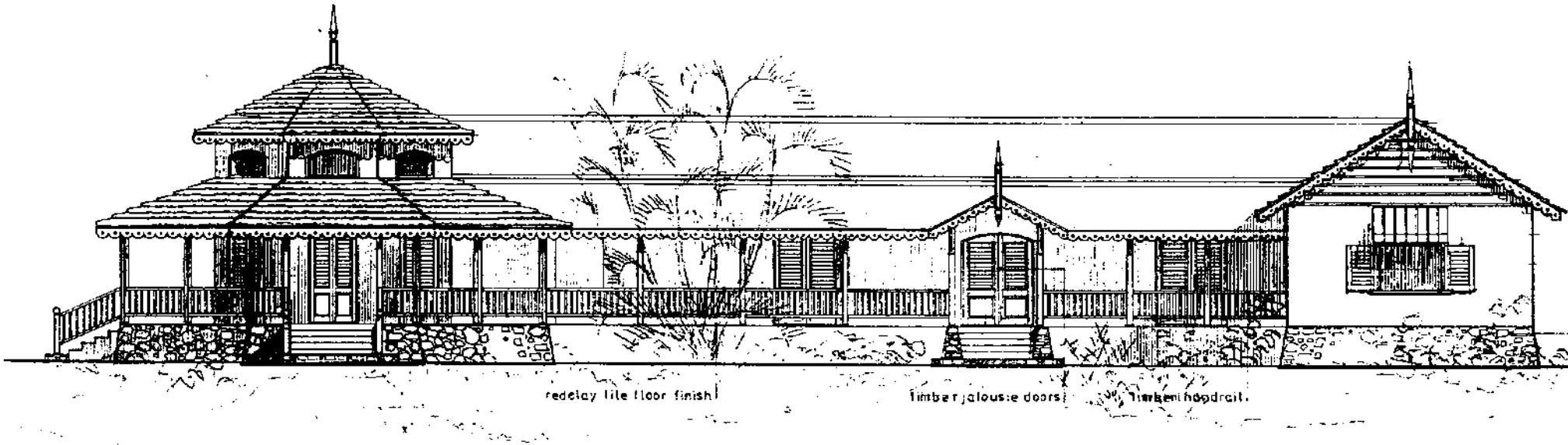
APPENDIX VI - MANAGEMENT AND DEVELOPMENT SCHEDULE SULPHUR SPRINGS NATURAL LANDMARK

Activities	Phase I	Phase II	Phase III
	1	2	3
	Y E A R		
A. Legal/Administrative			
i. Deliberate a legal basis for the enhancement and protection of the site.	x		
ii. Obtain Government (DCA) approval of policy and legislation for the management and enhancement of the Sulphur Springs.	x		
iii. Draft contracts for concessions of Restaurant, Vendor Booths, and Retail Sales Area, etc.		x	
B. Resource Management and Protection			
i. Mark boundaries of the Springs and post area against unauthorized use.	x		
ii. Prepare and implement a fire management plan.		x	
iii. Implement contour planting to stabilize slopes.	x		
iv. Implement landscape plan		x	
C. Research Programmes			
i. Prepare a detailed research and monitoring programme for the Springs.		x	
ii. Initiate monitoring programme.			x
iii. Carry out detailed flora and fauna inventory. Plants should be mapped and labeled.			x

Activities	Phase I	Phase II	Phase III
	1	2	3
	Y E A R		
D. Education/Interpretation Programme			
i. Prepare detailed education interpretation plan.		x	
ii. Contact schools and local groups			x
iii. Prepare brochure on amenities of the Springs and self-guiding Environmental Education Trail utilizing existing amenities.	x		
iv. Prepare video tape on the Springs to assist with fundraising.		x	
v. Establish programme for accommodating school groups at the Springs.			x
vi. Prepare education materials and exhibits for the visitor center		x	
vii. Prepare additional educational materials.			x
E. Development			
i. Implement detailed site plan for visitor center.	x		
ii. Conduct architectural and engineering feasibility study on cultural landmarks.		x	
iii. Prepare architectural/engineering plans for the visitor center.(Completed Feb. 1991)	x		
iv. Construct EE nature trail on "The Geologic Formation of the Calibou Volcano."	x		
v. Install utilities.	x		
vi. Demolish existing toilets.		x	

Activities	Phase I	Phase II	Phase III
	1	2	3
	Y E A R		
vi. Construct trails, picnic areas and scenic vistas as indicated on the site plan.		x	
vii. Rehabilitate access road parking area.	x		
viii. Renovate kiosks	x		
F. Personnel			
i. Appoint construction manager of the Springs.	x		
ii. Appoint maintenence staff.	x		
iii. Hire construction personnel.	x		
iv. Appoint interpretation/environmental education officer.		x	
v. Train remaining staff in a one month course as indicated in plan.			x

APPENDIX VII - ARCHITECTURAL DRAWINGS



FRONT ELEVATION

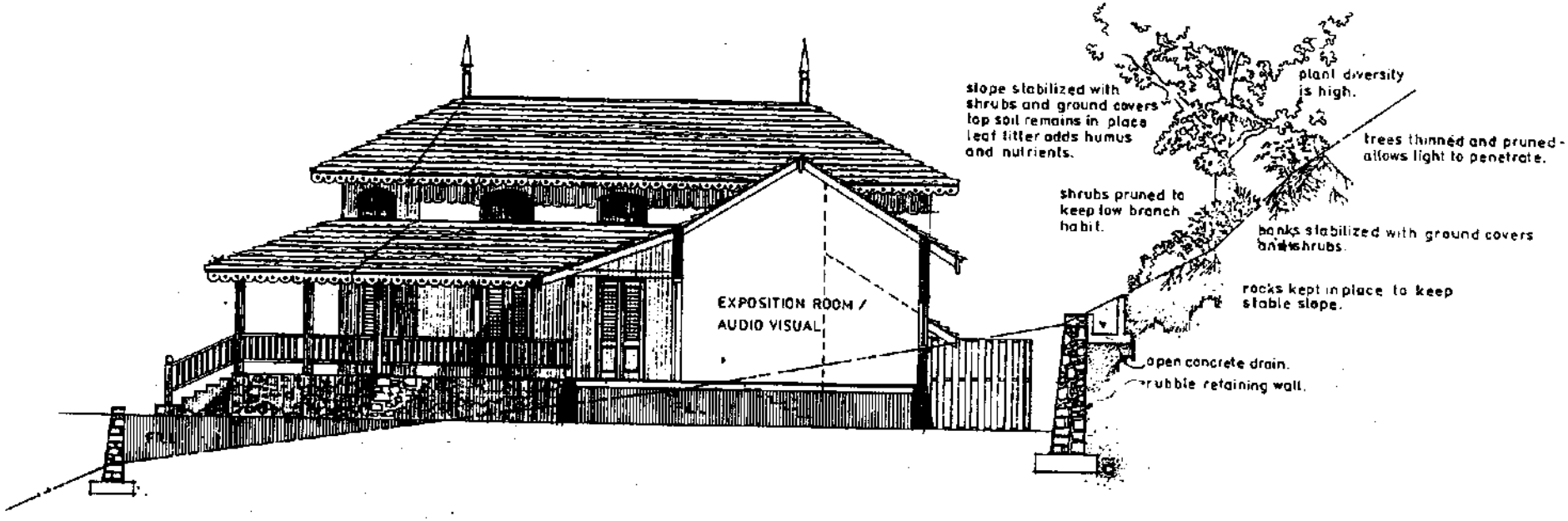
OAS/ST.LUCIA TOURIST BOARD

· SULPHUR SPRINGS ENHANCEMENT PROJECT

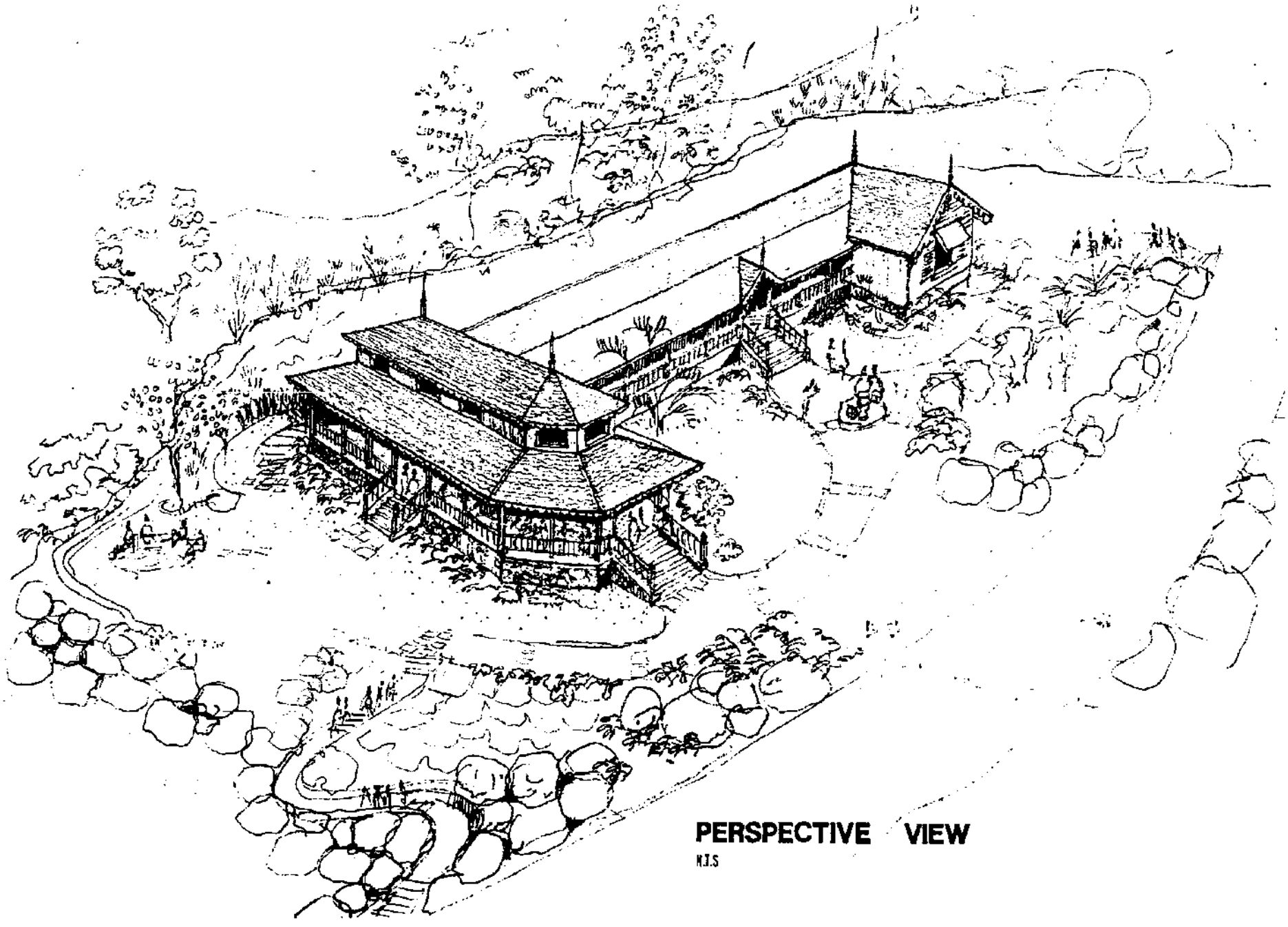
VISITOR CENTRE

SULPHUR SPRINGS

SOUFRIERE · ST LUCIA · W.I

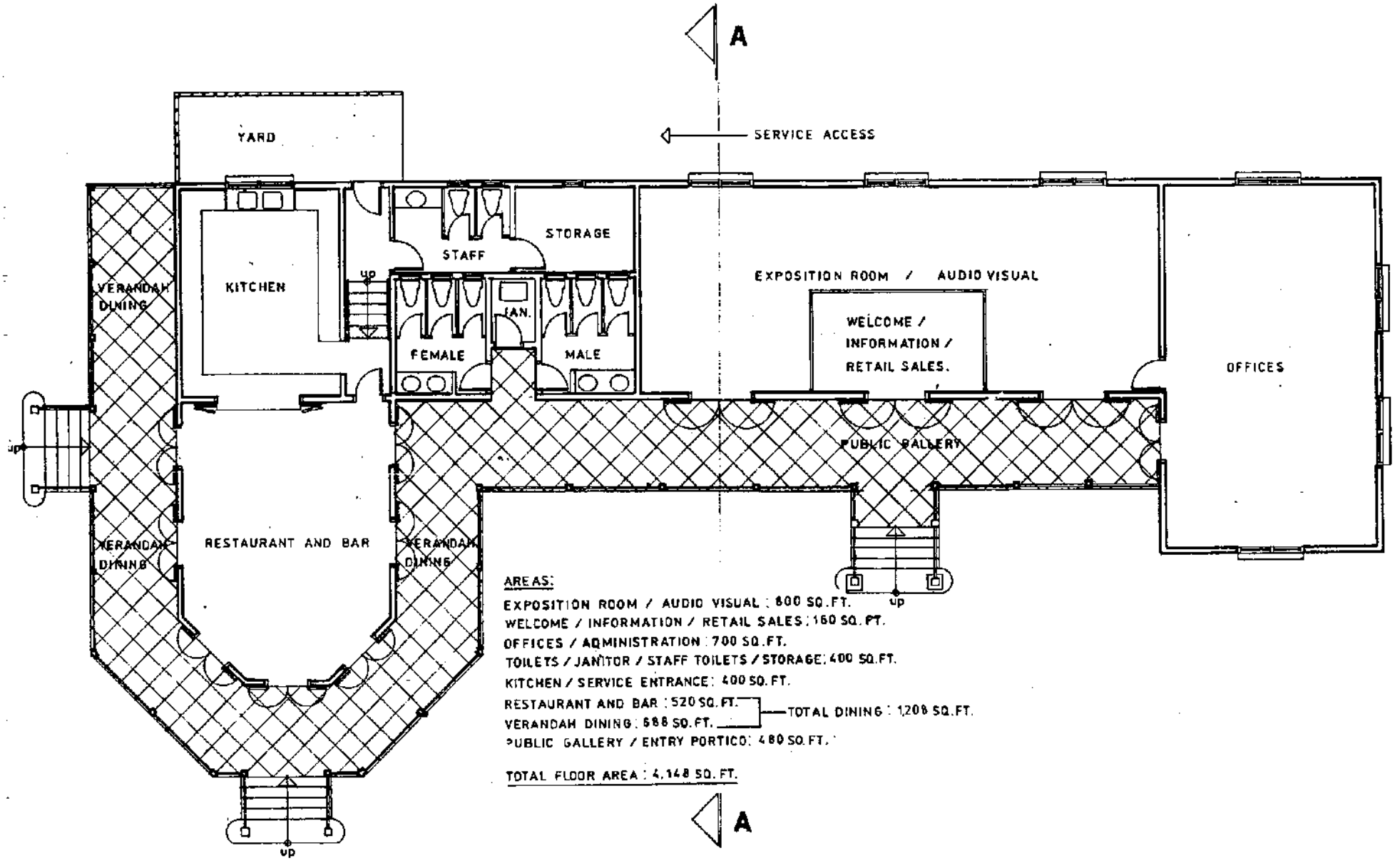


SECTION / ELEVATION A-A



PERSPECTIVE VIEW

N.T.S

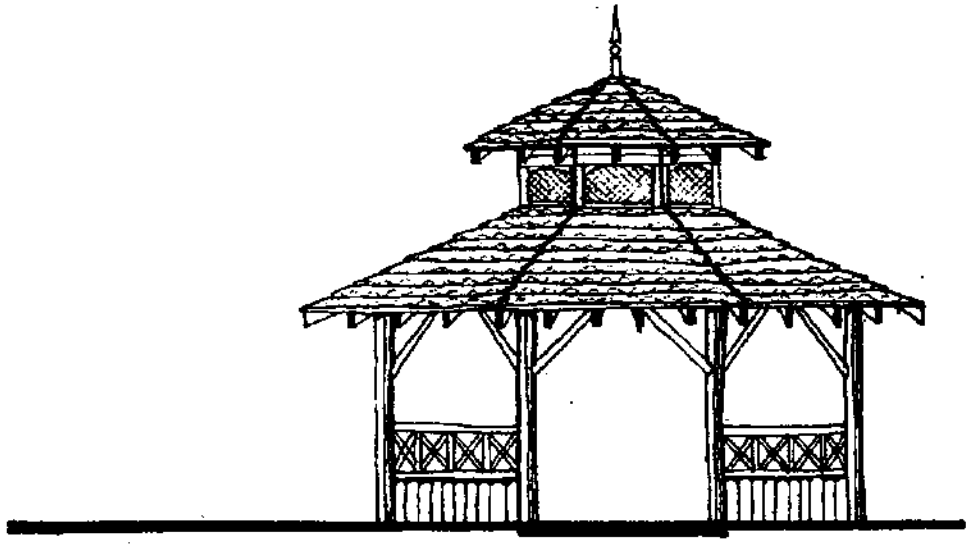


AREAS:

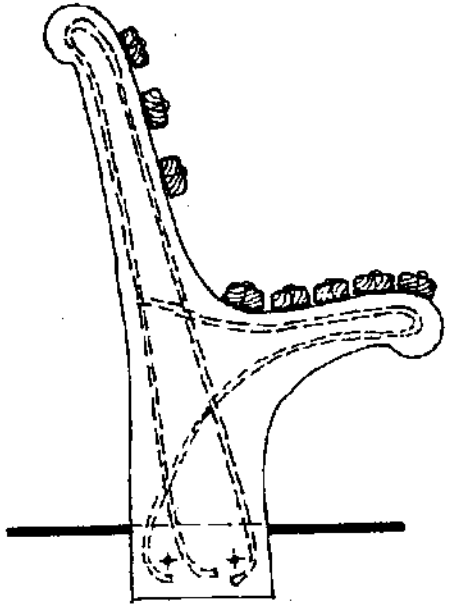
EXPOSITION ROOM / AUDIO VISUAL : 800 SQ.FT.
WELCOME / INFORMATION / RETAIL SALES : 160 SQ. FT.
OFFICES / ADMINISTRATION : 700 SQ.FT.
TOILETS / JANITOR / STAFF TOILETS / STORAGE: 400 SQ.FT.
KITCHEN / SERVICE ENTRANCE: 400 SQ. FT.
RESTAURANT AND BAR : 520 SQ. FT.
VERANDAH DINING : 688 SQ. FT. — TOTAL DINING : 1,208 SQ.FT.
PUBLIC GALLERY / ENTRY PORTICO: 480 SQ. FT.

TOTAL FLOOR AREA : 4,148 SQ. FT.

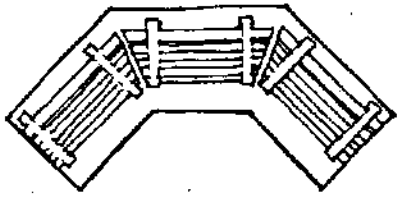
FLOOR PLAN



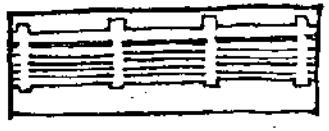
PROPOSED HUT · ELEVATION



ELEVATION



PLAN



PLAN

TYPICAL BENCH DETAILS

GENERAL NOTES:

New entrance sign to be erected at interseetion of main road and sulphur springs access road.

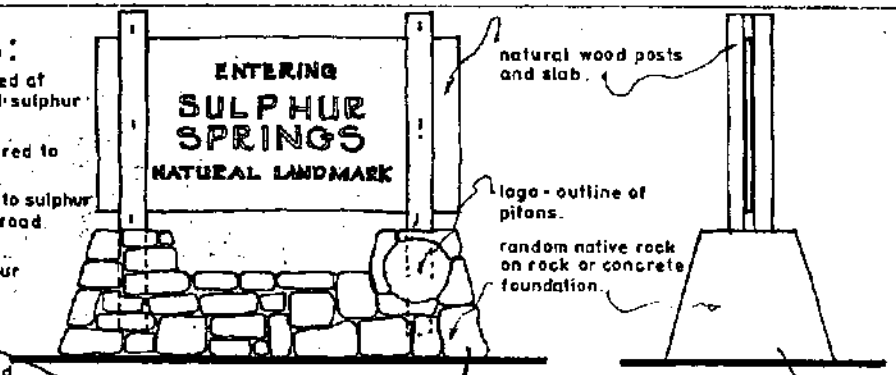
New one inch water main required to sulphur springs area.

Roadway from main road down to sulphur springs to be resurfaced and road drainage to be improved.

All existing signs within sulphur springs area to be removed.

Provide parking for 10 vehicles.

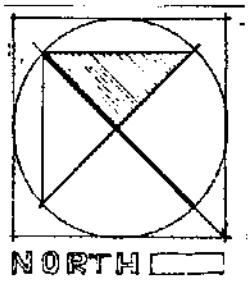
Sprinkler system to be provided.

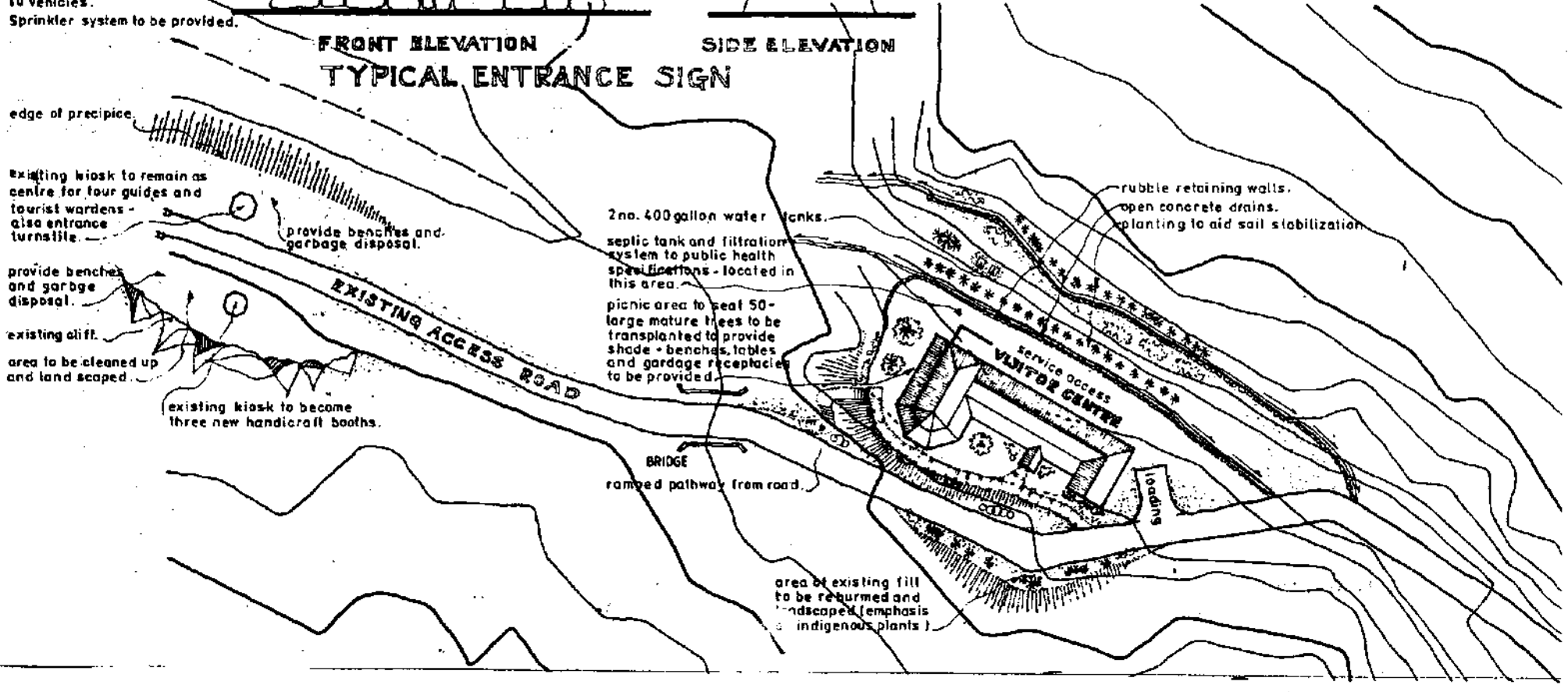


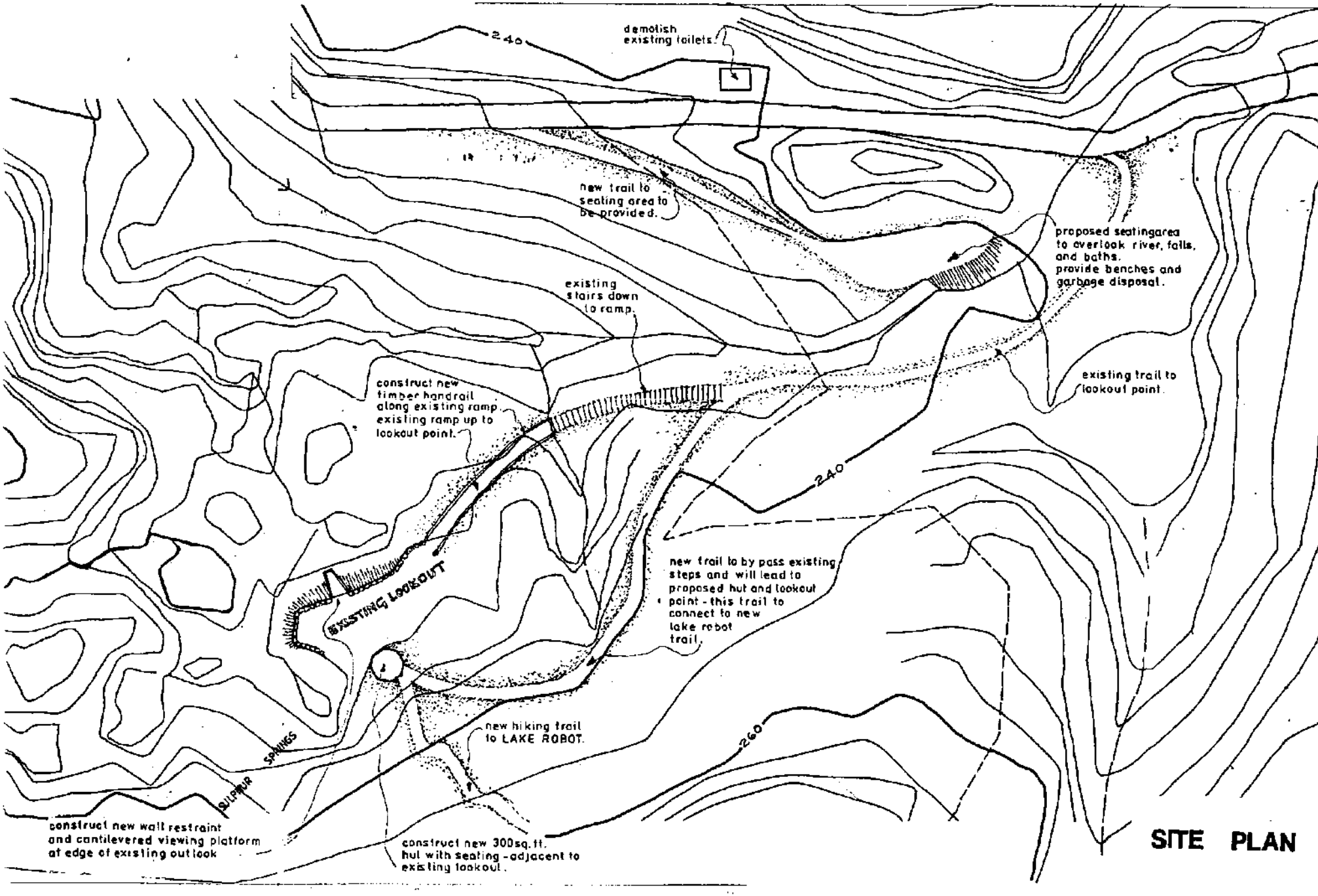
FRONT ELEVATION

SIDE ELEVATION

TYPICAL ENTRANCE SIGN






240
demolish existing toilets.
new trail to seating area to be provided.
proposed seatingarea to overlook river, falls, and baths. provide benches and garbage disposal.
existing stairs down to ramp.
existing trail to lookout point.
construct new timber handrail along existing ramp existing ramp up to lookout point.
240
EXISTING LOOKOUT
new trail to by pass existing steps and will lead to proposed hut and lookout point - this trail to connect to new lake robot trail.
new hiking trail to LAKE ROBOT.
260
SULPHUR SPRINGS
construct new wall restraint and cantilevered viewing platform at edge of existing outlook
construct new 300sq. ft. hut with seating - adjacent to existing lookout.
SITE PLAN

REFERENCES

Beard, J. S., 1949. The Natural Vegetation of the Windward and Leeward Islands, Oxford at the Claredon Press.

Breen, H. H., 1844. St. Lucia Historical Statistical, and Descriptive. Longman, Brown, Green and Longmans, London.

De LaTour, Lefort, 1787. Description Generale et Particuliere de L'Isle de Sainte Lucia.

Devaux, R. J., 1978. Check List of Birds of St. Lucia. The St. Lucia Naturalist Society, Castries.

Devaux, Robert, J., 1987. Mountains in the Arawak Culture of St. Lucia. Unpublished Paper. St. Lucia National Trust, Castries.

Devaux, Robert, J., 1975. Saint Lucia Historic Sites, Saint Lucia National Trust No. 1, Castries.

Earle, K.W. - Notes on the Geology of St. Lucia, Government Geologist to the Windward and Leeward Islands, September 6, 1923.

Evaluation of the St. Lucia Geothermal Resource - Summary Report, Los Alamos National Laboratory, N.Y. Trade and Development Program April, 1984.

Interpretive Plans - Soufriere Vicinity, 1985.
Organization of American States, Department of Regional Development. Done in Conjunction with the Government of St. Lucia.

Jesse, Rev. C., 1970. Outlines of St. Lucia History. The St. Lucia Archeological and Historical Society.

Merg and McLellan - Report on exploration of Geothermal Resources. ODA, Foreign and Commonwealth Office, London, June 1974.

Martin-Kaye, P. Dr. - Notes (mentioned in Outlines of St. Lucia's History).

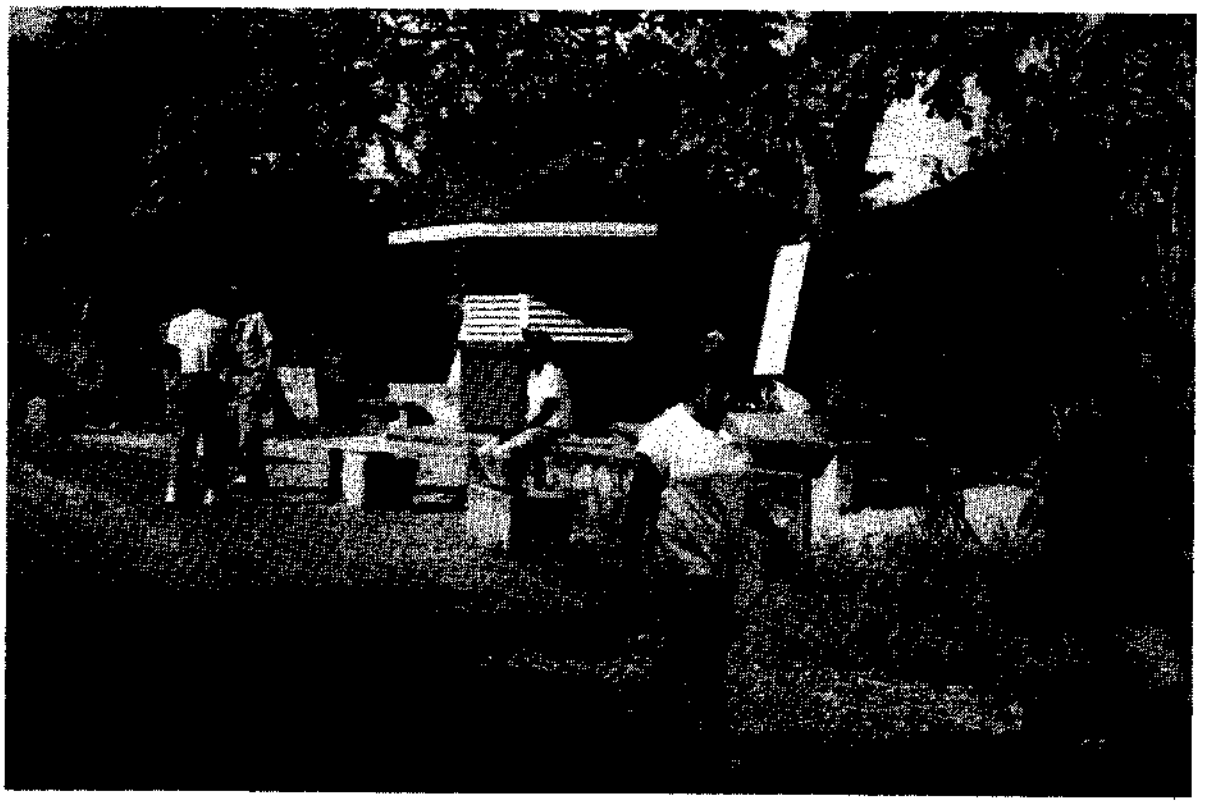
Newman, William R., 1965. A Report on General and Economic Geological Studies, St. Lucia, W.I. United Nations, Department of Economic and Social Affairs.

Organization of American States. 1987. The Optimum Size and Nature of New Hotel Development in the Caribbean. Dept. of Regional Development, Washington D.C.

Organization of American States, Department of Regional Development. 1985. Tourism Development Plan for St. Lucia, Done in Conjunction with the Government of St. Lucia.

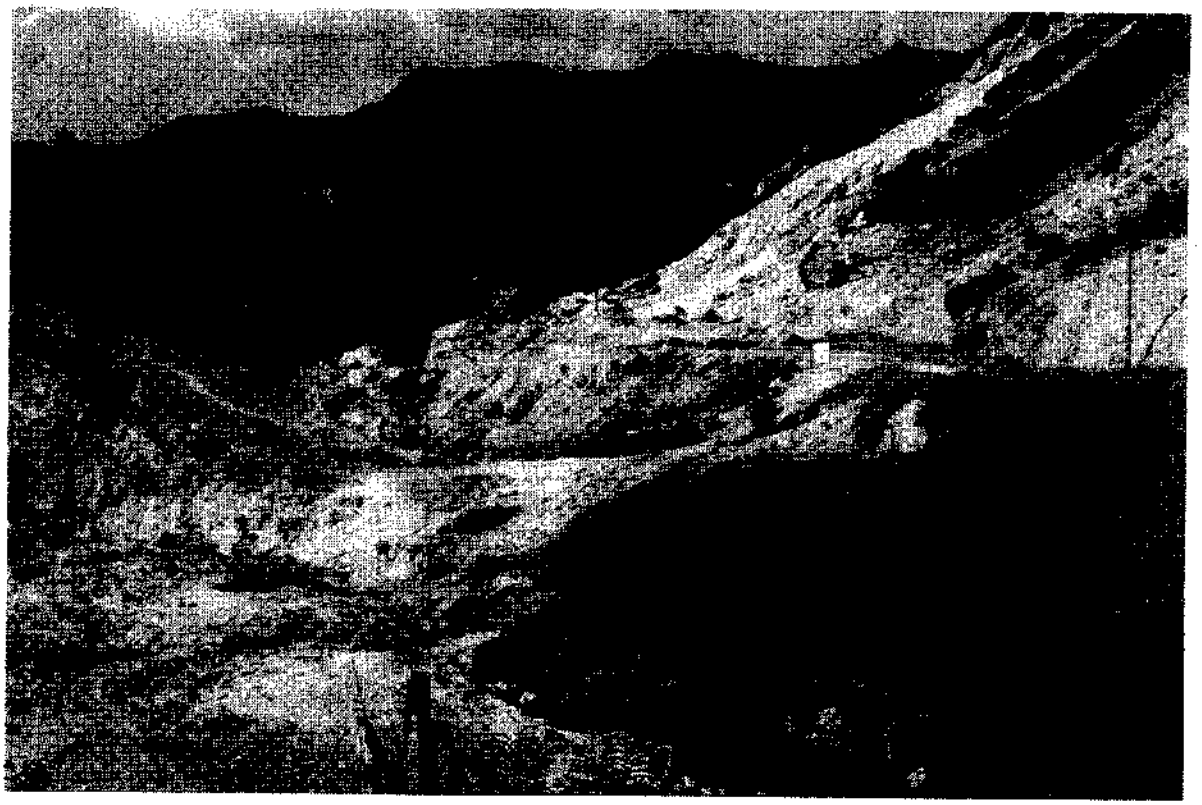
Proudman, R. and Rajala, R. 1981. Trail Building and Maintenance, Appalachian Mountain Club, U.S.A.

Rivera, R. J., D'more, F., Giusti, D, Rossi, R, and Tomaselli, F. 1990 Geothermal Project at St. Lucia (W.I.) - A Preliminary Assessment of the Resource.



1. View of the turnstile kiosk where tourists who have not booked their "around the island" tour or "sea safari" by a travel agent pay the EC$3 entrance fee. The travel agents reimburse the Tourist Board at the end of every month. This building is to remain utilized in its present capacity.

2. This kiosk is leased from the Tourist Board as a snack bar for EC$100/month. It is recommended to split this kiosk into 3 vendor booths. This will ensure that the vendors have an assigned area from which to sell their wares. Only vendors with licenses from the Tourist Board should be permitted to sell their handicraft, and only from this kiosk. As you may note, the local villagers are not presenting a very appealing picture. Garbage surrounds this kiosk. The area will be landscaped and rubbish bins placed at strategic points.



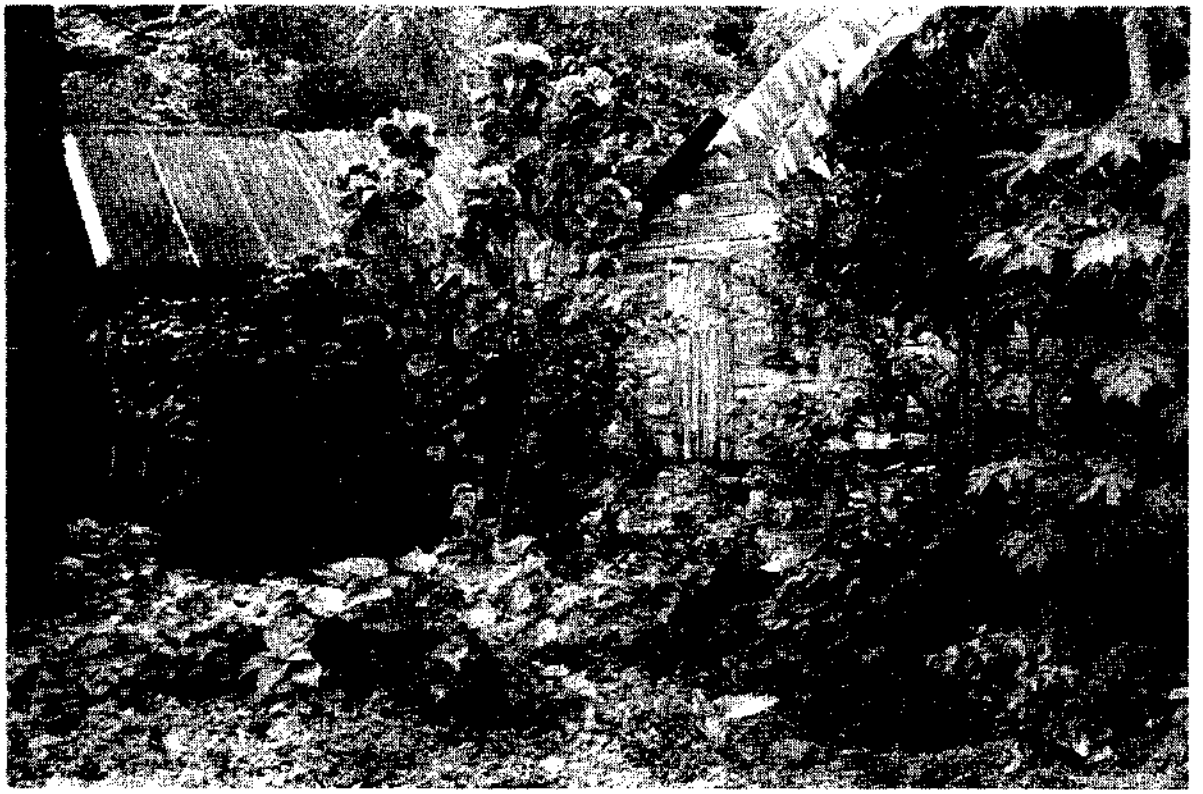
3. This is the view from the overlook. The visitor center is slotted to be placed in the white flat terrace behind the sign and to the right of the telephone pole. Tourists will be permitted to walk down to the bridge in order to feel and see the hot vapor bubbling from a fumarole. An interpretive sign will be placed as a subtle barrier to protect visitors from the dangers of the springs themselves.

4. The view of the solfatera shows several boiling sulphur springs. The one in the foreground was opened when a Tourist Board guide fell through the brittle surface to his waist, and suffered third degree burns over his lower body. Since then, the fragile area of the Sulphur Springs proper has been closed to tourists.

The site plan and interpretive action plan will strive to maximize the tourist educational experience without causing negative impact on the springs.

5. This geothermal well is located 500 meters to the south of the site of the Sulphur Springs. As part of the geothermal project, testing of this well will begin in February 1991. If the well proves feasible, a 3-5 megawatt electric power plant will be installed at this site producing electricity to the national grid. In order to minimize negative impacts such as noise and traffic, it is recommended to construct an alternative vehicular route to the well along the Rabot lake trail.

6. The old geothermal well drilled by the British in 1977 is to be incorporated into the interpretive program. The question of safety of the old well works will need to be studied.



7. The small village to the south of the Sulphur Springs has a population of around 25. The Sulphur Springs rehabilitation project should result in new employment opportunities for these people.

8. The entrance road to the Sulphur Springs is in poor condition. Parking is disorganized. The site plan will improve parking by defining parking spaces and will provide for a turn around area.

The new growth on the upper part of the denuded slope is Caribbean pine planted by the Forestry Department for erosion control. Hillside slope stabilization is to be incorporated into the rehabilitation program.

9. This is the view from the rest shelter of the overlook.

The Sulphur Springs are the result of recent volcanic activity which occurred in the very late Pleistocene period, about 40,000 years ago. The Soufriere Solfatera is not a true volcano, rather, it is a fault in sub-stratum rock through which the super heated sulphurous gases escape, heating the surface and sub-surface waters to about 180 degrees F.(82 degrees C.).

The mineral saturated water emerging from the Springs are reported to be highly medicinal and curative for several common ailments such as rheumatism and gout. Governor De Laborie ordered baths to be built for the soldiers in 1786. These were destroyed during the up-heavals of the French Revolutionary War in St. Lucia in 1795.

Folklore of the Arawak religion states that the fire God "Yokahu" slept in the volcanoes of the Antilles including the Sulphur Springs Solfatera. The Arawaks, who were the Amerindians from South America, occupied St. Lucia for about a millennium. The Caribs who later followed the Arawaks from South America were superstitious about the Solfatera because they named it "Qualibou" meaning "at the place of death."

Today the Qualibou is a peaceful place and a wonderful curiosity of nature.

Compiled by: Robert Devaux
Director
National Trust