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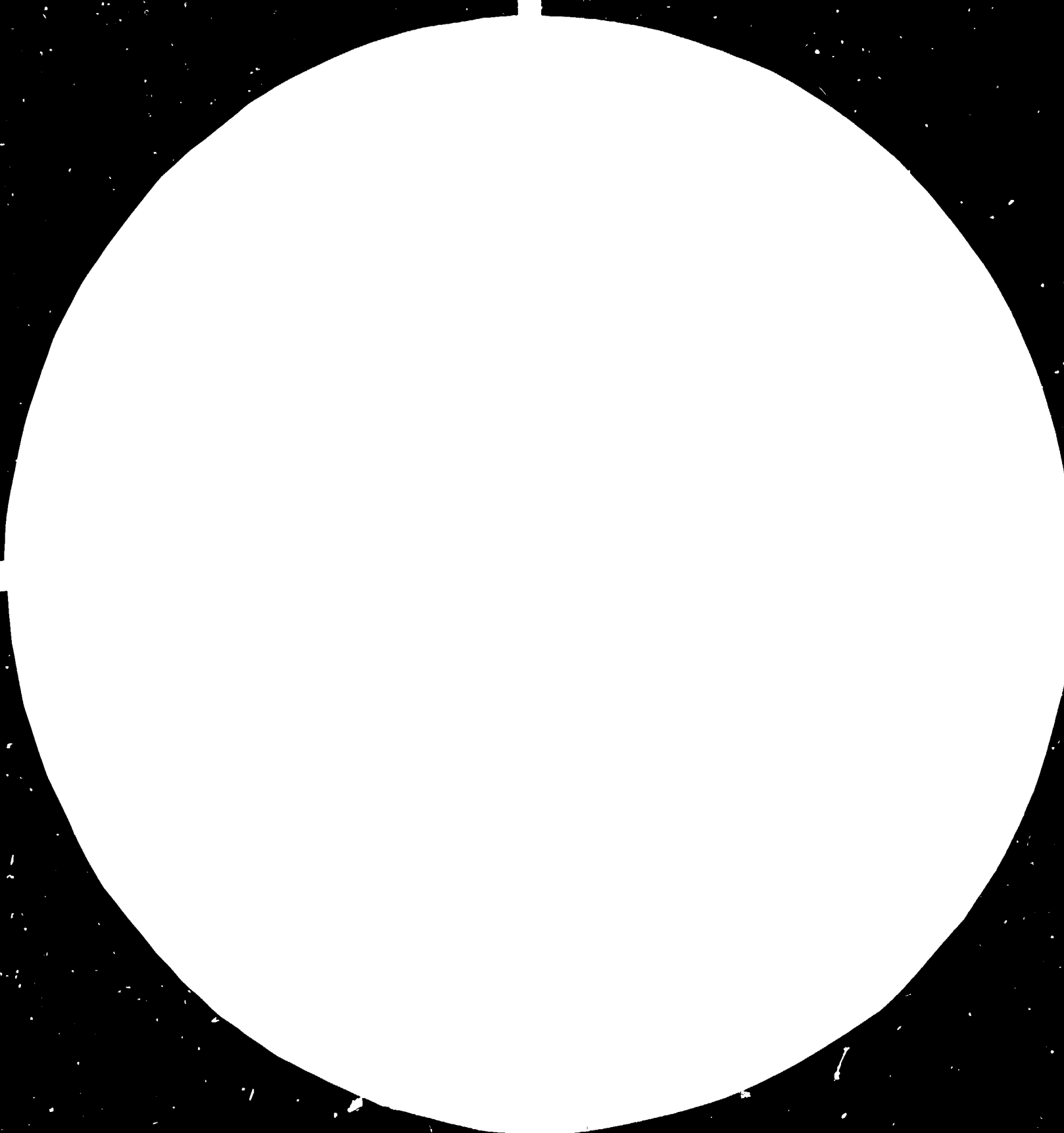

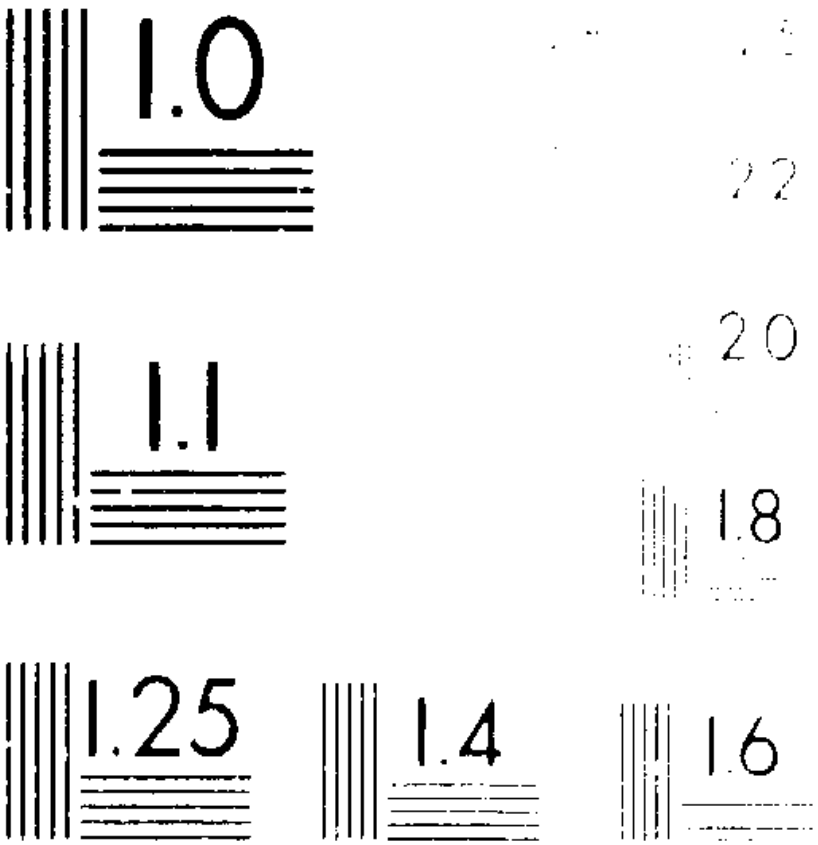
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ASSESSMENT OF THE POSSIBILITIES TO PRODUCE MINERAL WATER.

UC/STP/83/182

SAO TOME AND PRINCIPE

Technical report*

Prepared for the Government of Sao Tomé and Principé by the
United Nations Industrial Development Organization

Based on the work of Peter Sauer, Consultant
in Mineral Water and Soft Drink Industry

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Explanatory notes

The national currency of Sao Tome and Principe is the Dobra. During the period of the mission the value in terms of United States dollar was:

1 US$ = 43 Dobras

Abstract

According to job description UC/STP/83/182/11-01/31.7.C the assessement of the possibilities to produce mineral water in Sao Tome took place from 16 to 24 May 1984. The analysis of the mineral water took place from 28 May to 8 June in Switzerland.

The mineral water is of a good quality. The chance of competing with other mineral water being sold in neighbouring countries is good.

The sources have to be rehabilitated because the actual capacity is too low.

Possibilities to bottle water samples to test the market acceptability are given in the Flebe bottling plant as well as in the Rosema brewery.

The mineral water bottling plant is too old and too small for rehabilitation and expansion.

A new cargo-ship will arrive in August / September 1984 which should have capacity enough for export purposes.

Introduction

As the export of mineral water could be a source of income, the Government of the Democratic Republic of Sao Tome and Principe needs a well-founded study to decide whether it is viable to invest in such an enterprise.

The task of the consultant was:

- To get in contact with members of the Government to obtain and to review all the available documentations concerning the mineral water sources.
- To visit and to assess the situation concerning the water sources in their actual state.
- To visit and to assess the bottling plant in its actual state.
- To visit the Rosema Brewery and to review the possibilities to analyse the mineral water there and to bottle mineral water samples for the market test.
- As the Rosema Brewery (former Ceto Brewery) is not equipped for analysing mineral water, samples had to be taken to Switzerland and analysed there.

Recommendations

1. Make accessible the flowing out of mineral water so that the capacity of uncontaminated water can be determined. This procedure should be supervised by a hydrogeologist. Available hydrogeological maps should be studied carefully in advance. A further analysis of each source which would be used is necessary.

2. If the total capacity is at least 170 l / min., the mineral water should be collected by pipes. If the capacity is high, mineral water which is not used for bottling could be mixed with drinking water for domestic use as tape water.

3. It is recommended to fill mineral water in 1,5 litre plastic bottles which are suitable for still and carbonated products. The bottles could also be used for vegetable oil and soft drinks. Sao Tome produces fruits usable as flavor bases for soft drinks which also could be exported as well as the flavor bases themselves.

I. REVIEW OF THE MINERAL WATER

The mineral water sources

In the land register in Sao Tome four mineral water sources are registered (see annex 1):

Fonte da Flebe
Fonte da Queluz
Fonte da Milagrosa
Fonte da Bela Vista

The main components of rocks and soil of the island are clay and basalt. Basalt is unsoluble in water. Clay covers basalt and it seems to be a good filter for purification of the water. Basalt shows many fractures and clefts in which the water may flow off. This seems to be the reason why there are many sources but with small capacity.

The source of Queluz is within a pavilion. The water was used in former time. To ensure that the sample is representative and to avoid contamination by surface water, the sample has been collected from water flowing out of a pipe. On the ground of the pavilion there is a hole out of which free carbon dioxide is escaping. At present the water of Queluz is not used. The source is in bad condition. 100 - 200 m away there are further unused sources. According to former estimation the total capacity should be about 240 l / min. (1), which would be sufficient for bottling. Actually the capacity is very low. This seems to be the result of no maintenance.

The source of Flebe is still used but at present the capacity is low, too. Within a building there is a reservoir. When it is full the water runs over through the pipe. The sample was taken there. The capacity was measured there, too. Maybe the reservoir is not waterproof so that the quantity of water running over is not the same as the capacity of the source. The capacity of the source is estimated to be 90 l / min. (2)

Definition of natural mineral water according to EEC directive

Natural mineral water means water which originates in an underground water table and is extracted for human consumption.

Only the authorised treatments for filtration or decanting, oxigenation, the removal or addition of carbon dioxide, are permitted. Any chemical disinfection of the mineral water is forbidden. Standards are laid down for the numbers of microorganisms and maximum quantities of toxic substances which may be present.

Classification

with very low contents of minerals	mineral contents max. 50 mg / 1 (Spa)
with low contents of minerals	mineral contents 51 - 500 mg / 1 (Evian)
with high contents of minerals	mineral contents more than 1500 mg / 1 (Contrexeville)
acidulous mineral water	free carbon dioxide over 250 mg / 1

Recognition:

Only waters officially designated by the authorities are recognised as mineral waters. If the total content of minerals is at least 1000 mg / 1 or free carbon dioxide is at least 250 mg / 1 clinical examinations are no obligation for recognition.

Examination of the sources and the mineral waters

	Flepe	Queluz	
Collection			
Date:	25.5.1984	25.5.1984	
Time:	10.00	11.15	
Arrival at laboratory			
Date:	26.5.	26.5.	
Time:	18.00	18.00	
Commencing bact. examination:	28.5.	28.5.	
Appearence			
Turbidity:	clear	clear	
Colour:	colourless	colourless	
Odour:	odourless	odourless	
Taste:	pleasant	pleasant	
Temperature at time of coll. °C			
Water:	24	23	
Air:	25	25	
Capacity 1 / min. :	6,6	1	
Electrical conductivity at 20°C micro S / cm:	160	60	
Free carbon dioxide mg / l:	over 250	over 250	
pH:	5,14	4,7	
Hardness:	low	very low	
Bacteriological examination			Standards EEC
Colony counts / ml+			
20°C / 72 h:	20	40	under 100
37°C / 24 h:	7	15	under 20
E. coli / 100 ml:	0	0	0

+The examination should take place within 12 hours after bottling and the samples have to be stored at 4°C. Though these conditions could not be maintained the results are within the EEC-standards.

Chemical examination of mineral water Flebe and Queluz

	Flebe 1984	Flebe 1960 (3)	Queluz 1984
Cations			
Sodium	8,2	7,8	3,8
Magnesium	13	6,8	6,5
Calcium	11	12,8	4,8
	32,2	27,4	15,1
Anions			
Chlorine	18	12,4	7,1
Nitrate	under 0,5	4,0	under 0,5
Bicarbonate	83	61	37
Sulfate	6	6	7
	107	83,4	84,2
Silica as SiO_2	33	38	18
Total	172,2	148,8	84,2
Dry residue	110	111,6	44
Total hardness mEq / l	1,62	?	0,77
Classification according to EEC directive	acidulous mineral water (with low content of minerals)		acidulous mineral water (with low content of minerals)

Conclusions:

- Because of their purity and their contents of free carbon dioxide both waters can be recognised as natural mineral waters .
- The low sulfate contents are advantageous. High content may cause diarrhoea when the water demand is high.

II. ASSESSMENT OF THE BOTTLING PLANT

The Flebe bottling plant is located at the border of Sao Tome City, about 6 km away from the mineral water source of Flebe. The mineral water is pumped into a tank and transported by truck to the bottling plant. There it is filtered, cooled, carbonated and filled into glass bottles and sold as carbonated water. This water is well known and the quality is accepted.

The actual capacity is less than 2000 bottles per hour. The equipment is very old. Maintainance and repair are very time-consuming.

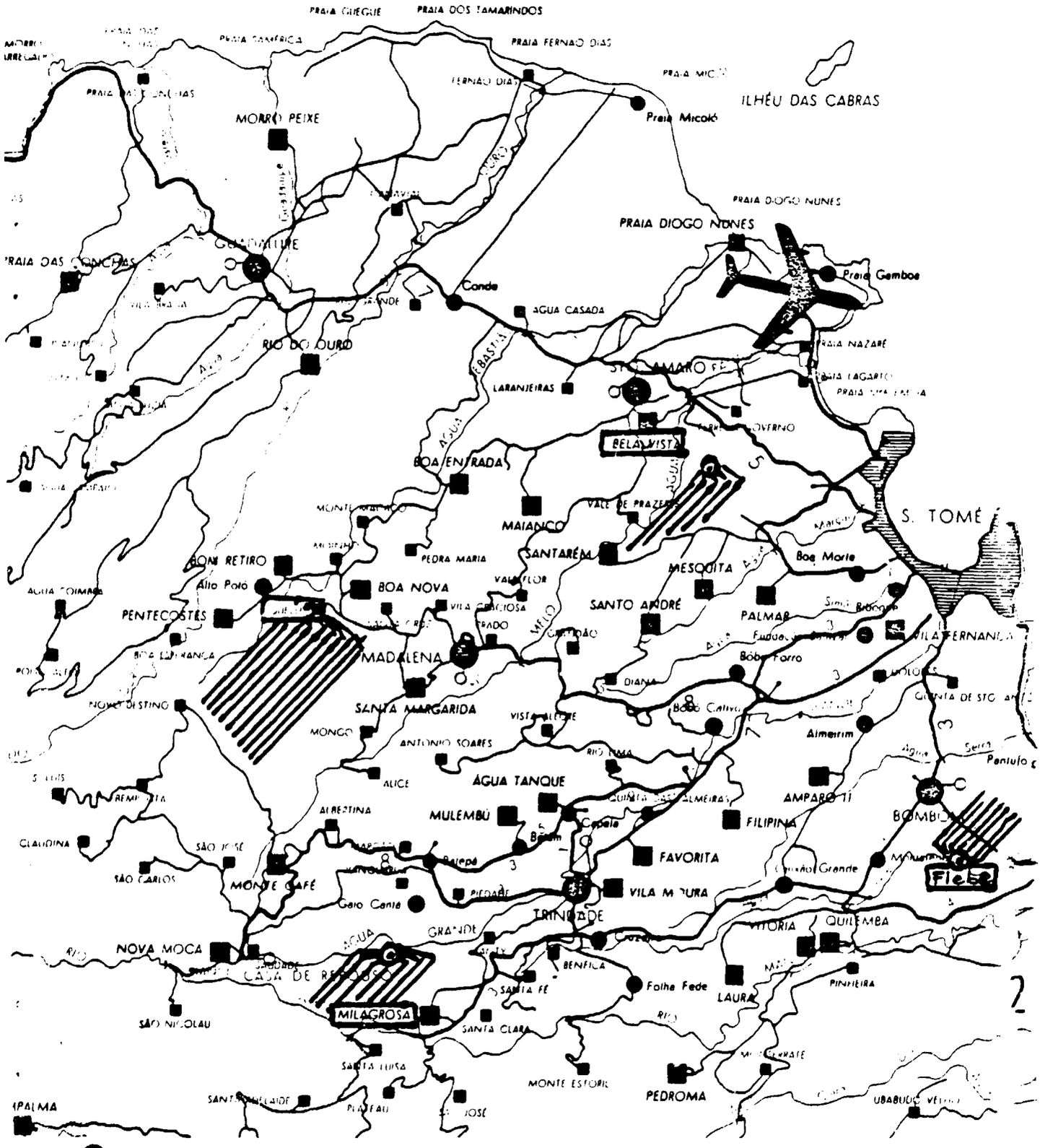
Conclusions:

- The existing equipment may be usable for some years to produce for the small local market.
- Mineral water is available in neighbouring countries in plastic bottles. To be competitive there mineral water has to be offered in plastic bottles.
- To obtain an interesting project profitability of a bottling plant a capacity of about 10,000 litres per hour is necessary. Investment for a capacity of 10,000 l / h:

	US$
Moulding equipment for plastic bottles	680,000.-
Bottling plant	910,000.-
Buildings and civil works	880,000.-
	2,470,000.-

ILHA DE S. TOMÉ

Annex 1



Annex 2

List of references:

(1), (2): ESTUDIO DE INVENTARIO Y EVALUACION DE MANANTIALES Y BOCATOMAS DEL AGUA POTABLE, SUS ESTADOS Y RENDIMIENTOS EN LAS ISLAS SAO TOME Y PRINCIPE
SI / STP / 77 / 803 / 11-01 / 31 . 7. C
page 14 resp. 13.

(3): BOLETIM DE ANALISE DE AGUA DA NASCENTE FLEBE - SAO TOME. INSTITUTO SUPERIOR TECNICO, LISBOA. 12 de Outubre de 1960.

Annex 3

Senior counterparts

Ministry for Industry, Construction and Habitation

Mr. Norberto Costa Alegre, Director for Industry and Energy

Rosema Brewery, Neves

Mr. Antonio Daio, Director General